

## Report of the Expert Group on the Risk of Contamination of the Public Water Supply by Backflow

“The Water Supply (Water Fittings) Regulations 1999 play a vital role in the protection of public health by safeguarding water supplies against contamination. An important component of this protection is the provision for backflow protection. Recent incidents have highlighted the continued need to review these provisions to ensure they continue to provide effective protection against the risk of contamination. Defra welcomes the review of the risk of contamination of the public water supply by backflow, undertaken by the Expert Group and its publication as an Information and Guidance Note. Defra endorses the report’s conclusions and underlines the importance of continued action to identify high risk sites so that effective backflow protection can be maintained.”

Mr. Peter Jiggins – *Head of Water Supply and Regulation  
Department for Environment, Food and Rural Affairs (Defra)*

### 1. Introduction

There have been a small number of significant incidents where the public water supply has been contaminated due to backflow at connected premises. The most severe incident was at Freuchie in Scotland, which resulted in hospitalisation of a large number of customers. A more recent incident involved contamination from a wastewater treatment works and prompted the DWI to issue information letter 4/2002.

Information Letter 4/2002 proposed a small expert group be established by the Water Supply Industry through WRAS to review the current approach to avoidance of contamination of supplies by backflow. This Information and Guidance Note reports the findings of that group and makes recommendations for the application of whole site backflow protection as a means to protect the public water supply from contamination.

### 2. Scope

The report does not include a review of the point of use backflow requirements set out in the Water Supply (Water Fittings) Regulations 1999 and Scottish Water Byelaws 2003. The existing requirements and

guidance are taken as currently published, interpreted and applied in practice. Further, it is not considered viable to amend existing requirements and Regulator’s specifications due to potential EU involvement.

The expert group limited its work to the role and application of zone and whole site backflow protection and its value as a public health measure to safeguard the wholesomeness of the public water supply.

### 3. The Water Supply (Water Fittings) Regulations 1999 and Scottish Water Byelaws 2003

For convenience all reference to the regulations includes the Scottish Water Byelaws 2003.

The requirements for backflow prevention are set out in Paragraph 15 of Schedule 2 to the regulations with reference to the fluid categories defined in Schedule 1 (Annex A). Paragraph 15(1) requires appropriate protection at every point of use. In addition, paragraph 15(4)(a) requires additional backflow protection where there is a risk of backflow between separately occupied premises and paragraph 15(4)(b) provides for whole site or part site protection to be installed when directed by the water supplier.

Chapter 6 of the Water Regulations Guide published by WRAS sets out the DEFRA guidance (G clauses) to the requirements and the Water Industry recommendations (R clauses) for complying with the requirements.

**G15.24** 'A whole-site or zone protection backflow prevention device should be provided on the supply or distributing pipe, such as a single check valve or double check valve, or other no less effective backflow prevention device, according to the level of risk as adjudged by the Water Undertaker where:

- a. A supply or distributing pipe conveys water to two or more separately occupied premises .....; or,
- b. A supply pipe conveys water to premises which under any enactment are required to provide a storage cistern.....'.

This provision is essentially for multi-occupied buildings to prevent backflow through a shared supply (or distributing) pipe between the separately occupied parts and may also be applied to other separately occupied premises.

**G15.25** 'The provision of zone or whole-site backflow protection should be in addition to individual requirements at points of use and within the system'

**G15.26** 'Zone protection may be required in other than domestic premises where particular industrial, chemical or medical processes are undertaken'

This Defra guidance, and the corresponding R clauses, do not clarify appropriate devices or applications. However, the Guidance confirms zone and whole-site protection are valid in addition to point of use protection. As such there is no requirement for any zone or whole-site backflow prevention device to be selected according to the fluid category (as applied to point of use protection). It remains a matter for each water undertaker to determine the circumstances under which additional protection is needed and the level of such protection. This report gives guidance in these matters.

#### **4. Water Industry Act 1991 (and corresponding Scottish enactment)**

Section 73 of the WIA sets out the offence of contaminating, wasting or misusing water. Section 75 sets out the powers of the water supplier to prevent damage and take steps to prevent contamination, which may be invoked independently or alongside the Fittings Regulations. Regulation 4(3) and Schedule 2, Para 15 (4)(b) give the water undertaker specific power to require whole-site or zone backflow protection, in addition to the powers available to it under sections 73 and 75 of the Act.

#### **5. Consequences of a Backflow Incident**

Backflow contamination may have significant effect on the water supply, as at Freuchie where there was widespread and severe gastro-enteritis following the contamination. In addition to the direct effect on customers the public image of the water supplier and general public confidence in the public supply is undermined. Significant recovery costs might be

incurred. In any serious backflow incident, the Drinking Water Inspectorate may consider whether there are grounds to bring a prosecution against the Water Supplier under Section 70 of the Water Industry Act 1991 for supplying water unfit for human consumption. It is assumed that any defence by demonstration of exercise of all due diligence would rest on the water supplier's policy and practice for enforcement of the Fittings Regulations. This might be tested against industry practice, but can certainly be expected to include an assessment by the water supplier of the application of zonal or whole site protection or other measures taken by its consumers, to protect water quality.

#### **6. Properties Requiring Whole-site and Zone Backflow Protection**

Schedule 1 to the regulations gives examples of fluids in each of the risk categories. It follows that sites where fluids in category 5 are frequently present represent the greatest risk to health if a backflow incident occurs. The Report of the Committee on Backsiphonage in Water Installations (DoE 1974) also identified premises that were subject to a high risk of backflow. In several instances it was recommended that the Water Supplier should consider additional protection at the point of supply at his own cost. This recommendation was not taken forward through into subsequent Model Byelaws and Departmental guidance and the owner/occupier of premises now has a clear responsibility to comply with the requirements of the regulations.

Since the publication of the Backsiphonage report, which was generally based on backflow protection by air-gaps with only limited use of mechanical devices, there has been significant development in the use, sophistication and reliability of mechanical backflow prevention devices. These devices provide economic and readily available options for providing backflow protection, in contrast to the installation of air gaps that can involve substantial alterations to plumbing systems. However, whereas the air gap, once installed, is simple and reliable, the mechanical devices do require maintenance, and it is possible that there is now a higher risk of accidental and ignorant breach of integrity of backflow protection. Such greater risk should be balanced against the ease of provision offered by mechanical devices.

#### **7. Role of Whole-site and Zone Backflow Protection**

Zone and/or whole-site backflow protection might be required on industrial, commercial and agricultural premises for a number of reasons including:

- As an interim measure, until full compliance with the regulations for point of use backflow protection is obtained.
- Where there is compliance for point of use backflow protection, but there is a risk that future modifications to the system and/or poor management might compromise compliance.

- Where there is compliance for point of use backflow protection, but there remains concern that the risk to public health associated with any potential backflow is significant and additional security is required.

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### 7.1 INTERIM BACKFLOW PROTECTION

The Water Supply Industry Best Practice Manual for Enforcement of the Water Fittings Regulations states that action to enforce Regulations will be proportionate to the risk of non-compliance. There are circumstances where additional whole or part-site protection can be employed with an acceptable level of risk in the short-term whilst permanent (point of use) improvements are carried out. However there may be cases where an unacceptably high risk is identified and temporary protection is insufficient to remove the risk. The water supplier is very likely to consider such cases to be emergencies justifying immediate disconnection under section 75. At no time can any undue risk be taken that might adversely affect the quality of the public water supply.

The decision to permit installation of a temporary device with the level of protection afforded by that device, depends on an individual risk assessment for the site. Such permission is an extension of the risk framework implicit in the regulations and should be documented with details of the agreement to install permanent protection, including a programme for works and any interim inspection and monitoring requirements.

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### 7.2 COMPROMISE OF COMPLIANCE

It is generally accepted that the vast majority of infringements of the regulations are through ignorance rather than wilful action. However, it must be acknowledged that point of use backflow protection might be compromised or rendered ineffective once the water supplier's representative has left the site of an installation.

There are circumstances where the water supplier's representative may have serious concerns that a breach of point of use protection is a strong possibility, having regard to the two main considerations of the attitude and competence of the occupier and of the complexity of the site water services and frequency of alteration to these. A well maintained installation with a trained and competent workforce and documented procedures would be considered more secure than a site with many contraventions on first inspection. Similarly, the attitude and co-operation received when securing compliance could be indicative of the future attention likely to be paid to maintaining compliance. Frequent relocation of water-using plant and mobile units would give concern that the high number of re-connections and possible alterations to the system might increase scope for errors and the risk of unprotected connection.

All such factors should be taken into consideration when deciding whether whole site or part site protection is needed to give security against contamination of the public water supply.

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### 7.3 HIGH RISK PREMISES

There are some premises where there would be significant consequences from contamination of the public water supply following a backflow incident. Likewise, there are also certain installations that pose additional risk of breach of backflow protection, no matter how well the installation is managed and maintained.

Particular risks are the presence of Fluid Category 5 alternative water supplies with pressurised systems at or above mains pressure. On sites with buried pipework the risk of inadvertent cross connection is greatly increased, particularly where accurate site layout drawings are not available. Where such conditions exist there should be consideration of whole site or part site backflow protection.

Guidance on assessing circumstances requiring additional protection is set out in Annex B.

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## 8. Backflow Prevention Devices

The requirement of the regulations for matching backflow risks, defined by fluid categories, with suitable backflow prevention devices applies only to point of use protection and not to zone and whole site protection. Accordingly, a methodology is necessary to determine the level of secondary protection required in different circumstances and the appropriate additional device(s) to provide it. Factors such as the reasons for requiring additional protection, fluid category, presence of alternative supplies, presence and size of on site pumping plant, complexity of site, level of site management and control, and general compliance at point of use will influence the decision. Every zonal or whole site device should be installed on the premises as close as reasonably practicable to the boundary of the zone or the site.

Guidance on specifying the backflow protection device is set out in Annex B.

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## 9. Maintenance and Testing

Any additional backflow devices required to be installed under the regulations are the responsibility of the occupier and should be inspected and tested as necessary. Where the required device is a RPZ valve (Type BA device) the requirements of the WRAS Information and Guidance Note No 9-03-02 should be applied. For other devices, the maintenance and testing regime and requirements for confirming adherence to such conditions should be set out in writing.

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## 10. Existing Supplies

There may be adverse consumer reaction, on grounds of associated disruption and additional maintenance and administrative costs, to requirements for installation of additional backflow devices, especially where there is compliance at point of use. The principle of 'proportionality' set out in the Best

Practice Manual must be applied, and consistent application of decision rules by all water suppliers should be aimed at. A model form of notice to provide additional backflow protection under paragraph 15(4)(b) is given at Annex C.

## 11. New Supplies

Where new high water-use or high risk fittings of the kinds required to be notified to the water supplier by Regulation 5 are installed, additional backflow prevention devices may be required as conditions of consent under paragraph 5(1)(c). It is proposed that, as a minimum, a verifiable check valve is installed as close as is practicable to the boundary of all new premises where water will be used for non-domestic purposes. Some premises may require a higher level of protection and this can be assessed in accordance with the guidelines in Annex B. The maintenance regime for the device should also be specified as a condition of the consent.

## 12. Demonstration of Due Diligence

Where additional protection is required at a site it is because there is a high risk of a backflow from that site, or the nature of the contaminants present on site would result in serious consequences if there were to be a backflow incident. Accordingly, the Water Supplier should keep a record of the risk assessment and decision to install the device and of the requirement for a maintenance regime associated with the device, to demonstrate all reasonable due diligence in preventing contamination of the public water supply.

## 13. Supplies for Domestic Purposes

Nearly all premises require a wholesome supply of water for domestic purposes. Whilst the water supplier has no statutory duty to ensure that water remains wholesome after the time of supply, it is prudent to presume it has a common law duty of care, arising from its role as an 'expert'.

For example:- circumstances where the water supplier might be aware of a contravention of the regulations in respect of point of use compliance, with associated risk of contamination of supplies intended for human consumption. This might apply in particular where whole-site protection is required as an interim measure as a consequence of failure to provide point of use protection. The water supplier should remind the occupier of the risk imposed by non-compliance with backflow requirements, and where appropriate of his duty under Health and Safety legislation.

## 14. Best Practice Manual on the Enforcement of the Regulations

The use of whole site and part site protection devices is likely to increase. It is recommended that the Water Supply Industry's Best Practice Manual for the Enforcement of the Regulations be revised to include specific explanation of the need for and use of

such devices. It is suggested that WRAS draft an appropriate section to be incorporated in the Manual at its next update.

## 15. Further Work

Mechanical backflow protection devices have been in service for many years since the former Water Supply Byelaws permitted their use. However, the service life and reliability of these devices is not known except for RPZ valves maintained in accordance with WRAS Guidance Note No 9-03-02. It is recommended that WRAS initiate a study of the performance of backflow devices to inform on any future work by British Standards and to advise the Secretary of State if amendment to the Regulators' specification should be considered.

## 16. Conclusions

The Water Fittings Regulations provide for the use of secondary backflow protection, either as zone or whole-site protection, where there is a high risk of contamination by backflow.

In order to ensure the safety of their drinking water supplies and, in the event of a contamination incident, to be able to demonstrate having acted with due diligence, Water Suppliers are recommended to review the need for secondary protection at existing higher risk sites in their areas of water supply.

Water Suppliers have the powers under Clause 15 of Schedule 2 to the Water Fittings Regulations to require secondary protection if they consider this may be required:

*as an additional safeguard where, despite point-of-use protection, there are concerns about continuing risks of contamination*

*or where activities on the site result in frequent alterations to plumbing systems*

*or as an interim measure pending full point-of-use compliance of a site.*

At new sites where water is to be used for non-domestic purposes or where fittings are to be installed which are specified under Regulation 5, as a minimum it is recommended that whole-site secondary backflow protection is provided using a verifiable check valve, in addition to compliance with the backflow requirements using point-of-use devices.

Backflow prevention devices can be used for secondary backflow protection against a higher level of backflow risk fluid category than would be permitted if the same device was used for point of use protection. Advice is given on suitable devices for different circumstances.

To remain effective, mechanical backflow prevention devices must be maintained and tested. Requirements should be included in customer agreements. It is recommended that WRAS should commission a study to provide information on appropriate maintenance and testing frequencies.

## ANNEX A: EXTRACTS FROM THE WATER SUPPLY (WATER FITTINGS) REGULATIONS 1999

### SCHEDULE 1

#### REGULATION 1 FLUID CATEGORIES

##### Fluid category 1

Wholesome water supplied by a water undertaker and complying with the requirements of regulations made under section 67 of the Water Industry Act 1991.

##### Fluid category 2

Water in fluid category 1 whose aesthetic quality is impaired owing to:

- a. a change in its temperature, or
  - b. the presence of substances or organisms causing a change in its taste, odour or appearance,
- including water in a hot water distribution system.

##### Fluid category 3

Fluid which represents a slight health hazard because of the concentration of substances of low toxicity, including any fluid which contains

- a. ethylene glycol, copper sulphate solution or similar chemical additives, or
- b. sodium hypochlorite (chlorox and common disinfectants).

##### Fluid category 4

Fluid which represents a significant health hazard because of the concentration of toxic substances, including any fluid which contains

- a. chemical, carcinogenic substances or pesticides (including insecticides and herbicides), or
- b. environmental organisms of potential health significance.

##### Fluid category 5

Fluid representing a serious health hazard because of the concentration of pathogenic organisms, radioactive or very toxic substances, including any fluid which contains

- a. faecal material or other human waste;
- b. butchery or other animal waste; or
- c. pathogens from any other source.

### SCHEDULE 2

#### Regulation 4(3) Requirements for water fittings

##### Backflow prevention

##### 15.

- (1) Subject to the following provisions of this paragraph, every water system shall contain an adequate device or devices for preventing backflow of fluid from any appliance, fitting or process from occurring.

Paragraph (1) does not apply to

- a. water heater where the expanded water is permitted to flow back into a supply pipe, or
- b. a vented water storage vessel supplied from a storage cistern,

where the temperature of the water in the supply pipe or the cistern does not exceed 25°C.

The device used to prevent backflow shall be appropriate to the highest applicable fluid category to which the fitting is subject downstream before the next such device.

- (4) Backflow prevention shall be provided on any supply pipe or distributing pipe

- a. where it is necessary to prevent backflow between separately occupied premises, or
- b. where the water undertaker has given notice for the purposes of this Schedule that such prevention is needed for the whole or part of any premises.

A backflow prevention device is adequate for the purposes of paragraph (1) if it is in accordance with a specification approved by the regulator for the purposes of this Schedule.

#### Requirements for water fittings etc. : Installation

##### REGULATION 4:

- (4) Where any requirement of Schedule 2 relates to a water system, every water fitting which forms part of that system shall be fitted or, as the case may be, altered or replaced so as to comply with that requirement.
- (6) For the purposes of this regulation, a water fitting is installed, connected, altered, repaired or disconnected in a workmanlike manner only if the work is carried out so as to conform
- a. to an appropriate British Standard, a European technical approval or some other national specification of an EEA State which provides an equivalent level of protection and performance;
  - b. to a specification approved by the regulator; or
  - c. to a method of installation approved by the water undertaker.

## ANNEX B:

### SELECTION OF DEVICES FOR WHOLE SITE AND ZONE PROTECTION

To be read in conjunction with the information and advice in Sections 7 and 8.

Backflow prevention devices can be used for secondary backflow protection against a higher level of backflow risk (fluid category) than would be permitted if the same device was used for point of use protection.

Against each of the three purposes of secondary backflow protection (discussed in section 7) the following table (overleaf) lists different backflow risks and circumstances where secondary protection may be required (e.g. degree of control or supervision of the risk equipment or process etc.), and recommends the corresponding fluid category rating for the secondary device.

In some cases, different fluid categories are given in the table for back pressure and backsiphonage protection. To decide whether the secondary protection needs to guard against back pressure or backsiphonage, in order to select the correct fluid category, the plumbing arrangements involving the contaminant should be assessed. For example, where the contaminant is in an open-topped vessel which is at atmospheric pressure, where no pumps are used to pressurise the contaminant, backsiphonage is the more likely risk because back pressure is unlikely to occur. Conversely, where there are pumps and pressurised pipelines containing the contaminated fluid, backpressure is possible. The appropriate fluid category should be selected based upon such an assessment.

Acceptable backflow prevention devices are described, with the appropriate maximum fluid category 'rating' for the protection they provide, in the Regulator's Specification for backflow prevention arrangements and devices. This is reproduced in the WRAS Water Regulations Guide (Sect. 6.3).

**Annex B: Table of risks and appropriate fluid categories for secondary backflow protection devices**

Description of risk to be assessed for additional whole site or zone backflow protection		Recommended fluid category rating of secondary backflow prevention device	
Purpose of secondary protection	Circumstances of special risk	Back Pressure	Back Siphonage
Interim Backflow Protection	Fluid 4 or 5 risk without point of use protection. Poor control/supervision of water use	4	3
	Fluid 4 or 5 risk without point of use protection. Responsible attitude to water use	3	3
	Fluid 4 or 5 risks with point of use protection a category below requirement	3	2
Compromise of Compliance	Fluid 4 or 5 risks. Frequent amendment to systems and poor records of site installation. Poor control/supervision of water use	4	3
	Fluid 4 or 5 risks. Frequent amendment to systems and poor records of site installation. Responsible attitude to water use	3	3
	Fluid 4 or 5 risks. Frequent and well documented amendment to systems.	3	2
	Fluid 4 or 5 risks. Frequent and well documented amendment to systems.	3	2
	Well managed installation with high overall compliance with requirements	2	-
High Risk Premises	Presence and frequent use of alternative water supplies of fluid category 5, with buried pipe systems.	4	3
	Presence and intermittent use of alternative water supplies of fluid category 5	3	3

**ANNEX C:**

**EXAMPLE OF NOTICE REQUIRING IMPROVED BACKFLOW PROTECTION**

*(Name of Water Undertaker)*

**WATER INDUSTRY ACT 1991 SECTION 75**

**WATER SUPPLY (WATER FITTINGS) REGULATIONS 1999, SCHEDULE 2, PARAGRAPH 15**

**REQUIREMENT FOR BACKFLOW PREVENTION**

[Address or Description of Premises]

Further to *(my visit to the above premises on)* [the arbitrator's determination on *(date)* in the Company's favour of the dispute between the Company and yourself as to whether the Company had unreasonably attached to its consent, under Regulation 5 of the above Regulations, to your installing a *(description of fitting)* at the above premises, a condition that an appropriate backflow prevention device be installed] I now give you formal notice, under paragraph 15 (4) of Schedule 2 to the above Regulations, that backflow prevention between the premises in the separate occupation of *(yourself/your company)* and of *(name of other occupier)* is required. A backflow prevention device of *(description)* should be installed at *(point x on the attached plan)* to ensure that fluids in *(category x)* cannot backflow *(from [either of the] premises into the Company's water mains)* [or] *(from one set of premises to the other)*.

This requirement is also imposed under section 75 of the Water Industry Act 1991, and you are required to take the step of installing the appropriate backflow prevention device before *(date)*.

If this step is not taken by that date then the Company may install the device itself and recover the reasonably-incurred expenses from you. If the case

becomes an emergency or the premises appear to be unoccupied and the device has not been installed by that date, the Company may disconnect the service pipe or otherwise cut off the supply of water.

This notice is issued without prejudice to the Company's right to take proceedings against the owner or occupier of the premises for contravention of section 73 of the Water Industry Act 1991 which relates to water fittings so out of order, in need of repair, or constructed or adapted or used as to cause or render likely contamination, waste, misuse or undue consumption of water.

Further copies of this Information and Guidance Note and technical information may be obtained from the WRAS website or by contacting WRAS at:

**The Water Regulations Advisory Scheme**  
 Unit 30 Fern Close, Pen-y-Fan Industrial Estate  
 Oakdale, Gwent NP11 3EH  
 Tel.: 01495 248454  
 Fax: 01495 249234  
 E-mail: info@wras.co.uk  
 Web: www.wras.co.uk