

The Use of Public Water Supplies in Railway Premises

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1. Introduction

All premises which have a connection to the public water supply are covered by the Water Supply (Water Fittings) Regulations 1999 (England and Wales), or the Scottish Water Byelaws 2004 or the equivalent legislation in Northern Ireland (referred to here collectively as 'the regulations'). They cover all plumbing systems, pipes above or below ground, water fittings and appliances which convey or receive water from the public supply system, or which could do so.

The occupiers of premises are responsible for the water systems within them. Anyone who installs or uses plumbing systems, water fittings or appliances which convey or receive water or which could do so, has a legal duty to comply with the regulations.

The purpose of the regulations is to prevent the –

WASTE

MISUSE

UNDUE CONSUMPTION AND
ERRONEOUS MEASUREMENT

CONTAMINATION

of water supplied by a public water supplier.

Under the regulations, water fittings must be 'of an appropriate quality and standard and be suitable for the circumstances in which they are used'. A major requirement of plumbing systems, water fittings and appliances is that they shall not cause contamination of drinking water – either by contaminants dissolving into the water from the materials of construction, or by allowing the backflow of contaminated fluids from appliances etc. into the supplying pipework, or by the inter-connection of drinking water pipework with any other fluid.

2. Scope

Many of the uses of water in railway premises are similar to those in many other industrial premises and the same precautions will apply to both. However, the filling of railway carriages with water for use in toilets and catering and the washing, servicing and maintenance of rolling stock can pose additional risks of contamination. This Information and Guidance Note (IGN) seeks to identify these risks and give guidance on their prevention.

The IGN encourages good practice and supports efforts to establish common procedures and installation criteria for the use of water supplies in railway premises. The Water Regulations Guide, published by the Water Regulations Advisory Scheme (WRAS), provides general guidance on how to meet the requirements of the regulations. The Guide is used throughout the Water Supply Industry and provides the information on which this IGN is based.

British Standard Specification BS 6700 entitled 'Design, Installation, Testing and Maintenance of Services Supplying Water for Domestic Use within Buildings and their Curtilages' is another useful reference document.

3. Some Useful Definitions

'**Backflow**' in pipework or appliances is defined as 'flow in a direction contrary to the intended normal direction of flow'.

'**Contamination**' includes any reduction in chemical or biological quality of water due to a change in temperature or the introduction of polluting substances;

'**Cross-connection**' is any connection between pipes or fittings conveying or containing wholesome water supplied by the Water Supplier and any other fluid, such as recycled water, rainwater or industrial process water.

'**Misuse of water**' This may be regarded as the use of water supplied by a Water Supplier for any purpose other than that for which it is supplied. This includes the use of the energy in the mains water supply as a means of providing motive power or for the generation of electricity.

'**Permeation**' occurs when a substance penetrates the material of which a pipe is made; for example diesel oil can permeate through polythene water pipe and cause an oily taint to the water being conveyed in the pipe.

'**Undue consumption of water**' refers to the operation of fittings and appliances that use more water for the purpose for which they were designed than that established by the performance criteria of the regulations, or more than is reasonable in comparison with other fittings or appliances serving similar purposes.

'**Waste of water**' occurs when water supplied by a Water Supplier is allowed to run to waste through faulty installation, a faulty appliance or poor maintenance or through any other fault; for example a leaking fitting or a dripping tap.

'**Wholesome water**' means water which meets the national standards for drinking water quality and is suitable for drinking, cooking and other domestic purposes; it is the quality of water which is supplied by the Water Supplier.

4. Responsibilities

4.1 The Water Supplier's duties

These are defined in various Water Industry Acts and include the duties:

- to supply wholesome water to premises for domestic purposes.
- to enforce the regulations in its area of supply.

Both these duties require the Water Supplier to ensure that there are adequate means for preventing backflow of water from the premises into the water mains, where it could cause contamination of drinking water supplied to others.

Regulations enforcement by the Water Suppliers includes:

- receiving notification in advance of proposed plumbing installation work;
- where proposals are acceptable, granting consent for the work to proceed;
- inspecting selected premises to check that their plumbing systems comply with regulations.

4.2 The Railway Premises occupiers and users

The occupiers and users of the railway premises includes the owners, leaseholders and tenants of railway premises. They have the duty:

- to notify the Water Supplier of any proposed plumbing work (*see Section 10.1*);
- to comply with any conditions attached to the Water Supplier's consent for that work.
- to ensure that plumbing systems are designed, installed and maintained to prevent the waste of water and to minimise the risk of contamination.

5. The Causes of Waste, Undue Consumption and Contamination

5.1 Where the water wastage and undue consumption risks are

Waste of water can occur because of:

- leaking underground pipes caused by poor installation or maintenance, accidental damage, corrosion, or inadequate depth of ground cover;
- poorly maintained taps, cistern inlet float valves, WC flushing valves etc., allowing leakage via overflows and drains;
- inadequate protection against freezing leading to burst pipes;
- users running water to waste from taps because of
 - the warming of cold water due to inadequate insulation of cold water pipes or storage cisterns or
 - poor design of hot water pipes, resulting in long pipe runs, and inadequate insulation of hot water pipes;
- poor control of auto-flushing urinals;
- hose pipes without self-closing flow control triggers, which allow users to leave hoses running unattended.

5.2 Where the contamination risks are

Contamination of water supplies can occur by the ingress of water into leaking underground pipes or fittings, by backflow of contaminated fluids into pipework or by plumbing fittings being in contact with contaminated substances. Examples of these risks in railway premises include:

- hose pipe outlets left immersed in puddles, drains etc.
- hose pipes or rolling stock water filling points in contact with toilet waste, bird or animal faeces and surface water;
- spillage of fuel and lubrication oils where they can come into contact with water pipes and hoses;
- cross-connections with other water sources such as re-used rainwater, recycled water (e.g. recycled carriage washing water) or private water supplies;
- process water, e.g. water softening treatment plant; antifreeze dilution equipment;
- incorrectly installed and poorly maintained water fittings and plumbing systems which fail to protect against backflow;
- storage of water intended for drinking etc. in cisterns with inadequate lids, vents, overflow pipes or screens;
- use of unsuitable materials in fittings, cisterns etc., resulting in contaminants dissolving into the water.

5.3 Backflow risks

Without suitable protection, backflow of contaminated water into plumbing systems can occur readily. The regulations require that every water system has adequate devices to prevent backflow.

An assessment is required of the backflow risk for each water fitting or appliance that contains water or other liquids and is connected to the plumbing system. The regulations define five levels of backflow risk called **Fluid Categories**.

Fluid category 1	Wholesome water supplied by a Water Supplier.
Fluid category 2	Water which would be in fluid category 1 except that its aesthetic quality is impaired, owing to a change in its temperature, or the presence of substances or organisms causing a change in its taste, odour or appearance. An example is 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 ethylene glycol, copper sulphate solution or similar chemical additives, or 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 chemical, carcinogenic substances or pesticides (including insecticides and herbicides), or 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 faecal material or other human waste, butchery or other animal waste or pathogens from any other source.

The regulations specify suitable backflow prevention devices for each fluid category. The fluid category should be assessed on the highest level of risk to which the water fitting is exposed. For example, a hose union tap used where the risks are no greater than in domestic premises could be acceptable with backflow protection to fluid category three, provided the hose pipe attached to it will only be hand-held and is used with a self-closing flow control trigger. But if the hose outlet could be exposed to greater contamination risks, for example in a drain, a WC or a container of toxic substances, or is left on the ground where it could be immersed in puddles etc., then it must be protected to fluid category five.

Backflow risks which may be commonly found on railway premises are identified using fluid categories in the following list. This list is representative only and must not be regarded as exhaustive.

5.4 Schedule of risks

	Appliance, process or point of use	Fluid Category
Hose Union Taps/Standpipes		
1	Domestic risk areas – hand-held, self-closing trigger flow control only	3
2	Hoses union taps and hoses in other risk areas	4/5*
Power/jet washers		
3	Permanently plumbed or portable units; drain jetting units	5
Carriage washing		
4	Automatic carriage washers – mains water use only	4
5	Automatic washers including use of recycled water	5
Water treatment plant		
6	Water softeners – ion exchange	3/4*
7	Anti-freeze preparation	3
8	Water recycling plant	5
9	Water other than from the public Water Supplier	5
Fire protection		
12	Fire hydrants	3/4/5*
13	Fire hose reels – (dedicated for fire purposes only)	2
14	Sprinkler systems – no additives	2
15	Sprinkler systems – pressurised or with additives	4
16	Open-topped water storage cistern for fire-fighting	5
17	Train/bowser filling points	5
Clothes and dishwashing machines		
18	Commercial/industrial use	4
Miscellaneous		
19	Soft drink dispensers	2/3*
20	Hot water heaters	2

Note: *For these types of risk, the fluid category is dependent on local circumstances and should be confirmed by the Water Supplier.

5.5 Protecting against the backflow risks

Backflow prevention devices are given a fluid category rating¹ which indicates the degree of protection they provide. By means of a risk assessment, including use of the list above, each appliance, process or point of use should be allocated a fluid category according to the contamination hazard likely to be present. Each appliance, process or water point-of-use must be protected by backflow prevention devices which have a fluid category rating equal to, or greater than, the assessed fluid category of the potential contaminants associated with the appliance or fitting. Examples of the ratings of backflow prevention devices are given in Section 5.4.

¹ These ratings are given in the 'Regulators' Backflow Specification for backflow prevention arrangements and devices' in the Government Guidance Document relating to Schedule 2 of the Water Supply (Water Fittings) Regulations 1999. (See Section 11. Further Information and Advice.)

6. Typical Backflow Prevention Arrangements and Devices for Different Fluid Category Risks

6.1 Fluid Category 5

Backflow of category 5 substances from cisterns, appliances or other fittings can be prevented by supplying them via a Type AA air gap, (Figure 1), by a Type AB or AD air gap, by a DC device (a pipe interrupter with a permanent atmospheric vent or a Type AUK arrangement (Figure 4).

The air gap, i.e. the vertical distance of the discharge point of the inlet pipe above the spillover level, must be at least twice the bore of the inlet pipe and never less than 20 mm.

To increase the water pressure, a booster pump can be fitted on the distributing pipes from cisterns incorporating air gaps, but consent from the Water Supplier is required if the flow is greater than 12 litres/minute.

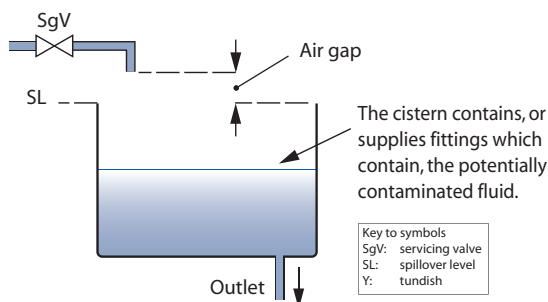


Figure 1: The Type AA air gap, with unrestricted discharge above the spillover level

6.2 Fluid Category 4

Cisterns or appliances containing a category four fluid can be fed via a Type AF air gap (see Figure 2) or a mechanical device such as a reduced pressure zone (RPZ) Valve (also known as a Type BA device).

Detailed information relating to RPZ valves is given in AIM 05-01, the combined WRAS Approved Installation Method and IGN 9-03-02 'Type BA device – Verifiable Backflow Preventer with Reduced Pressure Zone (RPZ Valve) Requirements for Installation, On-site Testing and Maintenance', available on the WRAS website or from Water Suppliers.

The inlet is below the spillover level of the cistern. The air gap (from the lowest part of the inlet to the critical

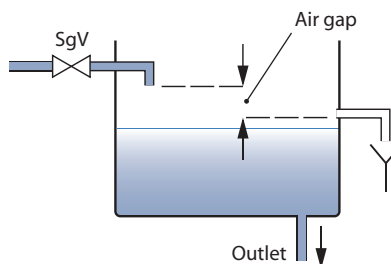


Figure 2: The Type AF air gap with a circular cross-sectional overflow.

level) is to be the greater of 20mm or twice the bore of the inlet pipework. The overflow must be suitably sized for the appropriate type of air gap e.g. for a Type AF air gap, an overflow of cross-sectional area of at least four times that of the inlet pipe is required.

6.3 Fluid category 3

Cisterns or appliances potentially containing a category 3 fluid can be fed with a Type AG air gap or via a mechanical backflow prevention device e.g. a double check (non-return) valve (Type EC or ED).

6.4 Fluid category 2

Cisterns or appliances potentially containing a category 2 fluid can be fed with a mechanical backflow prevention device, for example a single check (non-return) valve (Type EA or EB).

Further details of backflow prevention devices are given in Section 6 of the WRAS Water Regulations Guide and in the Government Guidance to the Regulations, which is available via the WRAS website. (See 'Further information and advice').

Note: Mechanical backflow prevention devices need planned inspection and maintenance or replacement because they can fail in service.

7. Examples of Backflow Prevention Arrangements

7.1 Carriage filling points

The typical train carriage water filling points are considered to be fluid category five risks because they are exposed to general environmental contamination and faecal matter from carriage toilet discharges. The hoses attached to standpipes used for filling trains are often exposed to faecal matter, fuel oil and surface water.

A fluid category five device must protect the standpipe taps supplying these hoses. This means the standpipe taps must be supplied from a break tank and a booster pump is required to provide adequate water pressure at the taps. The break tank (i.e. a water storage cistern) must have a type AB or AD air gap or DC device (see Figure 3).

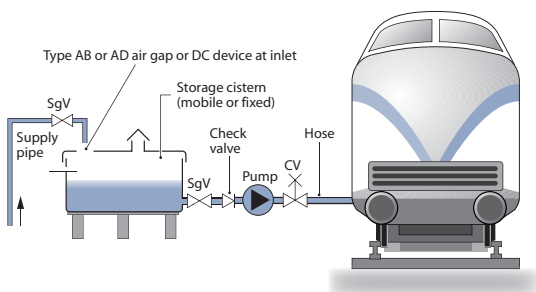


Figure 3: Example of a backflow prevention arrangement for protecting standpipes or hoses used for filling carriages with water, using a break tank with a fluid category five air gap and a booster pump.

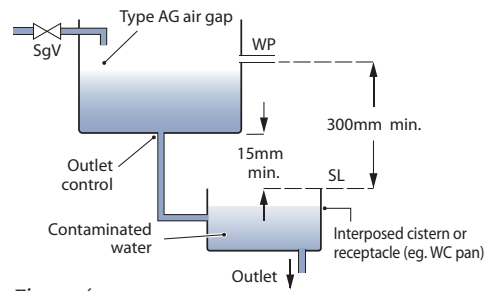


Figure 4a: Type AUK1 arrangement.

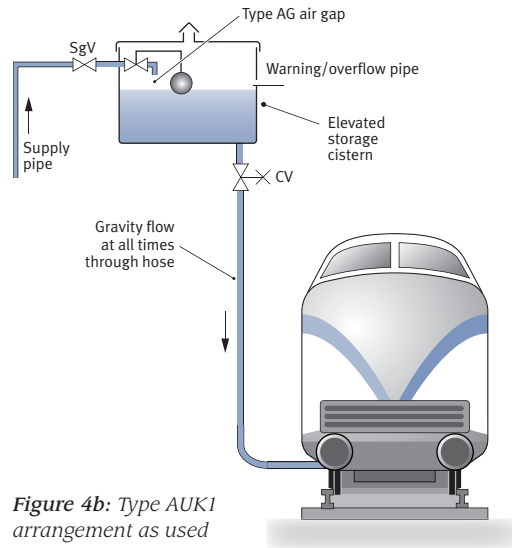


Figure 4b: Type AUK1 arrangement as used for filling trains.

An alternative arrangement, known as the type AUK1 air gap with interposed cistern, uses an elevated storage cistern with a type AG air gap, to supply water by gravity to the standpipes used for train filling (see Figures 4 a and b).

The Type AUK1 arrangement can also be used for other fluid category 5 backflow protection, including filling steam locomotives with mains-supplied water, where this is required.

An alternative for filling carriages with water is to use a mobile water bowser with a booster pump. The hose union tap used for filling the bowser must be protected by a fluid category five backflow prevention device, such as one of those described in Section 6.1.

7.2 Note regarding the quality of water used for filling train carriages

It is the responsibility of the train operator to ensure that the water supplied to trains for use in toilets and catering is of a suitable quality. It is recommended that there should be a written operating procedure or method statement covering matters such as the storage, security, disinfection and use of hoses, the cleaning of the hose connection points on the carriages before they are used and the regular cleaning and disinfection of water bowsters, where these are used. Train operating staff should be briefed and regularly updated in the application of these procedures and checks should be made by their supervisors that they are being followed in practice.

7.3 Separation of recycled water and mains supplies

Where recycled water use is supplemented by mains water, for example in carriage washing plant, it is essential to prevent backflow of recycled water into the mains supply. Mains water must be supplied to storage cisterns containing the recycled water via a fluid category five air gap (type AA, AB or AD air gap) (Figure 5).

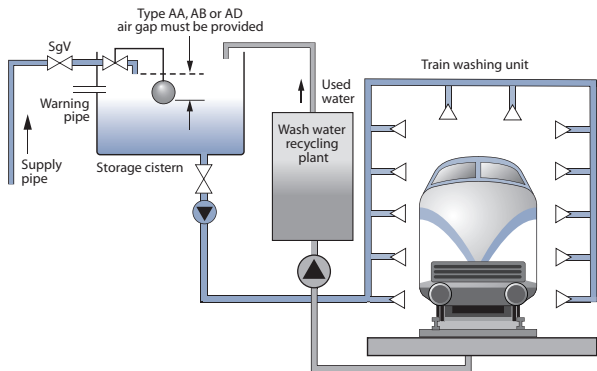


Figure 5. Separation of mains water and recycled water using a cistern with a fluid category five air gap.

7.4 Controlled emission toilet (CET) systems

Hose union taps and standpipes for hoses supplying water for use with trackside facilities for the emptying of controlled emission toilet systems must be protected by a fluid category five air gap in a break tank (cistern) similar to that shown in Figure 3. The break tank must not be used to supply water for any purpose which requires wholesome water because, in the event of a backpressure incident arising, for example, from malfunction of the compressed air or suction pump systems, contaminated water from the toilets could contaminate the stored water in the break tank.

8. Zone and Whole Site Backflow Prevention

In addition to point-of-use protection, Water Suppliers may require a secondary level of backflow protection where a particularly significant risk of contamination exists. This may be for a designated part of the water supply system within premises (a zone), or at or near to the boundary of the site on the supply pipe which connects it to the public supply water main (whole-site protection). Zone protection can also be used where a group of similar outlets exists in one area and backflow prevention for all these outlets can be provided more economically by a suitable backflow prevention device in place of several point-of-use devices. For example, all the hose union taps used for carriage filling in one set of sidings could be treated as a zone and supplied from the same break tank and booster pump incorporating the required air gap. Further information on zone and whole site protection is available in the WRAS Information and Guidance Note No. 9-04-05: 'Report of the Expert Group on the Risk of Contamination of the Public Water Supply by Backflow', which is available on the WRAS website or from Water Suppliers.

9. Pipes and Fittings in Contaminated Land

To prevent ingress of contamination, no pipe or fitting should be installed in or close to a cesspit or sewage effluent soak-away, regardless of any protection given. Soil beneath railway sidings, maintenance yards, refuelling points and tracks can be heavily contaminated with hydrocarbons such as fuel or lubrication oils. Water pipes made from plastic compounds, such as the widely-used blue polythene pipe, can be readily permeated by hydrocarbons. This can cause an oily taste in the water being conveyed, making it unfit to drink. Preferably, water pipes should not be installed where they are likely to become contaminated with oil or diesel fuel. Where this is impracticable, the water quality should be protected by the selection of a suitable pipe material. Examples suitable for use with hydrocarbons include barrier pipe (aluminium foil sandwiched between the layers of a polythene pipe) or ductile iron. More advice is given in the WRAS Information and Guidance Note 9-04-03 'The selection of materials for water supply pipes to be laid in contaminated land'. Other advice on the selection of pipe materials for use where land may be contaminated is given in a series of booklets produced by the UK Water Industry Research (UKWIR) entitled '04/WM/03/9 – Pipe Materials Selection and Specification for use in Contaminated Land' (see Section 12).

10. Other Ways in which the Regulations Affect Railway Premises

10.1 Notification

Regulation/Byelaw 5 requires that the local Water Supplier must be notified in advance for most types of plumbing installations and anyone installing or using the installation without the Water Supplier's consent could be committing a criminal offence.

Notification and consent is required for the installation of water fittings in connection with:

- the construction of buildings or structures in any premises;
- extensions or alterations of water systems in all premises other than houses;
- a material change of use of any premises;
- the installation in any premises of specified items. These include:
 - a pump or booster drawing more than 12 litres per minute;
 - a water treatment unit which produces a wastewater discharge or which requires the use of water for regeneration or cleaning;
 - a reduced pressure zone (RPZ) valve or other mechanical device for backflow protection against a fluid which is in Fluid Category 4;
 - a garden watering system (except one designed to be operated by hand);
 - the construction of a pond or swimming pool over 10,000 litres capacity, designed to be replenished automatically with water supplied by a public water supplier.

What details have to be provided?

The railway premises owner, the leaseholder or tenant, the installer or someone acting on their behalf can send notification to the local Water Supplier. To assist administration some water suppliers prefer or require Notification on their own form.

The details required are:

- a. The name and address of the person giving notice and, if different, the name and address of the person to whom the consent should be sent.
- b. A description of the proposed work or any significant change of use of the railway premises.
- c. The location of the relevant part of the premises and its use or intended use.
- d. A plan of those parts of the railway premises which relate to the proposed work and a diagram showing the pipework and fittings to be installed.
- e. If an Approved Contractor* is to do the plumbing work, the Approved Contractor's name and address.

*(*See Section 10.2 below for the benefits of using Approved Contractors.)*

The Water Supplier's consent

The Water Supplier has ten working days from the day of receipt in which to either refuse consent or to grant it, with or without conditions. If response is not made by the Water Supplier within the ten working days, consent is deemed to have been granted and the work can start, but the installation must be still comply fully with the regulations.

10.2 Approved contractors

The regulations encourage suitably qualified installers to be accredited as Approved Contractors (also known as Approved Plumbers) by the Water Supplier or other recognised organisations.

An Approved Plumber will give the customer and the water supplier a certificate stating that the installation work he or she has done complies with the regulations. In the event of breaches of the regulations in connection with the certified work, the owner or occupier can use the certificate as a legal defence against any resulting prosecution.

An Approved Plumber is permitted to undertake work on extensions or alterations of existing systems without prior consent, which can assist in the flexibility of timing in projects of this type and simplify the administration.

Some Water Suppliers operate their own Approved Plumbers schemes, but most support the national Water Industry Approved Plumbers Scheme (WIAPS), whose members have demonstrated their experience of plumbing work and knowledge of the regulations and have liability insurance cover.

Further information and a list of Approved Plumbers who are available for work is available from your Water Supplier and a list of Approved Plumbers is freely available on the WRAS website.

10.3 Requirements for water fittings

The regulations require that all water fittings are of an appropriate quality and standard and are suitable for the circumstances in which they are used. Fittings must be made of suitable materials which will resist corrosion and will not contaminate the water supply. They must be designed and made to be sufficiently robust to have an adequate service life without failing or leaking prematurely. To achieve this they must be manufactured to meet relevant European or British Standards or the Government's Performance Specification.

Approved fittings

Fittings which have been extensively tested against the Government's Performance Specification and are approved by the Water Supply Industry are listed in the WRAS Water Fittings and Materials Directory. Use of WRAS Approved Products, fitted in accordance with any approval conditions, should comply fully with the regulations and be readily accepted by the Water Suppliers' enforcement staff.



Water fittings with the British Standards 'Kitemark' which are manufactured to certain relevant British Standards which include the requirements of the regulations are accepted as complying with the regulations and require no further testing. A list of these is also given in the Water Fittings and Materials Directory.



If you are unsure about the acceptability of any water fitting, consult your local Water Supplier.

10.4 Water saving

Toilets (WCs) installed in premises (i.e. excluding trains) since January 2001 must have a maximum permitted flush volume of 6 litres, compared with the previously allowed 7.5 litres. Dual flush is permitted, using up to 2/3 the volume of the full flush. These changes, coupled with the introduction of drop valves, flap valves and pressure flushing valves as alternatives to the syphon as flushing devices, offer potential for saving water. WCs must comply with the Government's Performance Specification. Equipment specifiers and installers should ask manufacturers or suppliers to provide evidence of this in the form of a certificate of compliance.

Regulations also specify for urinals the maximum amount of water which may be used for flushing, the rate of filling and the 'out-of-hours' control of automatic flushing.

Water saving is also possible using efficient, low-volume, self-closing spray taps in washbasins and by using appropriate flow control devices for other water using appliances such as automatic flushing urinals.

11. Further Information and Advice

Your Local Water Supplier

Your local Water Supplier will respond positively to enquiries about existing and proposed water supply system installations and may be able to provide helpful advice on the application of the regulations. Regulations department contact details are on the WRAS website (www.wras.co.uk). The department can also be contacted via the Water Supplier's call centre whose number is given in telephone directories under Water.

The Water Regulations Advisory Scheme (WRAS)

WRAS is funded by all the UK Water Suppliers to publicise the regulations and to promote consistent interpretation of them and it offers an enquiry service for those who seek further information. Recent Water Industry interpretations of the regulations and copies of all the current advice leaflets can be printed from the WRAS website (www.wras.co.uk), which also gives information about publications including the Water Regulations Guide and the Water Fittings and Materials Directory. There are also links to the wording of the regulations and Government Guidance documents, which can be downloaded or printed. The website has contact details for the Water Suppliers' regulations departments and addresses to which you should send notifications. The Water Industry Approved Plumbers Scheme is described and contact details of Approved Plumbers are given.

References

The Water Supply (Water Fittings) Regulations 1999: Statutory Instruments SI 1999 No.1148 and 1506. The text is available from the Government website (*see below*).

Government Guidance Document relating to Schedules 1 and 2 of the Water Fittings Regulations, available from the Government website: www.defra.gov.uk/environment/water/industry/wsregs99/guide

Scottish Water Byelaws 2004: Copies available from Scottish Water.

The Water Regulations Guide gives the text of the Water Fittings Regulations, Scottish Water Byelaws, Government Guidance to the Regulations and the Water Industry's recommendations for complying with the regulations. It is published by and available from WRAS.

The Water Fittings and Materials Directory lists products which have been tested and approved by the Water Suppliers for their compliance with the regulations. It is available on the WRAS website.

12. Addresses

The Water Regulations Advisory Scheme (WRAS)

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The text of this Guide is included in the Publications section of the WRAS website and further copies may be obtained from the Water Regulations Advisory Scheme at the address given above or from your local Water Supplier.