SECTION 7

POINT OF USE/POINT OF ENTRY TREATMENT

Section Contents

Private Water Supplies

SECTION 7

SUMMARY 7.1 – 7.5

7.1 Introduction

A point of use (POU) device is any form of water treatment apparatus within a householder's premises, normally at the point of supply. Usually, only water for drinking and cooking is treated, so the householder must be made aware of the need to use the dedicated tap.

Point of use devices for small water supplies may need appropriate pre-treatment, and careful attention must be paid to maintenance.

7.2 and 7.3 Point of entry and point of use systems

Both are either single or multiple units, used to purify water by the removal of solids, chemicals and disinfectants. Point of entry (POE) systems are located outside the premises; point of use systems within, normally at the kitchen sink. However, the main difference is that in most POU systems, water cannot be stored following treatment.

7.4 Considerations of point of use treatment

In private water supplies, two or more systems will usually be needed, e.g. UV disinfection would need a pre-filter to remove turbidity.

7.5 Particulate filters

Particle filters can reduce turbidity and micro-organisms, or remove specific inorganic particulates like iron, aluminium or manganese compounds. Many are incorporated into proprietary point of use devices to protect subsequent processes such as activated carbon filtration, reverse osmosis or UV disinfection.

Filter replacement is after a specific time or volume depending on the quality of water being treated. Some filters have silver to prevent or inhibit bacteria. Hard water may block the device, and manufacturers' advice should be sought.

7.6 Reverse osmosis (RO) units

RO units will remove e.g. sodium, calcium, nitrate and fluoride, as well as pesticides, solvents and pathogens, but raw water supplies will usually require pre-treatment.

The RO membrane needs chemical cleaning, usually after several years, and periodic disinfection of the storage tank is recommended.

Water treated by RO will generally be very soft and will have insufficient fluoride to protect against dental caries, but this may be the only practicable means of rendering water potable. Some units have a 're-hardener' system.
RO also tends to waste water, but there may be no alternative.

7.7 Nitrate removal units

Ion exchange can be used to remove nitrate ions from water. However, excessive chloride concentrations could result and lead to corrosion of pipework and fittings.

Also, where this treatment is applied to a source with unsatisfactory bacteriological quality, it will be necessary to provide a disinfection stage after the resin.

7.8 Adsorption filters

Activated carbon - Granular activated carbon (GAC) is the most common medium employed although powdered activated carbon (PAC) and block carbon are also used.

Activated carbon filters will remove (to varying degrees) suspended solids, chlorine and organic contaminants, but their effectiveness can be limited by POU devices.

There is also concern that direct consumption of water from activated carbon devices may cause health problems due to bacteria from them.

Activated alumina filters - can remove arsenic and other chemicals, including fluoride.

7.9 Water conditioners

Ion-exchange softeners – necessitate a separate unsoftened drinking water supply.

'De-alkalisation' can also soften water, and resins are available as disposable cartridges that must be replaced as recommended by the manufacturer.

Chemical water conditioners – can reduce scale formation, and can be installed under mains pressure, but a disinfection stage may also be needed.

Physical water conditioners – generate magnetic or electrical fields or release trace concentrations of zinc or other metals, causing the calcium salts to encrust less. However, these devices are not proven, and they may also need a disinfection stage.

7.10 Disinfection units

Ultraviolet irradiation – POU units are available for domestic use. They should be as close as possible to the drinking water tap and are most effective with water of low colour and turbidity. Manufacturers' guidelines must be closely followed.

Chlorination – generally unsuitable for point of use treatment.

Ozonation – small package ozone units are available for a single home or business.

Combination devices – include a pre-treatment so the POU device can be effective.

7.11 Maintenance requirements

Regular maintenance is essential for safe drinking water. Manufacturers' maintenance instructions are a minimum requirement, since they may assume the equipment treats mains drinking water, while raw waters for private supplies will always be of worse quality than this.

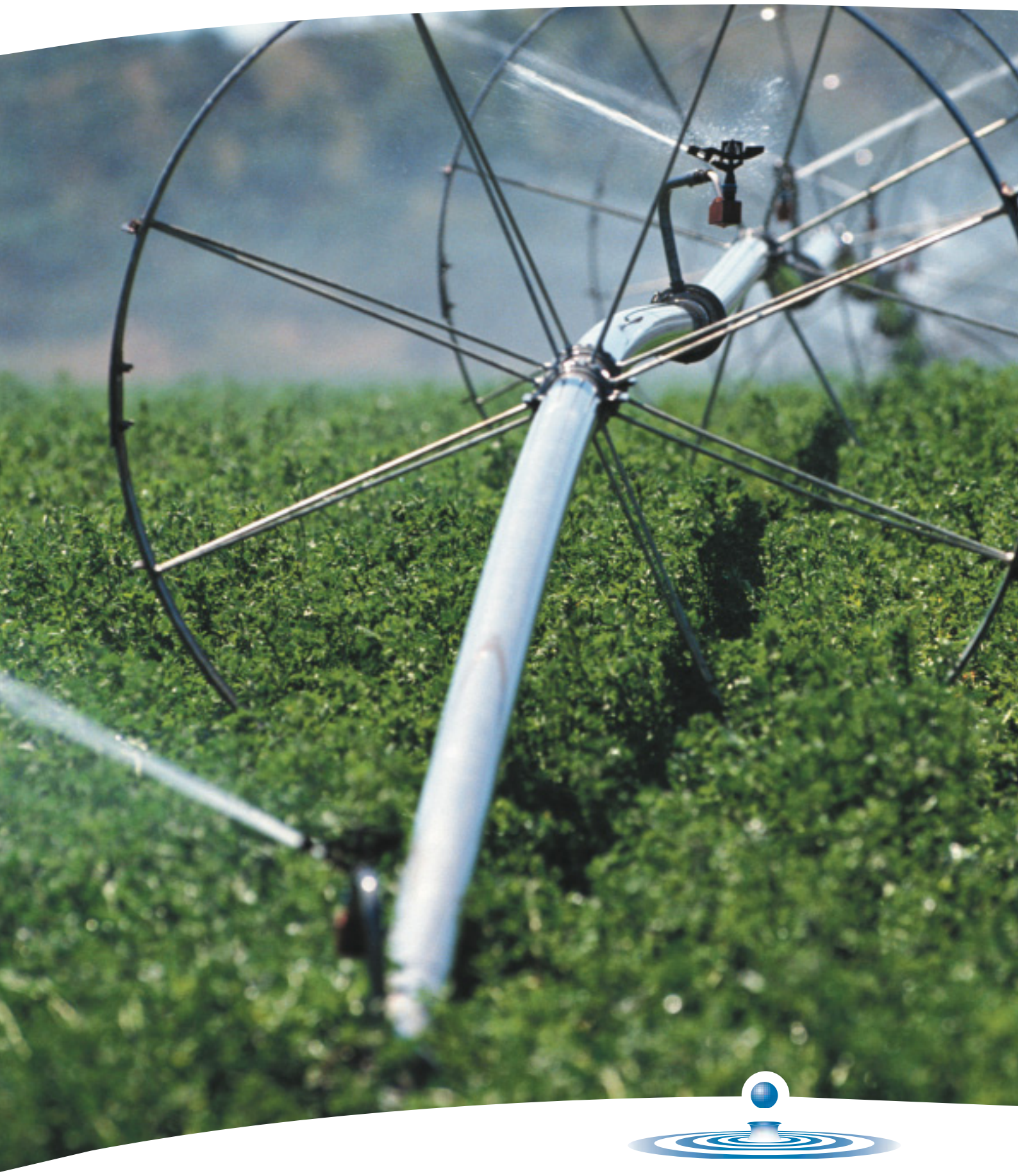
Key points to observe include disconnecting power before servicing; changing filter cartridges regularly and using special care to replace and clean UV lamps.

7.12 Quality assurance of point of use devices

Background – protocols have been produced for evaluating water treatment units.

NSF standards – developed by an independent, not-for-profit organisation working with manufacturers, users and regulators.

The test protocols – only products that conform to the test protocols or relevant (e.g. NSF) standards should be used for treatment of drinking water.



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7 POINT OF USE/POINT OF ENTRY TREATMENT

7.1 Introduction

A point-of-use device is any form of water treatment apparatus that may be installed or used by a householder within his premises and normally at the point of supply. A point-of-use device may be installed before the householder's tap (plumbed in-line or otherwise attached to the water pipe), connected to the tap by an adapter or separate from the plumbing system (such as a free-standing gravity filter). These devices handle relatively small volumes and it is usual for only water used for drinking and cooking to be treated. The treated water is supplied to a separate tap. It is important that the householder is made aware of the need to use the dedicated drinking water tap. Moreover, point of use treatment may not be appropriate if the untreated water would pose a risk to health if used for bathing or washing. In any case, it may be necessary to consider the possibility of providing an alternative supply, rather than attempting to improve a supply of inferior quality.

Some point of use devices have been designed and developed to provide additional treatment to mains water, although equipment designed for use with raw water sources is available. The manufacturers' recommendations regarding installation and maintenance are often based on arbitrary assumptions that take no account of the quality of individual water sources. In some cases quality typical of municipally treated water supplies is assumed. Recommendations concerning the replacement of filters are often vague and maintenance requirements may be underestimated. If the quality of water to be treated is poorer than mains water, maintenance requirements will be increased.

Contaminants in a raw water source may be present at higher concentrations than in a public supply and may affect the performance of some point of use devices. For example hardness compounds may precipitate on filters and membranes and iron and manganese compounds may deposit on UV tubes. Some manufacturers of point of use devices incorporating activated carbon specifically state that their devices should not be used on waters that are microbiologically unsafe or of unknown quality.

The foregoing observations do not rule out the application of point of use devices to small water supplies but appropriate pre-treatment may be required and careful attention must be paid to maintenance of the device. Where there is any doubt as to the effect of water quality on the performance of a point of use device, water quality data should be obtained and expert advice on the applicability of the device should be taken.

7.2 Point of entry

This is best described as a system, either a single unit or multiple units, which is used for the purifying of water by the removal of solids, chemicals and disinfectants.

It is important to remember that the point of entry system is located outside the premises and can, in fact, be some distance from the premises.

Depending on the system used the water may be stored after use. Table 7.1 details point of entry treatment systems.

7.3 Point of use system

This is best described as a system, either of a single or multiple units, which is used for the purifying of water by the removal of solids, chemicals and disinfectants.

The difference with the point of use treatment is that it is located within the premises, normally at the point of supply i.e. kitchen sink.

The main difference, however, is that in most points of use treatment, water cannot be stored following treatment.

Table 7.1 Point of entry treatments

Type of Treatment	Description	Removal of Parameters	Uses	Advantages	Disadvantages	Cost
Coagulation and flocculation.	The addition of chemical coagulant causing floc or precipitate which entraps impurities.	Turbidity, algae, iron, aluminium, solids.	Mostly on large scale private water supplies.	One of the best methods of removing algae. Does not require power supply.	Operational difficulties, knowledge of system, disposal of sludge, does not kill bacteria.	Relatively high.
Sedimentation (storage and settlement).	Water stored in a suitable tank or chamber where the reduced velocity of the flow allows particulate to settle out.	Solids, turbidity, colour.	Excellent system for small scale supply.	Will remove the majority of suspended solids; usually requires cleaning annually. Does not require power supply.	Contamination from ground water if installed incorrectly, does not kill bacteria.	Relatively low.
Screens.	Various sizes of screens and microstrainers.	Particulate material and debris.	Useful for supplies fed from surface water run offs eg streams, small lochs.	Useful for removal of particulate material. Does not require power supply.	Requires cleaning during parts of heavy use. Does not kill bacteria.	Relatively low.
Sand Filters.	Various types of sand filters available – slow sand filters rapid gravity sand filters & pressurised sand filters.	Removal of floc in conjunction with coagulation and flocculation, turbidity, colour, algae and some micro-organisms.	Can be used in some areas to treat upland surface waters. Has got potential for treatment of small scale supplies.	Will remove the majority of suspended solids and also excellent for removing algae.	Some operational difficulties, knowledge of systems, does not kill bacteria. Some require power supply.	Medium to expensive.

Table 7.1 Point of entry treatments (Cont'd)

Type of Treatment	Description	Removal of Parameters	Uses	Advantages	Disadvantages	Cost
Gravel Filters.	Water run through a tank containing gravel beds of different sizes of gravel.	Removal of turbidity, colour and algae.	Excellent system for small scale supplies.	Filters may only require cleaning once over several years. Does not require power supply.	Matching size of filter with flow rate.	Relatively low.
Chemical removal oxidation, ion exchange, reverse osmosis after ultra, micro and nano filtration.	Removal or iron, maganese, taste, odour and nitrate.	As per specific systems.	From small scale supply to larger.	Excellent systems for removal of specific chemicals.	Knowledge of system and also contamination of system from bacteria. Some require power supply.	Relatively low to relatively expensive.
Disinfection Chlorine.	Application of chlorine by use of various methods to disinfect the supply.	Pathogenic bacteria.	Suited to large scale supplies.	Residual effect excellent for stored waters.	Operational difficulties, knowledge of system. Requires power supply.	Relatively high.
Disinfect Ozone.	Disinfection of the water supply using ozone.	Pathogenic bacteria and viruses, ozone may also reduce colour, taste and odour.	Larger scale supplies.	–	Operational difficulties, knowledge of system. Requires power supply.	Exceedingly expensive.
Disinfection UV Radiation.	The passing of UV light into the water.	Pathogenic bacteria and viruses.	Excellent for small scale supplies.	Simple to operate.	Required power supply.	Relatively cheap.

Table 7.1 Point of entry treatments (Cont'd)

Type of Treatment	Description	Removal of Parameters	Uses	Advantages	Disadvantages	Cost
pH Control.	The passing of water through substances which will either increase or reduce the pH.	pH alteration.	From small scale supplies to large supplies.	pH control which affects other systems prevents plumbosolvency. Does not require power supply.	Does not kill bacteria.	Relatively cheap.

Table 7.2 Point of use systems

Type of Treatment	Description	Removal of Parameters	Uses	Advantages	Disadvantages	Cost
Particulate Filters.	Filters of pleated paper, woven cartridges, resin bonded cartridges or ceramic candles.	Particulate matter and inorganic particles.	Usually used to protect another point of use device such as UV disinfection.	Excellent for removing particulate matter.	Prone to blockage, can contaminate water with bacteria as bacteria can grow within the filters.	Relatively low to medium.
Activated carbon filters.	Utilisation of activated carbon to absorb suspended solids and other chemicals.	Suspended solids, turbidity, colour, taste, odour, chlorine, particulates, THMs.	Excellent system for removal of listed parameters and to protect other point of use systems.	Best method for removing listed parameters in small scale supplies.	Bacteria growth within the filter which can result in contamination of water supply.	Low to medium.
Reverse Osmosis Units.	The removal of contaminants by use of the reverse osmosis process.	Solids, turbidity, colour and to varying degrees, inorganic and organic chemicals.	Mostly for medium size private water supplies.	Excellent system for removal of most organic and inorganic substances.	Wastes a great deal of water. Reduces the hardness and alkalinity to unacceptable levels.	Medium to relatively high.
Anion exchange units.	The removal of ions using the anion exchange or the cation exchange method.	Used for the removal of calcium, magnesium and nitrate.	Small scale to large supplies.	Excellent system for removal of nitrates.	Regeneration requires to be carried out, softened water could have elevated sodium levels.	Low to medium.

Table 7.2 Point of use systems (Cont'd)

Type of Treatment	Description	Removal of Parameters	Uses	Advantages	Disadvantages	Cost
Disinfection unit (UV).	The passing of the UV radiation through the water to kill bacteria.	Removal of bacteria.	Small to large scale supplies.	Effective for the killing of pathogenic bacteria.	Requires continuous maintenance and bulb replacement mains supply.	Low to medium.

7.4 Considerations of point of use treatment

Some point of use devices are designed specifically to augment mains supply by the removal of chemicals such as chlorine.

In private water supplies where the condition of the water falls below that of the public supply, problems can be encountered with devices not operating correctly due to the vast quantities to be removed or the addition of such other contaminants which affect the capability of the unit. These results mean usually having to provide two systems or more to ensure effectiveness of the system. In particular, if water supplies with a high turbidity and colour are to be disinfected by UV radiation, a pre-filter will require to be fitted to remove turbidity and colour as the UV radiation is ineffective in highly coloured and turbid waters.