Water Use

Regulatory Method (WAT-RM-12)

Discharges from Water Treatment Works

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Update Summary

Version	Description
1.0	First issue for Water Use reference using approved content from the following documents: *WAT-RM-12_Discharges_from_WTW_and_Water_Supply_System_rev2* *Water_Treatment_Works_and_Water_Supply_System_guidance*
v1.1	Doc Reference revised to *WAT-RM-,* etc
v2.0	New base template applied, links to docs revised for new SEPA website, Nov 2008
v2.1	Note added to Section 2.1 regarding Domestic WTWs
v3.0	SW Water Hygiene Code of Practice clarification, Section 6.1.2 Note on PACs added
v3.1	Table 2 updated to 2009 SG Direction
v4.0	Minor edits to reflect changes from new Standards Directions 2014
v4.1	Update to clarify understanding of s6.1.2 Aluminium, WAT-SG-02 added to refs

Notes:
References: Linked references to other documents have been disabled in this web version of the document. See the References section for details of all referenced documents.
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Always refer to the online document for accurate and up-to-date information.

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1. Key Points

This document outlines the regulatory approach to control discharges from Water Treatment Works and water supply systems.

A Water Treatment Works may have associated water abstraction, resource management and impoundment issues. These issues should be considered by SEPA and the relevant guidance referred to.

This guidance provided in this document should be read in conjunction with:

- *WAT-RM-01: Regulation of Abstractions and Impoundments*
- *WAT-RM-05: Regulation of Trade Effluent Discharges to Surface Waters*
- *WAT-RM-06: Regulation of Trade Effluent Discharges to Groundwater*
- *WAT-RM-21: Allocation of Capacity and Protection of the Water Environment*
- *WAT-RM-28: Modelling for Water Use Activities*
- *WAT-SG-53: Environmental Quality Standards and Standards for Discharges to Surface Waters*

2. Introduction

2.1 Summary

Discharges from a water treatment works and water supply systems arise from a range of activities associated with the process of producing potable water such as; filter backwashing, treatment plant reject stream, cleaning of pipes and storage systems and emergency discharges.

SEPA considers that routine discharges to the water environment from the water treatment works, normally associated with clarification process, are 'activities liable to cause pollution' and SEPA will therefore require a licence for such discharges. SEPA will include occasional discharges from site operations at the water treatment works within the water use licence for the site. Low risk, occasional discharges will not require site specific conditions, however higher risk discharges may require site specific conditions within the licence to control the discharge.

SEPA will not normally licence occasional discharges from the water treatment works and water supply systems which are undertaken in accordance with Scottish Water's *Water Hygiene Code of Practice* or the *Water (Scotland) Act 1980*, as steps should have been taken to prevent pollution (e.g. removal of chlorine). However, where SEPA considers that the activity is liable to cause pollution then it will require to be licensed.

This method of regulation recognises the public health implications of water supply and other legislation or codes of practice controlling the industry.

A water treatment works may have associated water abstraction, resource management and impoundment issues. These issues should be considered by SEPA and relevant guidance referred to. All activities undertaken on a site should be included within the site water use licence.

NOTE: Domestic WTWs
Domestic water treatment systems have backwash discharges which can contain potentially polluting substances. Such small scale discharges should be registered as inorganic discharges. N.B. However if the discharge enters a treatment system such as a septic tank, then no separate authorisation is required.

2.2 Water Treatment Process

Treatment of abstracted water to potable standards normally consists of the following stages. The process is often simplified at small works with high quality sources. Additional stages can also be added for poor quality high risk waters.

1. Screening
   Leaves, twigs and any large debris are removed by screens.
2. Clarification
   Removal of suspended and colloidal matter.

a) A chemical coagulant may be added at this stage.
The main coagulants used are aluminium sulphate, iron salts and poly-electrolytes. This reacts with the water to form floc, which settles and carries any suspended particles with it. The floc also traps bacteria and absorbs colour, and as it settles it forms a sludge which is removed for disposal leaving behind a clarified water.

b) Most treatment works have to filter their water. Filters are commonly sand or anthracite or activated carbon. More modern technology may use membrane as a filtration step e.g. reverse osmosis, nano filtration, micro filtration, which separates dissolved substances from water by forcing the water through a membrane. Membrane technology removes virtually all substances including heavy metals, bacteria, cysts and viruses.

3. Disinfection
By chlorination, chloramination, ozonation or UV. Chlorination is used as the primary disinfection process for the public water supply system. Chloramination may occasionally be used as an alternative form of disinfection to chlorination. SEPA considers that the environmental risk from the use of chloramines is comparable to that from chlorine.

4. pH correction
Lime (calcium hydroxide) is added to make the water less acidic and less corrosive to metal pipes.

The treated water is then stored in large clear water tanks and man-made lakes (service reservoirs) prior to distribution in the potable water supply system to consumers.

Discharges from the water treatment works and water supply systems may contain pollutants such as suspended solids, chlorine, aluminium, iron or polyelectrolytes which can pose a risk of pollution of the water environment.

3. Authorisation Requirements

3.1 Routine Discharges

This section covers routine discharges from the Water Treatment Works.

SEPA considers that routine discharges to the water environment from the water treatment works are 'activities liable to cause pollution' under Section 20(3) of the *Water Environment and Water Services (Scotland) Act 2003* (WEWS).

SEPA will therefore licence such discharges, which are normally associated with the clarification process of removal of suspended and colloidal matter, e.g. backwash water and reject water. The content of the discharge will depend on the treatment process described in the *Introduction* section of this guidance. The most common discharges will be in service backwash water of filters and reject water. There should be no routine discharges of treated (chlorinated) water from a water treatment works.

Refer to section 3.2 for guidance on occasional discharges from a water treatment works or supply system.

SEPA's preferred hierarchy for disposal of backwash water and reject water, dependent on content and volume, is to:

1. Sewer
   (Scottish Water responsible for authorising)
2. Soakaway
   Assessment of a discharge to a soakaway should be undertaken in accordance with the guidance in *WAT-RM-06: Regulation of Trade Effluent Discharges to Groundwater*.
3. Water environment
   Routine discharges from the water treatment works to the water environment should be assessed in accordance with the guidance in *WAT-RM-05: Regulation of Trade Effluent Discharges to Surface Waters* and *Assessment of Receiving Waters* section of this guidance.

However, the disposal route may depend on the treatment process. For example, membrane treatment produces a large volume waste stream which may be more beneficial to return to the watercourse.

3.2 Occasional Discharges

This section covers occasional discharges from the Water Treatment Works and the Water Supply System.

There are many occasional discharges from the water supply systems (pre and post treatment), most of these rarely operate and cause no appreciable damage. They may occur during maintenance and construction and represent one-off discharges, others result from site operations leading to more predicable discharge frequencies e.g. safety showers, automatic monitors.

SEPA will not normally licence occasional discharges from the water treatment works and water supply systems which are undertaken in accordance with Scottish Water's *Water Hygiene Code of Practice* or the *Water (Scotland) Act 1980*, as steps should have been taken to prevent pollution (e.g. removal of chlorine). However, where SEPA considers that the activity is liable to cause pollution then it will require to be licensed. Scottish Water will be expected to contact SEPA where they are considering undertaking an activity which may be liable to cause pollution.

Polluting discharges that are the result of failure to manage and maintain the system appropriately would be classed as unauthorised discharges and appropriate enforcement action taken.

Consequently, it is important to devise a regulatory approach which allows the most effective use of the regulatory options available. The following guidance is provided.

3.2.1 Discharges Arising from Construction, Maintenance etc

The *Water (Scotland) Act 1980*, Section 33 (1), allows a water authority,…. "who are carrying out or are about to carry out the construction, alteration, repair, cleaning or examination of any reservoir, well, borehole, line of pipes, or other work forming part of their undertaking" to discharge water into any available watercourse.

The Water Authority must comply with the relevant subsections of Section 33 which defines the conditions under which a legal discharge may occur.

- s33 (3) - except in emergency and except insofar as may be otherwise agreed in writing….the water authority shall …

  a) give notice to any fishery district and SEPA (via Schedule 10(9) of NHS Act 1991) if the pipe is greater than 9".

  b) have due regard to any representations .

- s 33(9) - the authority shall take all necessary steps to secure that any water discharged by them under the provisions of this section shall be as free as reasonably practical from mud and silt, from solid, polluting, offensive or injurious matter and from any matter prejudicial to fish or spawn or to spawning beds or food of fish.

SEPA considers that discharges which result from construction or maintenance work can be adequately controlled via the conditions required in Section 33 of the *Water (Scotland) Act 1980* and Scottish Water's *Water Hygiene Code of Practice*. Licensing should only be considered in those circumstances where SEPA considers that the activity is liable to cause pollution, such as regular discharges to sensitive waters (e.g. low dilution, potential impact on Protected Area). It may be appropriate to issue a definition of the minimum requirements for types of activity covered by s33. This would constitute SEPA's view of "all necessary practicable steps". It

would be important to ensure that any definition clarified or extended the interpretation and could not be used to restrict the meaning of the Act.

SEPA would expect any discharge made under this Section 33 to be made under such arrangement so that:

- Non-polluting
  The discharge shall not cause pollution of the water environment (as defined under Section 20 of WEWS)
- Maximum dispersal
  The outlet shall be constructed and maintained so as to maximise the dispersion of effluent
- No discolouration
  The discharge shall not cause significant visible discolouration of the receiving waters by the effluent plume
- No destabilisation
  The discharge shall not result in the destabilisation of the banks or bed of the receiving water or flooding

The following are examples of occasional discharges associated with construction or maintenance:

Examples

Operation of Raw Water Reservoir Scour Valves

This is required periodically for safety checks and also to prevent build-up of silt. Such discharges should be made in line with the provisions set out in *Discharges Arising from Construction, Maintenance etc* above.

It may also be necessary to empty the reservoir to allow maintenance/refurbishment. This is potentially a polluting activity as the water may be heavily loaded with sediment and at a different temperature to the watercourse downstream. SEPA would require that steps are taken to prevent pollution downstream.

Such activities should be controlled under conditions within the licence for the impoundment.

Granulated Activated Carbon Residues - Initial Backwash Waters

Fines from the commissioning of granulated activated carbon plant which could cause impact on the receiving water should be eliminated from any discharges from the site. This would normally be achieved by collection of initial backwash waters followed by adequate on-site treatment or off site disposal or discharge to the foul sewer. Alternative approaches may be used, provided the discharger is able to satisfy SEPA that the effluent will be of adequate quality to protect the environment.

Service Reservoir / Clear Water Tank Cleaning

Service reservoir and clear water tank cleaning can generate large volumes of water during draining which could result in rapid flow in small streams, scouring of the bed and banks and high levels of suspended solids. The presence of chlorine in the final wash water after cleaning could also cause pollution.

Such discharges should be undertaken in accordance with Scottish Water's 'Water Hygiene Code of Practice', and a discharge to a watercourse should only be made where the chlorine content does not exceed than 0.1 mg/l. Depending on the sensitivity of the watercourse and dilution available, a lower chlorine residual may be required. Wash water containing sludges or chemical residues must not be discharged to a watercourse and alternative measures must be taken to remove them from the site.

SEPA would expect to be notified in advance of such activities and a rate of discharge agreed.

3.2.2 Occasional Discharges from Site Operations

SEPA will normally include occasional discharges from site operations at the water treatment works within the water use licence for the site. Low risk, occasional discharges will not require site specific conditions, however higher risk discharges will require specific conditions to control the discharge within the licence. Specific conditions should only be included where monitoring or sampling is anticipated. In other circumstances a "no environmental harm" condition should be imposed. At small sites there may be occasional discharges, e.g. small discharge to land, over which no control is required to prevent pollution of the water environment. In such cases the activity will not be authorised.

Examples

The following are provided as examples of the appropriate level of regulation of occasional discharges. This approach will provide a consistent and effective means of regulating treated-water discharges while minimising the administrative effort:

Safety Showers

Showers must be provided at WTW sites. They will discharge during routine testing (approximately fortnightly) and following an incident when treated water & any chemical residues will be released.

Preferred regulatory options:

- Discharge to public foul sewer
- The flow should pass to the effluent (backwash) line.
- The flow should be directed onto land.

If these options are not possible then:

- Dilution >500:1
  If the dilution of the maximum discharge flow under 95%ile exceedance river flows is greater than 500: 1 then the activity should be included within the licence but no specific conditions will be required.

- Dilution <500:1
  If the dilution is less than 500:1, then specific conditions requiring a flow limiting device, restricting non-emergency discharges to a suitable time of day (for inspection) and restricting the duration of the discharge. Where necessary the provision and maintenance of neutralisation equipment should be defined. The licence should require the keeping of a maintenance record.

Automatic monitors

Free chlorine monitors are used to monitor the free chlorine residual in the water supply line. These units may discharge up to 5 litres per minute.

Preferred regulatory options:

- Discharge to public foul sewer
- The flow should pass to the effluent (backwash) line.
- The flow should be directed onto land.

If these options are not possible then:

- Dilution >500:1
  If the dilution of the maximum discharge flow under 95%ile exceedance river flows is greater than 500: 1 then the activity should be included within the licence but no specific conditions will be required.

- Dilution <500:1
  If the dilution is less than 500:1 then specific conditions requiring a flow limiting device and, where necessary, the provision and maintenance of neutralisation equipment. The licence should require the provision of the maintenance record.

Emergency Discharges

Emergency overflows within the water supply system may operate in situations covered by the statutory defences defined under s33 of the Water (Scotland) Act. Conditions of s33, detailed in *Discharges Arising from Construction, Maintenance etc* above, still apply to discharges.

SEPA is currently discussing with Scottish Water the potential for a code of practice for methods for disposal of process waters in the event of a cryptosporidium incident at a water treatment works.

However, in other cases emergency overflows may occur under circumstances where the statutory defences would not apply. For example,

power failure, mechanical or electrical breakdown of plant may lead to discharges of treated water, which could cause pollution of the water environment.

SEPA shall include conditions within the site licence requiring the water treatment process to be operated and maintained in accordance with best practice so that it remains fully operational, except at times of unavoidable mechanical or electrical breakdown. SEPA will require all reasonably practicable means to avoid uncontrolled discharges of treated water during plant breakdown. There should be a requirement within the site licence to notify SEPA of any breakdown which results in unauthorised discharges from the site.

4. Assessment of Receiving Waters

As described in the previous sections, SEPA will licence routine discharges from the water treatment works and will also include occasional discharge from site operations at the water treatment works within the site licence. Low risk, occasional discharges will not require site specific conditions, however higher risk discharges may require specific conditions to control the discharge within the licence. SEPA may also decide to issue a licence for other occasional discharges to sensitive waters (e.g. low dilution, potential impact on protected area).

The water treatment works process will determine the constituents of the discharge. The first step in licensing a discharge is to define the water quality requirements of the receiving waters and the dilution available for the discharge. The catchment should be screened for any protected areas.

Refer to *WAT-RM-21: Allocation of Capacity and Protection of the Water Environment* and *WAT-RM-28: Modelling for Water Use Activities* for details.

Refer to the *Standards* section below for details of the relevant environmental quality standards or emissions standards to be met.

5. Determine Licence Conditions

Use *WAT-TEMP-18: Water Treatment Works Licence Template*.

According to the treatment process in question the licence should include relevant conditions (including descriptive) to limit the impact of the following:

- pH
- Suspended solids
- Aluminium/Iron/Polyelectrolyte residuals
- Chlorine
- Granulated Activated Carbon fines

Licence conditions should be set to ensure the discharge does not contribute to deterioration in water quality class, failure of any water quality standards or compromise achievement of the objectives of the Water Framework Directive.

Standards for determinands, other than suspended solids and pH, should be included only where an environmental need is identified. Numeric standards should only be included where the discharge will be included on SEPA's annual monitoring plan and routine inspections or sampling is anticipated.

Licences should also include conditions on maximum volume and rate of discharge.

All water use activities associated with the site should be included within the site licence, e.g. water abstraction, resource management and impoundment issues.

6. Standards

These standards are recognised as interim values and may be subject to modification as further data becomes available. They should be applied having regard to designation of the receiving water and environmental need.

Chlorine, iron and aluminium have been identified as Specific Pollutants from the indicative list of main pollutants in the Water Framework Directive. This guidance may therefore be amended or reviewed in light of developments arising from transposition of the Water Framework Directive's requirements, particularly in relation to development of environmental quality standards for Specific Pollutants.

6.1.1 Suspended Solids

Suspended solids discharged from water treatment works and supply system can cause aesthetic and environmental problems in some receiving waters. EQS values are difficult to establish and monitor because of flow dependency, and also because of widely differing background levels between different catchments. Accordingly a default licence standard of 100 mg/l has been identified. Where local conditions of poor dilution and aesthetic or environmental problems are important, more stringent standards may be applied.

Equally, however, it is recognised that significant costs should not be driven by this parameter in the absence of environmental/aesthetic need, and more relaxed standards may be applied where no such need exists, and where the achievement of the 100 mg/l standard would impose additional cost.

6.1.2 Aluminium

N.B. Poly-aluminium chloride (PAC) should be assessed according to this section and not section 6.1.3 Polyelectrolytes below.

Aluminium is acutely toxic to fish when there is the potential for precipitates to form in the receiving water, and may be chronically toxic in its dissolved form.

Reactive forms of aluminium in watercourses may be reduced by precipitation and complexation by dissolved organic matter in natural waters. Control of aluminium is therefore likely to be most important where pH differences between discharges and receiving waters are likely to cause precipitation, and also where dissolved organic carbon concentrations are low in the receiving water.

Environmental Quality Standards have been set for aluminium on the basis of "reactive aluminium". "Reactive aluminium" is considered to be the most toxicologically relevant form of aluminium in waters. Whilst these standards are useful for assessing the state of the environment, in particular assessing the potential toxicity of aluminium to aquatic life, they are not considered to be useful for numeric licence discharge quality standards.

Aluminium is a specific pollutant under the Water Framework Directive and UK standards are currently being derived.

In the meantime, where it is considered that a numeric discharge quality standard for a new discharge containing aluminium is required, an EQS of 1mg/l dissolved Aluminium should be used. This level of dissolved aluminium is expected to provide an adequate level of protection in the majority of watercourses. Under conditions of low pH and low concentrations of dissolved organic carbon more stringent standards may be required. It is recommended that where the pH of the receiving water is less than pH 5.5 and the concentration of dissolved organic carbon is less than 10 mg/l (C) a more stringent standard is applied, or the concentrations of reactive aluminium in the watercourse downstream of the discharge are assessed. A standard of 0.1 mg/l (dissolved Al) is proposed in those cases where pH < 5.5 and DOC < 10 mg/l.

The minimum solubility of aluminium in fresh waters occurs at around pH 6 due to the precipitation of amorphous aluminium hydroxides (e.g. gibbsite). It is recommended, therefore, that discharges containing significant concentrations of aluminium be adjusted to a pH of approximately 6.0 if necessary. This should minimise the possibility of the further precipitation of aluminium upon mixing with the receiving water.

In cases where there is difficulty in achieving the required standard in the watercourse the “Added Risk” approach may be considered. This approach is considered to be potentially applicable to naturally occurring substances (such as aluminium) and considers the contribution of background levels to the exposure. This approach essentially adds the background aluminium concentration to the proposed standard in order to define an acceptable level of aluminium in the environment. It is proposed that the application of this approach is considered on a case by case basis as required. It should be noted that this would require relatively detailed information on background levels of aluminium in the watercourse and consideration of “reactive aluminium” concentrations may be required in some cases. The Environmental Chemistry Unit will provide advice on these issues as appropriate.

Table 1 Summary of EQS standards for aluminium

pH	DOC	Al EQS
>5.5	Not applicable	1 mg/l (MAC)
<5.5	<10 mg/l	0.1 mg/l (MAC)

DOC: Dissolved organic carbon
MAC: Maximum allowable concentration

Existing discharges will not be reviewed to include Aluminium standards until UK (specific pollutant) standards are approved and SEPA has agreed a timetable for review of existing licences.

6.1.3 Polyelectrolytes

Cationic polyelectrolytes are highly toxic to fish through a surface active effect which causes gill damage. Acute toxicity occurs at concentrations as low as 300 µg/l, lower than the practical chemical analytical detection limit of approximately 1 mg/l.

Anionic and non ionic polyacrylamide polyelectrolytes are significantly less toxic (in the range 50 to 100 mg/l) but approximately the same detection limit as cationic forms.

Anionic and non ionic polyelectrolytes are therefore environmentally preferable in areas where water hardness and pH are low because polyelectrolyte activity will persist longer under such conditions and it is necessary to be able to measure authorised concentrations in the effluent for safe environmental concentrations to be demonstrated.

Where it is considered that a numeric discharge quality standard for a new discharge containing polyelectrolyes is required, SEPA's Environmental Chemistry Unit should be contacted to determine appropriate environmental quality standards for use.

6.1.4 Iron

Iron has been identified as a specific pollutant under the terms of the Water Framework Directive. *WAT-SG-53: Environmental Quality Standards and Standards for Discharges to Surface Waters* has the current EQS for iron.

Where SEPA considers there is a risk of precipitation and smothering from particulate iron settlement it may be appropriate to set a MAC for total iron. In such cases, SEPA's Environmental Chemistry Unit should be contacted to determine appropriate environmental quality standards for use.

6.1.5 Chlorine

Chlorine is highly toxic to fish and freshwater invertebrates. Serious environmental damage can be caused by discharges of chlorinated drinking water unless dechlorination is provided or a large dilution is available in the receiving water. Concentrations of total residual chlorine vary within the potable water distribution system: indicative concentrations at treatment works range from 0.3-0.5 mg per litre, while a typical tap concentration is 0.1mg per litre free chlorine.

The pH and temperature of the discharge should be carefully controlled as these affect the toxicity of chlorine. The temperature condition may however be omitted where dilution in the receiving water renders this control unnecessary.

Dechlorination of discharges is typically achieved by sodium thiosulphate dosing. A wide range of dosing equipment and chlorine monitors are

available which can be used to control chlorine concentrations prior to discharge.

WAT-SG-53 has the EQS for chlorine which should be used for determining numeric discharge quality standards where appropriate.

References

NOTE: Linked references to other documents have been disabled in this web version of the document See the Water >Guidance pages of the SEPA website for Guidance and other documentation (http://www.sepa.org.uk/regulations/water/engineering/engineering-guidance/).

All references to external documents are listed on this page along with an indicative URL to help locate the document. The full path is not provided as SEPA can not guarantee its future location.

Key References

- *WAT-RM-01: Regulation of Abstractions and Impoundments*
- *WAT-RM-05: Regulation of Trade Effluent Discharges to Surface Waters*
- *WAT-RM-06: Regulation of Trade Effluent Discharges to Groundwater*
- *WAT-RM-21: Allocation of Capacity and Protection of the Water Environment*
- *WAT-RM-28: Modelling for Water Use Activities*
- *WAT-SG-02: Modelling Continuous Discharges to Rivers*
- *WAT-SG-53: Environmental Quality Standards and Standards for Discharges to Surface Waters*
- *WAT-TEMP-18: Water Treatment Works Licence Template*

Standards

- *Standards Directions 2014*
  - The Scotland River Basin District (Surface Water Typology, Environmental Standards, Condition Limits and Groundwater Threshold Values) Directions 2014
  - The Solway Tweed River Basin District (Surface Water Typology, Environmental Standards, Condition Limits and Groundwater Threshold Values) (Scotland) Directions 2014

NOTE: This link provides access to the documents via a managed SEPA intranet page.The full set of Standards Directions for each river basin district in Scotland can also be found via the Publications page of the Scottish Government website (www.scotland.gov.uk/Publications/)

Legislation

- *Water Hygiene Code of Practice*, Scottish Water (Available from a SW Environmental Regulation Adviser)
- *Water Environment and Water Services (Scotland) Act 2003* (www.netregs.org.uk)
- *Water (Scotland) Act 1980*

- End of Document -