Supporting Guidance (WAT-SG-41)
Discharge of Chlorinated Effluents

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Update Summary

<table>
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<th>Version</th>
<th>Description</th>
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| v1.0    | First issue for Water Use reference using approved content from the following documents:  
WAT-SG-41 Discharge of Chlorinated Effluents-GD.doc |
| v2      | Chlorine standards updated, Background Chemistry section revised, docs use direct QP doc links |
| v2.1    | Env Stds text revised, ES table deleted |
| v2.2    | Text added relating to requirement when to have an appropriate assessment |

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.

Printing the Document: This document is uncontrolled if printed and is only intended to be viewed online.

If you do need to print the document, the best results are achieved using Booklet printing or else double-sided, Duplex (2-on-1) A4 printing (both four pages per A4 sheet).

Always refer to the online document for accurate and up-to-date information.
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1. Key Points

This document provides additional information on regulating discharges of chlorinated effluents and should be read in conjunction with the key regulatory methods relating to discharge of sewage and trade effluent and WAT-RM-12: Regulation of Discharges from Water Treatment Works.

Chlorinated effluent can be generated through several processes, most commonly:

- Disinfection of sewage discharges where there is a need to achieve specified microbiological standards in the receiving water;
- Disinfection of water prior to use, such as potable water supplies, cooling water and swimming pool water. The process using the treated water will then produce chlorinated effluent that requires to be discharged.

SEPA will require that discharges of chlorinated effluents containing or to waters with high organic matter are to have an appropriate risk assessment with reference to the use and release of chlorine and its reaction by-products the water environment. The concentration of chlorine by-products increases with higher organic content of wastewater and higher doses of chlorine.

However, SEPA recognises that chlorination of sewage effluents to achieve specified microbiological standards in the receiving water may be required as a short term measure pending completion of capital works or for experimental purposes (see section 4).

SEPA will encourage, where possible, alternative methods of disinfection. However, SEPA recognises some other methods also have the potential to result in pollution of the environment (e.g. copper biocides, ozonation).

- SEPA views that discharges of chlorinated effluent with a lower organic matter content (e.g. cooling water, potable water, swimming pool effluent) may not pose a significant risk to the water environment, as the amount of chlorinated by-products will be very low. SEPA will encourage the use of alternative forms of disinfection and alternative discharge arrangements where possible but may authorise low organic matter chlorinated discharges to the water environment (see section 5).
2. Introduction

Chlorination is a recognised method of disinfection of sewage discharges where there is a need to achieve specified microbiological standards in the receiving water. Chlorination is also applied to water supplies to ensure that water is potable, and less frequently for industrial discharges (e.g. alginate industry which uses chlorine during processing); cooling water discharges from power stations; swimming pools and fish processing (to minimise the release of infectious material during the handling of mortalities and wastes).

This guidance is therefore divided into two categories:

- **High organic content discharges**
  Authorisation of discharges of chlorinated effluents with high organic content, such as sewage and fish processing.

- **Low organic content discharges**
  Authorisation of discharges of chlorinated process effluent, or other effluent, with lower organic content, such as swimming pool effluent, cooling water and potable water treatment.
3. Background Chemistry

(Information in this section based on the following publications:


There are several chlorinating strategies involving any of the following agents: chlorine gas, hypochlorite, chlorine dioxide and chloramines. It is its oxidising power which gives chlorine its disinfection capability.

Chlorine (Cl2) added to water forms hypochlorous acid (HOCl) which dissociates to give an equilibrium mixture of hypochlorite (OCl−) and hydrogen ions (H+). The relative proportion of these is pH and temperature dependent. Hypochlorite and hypochlorous acid are known as free available chlorine and this is very effective at killing bacteria.

In polluted water, chlorine reacts with ammonia (where present) forming chloramines (mono-chloramine, di-chloramine and nitrogen trichloride). The chloramines are known as combined available chlorine, which is a weaker disinfectant than free available chlorine but is more stable, therefore more persistent in solution.

In seawater the chemistry of chlorine is more complex. Seawater contains ~68 mg/l bromide at full salinity: when chlorine is added it oxidises the bromide ions yielding hypobromous acid (HOBr). Many different chlorination by-products (CBPs) are generated Production of CBPs and their toxicology is highly dependant on salinity, pH and concentration of organic substances in the seawater.

The chlorination of organic compounds in water can result in the production of disinfection by-products such as trihalomethanes (THMs) e.g. chloroform, from the chlorination of humic substances.

SEPA will require that discharges of chlorinated effluents containing high organic matter, or to waters with high organic matter, are to have an appropriate risk assessment with reference to the use and release of chlorine and its reaction by-products the water environment. This is because discharges of chlorinated effluent have chlorine by-products present, especially trihalomethanes (THMs). The concentration of by-products increases with higher organic content of the wastewater and increased doses of chlorine. De-chlorination of the effluent does not remove the THMs that are formed as a by-product of the hypochlorite’s reaction with ammonia or organic matter. Of the THMs, chloroform is significant and has been shown to bioaccumulate in the vicinity of chlorinated wastewater discharges.

Under the Water Framework Directive (2000/60/EC), and the Priority Substances Directive (2008/105/EC) chloroform (trichloromethane) has
4. Discharges or receiving waters with High Organic Content

As mentioned above, SEPA will require that discharges or receiving waters with high organic matter are to have an appropriate risk assessment with reference to the use and release of chlorine and its reaction by-products the water environment.

If, due to technological or other advances, a discharger adequately demonstrates to SEPA that the use of chlorination does not pose an increased environmental or human health risk over other disinfection techniques, then SEPA may authorise the chlorination of effluents.

SEPA has a presumption for discharge to sewer or use of alternative forms of disinfection. Where neither option is feasible, given the likely high organic content of the discharge and likely production of chlorination by-products guidance in this section should be followed.

Consideration should be given to dechlorination (e.g. by dosing with sodium thiosulphate) before discharge. However, de-chlorination of the effluent does not remove the trihalomethanes that are formed as a by-product of the hypochlorite’s reaction with ammonia or organic matter.

The following guidance should be followed where short-term chlorination of sewage or organic effluents is necessary:

- Any discharge containing significant discharge of chlorine or its reaction by-products shall be licensed by SEPA through imposing numeric limits on the discharge at the point of entry to the aquatic environment.

- These limits must ensure that current environmental standards for those substances are not exceeded at the mixing zone / allowable zone of effect. See Section 6 for the relevant environmental standards.

Authorisation of such discharges should be in accordance with the following key documents:

- **WAT-RM-03: Regulation of Sewage Discharges to Surface Waters**
- **WAT-RM-05: Regulation of Trade Effluent Discharges to Surface Waters**
5. Low Organic Content

SEPA recognises that discharges of chlorinated effluent with a low organic matter content (e.g. cooling water, potable water, swimming pool) may not pose a significant risk to the receiving water. Trihalomethanes (THM) content in these effluents will be very low compared to that found in effluent with high amounts of organic matter and therefore pose less of an environmental concern.

SEPA will encourage discharge to sewer or soakaway (where appropriate) before consideration of a discharge to surface waters.

If alternative discharge arrangements are not feasible, SEPA may authorise a discharge of chlorinated effluent to surface waters. Specific guidance for different types of effluent with low organic matter is given below.

Authorisation of such discharges should be in accordance with:

- **WAT-RM-05**: *Regulation of Trade Effluent Discharges to Surface Waters*
- **WAT-RM-06**: *Regulation of Trade Effluent Discharges to Groundwater*
- **WAT-RM-12**: *Regulation of Discharges from Water Treatment Works*

The level of authorisation will depend on the volume and content of the discharge.

5.1 Swimming Pool Effluent

Effluents from swimming pool may be generated from intermittent backwash water from cleaning of filters and from draining the swimming pool (generally 1-2 times per year).

SEPA’s preference is for discharges of effluents from swimming pools to discharge to the foul sewer.

If necessary to discharge the swimming pool effluent to land (indirect to groundwater) or surface water, the level of authorisation will depend on the effluent volume and content. The activity will be authorised under the inorganic effluent registration or licence category. The applicant should be requested to provide information on the method for dechlorination of the effluent and the final effluent quality. The activity may be authorised provided:

- The discharge is de-chlorinated prior to discharge. (The preferred method is non-chemical removal of chlorine preferably by leaving to stand for at least 5 days or until no chlorine is detectable).
- The relevant Environmental Standard for chlorine will be met in the receiving water.
The following conditions, where applicable, should be included in the authorisation:

- The effluent shall be dechlorinated prior to discharge in accordance with method statement provided with the authorisation application or as agreed in writing with SEPA.
- The effluent shall contain no residual chlorine.
- The effluent shall have a pH value of not less than 6 nor greater than 9.
- The temperature of the discharge shall not exceed <$\circ$C.
  
  (optional)

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. Further guidance on inclusion of temperature conditions can be found in WAT-SG-85: Application of Standards to Thermal Discharges.

For discharges from draining down of a swimming pool the authorisation should also contain the following terms:

- The discharge shall not be made on more than X occasions per calendar year.

### 5.2 Cooling Water

Certain types of cooling waters will require disinfection prior to use. Given the volume of cooling water needed it is unlikely that a discharge to the sewer or soakaway will be feasible. SEPA should, however, encourage efficient water use on the site to minimise the chlorinated effluent.

A discharge of chlorinated cooling water will require to be licensed under the simple licence category. Consideration should be given to dechlorination (for example, by dosing with sodium thiosulphate) before discharge.

Modelling of the discharge will have to be undertaken to determine that the relevant Environmental Standards are met in the receiving water. Numeric limits for chlorine should be included if determined significant as detailed within WAT-SG-53: Environmental Quality Standards and Standards for Discharges to Surface Waters.

The following conditions, where applicable, should be included in the authorisation:

- The discharge shall not contain more than xx milligrams per litre of chlorine (total available chlorine or total residual oxidant as appropriate).
The discharge shall have a pH value of not less than 6 nor greater than 9.

The temperature of the discharge shall not exceed <$$>^\circ\text{C}$. (optional)

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. Particular consideration should be given to controlling the temperature for discharges to water designated under the *Fresh Water For Fish Directive (2006/44/EC)*.

Further guidance on inclusion of temperature conditions can be found in *WAT-SG-85: Application of Standards to Thermal Discharges*.

### 5.3 Potable Water Treatment and Supply

There should be no routine discharges of chlorinated (potable) water from a water treatment works. Discharges from the water treatment works and supply system which result from construction or maintenance work can be adequately controlled via the conditions of Section 33 of the *Water (Scotland) Act 1980*. Licensing of such discharges should only be considered in those circumstances where regular discharges are made to sensitive waters.

Planned releases of treated water should be dechlorinated prior to discharge to the water environment in accordance with Scottish Water’s ‘Water Hygiene Code of Practice’. The present water distribution network uses chlorine as the primary disinfectant. 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. Planned releases to environment should be treated according to current practice and provide little or no additional risk to the health of freshwater fish from the ammonia released due to dechlorination.

Further guidance on this issue is available in *WAT-RM-12: Regulation of Discharges from Water Treatment Works*.
6. Environmental and Drinking Water Standards

The environmental standards for chlorine and chlorine reaction by-products should be used for determining numeric discharge quality standards and for monitoring significant discharges. The current standards can be found in WAT-SG-53. Where appropriate drinking water standards may need to be used, and these are given in Table 1 below.

Guidance on modelling of water use activities is available in WAT-RM-28: Modelling of Water Use Activities and should be undertaken where appropriate. Modelling of discharges to rivers should be undertaken in accordance with WAT-SG-02: Modelling Continuous Discharges to Rivers and WAT-SG-11: Modelling Discharges to Coastal and Transitional Waters.

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<tr>
<th>Determinand</th>
<th>Drinking Water Standard</th>
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<tr>
<td>Trihalomethanes - Total (THM)</td>
<td>100 ug/l for one or any combination of the individual members of the family (except chloroform which must satisfy above)</td>
<td>1</td>
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1 Standards for the protection of drinking water (UK, EC(80/778/EEC and 98/83/EC), WHO)
7. 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 (www.sepa.org.uk/regulations/water/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.

7.1 Key References

- WAT-RM-03: Regulation of Sewage Discharges to Surface Waters
- WAT-RM-05: Regulation of Trade Effluent Discharges to Surface Waters
- WAT-RM-06: Regulation of Trade Effluent Discharges to Groundwater
- WAT-RM-12: Regulation of Discharges from Water Treatment Works
- WAT-RM-28: Modelling of Water Use Activities
- WAT-SG-02: Modelling Continuous Discharges to Rivers
- WAT-SG-11: Modelling Discharges to Coastal and Transitional Waters
- WAT-SG-53: Environmental Quality Standards and Standards for Discharges to Surface Waters
- WAT-SG-85: Application of Standards to Thermal Discharges

7.2 Other Documents

- Standards for the Protection of Drinking Water
  Drinking Water Directive 98/83/EC (CELEX: 31998L0083)
  Drinking Water Directive 80/778/EC (CELEX: 31980L0778)
- Water Environment (Controlled Activities) (Scotland) Regulations (www.sepa.org.uk)
- End of Document -