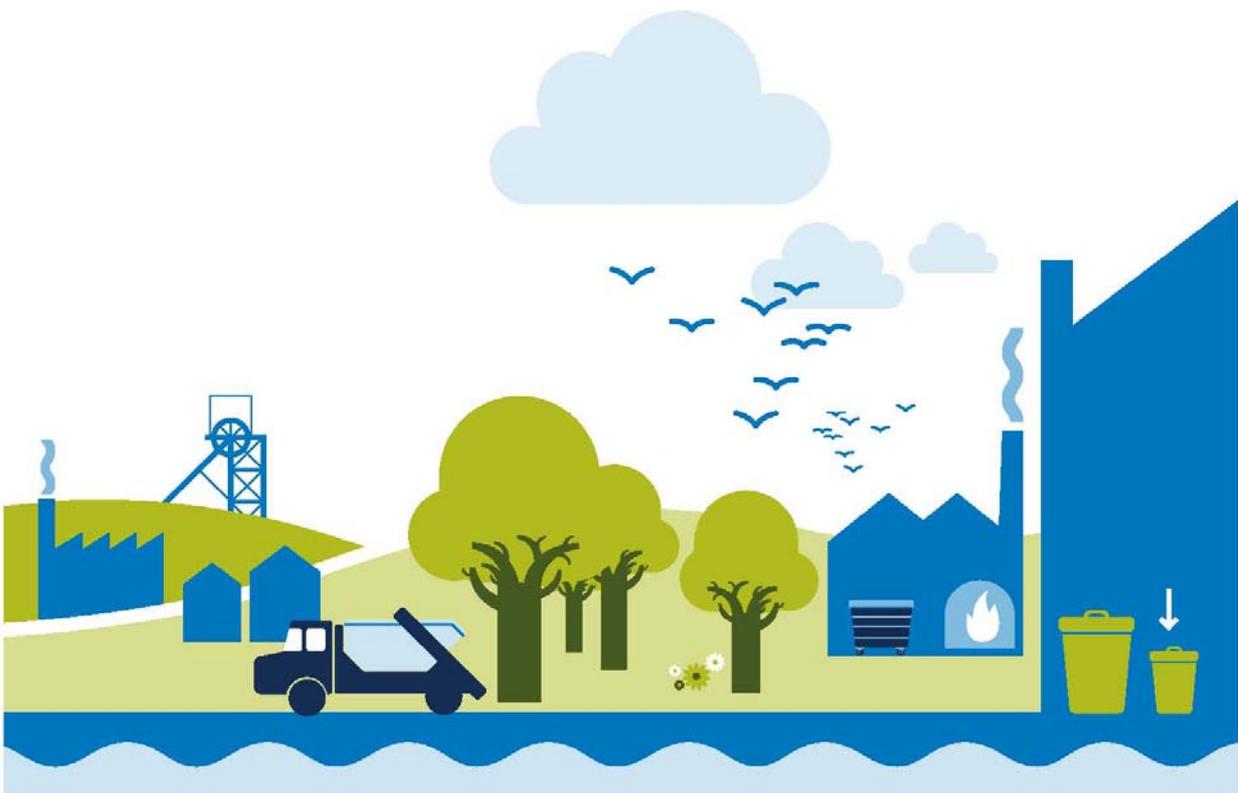


H1 Annex D-Basic Surface water discharges



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Published by:

Environment Agency
Horizon House, Deanery Road
Bristol BS1 5AH
Tel: 0117 934 4000
Email: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

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Annex D Basic Surface water discharges

This guide gives advice on assessing impacts from surface water discharges from installations and waste activities when applying for a bespoke permit under the Environmental Permitting Regulations.

It is part of the Environment Agency's H1 Environmental Risk Assessment Framework and should be read in conjunction with the H1 Environmental Risk Assessment – Overview guide to understand who needs to use it and how it fits in to the framework.

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Summary of changes

Below is a summary of changes made to this Annex since the launch in April 2010.

Annex version	Date	Change	Template version
Issue 2.1	May 2010	Insertion of tables within Appendix A and changes in text on p.12 to reflect additional requirements of the WFD direction dated Dec 2009. Correction to heading on Table A1.	H1 April 2010
Issue 2.2	December 2011	<p>Simplifying the Introduction and reformatting the document to respond to issues raised in the 2010 H1 public consultation.</p> <p>Appendix A updated to reflect content of the ministerial direction dated August 2010.</p> <p>Calculation of process contributions for discharges into estuarine and coastline environments are now based upon a site-specific assessment of the initial dilution.</p> <p>Version 2.0 (April 2010) contained typo saying 10% EQS as significance criteria-now removed.</p> <p>Stage 1 screening criteria are now consistent with the Mixing Zones guidance published by the European Commission (4%).</p> <p>Statistics associated with the calculation of process contributions have been refined.</p>	H1 April 2010

Introduction

About this guidance

This guide on assessing discharges to surface water is a part of the Environment Agency's **H1 Environmental Risk Assessment**¹ framework. It is aimed primarily at installations and waste operations with simple discharges to water. Those with insignificant impacts upon the receiving environment may be screened from the need for a detailed assessment. For other discharges it might be appropriate to use Annex (e).

You should follow this guide if:

- you are applying for a permit under the Environmental Permitting Regulations
- you need to carry out a bespoke risk assessment
- you are working through **H1 Environmental Risk Assessment**
- you have been advised to assess discharges to surface waters from your activity

You should not work through this guidance without first reading through **H1 Environmental Risk Assessment – Overview** to see how it fits in to the risk assessment process for permit applications and carrying out the necessary preliminary steps.

You do not need to work through this guidance if your activity does not involve the discharge of substances to surface waters.

Guides on assessing surface water discharges

The H1 guidance has more than one annex on surface water discharges which include:

- this basic screening tool suitable for most installations and waste operations discharging conservative pollutants such as priority substances and other metals and organic substances.
- H1 annex (e) which covers discharges from sewage treatment works, other discharges of pollutants such as ammonia and BOD (including those from installations and waste operations), and intermittent discharges such as those from combined sewage overflows and storm tanks.

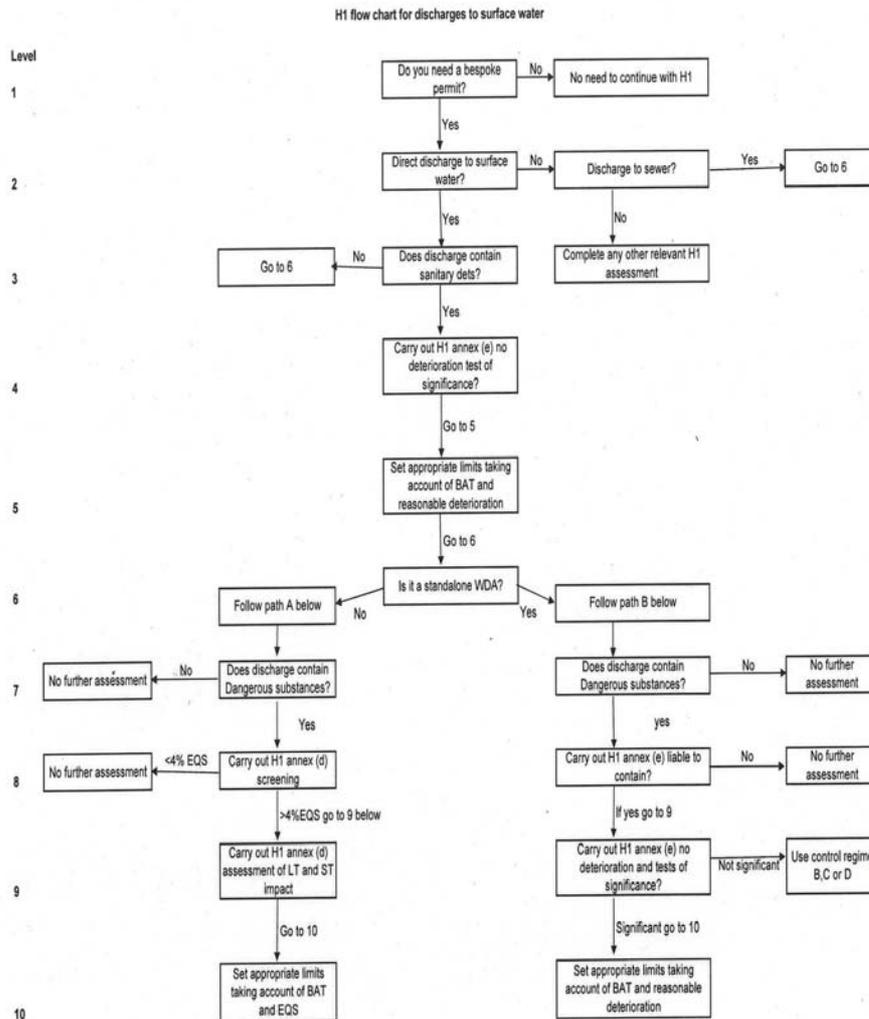
Although you may use which ever approach suits you best, we recommend that you are guided by the flow sheet which is included on the next page of this document. If you are unsure how to progress your assessment please contact your local Environment Agency office.

Note also that if you have a discharge to estuarine or coastal waters that contains sanitary determinands (such as ammonia, BOD) then you should contact your local Environment Agency office.

¹ Environment Agency. (2011) *H1 Environmental Risk Assessment – Overview*. Environment Agency, Bristol. (Available on the Environment Agency website)

Introduction

Flow sheet to guide operators in Surface Water Assessments



Introduction

Overview

This guide will help you quantify the impacts of substances and effluent released to surface water, which includes:

- rivers
- estuaries
- coastal waters
- lakes and canals.

To quantify the impact of discharges into surface waters we use one basic approach called chemical specific analysis. The method used in chemical specific analysis is described below. Its use is appropriate in situations where the chemical composition of the effluent is 'simple'.

A 'simple' effluent is one where all the components have been identified and where the toxicity of the effluent can be explained by the chemical properties of the individual components, including any potential for combined effects. An effluent which is likely to contain unknown chemicals, either as a result of process, breakdown or treatment cannot be considered 'simple'.

All effluents which cannot be considered to be 'simple' are classified as complex.

If you think your effluent may be 'complex' and therefore cannot be assessed using the procedure outlined in this annex, then you should contact your local agency office to discuss the approach you should follow. This may involve the use of Direct Toxicity Assessment (DTA).

The chemical specific approach used in this guide has five stages:

1. calculate the Process Contribution [PC] for either an emission to sewer, river, estuary or coastal water
2. screen out insignificant releases
3. undertake detailed modelling
4. assess the acceptability of releases, including the assessment of any Mixing Zones.
5. summarise your risks to water

If you are choosing between more than one set of control measures for your activity, you should carry out this assessment for each option to check the comparative performance of the various options.

It is important that you document your assessment as you go.

Receiving Water Objectives

The screening tool outlined in this annex is appropriate for use for all surface receiving waters except lakes and canals.

There will be differences in standards for different receiving waters, and it is extremely important therefore that you identify all the uses and designations for waters impacted by the discharge.

This includes designations such as:

- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Ramsar
- Sites of Special Scientific Interest (SSSI)
- Salmonid or cyprinid waters
- Shellfish Waters
- Bathing Waters
- Drinking water abstractions

You must assess risks to any of the above:

- within the boundary of your activity
- outside the boundary of your activity where you could directly affect a designated feature
- or indirectly affect the site's environmental quality

You should contact the Environment Agency or conservation agencies to discuss the scope of risk assessments for such sites. Operators may obtain copies of the Environment Agency Habitats Directive Handbook by requesting same from the following link: enquiries@environment-agency.gov.uk. The handbook contains a series of appendices which are specific to various media and explain the assessment process for existing and new sites.

Interpretation of different types of EQS

There are two types of EQS, and some substances have both, others just one or the other.

EQS-AA

This is the Annual Average standard, sometimes referred to as the long-term standard. Release for assessment against this standard are often called 'long-term' releases.

EQS-MAC

This is the 'Maximum Allowable Concentration', sometimes referred to as the short-term standard. It is normally represented as a 95%ile concentration over a year. Releases for assessment against this standard are often called 'short-term' releases.

European EQS

You should consider further control measures if an EU EQS is already exceeded or may be exceeded by the additional contribution from your proposed activity. For PPC activities, this should take into account the practicality and reasonableness of going beyond indicative BAT, based on the contribution that the installation makes toward the problem and the likelihood of remedial action elsewhere. In some cases, it may be appropriate for you to use control measures that are stricter than suggested in guidance (or considered to be Best Available Techniques under PPC) to protect the environment.

National UK EQS

Waste operators and installations should note that there is no explicit requirement to impose stricter conditions than indicative BAT to comply with national EQS. However, national EQS are a benchmark for harm and any significant contribution to a breach is likely to be unacceptable.

Non-statutory EQS

EQS have been derived for common substances. These do not carry any statutory basis but are considered a benchmark for harm and breaches of them should be viewed unacceptable.

Mixing Zones

Under the EQS Directive, defined mixing zones are permitted. A Mixing Zone is defined in the CIS guidance as "that part of a body of surface water restricted to the proximity of the discharge within which the Competent Authority is prepared to accept EQS exceedence, provided that it does not affect the compliance of the rest of the water body with the EQS".

European "Common Implementation Strategy guidance on setting Mixing Zones under the EQS Directive (2008/105/EC)" is published http://circa.europa.eu/Members/irc/env/wfd/library?l=/framework_directive/guidance_documents. This guidance describes a tiered approach to the assessment of discharges, and gives guidance on the acceptability of mixing zones.

For the purposes of this guidance, Mixing Zones only become an issue for coastal and estuarine waters (and for lakes and canals) for substances which are not screened out by the screening tool described here. Detailed modelling will identify the size and location of mixing zones. One of the key issues is the location of mixing zones in relation to the designations and other uses outlined above. A mixing zone which is acceptable in one location may not be acceptable in another due to, for example, the presence of key conservation species or a shellfish water.

H1 software tool

The Environment Agency has developed a software tool to perform the calculations given in detail in the following pages, which is available through our website². The tool is interactive, and allows you to navigate according to the type(s) of discharge or impact related to your operation. You enter the relevant data, such as effluent flow rate and release concentration, and the tool determines the Process Contribution (PC), Predicted Environmental Concentration (PEC), and Environmental Quotient (EQ). It contains the relevant EQS information, and hence is able to undertake the screening calculations. Finally it provides graphical summaries and prompts you to enter details of your assessment as you go. It has 'help' information both for individual data entry boxes and for each page.

Choosing the right benchmark

Use the appropriate environmental quality standard for each substance. The EQSs for releases to water may vary for different receiving water (inland, estuarine or coastal). Select the appropriate standard from Appendix A.

Appendix A1 gives standards for Priority Substances.

Appendix A2 gives Environment Agency non-statutory EQSs.

Appendix A3 gives standards for Specific Pollutants and standards for nutrients and sanitary determinands.

Appendix A4 and A5 give general physico-chemical standards.

Appendix A6 gives environmental standards for 'Other Substances' defined in the Ministerial Direction.³

Note that many of the above standards are provided for completeness. The screening approach outlined here cannot be used for the following substances:

Total ammonia, un-ionised ammonia, BOD, COD, DO, reactive phosphorus, total phosphorus, dissolved inorganic nitrogen, pH, temperature.

Impact assessment for these substances requires a water quality modelling approach, and for discharges to rivers of these substances, annex (e) should be used. For discharges of these substances to estuarine or coastal waters there is no specific guidance at present. If you are in doubt as to how to proceed in these cases, please contact your local Agency office.

Details of receiving waters defined as a designated fisheries under the EC Fisheries Directive can be found [here](#). There are different standards for salmonid and cyprinid waters. You should be aware of standards that apply to other Protected Areas which may be affected by discharges. Details on Protected Areas are available via the Environment Agency [website](#). The onus is on the discharger to check whether the discharge impacts on any other

² <http://www.environment-agency.gov.uk/business/topics/permitting/36414.aspx>

³ The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010. ISBN 978-0-85521-192-9 (web only publication).

use areas such as shellfish waters. The Environment Agency chemicals database lists standards for all receiving water types and is available [here](#).

You should always use the most stringent standard if more than one is applicable to a particular water.

Discharges to sewers

Discharges from installations to sewer should still be assessed to ensure that the chosen option is appropriate. For example, specialised on-site treatment may be a better option than discharge to sewer, where the effluent is passed through a standard treatment process.

Correction factor for discharges to sewers

Where a release takes place first to sewer and is then treated at a sewage treatment works, pollutants may undergo physical, chemical and biological changes that affect their form, concentration and subsequent environmental impact on the receiving water. The extent of removal during sewage treatment will depend on the interaction between the properties of the substance, the degree of treatment and operational characteristics of the works. It can be assumed that temperature and pH of releases to sewer do not need to be further assessed at the final point of discharge.

The release rate of substances discharged to sewer can be adjusted to take account of the treatment process by:

$$RC_{\text{corr}} = RC_{\text{act}} \times \text{STRF}$$

where

- RC_{corr} = corrected mean release concentration allowing for any attenuation of pollutant during sewage treatment (mg/l)
- RC_{act} = actual mean release rate of pollutants discharged to sewer (mg/l)
- STRF = sewage treatment reduction factor representing the remaining proportion of the pollutant in the effluent following treatment.

For EQS-AA, you should use the mean release concentrations, and for EQS-MAC you should use the 95%ile release concentration .

Appendix B gives generic substance specific sewage treatment reduction factors (STRF). You may also use site specific measured reduction factors if they are available and you can provide details of their derivation. Apart from some highly soluble ionic species, removal efficiencies are only occasionally less than 40% and often greater than 80-90%.

The corrected release concentration from sewers should then be used to calculate process contributions to rivers, estuaries and coastal waters.

Note that the H1 software tool can be used to calculate and present corrected sewage release concentrations.

Calculate your process contribution (PC)

The first step of the assessment is to calculate your process contribution (PC), which is the concentration of each effluent constituent in a surface water after dilution, and to carry out a simple screening assessment to identify insignificant releases.

You will need to choose a suitable method depending on whether your discharge is to a river, estuary or coastal water. You will also need to use a correction factor if you discharge to a sewer and subsequent treatment before discharge into one of these waters.

You will also need to take account of the different types of Environmental Quality Standards (EQS). For most substances, there is an Annual Average EQS (EQS-AA) and many of those also have a Maximum Allowable Concentration EQS (EQS-MAC). Where a substance has an EQS-AA and an EQS-MAC, for many discharges, the initial simple screening process need only be undertaken using the EQS-AA. But importantly, if the substance is released in batches rather than continuously, or if there is a large variation in the release load with time, then the test should also be undertaken for EQS-MAC as well as EQS-AA. If in doubt, consult the local Agency office.

Where the substance has an EQS-MAC only, then of course the assessment should be based on that.

You must use different statistics depending on which type of EQS is being used.

Effluent flow rate (EFR)

For EQS-AA use the mean effluent flow rate, and for EQS-MAC use the 5% exceeded or maximum effluent flow rate.

Release concentration (RC)

Where a release takes place to sewer and is then treated at a sewage treatment works, the release concentration (RC) should be modified by the sewage treatment reduction factor calculated above to give the corrected release concentration (RC_{corr}). Otherwise the actual release concentration should be used (RC_{act}).

For EQS-AA use the mean release concentration, and for EQS-MAC use the 95%ile release concentration. Note, however, that for EQS-MAC, high effluent flow rates may not ever coincide with high release concentrations, in which case it would be more realistic to use the 95%ile discharge load ($EFR \times RC$).

Where the process water is abstracted from the same water body as that to which it is ultimately discharged, the Release Concentration used should be the additional increase in release concentration for a given substance over the background level.

Process contributions for discharges to rivers

The process contribution of substances released to inland rivers is given by:

$$PC = \frac{(EFR \times RC)}{(EFR + RFR)}$$

where

- PC = process contribution ($\mu\text{g/l}$)
- EFR = effluent flow rate (m^3/s)
- RC = release concentration of the pollutant in the effluent ($\mu\text{g/l}$)
- RFR = river flow rate (m^3/s).

River flow rate (RFR)

Site specific values for Q_{95} river flows should be used, where Q_{95} is the 95% exceeded flow. Information on river flow rates can be obtained from:

- Centre for Ecology & Hydrology (CEH)
- National River Flow Archive <http://www.ceh.ac.uk/data/nrfa/index.html>
- the UK Hydrometric Register (ISBN 0948540842)
- Environment Agency Customer Service Centre – measured flow data.
- Licensed data suppliers eg. Wallingford Hydro Solutions
[http://109.108.142.92/\\$sitepreview/hydrosolutions.co.uk/consultancy-3-1.asp](http://109.108.142.92/$sitepreview/hydrosolutions.co.uk/consultancy-3-1.asp)

Process contributions for discharges to estuaries

Definition of an estuary

For our purposes in England & Wales, an estuary can be defined as “a semi-enclosed coastal body of water which has a free connection with the open sea and within which sea water is measurably diluted with fresh water derived from land drainage” (Cameron and Pritchard 1963).

Estuaries are usually divisible into three sectors: (a) a marine or lower estuary, in free connection with the open sea, (b) a middle estuary, subject to strong salt and freshwater mixing, and (c) an upper or fluvial estuary, characterised by freshwater but subject to daily tidal action, see Figure 1 below (from Sharples, Waniek, and Ribeiro, 2001). The upper estuary joins the river at the tidal limit.

For any discharge location, the characteristics may vary so much over a tidal cycle and over the seasons that at low tide it is freshwater dominated (as per the upper estuary type) and at high tide it is seawater dominated (as per the lower estuary type). For this simple assessment use the following approaches:

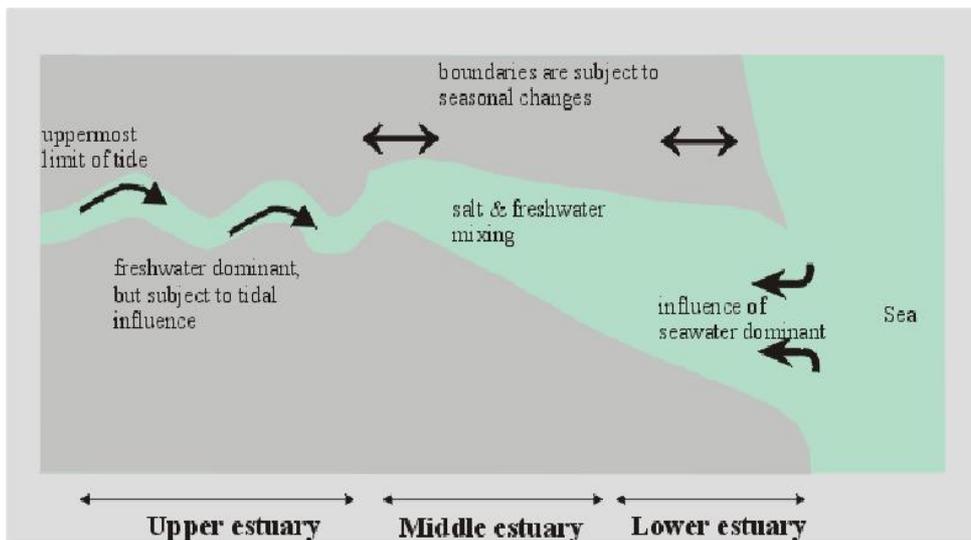


Fig. 1 A schematic map of a typical estuary showing the divisions into lower, middle and upper estuary. The boundaries are transition zones that shift according to the seasons, the weather and the tides.

Discharge to upper estuary

The process contribution in these situations can be calculated using the equation given earlier for discharges to rivers, using the freshwater flow to the estuary upstream of the discharge point.

Discharge to middle estuary

As for the upper estuary, the PC can be estimated very conservatively using the equation for discharges to rivers, based on the total freshwater flow to the estuary upstream of the discharge. If the result of this assessment leads to the discharge being screened out (see below) then no further assessment is required. If however, the discharge cannot be screened out using this conservative approach, then you may wish to use the more accurate and possibly less conservative initial dilution approach as outlined below for coastal waters.

Discharge to lower estuary

In the lower estuary, the salinity is relatively high and the assessment of the PC is based on the initial dilution (ID) following the procedure outlined below for coastal waters.

Process contributions for discharges to coastal waters

In coastal waters, the assessment of the PC is based on the initial dilution (ID).

Initial dilution (ID)

ID is the dilution afforded to a buoyant discharge as it rises from near the sea-bed to the surface. It is dependent on a number of factors including diffuser geometry, water depth, the buoyancy of the effluent, the magnitude of the discharge, and the strength of the ambient current.

The buoyancy results primarily from the density difference between the 'freshwater' discharge and the saline receiving water. There may also be a small additional buoyancy if the discharge is warmer than the receiving water as is often the case, but the opposite can occur.

Initial dilution will vary significantly at different states of the tide, being lowest at low water slack (low water depth, low ambient currents, lower buoyancy). For EQS-AA, you must determine an approximation of the mean dilution, whereas for EQS-MAC you must determine the minimum ID, which as a general rule will be near to Low Water or around slack tide.

The Agency has developed a simple spreadsheet application for the computation of ID. This is available on our web-site, see [Environment Agency - Horizontal guidance](#)

The value of ID as defined here will always be greater than or equal to 1.

If the discharge is not buoyant, or becomes trapped below the surface, then detailed modelling will be required. You should consult your local Agency contact.

ID for discharges to sewer

For discharges to sewer, there is the additional dilution (AD) of the effluent in the water company discharge on top of the ID of the discharge from the Water Company outfall. This dilution should be calculated as follows:

$$\text{For EQS-AA, } AD = (1.25 \times DWF - EFR_{\text{mean}}) / EFR_{\text{mean}}$$

$$\text{For EQS-MAC, } AD = (1.25 \times DWF - EFR_{\text{max}}) / EFR_{\text{max}}$$

where

- DWF is the permitted Dry Weather flow for the Water Company discharge (m³/sec)
- EFR_{mean} is the mean effluent flow rate (m³/sec)
- EFR_{max} is the 5% exceeded or maximum effluent flow rate (m³/sec)

The permitted DWF of the Water Company discharge can be obtained from your local Agency contact.

Note that at present the H1 tool does not have the capability to receive the relevant data and calculate the AD. You should do this separately and use the results to compute the adjusted ID which can then be input to the tool.

To enable the process contribution to be calculated without having to contact the Water Company for details of the ID from their discharge, the following default values of ID can be used:

For EQS-AA,	Mean $ID_{WCO} = 50$
For EQS-MAC	Minimum $ID_{WCO} = 10$

The total ID for discharges to sewer is:

$$ID = ID_{WCO} \times AD$$

If the use of the above default values of ID results in the substance not being screened out, then you can contact the water company for details of the actual ID. This could lead to the substance being screened out. If you experience difficulties obtaining the required ID information from the water company, then contact your local Environment Agency officer.

Near-shore Discharges

Where the discharge is not covered at all states of the tide or is barely covered at Low Water, then the ID from the outfall has to be taken to be 1. However, for discharges to sewer, the Additional Dilution (AD) can also be taken into account in the value of ID used.

Estimating process contribution from initial dilution (ID)

The process contribution based on ID is as follows:

$$PC = \frac{RC}{ID}$$

where

- PC = process contribution ($\mu\text{g/l}$)
- RC = release concentration of the pollutant in the effluent ($\mu\text{g/l}$)
- ID = Initial Dilution

For EQS-AA use the mean ID.

For EQS-MAC use the minimum ID.

Discharges to lakes and canals

For discharges to lakes and canals, because of the difficulty in providing generic characterisation of flow and dispersion, no simple screening tool has been developed. All discharges to lakes and canals require a site-specific assessment.

Multiple discharge points

Where a substance is released into a river or upper estuary from different discharge points, the individual process contributions must be combined. This assumes, for simplification purposes, that the contribution of the diluted effluent from discharge points that are in reasonable proximity can be regarded as being diluted within the same volume of water. Where the receiving water is estuarine or coastal (excluding upper 'fluvial' estuaries), then unless the discharge points are very close together, the process contributions do not need to be combined.

Screen out insignificant releases

The second step of the assessment is to screen out insignificant releases emitted in such small quantities that they are unlikely to cause a significant impact on the receiving water.

For many releases, this test need only be undertaken for the Annual Average or long term EQS (AA). However, if the substance only has an EQS-MAC or short term assessment then that is the criteria against which the test must be undertaken.

And importantly, if the substance is released in batches rather than continuously, or if there is a large variation in the release load with time, then the test should also be undertaken for EQS-MAC as well as EQS-AA. If in doubt, consult the local Agency office.

To undertake the screening process:

- Compare the process contribution (PC) of each substance emitted against its relevant environmental standard in Appendix A;
- Releases can be screened out where the appropriate PCs are < 4% of the EQS.

You should ensure that the process contributions use the same statistical basis as the environmental EQSs.

Note that the 4% thresholds suggested for screening releases do not take the background environmental quality into account, which may dominate long-term process contributions. This threshold is based on the judgement that:

- It (the threshold) is substantially below the acceptable environmental concentrations for the protection of the environment and allows a substantial margin of safety
- Since the process contribution of each pollutant resulting from the discharge is a small percentage of the EQS concentration, it can only make a small contribution to any EQS exceedance
- There is insufficient information for releases to water to justify selecting a less stringent screening criterion, although this may change in the future.

Calculating the Predicted Environmental Concentration

For releases where the above screening criterion is exceeded, the predicted environmental concentration (PEC) should be determined for both long-term and short-term releases. This is the actual concentration in the environment, not the additional concentration resulting from the release. Ultimately, it is the actual concentration that is important.

The PEC is the sum of the Process Contribution and background concentration.

As a first order approximation, the following equation is valid:

$$PEC = PC + BC$$

where

- PEC = Predicted environmental concentration ($\mu\text{g/l}$)
- PC = Process contribution ($\mu\text{g/l}$)
- BC = Mean background concentration ($\mu\text{g/l}$) (upstream concentration for rivers)

Only if the dilution used in the calculation of the PC is less than 10:1 is a more accurate calculation required:

For rivers,
$$PEC = \frac{(EFR \times RC) + (RFR \times BC)}{(EFR + RFR)}$$

For coastal waters,
$$PEC = \frac{[RC + BC \times (ID-1)]}{ID}$$

where

- PEC = Predicted environmental concentration ($\mu\text{g/l}$)
- EFR = mean or 95%ile effluent flow rate (m^3/s)
- RC = mean or 95%ile concentration of pollutant in the effluent ($\mu\text{g/l}$)
- RFR = Q_{95} (95% exceeded) river flow rate (m^3/s)
- BC = Mean background concentration ($\mu\text{g/l}$).
- ID = Mean or minimum Initial Dilution

You will need to estimate PEC for both short- and long-term releases, **even if the screening process was not applied to the EQS-MAC.**

Background or ambient concentrations in rivers should be measured upstream of the point of effluent discharge. For all waters, further guidance on appropriate background data may be obtained from the Agency's local or regional office.

Since the peaks of short term process contributions are unlikely to coincide with short-term fluctuations in ambient concentrations, you may use long-term ambient concentrations to estimate short-term PEC.

The long- and short-term PECs are used to further assess the acceptability of the discharge, see next section.

Decide if you need more detailed modelling

If a release has not been screened out as insignificant (based on the PC being less than 4% of the EQS), then it may still be acceptable. In order to determine the acceptability of the release, further detailed modelling may be required. The guidelines presented here can help you decide whether to carry out more sophisticated modelling, but should be used as rules-of-thumb rather than prescriptively.

As a guide, more complex modelling, to give a more accurate assessment, should be considered if any of the following apply:

- The quality and flow rate of your discharge vary significantly or the flow in the receiving water varies considerably throughout the year.
- For rivers, the long-term PEC is above 70% of the relevant EQS-AA environmental benchmark or the short-term PEC is above 20% of the relevant EQS-MAC environmental benchmark.
- For coastal waters the long-term PEC is above 100% of the relevant EQS-AA or the short-term PEC is above 100% of the relevant EQS-MAC.
- The equivalent situation for estuaries is dependent on whether the discharge location is considered to be predominantly “riverine” or predominantly “coastal”.
- Nature conservation sites, sensitive ecological receptors or protected habitat such as shellfish beds or fisheries are nearby. See: <http://publications.environment-agency.gov.uk/PDF/GEHO0111BTJD-E-E.pdf>
- Water is abstracted nearby for potable supply or agriculture.

You should also bear in mind what data you will need to collect to support any further assessment. It may be that using a simplified assessment methodology will give somewhat pessimistic predictions whereby the Environment Agency may seek the use of ‘Additional Control Measures’ to reduce the residual impact. Alternatively, the applicant may seek to undertake detailed modelling which is likely to produce lower predictions, but this may be at the cost of paying a third party to carry out the detailed assessment. If you decide that further modelling would be useful, you should describe the methods and data used and revise the process contributions accordingly. This information should usually be submitted as a separate report.

For discharges to estuarine or coastal waters, the PEC refers to the concentration after Initial Dilution – a relatively small area of impact. So, for example, the PEC may be in excess of the EQS. In such circumstances, further modelling is required to determine the size and location of the Mixing Zones (long- and short-term) associated with each substance. Where a substance is released from multiple discharge points, then all Mixing Zones need to be considered in combination.

If you require advice as to what modelling to undertake, then you can obtain this from the Environment Agency’s National Permitting Service.

Assess the acceptability of releases

Whether or not you have undertaken further modelling to determine the impact of the discharge more accurately, you now need to assess the acceptability of your releases.

Rivers

For rivers, you will need to check if your releases are acceptable by comparing the PECs against the appropriate short- and long-term environmental quality standards in Appendix A. Make sure that you also check effluent temperature and pH against appropriate standards and use the correct statistical basis for comparisons.

Releases are unlikely to be acceptable where:

- The EQS is already exceeded in the surface water.
- The process contribution will cause the EQS to be exceeded in the surface water and makes a major contribution to that breach.
- The process contribution is a major proportion of the EQS.

Where a new installation would only make a minor contribution to a breach, it will sometimes be more desirable for Regulators (and Local Authorities where relevant) to consider controls on other major sources of pollution rather than imposing excessive costs or refusing a permit.

You should provide a summary of this comparison and explain whether you think your releases are acceptable.

If you are choosing between several control options, you should normally discount those that lead to any of the above scenarios.

Estuarine and Coastal Waters

For estuarine and coastal waters, if the EQS is achieved after Initial Dilution (i.e. the PEC is less than the EQS), then the discharge is likely to be acceptable. If the PEC is greater than the EQS, then the acceptability is dependent on the size and location of the Mixing Zone.

Refer to CIS Mixing Zones guidance for further information:

http://circa.europa.eu/Members/irc/env/wfd/library?l=/framework_directive/guidance_documents

You should provide details of the location and extent of the Mixing Zone in relation to conservation and other features, and explain whether you think your releases are acceptable.

Make sure that you also check effluent temperature against appropriate standards and use the correct statistical basis for comparisons.

If you are choosing between several control options, you should normally discount those that lead to unacceptably large Mixing Zones.

Summarise your risks to water

The final step of your assessment is required if you are undertaking a BAT assessment, and are comparing a number of different options. For each option, the procedure involves summing the impacts from all of the substances which have not been screened, leading to an “Environmental Quotient” (EQ).

The EQ approach does not provide a completely accurate assessment of the effects of the releases on the environment but is a useful tool to compare the relative importance of impacts. It assumes that:

- effects are linearly proportional to their concentration
- EQSs correspond to identical levels of effect for all substances
- there are no synergistic or antagonistic effects between substances.

EQs provide simple, robust indicators of relative impacts which are sufficient for the majority of applications and comparing control options at a particular location, where the nature of the receiving environment will be effectively the same for all options.

To do this:

- list released substances that have potentially significant long-term effects (i.e. those not screened out)
- calculate the Environmental Quotient (EQ) for each of these
- estimate the total impact for each proposed control option by summing all its EQs.

You should say if a proposed option has insignificant releases because they have all been screened out.

Calculating the Environmental Quotient

The Environmental Quotient is the ratio of the process contribution to its appropriate benchmark and allows you to compare the relative importance of released substances.

Note that this approach is not suitable where the effluent composition is unknown or there is insufficient information on the toxic effects of individual constituents, combinations of substances or breakdown products. More complex discharges will need to use Direct Toxicity Assessment (DTA) as discussed in the Introduction.

The Environmental Quotient is given by:

$$EQ = \frac{\text{Process Contribution}}{EQS}$$

where:

- EQ is the Environmental Quotient
- Process Contribution is calculated as before
- EQS is the statutory or non-statutory environmental quality standard

Estimating the total impact

The sum of EQs for individual substances gives a theoretical index of the total impact of an effluent (given the assumptions set out above):

$$EQ_{\text{total}} = EQ_{\text{substance 1}} + EQ_{\text{substance 2}} + \dots + EQ_{\text{substance n}}$$

You can then use the total EQ to compare the relative impact of different options on surface waters. You can also use a similar approach to carry out a cross-media assessment and judge the relative impacts on different environmental media (see *H1 Environmental Risk Assessment - Choosing Control Measures and Cost-Benefit Analysis*, which is another annex to H1)

Note that the H1 software tool will perform these calculations for you and present this information as histograms.

Short term impacts

The EQ approach presented here applies only to the long-term releases.

Short-term effects are determined primarily to assess whether options are acceptable. It is more appropriate to use long-term effects to compare relative environmental impact between options. The weight that short term effects should play in the final ranking of options and selection of appropriate measures should be commensurate with the importance of the effects. You should also justify the way that you have dealt with short-term impacts when choosing appropriate control measures.

What you should do next

If you are happy that you have completed your assessment of surface water discharges correctly, you should:

- complete any other risk assessments for your activity, as set out in Step 2 of **H1 Environmental Risk Assessment – Overview**
- if you have assessed all the risks from your activity, continue with Step 3 of **H1 Environmental Risk Assessment – Overview**.

You should also document your assessment of releases to surface waters.

Appendix A – Environmental Quality Standards

A1: Table of environmental quality standards for Priority Substances and other pollutants used to classify chemical status

Note: With the exception of cadmium, lead, mercury and nickel the EQS values are expressed as total concentrations in the whole water sample. In the case of these metals the EQS refers to the dissolved concentration, i.e. the dissolved fraction of a water sample obtained by filtration through a 0.45 µm filter or any equivalent pre-treatment. EQS may be revised over time, due to new legislation or new scientific information. The Regulators will update the data in this guidance from time to time, and the Operator should ensure that they use the most up to date of these benchmarks.

Table A1 EQS for Priority substances and other pollutants

No.	Name of substance	CAS number (a)	AA-EQS ⁽ⁱ⁾ Inland surface waters (ug/l) ⁽ⁱⁱ⁾	AA-EQS ⁽ⁱ⁾ Other surface waters (ug/l)	MAC-EQS ⁽ⁱⁱⁱ⁾ Inland surface waters (ug/l) ⁽ⁱⁱ⁾	MAC-EQS ⁽ⁱⁱⁱ⁾ Other surface waters (ug/l)
(1)	Alachlor	15972-60-8	0.3	0.3	0.7	0.7
(2)	Anthracene	120-12-7	0.1	0.1	0.4	0.4
(3)	Atrazine	1912-24-9	0.6	0.6	2.0	2.0
(4)	Benzene	71-43-2	10	8	50	50
(5)	Brominated diphenylether ^(iv)	32534-81-9	0.0005	0.0002	N/A	N/A
(6)	Cadmium and its compounds (depending on water hardness classes) ^(v)	7440-43-9	≤0.08 (Class 1) 0.08 (Class 2) 0.09 (Class 3) 0.15 (Class 4) 0.25 (Class 5)	0.2	≤0.45 (Class 1) 0.45 (Class 2) 0.6 (Class 3) 0.9 (Class 4) 1.5 (Class 5)	≤0.45 (Class 1) 0.45 (Class 2) 0.6 (Class 3) 0.9 (Class 4) 1.5 (Class 5)
(6a)	Carbon tetrachloride ^(vi)	56-23-5	12	12	N/A	N/A
(7)	C10-13 Chloroalkanes	85535-84-8	0.4	0.4	1.4	1.4
(8)	Chlorfenvinphos	470-90-6	0.1	0.1	0.3	0.3
(9)	Chlorpyrifos (Chlorpyrifos-ethyl)	2921-88-2	0.03	0.03	0.1	0.1
(9a)	Cyclodiene pesticides: Aldrin ^(vi) Dieldrin ^(vi) Endrin ^(vi) Isodrin ^(vi)	309-00-2 60-57-1 72-20-8 465-73-6	∑ = 0.01	∑ = 0.005	N/A	N/A
(9b)	DDT total ^{(vi), (vii)}	not applicable	0.025	0.025	N/A	N/A
	para-para-DDT	50-29-3	0.01	0.01	N/A	N/A

No.	Name of substance	CAS number (a)	AA-EQS ⁽ⁱ⁾	AA-EQS ⁽ⁱ⁾	MAC-EQS ⁽ⁱⁱⁱ⁾	MAC-EQS ⁽ⁱⁱⁱ⁾
			Inland surface waters (ug/l) ⁽ⁱⁱ⁾	Other surface waters (ug/l)	Inland surface waters (ug/l) ⁽ⁱⁱ⁾	Other surface waters (ug/l)
	^(vi)					
(10)	1,2-Dichloroethane	107-06-2	10	10	N/A	N/A
(11)	Dichloromethane	75-09-2	20	20	N/A	N/A
(12)	Di(2-ethylhexyl)-phthalate (DEHP)	117-81-7	1.3	1.3	N/A	N/A
(13)	Diuron	330-54-1	0.2	0.2	1.8	1.8
(14)	Endosulphan	115-29-7	0.005	0.0005	0.01	0.004
(15)	Fluoranthene	206-44-0	0.1	0.1	1	1
(16)	Hexachlorobenzene	118-74-1	0.01	0.01	0.05	0.05
(17)	Hexachlorobutadiene	87-68-3	0.1	0.1	0.6	0.6
(18)	Hexachlorocyclohexane	608-73-1	0.02	0.002	0.04	0.02
(19)	Isoproturon	34123-59-6	0.3	0.3	1.0	1.0
(20)	Lead and its compounds	7439-92-1	7.2	7.2	N/A	N/A
(21)	Mercury and its compounds	7439-97-6	0.05	0.05	0.07	0.07
(22)	Naphthalene	91-20-3	2.4	1.2	N/A	N/A
(23)	Nickel and its compounds	7440-02-0	20	20	N/A	N/A
(24)	Nonylphenol (4-Nonylphenol)	104-40-5	0.3	0.3	2.0	2.0
(25)	Octylphenol ((4-(1,1',3,3'-tetramethylbutyl)-phenol))	140-66-9	0.1	0.01	N/A	N/A
(26)	Pentachlorobenzene	608-93-5	0.007	0.0007	N/A	N/A
(27)	Pentachlorophenol	87-86-5	0.4	0.4	1	1
(28)	Polyaromatic Hydrocarbons (PAH) ^(viii)	N/A	N/A	N/A	N/A	N/A
	Benzo(a)pyrene	50-32-8	0.05	0.05	0.1	0.1
	Benzo(b)fluoranthene	205-99-2	$\Sigma = 0.03$	$\Sigma = 0.03$	N/A	N/A

No.	Name of substance	CAS number (a)	AA-EQS ⁽ⁱ⁾ Inland surface waters (ug/l) ⁽ⁱⁱ⁾	AA-EQS ⁽ⁱ⁾ Other surface waters (ug/l)	MAC-EQS ⁽ⁱⁱⁱ⁾ Inland surface waters (ug/l) ⁽ⁱⁱ⁾	MAC-EQS ⁽ⁱⁱⁱ⁾ Other surface waters (ug/l)
	Benzo(k)fluoranthene	207-08-9				
	Benzo(g,h,i)-perylene	191-24-2	Σ = 0.002	Σ = 0.002	N/A	N/A
	Indeno(1,2,3-cd)-pyrene	193-39-5				
(29)	Simazine	122-34-9	1	1	4	4
(29a)	Tetrachloroethylene ^(vi)	127-18-4	10	10	N/A	N/A
(29b)	Trichloroethylene ^(vi)	79-01-6	10	10	N/A	N/A
(30)	Tributyltin compounds (Tributyltin-cation)	36643-28-4	0.0002	0.0002	0.0015	0.0015
(31)	Trichlorobenzenes	12002-48-1	0.4	0.4	N/A	N/A
(32)	Trichloromethane	67-66-3	2.5	2.5	N/A	N/A
(33)	Trifluralin	1582-09-8	0.03	0.03	N/A	N/A

(a) Chemical Abstracts Service

Notes to Table of Priority Substances:

- (i) This parameter is the annual average value of the Environmental Quality Standard expressed as the arithmetic mean of the concentrations measured at each representative monitoring point within the water body at different times during the year. Unless otherwise specified, it applies to the total concentration of all isomers.
- (ii) Inland surface waters encompass rivers and lakes and related artificial or heavily modified water bodies.
- (iii) This parameter is the Environmental Quality Standard expressed as a maximum allowable concentration (EQS – MAC). Where the MAC – EQS are marked as “not applicable”, the AA EQS values are considered protective against short-term pollution peaks in continuous discharges since they are significantly lower than the values derived on the basis of acute toxicity.
- (iv) For the group of priority substances covered by brominated diphenylethers (No.5) listed in Decision 2455/2001/EC, an EQS is established only for congener numbers 28, 47, 99, 100, 153, and 154.
- (v) For cadmium and its compounds (No.6) the EQS values vary dependent upon the hardness of the water as specified in five class categories (Class 1: <40mg CaCO₃/l, Class 2: 40 to <50 mg CaCO₃/l, Class 3: 50 to <100 mg CaCO₃/l, Class 4: 100 to <200 mg CaCO₃/l, Class 5 ≥200 mg CaCO₃/l).

- (vi) This substance is not a priority substance but one of the other pollutants for which the EQS are identical to those laid down in the legislation that applied prior to the entry into force of this Directive.
- (vii) DDT total comprises the sum of the isomers 1,1,1 – trichloro-2,2 bis (p-chlorophenyl) ethane (CAS number 50-29-3; EU Number 200-024-3); 1,1,1-trichloro-2 (o-chlorophenyl)-2-(p-chlorophenyl)ethane (CAS number 789-02-6; EU Number 212-332-5); 1,1 –dichloro-2,2 bis (p chlorophenyl) ethylene (CAS number 72-55-9; EU Number 200-784-6); and 1,1 –dichloro-2,2 bis (p-chlorophenyl) ethane (CAS number 72 54-8; EU Number 200-783-0).
- (viii) For the group of priority substances of polyaromatic hydrocarbons (PAH) (No.28), each individual EQS is applicable, i.e., the EQS for Benzo(a)pyrene, the EQS for the sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene and the EQS for the sum of Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene must be met.

A2: Table of Environment Agency Non-Statutory Environmental Quality Standards

Substance (Operational)	EQS Value	
	Freshwater	Saltwater
Abamectin	0.01ug/l (AA) 0.03ug/l (MAC)	0.005ug/l (AA) 0.01ug/l (MAC)
Bromine	2ug/l (TRO) (AA) 5ug/l (TRO) (MAC)	10ug/l (TRO) (MAC)
Bromoxynil	100ug/l (AA) 1000ug/l (MAC)	100ug/l (AA) 1000ug/l (MAC)
Carbendazim	0.1ug/l (AA) 1ug/l (MAC)	0.1ug/l (AA) 1ug/l (MAC)
Chloride	250000ug/l (AA)	
3-chlorophenol 4-chlorophenol	50ug/l (AA) 250ug/l (MAC) Total and individual monochlorophenols	50ug/l (AA) 250ug/l (MAC)
Chlorothalonil	0.1ug/l (AA) 1.0ug/l (MAC)	0.1ug/l (AA) 1.0ug/l (MAC)
Chlorpropham	10ug/l (AA) 40ug/l (MAC)	10ug/l (AA) 40ug/l (MAC)
Chlorotoluron	2ug/l (AA) 20ug/l (MAC)	2ug/l (AA)
Cobalt (Dissolved)	3ug/l (AA) 100ug/l (MAC)	3ug/l (AA) 100ug/l (MAC)
Coumaphos	0.01ug/l (AA) 0.1ug/l (MAC)	0.04ug/l (AA) 0.4ug/l (MAC)
Dichlorobenzene (Sum of all dichlorobenzene isomers)	20ug/l (AA) 200ug/l (MAC)	20ug/l (AA) 200ug/l (MAC)
Diflubenzuron	0.001ug/l (AA) 0.015ug/l (MAC)	0.005ug/l (AA) 0.1ug/l (MAC)
Doramectin	0.001ug/l (AA) 0.01ug/l (MAC)	0.001ug/l (AA) 0.1ug/l (MAC)
EDTA	400ug/l (AA) 4000ug/l (MAC)	400ug/l (AA) 4000ug/l (MAC)
Fenchlorphos	0.01ug/l (AA) 0.1ug/l (MAC)	0.01ug/l (AA) 0.1ug/l (MAC)
Fluoride (Dissolved)	1000ug/l(AA) (<50mg/l CaCO3) 3000ug/l (MAC) (<50mg/l CaCO3) 5000ug/l (AA) (>50mg/l CaCO3) 15000ug/l (MAC) (>50mg/l CaCO3)	5000ug/l (AA) 15000ug/l (MAC)

Substance (Operational)	EQS Value	
	Freshwater	Saltwater
Formaldehyde	5ug/l (AA) 50ug/l (MAC)	- -
Hydrogen sulphide	0.25ug/l (AA) 1.0ug/l (MAC)	10ug/l (MAC)
Ioxynil	10ug/l (AA) 100ug/l (MAC)	10ug/l (AA) 100ug/l (MAC)
Ivermectin	0.0001ug/l (AA) 0.001ug/l (MAC)	0.001ug/l (AA) 0.01ug/l (MAC)
Malachite green	0.5ug/l (AA) 100ug/l (MAC)	0.5ug/l (AA) 100ug/l (MAC)
Mancozeb	2ug/l (AA) 20ug/l (MAC)	2ug/l (AA) 20ug/l (MAC)
Maneb	3ug/l (AA) 30ug/l (MAC)	3ug/l (AA) 30ug/l (MAC)
MCPA	2ug/l (AA) 20ug/l (MAC)	2ug/l (AA) 20ug/l (MAC)
Methiocarb	0.01ug/l (AA) 0.16ug/l (MAC)	0.01ug/l (AA) 0.16ug/l (MAC)
NTA	1000ug/l (AA) 10000ug/l (MAC)	3000ug/l (AA) 30000ug/l (MAC)
Pendimethalin	1.5ug/l (AA) 6ug/l (MAC)	1.5ug/l (AA) 6ug/l (MAC)
Phthalates:-		
- Dimethyl phthalate	800ug/l (AA) 4000ug/l (MAC)	800ug/l (AA) 4000ug/l (MAC)
- Diethyl phthalate	200ug/l (AA) 1000ug/l (MAC)	200ug/l (AA) 1000ug/l (MAC)
- Dibutyl phthalate	8ug/l (AA) 40ug/l (MAC)	8ug/l (AA) 40ug/l (MAC)
- Butylbenzyl phthalate	20ug/l (AA) 100ug/l (MAC)	20ug/l (AA) 100ug/l (MAC)
- Dioctyl phthalate	20ug/l (AA) 40ug/l (MAC)	20ug/l (AA) 40ug/l (MAC)
Pirimicarb	1ug/l (AA) 5ug/l (MAC)	1ug/l (AA) 5ug/l (MAC)
Pirimiphos-methyl	0.015ug/l (AA) 0.05ug/l (MAC)	0.015ug/l (AA) 0.05ug/l (MAC)
Prochloraz	4ug/l (AA) 40ug/l (MAC)	4ug/l (AA) 40ug/l (MAC)
Propetamphos	0.01ug/l (AA) 0.1ug/l (MAC)	0.01ug/l (AA) 0.1ug/l (MAC)

Substance (Operational)	EQS Value	
	Freshwater	Saltwater
Propyzamide	100ug/l (AA) 1000ug/l (MAC)	100ug/l (AA) 1000ug/l (MAC)
Silver (Dissolved)	0.05ug/l (AA) 0.1ug/l (MAC)	0.5ug/l (AA) 1ug/l (MAC)
Sodium	No EQS	No EQS
Sulphate	400000ug/l (AA)	No EQS
Styrene	50ug/l (AA) 500ug/l (MAC)	50ug/l (AA) 500ug/l (MAC)
Tecnazene (Total)	1ug/l (AA) 10ug/l (MAC)	1ug/l (AA) 10ug/l (MAC)
Thiabendazole	5ug/l (AA) 50ug/l (MAC)	5ug/l (AA) 50ug/l (MAC)
Tin (Inorganic)	25ug/l (AA) (Total)	10ug/l (AA) (Dissolved)
Triallate	0.25ug/l (AA) 5ug/l (MAC)	0.25ug/l (AA) 5ug/l (MAC)
Tributyl phosphate	50ug/l (AA) 500ug/l (MAC)	50ug/l (AA) 500ug/l (MAC)

TAC = Total Available Chlorine
 TRO = Total Residual Oxidant
 AA = Annual average
 MAC = Maximum Allowable Concentration

A3 : Specific Pollutants

The standards for Specific Pollutants set out below must be applied for the purpose of classification of the relevant components of Ecological Status of Surface Waters

Table 1: Environmental Standards for 2,4-Dichlorophenoxyacetic acid (2,4-D)			
'Good' standards for rivers and freshwater lakes		'Good' standards for transitional and coastal waters	
Column 1	Column 2	Column 3	Column 4
Annual mean (µg/l)	95-percentile (µg/l)	Annual mean (µg/l)	95-percentile (µg/l)
0.3	1.3	0.3	1.3

Note to Table 1 - The standards for 2,4-D specified in Column 2 and Column 4 of Table 1 must not be used for the purpose of classifying the ecological status or potential of bodies of surface water.

Table 2: Environmental Standards for 2,4-Dichlorophenol	
'Good' standards for rivers and freshwater lakes	'Good' standards for transitional and coastal waters
Column 1	Column 2
Annual mean (µg/l)	Annual mean (µg/l)
20	20

Table 3: Environmental Standards for un-ionised ammonia as nitrogen	
'Good' standards for rivers and freshwater lakes	'Good' standards for transitional and coastal waters
Column 1	Column 2
Annual mean (µg/l)	Annual mean (µg/l)
Not applicable	21

Table 4: Environmental Standards for arsenic	
'Good' standards for rivers and freshwater lakes	'Good' standards for transitional and coastal waters
Column 1	Column 2
Annual mean (µg/l)	Annual mean (µg/l)
50	25

Note to Table 4 – The standard for arsenic refers to the dissolved fraction of a water sample obtained by filtration through a 0.45µm filter or any equivalent pre-treatment.

Table 5: Environmental Standards for chlorine (a)		
'Good' standards for rivers and freshwater lakes		'Good' standards for transitional and coastal waters
Column 1	Column 2	Column 3
Annual mean concentration (µg/l) of total available chlorine ⁴	95-percentile concentration (µg/l) of total available chlorine	95-percentile concentration (µg/l) of total residual oxidant ^(b)
2	5	10

Notes to Table 5 –

(a) The standards for chlorine specified in Column 2 and Column 3 of Table 5 must not be used for the purpose of classifying the ecological status or potential of bodies of surface water.

(b) The total “total residual oxidants” refers to the sum of all oxidising agents existing in water, expressed as available chlorine.

Table 6: Environmental Standards for chromium VI		
'Good' standards for rivers and freshwater lakes	'Good' standards for transitional and coastal waters	
Column 1	Column 2	Column 3
Annual mean concentration (µg/l) of dissolved chromium VI	Annual mean concentration (µg/l) of dissolved chromium VI	95-percentile concentration (µg/l) of total dissolved chromium VI
3.4	0.6	32

Note to Table 6 – The standard for chromium VI specified in Column 3 of Table 6 must not be used for the purpose of classifying the ecological status or potential of bodies of surface water.

Table 7: Environmental Standards for chromium III	
'Good' standards for rivers and freshwater lakes	
Column 1	Column 2
Annual mean concentration (µg/l) of dissolved chromium III	95-percentile concentration (µg/l) of dissolved chromium III
4.7	32

Note to Table 7 – The standard for chromium III specified in Column 2 of Table 7 must not be used for the purpose of classifying the ecological status or potential of bodies of surface water.

⁴ Total available chlorine is the sum of the residuals of free available chlorine (FAC) and combined available chlorine (CAC). FAC is defined as that residual chlorine existing in water as chlorine, hypochlorous acid and hypochlorite ion. CAC is defined as that residual chlorine existing in water in chemical combination with ammonia (i.e monochloramine, dichloramine or nitrogen trichloride) or organic nitrogen compounds.

Table 8: Environmental Standards for copper		
Water hardness bands to which the corresponding river and freshwater lake standards in Column 2 apply	'Good' standards for rivers and freshwater lakes	'Good' standards for transitional and coastal waters
Column 1	Column 2	Column 3
Annual mean concentration of Ca CO ₃ (mg/l)	Annual mean concentration (µg/l) of dissolved copper	Annual mean concentration (µg/l) of dissolved copper
0 – 50	1	5
50 – 100	6	
100 – 250	10	
> 250	28	

Table 9: Environmental Standards for cyanide			
'Good' standards for rivers and freshwater lakes		'Good' standards for transitional and coastal waters	
Column 1	Column 2	Column 3	Column 4
Annual mean concentration (µg/l) of hydrogen cyanide	95-percentile concentration (µg/l) of hydrogen cyanide	Annual mean concentration (µg/l) of hydrogen cyanide	95-percentile concentration (µg/l) of hydrogen cyanide
1	5	1	5

Note to Table 9 – The standards for cyanide specified in Column 2 and Column 4 of Table 9 must not be used for the purpose of classifying the ecological status or potential of bodies of surface water.

Table 10: Environmental Standards for cypermethrin			
'Good' standards for rivers and freshwater lakes		'Good' standards for transitional and coastal waters	
Column 1	Column 2	Column 3	Column 4
Annual mean (ng/l)	0.1	Annual mean (ng/l)	0.1
95-percentile (ng/l)	0.4	95-percentile (ng/l)	0.4

Note to Table 10 – The 95 percentile standards for cypermethrin specified in Row 2 of Table 10 must not be used for the purpose of classifying the ecological status or potential of bodies of surface water.

Table 11: Environmental Standards for diazinon			
'Good' standards for rivers and freshwater lakes		'Good' standards for transitional and coastal waters	
Column 1	Column 2	Column 3	Column 4
Annual mean (µg/l)	95-percentile (µg/l)	Annual mean (µg/l)	95-percentile (µg/l)
0.01	0.02	0.01	0.1

Note to Table 11 – The standards for diazinon specified in Column 2 and Column 4 of Table 11 must not be used for the purpose of classifying the ecological status or potential of bodies of surface water.

Table 12: Environmental Standards for dimethoate			
'Good' standards for rivers and freshwater lakes		'Good' standards for transitional and coastal waters	
Column 1	Column 2	Column 3	Column 4
Annual mean (µg/l)	95-percentile (µg/l)	Annual mean (µg/l)	95-percentile (µg/l)
0.48	4.0	0.48	4.0

Note to Table 12 – The standards for dimethoate specified in Column 2 and Column 4 of Table 12 must not be used for the purpose of classifying the ecological status or potential of bodies of surface water.

Table 13: Environmental Standards for iron	
'Good' standards for rivers and freshwater lakes	'Good' standards for transitional and coastal waters
Column 1	Column 2
Annual mean concentration (mg/l) of dissolved iron	Annual mean concentration (mg/l) of dissolved iron
1	1

Table 14: Environmental Standards for linuron			
'Good' standards for rivers and freshwater lakes		'Good' standards for transitional and coastal waters	
Column 1	Column 2	Column 3	Column 4
Annual mean (µg/l)	95-percentile (µg/l)	Annual mean (µg/l)	95-percentile (µg/l)
0.5	0.9	0.5	0.9

Note to Table 14 – The standards for linuron specified in Column 2 and Column 4 of Table 14 must not be used for the purpose of classifying the ecological status or potential of bodies of surface water.

Table 15: Environmental Standards for mecoprop			
'Good' standards for rivers and freshwater lakes		'Good' standards for transitional and coastal waters	
Column 1	Column 2	Column 3	Column 4
Annual mean (µg/l)	95-percentile (µg/l)	Annual mean (µg/l)	95-percentile (µg/l)
18	187	18	187

Note to Table 15 – The standards for mecoprop specified in Column 2 and Column 4 of Table 15 must not be used for the purpose of classifying the ecological status or potential of bodies of surface water.

Table 16: Environmental Standards for permethrin	
'Good' standards for rivers and freshwater lakes	'Good' standards for transitional and coastal waters
Column 1	Column 2
95-percentile (µg/l)	95-percentile (µg/l)
0.01	0.01

Table 17: Environmental Standards for phenol			
'Good' standards for rivers and freshwater lakes		'Good' standards for transitional and coastal waters	
Column 1	Column 2	Column 3	Column 4
Annual mean (µg/l)	95-percentile (µg/l)	Annual mean (µg/l)	95-percentile (µg/l)
7.7	46	7.7	46

Note to Table 17 – The standards for phenol specified in Column 2 and Column 4 of Table 17 must not be used for the purpose of classifying the ecological status or potential of bodies of surface water.

Table 18: Environmental Standards for toluene			
'Good' standards for rivers and freshwater lakes		'Good' standards for transitional and coastal waters	
Column 1	Column 2	Column 3	Column 4
Annual mean (µg/l)	95-percentile (µg/l)	Annual mean (µg/l)	95-percentile (µg/l)
50	380	40	370

Note to Table 18 – The standards for toluene specified in Column 2 and Column 4 of Table 18 must not be used for the purpose of classifying the ecological status or potential of bodies of surface water.

Table 19: Environmental Standards for zinc		
Water hardness to which the corresponding river and freshwater lake standards in Column 2 apply*	'Good' standards for rivers and freshwater lakes	'Good' standards for transitional and coastal waters
Column 1	Column 2	Column 3
Annual mean concentration of Ca CO ₃ (mg/l)	Annual mean concentration (µg/l) of total zinc	Annual mean concentration (µg/l) of dissolved zinc
0 – 50	8	40
50 – 100	50	
100 – 250	75	
> 250	125	

Note to Table 19 – *The standards applicable to intermediate water hardness must be calculated by simple linear interpolation.

Table 20: Environmental Standards for total ammonia in all freshwater lakes			
High		Good	
Standards for lakes with: an annual mean concentration of Ca CO ₃ (mg/l) ≤ 50, or an annual mean concentration of Ca CO ₃ (mg/l) > 50 to ≤ 200 and an altitude > 80 metres above mean sea level	Standards for lakes with: an annual mean concentration of Ca CO ₃ (mg/l) > 50 to ≤ 200 and an altitude ≤ 80 metres above mean sea level	Standards for lakes with: an annual mean concentration of Ca CO ₃ (mg/l) ≤ 50, or an annual mean concentration of Ca CO ₃ (mg/l) > 50 to ≤ 200 and an altitude > 80 metres above mean sea level	Standards lakes with an annual mean concentration of Ca CO ₃ (mg/l) > 50 to ≤ 200 and an altitude ≤ 80 metres above mean sea level
90 – percentile (milligrammes of ammoniacal nitrogen per litre)			
0.2	0.3	0.3	0.6

A4 : Criteria for identifying the types of river, lake, transitional or coastal water to which the environmental standards in A5 apply

Table 1: Criteria for identifying the types of river to which the dissolved oxygen (a) biochemical oxygen demand(b) and ammonia(c) standards for rivers apply					
Site Altitude	Alkalinity (as mg/l Ca CO ₃)				
	Less than 10	10 to 50	50 to 100	100 to 200	Over 200
Under 80 metres	Type 1	Type 2	Type 3	Type 5	Type 7
Over 80 metres			Type 4	Type 6	

Notes to Table 1 –

(a) The environmental standards for dissolved oxygen are specified in Table 1 in section A5 of this Annex.

(b) The environmental standards for biochemical oxygen demand are specified in Table 2 in section A5 of this Annex.

© The environmental standards for ammonia are specified in Table 3 in section A5 of this Annex.

Table 2: Criteria for identifying types of river to which the reactive phosphorus standards for rivers apply(a)		
Altitude	Annual mean alkalinity (as mg/l Ca CO ₃)	
	<50	>50
Under 80 metres	Type 1n	Type 3n
Over 80 metres	Type 2n	Type 4n

Note to Table 2 – (a) The environmental standards for reactive phosphorus are specified in Table 5 in section A5 of this Annex.

Table 3: Criteria for identifying types of lake to which the dissolved oxygen standards for rivers apply(a)	
Type	Description
Salmonid	Freshwater lakes which would naturally support populations of salmonid fish
Cyprinid	Freshwater lakes which would not naturally support populations of salmonid fish

Notes to Table 3 – The environmental standards for dissolved oxygen in freshwater lakes are specified in Table 7 in section A5 of this Annex.

Table 4: Geological characteristics used to identify geological categories to which the lake total phosphorus standards apply			
Geological category	Annual mean alkalinity Micro-equivalents per litre	Annual mean conductivity Micro Siemens per centimetre	Solid geology of the catchment of the [lake] (% of catchment)
Low alkalinity	<200	≤70	
			>90% siliceous
Modern alkalinity	200-1000	>70-250	>50% siliceous and ≤90% siliceous
High alkalinity	>1000	>250-1000	≥50% calcareous
Marl		>250-1000	>65% limestone

Table 5: Depth characteristics used to identify depth categories to which the lake phosphorus standards apply	
Depth category	Mean depth (metres)
Very shallow	<3
Shallow	3-15
Deep	>15

Table 6: Criteria for identifying types of transitional and coastal water to which the dissolved inorganic nitrogen standards for transitional and coastal waters apply	
Type	Annual mean concentration of suspended particulate matter (mg/l)
Very turbid	>300
Medium turbidity	<100-300
Intermediate	10-100
Clear	<10

A5 : General Physico-chemical Standards

The following tables define environmental standards for water quality in rivers and in lakes.

Table 1: Standards for dissolved oxygen in rivers				
Dissolved Oxygen (per cent saturation)				
(10 – percentile)				
1	2	3	4	5
Type	High	Good	Moderate	Poor
1,2,4 and 6 Salmonid	80	75	64	50
3,5 and 7	70	60	54	45

Table 2: Biochemical oxygen demand (BOD) standards for rivers (i)				
Biological Oxygen Demand (mg/l)				
(90 – percentile)				
Type	High	Good	Moderate	Poor
1,2,4,6 and Salmonid	3	4	6	7.5
3,5 and 7	4	5	6.5	9

Note to Table 2 – (i) Biochemical oxygen demand shall not be used in clarifying the status of water bodies.

Table 3: Ammonia standards for rivers				
Total ammonia as nitrogen (mg/l)				
(90 – percentile)				
Type	High	Good	Moderate	Poor
1,2,4 and 6	0.2	0.3	0.75	1.1
3,5 and 7	0.3	0.6	1.1	2.5

Table 4: Standards for acid conditions in rivers	
pH – all river types in England and Wales	
High	Good
pH 6 as 5 percentile	pH 5.2 as a 10 percentile
pH 9 as a 95 percentile	

Table 5: Phosphorus standards for rivers				
Reactive phosphorus standards	Concentration as µg/l as annual means			
	Type	High	Good	Moderate
1n	30	50	150	500
2n	20	40	150	500
3n & 4n	50	120	250	1000

Table 6: Temperature standards for rivers								
Column 1	Column 2		Column 3		Column 4		Column 5	
	High		Good		Moderate		Poor	
River temp type	Non-cyprinid	Cyprinid	Non-cyprinid	Cyprinid	Non-cyprinid	Cyprinid	Non-cyprinid	Cyprinid
River temp (°c) as an annual 98-percentile standard	20	25	23	28	28	30	30	32
Increase or decrease in temp (°c) in relation to the ambient river temp, as an annual 98-percentile standard	2	2	3	3	-	-	-	-

Note to Table 6 – The standards specified for temperature in Row 4; Columns 2 and 3 of Table 6 must not be used for the purpose of classifying the status of bodies of surface water except where the water receives consented thermal discharges.

Table 7: Dissolved oxygen standards for freshwater lakes		
Status	Mean in July – August (mg/l)	
	Salmonid	Cyprinid
High	9	8
Good	7	6
Moderate	4	4
Poor	1	1

Note to Table 7 – The mean for mixed lakes is throughout the whole water column and the mean for stratified lakes is for readings taken in hypolimnion.

Table 8: Acid condition standards for all freshwater lakes	
High	Good
Acid Neutralising Capacity (micro equivalents per litre) as annual mean values	
>40	>20

Table 9: Salinity standards for freshwater lakes with no natural saline influence	
Status	Proposed boundary
	Annual mean (micro Siemens per centimetre)
Good	1000

Table 10: Standards for Total phosphorus standards for freshwater and brackish lakes			
Annual mean total phosphorus concentration ($\mu\text{g/l}$)			
Column 1	Column 2	Column 3	Column 4
High	Good	Moderate	Poor
$(R \div H)$ or 5, whichever is the larger value	$(R \div G)$ or 8, whichever is the larger value	$[(R \div G) \div 0.5]$ or 16, whichever is the larger value	$[(R \div G) \div 0.25]$ or 32, whichever is the larger value

Table 11: Type-specific total phosphorus standards for freshwater and brackish lakes where the standards specified in Table 10 do not apply				
Type	Annual mean concentration of total phosphorus ($\mu\text{g/l}$)			
Column 1	Column 2	Column 3	Column 4	Column 5
Geological and depth category	High	Good	Moderate	Poor
High alkalinity; shallow - Region 1	16	23	46	92
High alkalinity; shallow - Region 2	25	35	70	140
High alkalinity; very shallow - Region 1	23	31	62	124
High alkalinity; very shallow - Region 2	35	49	98	196
Moderate alkalinity; deep	8	12	24	48
Moderate alkalinity; shallow	11	16	32	64
Moderate	15	22	44	88

alkalinity; very shallow				
Low alkalinity; deep	5	8	16	32
Low alkalinity; shallow	7	10	20	40
Low alkalinity; very shallow	9	14	28	56
Marl; shallow	9	20	40	80
Marl; very shallow	10	24	48	96

Table 12: Dissolved oxygen standards for transitional and coastal waters with salinities normalised to 35.

Column 1	Column 2
Boundaries	Dissolved oxygen concentration (mg/l) as 5-percentile values with a compliance period of at least 1 year
High	5.7
Good	4.0
Moderate	2.4
Poor	1.6

Table 13: Dissolved oxygen standards for transitional and coastal waters with salinities (i) < 35

Column 1	Column 2
Boundaries	Dissolved oxygen concentration (mg/l) as 5-percentile values with a compliance period of at least 1 year
High	= 7-(0.037 x (salinity))
Good	= 5-(0.028 x (salinity))
Moderate	= 3-(0.017 x (salinity))

Table 14: Dissolved inorganic nitrogen standards for coastal waters salinity 30 – 34.5

Mean dissolved inorganic nitrogen concentration (micromoles per litre) during the period 1 November to 28 February		
Column 1	Column 2	Column 3
Type	High	Good
Clear	12 ⁽ⁱ⁾	18 ⁽ⁱ⁾
		99-percentile standard for the period 1 November to 28 February
Intermediate turbidity	18 ⁽ⁱ⁾	70 ⁽ⁱ⁾
Medium turbidity	18 ⁽ⁱ⁾	180 ⁽ⁱ⁾
Very turbid	18 ⁽ⁱ⁾	270 ⁽ⁱ⁾

Notes to Table 14 – ⁽ⁱ⁾The standard refers to the concentration of dissolved inorganic nitrogen at a mean salinity of 32 for the period 1st November to 28th February. If the standard in column 3 is exceeded then status is moderate.

Table 15: Dissolved inorganic nitrogen standards for transitional waters (salinity 25), or parts thereof		
Mean dissolved inorganic nitrogen concentration (micromoles per litre) during the period 1 st November to 28 th February		
Column 1	Column 2	Column 3
Type	High	Good
Clear	20 ⁽ⁱ⁾	30 ⁽ⁱ⁾
		99-percentile standard for the period 1 st November to 28 th February
Intermediate turbidity	30	70
Medium turbidity	30	180
Very turbid	30	270

Notes to Table 15 – ⁽ⁱ⁾The standard refers to the concentration of dissolved inorganic nitrogen at a mean salinity of 25 for the period 1st November to 28th February of 32. If the standard in column 3 is exceeded then status is moderate.

A6 : 'Other Substances'

Where necessary, the environmental standards in the Table below must be applied for the purposes set out in paragraph 4 of the Directions⁵.

Table 1: 'Other Substances'		
Name	AA-EQS(s) (ug/l)	
	Inland surface fresh waters	Coastal waters and relevant territorial waters
4-chloro-3-methyl-phenol	40	40
Bentazone	500	500
Fenitrothion	0.01	0.01
2-chlorophenol	50	50
Biphenyl	25	25
Malathion	0.01	0.02
1,1,1-trichloroethane	100	100
Chloronitrotoluenes	10	10
Triphenyltin and its derivatives	n/a* 0.02	n/a* 0.008
Dichlorvos	0.001	0.04 0.6
Xylene	30	30

*n/a means that there is no limit in place aligned to an annual average of samples taken across the year. The values given for Triphenyltin are absolute values that should not be exceeded in any taken sample. The value for Dichlorvos of 0.6ug/l is also an absolute value which runs in conjunction with the annual average values given in the table for that substance.

⁵ The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010

Appendix B - Reduction of Substances by Sewage Treatment

The first columns show the percentage removal rates for each substance. The last three columns show the sewage treatment reduction factor you should use in calculating the corrected concentration remaining in your effluent after sewage treatment. Some substances are not removed by the treatment process, but may be substantially volatilised during the process. You should allow for this in calculating the remaining concentration.

Substance	Removal rates			Sewage Treatment Reduction Factor (STRF)		
	% from water activated sludge plant	% from water filter	% volatilised	proportion left in activated sludge plant	Proportion left in filter	proportion left in effluent after volatilisation
1,2,3,4,5,6-Hexachlorocyclohexane (HCH)	65	37		0.3500	0.6300	
1-Ethyl-3,5-dimethylbenzene	-	-	44.88			0.5512
1-Hexene	-	-	93.81			0.0619
2-(Methoxyethoxy)ethanol	-	-	0.18			0.9982
2,4-dichlorophenoxyacetic acid (2,4-D) – ester and non-ester	0	0	-	1.0000	1.0000	
2-Ethoxyethanol	-	-	0			1.0000
2-Ethoxyethylacetate	-	-	0.18			0.9982
2-Methoxyethanol	-	-	0			1.0000
2-Methoxyethyl acetate	-	-	0.01			0.9999
2-Methyl-2-butene	-	-	97.49			0.0251
2-Nitropropane	-	-	5.69			0.9431
3-Methyl-1-butene	-	-	98.35			0.0165
4,4'-Methylene dianiline	-	-	0			1.0000
4,4'-Methylenebis(2-chloroaniline)	-	-	0			1.0000
4-4'-Methylene diphenyl diisocyanate	-	-	0.01			0.9999
4-tert-butyltoluene	97.2	97.2	-	0.0280	0.0280	
Acetaldehyde (Ethanal)	-	-	3.14			0.9686
Acrolein	-	-	5.81			0.9419
Acrylamide (2-Propenamide)	-	-	0			1.0000
Acrylonitrile (2-Propenenitrile)	-	-	6.46			0.9354
Alachlor	25	25	-	0.7500	0.7500	
Aldrin	99.94	99.94		0.0006	0.0006	
Allyl alcohol (2-Propen-1-ol)	-	-	0.28			0.9972
Amitrole (Aminotriazole)	-	-	0			1.0000
Ammonia	95	90		0.0500	0.1000	
Aniline [Benzeneamine]	95	95		0.0500	0.0500	
Anthracene	97	92		0.0300	0.0800	
Antimony and compounds - as Sb	-	-	0			1.0000
Arsenic and compounds - as As	11	11		0.8900	0.8900	
Asbestos	80	80		0.2000	0.2000	

Substance	Removal rates			Sewage Treatment Reduction Factor (STRF)		
	% from water activated sludge plant	% from water filter	% volatilised	proportion left in activated sludge plant	Proportion left in filter	proportion left in effluent after volatilisation
Atrazine	99.8	3.67	-	0.0020	0.9633	
Azamethiphos	8.9	8.9	-	0.9110	0.9110	
Azinphos-methyl	99.86	99.86	-	0.0014	0.0014	
Benzene	100	98		0.0000	0.0200	
Benzo (a) pyrene	-	-	0			1.0000
Benzo (b) fluoranthene	-	-	0			1.0000
Benzo (g,h,i) perylene	90	90		0.1000	0.1000	
Benzo (k) fluoranthene	-	-	0			1.0000
Benzyl butyl phthalate (BBP)	96	80		0.0400	0.2000	
Benzyl chloride (Chloromethylbenzene)	-	-	15.49			0.8451
Beryllium and compounds - as Be	-	-	0			1.0000
Bisphenol-A (BP)	95	92	-	0.0500	0.0800	
Boron and compounds - as B	-	-	0			1.0000
Brominated diphenylethers - penta-, octa- and deca- BDE	91	91		0.0900	0.0900	
Bromoethene	-	-	82.19			0.1781
Butadiene (1,3-Butadiene)	-	-	96.06			0.0394
Butene – all isomers	-	-	98.03			0.0197
Cadmium and compounds - as Cd	50	50		0.5000	0.5000	
Carbon disulphide	-	-	0			1.0000
Carbon tetrachloride (Tetrachloromethane)	95	96		0.0500	0.0400	
Chlordane	92.9	92.9	-	0.0710	0.0710	
Chlordecone	87	87	-	0.1300	0.1300	
Chlorfenvinphos	90	90	-	0.1000	0.1000	
Chlorides - as Cl	0	0	-	1.0000	1.0000	
Chloroethane	-	-	90.03			0.0997
Chlorofluorocarbons (CFCs)	-	-	96.31			0.0369
Chloroform (Trichloromethane)	91	99		0.0900	0.0100	
Chloroprene	-	-	94.47			0.0553
Chlorpyrifos	93	90	-	0.0700	0.1000	
Chromium and compounds - as	84	48		0.1600	0.5200	

Substance	Removal rates			Sewage Treatment Reduction Factor (STRF)		
	% from water activated sludge plant	% from water filter	% volatilised	proportion left in activated sludge plant	Proportion left in filter	proportion left in effluent after volatilisation
Cr						
Chrysene	-	-	0.01			0.9999
Clotrimazole	97.2	97.2	-	0.0280	0.0280	
Copper and compounds - as Cu	84	49		0.1600	0.5100	
Crotonaldehyde	-	-	1.07			0.9893
Cumene hydroperoxide	-	-	0.01			0.9999
Cyanides - as CN	68	68	-	0.3200	0.3200	
Cypermethrin	98	95	-	0.0200	0.0500	
Di(2-ethylhexyl)phthalate (DEHP)	95	90		0.0500	0.1000	
Diazinon	99.84	93.56		0.0016	0.0644	
Dibutyl phthalate (DBP)	99.8	99.8		0.0020	0.0020	
Dichlorodiphenyltrichloroethane (DDT) – all isomers	99.95	99.95		0.0005	0.0005	
Dichlorvos	89.97	89.97		0.1003	0.1003	
Dieldrin	99.94	99.94		0.0006	0.0006	
Diethyl aniline (N,N-diethyl benzenamine)	-	-	7.83			0.9217
Diethyl ether	-	-	33.5			0.6650
Diisopropyl ether	-	-	47.4			0.5260
Dimethyl sulphate	-	-	0.23			0.9977
Dimethylaniline (N,N-dimethylbenzenamine)	-	-	2.91			0.9709
Dimethylformamide	-	-	0			1.0000
Dimethyl-o-toluidine	-	-	4.51			0.9549
Dimethyl-p-toluidine	-	-	2.48			0.9752
Dioxane	-	-	0			1.0000
Diphenylamine	-	-	0.17			0.9983
Diuron	40	20	-	0.6000	0.8000	
Dodecylphenol	76.2	76.2	-	0.2380	0.2380	
Emamectin benzoate	94.1	94.1	-	0.0590	0.0590	
Endosulfan	99.99	99.99	-	0.0001	0.0001	
Endrin	99.94	99.94		0.0006	0.0006	
Ethyl acrylate	-	-	13.44			0.8656
Ethyl benzene	87.1	85		0.1290	0.1500	

Substance	Removal rates			Sewage Treatment Reduction Factor (STRF)		
	% from water activated sludge plant	% from water filter	% volatilised	proportion left in activated sludge plant	Proportion left in filter	proportion left in effluent after volatilisation
Ethyl bromide	-	-	73.99			0.2601
Ethylene (Ethene)	-	-	98.57			0.0143
Ethylene dichloride (1,2-Dichloroethane)	34.04	34.04		0.6596	0.6596	
Ethylene oxide (1,2-Epoxyethane)	92.2	92.2		0.0780	0.0780	
Ethyltoluene – all isomers	-	-	61.62			0.3838
Fenitrothion	99.86	99.86	-	0.0014	0.0014	
Fluoranthene	93.5	93.5	0.06	0.0650	0.0650	
Fluorides - as F	50	50	-	0.5000	0.5000	
Fluorine and inorganic compounds – as HF	-	-	0			1.0000
Formaldehyde (Methanal)	-	-	0.02			0.9998
Halogenated organic compounds - as Cl	24	24	-	0.7600	0.7600	
Halons	-	-	98.64			0.0136
Heptachlor	92.6	92.6		0.0740	0.0740	
Hexabromobiphenyl	94.1	94.1		0.0590	0.0590	
Hexabromocyclododecane	60	60		0.4000	0.4000	
Hexachlorobenzene	97	74		0.0300	0.2600	
Hexachlorobutadiene	100	83		0.0000	0.1700	
Hexane	-	-	85.3			0.1470
Hydrobromofluorocarbons (HBFCs)	-	-	96.06			0.0394
Hydrochlorofluorocarbons (HCFCs)	-	-	52.83			0.4717
Hydrofluorocarbons (HFCs)	-	-	88.32			0.1168
Indeno (1,2,3-c,d) pyrene	-	-	0			1.0000
Iodomethane	-	-	66.87			0.3313
Isodrin	93.5	93.5	-	0.0650	0.0650	
Isophorone	-	-	0.37			0.9963
Isophorone di-isocyanate	-	-	0.95			0.9905
Isoprene	-	-	95.81			0.0419
Isoproturon	55	55	-	0.4500	0.4500	
Lead and compounds - as Pb	82	20		0.1800	0.8000	

Substance	Removal rates			Sewage Treatment Reduction Factor (STRF)		
	% from water activated sludge plant	% from water filter	% volatilised	proportion left in activated sludge plant	Proportion left in filter	proportion left in effluent after volatilisation
Lindane	37	37	-	0.6300	0.6300	
Linuron	99.99	99.99	-	0.0001	0.0001	
Long chain (C ₁₈₋₂₈) chlorinated paraffins (LCCPs)	93	93	-	0.0700	0.0700	
Malathion	99.99	99.99	-	0.0001	0.0001	
Maleic anhydride	-	-	0			1.0000
Manganese and compounds - as Mn	-	-	0			1.0000
Mecoprop	41	41	-	0.5900	0.5900	
Medium chain (C ₁₄₋₁₇) chlorinated paraffins (MCCPs)	93	93	-	0.0700	0.0700	
Mercury and compounds - as Hg	76	56	-	0.2400	0.4400	
Methane			100			0.0000
Methanol	99	99		0.0100	0.0100	
Methyl bromide (Bromomethane)	-	-	70.48			0.2952
Methyl chloride (Chloromethane)	-	-	77.01			0.2299
Methyl chloroform (1,1,1-trichloroethane)	-	-	85.84			0.1416
Methyl chlorophenoxy acetic acid (MCPA)	3	3	-	0.9700	0.9700	
Methyl isocyanate	-	-	27.91			0.7209
Methylene chloride (Dichloromethane)	94.5	90		0.0550	0.1000	
Mirex	80	80		0.2000	0.2000	
Naphthalene	100	92		0.0000	0.0800	
Nickel and compounds - as Ni	34	47		0.6600	0.5300	
Nitrobenzene	-	-				
Nitrogen – total	52	52	-	0.4800	0.4800	
Non-methane volatile organic compounds (NMVOCs)	-	-	50			0.5000
Nonylphenol ethoxylates	79	79	-	0.2100	0.2100	
Nonylphenols	71	71	-	0.2900	0.2900	
Octylphenol ethoxylates	79	79	-	0.2100	0.2100	

Substance	Removal rates			Sewage Treatment Reduction Factor (STRF)		
	% from water activated sludge plant	% from water filter	% volatilised	proportion left in activated sludge plant	Proportion left in filter	proportion left in effluent after volatilisation
Octylphenols	73	73	-	0.2700	0.2700	
Organotin compounds - as Sn	90	90	-	0.1000	0.1000	
Para-Dichlorobenzene (1,4-Dichlorobenzene)	-	-	44.42			0.5558
Particulate matter – PM10	-	-	0			1.0000
Particulate matter – PM2.5	-	-	0			1.0000
Particulate matter – total	-	-	0			1.0000
Pentachlorobenzene	83.6	83.6		0.1640	0.1640	
Pentachlorophenol	96	76		0.0400	0.2400	
Pentane	-	-	94.24			0.0576
Pentene – all isomers	-	-	97.77			0.0223
Perfluoro octanyl sulphate (PFOS)	96	96	-	0.0400	0.0400	
Perfluorocarbons (PFCs)	-	-	0			1.0000
Permethrin	80	80	-	0.2000	0.2000	
Phenols - phenols and simple substituted phenols	83	83	-	0.1700	0.1700	
Phosgene	-	-	77.22			0.2278
Phosphorus containing compounds - as P	20	20	-	0.8000	0.8000	
Polychlorinated biphenyls (PCBs)	98	84.47	-	0.0200	0.1553	
Polychlorinated biphenyls (PCBs) – as WHO TEQ	-	-	0.01			0.9999
Polychlorinated dibenzodioxins and dibenzofurans (PCDDs/PCDFs) (as I- TEQ and WHO-TEQ)	82	82		0.1800	0.1800	
Polycyclic aromatic hydrocarbons (PAHs)	80	80	-	0.2000	0.2000	
Propetamphos	13	13	-	0.8700	0.8700	
Propylbenzene	-	-	70.55			0.2945
Propylene	-	-	98.27			0.0173
Propylene oxide	5	5		0.9500	0.9500	
Selenium and compounds - as Se	-	-	0			1.0000
Short chain (C ₁₀₋₁₃) chlorinated	93	93	-	0.0700	0.0700	

Substance	Removal rates			Sewage Treatment Reduction Factor (STRF)		
	% from water activated sludge plant	% from water filter	% volatilised	proportion left in activated sludge plant	Proportion left in filter	proportion left in effluent after volatilisation
paraffins (SCCPs)						
Simazine	99.74	99.74	-	0.0026	0.0026	
Styrene	-	-	50.32			0.4968
Sulphur hexafluoride	-	-	99.57			0.0043
Sulphur oxides (SO2 and SO3 as SO2)	-	-	0			1.0000
Teflubenzuron	59.2	59.2	-	0.4080	0.4080	
Tert-Butyl methyl ether (MTBE)	99	99	-	0.0100	0.0100	
Tetrabromo-bisphenol A (TBBPA)	98	98	-	0.0200	0.0200	
Tetrachloroethane (1,1,2,2-tetrachloroethylene)	-	-	14.15			0.8585
Tetrachloroethylene	96	95		0.0400	0.0500	
Tetrafluoroethylene	-	-	99.28			0.0072
Toluene	100	96		0.0000	0.0400	
Toluene diisocyanate – all isomers	-	-	0.5			0.9950
Total organic carbon (TOC)			100			0.0000
Toxaphene	91	91		0.0900	0.0900	
Tributyltin and compounds – as TBT	99.96	99.96		0.0004	0.0004	
Trichlorobenzene - all isomers	100	88		0.0000	0.1200	
Trichloroethylene	79.58	79.58		0.2042	0.2042	
Trichlorotoluene	-	-	8.15			0.9185
Triclosan	98	98	-	0.0200	0.0200	
Trifluralin	99.91	80.59	-	0.0009	0.1941	
Trimellitic anhydride	-	-	0			1.0000
Trimethylbenzene – all isomers	-	-	54.88			0.4512
Triphenyltin and compounds – as TPT	90	90	-	0.1000	0.1000	
Vanadium and compounds - as V	-	-	0			1.0000
Vinyl acetate	-	-	18.36			0.8164
Vinyl chloride	96.6	96.6		0.0340	0.0340	
Xylene – all isomers	100	93.5		0.0000	0.0650	
Zinc and compounds - as Zn	81	43		0.1900	0.5700	

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