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Department of the Environment

ENVIRONMENT AND HERITAGE SERVICE

GUIDANCE NOTE ON THE FORMULATION OF DISCHARGE STANDARDS FOR WASTE WATER TREATMENT WORKS

GUIDANCE NOTE 1 – DISCHARGES TO RIVERS AND STREAMS

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GUIDANCE NOTE 1 – DISCHARGES TO RIVERS AND STREAMS

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GUIDANCE NOTE SGN1/01 - DISCHARGES TO FRESHWATER WATERCOURSES

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1. INTRODUCTION

1.0. This Guidance Note describes the procedures for formulating numerical discharge standards for Waste Water Treatment Works (WWTW or 'works') to meet the environmental requirements of the receiving waters. It includes the factors to be considered and the methodology of the calculations. The standards are known as Environmental Needs Standards (ENS). This Note is largely based on the Guidelines adopted by the England and Wales Environment Agency to whom acknowledgement is given.

1.1. WWTW Design Discharge Standards are quoted as spot sample standards for BOD, suspended solids, COD, ammonia, phosphorus and nitrogen. This Guidance Note deals with the formulation of spot sample Environmental Needs Standards for these parameters, which are important features for WWTW design.

1.2. This Guidance Note deals with discharges to rivers and streams only. Discharges to freshwater loughs and lakes, estuaries and coastal waters will be covered by Guidance Notes 2 and 3 which will be issued in due course. It also does not consider discharge standards for intermittent discharges which are covered by Annex 8 of the Urban Waste Water Treatment Regulations (Northern Ireland) 1995 Guidance Note.

1.3. Environmental Needs Standards for Water Service WWTW are formulated on receipt of Form WSR1 - 'Initial Request for Waste Water Effluent Discharge Conditions' for Water Service Discharges or on receipt of a Water Order (1999) application form for private discharges. Environmental Needs Standards may differ from standards required by the Urban Waste Water Treatment Directive. Examples of the application forms for both Water Service and private discharges are given in Appendix A.

1.4. The formal Registered Standards for Water Service WWTW, including limit values for parameters required for Dangerous Substances as defined by EC Directive 76/464/EEC or other substances requiring control, are formulated on receipt of Form WSR2 'Application for Registered Standards in Respect of Water Service Discharges'.

1.5. EHS will endeavour to complete initial applications for discharge standards within 4 months.

2. EU DIRECTIVES

2.0. The EU Directives listed below are statutory requirements and have been absorbed into N.I. legislation and need to be complied with at all times. Their environmental standards are therefore taken into account when discharge standards to freshwaters are formulated.

2.0.1. Urban Waste Water Treatment Directive - 91/271/EEC;

2.0.2. Quality of Freshwaters to Support Fish Life - 78/659/EEC;

2.0.3. Dangerous Substances Directive - 76/464/EEC;

2.0.4. Nitrate Directive - 91/676/EEC;

2.0.5. Quality Required for Surface Water Intended for the Abstraction of Drinking Water - 75/440/EEC;

2.0.6. Habitats Directive - 92/43/EEC.

2.0.7. Birds Directive – 79/409/EEC

2.0.8. Water Framework Directive – 2000/60/EC

2.1. Currently, there are no inland bathing waters identified under the EU Bathing Waters Directive. The Directive may, however, need to be considered in cases where there is a discharge to a freshwater river which may affect a nearby bathing area.

2.2. Requirements of the Urban Waste Water Treatment Directive (UWWTD). These are set out in the Urban Waste Water Treatment Regulations (Northern Ireland) 1995 with further interpretation and operational details provided in the Guidance Note to the UWWTD Regulations. In cases where the initial dilution of the effluent with the river is poor, Environmental Needs standards may need to be more stringent than those required by the Directive. For works with a design population equivalent (PE) of 2000 or greater, the UWWTD 95%ile composite standard of 25mg/l BOD will be the maximum considered. Whilst suspended solids are not a mandatory UWWTD parameter for the UK, suspended solids standards will normally be set for ENS. The UWWTD also stipulates a composite COD standard of 125mg/l. ENS are generally formulated in terms of spot sample standards and details of the relationship found to exist between spot sample standards and composite sample standards are given later. Total phosphorus and total nitrogen standards may also be required for freshwater discharges to areas declared ‘sensitive’ under the Directive. Such standards are set as annual means as opposed to the 95%iles for sanitary determinands. For phosphorus standards, these will normally be set at 2mg/l or 1mg/l, depending on local circumstances and the PE of the works. For nitrogen, the standard will be 10 or 15 mg/l, depending on the PE. Total nitrogen standards may also be required for WWTW discharging to rivers which are considered to impact an estuarine or coastal sensitive area. It must be borne in mind, however, that UWWTD compliance may be assessed by percentage reduction in terms of removal by the works of a given parameter rather than compliance with limit values. The limit values, however, if equivalent to or more stringent than the Environmental Needs Standard, are those that new or upgraded UWWTD schemes should be designed to achieve.

2.3. Requirements of the EC Quality of Freshwaters to Support Fish Life Directive (referred to as the Freshwater Fish Directive). Designated waters are required to comply with certain chemical conditions with more stringent requirements for salmonid as opposed to cyprinid designated waters. The main implication of the Fish Directive on discharge standards for WWTW is the mandatory 95%ile total ammonia standard of 1mg/l (0.78mg/l as N) for both salmonid and cyprinid waters.

2.4. Requirements of the EC Dangerous Substances Directive. Discharge standards for List 2 Dangerous Substances will be set with regard to the current or proposed Environmental Quality Standards (EQSs). No increase in loadings of List 2 substances will be permitted. Discharges of List 1 Dangerous Substances should be eliminated and will therefore only be considered if proposals for their subsequent elimination from the discharge can be demonstrated.

2.5. Requirements of EC Nitrates Directive. Whilst specifically aimed at agricultural inputs, attention may be required to ensure that nitrate limits are not exceeded in designated nitrate vulnerable zones.

2.6. Requirements of the Quality Required for Surface Water Intended for the Abstraction of Drinking Water Directive. Account of this Directive needs to be taken in cases where a discharge may be expected to influence water quality at a drinking water abstraction point.

2.7. Requirements of the EC Habitats Directive. Consideration of this Directive in Special Areas of Conservation (SACs) may be required.

2.8. Requirements of the Conservation of Wild Birds Directive. Consideration of this Directive in Special Protection Areas (SPAs) may be required.

2.9. Requirements of the Water Framework Directive. This recently agreed Directive will eventually subsume other existing Directives such as the Freshwater Fish Directive and the Dangerous Substances Directive. Its focus is on river catchment management. Direct implications arising from it will be considered in later versions of this policy.

3. RIVER QUALITY

3.0. The quality of rivers in NI are graded using a river quality classification scheme known as the General Quality Assessment (GQA) scheme. The standards for the parameters employed; Dissolved Oxygen (DO) percentage saturation, BOD and ammonia, are as follows:

Table 1 – Standards for the Chemical GQA

GQA GRADE	**DO %Saturation**	**BOD mg/l**	**Ammonia mgN/l**
	10%ile	90%ile	90%ile
A	80	2.5	0.25
B	70	4	0.6
C	60	6	1.3
D	50	8	2.5
E	20	15	9.0

F	<20	-	-

3.1. The principle behind the formulation of discharge standards for effluent discharges is to ensure that the discharge does not cause harm to the environment, and that the receiving water quality does not deteriorate. It has to be recognised that the introduction of any effluent into a body of water will cause local changes to the water quality; it is EHS's responsibility to ensure that these changes do not amount to an overall deterioration.

3.2. In order to ensure consistency of approach, the following definition of no deterioration has been adopted and applies to all discharges to classified rivers:

EHS will not permit significant within-class deterioration nor a reduction in river class below that of the existing Environmental Quality Objective (EQO). In determining discharge standards and compliance with the no deterioration requirement, the following criteria will be used:

a) all new or upgraded schemes will be expected to ensure that the receiving waters will (providing upstream river quality is adequate) meet or exceed GQA Class B (except in the unlikely event of a discharge to a derogated port area).

b) changes in determinands should be kept to a minimum and ideally not cause a downstream increase of more than 10% in the mean and 90%ile concentrations of key determinands as measured/estimated upstream of the discharge, unless there is insignificant environmental change as a consequence. It is appreciated that adherence to an increase of not more than 10% is often difficult and that a degree of subjectivity may be required.

4. DISCHARGE STANDARDS

4.0. This Guidance Note primarily covers the formulation of BOD and total ammonia standards. Suspended solids standards will normally be required also and will often be set at 1.5 times the BOD value. Local conditions will be taken into account, e.g. the presence of salmonid spawning grounds in the vicinity of the discharge may lead to the need for tighter solids control.

4.1. Standards for BOD are set as BOD_5 (ATU), i.e. with nitrification suppressed by allylthiourea and are expressed in milligrammes per litre (mg/l).

4.2. Standards for suspended solids are set with reference to drying at 105^{o}Centrigrade and are expressed in milligrammes per litre.

4.3. Standards for total ammonia are expressed in milligrammes per litre of nitrogen.

4.4. Discharge standards for these three parameters are set on a 95%ile compliance basis. Compliance will be assessed using the ‘look-up’ table as specified by UWWTD. This is presented in Annex D.

4.5. Discharge standards formulated by the methodology described in this Guidance Note are based on compliance monitoring by spot sampling techniques. A translation table showing the equivalent values based on composite sampling techniques (for Urban Waste Water Treatment Directive purposes) is given below. This table has been derived

from studies carried out to assess the relationship between data obtained using both sampling techniques.

Table 2 - Composite/Spot sample translation table

BOD 95%ile		**Suspended Solids 95%ile**		**Ammonia 95%ile**	
Composite	Spot	Composite	Spot	Composite	Spot
25	31	50	70	30	33
20	25	45	63	20	22
15	19	40	56	10	11
12	15	35	49	5	5
10	13	30	42		
		25	35		

4.6. The spot equivalent of the UWWTD BOD composite standard of 25mg/l is normally rounded up to 30mg/l. A suspended solids (SS) figure of 50mg/l would normally be set with this.

4.7. It is EHS policy that all new or upgraded sewage schemes discharging to freshwaters should provide at least secondary treatment.

4.8. For new or upgraded works serving population equivalents of 2000 or greater, no spot sample standard more relaxed than 30/50 BOD/SS will be considered.

4.9. For new or upgraded works serving population equivalents between 250-1999 no spot sample standard more relaxed than 40/60 BOD/SS will be considered.

4.10. Works serving population equivalents of less than 250 may have descriptive (ie non-numeric) standards for regulatory purposes, providing their effluents contain insignificant levels of trade effluent. EHS policy on descriptive standards is described in policy document RPD 2/97. Design standards for such works will not be more relaxed than a spot sample standard of 40/60 BOD/SS. Should such works have a significant industrial component, numeric standards may be applied which would be not more relaxed than a spot sample 40/60 BOD/SS standard.

4.11. Discharge standards for new or upgraded works will always be accompanied by the flows on which the standards are based.

4.12. In some cases the procedures for formulating standards will lead to standards which are highly demanding in terms of the capabilities of the technology available to treat wastewaters at reasonable cost. Where this is the case, EHS will provide specific justification for imposing standards which are stricter than the following:

BOD	10 mg/l;
Suspended Solids	10 mg/l;
Ammonia	5 mg/l as N.

4.13. In setting standards, each effluent will be allowed the full dilution capacity of the water at the point of discharge for the purpose of calculations, taking account of the limits

defined by the existing EQO and by the no deterioration requirement as defined in paragraph 3.2. This will require rapid and efficient dilution in the first phases of mixing.

4.14. If the capacity of a watercourse is fully committed (and likely to remain so for the foreseeable future) at a site, EHS will refuse applications for new discharges pending a review of the discharge standards of the existing discharges.

5. DANGEROUS SUBSTANCES AND OTHER SUBSTANCES REQUIRING CONTROL

5.1. Discharge standards for Dangerous Substances and any other substances requiring control will be formulated on receipt of information on Form WSR2 Application for Registered Standards in respect of Water Service Discharges. **Note that EHS will determine which substances require control and therefore the discharger is required to supply as complete information as possible as to the likely constituents of the effluent.**

5.2. Discharge standards for such substances will be assessed using the current or proposed Environmental Quality Standard for that substance in freshwaters if in existence. If monitoring data is available, an assessment of Dangerous Substances in the current effluent will be made along with any information given on the application form. If no EQS is or is likely to be available, then environmental toxicology data may be required. Ecotoxicological data may also be required for discharges of complex trade compounds. Standards assessed from toxicology data will normally be based on a dilution from the Predicted No Effect Concentration (PNEC) and the dilution in the river. Provision of relevant data will be the responsibility of the discharger. Full details of ecotoxocological assessments are given in the Scottish and Northern Ireland Forum for Environmental Research (SNIFFER) report SR 3846 – 'Ecotoxicological Risk Assessment Manual for Chemicals in the Aquatic Environment'. A list of Environmental Quality Standards is available on request.

5.3. No one discharge should use all the available 'capacity' for any particular substance. Discharge standards for Dangerous Substances will be set on a Maximum Allowable Concentration (MAC) basis, i.e. values not to be exceeded, and a maximum load per annum may also be given.

6. FORMULATION OF DISCHARGE STANDARDS

6.0. Methodology

6.1. The calculations are based on the Mass-Balance Equation which can describe the mixing of a discharge with a river:

$$T = \frac{FC + fc}{F + f}$$

where:

F is the river flow upstream of the discharge;

C is the concentration of pollutant in the river upstream of the discharge;

f is the flow of the discharge;

c is the concentration of pollutant in the discharge; and

T is the concentration of pollutant downstream of the discharge.

6.2. The equation is based on the Principle of Conservation of Mass and if the variables all refer to the same instant in time, then the resultant value of T can be calculated. In reality, the distributions of the variables have to be modelled.

6.3. This type of statistical calculation is referred to as Combined Distribution (CD) methodology and requires multiple calculations carried out on a PC. The software is supplied by the England and Wales Environment Agency and is in the public domain. The version in use as of 1st January 2002 is version 2.4 and the status of the software is checked frequently with the proprietor.

6.4. The methodology uses the Monte-Carlo Simulation (MCARLO) in which a value for each of the variables F, C, f and c is plucked randomly from the full range of possible values. (For each variable the process of random selection is weighted so that a large set of selections will re-produce the distribution of values).

6.5. A value for T is calculated from each set of values of F, C, f and c using the above equation. The sequence of selection and mass balance is repeated until enough values of T have been calculated to define its distribution. Each value of T (or each value of F, C, f or c) is called a shot. Routine calculations will use 1000 or more shots for T.

6.6. In MCARLO it is common to assume that F, C, f and c follow the log-normal distribution but other distributions can be used. It is generally assumed that the distributions of BOD and Ammonia are log-normal.

6.7. With MCARLO a default correlation of 0.6 is imposed between F and f as both are affected by rainfall. The other variables are assumed to be independent and the default correlations are set to 0. All correlations may, however, be overwritten.

6.8. MCARLO can also test the assumptions that data are Log-Normal.

6.9. MCARLO calculations can either be carried out forwards or backwards. Forward calculations work out the downstream water quality for any chosen discharge quality whilst backwards calculations calculate the discharge quality required to meet a target in a river.

7. DATA REQUIREMENTS

7.0. The following information is required from the discharger:

a) Works Name,

b) Population Equivalent of agglomeration to be served - based on an influent loading of

60 grams of BOD per person per day,

c) Receiving Watercourse Name,

d) Easting and Northing of preferred discharge point to 10 figures or Irish Grid Reference to 8 figures (i.e. resolution to 10 metres),

e) The design Dry Weather Flow (DWF) in m^3 per day for the proposal,

f) The Average Daily Flow for the proposal,

g) The Flow to Full treatment for the proposal,

h) If the discharge is to be non-continuous, the complete discharge flow regime.

7.1. The following information will be collated by EHS:

a) The upstream chemical river quality (if available),

b) Any Environmental Quality Objective (EQO) for the watercourse,

c) Any requirements under any of the EC Directives listed in 2.0 above,

d) The Q_{95} low river flow immediately upstream of the proposed discharge point,

e) The Mean Daily river flow immediately upstream of the discharge point,

f) An assessment of the amenity value of the proposed discharge location.

8. UPSTREAM RIVER QUALITY

8.0. Where the upstream river water quality complies with the existing EQO, the measured upstream quality should be used in the discharge standard calculation where feasible (see below). Data from neighbouring or similar rivers may also be used if considered appropriate.

8.1. If the sensitivity of river monitoring data is checked it will often be found that the data on the upstream river quality is the most important source of uncertainty. The statistical uncertainty in estimates of percentiles can be large. For ammonia, for example, an estimate of a 95-percentile based on 36 samples can easily have a 90 % confidence interval which extends from -50% to + I00% of the value estimated.

8.2. This uncertainty is caused by the Laws of Chance in sampling, or Sampling Error, and presumes that there are no additional errors in sampling and chemical analysis.

8.3. The ordinary mean and standard deviation are required for river quality just upstream of the point of discharge. To avoid the effects of unusual hydrology, and to minimise the effects of statistical Sampling Error on small sets of data, it is best to use results for around 3-4 complete years. It is important to use complete years data to allow for

seasonal fluctuations.

8.4. The data should be examined for the presence of less-than or greater-than the limit of detection values. For less-than values, if it is considered that the effect of treating them at face value would lead to unrealistic statistics they should be handled by the 'double-substitution rule' described by Ellis, Van Dijk and Kinley (1993). This states that, for datasets where zero is the lowest possible value, the statistical calculation should be performed twice, once with the less-thans substituted as zero and again with them substituted as their face value. Only when the difference is of no practical importance should a single halved value be substituted.

8.5. For greater-than values, they should be replaced by their face value and the subsequent calculations annotated that the results are an under-estimate. This is except in rare cases where an upper bound (i.e. an absolute maximum which it is logically impossible for the values of the determinand to exceed) exists. Here the calculations should be performed twice with the actual result being somewhere in between the two values. A degree of subjectivity will be required in the interpretation of the results of calculations that contain greater-than values.

8.6. The next step is to consider outlying values (both high and low) which may also distort statistics. Outliers may be estimated by visual inspection or identified statistically by using a program TDF-MOT (Test Data Facility - Multiple Outlier Testing) developed by Ellis *et al*. For each dataset run through TDF-MOT, the test statistic T_{max} will most likely be set to that value for the numbers of samples in order to idenfity outliers at the 1% level.

8.7. Once less-than values and outliers have been dealt with, the mean and standard deviation may be calculated.

8.8. The objective class will almost always be either GQA Class A or B. For small upland streams, Class A may often be applicable. A target class of lower than Class B will only be considered in certain urban areas and in no case will it be lower than Class D.

8.9. If there is little or no information, or the upstream River Quality Monitoring Station is considered either too remote or unrepresentative of conditions immediately upstream of the discharge under study, then the mid-point of the objective class may be used as input to the calculations. For ammonia, however, it is sometimes found that where the BOD is approaching the middle of GQA Class B, the ammonia can be of a correspondingly higher quality (as evidenced by downstream, remote upstream monitoring or monitoring of similar rivers). In such cases, it may be unfairly restrictive to use an assumed ammonia in the middle of Class B and a higher quality upstream ammonia value may be used, provided adequate justification is given. Similarly, downstream and remote upstream BOD and ammonia data (or estimates based on them) may also be used with appropriate justification. Assumptions in the objective class may also be used in situations where improvements (e.g. elimination of overflows) may be expected to produce improvements in upstream water quality in the future.

8.10. Where the nearest upstream monitoring point is some distance upstream of the discharge, the effects of natural purification from the monitoring point to the point in the river just upstream of the discharge can be calculated for BOD and ammonia. The addition of tributaries and other discharges, however, can complicate the situation and

in practice it can be simpler to use estimated upstream river data in such cases.

8.11. If there has been a change in river quality during the past 3-4 years due to an improvement in the quality of the upstream river quality, assumptions in the objective class may be used as above.

8.12. In some cases, where the discharge is below the confluence of two rivers, river quality may need to be interpolated from quality stations on each river.

8.13. Some discharges enter a stream close to its confluence with another watercourse. Here, the calculation may need to take account of the river quality targets of both rivers.

8.14. Tight standards should not necessarily be applied because poor water quality upstream of a discharge provides poor quality water for dilution. As stated previously, the upstream reaches may be presumed to be improved. However, nothing in the above can permit an EC Directive to be breached, including discharges of Dangerous Substances.

9. RIVER FLOW

9.0. All Q_{95} low flow estimates derived either from catchment characteristics or obtained directly from flow gauging stations will be $Q_{95}(1)$ estimations, i.e. the 95%ile one day averaged flow over a given period. Mean and $Q_{95}(1)$ flows estimated using gauged records and/or catchment characteristics only are based on Micro Low Flow software (Institute of Hydrology, 1986) and the Northern Ireland low flow estimation (provisional) method as described in EHS/Rivers Agency paper ‘Low Flow Estimation in Northern Ireland' (March 2000).

9.1. New discharges to watercourses with a catchment area below 2km^2 will not normally be considered (the estimated Q_{95} would be unreliable due to the limitations of the current estimation model). Watercourses in such catchments would be considered vulnerable to drying up after prolonged periods of dry weather. It should also be noted that there is a high degree of uncertainty with estimated flows for catchments between 2-5km^2 due to the limitations of the current model, and these will only be estimated if observed flow records are available for the catchment under investigation or for a similar 'type' catchment. If no flow estimation is available, a pragmatic approach may be required.

9.2. Flow data is assumed to be log-normally distributed unless otherwise advised. Should there be reason to suspect that this is not the case then this should be taken account of in the discharge standard calculations.

10. DISCHARGE FLOW

10.0. The Mean Daily Flow (MDF) and the standard deviation are required for the calculations. If the mean daily flow is not supplied, it may be estimated as 1.25 times the Dry Weather Flow (DWF). Alternatively, the multiplicative factor may be estimated from information gained from similar geographical sewerage catchments. The standard deviation is taken as one third of the mean.

10.1. For discharges that may be non-continuous (e.g. from batch processes such as sequencing batch reactors (SBRs)), it is essential that details of the complete discharge flow regime are supplied. For works employing SBR units, CHECK EA….. Even with balancing tanks, however, this can still result in higher flows over discreet periods that would not be consistent with the log normal distribution normally employed for effluent discharges. In such cases, it may be necessary to set standards based on periods of continuous flows, rather than just the DWF and MDF.

11. DISCHARGE QUALITY

11.0. Discharge standard calculations will normally be carried out forwards to examine the effect of a range of discharge standards.

11.1. The mean and standard deviation or the mean and 95%ile of the discharge quality are required as input to MCARLO. As the standard will be set as a 95%ile it is usual that this and the mean are used (although it is, in effect, immaterial). The mean is normally set at slightly over half the 95%ile; for example, for a 95%ile of 20 the mean would be input as 11. This is based on the assumption that the coefficient of variation (CV, the ratio of the standard deviation to the mean) is around 0.5 which is a common rule of thumb for effluent quality. The CV may, however, vary depending on the type of treatment and if data are supplied relevant to the type of works to be built then an alternative ratio may be used – the discharger may wish to consider this. Sensitivity of any calculation to a change in CV (and other data) is described below.

11.2. Should downstream water quality be critical, then a range of CV values to produce estimated means may be investigated. Backwards calculations to work out standards required to meet river targets may also be done. Here, the CV for the target river quality can be estimated from other monitoring stations on the same or similar quality rivers.

11.3. From the above, it should be borne in mind, that, unless otherwise advised, **the mean effluent quality required will be approximately half the 95%ile.**

12. DOING THE CALCULATIONS

12.0. The software used for the calculations runs on the Windows operating system. The relevant data is input in a table window along with details of the discharge location and the parameter under investigation - only one parameter may be investigated at a time. For the forwards calculation the results table shows the effect on river quality downstream of the discharge for any chosen discharge quality. For the backwards calculation the output shows the required discharge quality needed to meet the river quality target.

12.1. Whilst ammonia standards primarily take account of the total ammonia requirements of the Freshwater Fish Directive, they may also be verified against the Directive's requirements for un-ionised ammonia. This analysis is available on the MCARLO software and requires input of a range of parameters, most of which are included in EHS's chemical monitoring programme. Where actual data are not available, estimations for a similar river should be input where possible, as the default values

supplied may be somewhat different from typical local conditions.

12.2. Once a suitable discharge standard has been arrived at, sensitivity tests may be performed to test the sensitivity of the results to changes in the input data. This is again available as a menu option where each of the key variables is altered by around 10% (0.1 for correlation coefficients) at a time; the effect of this is calculated and the effect on the discharge standard is given.

13. RESULTS WHICH ARE SENSITIVE TO DATA

13.0. This will occur when using measured upstream quality data when, for example, the upstream quality is close to the river target and therefore there is only a small potential for increase in a given parameter to still remain within the target quality. This capacity may increase several fold if the data for the calculation are changed slightly.

13.1. In such cases, the upstream data should be checked to investigate whether there may have been improvements to upstream discharges or, depending on the distance of the monitoring station upstream, whether natural purification of BOD or ammonia would be likely to significantly alter the quality immediately upstream of the discharge point.

14. DISCHARGES WITH LITTLE DILUTION

14.0. When the 5-percentile river flow is small in relation to the discharge flow, the calculated standard will work out close to the concentration entered for the river target. This reflects the fact that where there is no dilution from the river, the standard would need to be the same as the river target.

14.1. In such cases, it may be necessary to insist that the discharge goes elsewhere. The decision may, however, depend on whether the watercourse is important enough to be treated as a river and be classified; if so it will have a minimum EQO of GQA Class B. It should be borne in mind that small watercourses are often suitable for fish spawning and nursery habitats and may be particularly sensitive to pollution.

14.2. In some cases, it may be necessary to obtain advice from the relevant Fishery Board as to the actual or potential fishery interest in small streams.

14.3. As stated previously, EHS are unlikely to approve discharges to watercourses that are likely to dry up for considerable periods of time. In such cases alternatives such as other streams or sub-soil irrigation should be considered. Exceptions may be made for proposals for small schemes for which a tertiary treatment facility (such as a reed-bed) is to be provided which is capable of treating sewage to a high standard. Avoidance of nuisance is essential.

14.4. A pragmatic approach is also required for discharges to drainage ditches. If the water quality in the ditch is a problem to public health or constitutes a nuisance, alternative actions may be necessary.

15. UPPER TIERS

15.0. The Urban Waste Water Treatment Directive requires that upper tier standards, i.e. those values not to be exceeded, are set for certain parameters. For the UWWTD composite BOD and COD standards, the upper tier value should be twice the limit value. For the corresponding composite suspended solids standard, a multiple of 2.5 will be used. These multiples also apply to the spot sample equivalents. Suspended solids upper tiers may not be applied in cases of high dilution.

15.1. Upper tiers will not be applied to design standards for works serving PEs of less than 250.

15.2. For works PE between 250-1999 (i.e. not covered by UWWTD standards), upper tiers are applied if it is considered that the extra degree of control that they provide is required. For these works and those requiring Environmental Needs Standards tighter than UWWTD, the corresponding upper tiers for a range of values are given below. The relationships between 95%iles and upper tiers have been derived from an extensive UK-wide experimental programme.

Table 3 – Upper tier values for BOD and Ammonia

BOD		**AMMONIA**	
95%ile	**Upper Tier**	**95%ile**	**Upper Tier**
32	65	**33**	**65**
31	**65**	32	64
30	64	31	62
29	63	30	61
28	63	29	60
27	62	28	58
26	61	27	57
25	**60**	26	56
24	59	25	54
23	58	24	53
22	58	23	51
21	57	**22**	**50**
20	56	21	49
19	**55**	20	48
18	54	19	47
17	53	18	46
16	51	17	46
15	**50**	16	45
14	50	15	44
13	**50**	14	43
		13	42
		12	41
		11	**40**
		10	37
		9	33
		8	30
		7	27

		6	23
		5	**20**

15.2. Note that the bold values in the table above are taken from the Urban Waste Water Implementation Group agreed papers.

15.3. For BOD - for 95%iles between 32 & 40 multiply by 2, for 95%iles less than 13 the multiplier will be determined on a case by case basis.

15.4. For ammonia - for 95%iles greater than 33 multiply by 2, for 95%iles less than 5 the multiplier will be determined on a case by case basis.

15.5. Upper tiers for suspended solids will be set on a case by case basis. If set a multiple of 2.5 will generally be used.

15.6. In some cases, particularly those with poor dilution or discharging to important fishery interest watercourses, the upper tier may be sensitive and further investigation may be required. For these cases the 'Monte Carlo for Upper Tiers' option on the mass-balance software is used. Upper Tiers are set at the 99.9%ile level and this package calculates the relevant upper tier for a given downstream river target.

16. SEASONAL DISCHARGE STANDARDS

16.0. In some cases, it may be appropriate to apply standards which differ according to the time of year. Generally this will be for ammonia standards with different standards for summer and winter. If, for example, the all year ammonia standard is 5.0mg/l, it may be possible to relax the winter standard to 7.0mg/l but the summer standard would be tightened to 3.0mg/l.

16.1. Separate calculations are required for summer and winter to formulate seasonal standards.

16.2. EHS will take advice from the relevant Fishery Board as to the most appropriate seasonal split for the river or stream receiving the discharge.

16.3. The summary statistics for summer and winter river quality will be 25% less precise than the corresponding values for the complete year which can lead to cases where one season appears worse than the other purely because of the action of chance in sampling.

16.4. The main cause of seasonal differences in water quality is that natural purification is less effective in winter due to lower temperatures and shorter retention times.

16.5. For cases in which estimated river quality data is being used, data from the nearest RQS will be used to obtain the relative ratios of BOD and ammonia levels for summer and winter.

16.6. There are no separate river quality standards for summer and winter so the same river quality targets will be used for both seasons.

16.7. EHS will use summer and winter river flow statistics based on seasonal flow duration curves where available.

16.8. Once all the relevant information has been obtained, seasonal discharge standards will be formulated using similar methodology as for year-round standards.

17. CONSULTATION AND ISSUE

17.0. Once discharge standards have been formulated, EHS will begin the consultation process. For Water Service discharges, the relevant Fishery Board will be consulted along with Natural Heritage if necessary. For Water Order applications all statutory consultees will be contacted.

17.1. Following successful completion of the consultation process, the applicant will be notified of the required discharge standard. Should they wish to appeal against the standard they should do so in writing within 28 days.

17.2. Environmental Needs Standards come into effect one year after the date of commissioning of a works, i.e. one year after Water Service take over operation of the plant.

17.3. Environmental Needs standards may be subject to review after a period of four years or at any time if EHS is required to do so in order to comply with its statutory duties.

REFERENCES

DOE (NI) *The Urban Waste Water Treatment Regulations (Northern Ireland) 1995 Guidance Note,* 1999

EC Directive 75/440/EEC *'concerning the quality required of surface waters intended for the abstraction of drinking water in the Member States'.*

EC Directive 76/464/EEC *'on pollution caused by certain dangerous substances into the aquatic environment of the community'.*

EC Directive 78/659/EEC *'on the quality of freshwaters needing protection or improvement in order to support fish life'.*

EC Directive 91/271/EEC *'concerning urban waste water treatment'.*

EC Directive 91/676/EEC *'concerning the protection of waters against pollution caused by nitrates from agricultural sources'*.

EC Directive 92/43/EEC *'on the conservation of natural habitats and of wild fauna and flora'.*

EC Directive 79/409/EEC *'on the conservation of wild birds'.*

Environment Agency, *Calculation of River Needs Consents,* updated regularly.

Ellis, J.C., Van Dijk, P. A. H., and Kinley, R. D., *R & D Note 241 - Codes of Practice for Data Handling - Version 1*, WRc, 1993

Scottish and Northern Ireland Forum for Environmental Research (SNIFFER), *Ecotoxicological Risk Assessment Manual for Chemicals in the Aquatic Environment,* WRc, 1995

APPENDIX A - Form WSR1 - Initial request for sewage effluent discharge conditions

APPENDIX B - Water Order Application form

APPENDIX C - Form WSR2 – Application for Registered Standards in respect of Water Service Discharges.

APPENDIX D - The look-up table

Samples taken in any year	Maximum permitted number of samples which may exceed the 95%ile standard
4-7	1
8-16	2
17-28	3
29-40	4
41-53	5
54-67	6