NRA-Water Quality Series 1

Discharge consent and compliance policy: a blueprint for the future

NRA

National Rivers Authority

Water Quality Series No.1

DISCHARGE CONSENT AND COMPLIANCE POLICY:

A BLUEPRINT FOR THE FUTURE

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CONTENTS

PREFACE

The National Rivers Authority set up a Policy Group on Discharge Consents and Compliance in July 1989 with terms of reference that were agreed with the Secretary of State for the Environment. The Board of the NRA has now approved the Report and a copy has been sent to the Secretary of State for the Environment. The NRA is now pleased to publish it.

Within the NRA, the implementation of the recommendations, which differ in their time-scales and the sort of action they call for, will obviously require discussion and planning. The Secretary of State will also wish to reach his own conclusions on the Report. The publication of the Report provides a basis for consultation.

In the meantime, the Board sees the Report as providing an important review of the discharge consent system and commends it to the attention of discharger and the public generally. As the NRA moves towards implementing various parts of the Report, taking account of comments by the Secretary of State and others, the NRA will be indicating its intentions and looking for constructive responses from many dischargers. It is in everyone's interest to have a consent system working effectively and holding public respect.

Signature: Crick Howell .....

CHAIRMAN

EXECUTIVE SUMMARY

1 The consents issued for each effluent discharge to inland and coastal waters have to serve at least two key purposes; as law enforcement instruments, setting obligations on the discharger and as technical specifications of limits and conditions that the discharge must stay within to avoid harm to the receiving waters. Compliance by discharges with these requirements has long been ragged, and piecemeal changes to the consent system in the last ten years have added to the anomalies and scope for confusion (see Chapter 2).

2 Among the key changes which this Report recommends are:-

i) all environmentally sensitive discharges with numeric limits set for effluent flow and concentrations of determinands should include absolute limits not open to be exceeded at anytime. Further limits in 80 or 50 percentile form can then be added to refine requirements which routine performance must stay within. This would put controls for discharges from industry and from sewage works on the same footing and make the assessment of compliance or non-compliance more clear-cut. (See Chapters 4 and 5, recommendations 3, 8-11).

ii) in the selection of determinands for numeric limitation, more emphasis should be placed on restricting ammonia, and preparations should be made over several years to substitute Total Organic Carbon (TOC) for Biochemical Oxygen Demand (BOD) and Turbidity for Suspended Solids as conventional sanitary determinands in many consents (discussed in Chapter 5).

iii) These changes would also fit in with the National Rivers Authority (NRA) promoting a wider spread of automatic and continuous monitoring by dischargers (see Chapter 6).

3 A broader purpose of many recommendations in the Report is to engage dischargers in the provision of full and accurate initial information to the NRA about discharges and to update this when circumstances change. This should be part of their commitment to a positive management interest in their performance in waste disposal as in any other part of their business. It is in the interests of all competent and careful dischargers that the NRA should also be forceful in requiring possible laggards to comply fully with their consent obligations. Chapter 7 discusses the motivation of dischargers and recommends the introduction of Action Warnings as a new formal and urgent signal with a strong preventative emphasis. This would convey to everyone concerned with a specific discharge that better control and more care are imperative.

4 The NRA will require adequate resources to maintain the necessary levels of independant unpredictable sampling of discharges at any time of day or night, on a tripartite basis when appropriate. There are legal constraints on the NRA using information provided by dischargers to incriminate them in Court as well as other

hazards in letting enforcement depend wholly on self-monitoring by dischargers.

5 For the implementation of these recommendations, many consents may need to be reviewed and Chapter 8 indicates that programmes for this work should go forward on a catchment-related basis with regular progress reports being made locally and nationally. The capacity of some catchments to accept further discharges is already exceeded.

6 This Report is not just aiming to sort out the consequences of piecemeal past changes, but to provide for more effective control of discharges in the 1990's as claims to use the water environment for waste disposal and other purposes threaten to become more intense and more likely to generate conflicts.

CHAPTER 1

THE POLICY GROUP ON DISCHARGE CONSENTS AND COMPLIANCE

1 Much increased public and political attention is being directed to protecting the natural environment from damage by man-made activities. These activities include the widespread use of rivers, estuaries and coastal waters for the discharge and disposal of liquid wastes and drainage flows, mostly after treatment. They also include the use of rivers as major sources of drinking water. In addition inland and coastal waters have a high conservation and fisheries value and are the scene of healthy recreation such as swimming, angling and boating in which millions of people take part.

2 Most of these uses depend on sustaining the natural health and ecology of water in the open environment. That in turn depends on potentially damaging discharges being permitted only within well-defined limits and subject to obligations which dischargers see they must fulfil. This Report is concerned with how these limits and obligations are expressed in the consents issued to dischargers, and how compliance with the terms of consents is assessed, encouraged and where necessary enforced.

Terms of Reference

3 The Discharge Consents and Compliance Group was set up formally by the National Rivers Authority at its first meeting on 20 July 1989, at the request of the Secretary of State for the Environment, soon after the Water Act 1989 received Royal Assent. The terms of reference for the Group were settled as follows:-

"to review the way in which discharge consents for all discharges to controlled waters are set; the appropriate levels of compliance for different types of discharger; and the way in which compliance with these consents is assessed and monitored."

4 The objectives to which the review was directed were expressed as to consider:

a) how the regulator and the discharger should assess whether a particular discharge met the terms of its consent; and the confidence to be placed in that assessment;
b) the extent to which consent requirements for different types of discharge should be put on a common basis, and how any differences might be justified;
c) how compliance levels should be expressed for different types of discharge;
d) how best to ensure that discharges are properly classified as compliant or non-compliant, given that an offence could lead to enforcement action by the NRA or by third parties.

5 Among the range of issues that the Group should consider in its work the following were marked out:

i) whether consent conditions should be expressed at a 95%ile level (as currently for sewage treatment works), should be 100% (as currently in industrial discharges), or on some alternative basis; how these compliance levels serve to ensure that river quality objectives are met, and how to provide appropriate incentives to effective pollution control by dischargers;

ii) whether different rules are appropriate for different determinands in the light, for example, of the requirements of EC Directives;

iii) the sampling frequencies and methodology to be adopted for each type of discharge;

iv) the rules and methodology for assessing whether or not - on the basis of a particular set of samples - a discharge is regarded as meeting the required level of compliance;

v) the allowance to be made for statistical sampling error and for the effects of different sampling frequencies;

vi) the resource implications for industry and for the NRA of any new system of consents which may be recommended;

vii) the role of consent conditions in relation to quantity of discharge or polluting load;

viii) the type of conditions to be applied in respect of intermittent and/or emergency discharges.

6 The membership of the Group has been as follows:

Mr David Kinnersley: NRA Board Member (Chairman)
Professor Ron Edwards: NRA Board Member
Mr Quentin Gray: Solicitor, NRA South West Region
Dr Geoffrey Mance: Regional General Manager, NRA Severn Trent Region
Dr Jan Pentreath: Chief Scientist, NRA
Dr Clive Swinnerton: Technical Director, NRA

Mr Julian Ellis of the Water Research Centre at Medmenham has been fully involved as a Technical Adviser to the Group and Mr David Brewin of NRA Severn Trent has acted as Secretary to the Group.

7 The Group made a brief interim Report to the NRA Board in December 1989. With the Board's support, the Group organised an invitation meeting early in February so that it could hear the views of a number of outside bodies and people before reaching the conclusions now embodied in this Report. For views expressed on this occasion and much other support and encouragement given to them in the course of their work, all members of the Group put on record here their warmest thanks. The Severn Trent regional office of the NRA at Solihull has carried a considerable extra burden of word-processing work, for which we are most grateful.

CHAPTER 2

THE CONTEXT OF THIS REPORT

8. The Water Act 1989 which created the National Rivers Authority (NRA) transferred to it the pollution control function of the former regional water authorities (with other functions not directly relevant here). This function dates from legislation of 1951 which has been modified several times since then, including changes made by the 1989 Act but not yet implemented.

9. During debates in Parliament on this Act, Lord Crickhowell, then Chairman of the NRA Advisory Committee and Chairman designate of the NRA, pointed to major shortcomings in this system of discharge consents as the NRA would inherit it (see Annex 1). These shortcomings, which the Act would not wholly remedy, arise mostly from successive piecemeal changes made to the consent system during the previous ten years or so. On its own, each of these changes may have been helpful or necessary at the time it was made: cumulatively, they had the effect of confusing and weakening the system and its enforcement.

10. There was a problem of poor compliance before the water authorities were themselves created in 1974. The 'Jeger' Working Party on Sewage Disposal, reporting in 1970, found that 60% of sewage works were discharging final effluents in breach of their consents, and that the quality of industrial effluents discharged to rivers was more unsatisfactory than that of sewage works effluents (Jeger Report, 'Taken for Granted', paragraphs 50 and 152). The first two decades of the consent system were also notable for a requirement of secrecy save where details of consents had to be disclosed for a statutory purpose such as prosecution, and for the setting of limits being generally on a rule-of-thumb basis.

The Discharge Consent System 1974-88

11. Two main lines of change have been bearing on the consent system during the last 15 years. One was legislative, through the Control of Pollution Act 1974. This notably reversed the tradition of secrecy. In place of that, there were to be official registers of consents and sampling results open to public inspection. The Act also ended the earlier requirement that private prosecutions for breaches of consent could only be initiated with the Attorney-General's approval. These major changes however hung over the system a very long time without actually happening: they were only implemented in 1985.

12. In the meantime, the water authorities and the National Water Council in a co-ordinating role (until its abolition in 1983) began the second main line of change by starting to review policy and the standards of individual consents. A document called 'River Water Quality, the Next Stage: A Review of Consent Conditions' was published in 1978. This signalled moves towards linking consent standards to concepts of water quality standards or objectives for particular lengths of river or areas of coastal water. These

objectives would reflect intended uses of the waters, for example as drinking water sources, as fisheries or for other recreational uses, and for combinations of such uses.

13. This review continued in several phases through much of the 1980s mostly focussed on sewage works discharges and not on those from industry. Some consents were tightened, and others were relaxed, but there was little or no publication of the scale of these changes regionally or nationally. However, this review did not really address issues of compliance. It did not alter one important feature of the consent system, that consent limits were expressed legally as requiring 100% compliance, but it was understood in practice that if 95% or more of samples taken were within the limits, that was regarded as adequate.

14. This 'double-meaning' of the consent limits is discussed further in Chapter 4, but its relevance here is that it caused less difficulty as long as the consent system was mostly kept from public scrutiny. When public registers were launched in 1985, the DoE felt bound to do something about it. For sewage works discharges alone, they made a General Variation Order which changed the legal obligation in all the relevant consents to a requirement that the proportion of samples meeting the limits should not be significantly lower than 95%. Thus assessment of whether or not a sewage works discharge was complying with the legal obligations became dependent on a so-called 'look-up table'. This indicated for any given number of samples taken in a stated time-period (usually 12 months) the number of breaches of the limit that the percentile form of the limit allowed. As the registers became available and the privatisation debates attracted attention to sewage works, it became clear and well-known that about one in five sewage works were making discharges of lower quality than their consents authorised even with percentile limits and the margins of error they allow for (see Chapter 6 paragraphs 19-22).

Former Exemption from Tripartite Sampling

15. The change just mentioned fitted alongside an existing anomaly between consents for sewage works discharges and all other consents. To be used as evidence in Court, samples of all other discharges taken for official purposes had to be taken on a tripartite basis (with one part handed to the discharger) but this did not apply to the discharges that water authorities were themselves making as sewage works operators. Under percentile limits, it is necessary to take several samples over a period to show whether or not an offence has been committed, and doing that on a tripartite basis would be very burdensome. So some consents had percentile limits, and some were enforceable only by tripartite sampling, but these two rules did not apply together to the same consents.

Changes During 1989

16. The Water Act 1989 was, however, changing the status of water authorities. As private companies without the role of pollution

controllers, there was a case for giving them the protection of tripartite sampling in future. Ministers did not see it as practicable to end the application of percentile limits to sewage works at the same time so consents for these would be subject to look-up tables and tripartite sampling. This was one point to which Lord Crickhowell's comments quoted in Annex 1 particularly related: the consent system was having yet more piecemeal changes added to those made earlier.

17. 1989 also brought other changes in legislation and administration. The Act provides for water quality objectives (WQOs) to be set by the Secretary of State for specific areas of water, and the NRA would have a statutory duty to exercise its powers so that as far as practicable these are achieved. The DoE and Welsh Office also varied the individual consents of about 800 sewage works, so that their current discharges would not be in breach of limits set for them at current levels of performance or during the period of projected capital expenditure to improve them. These relaxed consents were subject to time-limits and to so-called upper-tier limits that it would be an offence to breach at any time. The view was also taken that several thousand storm overflows hitherto not consented should be issued with consents, so their legality could not be in doubt for the prospectuses that water authorities were to issue for their flotation. The Water Act also made more definite provision for the NRA to apply charges to direct discharges, a topic which is discussed briefly in Chapter 7.

18. Finally as our Report is prepared, the Government is legislating its Environmental Protection Bill, which will give Her Majesty's Inspectorate of Pollution (HMIP) a role in issuing, as part of Integrated Pollution Control, permits for discharges to controlled waters which are for other pollution control purposes in the jurisdiction of the NRA. Details of the liaison between HMIP and the NRA are still being worked out at the time of writing.

19. Thus the context for this policy review is wider than the privatisation of water authorities including their sewerage services. It has to take into account more than 10 years of piecemeal changes to the consent system, initiatives by Government and the European Community some of which are still under discussion, and changing attitudes among dischargers and the public generally.

CHAPTER 3

THE PURPOSES AND TYPES OF CONSENTS

20. Discharge consents take their legal character from the form of the pollution control legislation which makes it an offence to cause or knowingly permit polluting matter to enter what are described as controlled waters. Having a consent for a discharge and complying with it is then a defence against committing the offence. This defence only relates to that statutory offence: it has no force in civil or common law actions which those with riparian rights may take to keep their property free of pollution or claim damages if it does occur. Consents may affect riparian rights indirectly, by influencing whether or not a discharger may gain the basis for a prescriptive right to discharge.

21. The form of the main legislation throws great weight on how consents are framed, and the limits and obligations they set in authorising each discharge. Limits can be expressed in different ways even while aiming at the same standards, so the discussion of limits needs to be as precise as we can make it. This and the next two chapters focus on these issues. Chapter 6 then discusses sampling and monitoring to assess compliance, and Chapter 7 takes up the motivation of dischargers and other considerations.

22. As the law is directed to excluding discharges, consents may be described as defining the limits of those that can be environmentally acceptable. For several reasons including the complexity of effluents arising for disposal and the many other claims to use controlled waters, defining the acceptable has itself become a more complex process than it was two or three decades ago. The application of percentile limits has tended to work against the clarity and precision desirable in legal instruments. Moreover, the increasing claims on the water environment make it more desirable or necessary to commit dischargers to maintain an active and careful interest in how they operate their discharges in practice.

23. Thus there is in the framing of consents a need to hold three purposes in a sort of constructive tension or balance:-

i) defining the acceptable discharge in sufficient technical detail for the receiving waters to be protected from damage at all times;
ii) maintaining the clarity and precision of the legal obligations in the consent so that they can be readily enforced;
iii) enabling dischargers to understand and remember their obligations, and committing them in future to positive roles in sustaining full compliance with those obligations.

These points will be re-appearing in one or another aspect in most of the chapters which follow this one.

The Availability of Data

24. For a discussion which has to start from the current situation, however, we are at once confronted with an obstacle. While several

regional water authorities made a practice of publishing some figures about discharges in their regions, this was not done in any standard way nor were figures analysed or published nationally to give any perspective on the discharge consent system in operation. Thus very little national data is available and during our work we have not been able to mount a special exercise to gather it. Annex 2 gives the only figures we have on the spread or scale of present discharge consents.

25. As Annex 2 refers to some 139,000 consents as probably active, including some 12,000 which are regularly sampled, some categorisation is desirable. One in common use is between numeric consents and non-numeric ones, but this is far from clear-cut, as many consents include a combination of numeric limits and other conditions. We find it useful here to refer to three categories which still have some overlap, but can reflect a difference in the significance of the discharges as well as in the form of the consent:

i) Numeric Consents apply to significant discharges for which the consent specifies numeric limits for the flow and for concentrations of one - or more commonly several - constituents or determinands. These are the consents for which compliance is commonly monitored and assessed by regular or continuous sampling and the comparison of results with the relevant limits. Chapters 4 and 5 take up the definition of these limits and the choice of determinands.

ii) Non-numeric consents relate to a variety of significant discharges where - with or without numeric limits on flow - the conditions which substantially influence the acceptability of the discharge are not so readily expressed in terms of numeric limits on quality determinands. Such conditions often relate, for example, to the technical requirements which must be met by processes or facilities through which the effluent passes before discharge. Storm overflows only actuated by rainfall and some sea outfalls are examples of discharges covered by non-numeric consents as we use this term.

iii) Descriptive consents are strictly a sub-group of (ii) above, but generally relate to smaller discharges of little or no environmental significance. The DoE have used this term specially to refer to consents for very small sewage works, but it is convenient here to use it more widely for the sub-group of non-numeric consents covering small discharges of little or no significant impact. This is not to devalue either the importance of having them on record in the consent system or the need for dischargers always to comply with the requirements they specify.

This last category (iii) is almost certainly the largest group in the Annex 2 total, and a later part of this chapter comments further on categories (ii) and (iii) above.

26. The lack of reliable data may to some extent be attributed to the consents being administered by 10 separate regional authorities each with their own procedures. A larger influence is probably the system having been committed to be kept out of public scrutiny for more than 30 years up to 1985. The system of water abstraction licensing was more open from the start, and far more information about volumes licensed for various uses has been published. The move to public

registers of consents and sampling results was welcome and overdue, but as yet it has not led to the aggregation and analysis of data that would be helpful for both national policy formation and a better degree of public information and accountability. This leads to our first recommendation:-

*** Recommendation 1: The NRA should commit the necessary resources to analysing and publishing annually data about the numbers of consents in operation, and the discharges they regulate, with estimates of the degree of compliance among those regularly sampled. Publication of data then available should in any event begin in 1991.

Information from Dischargers

27. It is hardly possible to assess how major dischargers have reacted to the opening of registers in 1985. We hope they take a constructive attitude towards it, but it would be understandable if some of them are anxious about the hugely increased public and media attention to environmental pollution possibly working to their disadvantage - even if their own record of compliance is a good one.

28. One of the most important things we have to say in this connection is that the discharge consent system must be seen by dischargers as depending on a good flow of information from them to the NRA. This is specially relevant at the time of first application. The would-be discharger should in his own interest provide to the NRA the fullest and clearest information about the effluents he will discharge and the site conditions, processes, etc that will give rise to them. Inevitably, the application form reflects its status as the beginning of a statutory process leading to the issue of a consent as a formal legal instrument. Its role as the information basis from which the NRA will deal with the intended discharge is at least as important. A large number of discharges and consents continue for many years with little or no alteration, but if the effluent or the site conditions or activities giving rise to it change, dischargers should make every effort to keep the NRA informed and up to date about such changes. On this we make a double-barrelled recommendation:

*** Recommendation 2: The NRA should review urgently the layout and guidance given for the completion of application forms for consents. While such a review must allow fully for the statutory status of consents and the application form sometimes having to be produced in Court, the review should also:

i) ensure that the design and wording of the form helps applicants to understand what information is required and to give it fully, and leaves them in no doubt that withholding information about the effluents involved may put in question the full validity of the consent to be issued;
ii) include a prominent reminder on the copy to be retained by the applicant that any alteration in the scale or character of the discharge or the site conditions giving rise to it should be notified to the NRA. In many consents this may be appropriately included as a condition of the consent which it would be an offence to neglect.

29. There is specific provision in Section 118 of the Water Act 1989 for the NRA to obtain information whether or not the consent provides for that, but in the interests of the NRA's efficiency we wish to emphasise the need for a ready flow of information from dischargers to the NRA. We acknowledge that very many dischargers are already alert to keeping the NRA well-informed about their discharges.

What the Consent Covers

30. In a decentralised system that has operated for nearly 40 years, there have understandably been differences of practice and interpretation. The ways in which application forms and consents are related to each other are sometimes mentioned in this context. Now that public registers are in operation and consents may sometimes be consulted to gain better understanding of a register entry, we believe that generally consents should be self-contained in their drafting, and not depend on cross-references to application forms.

31. In some situations, different views seem to have been formed about what is not mentioned in consents. For example, where no limit for ammonia is stated in a consent for a sewage works discharge, it is sometimes argued that no limit applies and no offence can be committed by whatever level of ammonia the effluent includes. Such a view cannot possibly help the effective administration of pollution control, and it seems important to remove any scope for misunderstanding about this that there may be. Accordingly we recommend:-

*** Recommendation 3: Numeric consents should be self-contained in their drafting, and should include a standard rubric to the effect that they are not to be taken as providing a statutory defence against a charge of pollution in respect of any constituent for which they do not specify limits. Existing consents should have this rubric added.

32. Toxicity limits and testing are often relevant to the limited number of consents where complete definition of the effluent is difficult, and this is discussed further in Chapter 6. As the Water Act makes it an offence to cause any poisonous, noxious or polluting matter to enter controlled waters without a consent, the essential point is that the consent therefore needs to be as specific as possible in defining the nature of the discharge it does authorise.

Which Discharges Require Consents

33. There have been differences also in regional practices about which types of discharge may not require a consent. The main and widely well-understood rule is that any discharge which may carry at any time any poisonous, noxious or polluting matter into a watercourse needs authorisation by a consent. The fact that a discharge is only actuated by rainfall, or only drains natural run-off, is not assuredly a basis for regarding a consent as unnecessary, since the absence of any pollution is the key feature. However, for minor discharges (such as from a septic tank) to the soil rather than to a watercourse, the location and the nature of the receiving strata are important.

34. In various parts of the country, the protection of underground water sources - which may be very widespread - requires that no risk of contamination reaching groundwater through the strata should be allowed to arise. Thus the NRA is given in the Water Act 1989 powers to serve prohibition notices wherever there appears any risk of this sort. In sensitive areas, discharges of any sort to the soil should be expected to require consents. Elsewhere, discharges from individual house septic tanks well away from any watercourse may be seen as not requiring consents. NRA offices may wish to attract enquiries in case of doubt by would-be dischargers. We are told that at present Counsel's Opinion is being sought on some points related to the application of Prohibition Notices. As regional requirements for very minor discharges to be consented may change from time to time, we recommend:

*** Recommendation 4: Where not already available, NRA Regional Offices should prepare a leaflet on the areas where septic tanks etc do and do not require consents, and maintain regular liaison with District Council Planning Offices about these demarcations.

Non-Numeric Consents

35. The ways in which these consents specify the discharger's obligations vary. For storm overflows, the consent often specifies in numeric terms the flow which is to be carried forward in the sewerage system before the overflow operates (rather than flow limits for the overflow itself). Specific requirements about the levels of screening and other features of the facilities to be installed are also often appropriate for specific mention in the consent.

36. In all cases the specification in the consent (and earlier, in the application) of the sources of the effluent being discharged is necessary. This can affect the effluent quality in many different urban and rural settings and is a feature of the discharge that can change over a period as some local activities decline and others, including general building development and hard-surface areas, increase. Discharges influenced by rainfall are discussed further in Chapter 5 in a passage about defining limits to flow.

Marine Outfalls

37. Sewage disposal outfalls to marine and some estuarine waters are covered by consents which are more likely than others to overlap any numeric/non-numeric demarcation. By and large the effectiveness of a marine outfall in disposing of sewage in an environmentally acceptable way is determined by several different major factors, including its location, the dilution and dispersive capacity that the receiving waters provide, and the provision of adequate facilities such as screening and appropriate configuration of diffusers. The consent conditions need to reflect these factors with specific detail such as the location, number and length of diffusers, the level of screenings and the disposal of screenings. Such detail needs to be sufficiently explicit to ensure that the discharger will have no option but to install screening plants which are demonstrably efficient. In addition to such non-numeric conditions, a consent for a sea outfall may be expected to have an upper flow limit in numeric terms, to

protect the receiving waters against being overloaded, and other numerical limits if the effluent includes any trade components containing persistent pollutants. The recent announcement on minimum levels of conventional treatment for marine discharges will not alter the need to achieve bacterial standards in the receiving waters.

38. These considerations point to the discharger having a great deal of information to gather and provide to the NRA as all the preparatory work of designing the projected discharge facilities goes forward. Information about the frequency and duration of storm events and the modelling of dispersive capacity will often form part of this, and in plant design, provision for flow measurement is necessary as this should be a consent condition for significant direct marine discharges. In this general perspective, non-numeric consents can be seen as by no means less rigorous than numeric consents in the obligations they often need to put on dischargers. We therefore include a recommendation to express this aspect:

*** Recommendation 5: Whereas numeric consents are mostly focussed on limits to be met by the effluent discharged however it may arise, non-numeric consents must often be specific and unequivocal about the facilities and processes from which the discharge is to be made. This applies especially to marine outfalls, and will make the consent conditions for them notably different in some respects from those conventionally applying, for example, to sewage works discharges.

39. There are other provisions, for example in the Food and Environmental Protection Act, which relate to the laying of pipes for marine outfalls. These do not reduce in any way the need for a discharge consent to be obtained and for its requirements to be as full and specific as may be necessary to ensure that the consequences of the discharge remain at all times within the limits of acceptability.

Descriptive Consents and Maintenance Obligations

40. We have already characterised descriptive consents as applying to discharges of minimal environmental significance at any time but have indicated that, according to local geological conditions, their inclusion in the consent system may still be essential. The consents for such discharges will always have as standard features a description of the location of the discharge and the facilities giving rise to it. Where this process is - as it often is - disposal of household sewage, the consent should be explicit and precise about the number of separate dwellings or other units connected to the discharge point, so that it is clear that any increase in that number must be notified to the NRA.

41. The other important feature of such a consent should be the indication of obligations for regular maintenance of the facility which it would be an offence for the discharger to neglect. This is relevant to many types of discharge larger than are covered by merely descriptive consents, especially marine outfalls. For any regime directed to pollution prevention, clearly a deterioration in performance over time will be increasing the likelihood of pollution occurring on some occasion. Regular and careful maintenance must be one of the best counter-measures to guard against this. Consent conditions can

include not only maintenance obligations but also requirements that records be kept of maintenance carried out. This can be a useful extra safeguard against its being forgotten over the long periods when the same consent may continue in force. Thus we recommend:

*** Recommendation 6: For all types of consents including simple descriptive ones, maintenance obligations and the keeping of maintenance records should widely be standard conditions. Where necessary these obligations should cover all the facilities associated with the discharge, and there should be occasional inspections of the facilities and (where relevant) maintenance records to ensure compliance.

*** Recommendation 7: For simple descriptive consents, it may often be appropriate to include a standard wording excluding any trade or farm waste or any increase in the number of dwellings connected to the discharge, so that the discharger recognises that any development likely to change or influence the scale or character of the discharge must be notified to the NRA.

Other Types of Consent

42. References are sometimes made to 'deemed' consents, 'rationalised' consents, and 'interim' consents. These categories usually refer to consents granted in some transitional situation now past, and not yet in all cases updated or reviewed. For example, applications not dealt with under the 1961 Rivers (Prevention of Pollution) Act were given deemed consent pending determination when the Control of Pollution Act (COPA) Part II (1974) was implemented in January 1985. Discharges to tidal waters which were not authorised before that implementation were exempted from control if they were outside certain criteria. This exemption was lifted in October 1987 and each discharge was given deemed consent with determination intended on or before October 1992.

43. In the preparations for flotation of the water utility companies, many sewage works unable to comply with their consents were given more relaxed standards. These consents were made genuinely temporary by including time limits which would bring into effect tighter conditions again at or before April 1992.

44. These various categories should not be of continuing significance to the NRA's long-term policies to apply and enforce better-framed consents in future. They require notice, however, as showing how there have repeatedly been patchwork transitions in the past. Sustained effort and adequate staff resources will be needed to do better now, and priorities for this are discussed further in Chapter 8.

The Advertising of Applications for Consents

45. In place of the earlier lack of publicity, prior to the implementation of COPA, there is now a requirement that applications for consents should be advertised and a copy sent to the local authority within whose area the discharge is to be made. The NRA is empowered to dispense with these procedures if it considers that the discharge will have no appreciable effect on the receiving waters and proposes to approve the application. We see this provision as making for sensible economy and flexibility in consent application procedures while recognising that public information about projected significant discharges must be provided for. Public registers of consents and sampling results are referred to at the end of Chapter 6.

CHAPTER 4

DEFINING LIMITS

Load, Concentration and Flow

46. The potential environmental threat posed by a discharge in respect of each major pollutant it carries depends on two key factors:

    i) the polluting load - that is, the amount of material per unit time being carried by the discharge; and
    ii) the scale and condition of the receiving waters relative to the discharge.

    In broad terms, a discharge of low flow into receiving waters that are large will generally have little impact, in the absence of highly toxic or accumulative substances. By contrast, even discharges of moderate flow can have a notable impact on receiving waters that are small or slow-moving - that is, where the effluent receives little dilution.

47. Although load is the characteristic of primary importance in determining environmental impact, the direct measurement of load - in effluents or in receiving waters - is technically difficult. In practice, therefore, load is almost invariably obtained indirectly from measurements of concentration and flow.* It follows therefore, that the limits by which consents seek to control the polluting load of a discharge generally have to be expressed in terms of flow rates and concentrations of substances or determinands in the discharge. Thus a consent with any numeric limits is likely to include several of them for different determinands. There are nevertheless some circumstances in which it is very desirable for the consent to specify limits directly on load. We return to this point at the end of the chapter.

Mass-balancing

48. For man-made and natural reasons, discharges and the waters receiving them are subject to continual variation - both in flow and in the concentrations of their various constituents. This very much complicates the process of determining and expressing in numerical terms what pattern of effluent flow and quality will be acceptable and ensure that the relevant Water Quality Standards for the receiving water are achieved. For this reason there is a well-established methodology in the water industry for handling such evaluations, using mass-balance modelling techniques. This can be applied 'forwards' to quantify the impact of a given effluent, or 'backwards' to find the effluent quality required to meet a specified receiving water quality.

49. Because the modelling process focuses on the inevitable component of variability in effluent quality, the output from the mass-balancing process is not a single number but a statistical 'distribution' showing the aggregate spread of concentrations that would achieve the

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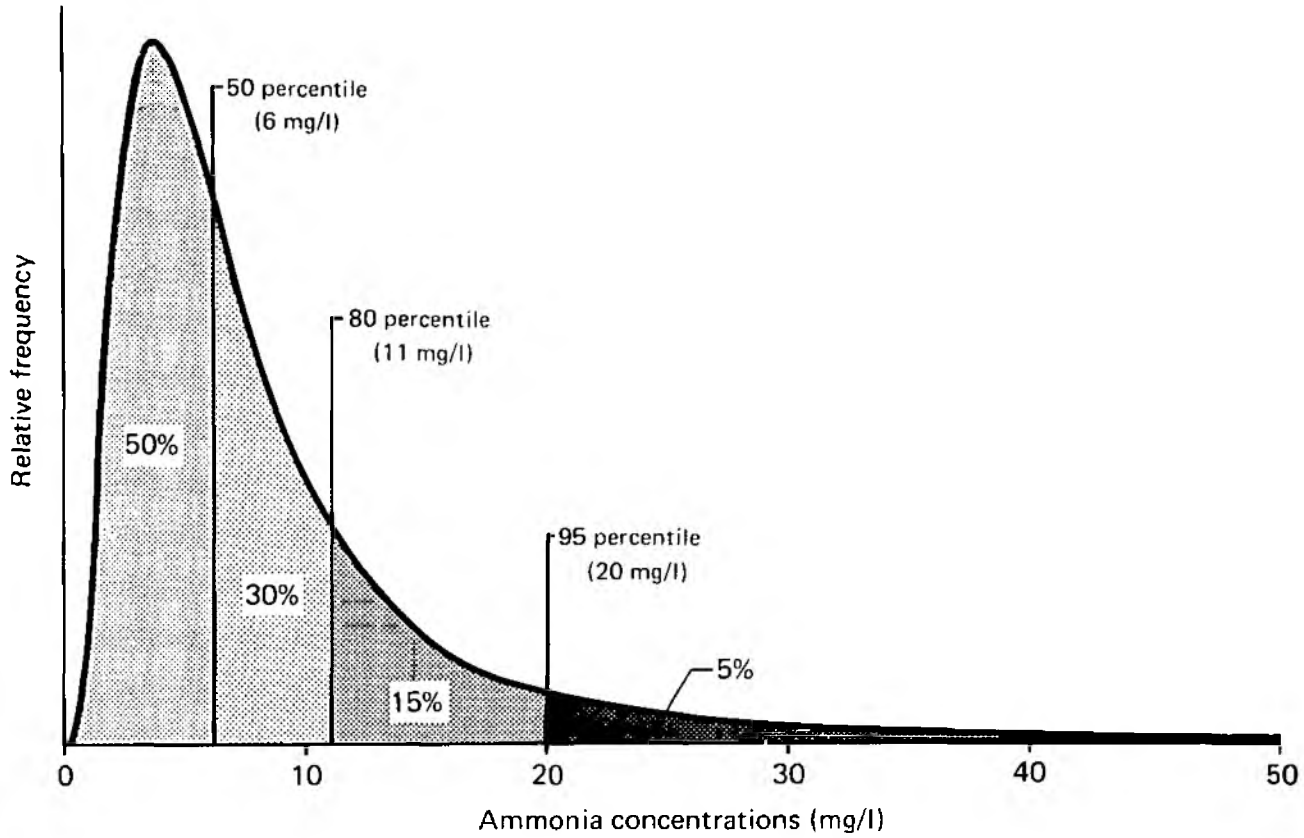
* Concentration expresses the quantity of a substance per unit of volume; flow describes volume per unit time. Hence load is the product of concentration and flow.

required water quality standard - as illustrated in Figure 1. Various percentile concentrations are shown on the figure. These tell us that the required effluent ammonia levels should keep below 6 mg/l for 50% of the time, below 11 mg/l for 80% of the time and below 20 mg/l for 95% of the time. Ammonia must at all times be below 50 mg/l. Thus for this particular effluent, any (or all) of these concentrations are suitable candidates for consent limits.

Figure 1: Typical distribution of required effluent ammonia concentrations



50. This leads us directly to one of the central issues in the definition of limits: which of these limits from the modelling process are appropriate to include in the consent as a legal instrument? We will be discussing that question shortly; but before that there is one more general point to be made. That concerns the time period over which the limits are to apply. Though we never stated it explicitly, the modelling process underpinning Figure 1 assumed a particular time period in which all the relevant variations were occurring. Common modelling practice has been for this to be a number of years (reflecting the data base from which many of the model's assumptions and inputs are derived). Thus some of the variation represented by Figure 1 - perhaps even a large part - will be reflecting seasonal influences. But in terms of limits in consents, absolute limits that we are about to discuss apply instantaneously and percentile limits require a time-period reference which still has to take account of the practicalities of enforcement. It will often, therefore, be necessary and desirable for the inputs to the modelling to relate to a shorter

assessment period - three or six months, say. Provided this requirement were made plain at the limit-setting stage, it would present no great technical problems.

We raise the time-period issue here to emphasise its integral part in the definition of limits, but the question of what might be a suitable assessment period is more conveniently addressed in Chapter 6.

Absolute Limits

51. Limits expressed in terms that make it an offence for the discharge to exceed them at any time are called absolute. (They are also known as maximum limits.) They are absolute in that compliance with such limits is tested by instantaneous 'spot' sampling. They are also absolute in the sense that the offence is committed by any exceedence whether or not it has damaging consequences (though this may influence decisions to be taken on enforcement action). Until 1985, the limits in all numeric consents were expressed in absolute terms, and apart from sewage works discharges, they still are.

52. For various reasons indicated in earlier chapters, absolute limits came to be regarded in practice as not really applying as strictly as they were stated in consents. The notion that compliance for 'most of the time' was acceptable became widespread. A sort of spurious objectivity was often lent to this interpretation by describing the required compliance as being for '95% of the time', long before detailed attention was given to the definition or interpretation of this in formal statistical terms. This may suggest, confusingly, that discretion or opinion has a part in saying whether or not a breach of the consent has occurred, or that the results of a single sample are not to be considered alone. It also mixes informal understandings with formal legal obligations. Desirably, however, the assessment of compliance should be precise and objective. Practical decisions about enforcement action will of course involve other factors besides sample results, but these should be considered separately.

53. This type of attitude towards absolute limits is not confined to England and Wales. For example, one of the Scottish River Purification Boards has stated that it regards compliance by 80% or more samples as being satisfactory, and by 50-80% of samples as marginal. These are general statements, subject to none of the exceedences being gross or causing serious damage. Extreme incidents could still be prosecuted, because in Scotland, in formal legal terms, all consent limits are still expressed as absolutes, and references to percentiles have no legal force.

54. The moves towards greater statistical clarity for at least the sewage works discharge consents in England and Wales were stimulated by the opening of public registers of consents and sampling results in 1985. As mentioned in Chapter 2, DoE then made a General Variation Order which had the effect of changing consents for sewage works discharges from including only absolute limits to including only percentile limits. This change had two consequences. First, it introduced into the assessment of compliance the use of the so-called 'look-up table' - the rationale of which we will be outlining briefly in Chapter 6. But secondly, it very much weakened the scope for enforcement, because no single exceedence would now constitute an offence.

55. Our terms of reference call for us to consider whether consent requirements for all discharges should be on a common basis. Relating this primarily to discharges with numeric limits, our conclusion is that they should all have absolute limits. For discharges as significant as many sewage works discharges are, consents without absolute limits are not satisfactory. Moreover we do not accept that there should be a major difference in the type of limits set for sewage works from those set in all other numeric consents, for discharges from a wide range of industries. Thus we recommend:

*** Recommendation 8: All numeric consents should include absolute limits for all relevant determinands.

Percentile Limits

56. We know there are views that with restoration of absolute limits to all numeric consents for sewage works discharges, the use of percentile limits formally or informally should be dropped. However, we believe that in the new setting the use of percentile limits can bring a more complete degree of control bearing on routine operating levels while the absolute limits constrain peak discharges. There are four common types of situation (perhaps overlapping to some extent) in which the addition of percentile limits is particularly useful:

i) for those types of effluent open to manipulation - that is, where the discharger is to some extent able to manage or distort the effluent quality distribution - a percentile limit would prevent the discharger from operating permanently just below an absolute limit set to control occasional peaks.

ii) for other types of effluent which, in contrast, have a large random component of variation, an absolute limit on its own will need to be so much higher than 'usual' quality levels (see Figure 1) that its sensitivity to even quite a marked deterioration in routine effluent quality will be very poor.

iii) there are many effluents whose impact on their receiving waters is related not only to instantaneous peak concentrations of their significant constituents, but also to the cumulative impact of the more usual concentrations of those constituents over periods of time. A percentile limit can provide an effective direct control on 'chronic' effects of this sort.

iv) the final benefit is more technical but none the less important. As we remarked earlier in the chapter, assumptions are made during the process of setting consent limits about the nature of the variations of effluent quality. The inclusion of a percentile limit (or, in particularly sensitive cases, two separate limits) in addition to the absolute provides a safeguard against it not conforming with those assumptions.

57. There are some practical arguments in favour of percentile limits at a variety of levels. When we come to the question of which percentile is better than which other, it is worth first making a general point. As we have remarked earlier, the 95 percentile evolved in recent years largely as a 'fudged maximum'. With absolute limits always in place, there is no longer any need to continue specifically with that level of percentile: if there are statistical or other grounds for advocating other percentiles, we would be free to take advantage of that.

58. It transpires that, for certain broad categories of effluent, there is a strong case for adopting the 80 percentile in preference to the 95 percentile. The argument is too statistically involved to reproduce in any detail here, but in essence there are three main benefits in terms of control:

i) a greatly improved sensitivity to detect real deteriorations in effluent quality from a limited number of samples of a discharge which will generally be prone to much variation;

ii) an additional control over a level of effluent concentration that will generally be relatively tight - certainly in comparison with the absolute limit - and yet needs to be met by the effluent for a relatively large proportion of the time (ie 80%); and

iii) a more effective and robust use of effluent quality data generally.

59. In cases where routine performance needs to be most tightly controlled to protect the receiving waters, it will often be of advantage to impose a 50 percentile limit in addition to or instead of the 80 percentile. Additional control on the more routine level of a discharge, as distinct from its maximum level, may also be relevant to the achieving of water quality objectives for particular purposes: such objectives are being given more emphasis both in the 1989 Water Act and some EC Directives. Controls related to the sustained performance of a discharge are very suited to engaging the attention of dischargers to good management of their discharge as a regular operational commitment.

60. On the question of which discharges should be subject to percentile limits in addition to the absolute limits which all numeric consents should include, the answer should be related to the environmental significance of each discharge. In brief, the more vulnerable the receiving waters may be to the substances which the discharge contains, the more appropriate it will be for the consent to include some measure of normal or typical levels of performance. Thus we recommend:

*** Recommendation 9: For environmentally significant discharges, whether from sewage works, industrial sites or other sources, the NRA should promote the application of 80 percentile limits in addition to the absolute limits which all numeric consents should have. These should be related to a clearly stated rolling time period. Where appropriate 50 percentile limits should additionally or alternatively be applied.

61. The scope to control routine levels of discharge (as well as peaks) is of growing importance because there are areas of the country where the polluting load that rivers can accept - that is, its carrying capacity - is already fully utilised by existing discharges. The scope for accepting new discharges or increases in existing ones will depend heavily on other claims on the river's capacity being reduced, e.g. by improving the quality or reducing the flow of some effluents currently being discharged. The additional control that percentile limits can bring will be of particular value in such areas.

Limits on Loads

62. As we remarked earlier in the chapter, there are some discharges where limits on the total load of a substance discharged over a given period will be appropriate. Although this may most often relate to substances which are accumulative, it is also relevant to discharges going into receiving waters such as estuaries or canals where effluents may have long residence times due to the low dispersive conditions of the receiving waters. In this type of situation, the build-up of discharges (which may not be continuous) and the keeping of records can be as important as the setting of the actual limits. In cases where there is a risk of deliberate manipulation of the discharge, the NRA may wish to build additional constraints into the consent relating to the maximum allowed total daily or monthly load. Accordingly we recommend:

*** Recommendation 10: For discharges where the effluent or their constituents may build up in the receiving waters, consents should include limits on loads. Conditions requiring dischargers to maintain records of the mass of a substance discharged over a given period and, in appropriate cases, to notify the NRA when a stated proportion of the total mass authorised for the relevant period has been discharged, may also be desirable.

Numeric Transitions

63. We have indicated earlier that absolute limits should have their primacy re-asserted and their clarity for compliance assessment freed from confusion. To this end they must be taken in future as meaning what they say: absolute compliance equals full, not proportional or percentile compliance.

64. For the great majority of sewage effluents - and for a minority of industrial effluents whose limits have been interpreted on an informal percentile basis - realistically attainable absolute limits do not at present exist, and so these will need to be newly set. The methodology by which this will be done is a topic for the reviewing of individual consents that we expect to follow our Report. We would, however, just remark that we are generally unsympathetic to the notion of a standard multiplier between percentile and absolute limits - such as came into discussion during 1989 when DoE set so-called upper-tier limits in absolute terms in consents for some sewage works. Even for sewage effluents the statistical evidence for standard multipliers is slender; it is much more so for industrial discharges. For an effective balance between protection of the receiving water and cost to the discharger, accordingly, we believe that the setting of absolute limits must necessarily take into account the circumstances obtaining for each individual discharge.

65. When we turn to the setting of percentile limits, our proposal to move from 95 percentiles (where these already exist) to 80 or 50 percentiles means that a transition will be needed in a great many cases. As a general principle, we propose the notion that where the existing discharge poses no risk of harm to the receiving water the revision of consent limits should be 'neutral'. Some uncertainty was expressed at our Consultation Meeting as to what we intended by this term, and so we take some care to clarify it here.

66. Suppose the result of a mass-balance exercise in 1985 had produced the required distribution of effluent ammonia quality shown earlier in Figure 1. As we explained in paragraph 49, an effluent whose variations in ammonia quality over time were to match (or improve on) this profile would ensure that the desired Water Quality Standard in the receiving water was being met. In this example the required 95 percentile effluent quality is 20 mg/l, and so that is the figure that in 1985 would have been written into the ammonia consent. Now we wish to set an 80 percentile. Figure 1 shows that the equivalent limit would be 11 mg/l. In other words, the required effluent quality is exactly the same (for an effluent precisely exhibiting this type of variability) whether we demand that ammonia is below 11 mg/l for 80% of the time or is below 20 mg/l for 95% of the time; and that is what we mean by a 'neutral' revision of consent limits.

67. To summarise, therefore, a neutral revision should involve no tightening (or slackening) of the required effluent performance; and we believe that for a large proportion of effluents such a revision will be appropriate. Where, in such cases, the 95 percentile limits for sewage effluents have previously been derived by an appropriate mass-balance modelling exercise for which the inputs are still valid it will often be straightforward to set the equivalent 80 percentile. Otherwise, a modelling exercise will need to be conducted from scratch.

68. Where, however, current consent levels have become less effective than is now needed for control, or current effluent performance presents the risk of harm to the receiving water, an appropriate degree of tightening on a suitable timescale should be incorporated into the exercise. Conversely, there are a few long-standing consents which have no environmental relevance now, and the opportunity should be taken to reset some of these at more meaningful levels.

CHAPTER 5

LIMITS TO FLOWS AND CHOICE OF DETERMINANDS

Flow Measurement

69. The limits which Chapter 4 was discussing mainly relate to concentrations of significant polluting substances in the discharge. As we emphasised at the start of that chapter, the aim must be to control the polluting load; and that calls for limits regulating the flow of the effluent as well as the concentrations of its various constituents. In order to provide an unambiguous and straightforward basis for enforcement, all numeric consents should include a flow limit which takes the form of an absolute value that must never be exceeded. For premises which could give rise to a highly variable flow, however, additional time-related constraints on the cumulative total flow may be required beyond the instantaneous absolute limit. Depending on circumstances, these could include daily, weekly, monthly, quarterly or annual total volumes discharged. Thus we recommend:

*** Recommendation 11: All numeric consents should include absolute limits for instantaneous effluent flow. Where flows are particularly variable, it may be necessary to include additional limits related to total volumes discharged over specified longer periods.

70. Effluent flows may be measured on occasional visits or more continuously by automatic equipment put in place temporarily or permanently. The discharger would probably provide such equipment if it were to be permanent, either because he wanted information for his own operational management or because the NRA required it as a condition of the consent. In the latter case, it should be a mandatory requirement in the consent that the discharger adequately and demonstrably calibrates and maintains the equipment. The NRA is also entitled under the relevant statutory provisions to include in consents what may be called reasonable administrative conditions (eg about the keeping of records) as well as conditions on the actual state of the effluents to be discharged.

71. Where flow measurements are to be made only on a short term or occasional basis by the NRA, the arrangements intended for this should be discussed with the discharger, to avoid disruption of his normal activities and to ensure that the measurement can be made without interference. It may not be desirable, however, to say when such measurements will be made.

Discharges Influenced by Rainfall

72. Discharges from sewage works, storm overflows on sewerage systems and some other points are heavily influenced by rainfall and surface run-off. Numeric limits cannot reasonably be set for discharges that are (for the time being) beyond the discharger's control, but consents can define the nature of the flows to be discharged in these situations. Overflows are only acceptable subject to well-established criteria for how much of the flow will be carried to treatment

processes or diverted to holding tanks before the overflow operates. Inclusion of trade effluent flows in overflows is to be avoided or restricted as fully as possible. Consents should be specific in insisting on screens or other safeguards against the discharge of unacceptable solids. Consents for overflows should usually be related to recognised best practice in the design of sewers and storage capacity.

73. Making the best use of modelling techniques for sewer flows can help the framing of consents for discharges influenced by rainfall. Consents need to make clear where the limits indicated or exemptions from them relate specifically to dry weather conditions or periods of rainfall. Where the consent allows variations for the effects of rainfall, these should be worded so that they cannot be taken as authorising overloads and overflows building up from other causes. Conditions requiring review of the consent if the relevant flows are markedly increased by building development or other factors, or actual performance deviates from the design assumptions, should also be included. Thus we recommend:-

*** Recommendation 12: Consents for discharges influenced by rainfall need to be as specific as possible in the nature of flows authorised for discharge, under dry and under rainfall conditions. References to the design criteria for flows going to full treatment and to overflows or storage, and safeguards against the discharge of solids should be explicitly mentioned in consents for new and refurbished overflows.

Special Situations

74. There are various situations where a discharge is actuated only by rainfall and consists only of surface run-off or seepage. Dischargers should not think that this in itself means that consents may be unneccessary. Surface run-off and seepage are increasingly subject to contamination, in urban and rural settings. Consents are necessary unless it is clear beyond doubt that a discharge will not carry poisonous noxious or polluting matter. Particular hazards in this context include run-off from quarries and mineral workings or other areas of ground disturbance, and from construction sites where discharges may be made only for a limited period. In such disturbed and changing situations safeguards against pollution may be makeshift or non-existent. The procedure for getting consents may also be thought by some dischargers too slow for such situations (as well as costly once application charges come into force).

75. Yet in various ways, discharges from such special situations continue to have significant impacts on water quality, and often cause damage. Many of the pollution incidents recorded annually may arise from some of these situations. Thus we recommend:

*** Recommendation 13: The NRA should gather systematic data on pollution caused by temporary discharges which are unconsented, and by discharges from various special situations such as mineral workings. The NRA should then promote, in the light of this data, programmes to emphasise the need for discharges to be consented, possibly by accelerated procedures if they are to be very short term; and take enforcement action against dischargers who ignore or defy any need for a consent.

Intermittent Discharges

76. From batch production processes and some other situations there are intermittent discharges not under the influence of rainfall or other natural factors. All the usual considerations about limiting flow and concentration apply to consents for these discharges, but it may often be important to include additional obligations about record-keeping so that any unusual effects in the receiving waters can be checked as related or unrelated to intermittent discharges.

Choice of Determinands

77. In connection with the choice of determinands and the differing limits set for them, the NRA has to deal with a very mixed inheritance of consents, for reasons which will already be evident from Chapter 2. In Annex 3 we show some information on this, based only on discharges from sewage treatment works because data for these consents were easier to gather and compare (as at December 1988), and because it made more sense to compare the performance of an essentially similar practice in different regions, rather than compare different practices in different regions. We would not expect complete uniformity within or between regions in the limits set at different locations (principally because of differences in the receiving waters and the dilutions they provide); but for similar processes and discharges the determinands selected for numerical limits should be rather more consistent than Annex 3 shows them to have been. The application of limits for ammonia appears especially inconsistent. This raises issues of controls being even-handed as well as objectively appropriate: where the importance of a determinand in controlling a certain category of discharge is generally recognised, it should not be regarded as discriminatory towards dischargers whose consents lack limits for that determinand to require those omissions to be put right.

*** Recommendation 14:

In new and reviewed consents there should be consistent application of limits for ammonia in all discharges to which this is relevant.

78. On the selection of determinands generally, a Royal Commission on Sewage Disposal in the first two decades of this century had a curiously long-lasting and pervasive influence. It introduced a test directed to the ability of effluents and river waters to consume oxygen. The measurement was to be made in a sealed sample over five days at a steady temperature (20°C), and the test is known as Biochemical Oxygen Demand (BOD). For many years there have been misgivings about this test, which have been far from assuaged by changes made in the late 1970s to eliminate the effects of ammonia in the sample being oxidised.

79. An often claimed advantage of the BOD test - that it measures the deoxygenating capacity of the effluent within a watercourse - is generally recognised to be an over-simplification. Furthermore, the five-day duration of the BOD test makes it time-consuming in analysis, and unsuitable for any kind of automatic or continuous monitoring. A detailed appraisal of these and other limitations of BOD as a control parameter is provided in a report published by the Water Research Centre (1954-M, October 1988).

80. As to what would be a useful improvement on BOD, our recommendation is total organic carbon (TOC). For many categories of effluent there are consistent relationships between BOD and TOC which would permit conversion of BOD to equivalent TOC values - though in other instances, case-specific relationships would need to be developed. We acknowledge that TOC is no more useful than BOD for oxygen modelling, but on the positive side, TOC can be measured more cheaply, quickly and reliably and is easily adapted to continuous monitoring. Whilst recognising, therefore, that there will be some discharges for which BOD would remain the more appropriate determinand, we believe that for the majority of discharges a move from BOD to TOC would be a worthwhile change.

81. Another traditional determinand has been suspended solids. The suspended solids content of effluents has a potentially considerable impact on receiving waters: the oxygen content of the overlying water; and even where the solids are inert, they can form a blanket over natural bed sediments and prevent biological activity within them.

82. Despite being a useful pollution control determinand, however, suspended solids share with BOD the disadvantage that it is not amenable to continuous monitoring (although it does not suffer from the other analytical and time-scale drawbacks of BOD). This leads us to recommend turbidity as a general surrogate for suspended solids. Again, we recognise that there will be specific circumstances in which turbidity does not provide an adequate replacement; but as a general rule we believe that a move from suspended solids to turbidity limits in consents would be beneficial - especially for the larger, more environmentally sensitive discharges. The use of TOC as an alternative to BOD is already allowed for in the draft EC Directive on municipal waste water although there is, as yet, no reference to turbidity.

83. The question of changing these traditional determinands of BOD and suspended solids was one of the matters discussed at our Consultation Meeting, when it was evident that the proposition generated a real measure of concern. BOD in particular may be said to have something like the status of a family antique: having inherited it, many resist parting with it, although few can rebut the arguments that it is of limited reliability and usefulness. In any event, we do not see replacing these determinands suddenly as a realistic or indeed desirable proposition. The primary requirement is for a sustained period of parallel measurement of the traditional determinands and their proposed replacements. The exercise should focus on the larger effluents - those being the prime candidates for continuous monitoring in the future. It is probably more important to make the change for sewage effluents than for other categories of discharge, and so the exercise should reflect that emphasis. The data-gathering should extend over sufficiently long a period - about four years would be a useful goal - for the character and robustness of the BOD : TOC and suspended solids: turbidity associations to be soundly established. From this information base, the NRA would then be in a strong position to effect an appropriate translation of consent limits from the traditional to the new determinands wherever this seemed useful. Accordingly, we recommend:

*** Recommendation 15: The NRA should make a commitment to gather the data necessary to evaluate the suitability of TOC and turbidity as new determinands for inclusion into consents in place of BOD and suspended solids. If a sustained period of parallel assessment produces sufficiently encouraging results, the aim should be to begin using the new determinands as replacements for the old about five years from now.

Toxicity Limits and Testing

84. Some discharges - especially those arising from industrial batch production processes - can contain a complex and variable cocktail of toxic chemicals which it is impractical or even impossible to identify and control by means of individual limits. For significant discharges of this sort, toxicity testing provides an effective control of their overall impact on the receiving water. In such cases the consent should specify the maximum acceptable level of toxicological response, and also stipulate the frequency with which this limit should be tested using one of the routinely available tests. Thus we recommend:

*** Recommendation 16: For environmentally significant discharges of complex composition where not all important constituents can be individually identified and numerically limited, consents should specify a clearly-defined toxicity limit, the appropriate form of toxicity test to be used, and the minimum frequency with which it should be applied.

CHAPTER 6

MONITORING AND THE ASSESSMENT OF COMPLIANCE

85. The NRA has to monitor the water environment generally (lakes, rivers, estuaries and coastal waters) and the effluents consented for discharge to these waters. This discussion of monitoring and sampling for compliance relates only to discharges (although monitoring of receiving waters may often be relevant to deciding consent conditions or checking the consequences of non-compliance).

86. The term 'sampling', generally refers to all the steps from taking the actual sample to getting the results after analysis. We use 'monitoring' usually to mean the supervision of water quality or compliance over a period of time.

87. Effluent sampling in Britain has generally been based on instantaneous or spot samples. We are aware of pollution control practice in some other countries involving the use of composite or qualified samples taken over periods of hours or days and analysed together, but introducing these here would add to already complex processes with no benefit in our view. To demonstrate compliance with limits on mass inputs (referred to at the end of Chapter 4), it is necessary to obtain a value which is the product of flow rate and concentration. For the latter, the data could be obtained from a series of spot samples or from a single sample taken from sub-samples which are combined.

88. For the 12,000 or so discharges regularly sampled out of nearly 140,000 consented discharges in total, much sampling is bound to be routine, but this should not make it predictable to the point where dischargers can actually anticipate it. The unpredictable sampling can be not only a check on malpractice but also a reminder to even a conscientious discharger that a continuous discharge to the open environment requires care and vigilance at all times.

89. The NRA expects to be strongly increasing its practical checks on pollution by means of sampling frequencies and patterns which are being reviewed in detail. For reasons related to the pattern of effluent discharges and the best use of NRA staff resources, much effluent sampling takes place within normal working hours on five days a week. But this must not carry any expectation that sampling at other times is excluded, either because the discharger does not find it convenient or as a result of the NRA not arranging it. Chemical and biological monitoring of the receiving waters also provides some indications of effluent performance over longer time intervals. Depending on the operating patterns of processes giving rise to the effluents, it may be specially important to include in sampling programmes the taking of some samples at night, at weekends and at periods when maintenance work is done. It is in periods when normal routines are suspended that either accidents or malpractice may occur in otherwise well-conducted procedures (especially if contractors not familiar with those procedures are on site for special work). We therefore recommend:-

*** Recommendation 17: The NRA should include in all relevant consents conditions indicating access and facilities required for flow measurements and the taking of samples to be done by the NRA at whatever times in the day, night or week it judges appropriate. The NRA should also encourage sampling staff to maintain the practice of making their visits unpredictable.

Sampling Results

90. This report refers repeatedly to the need for dischargers to be interested in their record of compliance with consent obligations. It is already standard practice for dischargers to be notified of sampling results which cause concern as they become available, but to make for better communication and more positive attitudes, we recommend:-

*** Recommendation 18: Whilst it is not the practice of the NRA generally to notify the discharger on each occasion of the results of the sample taken from his discharge, there should be regular dialogue between the NRA and the discharger covering satisfactory results over a period as well as highlighting any variations calling for explanation or causing concern.

Tripartite Sampling

91. The special type of sample known as tripartite needs extra comment in this context. These are samples divided into three parts as taken, one part of which is handed to the discharger, one part analysed by the NRA and one part retained for reference if need be. It is a statutory requirement that effluent samples which are taken by the NRA or at their request must have been taken in tripartite form if the results of analysis from them are to be accepted as evidence in Court.

92. Our enquiries suggest that on a broad estimate (including where necessary the cost of having a witness to the procedures) the average cost of tripartite samples is five times the cost of conventional sampling (around £60 per sample, including analysis, against £12). This obviously leads us to consider whether we should urge a change in the tripartite obligation. But we believe this is viewed by dischargers and the Courts as a key element in the just protection of the discharger's interests. The case for changing it rests on the desirability of reducing costs at the same time as sharpening the general thrust of enforcement work.

93. As matters stand, with the Water Act 1989 requiring tripartite sampling in respect of sewage effluents as an evidential requirement (where that was not necessary before), we do not recommend any change at this time (any major change would require further legislation). We observe that, once charges for direct discharges are producing income to fund monitoring work, the extra costs of tripartite sampling will come to fall on dischargers, the group whose interests it protects. In the general run of events, we would also expect tripartite samples to be taken in various situations where later a prosecution might not be pursued. That should not be regarded necessarily as wasted effort.

94. In relation to absolute limits, where a single breach could give rise to Court proceedings, the requirement for a tripartite sample as part of NRA evidence in such proceedings will generally be straight forward. For percentile limits where results from a sequence of samples are usually required (to show exceedances of limits more frequent than BS 5700 would indicate as acceptable), non-tripartite sampling can be acceptable to show the representative sampling regime applied, though the results of the samples on which the prosecution was taken would need to be in tripartite form. We would expect tripartite sampling to be more often directed to discharges at risk of breaching their absolute limits in various circumstances, but percentile limits can and will be equally enforceable over the time periods to which they are related. As experience is gained of sampling for absolute limits on all discharges with numeric limits and for percentile limits on some discharges related to their more routine performance, the balance of tripartite sampling effort can be kept under review. Certainly the resources necessary to enable regular non-tripartite monitoring to be switched to tripartite basis when a specific discharge threatens to be in breach of its limits repeatedly or significantly must be available for ready use within each NRA region.

95. We are asked to consider accident and emergency situations, and two points arise on these. First, consents should not be issued for emergency overflows or discharges unless it is clear that major hazards or damage to plant might arise if such discharges were not authorised in emergencies. Plant design should in any event moderate the need for them as fully as practicable. We refer to this again briefly in Chapter 7. There is a provision in Section 108 of the 1989 Act for emergency discharges subject to important conditions, including prompt notification of the NRA, but we would emphasise the need even in an emergency for as much continued control as possible of what is actually released from the scene of the emergency. The second point is that, as tripartite samples are necessary for NRA evidence in Court, the priorities of remedial action must not lead to the taking of the necessary samples being overlooked or neglected.

EC Directives

96. The Dangerous Substances Directives and the draft EC Directive on municipal waste waters make reference to sampling on a 24-hour average flow-proportional basis, for assessing compliance with some limits. We do, however, think it probable that the future sampling and compliance procedures recommended in this Report will be more demanding of effluent quality than will the criteria in the Directives. We are not sure of the practical enforceability of some of these sampling requirements.

Intensity and Accuracy of Sampling

97. One of the topics that the Group was asked to consider was the question of the minimum sampling frequencies with which various sizes and categories of effluent should be sampled. This is a wide and complex issue of major importance, as sampling frequency is the

factor that principally determines the effectiveness with which the NRA's compliance monitoring programmes can detect deteriorations in dischargers' performance. Guidance on sampling frequencies will be provided by another NRA group specifically considering this issue which is due to report shortly.

98. We do, however, feel it useful to comment on a closely related aspect, namely the frequency of compliance assessment. Unlike absolute limits, percentile limits always have a stated time-reference within which the number of allowed exceedences is to be counted and limited. Hitherto this has been 12 months, but that can be an unduly long period (even on a rolling basis) for enforcement action to be as vivid a possibility as it should be. Accordingly we believe that shorter assessment periods of six or even three months may be appropriate in some cases, and we will be stating this recommendation formally later in the chapter.

99. Sampling frequency is a factor of obvious importance; less obvious but equally important is the accuracy of sampling. The integrity of a monitoring programme ultimately depends on there being sound and well-maintained protocols covering the sampling process itself, the preservation and transportation of samples, methods of laboratory analysis, and data handling and computer routines. To check the continuing effectiveness of these aspects, audits of sampling and analytical procedures and results should be provided from time to time.

On this and other matters covered in paragraphs 91 to 99 we recommend:

*** Recommendation 19: Sampling programmes need to be economical, but frequencies must be adequate for results to provide a basis for decision or enforcement. Detailed guidance on required effluent sampling frequencies will be provided by the NRA's Sampling Group. Tripartite sampling should not be regarded as wasted effort if no prosecution follows. To promote efficiency, comparisons of sampling cost and frequency should be made between regions from time to time as well as audits of sampling and laboratory procedures.

*** Recommendation 20: In standard procedures for dealing with emergencies and accidents the obtaining of samples necessary for subsequent enforcement action should be explicitly included.

The Assessment of Compliance

100. This section is primarily concerned with the assessment of compliance with numerical consent limits - both absolute and percentile. It is important to remember, however, that compliance will also need to be assessed against a whole range of non-numeric conditions. Although the requirements in such cases are often focussed on the facilities or process from which the effluent has come (rather than on the characteristics of the effluent itself), they will commonly call for a degree of continuing vigilance - as, for example, through a requirement for regular reporting of maintenance.

101. Absolute limits The assessment of compliance against absolute limits is very straightforward. If the analysis of any one sample taken from the effluent exceeds the relevant limit, a breach of the consent has been committed. It should be emphasised that any sample - whether taken as a part of the routine compliance programme or during a special investigation - may be used in the assessment. Indeed, it would be not only valid but desirable to include in the assessment the results of any follow-up samples that may have been triggered in the first place by a suspicion that the absolute limit was being exceeded.

102. A case can be argued for including in the assessment an allowance for analytical error. But absolute limits are usually set in a robust way that makes a specific further allowance for analytical error unnecessary.

103. Percentile limits Given 'perfect' information on effluent quality through the assessment period - as if from an error-free continuous monitor - we would be able to note the exact proportion of time that effluent quality was within the limit (the 80 percentile, say) for at least the required percentage of time (viz 80%). In practice, however, the assessment usually has to be based on a relatively few samples from a continuously varying process, and this introduces uncertainty: on the evidence of the samples taken we can form an estimate of how the effluent has been performing, but the true performance of the effluent may have been either better or worse than this - we have no way of knowing.

104. In order, therefore, to demonstrate beyond reasonable doubt - in the way that the Courts require - that a discharge has failed to meet its percentile consent limit, we must allow the observed performance to be some degree poorer than the required percentage figure (by an amount depending on the number of samples in the assessment). This is the principle underlying the 'look-up table' method of compliance assessment that was introduced by DoE in 1985.

105. The look-up table is in fact just part of a wider methodology of statistical quality control set out in British Standard BS 5700, and we propose that this standard should form the basis of future compliance assessment with percentile limits. For percentile limits presently assessed with the look-up table the misclassification risk for a just-satisfactory discharge is 5%, and we do not suggest changing that in future applications of BS 5700. Compliance Tables will be constructed accordingly for the 50 and 80 percentiles (and any other percentile limits that may be relevant) using the appropriate procedure** from BS 5700: these will specify the minimum number of samples out of any particular total number which must comply with the percentile limit.

** By way of a brief technical note, we state that compliance with percentile standards will be judged using a 'counted attributes control chart for synthetic defectives', as described in the companion British Standard BS 5701 - but derived using exact binomial theory rather than the approximate Poisson approach taken in BS 5701. A good account of the procedure is given in Section 3.2 of BS 5700.

106. Where percentile limits apply, it is an important principle that the sampling is representative of the whole assessment period, in order not to place undue emphasis on any shorter-lived influences and so bias the overall set of results. For whatever reason they are taken, additional samples will bias the temporal representativeness of a randomly planned programme. Accordingly only those samples taken (whether on a conventional or tripartite basis) as part of the routine monitoring programme should be used in assessing compliance with percentile limits. We stress, however, that this is not a demand for the programme to be mapped out rigidly long in advance. The choice of days and times of sampling may and should remain highly flexible and unpredictable to the discharger. The key requirement is simply that the taking of samples for percentile compliance purposes should not be deliberately influenced, and thus possibly biased, by short-term perceptions of effluent quality within the full period set for the percentile assessment to apply.

107. Aggregate versus determinand compliance Where percentile limits are set for several determinands in a discharge, a related issue is whether exceedences are counted within the relevant time period separately for each determinand or in aggregate. There has been some doubt on this point even in the effect of changes made by DoE: the General Variation Order of 1985 reflected in Schedule 1 the policy intention of separate counting, but some consents issued by DoE between January 1985 and August 1989 are said to be ambiguous about it. The statistical point is that aggregation alters the incidence of exceedences originally allowed for each determinand. Thus if, for example, two determinands were assessed in aggregate against their 80 percentile limits, this would effectively be the same as redefining those limits as 90 percentiles. In short, if a percentile limit is set on an individual-determinand basis, compliance with that limit must be assessed on the same basis.

On these points of compliance assessment we therefore recommend:

*** Recommendation 21: Any type of sample, whether routine or investigational, may be used in assessing compliance with absolute limits.

*** Recommendation 22: Percentile limits must always be related to specified time periods. For the assessment of compliance by tables based on BS 5700, consents should specify rolling time periods: these need not always be for 12 months, and in cases of discharges needing careful supervision periods of six months or less will be preferable. The assessment should be based solely on results from the routine monitoring programme: special or investigational samples introduce bias and should not be used for this purpose.

*** Recommendation 23: The counting of exceedences against percentile limits should be separate for each determinand having such limits. The NRA should adopt a standard form of words to put this beyond doubt in all consents that include percentile limits.

Continuous Flow Monitoring

108. Where continuous or automatic measurement is required - whether for effluent flow or for the concentration of a pollutant in the effluent - the NRA should generally define the obligation in terms of data to be provided, at what intervals, and with what degree of accuracy, rather than require any particular type of equipment to be used. It may often be advantageous if provision can also be made for remote access from an NRA office to the monitoring facility or the data it generates.

109. There would be great advantage if continuous monitoring could be reliably extended for quality determinands at reasonable cost. The cost of present equipment for monitoring many determinands tends to be influenced by limited demand whilst for other determinands methods and equipment are not yet available. However, initiatives by the NRA could create a bigger market in this general area and lead to lower unit costs and the wider availability of appropriate equipment. It would in any case by advantageous for the NRA to maintain close contact with the manufacturers of continuous monitoring equipment with a view to accelerating developments and reducing costs.

"Discharger" Monitoring

110. On the subject of monitoring (whether discrete or continuous) carried out by the discharger himself there are two main considerations. First, continuous monitoring of determinands can be helpful, especially in relation to percentile limits, where the emphasis is on sustained controls in which the discharger has as much interest as the NRA. This might be called mutual monitoring, where the NRA is able to validate and accept the adequacy and accuracy of ongoing data collection that the dischargers would expect to be mostly gathering for their own management purposes anyway. We hope there may be a substantial extension of this over the next few years.

111. We do not think, however, that any form of self-monitoring by dischargers can be sufficient on its own. Even continuous monitoring data inevitably lacks the assurance of impartiality, whilst self-monitoring taking the form of discrete snap sampling suffers additionally from the absence of any element of unpredictability. More significantly, although it is well recognised in France and the United States (for example) that self-monitoring results can be used as evidence in Court, Britain and several other countries have the opposite legal tradition - described to us as having 'a bias against self-incrimination'. We therefore see extensions of monitoring by dischargers, especially with continuous and automatic equipment, as capable of greatly extending the supervision of discharges both by those who make them, and indirectly by the NRA, but not as ending the need for replacing NRA monitoring nor contributing to higher levels of enforcement action. Thus we recommend:

*** Recommendation 24: The NRA should promote continuous monitoring of environmentally significant discharges where technology and circumstances make that possible with adequate reliability at reasonable cost. This may be achieved by voluntary arrangements with dischargers or through consent conditions. On either basis, validation by the NRA of equipment and data and in suitable cases remote access facilities for the NRA should be provided for.

*** Recommendation 25: Monitoring directly by the NRA must continue as our independent check, on a tripartite basis where necessary, and generally, where dischargers are undertaking some self-monitoring as well as where they are not. The scale of this work should be decided on local circumstances and on the basis of general policy on sampling frequencies.

*** Recommendation 26: Where automatic or continuous monitoring is required, consents should usually indicate the types of data needed and the degree of accuracy required rather than the particular equipment to be used. Consents should provide for independent certification of the equipment's accuracy at regular intervals and in appropriate cases may require facilities for the NRA to interrogate the equipment remotely.

112. What evidence is admissible in Court must remain a matter for individual Courts to decide in the circumstances of each case under the various rules and precedents on such matters. However, it is open to the NRA to reassure individual dischargers about data it will not use as evidence - for example, when new continuous or other monitoring arrangements are under discussion with a discharger who will play a large part in their operation. Acceptance that no use will be made by the NRA of some types of data as evidence in Court may make the arrangements more acceptable to the discharger, yet still useful to the NRA. It should be made clear, however, that when the self-monitoring shows the discharge at risk of being unsatisfactory, the NRA will be likely to increase sampling as necessary. In all situations where the discharger may play an active role in gathering data for the NRA, it is desirable to avoid misunderstandings about the status of that data. In contrast to such discretion as the NRA has about what data it will use or not as evidence in Court, the rules about what data must or must not be included in public registers are much more rigid. Thus we recommend:

*** Recommendation 27: The NRA should always be ready to indicate to dischargers which of the data they may be expected to provide has to appear on the register. The NRA can and should also indicate which data they will not rely on as evidentiary.

Public Registers

113. In this final section it is worth setting out how the various types of sampling referred to relate to public registers:-

i) Under present legislation, the registers have to include all results of analysis samples taken by, on behalf of, or as a requirement (eg in a consent) of, the NRA.

ii) Samples taken by or for the NRA can only be used for the purpose of prosecution if they were taken on a tripartite basis - which most effluent monitoring samples are not.

iii) However, samples taken by other bodies of all sorts (voluntary, commercial etc) who may have access to a discharge point can be quoted in evidence without being tripartite.

iv) Not having been taken by the NRA, results of these samples are not required to be recorded in public registers.

114. Thus public registers give a full record of NRA-initiated sampling of consented effluent discharges, but not all the information available if there has been other sampling as well (whether these results have been volunteered to the NRA or not). We are told that if the Government under new legislation makes the monitoring of some effluent discharges to controlled waters the responsibility of HMIP, the rules will be amended to require the results of HMIP-initiated sampling to be included in the public registers kept by the NRA.

115. It is also relevant here to refer to the changes which adoption of our recommendations would bring to the public registers of consents and the sampling results recorded in them. Hitherto, registers have included many consents (for industrial discharges) applying absolute limits and many others (for sewage works discharges) applying only percentile limits. For this second category, registers can be expected to show a number of exceedences of the limits set in consents without these exceedences necessarily representing a breach of the consent: percentile limits are focussed on a specified proportion of samples complying with or failing the specific standards set.

CHAPTER 7

THE MOTIVATION OF DISCHARGERS AND OTHER CONSIDERATIONS

116. Following adoption and implementation of our recommendations, all consents with numeric limits would have absolute limits. (Paragraphs 51-55: Recommendation 8). Any exceedence of these limits at any time would then be a breach of the consent and an offence. In this sense, the register entries would be more rigorous than they are at present in respect of sewage works discharges.

117. We are also recommending the application of percentile limits additionally to some discharges going to sensitive receiving waters, because these additional limits can provide extra discipline for the routine or average levels of discharges to which they are applied. (Paragraphs 56-60: Recommendation 9). The effect of these new style percentile limits (often at 80 or 50 percentile levels) being included in public registers will be:-

i) to increase the information which the registers give about some discharges.

ii) to show in respect of the percentile limits larger numbers of exceedences which may still be within the limits the consent sets in this way. As and when these new-style entries come to be entered in public registers, it will be important that suitable explanations and distinguishing marks are available with the register to help people to interpret them correctly. The distinction between absolute limits (any exceedence = breach of consent) and percentile limits (exceedences beyond a specified proportion of samples = breach of consent) will require to be made as clear and emphatic as possible. Thus we recommend:

*** Recommendation 28: With the increased number of results likely to be flagged as exceedences on the public registers following the introduction of 80 and 50 percentile limits, the NRA should develop a clear introductory note on the meaning and interpretation of percentile limit exceedences, and arrange for this to be readily available by anyone consulting the public registers.

118. The consent system can be seen as having two somewhat different thrusts in relation to the motivation of dischargers. One of these, which may be called the enforcement thrust, is liable to be adversarial in spirit, because some businesses will not achieve and sustain the necessary safeguards against their effluents causing damage unless they are compelled to do so.

119. In our view it is essential that the framing of discharge consents, the definition of limits for specific determinands, the scale of sampling effort and other monitoring should all be clear and robust so that no dischargers think that slackness or deliberate malpractice on their part may escape notice. If possible, the NRA

has to demonstrate untiring vigilance on every length of river or coastal waters where discharges are made, and the precise limits which each discharger has to achieve must not seem to be in doubt or open to argument.

120. A second thrust of the consent system, perhaps suitably termed the compliance thrust, is to define for competent well-motivated dischargers the standards and limits by reference to which they should manage their discharges of effluent as they manage other aspects of their business, such as their energy consumption or their transport arrangements. It is especially important that effluent discharges to the aquatic environment should not be regarded as an easy option not needing much attention once the necessary equipment is installed. We think it right in this Report to make recommendations that will encourage and promote compliance as good for the environment which the community has to sustain and, in some situations at least, good for the company concerned as well.

Benefits of Pollution Control to Industry

121. Two initiatives by Government recently attracting attention confirm that environmental care need not always be a drag on commercial progress. The Department of Trade and Industry have published "Cutting Your Losses: a Business Guide to Waste Minimisation". This gives information about waste reduction, recycling within the process and waste recovery for other uses. Moreover, it outlines methods for waste minimisation audit within a business and gives a series of case studies from named companies. For example, equipment costing £25,000 has an estimated payback period of three weeks in one company, and in another the payback period is less than three years on an expenditure of £90,000. A study which the Department of Environment commissioned from consultants shows benefits to selected industries from pollution control.***

122. We quote these reports from work which the Government has promoted because we welcome the priority which Departments are giving to this subject. More significantly, the detail they include clearly rebuts the notion that pollution control always has to be an extra burden which management should always resist. Recognition that compliance with pollution control obligations can involve extra cost yet still be a positive part of the business plan is gaining ground in many go-ahead companies. There are, however, many others which, whatever their other virtues, are still laggards in their attitudes and achievements as effluent dischargers.

123. Our purpose in this chapter is to suggest ways in which the NRA may be able to move some of these laggards forward into the reliable compliance group rather than have them drop back into a lengthening list of dischargers who have to be prosecuted.

*** 'Industry Costs of Pollution Control' from Ecotec Research & Consulting Limited, Birmingham, price £15.

Prosecutions

124. One obvious step covered in earlier chapters is to make the limits which consents set well-expressed and as free of ambiguity and misunderstanding as they can be made. A second step is to keep sampling and enforcement action both well spread and well publicised. The Courts may help in this in imposing substantial penalties where they consider that justified. There has recently been one fine set at £1 million for a pollution of the River Mersey. The NRA should seek to ensure that appropriate cases are heard by the Crown Court which can impose the highest levels of penalty. As many companies increasingly look to their 'green' reputation, convictions which attract press attention can cause more than financial concern in some company boardrooms.

125. We do not consider that this Group should propose the NRA's prosecution policy for the future, but there is one point we would make. Regular dischargers show their attitudes to compliance by their conduct over a period: those attitudes are widely conscientious and painstaking, but in some cases there is a repeated lack of effort and regard for achieving compliance. Our recommendation is:-

*** Recommendation 29: The NRA needs to consider all relevant circumstances in deciding on prosecution in individual cases including the discharger's record of care. Where a discharger has shown little or no care, or active contempt, for consent obligations over a period, this should be a factor in favour of prosecution. The NRA must not be regarded as reluctant to prosecute in situations where significant pollutions occur and relevant evidence is available.

Personal Designation in Consents and Updatings

126. Many thousands of consents for minor discharges not subject to sampling have largely dropped out of notice by those who hold them as they have continued through changes of company management, property ownership and the like. The major change in 1985 from a system largely concealed by statute to one exposed in public registers may not have made much difference to this.

127. Yet it is the purpose of a consent to define operating and maintenance obligations which the discharger is required to fulfil. Such obligations need to be refreshed and made prominent in the discharger's attention from time to time, even for minor consents. In the case of consents granted to corporate bodies, it would be sensible to have some one member of management personally designated on the consent application as having a direct continuing concern with the operation of the discharge. This will usually be the holder of some recognised post with relevant responsibilities, but having the name of the holder will promote personal involvement. There would be no question or intention of such a designation having any legal implications whatever: wherever the consent is given to a corporate body, any legal process must relate to that body or to representatives of it selected on other considerations.

128. Thus we make two recommendations, both intended to give the relevant consent a degree of personalisation and renewal in the discharger's attention. The first is directed primarily to new applications for larger discharges, and the other for minor discharges:

*** Recommendation 30: Application forms by corporate bodies for discharge consents should require the applicant to designate by name and post a manager of an appropriate level to take a direct interest in the good operation of the discharges in compliance with the limits which the consent will define. Other contacts may be used in addition for day-to-day purposes as convenient, but the NRA will aim to maintain dialogue and liaison with the designated person from time to time and any change in the person assigned this task should be notified to the NRA.

*** Recommendation 31: For many discharges not subject to regular sampling, any billing system introduced for annual charges should include a section or enclosure where from time to time the discharger can notify any change in circumstances relating to the discharge (eg change of occupier) or confirm that no changes have occurred and any maintenance obligations have been fulfilled. Application forms for consents should be revised to make clear that this practice will be introduced.

Action Warnings

129. On measures related to discharger motivation and enforcement it is clear that the number of prosecutions taken by the NRA attracts notice, but that little is heard of very many cases where dischargers are specifically warned of occasionally or potentially unsatisfactory discharges. Where such warnings relate to major continuing discharges and perhaps to a sequence of unsatisfactory variations in some feature of the discharge, it would be useful to give the warning a higher profile, especially within the company or other entity making the discharge. The name suggested for this is an Action Warning.

130. An Action Warning is in no way intended as a substitute for prosecution which, if it is under consideration, should go ahead or not on its own merits. The main thrust of an Action Warning is essentially towards prevention. It should give the discharger an emphatic indication that greater care is urgent, that operation of the discharge and possibly of facilities or plant giving rise to it must be improved. Very often the warning could specify something of the improvement seen as necessary, though it must be left to management to work out their best operational response in these circumstances. Often an Action Warning might also be a signal that NRA processes of monitoring including tripartite sampling will be intensified (or introduced if not already operating).

131. The NRA might also consider whether, when an Action Warning has been given (and internal procedures for taking decisions on that would need to be well-defined), the discharger should be called on after an interval to report improvements made and sustained.

132. The NRA need not expect to publish the names of dischargers given Action Warnings, although the numbers of such warnings would be a useful extra measure of the scale of enforcement action. The main impact of an Action Warning should be to register at every level in the discharging company including among its Directors that extra care and effort has to be made in managing discharges. Thus:

*** Recommendation 32: The NRA should introduce a system of formal Action Warnings on the lines indicated above, in addition to existing procedures for warning dischargers when their effluents are or threaten to be unsatisfactory.

133. At our Consultation Meeting where this proposal was discussed among others, the point was made that in the same spirit, the NRA might consider publishing from time to time lists of named major dischargers notable for a sustained full compliance with their consent obligations. It was acknowledged in discussion, however, that there could be misunderstanding about names not appearing in the list because they made no direct discharges.

Charges for Discharges

134. As noted in Chapter 2, the 1989 Act makes more positive provision than earlier legislation for charges to be applied to consents for direct discharges to controlled waters. Such charges have applied in France and the Netherlands for over 20 years and in West Germany for nearly 10 years. Analogous charges for water abstraction licences have applied in England and Wales since the mid-1960s. Charges for discharges can be influential in motivating dischargers to be more economical in the claims they make on rivers as waste disposal channels and water resources. As there are already areas within England and Wales where the whole capacity of rivers is already committed by currently authorised discharges to them, the issues of allocation - between existing dischargers and new applications and perhaps between waste disposal and other uses - will have to be given a lot more attention than has been necessary before.

135. These charges will be an important source of new funding for the NRA's pollution control work. This work needs to be extended, in monitoring discharges and the condition of receiving waters; and it must not be hampered by an arbitrary shortage of funding. Drawing the costs of pollution control work from the holders of consents has a good rationale in both equity and economics - and there are arguments for the level of these charges to reflect the use of natural resources as well.

136. The NRA will be introducing the start of these charges in the next year and considering the stages beyond that. We recognise the strong case there is for charges to be made for new applications, but we would emphasise that this should not be allowed to lead to would-be discharges going ahead without applying for consents. We believe charges will be important also in improving the database which is maintained about consents, but we make no recommendations on these points here.

Water Quality Objectives

137. The 1989 Act provides for the Secretary of State to set water quality objectives for specific lengths of river or other controlled waters. Some EC Directives have the same effect more generally, in relation to the waters being designated as fisheries, drinking-water sources, or bathing waters for example. These objectives set frameworks within which consents for individual discharges can usually be settled with a clear purpose in view - achievement of the objective. Save where there are direct conflicts between claims for discharge capacity, these frameworks may reduce the scope for argument about benefit/cost considerations in relation to the standards set for individual discharges.

138. We are aware of a proposed EC Directive on municipal wastewater treatment being in preparation but it is not yet in a form where we can usefully comment on the compliance aspects of it.

Limiting Accidental Pollutions

139. Although accidents and emergencies may occur at sites where consented discharges are made, very many of them happen elsewhere. Thus they are not strictly matters of compliance. Yet preventing or limiting pollutions which follow accidents or fire depends on the same kind of care being exercised, for example by people involved in the design or construction of buildings on riverside sites, as this Report calls on dischargers to maintain at all times. Thus the NRA needs to promote as widely as it can the motivation of such people who are not dischargers to be active and alert in reducing the scope for accidental pollutions.

CHAPTER 8

RESOURCE IMPLICATIONS, PRIORITIES AND SUMMARY OF RECOMMENDATIONS

140. This Report comes to be made, as Chapter 2 indicated, after ten or more years of piecemeal changes to the consent system. But as well as those changes in what may be called (at any one time) deliberate policy of the Government or the water agencies, there have been other broader influences at work. These include, for example, much more public attention to pollution and the state of the environment, more disposition by national governments and the European Community to set specific standards for water quality, and more demands on water as a natural resource to serve various purposes for industry, agriculture and recreation in a society that is more productive, more mobile and more leisure-orientated all at the same time.

141. For the resource implications of our Report, we draw three points from this view of the present situation:

i) while parts of what we recommend certainly call for a sense of urgency, the main need is for existing and extra effort on the control of discharges through the consent system to be sustained at a more effective level for the next five to ten years. We comment on the shortage of data elsewhere, but here we must say we have reason to believe that there may still be substantial non-compliance by some dischargers - as well as much effort by others to meet their obligations.

ii) the additional effort is not some kind of 'green option' that can alternatively be postponed for another ten years as it often was through the 1980s. The claims and pressures on the water environment must now be dealt with more deliberately, in terms of allocations, quality standards and securing compliance.

iii) we have to propose some practical approach to implementing a report which takes account of this situation as we see it now and likely to develop further in the 1990s.

142. The basis for this practical approach should in our view be that implementation of recommendations adopted should go forward on a catchment basis within a strategy set by the NRA nationally. There are several reasons for this.

143. We have referred often in this Report to environmentally significant discharges, to the state of receiving waters and similar points of an essentially local character. Thus any implementation effort must have a strong local orientation and involvement. The catchment is where the impacts of all discharges from industry, sewage works and other sources can be considered together in relation to the capacity of the receiving waters and equitably in relation to each other, both in technical and economic terms. A key step in the catchment approach will of course be deciding the catchments which are to be dealt with first, but these

decisions can have a rationale that helps to explain the whole exercise within and outside the NRA. The catchments (and some areas of coastal waters) that need to be near the top of the agenda are those where:

i) the capacity of the receiving waters to accept discharges with any significant polluting load is already overcommitted or close to that;
ii) the water quality objectives to be set by the Secretary of State may be expected to be difficult to achieve, or the subject of argument about whether it is even realistic or necessary to aim for them;
iii) special situations such as the prevalence of diffuse pollutions or major changes in land-use may be interacting with and changing the water quality conditions which existing consents have been directed to maintaining.

These categories are not mutually exclusive, and some areas may fit into all three of them. Equally, they may help in the selection of the priority catchments within regions as well as nationally.

144. We believe this approach would help to give the NRA as a national body an additional way of building national priorities in close reflection of local river basin situations and problems. It would have another advantage too. The catchment-based approach would be very suitable for showing nationally (say to MPs, for example) and locally (say to County and District Councils) the progress of NRA work not just in implementing a report but in applying a far more positive approach to the control of discharges generally. This will be particularly important where water quality considerations may suggest any threat of a constraint on land-use changes or development.

145. Our recommendations will be considered alongside other work we know to be going forward, - on sampling frequencies, for example, and on the checking of consent data for charging purposes. The executive management of the NRA will be concerned to co-ordinate these various initiatives to best advantage. We do not suggest that all of them can readily be fitted rigidly into a catchment-by-catchment approach. But we believe that such an approach will often provide a good framework for ensuring that in the end all the new practices are fitted together coherently where the existing discharges are supervised and claims for new ones considered.

146. We also recognise that, for example, the emphasis we put on absolute limits being included in all consents suggests that putting such limits into the many sewage works without them should be a priority. However, the aim would not be just to add the absolute, but to consider the receiving waters and set absolute and where appropriate percentile limits for several determinands - including ammonia if there were no limit for that already. Thus the work of dealing with the lack of an absolute limit cannot help being close to a review of part of a catchment, and there are indeed a number of catchments far more dominated by sewage works discharges than industrial effluents. Deciding the order in which catchments should be reviewed can take account of this too.

147. We should refer here to the strains under which the NRA is working as a relatively new public body which finds that its functions are the focus of keen and continuing political attention, in the fields of flood defences and water resources as well as in pollution control. These strains are inevitably increased at a time when the Government is shaping legislation and a new role for HMIP including the authorisation of some discharges to waters for which the NRA has to achieve water quality objectives and control many thousands of other discharges. We have tried in this Report to give a stronger sense of direction to the work of granting and enforcing discharge consents, especially when they have been reviewed on the lines we recommend. We believe it will have damaging consequences far beyond the actual administration of the NRA if the work which it may be decided to undertake following this Report is put in hand, and then seriously disrupted or delayed. Thus our final recommendation is:

*** Recommendation 33: Much of the work of implementing our recommendations as they are adopted should go forward on a catchment basis with the sort of factors we have indicated influencing the priority for each catchment. This approach should lend itself well to providing worthwhile progress reports locally and nationally as the work goes forward on a well-defined time-table.

148. Finally, as this chapter has to refer to internal NRA priorities, we would repeat that compliance is by no means a matter for the NRA alone. The public and the media are already showing it is a matter of great interest to them too. We hope this Report helps very many dischargers to develop the constructive role that some of them already take. We are seeking not to add to the troubles which any regulatory process may seem to threaten but to engage them more fully in pollution prevention as an active and successful part of their overall business activity.

SUMMARY OF RECOMMENDATIONS

The Purposes and Types of Consents

Recommendation 1: The NRA should commit the necessary resources to analysing and publishing annually data about the numbers of consents in operation, and the discharges they regulate, with estimates of the degree of compliance among those regularly sampled. Publication of data then available should in any event begin in 1991. (Paragraph 26)

Recommendation 2: The NRA should review urgently the layout and guidance given for the completion of application forms for consents. While such a review must allow fully for the statutory status of consents and the application form sometimes having to be produced in Court, the review should also:

i) ensure that the design and wording of the form helps applicants to understand what information is required and to give it fully, and leaves them in no doubt that withholding information about the effluents involved may put in question the full validity of the consent to be issued;

ii) include a prominent reminder on the copy to be retained by the applicant that any alteration in the scale or character of the discharge or the site conditions giving rise to it should be notified to the NRA. In many consents this may be appropriately included as a condition of the consent which it would be an offence to neglect.

(Paragraph 28)

Recommendation 3: Numeric consents should be self-contained in their drafting, and should include a standard rubric to the effect that they are not to be taken as providing a statutory defence against a charge of pollution in respect of any constituent for which they do not specify limits. Existing consents should have this rubric added. (Paragraph 31)

Recommendation 4: Where not already available, NRA Regional Offices should prepare a leaflet on the areas where septic tanks etc do and do not require consents, and maintain regular liaison with District Council Planning Offices about these demarcations. (Paragraph 34)

Recommendation 5: Whereas numeric consents are mostly focussed on limits to be met by the effluent discharged however it may arise, non-numeric consents must often be specific and unequivocal about the facilities and processes from which the discharge is to be made. This applies especially to marine outfalls, and will make the consent conditions for them notably different in some respects from those conventionally applying, for example, to sewage works discharges. (Paragraph 38)

Recommendation 6: For all types of consents including simple descriptive ones, maintenance obligations and the keeping of maintenance records should widely be standard conditions. Where necessary these obligations should cover all the facilities associated with the discharge, and there should be occasional inspections of the facilities and (where relevant) maintenance records to ensure compliance. (Paragraph 41)

Recommendation 7: For simple descriptive consents, it may often be appropriate to include a standard wording excluding any trade or farm waste or any increase in the number of dwellings connected to the discharge, so that the discharger recognises that any development likely to change or influence the scale or character of the discharge must be notified to the NRA. (Paragraph 41)

Defining Limits

Recommendation 8: All numeric consents should include absolute limits for all relevant determinands. (Paragraph 55)

Recommendation 9: For environmentally significant discharges, whether from sewage works, industrial sites or other sources, the NRA should promote the application of 80 percentile limits in addition to the absolute limits which all numeric consents should have. These should be related to a clearly stated rolling time period. Where appropriate 50 percentile limits should additionally or alternatively be applied. (Paragraph 60)

Recommendation 10: For discharges where the effluent or their constituents may build up in the receiving waters, consents should include limits on loads. Conditions requiring dischargers to maintain records of the mass of a substance discharged over a given period and, in appropriate cases, to notify the NRA when a stated proportion of the total mass authorised for the relevant period has been discharged, may also be desirable. (Paragraph 62)

Limits to Flow and Choice of Determinands

Recommendation 11: All numeric consents should include absolute limits for instantaneous effluent flow. Where flows are particularly variable, it may be necessary to include additional limits related to total volumes discharged over specified longer periods. (Paragraph 69)

Recommendation 12: Consents for discharges influenced by rainfall need to be as specific as possible in the nature of flows authorised for discharge, under dry and under rainfall conditions. References to the design criteria for flows going to full treatment and to overflows or storage, and safeguards against the discharge of solids should be explicitly mentioned in consents for new and refurbished overflows. (Paragraph 73)

Recommendation 13: The NRA should gather systematic data on pollution caused by temporary discharges which are unconsented, and by discharges from various special situations such as mineral workings. The NRA should then promote, in the light of this data, programmes to emphasise the need for discharges to be consented, possibly by accelerated procedures if they are to be very short term; and take enforcement action against dischargers who ignore or defy any need for a consent. (Paragraph 75)

Recommendation 14: In new and reviewed consents there should be consistent application of limits for ammonia in all discharges to which this is relevant. (Paragraph 77)

Recommendation 15: The NRA should make a commitment to gather the data necessary to evaluate the suitability of TOC and turbidity as new determinands for inclusion into consents in place of BOD and suspended solids. If a sustained period of parallel assessment produces sufficiently encouraging results, the aim should be to begin using the new determinands as replacements for the old about five years from now. (Paragraph 83)

Recommendation 16: For environmentally significant discharges of complex composition where not all important constituents can be individually identified and numerically limited, consents should specify a clearly-defined toxicity limit, the appropriate form of toxicity test to be used, and the minimum frequency with which it should be applied. (Paragraph 84)

Monitoring and the Assessment of Compliance

Recommendation 17: The NRA should include in all relevant consents conditions indicating access and facilities required for flow measurements and the taking of samples to be done by the NRA at whatever times in the day, night or week it judges appropriate. The NRA should also encourage sampling staff to maintain the practice of making their visits unpredictable. (Paragraph 89)

Recommendation 18: Whilst it is not the practice of the NRA generally to notify the discharger on each occasion of the results of the sample taken from his discharge, there should be regular dialogue between the NRA and the discharger covering satisfactory results over a period as well as highlighting any variations calling for explanation or causing concern. (Paragraph 90)

Recommendation 19: Sampling programmes need to be economical, but frequencies must be adequate for results to provide a basis for decision or enforcement. Detailed guidance on required effluent sampling frequencies will be provided by the NRA's Sampling Group. Tripartite sampling should not be regarded as wasted effort if no prosecution follows. To promote efficiency, comparisons of sampling cost and frequency should be made between regions from time to time as well as audits of sampling and laboratory procedures. (Paragraph 99)

Recommendation 20: In standard procedures for dealing with emergencies and accidents the obtaining of samples necessary for subsequent enforcement action should be explicitly included. (Paragraph 99)

Recommendation 21: Any type of sample, whether routine or investigational, may be used in assessing compliance with absolute limits. (Paragraph 107)

Recommendation 22: Percentile limits must always be related to specified time periods. For the assessment of compliance by tables based on BS 5700, consents should specify rolling time periods: these need not always be for 12 months, and in cases of discharges needing careful supervision periods of six months or less will be preferable. The assessment should be based solely on results from the routine monitoring programme: special or investigational samples introduce bias and should not be used for this purpose. (Paragraph 107)

Recommendation 23: The counting of exceedences against percentile limits should be separate for each determinand having such limits. The NRA should adopt a standard form of words to put this beyond doubt in all consents that include percentile limits. (Paragraph 107)

Recommendation 24: The NRA should promote continuous monitoring of environmentally significant discharges where technology and circumstances make that possible with adequate reliability at reasonable cost. This may be achieved by voluntary arrangements with dischargers or through consent conditions. On either basis, validation by NRA of equipment and data and in suitable cases remote access facilities for the NRA should be provided for. (Paragraph 111)

Recommendation 25: Monitoring directly by the NRA must continue as our independent check, on a tripartite basis where necessary, and generally, where discharges are undertaking some self-monitoring as well as where they are not. The scale of this work should be decided in local circumstances and on the basis of general policy on sampling frequencies. (Paragraph 111)

Recommendation 26: Where automatic or continuous monitoring is required, consents should usually indicate the types of data needed and the degree of accuracy required rather than the particular equipment to be used. Consents should provide for independent certification of the equipment's accuracy at regular intervals and in appropriate cases may require facilities for the NRA to interrogate the equipment remotely. (Paragraph 111)

Recommendation 27: The NRA should always be ready to indicate to dischargers which of the data they may be expected to provide has to appear on the register. The NRA can and should also indicate which data they will not rely on as evidentiary. (Paragraph 112)

Recommendation 28: With the increased number of results likely to be flagged as exceedences on the public registers following the introduction of 80 and 50 percentile limits, the NRA should develop a clear introductory note on the meaning and interpretation of percentile limit exceedences, and arrange for this to be readily accessible by anyone consulting the public registers. (Paragraph 117)

The Motivation of Dischargers and Other Considerations

Recommendation 29: The NRA needs to consider all relevant circumstances in deciding on prosecution in individual cases including the discharger's record of care. Where a discharger has shown little or no care, or active contempt, for consent obligations over a period, this should be a factor in favour of prosecution. The NRA must not be regarded as reluctant to prosecute in situations where significant pollutions occur and relevant evidence is available. (Paragraph 125)

Recommendation 30: Application forms by corporate bodies for discharge consents should require the applicant to designate by name and post a manager of an appropriate level to take a direct interest in the good operation of the discharges in compliance with the limits which the consent will define. Other contacts may be used in addition for

day-to-day purposes as convenient, but the NRA will aim to maintain dialogue and liaison with the designated person from time to time and any change in the person assigned this task should be notified to the NRA. (Paragraph 128)

Recommendation 31: For many discharges not subject to regular sampling, any billing system introduced for annual charges should include a section or enclosure where from time to time the discharger can notify any change in circumstances relating to the discharge (eg change of occupier) or confirm that no changes have occurred and any maintenance obligations have been fulfilled. Application forms for consents should be revised to make clear that this practice will be introduced. (Paragraph 128)

Recommendation 32: The NRA should introduce a system of formal Action Warnings on the lines indicated above, in addition to existing procedures for warning dischargers when their effluents are or threaten to be unsatisfactory. (Paragraph 132)

Resource Implications and Priorities

Recommendation 33: Much of the work of implementing our recommendations as they are adopted should go forward on a catchment basis with the sort of factors we have indicated influencing the priority for each catchment. This approach should lend itself well to providing worthwhile progress reports locally and nationally as the work goes forward on a well-defined time-table. (Paragraph 147)

ANNEX 1

DISCUSSIONS IN PARLIAMENT

1. At Report Stage in the House of Lords, Lord Crickhowell said:-

> "At an earlier stage of the proceedings, I expressed my views about some of the shortcomings of the present system of look-up tables. The Minister spelt out in some detail the case for them. It is right to report that the Secretary of State has invited the NRAAC to begin an inquiry into the best way to administer the system of monitoring, including the use of look-up tables. He has asked that we should start such an inquiry, and that it should be carried forward by the NRA.
>
> I am sure that it is right to say that we shall look at the matter with a completely open mind, taking into account both the virtues and the demerits of the present system. I am sure the NRA will come forward in due course with its report on the basis of the judgements it makes. It does not feel committed either one way or the other to replacing or retaining the look-up tables system. The important thing is to find a definition of 95 percentile compliance that can be a simple task. It is a complicated issue, but the NRAAC has been commissioned by the Secretary of State to undertake such an inquiry and it has already set the work in hand"..(House of Lords Hansard, 13 June, Col 1277).

2. The views which Lord Crickhowell had expressed in earlier debates were included in parts of his speech on the Second Reading of the Water Bill in the House of Lords:-

> "The truth is that at present we have a system of discharge consents that is to a significant extent not based on objective standards but designed to do little more than maintain the status quo and ensure that at least the situation does not get worse. The arrangements have been designed with a view to avoiding an embarrassing number of failures and an excessive number of prosecutions of public organisations. Even when set on that basis, they have not fulfilled the objective and a considerable number of sewage treatment works consistently fail to achieve satisfactory standards".
>
> and later....
>
> "I have referred previously in this House to the subject of look-up tables. Properly used they can be a useful tool to avoid some of the inherent difficulties which arise when performance must be measured on the basis of relatively few samples. What was wrong was that more weight was given to the need to protect the water authorities against unfair prosecution than to the need to protect the environment and river users. My Committee feels most strongly that the

present system cannot be a satisfactory basis for monitoring discharge consents except for the shortest possible transitional period. In our view, both the effectiveness of the NRA's monitoring function and public confidence are dependent on that being accepted and water authorities being placed in the same position as all other dischargers.

We should much prefer an immediate decision and a clean timetable for implementation. But if the constraints dictated by an imminent flotation - and the legal complications of that are extraordinary - lead the Secretary of State to decide that there must be further consultation about method, it is a job that the new NRA should be told to do speedily and independently of a new review of standards (which is a separate issue) with a view to early introduction of the new arrangements. My Committee fully understand the resource problems of implementing large capital programmes and will always be ready to discuss reasonable timetables for compliance. We are not prepared to compromise the integrity of the NRA by endorsing arrangements which we believe to be fundamentally unsound". (House of Lords Hansard, 17 April 1989, Cols 579 and 581 - 582".

ANNEX 2

NUMBERS OF DISCHARGE CONSENTS BY REGION

NOTE: The figures given in this Table are no more than those we have been able to assemble while our other work was going forward. The figures should not be regarded as either precise or wholly reliable, because as a Group we cannot make them so. We believe it is the first time any such figures have been published in England and Wales.

		Discharges	
NRA Region	Total Consents	Regularly Sampled	Annual Applications
Anglian	27,000 (a)	887	2,300
Northumbrian	5,500	454	275
North West	15,000	1,209	240
Severn Trent	23,000	3,092	1,140
Southern	11,000	627	745
South West	11,000	700	1,200
Thames	9,200	1,300	1,000
Welsh	14,500	1,911	1,110
Wessex	7,000	642	600
Yorkshire	16,100	1,260	450
Total	139,300	12,082	9,060 (b)

(a) About 50% of these consents relate to septic tanks
(b) About 400 relate to septic tanks.

ANNEX 3

HISTORICAL SEWAGE EFFLUENT LIMITS IN ENGLAND AND WALES

1. Introduction

We have commented in the main body of the report on the fragmented, patchwork nature of effluent consent limits inherited by the NRA - a legacy of many decades of rule-of-thumb standard setting, followed by a long drawn-out review of consents that proceeded through several phases from about 1978 onwards.

This inheritance includes, obviously, very many consents for discharges by all sorts of industrial units and from agricultural activities, as well as for the very substantial discharges arising from sewage treatment works and storm overflows which were until last year the responsibility of water authorities, and are now part of the businesses of the water service companies. This Group could not, in the time and with the resources available to it, undertake any thorough or complete survey of existing consents, as to the standards set or the extent of compliance. However, to provide some limited indication of just how varied the inherited consents had become - both within and between regions - we have been able to assemble with the help of others data for one sector only, the consents relating to sewage treatment works with consents including numeric limits. The ten data sets were collated and summarised by WRc, and in this Annex we summarise and provide a brief commentary on some aspects of this data.

2. Numbers of sewage treatment works with numeric consents

The study was limited to sewage treatment works (STWs) serving a population-equivalent figure of 250 or greater. The great majority of these were water authority treatment works; typically, private treatment works accounted for no more than a couple of dozen non-trivial effluents across a region. We also limited the study to the three sanitary determinands - BOD, SS and ammonia. (Indeed, it was instructive to see how rarely numeric limits existed for other determinands such as the toxic metals.)

The data for the ten regions is summarised in Tables 1, 2 and 3.

A comparison of the final two rows of each table shows the number of consents out of the total for each region with no numeric limit for the determinand indicated. These proportions are illustrated in Figure 2. For BOD and SS, only a small proportion of STWs are without numerical limits. The picture is quite different, however, for ammonia: Wessex, and to a lesser degree Thames and Anglian, do have a history of quite extensive coverage, but across the other seven regions ammonia limits have been less frequently applied and in some cases almost non-existent.

3. Distribution of BOD limits within and between regions

We turn now to look in more detail at the data on BOD limits. For those STWs (the great majority) which do have BOD limits, Figure 3 shows for each region how these were distributed across the concentration range. For North West, for example, the tower marked 30 mg/l shows that about 50% of effluents had a BOD limit in the range 26-30 mg/l; a further 17% or so had BOD limits in the range 56-60 mg/l; and so on. All ten histograms have been drawn to the same scale so that comparisons can readily be made between regions.

Looking at any one of these 10 histograms, we should not be surprised to see a wide-spread of BOD limits. After all, the basis of the EQO approach to limit-setting is that the severity of the limit is governed by (i) the impact of the effluent on the receiving water, coupled with (ii) the Quality Objectives of that receiving water. What is extraordinary, however, is the great variety in the shapes of the histograms between regions. The most dramatic contrast is that between Thames and Welsh; but there are plenty of other striking examples.

Of course, some of the variety may fairly be ascribed to real differences between regions - both in the proportions of different categories of receiving water and in the typical dilutions provided by them. That is obviously not the whole answer: the long and varied history of consent-setting policies from region to region has also surely made a major contribution to the wide differences that we see here. We believe that the reviews of consents necessary to give effect to the Group's recommendations will have to address any such extreme differences and inconsistencies - although without making uniformity a special objective in itself.

Table 1: Suspended solids consent limits - frequencies by region & concentration

mg/l	A	N	NW	S	ST	SW	T	Wh	Wx	Y
1	3									
10	2			2		2	7			
15	8			1	5	12	12		4	1
16								1		
17								1		
19								1		
20	24			10	18	3	16	2		
21								1		
25	26		2	1	34	3	16	1	5	
26	1									
28								1		
29								2		
30	281	4	12	71	76	88	34	58	57	51
31								5		
32								7		
33								3		
34							1	7		
35	58	4		4	36	13	6	7	13	14
36								6		
37								7		
38								8		
39								2		
40	124	10		83	65	11	16	19	41	34
41								5		
42								9		
43								9		
44								8		
45	47	2	146	6	226	15	179	14	14	17
46								6		
47								4		
48								8		
49								1		
50	78	39	1	18	51	26	3	22	42	54
51								1		
55	14			2	5	4	1	28	9	10
56								1		
60	127	35	58	84	88	33	5	40	31	68
61			1							
65	10				4	1	1	18		15
66								2		
70	18	13	2	6	38	14		21	10	31
75	20	1	14		1	4		21	2	11
79					1					
80	32	22	8	4	34	8		25	12	13
85						2	1	14		2
90	16	22	37	13	37	1	1	11	3	11
95						2	1	10		3
100	17	12	2	1	10	2		39	5	9
105					1					2
110			1		3			20		3
115										1
120	3	6	14	2	4			11	1	1
125					1					
130	1				2			9		3
140		3						6		
145								1		
150	5	7	14		4	8		105	4	199
>150	24	5	14	11	4	2		64	7	9
None	26	2	2	31	32		11	78		6
Total:	965	187	328	350	780	254	311	750	260	568

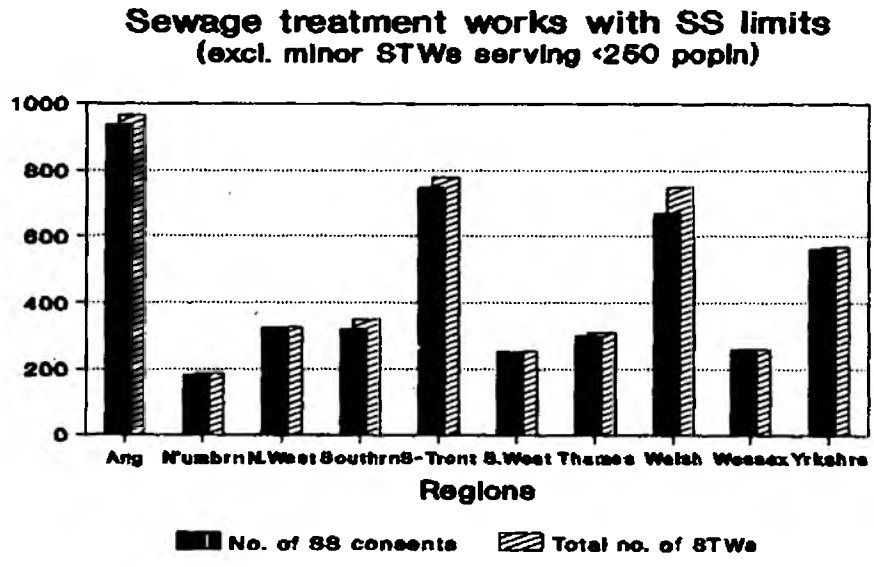
Table 2: BOD consent limits - frequencies by region & concentration

mg/l	A	N	NW	S	ST	SW	T	Wh	Wx	Y
1	3									
5						1				
6				1						
7							2			
8				1			2			
9							2			
10	8			3	11	13	21	1	3	
11								1		
12	4			1			10			
13	2							1		
14								1		
15	102		2	58	53	8	21	6	12	2
16							2	1		
17								1		
18	1						5	5		
19	1							1		
20	236	10	11	61	109	96	34	63	64	69
21								5		
22	1						1	13		
23							1	9		
24								7		
25	108	28	3	34	208	17	14	15	33	28
26	1							9		
27								11		
28								3		
29								3		
30	103	26	141	55	104	34	173	21	43	56
31							1	9		
32								6		
33								7		
34								6		
35	31	14		4	44	9	7	11	15	29
36								3		
37								7		
38								7		
39					1			5		
40	106	33	36	66	57	35	7	27	28	79
45	20				30	6		42	10	12
50	37	28	52	5	54	9	2	33	20	23
55	6					4		24	1	7
60	16	17	12	11	33	4		24	8	18
65	2				1	2		15	3	8
70	7	6		1	12			14	5	11
75	6		27		3	2	2	24		3
80	3	6	9	2	11			14	3	3
85	2							9		1
90		3		1	7		1	9		3
95								5		1
100	3	4	7	1	4	4		16	1	6
110	1	1						9		2
120		1				2		8	1	1
130			1					7		1
140								1	1	
150	3		8	2		2		83	2	1
>150	11	1	2	5	2	1		60	4	9
None	141	9	17	38	36	5	3	88	3	194
Total:	965	187	328	350	780	254	311	750	260	568

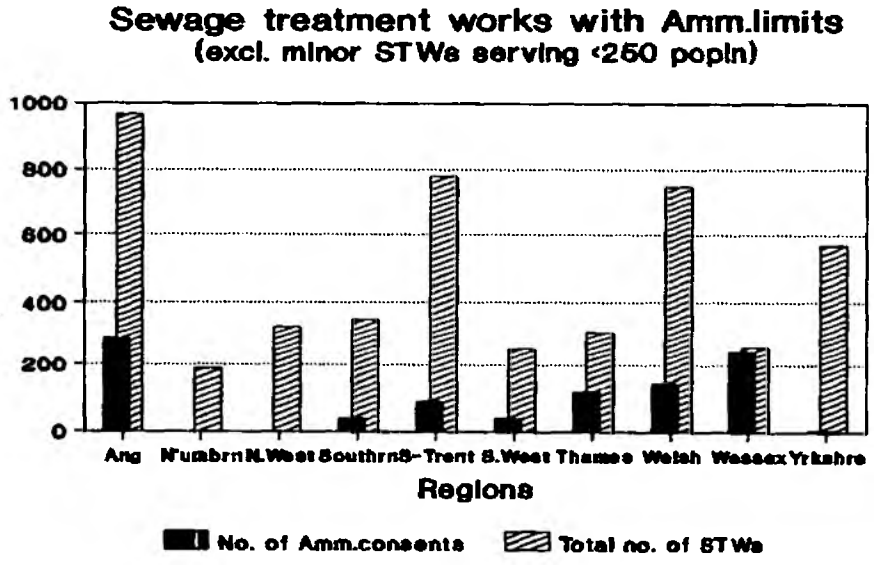
Table 3: Ammonia consent limits - frequencies by region & concentration

mg/l	A	N	NW	S	ST	SW	T	Wh	Wx	Y
1	3									
2							1			
3							4			
4	1						4	1		
5	19			9	15	18	17	4	6	2
6	4				1		9			
7	10			1	3	2	6	2		
8	7		1	1	1		5	3		
9							2	2		
10	99		1	18	41	16	20	8	78	1
11								1		
12	7			2			5			
13	3									
14								2		
15	63			5	17	1	14	9	56	
16							1			
17							1	1		
18								1		
20	37		1	1	6	2	19	7	51	
22								1		
23								1		
25	9				2		6	17	19	
27								1		
30	13				2		2	12	15	
35	5						1	1	6	
36								1		
38								1		
40	4						1		7	
44							1	1		
45								1	1	
47								1		
48								1		
50	1			1				56	5	1
53							1			
55								1		
65				1				1		
70				1				1	1	1
75								1	1	
80								1		
100								1		
110								1		
None	680	187	325	310	692	215	191	607	14	563
Total:	965	187	328	350	780	254	311	750	260	568

Figure 2

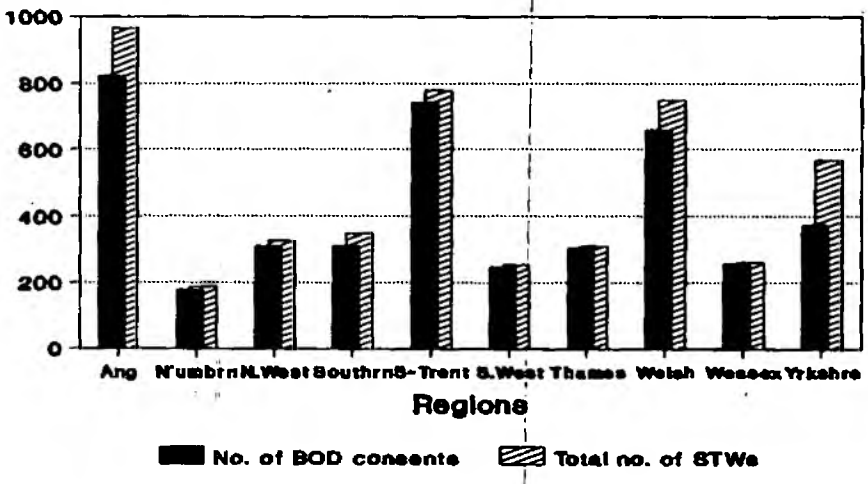


As at Dec 1988



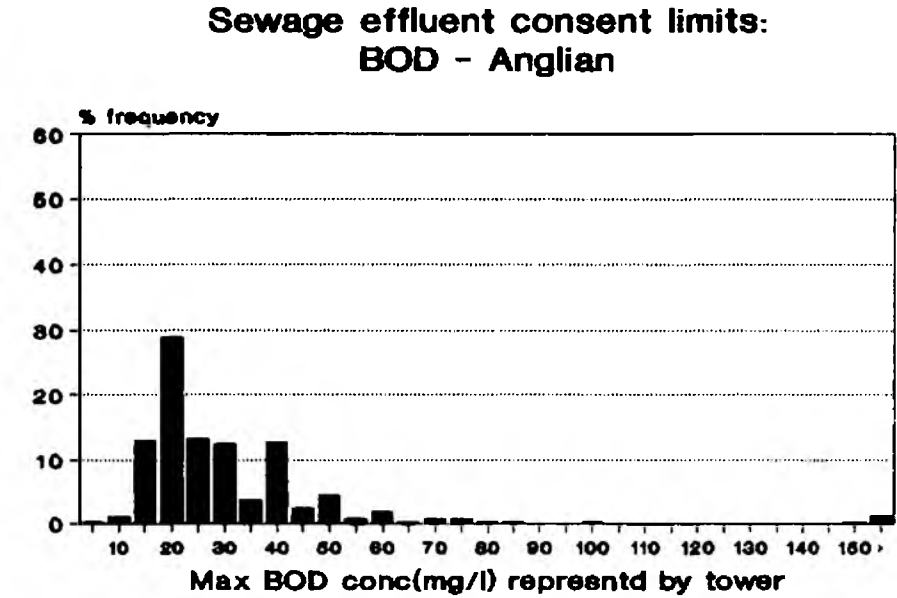
As at Dec 1988

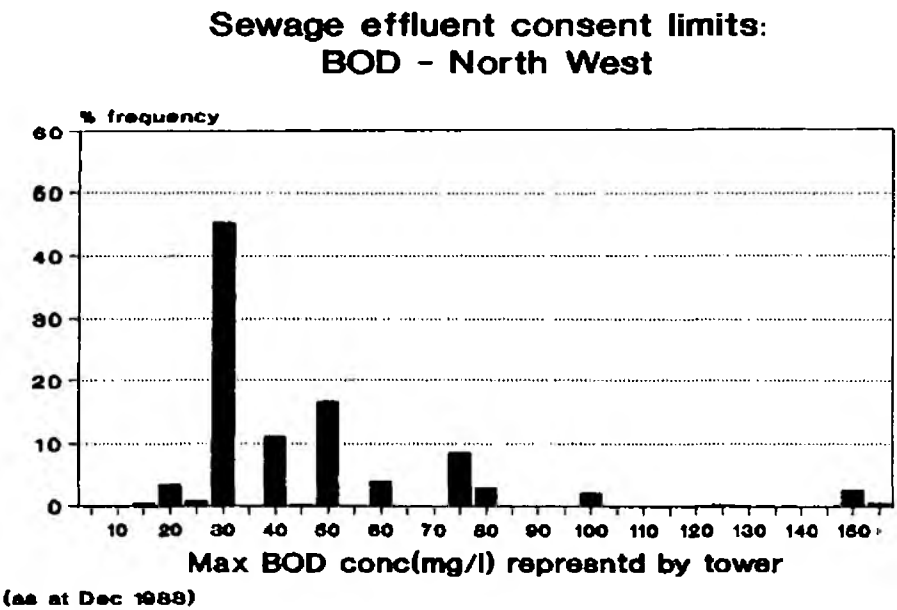
Sewage treatment works with BOD limits
(excl. minor STWs serving <250 popln)



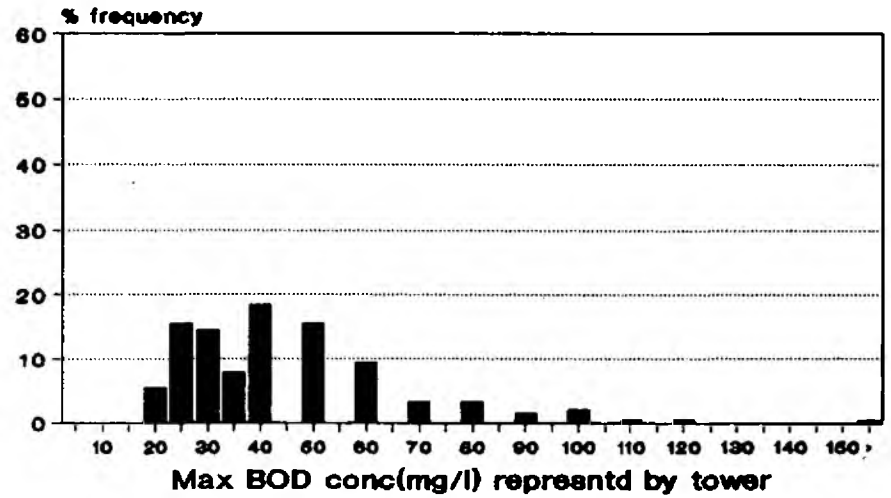
As at Dec 1988

Figure 3(a)


Sewage effluent consent limits:
BOD - Anglian
% frequency
60
50
40
30
20
10
0
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Max BOD conc(mg/l) represntd by tower
(as at Dec 1989)

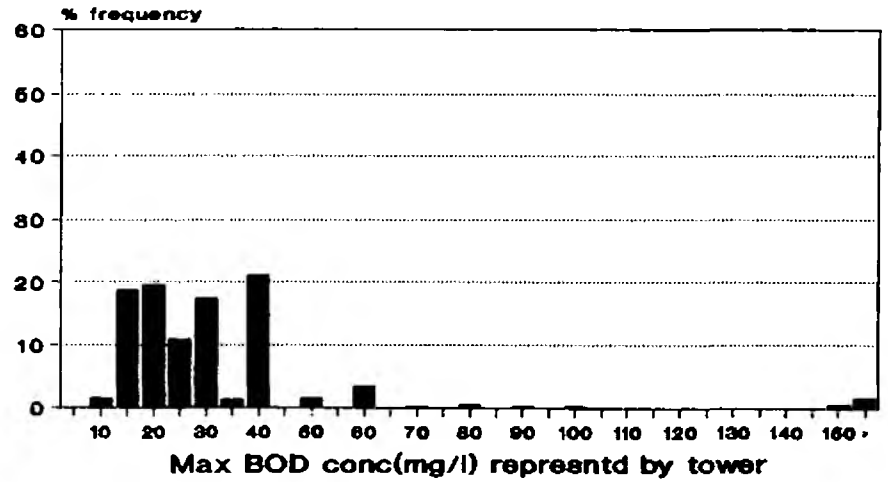

Sewage effluent consent limits:
BOD - North West
% frequency
60
50
40
30
20
10
0
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Max BOD conc(mg/l) represntd by tower
(as at Dec 1988)

Sewage effluent consent limits: BOD - Northumbrian



(as at Dec 1988)

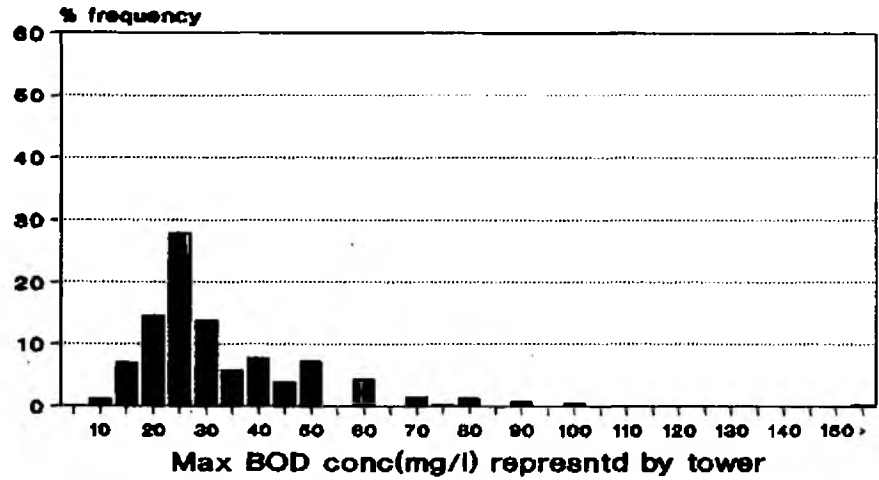
Sewage effluent consent limits: BOD - Southern



(as at Dec 1988)

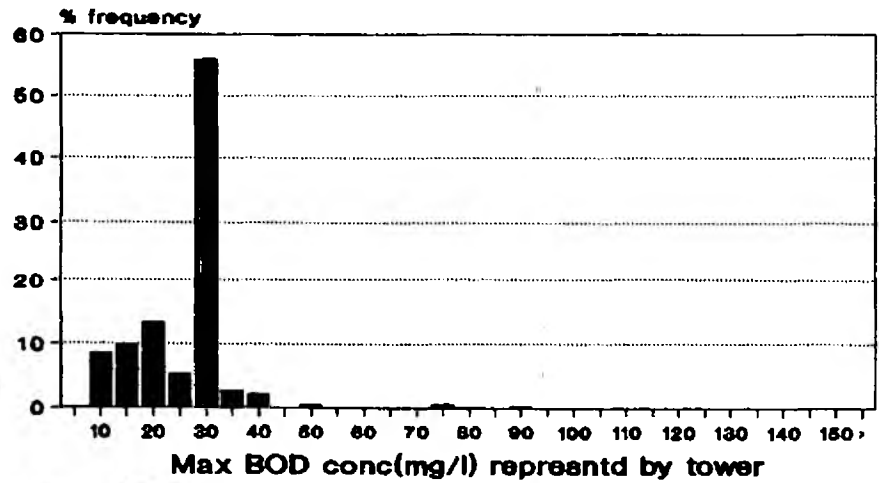
Figure 3(b)

Sewage effluent consent limits: BOD - Severn-Trent



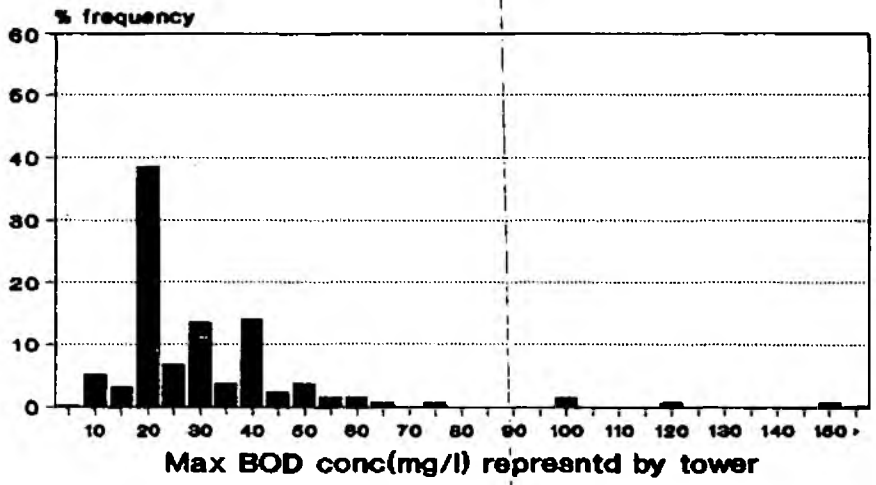
(as at Dec 1988)

Sewage effluent consent limits: BOD - Thames



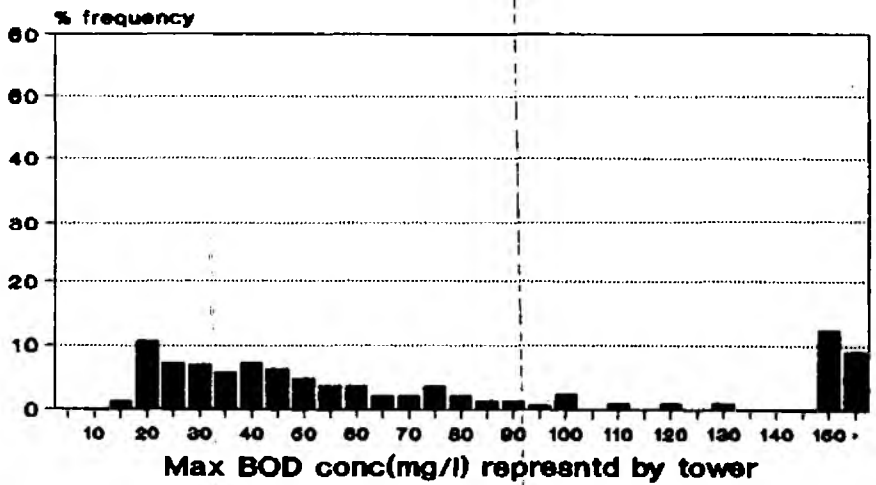
(as at Dec 1988)

Sewage effluent consent limits: BOD - South West



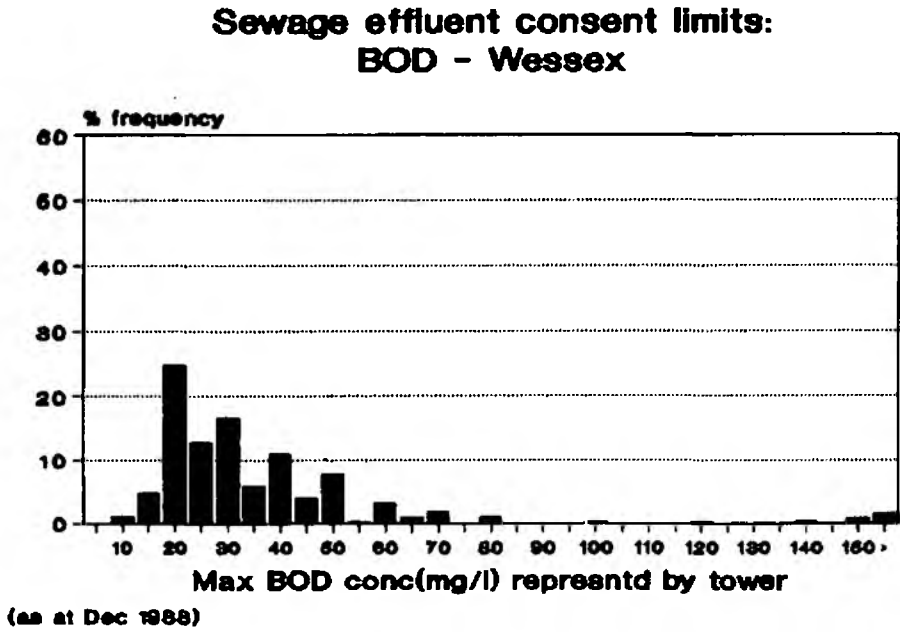
(as at Dec 1988)

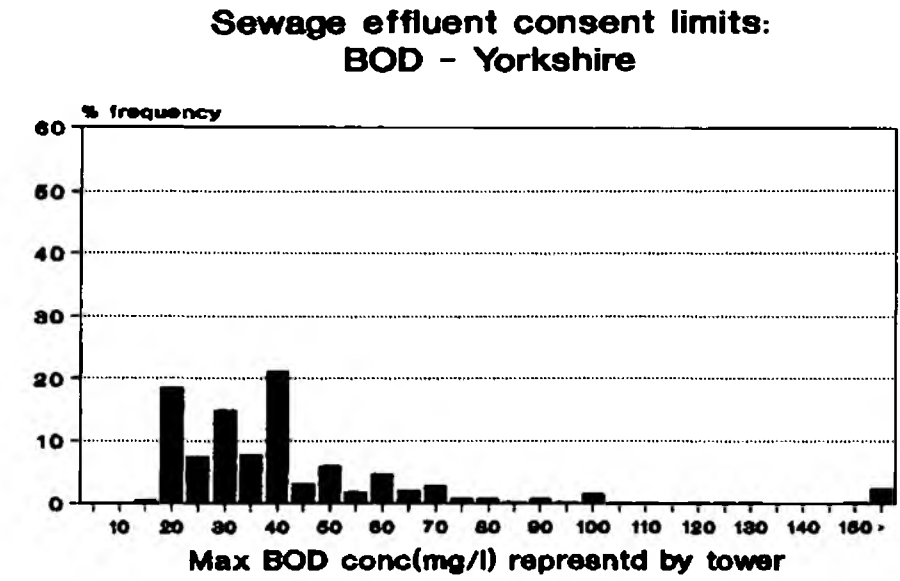
Sewage effluent consent limits: BOD - Welsh



(as at Dec 1988)

Figure 3(c)


Sewage effluent consent limits:
BOD - Wessex
% frequency
60
50
40
30
20
10
0
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150+
Max BOD conc(mg/l) represntd by tower
(as at Dec 1988)


Sewage effluent consent limits:
BOD - Yorkshire
% frequency
60
50
40
30
20
10
0
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150+
Max BOD conc(mg/l) represntd by tower
(as at Dec 1988)

ANNEX 4

AVAILABILITY OF CONSENT REGISTERS FOR PUBLIC INSPECTION

1. The National Rivers Authority has duties to maintain Registers of Discharge Consents and of monitoring results for them, and to make these Registers available for public inspection. Dischargers and local authorities have no obligations to make data or details of consents available. The NRA welcomes and strongly supports an open style for pollution control (even if it were not a statutory duty). There are, however, some complications to its administration, and this Annex is intended to make clear, at least in general terms, what the arrangements for it are.

2. In very many cases the actual Consents (and usually the completed application forms relating to them) are in paper records filed normally in NRA Regional Offices. The monitoring results by contrast are in many situations held in computerised form.

3. Both types of information in these respective formats can generally be made available at the main NRA regional office for the region where the discharge is made, usually between 10.00am and 4.00pm Mondays to Fridays, with the possibility of delays during the lunch period. Making an appointment before the visit may enable the relevant material to be identified in advance, but this is not obligatory. With or without an appointment the NRA cannot necessarily arrange for anyone to discuss or interpret any of the material made available, and this should not be expected. There is no charge for inspection of paper or computer records. When photocopies or print-outs are requested so they can be taken away, these will be provided when reasonably possible and charges are usually made for this extra service.

4. Making such material available at the main office in each Region fulfils the NRA's duty under the statutory rules governing discharge consent registers. However, for the data that is on computer records, it may often be possible to provide some or all of the material people wish to inspect at more local offices which the NRA has within the Region. Enquiries may be made about this at such offices on the same basis as the main office. How readily these local offices can provide what is requested will obviously depend on circumstances at the time: the smaller offices have neither the facilities nor the staff to deal with public access to data on a regular basis. Though it is not part of these statutory obligations, the NRA is glad nevertheless to arrange more local access and staff have been asked to arrange for this where they can without disrupting other work.

5. The addresses and telephone numbers of the NRA's ten <u>regional</u> offices are as follows:

Anglian Region
Kingfisher House
Goldhay Way
Orton Goldhay
Peterborough PE2 0ZR

Tel: (0733) 371811

South West Region
Manley House
Kestrel Way
Exeter
EX2 7LQ

Tel: (0392) 444000

Northumbrian Region
Eldon House
Regent Centre
Gosforth
Newcastle upon Tyne NE3 3UD

Tel: (091) 213 0266

North West Region
PO Box 12
Richard Fairclough House
Knutsford Road
Warrington WA4 1HG

Tel: (0925) 539999

Severn Trent Region
Sapphire East
550 Streetsbrook Road
Solihull
B91 1QT

Tel: (021) 711 2324

Southern Region
Guildbourne House
Chatsworth Road
Worthing
West Sussex BN11 1LD

Tel: (0903) 820692

Thames Region
Kings Meadow House
Kings Meadow Road
Reading
RG1 8DQ

Tel: (0743) 535000

Welsh Region
Rivers House
St Mellons Business Park
St Mellons
Cardiff CF3 0EG

Tel: (0222) 770088

Wessex Region
Rivers House
East Quay
Bridgwater
Somerset TA6 4YS

Tel: (0278) 457333

Yorkshire Region
21 Park Square South
Leeds
LS1 2QG

Tel: (0532) 440191

6. There is no public access to any data on discharge consents or monitoring in the NRA's London office.

ANNEX 5

GLOSSARY OF KEY TERMS

Absolute limit	Numerical standard that must never be exceeded.
Action-warning	Warning given to discharger of deteriorating performance which requires explanation and appropriate corrective action, but not substituting for formal legal action.
Ammonia - Ammoniacal nitrogen	One of the three standard 'sanitary' determinands widely used in characterising effluent quality.
Automatic monitoring	A process whereby aqueous samples are taken, either discretely or continuously, independently of human intervention.
BOD - Biochemical Oxygen Demand	The mass concentration of dissolved oxygen consumed under specified conditions by the biological oxidation of organic and/or inorganic matter in the sample. One of the three standard 'sanitary' determinands widely used in characterising effluent quality.
BS 5700	British Standard guide to process control using quality control charts and cusum methods.
COD - Chemical Oxygen Demand	The mass concentration of oxygen equivalent to the amount of dichromate consumed by dissolved and suspended matter when a sample is treated with that oxidant under defined conditions.
Compliance monitoring	Routine or pre-planned sampling of an effluent undertaken for the specific purpose of testing for compliance with consent limits.
Compliance assessment	A procedure applied to the results from an effluent sampling programme to determine, for any particular determinand, whether or not the effluent has met its numeric limits.

Consent	A statutory document issued by the NRA to indicate any limits and conditions subject to which the discharge of an effluent to receiving waters is to be made if the consent is to provide a defence against the statutory offence of causing pollution.
Continuous monitoring	A process whereby a particular determinand is measured continuously (or at some predetermined high frequency) from a body of water or effluent.
Controlled waters	Inland and coastal waters to which pollution control legislation applies generally or by individual or local designation.
Descriptive consent	Sub-group of non-numeric consents covering small discharges of little or no environmental significance.
Determinand	Literally 'that which is to be determined'. General term for any numerical property of a sample (usually the concentration of some pollutant) whose value is required.
Discharger	Person or corporate body making a discharge; in this report generally assumed to be the holder of the discharge consent related to it.
Effluent	A water or waste water discharge from a treatment plant, industrial process or lagoon.
EQO - Environmental Quality Objective	The statement or category of water quality that a body of water should match, usually to be suitable for uses identified by the agency setting the objective.
EQS - Environmental Quality Standard	That concentration of a substance which must not be exceeded by some stipulated statistical measure (eg, mean, percentile or maximum) if a specified EQO of the aquatic environment is to be maintained.

Exceedence	A term used in the context of assessing compliance with a percentile limit to denote a determinand value that exceeds its numeric limit.
Flow	Numerical measure of the volume of a river or effluent passing per unit time through a particular cross-section. Typical units of flow are litres/sec and Ml/day.
Load	The quantity or mass of any substances transported by an effluent per unit time; obtained at any instant by the product of i) concentration of the substances, and ii) effluent flow
Look-up Table	Table listing the maximum allowed numbers of exceedences of a 95%ile standard for various total numbers of samples; the test procedure in use and England and Wales since 1985 for assessing sewage effluent compliance.
Mass	The quantity of a substance - for example, the mass (in kg) of suspended solids in a holding tank.
Non-numeric consent	A consent for a significant discharge in which conditions are specified about various features of the discharging facility and its operation and maintenance as major controls, whether or not limits on flow are also included.
Numeric consent	A consent for a significant discharge in which numerical limits are set (as absolutes or percentiles) on the concentration or load of any substance, and on effluent flow, and these form a major part of any compliance testing.
Percentile limit	A numerical limit that must be achieved or bettered for at least some stated percentage of the time over a specified assessment period. For example, an 80 percentile limit must be met for at least 80 percent of some stated time period.

Population -
Statistical population ..... The totality of portions or aliquots of the effluent that have the opportunity of being selected by a monitoring programme in other words, the collection of all the thousands of possible observations that could have been made during the assessment period given continuous, error-free monitoring, thereby defining the true performance of the effluent over that period.

Pre-programmed monitoring ..... Monitoring carried out broadly in accordance with a schedule of frequencies and locations prepared before the start of the assessment period, though appearing unpredictable to the discharger.

Public register ..... A statutory record of discharge consents and the results of analysis of water and effluent samples taken by or on behalf of the NRA, available for inspection by the general public (Under the provisions of the Water Act 1989) at certain NRA offices.

Random sampling ..... A form of sampling in which every portion of the underlying population of values has an equal chance of being selected by the monitoring programme.

Representative sampling ..... Shorthand term for any scheme that attempts to improve on the degree to which random sampling captures the behaviour of the underlying population by sampling from identified sub-groups of the population - as, for example, by choosing one sample at a random time each month rather than choosing 12 samples at entirely random times over the whole year.

Routine monitoring ..... Monitoring carried out according to a pre-planned or pre-programmed schedule - though appearing unpredictable to the discharger - in order to gain a representative picture of quality in the sampled body of water.

Rubric ..... Guidance note included in a document about its usage or status, not forming part of its main content.

Sample	A portion or aliquot removed from the effluent or other body of water, either for some immediate investigative purpose or as part of a routine monitoring programme.
Suspended solids	Solids removed by filtration or centrifuging under specified conditions. One of the three standard 'sanitary' determinands widely used in characterising effluent quality.
TOC - Total Organic Carbon	The quantity of carbon present in the organic matter which is dissolved or suspended in water.
Tripartite sample	An effluent sample taken with a witness and split into three parts, two of which are retained by the regulator and the discharger, the third part being kept aside as an independent check. Generally the only type of 'official' or 'regulatory' sample formally admissible as legal evidence.
Turbidity	Reduction of transparency of a liquid caused by the presence of undissolved matter.
Upper-tier limit	An absolute limit added to a number of consents for sewage works discharges where in 1989 the percentile limits were being relaxed for a time period while work necessary to improve performance was to be undertaken.
WQO - Water Quality Objective	An Environmental Quality Objective given a statutory basis by regulations made under the Water Act 1989.

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