



guardians of drinking water quality

## DRINKING WATER INSPECTORATE

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Information Letter 4/96

### **To: Board Level Contacts of Water and Sewerage Companies and Water Companies in England and Wales**

Dear Sir/Madam

#### **Monitoring of Distribution System Undertakings**

##### **1. Introduction**

In Information Letter 5/95, I advised companies of procedures being put into place for the continual review of the new distribution system undertakings. Discussions have now been held individually with all the companies for which distribution system undertakings will be required, and also with the industry collectively through the Water Services Association and Water Companies Association. Following these discussions, this letter gives further detail and clarification of the requirements set out in Information Letter 5/95, and also replaces an informal draft note produced on 9 October 1995. Three main areas are covered,

- the programme for monitoring and reporting,
- methods for pre- and post-renovation assessment (PPRA), and
- information to be recorded and reported.

##### **2. Background**

As part of the AMP2 process, companies evaluated the need for renovation of their distribution systems. This process produced estimates of the work required in each company's area. The Inspectorate and companies recognise that further investigations are needed at zonal or sub-zonal level to identify requirements more precisely, and continuing programmes for this purpose are needed.

In most cases companies have submitted new undertakings to carry out renovation for water quality purposes. There is a requirement to demonstrate the need for and benefits of the renovation work in these undertakings. To

help companies meet this requirement, the Inspectorate is introducing a system for reporting results of PPRA.

### **3. Programme for monitoring and reporting**

#### **3.1 Regular reporting**

A Company summary is required annually. In addition, companies will be required to report annually on progress in carrying out renovation work and on the results of PPRA as follows:

By 15 April 1996	Zone action statements (ZASs) (new format), including renovation work carried out in 1995.
By 28 February 1997	ZASs for zones with changes, including renovation work carried out in 1996, and PPRA for renovation work carried out in 1995 (and 1996 where possible).
By 28 February 1998	ZASs for zones with changes, including renovation work carried out in 1997, and PPRA for renovation work carried out in 1996 (and 1997 where possible).
By 28 February 1999	ZASs for zones with changes, including renovation work carried out in 1998, and PPRA for renovation work carried out in 1997 (and 1998 where possible).
By 28 February 2000	ZASs for zones with changes, including renovation work carried out in 1999, and PPRA for renovation work carried out in 1998 (and 1999 where possible).
By 30 June 2000	ZASs for zones with changes, including renovation work carried out in Q1 2000 (and PPRA for renovation work carried out in 1999 and Q1 2000 where possible).

Where a renovation scheme spans two calendar years, progress should be reported in each of the two years as appropriate; for each year, reference should be made to the other year's work. PPRA results should be reported within two years of renovation work starting. Where the methods of assessment used allow, companies are encouraged to report results earlier than the timetable above.

#### **3.2 Audit**

Companies' programmes of renovation work will be monitored by audit. These audits will be held throughout the year by arrangement with the individual companies. They will include scrutiny of arrangements for investigation, monitoring and survey of water quality and consumers' perceptions, procedures for the planning and execution of the renovation work, records of investigations and measurements, and records of work carried out. Site visits may be included.

### **4. Strategies and methods for pre- and post-renovation assessment**

Companies are expected to use their best endeavours to develop strategies, procedures and criteria which are effective in

- identifying significant water quality problems,
- assigning appropriate priorities to their solution,
- identifying effective remedial actions, and
- demonstrating the benefits of those actions in improved water quality and consumers' perception.

These shall include procedures for PPRA. The purposes of PPRA are

- to establish that water quality before renovation is unsatisfactory and remedial work is required,
- to establish that water quality after renovation is satisfactory, and
- to compare water quality before and after renovation to demonstrate that the renovation has been effective.

Methods to be used for quantifying water quality problems in target areas before and after renovation of distribution systems are described in Annexes A and B. Companies are also expected to have in place adequate procedures for identifying areas where water quality may be unsatisfactory. Strategies should include methods for assigning an appropriate priority to remedial work. In addition, procedures are needed for diagnosing causes of problems and choosing effective solutions to them. These are regarded as pre-requisites, and are not considered in Annex A. However, inadequacies in these respects may become evident in unsatisfactory results from post-renovation assessment. The adequacy of companies' arrangements and the outcome of PPRA will be assessed in detail during audit.

The criteria which are established initially will be used to judge the effectiveness of companies' programmes of work, and the Inspectorate expects that these criteria will be met. The Inspectorate will keep under review the continuing adequacy of the companies' arrangements, strategies and criteria for distribution system improvement work. The Inspectorate recognises that understanding of problems of water quality in distribution and techniques for their investigation are imperfect, and companies may make progress in further developing their understanding of these matters. The Inspectorate will be willing to discuss proposals for amendments to strategies and criteria in the future with individual companies where there is substantial evidence that the original criteria adopted were incorrect. A company making such proposals would need to be prepared to provide considerable supporting evidence to enable the Inspectorate to determine which aspects of the company's strategy or its implementation were deficient, and what further action, if any, is appropriate. It is expected that any proposals for amendments to criteria would relate to exceptional circumstances only.

## **5. Information to be recorded and reported**

### **5.1 Information to be recorded**

Companies should maintain fully auditable detailed records of data and analyses arising from the following:

- investigations to establish the nature and severity of problems and to diagnose their causes,
- priority ranking,
- the selection of remedial actions and
- pre- and post-renovation assessment.

Companies should also maintain fully auditable detailed records of renovation work carried out for water quality purposes.

These records should include clear delineation of areas subject to renovation work and areas subject to pre- and post-renovation assessment. Where the company chooses to assess areas smaller than a Water Supply Zone, the sub-division of the zone should be clearly defined and all parts of the zone accounted for. Where the definition of these areas may be subject to change, for example if they are based on metered districts whose boundaries may change, such changes should be easily auditable, and due consideration must be given to the implications of such changes for pre- and post-renovation assessment.

## **5.2 Information to be reported annually**

Summary information on renovation work carried out and pre- and post-renovation assessments made should be reported annually, following the timetable in paragraph 3.1. The information required is set out in Annex C.

## **6. Enquiries**

Enquiries concerning this letter should be directed to Mr M J Purcell, Principal Inspector, (020-7944-5993), Room 2/F4, Ashdown House, 123 Victoria Street, London SW1E 6DE.

Copies of this letter have been sent to the Secretaries of the Water Services Association and the Water Companies' Association, to the Director General of Water Services, to the Head of Water Services Division of the Department of the Environment, and to the Head of Environment Division in the Welsh Office.

Yours faithfully,

M J Rouse  
Chief Inspector

## **ANNEX A : METHODS FOR PRE- AND POST-RENOVATION ASSESSMENT**

### **A.1 Consistency**

- Companies will be expected to specify in advance methods for quantifying problems and criteria for assessing results, and to agree these with the Inspectorate.
- The methods and criteria chosen should be consistent with, but not necessarily the same as or restricted to, the 'parameters' in the undertaking. (Draft undertakings which have been submitted are concerned with discoloured water problems, including exceedences of PCVs for iron, manganese, aluminium and turbidity, and exceedences of the PCV for PAH . This is reflected in the methods discussed in Sections A.3 and A.4. Any additional requirements should be discussed with the Inspectorate.)
- The methods and criteria chosen should be consistent with the cause of the problem and the remedial method.
- All methods and sampling regimes should be directly comparable before and after renovation.

Companies will be expected to use the specified methods on all relevant work, except as follows.

- Where renovation work is imminent or has already been carried out, transitional methods may be adopted. In general, post-renovation sampling may be made consistent with pre-renovation sampling, rather than with the methods which may be adopted in the longer term. Proposals for such transitional methods should be discussed with the Inspectorate.
- Companies may supplement the methods specified in their strategy documents with other methods. Where companies believe there is a strong case for using results from these methods as well as the specified methods, companies are asked to discuss this with the Inspectorate. However, such a change must be regarded as exceptional.

### **A.2 Geographic areas to be assessed**

Compliance with statutory requirements for water quality is monitored on the basis of Water Supply Zones (WSZs). Pre- and post-renovation assessments which cover the whole of a WSZ will be accepted. However, it is acknowledged that water quality problems can sometimes be shown to be confined to parts of a WSZ, and that there are sometimes practical difficulties in tackling problems affecting the whole of a zone within a reasonable period. Provided that either of these conditions can be shown to apply, pre- and post-renovation assessments which cover discrete and definable sub-divisions of a WSZ will also be accepted. In these cases, the sub-zones chosen should be hydraulically discrete, as far as reasonably practicable, and designed to minimise any effect from areas where renovation is still needed. Companies should keep clear records to show how WSZs are divided into the sub-zones

to be assessed, and the relationship between these and the areas subject to renovation, including cross references between different recording systems.

### **A.3 Types of method for assessing discoloured water problems**

It is recognised that discoloured water problems are difficult to measure, and all available methods have weaknesses. In particular, these problems are often intermittent, and a frequency of occurrence which may be unacceptable to consumers can be difficult to capture by conventional water sampling techniques. Alternative means of assessment are subjective and indirect. For this reason, the Inspectorate would find acceptable programmes which incorporate at least two distinct and complementary methods of assessment, with at least one from each of the following lists A and B.

List A:

- Enhanced Enhanced routine random sampling
- random spot sampling surveys,
- structured spot sampling surveys ( representing different locations in the system and different mains materials ).

For each of these, appropriate determinands would be filter paper colour (fpc), iron, manganese and aluminium. Other determinands, such as pH, temperature and chlorine, may be useful for interpretation, but would not be used in a quantitative assessment. Where archive data are used, different types of sample must be distinguished, especially samples taken in response to consumer complaints.

List B:

- Consumer questionnaires,
- records of complaints.

### **A.4 Types of method for assessing PAH problems**

Companies will be expected to carry out representative pre- and post-renovation sampling and analysis for at least the six regulated PAH. This sampling should be structured to take account of the residence time of the water as it passes through different parts of distribution system, and include both dead ends and through mains.

### **A.5 Site selection**

Companies will be expected to specify the methods used to select sampling sites for pre- and post-renovation assessment. Sampling regimes should be either fully random within the target area or stratified to represent different positions in the network and mains materials. Selection of sites before and after renovation should be on the same basis.

### **A.6 Criteria**

Companies will be expected to set the following criteria for the methods of assessment adopted from List A and List B.

#### **a) Satisfactory performance, List A**

Satisfactory performance for determinands in List A should be defined (e.g. 'not more than w % of samples should exceed x µg/l Fe'). Threshold concentrations or values set for regulated determinands may be the same as or lower than the PCV, but should be realistic taking into account the chosen limit for frequency of exceedence.

#### **b) Satisfactory performance, List B**

Satisfactory performance for measures in List B should be defined (e.g. 'the complaint frequency should not exceed y per year per thousand population').

#### **c) Substantial difference**

A margin between the results of pre-renovation sampling and those of post-renovation sampling should be set which would constitute a substantial difference representing a worthwhile improvement (e.g. the proportion of samples exceeding the threshold in pre- and post-renovation sampling to differ by at least z %).

#### **d) Statistical significance**

The difference between results of pre-renovation sampling and those of post-renovation sampling should be statistically significant at the 90% confidence level.

### **A.7 Numbers of samples**

Numbers of samples or other data in pre- and post-renovation assessments should be sufficient to demonstrate compliance with the criteria in A.6, including the requirement for a statistically significant difference. Passive methods of monitoring, such as the use of records of complaints, require statistically valid numbers of data just as much as do active methods. Companies are expected to specify sample numbers or the basis on which they are chosen.

In principle, sufficient samples are required to demonstrate a statistically significant difference, whatever the size of the renovation scheme. It may be acceptable to aggregate the results from small renovation schemes within a zone to achieve the acceptable number of samples, provided that it can be demonstrated that the renovation schemes and the sampling are closely comparable. (This is expected to be applied most often to renovation schemes to deal with PAH.) Companies considering this option are asked to discuss it with the Inspectorate.

## **A.8 Statistical analysis**

Data from monitoring and sampling should be collated and simple tests should be carried out to demonstrate the statistical significance of differences between comparable results from before and after renovation. Results should be reported in annual returns. Suitable tests are outlined in Annex B. The Inspectorate recognises that water companies may wish to use more sophisticated analyses to test the success of their renovation work for their own purposes. However, it is important that results from companies can be assessed on a common basis. If companies wish to use methods other than those in Annex B, they are asked to discuss this with the Inspectorate. If the proposed methods are equivalent to those in Annex B, they may be added to a short menu of methods to be made available to all companies.

## **A.9 Timing of sampling**

Water sampling should take account of seasonal differences in the prevalence of problems by either

- sampling for a whole year before and after renovation, or
- sampling during the season when records show that problems are likely to be worst.

Where post-renovation sampling surveys are conducted, time should be allowed for disturbance caused by the renovation work to have dissipated (a month should suffice). Where questionnaires are conducted, a sufficient period should be allowed after the renovation work to represent the changed performance, including, say, the whole of a summer.

Companies are asked to report results of pre- and post-renovation assessments together, annually by 28 February within two years of renovation work starting.

## **A.10 Quality of water entering the zone or sub-zone**

The quality of water supplied from treatment works should be recorded during the period when pre- and post-renovation sampling and renovation work are carried out, and results analysed to demonstrate whether significant changes have taken place. In some cases, for example where appreciable improvements have been made to the treatment works, it may be necessary to repeat the pre-renovation sampling. Alternatively, where such problems are anticipated, results from a closely comparable area may be used as a control; sampling would be carried out in the control area at the same time as in the project area, both before and after the renovation work.

## **A.11 Effects of operational events and external influences**

Consumers' perception of water quality is influenced by intermittent events which disturb the distribution system. As companies are expected to maintain water quality to consumers, no allowance in interpreting post-renovation



assessments may be made for operational changes or acts by outside agencies which lead to disturbance to the supply and distribution systems causing deterioration in water quality.

When devising integrated renovation strategies, companies are expected to give consideration to the potential for deterioration in water quality caused by the condition of upstream pipework. Accordingly, no allowance in interpreting post-renovation assessments may be made for such deterioration.

**ANNEX B : STATISTICAL ANALYSIS OF RESULTS**

Now superseded by Annex B of IL 8 / 97 (18 April 1997).

**ANNEX C : REPORTING PROGRESS WITH DISTRIBUTION UNDERTAKINGS**

Now superseded by IL 17 / 99 (20 December 1999)