



SCOTTISH EXECUTIVE

Environment Group

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Your ref:
Our ref: 2DWE/25/2

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Information Letter 3/2004

Dear George

Microbiological quality of water leaving treatment works and in service reservoirs: Drinking Water Safety Plans and Regulation

Purpose

1. The purpose of this letter is to highlight the Division's concern about the number of samples failing microbiological standards and to explain the Division's expectations of Scottish Water regarding the actions to be taken in the event of microbiological failures at water treatment works and service reservoirs. To this end, the letter introduces the Division's policy in respect of a Drinking Water Safety Plan (DWSP) approach to the treatment and supply of drinking water and encourages Scottish Water to take account of this approach.

Background

2. Application of the regulatory framework since 1990 has facilitated significant improvements in drinking water quality. Yet in 2002, whilst 99.48% of all tests on regulatory samples taken from water treatment works, service reservoirs and water supply zones met the standards, 52.6% of the total number of test failures (i.e. 936 out of 1,778) were for microbiological parameters. This can be further broken down into 11.6% at water treatment works; 27.9% at service reservoirs; and 13.2% in zones. In 2002, 22.4% of all treatment works failed the total coliform standard and 13.5% of works failed the faecal coliform standard. In addition, 12.4% of service reservoirs contained coliform bacteria in more than 5% of samples and failed the total coliform standard and 4.2% of service reservoirs failed the faecal coliform standard.



I recognise that the majority of treatment works and service reservoirs met the standards in 2002 but, taking into consideration the low frequency of sampling and the small volume of water analysed, the degree of failure is significant and I am confident Scottish Water will wish to improve in this very important aspect of its performance.

3. The importance of demonstrating that drinking water meets the microbiological standards and the contribution this activity makes to the protection of public health cannot be overestimated. Part I of “The Microbiology of Drinking Water 2002” (and all earlier editions of this internationally recognised best practice document hitherto known as Report 71) sets out the public health rationale for robust treatment, including disinfection, and appropriate monitoring of supplies. Scottish Water should be following these principles in full.

4. The Water Supply (Water Quality) (Scotland) Regulations 2001 (the Regulations) set out the requirements for the microbiological quality of water leaving water treatment works and in service reservoirs. The prescribed standard for coliform bacteria and *Escherichia coli* (*E.coli*) in water leaving a treatment works is 0 per 100 ml. The same standards apply at service reservoirs, but regulation 4(6) permits up to 5% of samples taken from a service reservoir in one year to contain coliform bacteria. Regulation 25 requires all water supplies to be disinfected and all supplies derived from surface water sources to receive such additional treatment as necessary

5. The World Health Organisation has recognised that the most effective and protective means of consistently assuring the quality of drinking water and safeguarding public health is through the application of a preventative DWSP that encompasses all the steps in water protection from catchment to the consumer. The European Commission views DWSPs as the way forward for the Drinking Water Directive. Although a new Directive is unlikely before 2009, adoption of the principles and practice, encompassed in such plans, is to be encouraged. Such plans should not be seen as something new. The Division views them as a tool for developing and reinforcing existing good practice.

6. The primary objectives of a DWSP are :

- the awareness and prevention of contamination of source waters;
- the reduction or removal of contamination through appropriate barriers, including treatment processes, to meet defined water quality targets; and
- the prevention of contamination of treated water during transfer, storage, distribution and delivery to consumers.

7. It is recognised that only the second of these objectives is wholly under the control of Scottish Water and I shall be seeking ways of working with Scottish Water to develop the DWSP approach to the whole water supply chain. Meanwhile treatment of water and its distribution to the curtilage of premises are areas where the principles of a DWSP can be, and in many cases are already, being applied by Scottish Water. I see DWSPs not only as a means of sustaining safe drinking water supplies, but also as an effective tool for investigating and reducing microbiological failures.

8. Whilst validation at the end of the treatment chain using microbiological tests is necessary and will remain an essential element of drinking water regulation into the future, such verification should not be mistaken as a determination of the safety of treated water. Such testing has well understood limitations, namely:

- it is based on indicator organisms, not individual pathogens;



- the capability of microbiological detection methods gives limited early warning;
- the volumes of water tested are small; and
- grab samples rarely detect short term changes in water quality.

9. DWSPs help to overcome these drawbacks by:

- enabling the development of an understanding of the specific water system;
- identifying potential sources of contamination and how they may be controlled; and
- by implementing monitoring of critical control measures to continuously verify water treatment and disinfection is adequate at all times.

Occurrence of coliform bacteria including *E.coli* in water leaving treatment works.

10. Samples collected for compliance purposes which contain coliform bacteria, including *E.coli*, contravene the national requirements for wholesomeness (regulation 4(4)a). The Division's view is that coliform bacteria should not be detected in the treated water leaving a properly and adequately operated water treatment works. Occasionally Scottish Water have been able to show retrospectively that the most probable cause of a coliform detection was a breakdown in the sampling/analysis process rather than a failure of the processes of water treatment and disinfection. However rarely has such investigative evidence been compelling. The Division will continue to require robust evidence to be provided that the cause of a microbiological failure was the process of sampling/analysis (including the sample tap). As a matter of principle, all contraventions of the microbiological standards will be viewed as an indication of a failure to adequately treat and/or disinfect the water and therefore also a potential contravention of regulation 25.

11. Scottish Water are expected to investigate all detections of coliform bacteria promptly and thoroughly, taking appropriate remedial action as necessary to prevent further contraventions. The Division will require a full report of each investigation in order to assess the extent of the contravention. The investigation should focus clearly on water treatment performance but should also consider source water quality and the sampling/analysis process. The investigative steps should be documented within Scottish Water's DWSP as applied to the specific water treatment works. Annex A to this letter lists a number of items that the Division would expect Scottish Water to include in its investigations as part of its DWSP. The list is not exhaustive. Part 1 of The Microbiology of Drinking Water 2002 gives further guidance on such investigations.

12. Where Scottish Water do not have works specific DWSPs the Division expects these to be developed, implemented and kept under review, irrespective of whether there have been contraventions of microbiological standards in the water leaving the water treatment works. I would expect Scottish Water to have comprehensive treatment DWSPs in place as soon as practicable. The Division will be checking and reporting on Scottish Waters' progress with developing DWSP's through the technical audit process in 2005.

Occurrence of coliform bacteria including *E.coli* in water in service reservoirs.

13. The Regulations permit up to 5% of samples taken during a calendar year at service reservoirs for compliance purposes to contain coliform bacteria. Where more than 5% of samples contain coliform bacteria, or any sample contains *E.coli*, the wholesomeness requirements of regulation 4(5) have been contravened.

14. The Division expects Scottish Water to promptly and thoroughly investigate all detections of coliform bacteria and *E.coli* in water in service reservoirs and take appropriate remedial action as



necessary to prevent further contraventions. The Division will require a full report of each investigation in order to assess the extent of the contravention. The investigation should focus clearly on the integrity of the reservoir and associated pipework but should also consider the performance of upstream treatment works and the sampling/analysis process. The investigative steps should be documented within the DWSP as applied to the specific distribution system. Annex A to this letter lists a number of items that the Division would expect Scottish Water to include in its investigations as part of its DWSP. The list is not exhaustive. Part 1 of the Microbiology of Drinking Water 2002 gives further guidance on such investigations.

Quality of water at the consumer's tap.

15. I will issue separate guidance on detections of coliform bacteria and *E.coli* at consumers' taps and how the DWSP approach will be taken forward by the Division in relation to distribution system integrity and water supply hygiene practice.

Enquiries

16. Enquiries about this letter should be addressed to Colin McLaren (Tel No: 0131 244 0186) or Email: Colin.mclaren@scotland.gsi.gov.uk. Please acknowledge receipt of this letter using the attached form.

17. I have copied this letter to Catherine Benton for her information.

Yours sincerely

Tim Hooton



Please complete the acknowledgement below and return it to:

Ewan J Young
Scottish Executive
Environment Group
Drinking Water Quality Division
Area 1-H
Victoria Quay
EDINBURGH
EH6 6QQ

I acknowledge receipt of Information Letter 3/2004

Microbiological quality of water leaving treatment works and in service reservoirs: Drinking Water Safety Plans and Regulation

Signed _____

Name _____

Position _____

Address _____

Date _____



ANNEX A – Guidance on DWSP approach to microbiological test failures

WHO Primary Objectives of Drinking Water Safety Plans

Prevention and awareness of contamination of source waters

Reduction or removal of contamination through treatment to meet water quality targets

Prevention of contamination during treatment, storage and distribution.

WHO Approach to developing a Drinking Water Safety Plan:

Identify the hazard

Assess the risk

Define multiple barriers, establish operational control criteria (targets)

Define corrective action

Verify corrective action

Document (including communications processes)

Verify and audit (internal/external)

Background information on the application of the water safety plan approach to microbiological safety of drinking water is available in the OECD/WHO publication entitled Assessing Microbial Safety of Drinking Water: improving approaches and methods. 2003. ISBN 92-64-09946-8 also available at www.who.int/docstore/water_sanitation_health/GDWQ.

DWQD Application of the DWSP approach to microbiological test failures at treatment works

Coliform bacteria, and *E.coli* in particular, are indicators of faecal pollution of water and the possible presence of pathogens (*the hazard*).

Exposure to drinking water containing viable pathogens may give rise to infection in susceptible people (*the risk*).

Prevention and awareness of faecal pollution of raw water, sufficiency and adequacy of treatment steps including disinfection, restricted access and hygiene arrangements, normal operational control criteria (*define the barriers*)

Continuous monitoring at critical control points, actions to be taken, and by whom, when out of range, including response to alarms, instrument checks, (*define corrective action*)

Operational audit of works performance, daily, weekly, monthly reviews of control data versus control targets by operational management (*verify corrective action*)

Review and amend operating and maintenance procedures, staff training, management performance reporting and learning from corrective actions (*document*)

Operational and regulatory monitoring of raw and treated water, periodic audits of works (*verify and audit, internal = water company, external =DWQD*)



Investigative steps to be considered following contravention of the coliform bacteria or *E.coli* standard at a water treatment works

Review of raw water quality changes and treatment performance data at least 48 hours prior to the failing sample being taken; coagulation and filtration stages (as appropriate); chlorine dose and residuals;

Where lessons learnt from previous failures led to a revision of the operating procedures (and DWSP), evidence that the revised plan and procedures had been implemented

Actions listed in section 8 of Part I of the Microbiology of Drinking Water 2002;

Evidence that the conclusions of the investigation had been reported to and accepted by the person with managerial responsibility for the quality of water leaving the site and confirmation by them that any remedial action identified has been satisfactorily completed or a date for completion is identified for any work yet to be undertaken.

For *E.coli* contraventions details of steps taken to safeguard public health, such as communications with health and local authorities, sampling of water in supply, testing for other indicators and/or pathogens and/or larger volume samples, increased chlorine residuals, boil water advice etc.

Auditable evidence (of the type normally provided for audit trail data) that the sampling and analysis practices associated with the sample were satisfactory .

Investigative steps to be considered following contravention of the coliform or *E.coli* standard at a service reservoir.

Site inspection of service reservoir for breaches of integrity (including on site chlorine residual checks for evidence of ingress of faecal matter).

Review of any site chlorine dosing and residual measurements for at least 7 days prior to the failing sample being taken

Review of chlorine residual data from upstream and downstream sites for at least 7 days prior to and 7 days after the failing sample being taken;

Review of any existing operating regime in place to manage turnover,

Date and report of last internal reservoir inspection, review of identified deficiencies and any delays in progress with implementation of remedial actions

Actions listed in section 8 of Part I of the Microbiology of Drinking Water 2002.

Evidence that the conclusions of the investigation had been reported to and accepted by the person with managerial responsibility for the quality of water leaving the site and confirmation by them that any remedial action identified has been satisfactorily completed or a date for completion is identified for any work yet to be undertaken.



For *E.coli* contraventions details of steps taken to safeguard public health, such as communications with health and local authorities, sampling of water in supply, testing for other indicators and/or pathogens and/or larger volume samples, increased chlorine residuals, boil water advice, etc,

Auditable evidence (of the type normally provided for audit trail data) that the sampling and analysis practices associated with the sample were satisfactory .

