



guardians of drinking water quality

## DRINKING WATER INSPECTORATE

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Mr Peter Simpson  
Managing Director  
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Dear Mr Simpson

### DRINKING WATER QUALITY EVENT

**Detection of *E.coli* in a consumer's tap sample on 1 June 2010 and the subsequent identification of cross connections between a rain water harvesting system and the potable water supply on the Upton Eco-Housing Development, Northamptonshire.**

#### 1. Introduction

- 1.1. The purpose of this letter is to inform you of the conclusions and recommendations arising from the Inspectorate's assessment of the event involving the detection of *E.coli* in a consumer's tap on 1 June 2010 and the subsequent identification of cross connections between the incoming mains supply and rainwater harvesting systems at properties on the Upton Eco-Housing Development. This was classified using a risk-based approach as a **serious** event.
- 1.2. When notified of an event, the Inspectorate gathers information considered to be relevant and assesses this in conjunction with information provided by the Company about the circumstances of the event and any actions taken. The Inspectorate then considers the way in which the event was handled and whether any breaches or offences occurred. The Company notified the Inspectorate of this event on 1 June 2010. I have set out my conclusions and recommendations below.

## 2. Overview of the event

- 2.1. The Upton Eco-Housing Development is located within Anglian Water Services Northampton West water Supply Zone. Drinking water supplies to properties on the housing development are supplied by Anglian Water from Pitsford and Wing Water Treatment Works (WTW). Currently the wider Upton estate consists of approximately 900 properties of which 550 form part of the Eco Housing Development.
- 2.2. The Upton estate has been developed in a number of phases, each of which has been built by different developers. These include; Miller Homes, Cornhill (now ZeroC), Barratt Homes, Mansell Construction built on behalf of the Metropolitan Housing Association (MHA) and David Wilson (now merged with Barratt Homes).
- 2.3. On 26 January 2010 Anglian Water received a complaint of a “sewage” odour in tap water from the occupier of ■ Scribers Drive, Upton. In response samples were taken from the property and the upstream hydrant. These samples gave satisfactory bacteriological results. However, a sample taken from the kitchen tap was associated with a “sulphide” odour.
- 2.4. Anglian Water returned to the property on 29 January to take other samples at the property, supply pipe, boundary box and a downstream property. In addition the supply pipe to ■ Scribers Drive was flushed and a new boundary box was installed.
- 2.5. Unusual odours were present in samples taken from the kitchen tap at Scribers Drive. Further samples were taken from the property on 1 February. These samples were reported as bacteriologically satisfactory. On reporting the satisfactory results to the consumer, it became evident that the “sewage” odour was ongoing in an upstairs bathroom tap.
- 2.6. Further samples were taken on 5 February. During this fourth visit, the Network Technician identified the presence of a rainwater harvesting system at the property and a water fittings inspection was arranged for 12 February.
- 2.7. Unfortunately, the water fittings inspection could not be completed due to the location of the pipe work behind the fitted kitchen units. The consumer was advised by Anglian Water to arrange another appointment and to have a plumber present to allow for access to the hidden pipe work. The customer was contacted by the Company on 23 February and by letter on 8 March to emphasise the need for a full water fittings inspection.

- 2.8. On 30 May Anglian Water received a further complaint of a “sewage/onion” odour to the water from ■ Scribers Drive. Samples were taken from the property. These samples contained greater than 100/100ml *E.coli* and coliforms. The consumer was advised of the results. Bottled water was provided, which the consumer was advised to use until otherwise notified. Subsequent follow up samples gave satisfactory bacteriological results.
- 2.9. Viridian Housing Association manages a number of properties on the Upton Development including ■ Scribers Drive, and was contacted by Anglian Water regarding adverse bacteriological results and the actions required to help resolve the matter.
- 2.10. By 4 June, Viridian Housing Association had informed Anglian Water Services that they had identified an open cross connection at ■ Scribers Drive between the rainwater harvesting system and the drinking water supply and that it had been duly disconnected. The tenant at ■ Scribers Drive was moved to alternative accommodation, whilst remediation work was carried out at the property to chlorinate the internal plumbing system.
- 2.11. A meeting was held on 8 June to determine the number of properties potentially containing similar rainwater harvesting systems. As a result, 26 properties under the management of Viridian Housing Association were identified as having the same type of rainwater harvesting system manufactured by Freerain. Anglian Water acted immediately to issue boil water notices and an explanatory letter to all of these properties, along with bottled water. Samples were taken from each property. Work was undertaken by Viridian and the Company to isolate and disconnect the rainwater harvesting systems.
- 2.12. Cross connections were found at all 26 properties. Fortunately in these cases, unlike that at ■ Scribers Drive, the isolation valve was in the “closed” position.
- 2.13. On 9 June, a further 62 properties were identified as being fitted with the same Freerain rainwater harvesting systems. Of these, 62 privately owned properties were built by Miller Homes, who also built 22 of the 26 properties managed by Viridian Housing Association. The remaining four properties also managed by Viridian were built by Cornhill (ZeroC). Fittings inspections were scheduled for these properties.
- 2.14. A second “open” cross connection was identified at ■ Telford Street on the evening of 9 June. The property was sampled and the consumer issued with a boil water notice and bottled water. The results of the samples were satisfactory.

2.15. By 10 June, all but 3 properties managed by Viridian Housing Association had been inspected and the cross connection disconnected. A further 44 private properties built by Miller Homes had also been inspected and the cross connection disconnected. Boil water notices were lifted at all properties that had been inspected, where satisfactory sample results had been obtained and where the cross connection had been disconnected.

2.16. The Company continued its investigations, with dialogue between the Company, developers and the rainwater harvesting manufacturers regarding the number of properties potentially containing rainwater harvesting systems. Table 1 identifies the total number and type of rainwater harvesting system installed by each of the developers at Upton.

**Table 1. A summary of the final number of rainwater harvesting systems (RWHS) on the Upton Eco-development by developer.**

Developer	Private properties with RWHS	Viridian Housing Association properties with RWHS	Total No. of properties with RWHS	Rainwater harvesting system manufacturer
Miller Homes	62	22	84	Freerain
Cornhill (ZeroC)	22	4	26	Freerain
Barratt Homes	18	8	26	GRAF
MHA	6	0	6	These are not full rainwater harvesting systems. Pipe work allows water to be collected from the green roof and gravity fed to a collection tank, before being used for toilet flushing. These system form part of experimental eco-homes built by Mansell Construction.
<b>Total</b>	<b>108</b>	<b>34</b>	<b>142</b>	

2.17. A media article appeared in the Northampton Chronicle and Echo on 15 June 2010 about the finding of *E.coli* at █ Scribers Drive.

- 2.18. The Company identified a third “open” cross connection on 17 July at Scribers Drive. The consumer was issued with a boil water notice and bottled water. The cross connection was disconnected and samples taken, which proved satisfactory.
- 2.19. To date, three open cross connections between the rainwater harvesting system and the drinking water supply have been identified at the Upton Eco-housing development.

### 3. Actions taken by the Company

- 3.1. I am **critical** of the fact that it took four visits by Anglian Water to identify the link between the water quality complaint and presence of a rainwater harvesting system at Scribers Drive between 26 January and 5 February. Furthermore, and of a more serious concern is that it wasn't until the consumer complained again on 30 May, some four months after the original complaint, that the company identified a cross connection causing contamination of the drinking water supply. Whilst, I acknowledge that rainwater harvesting systems are not common place, I would have expected the Company Network Technicians to have checked for any unusual and/or additional supply arrangements at the property during the initial investigation. I was **minded to recommend** that the Company should ensure that checks are made for the presence of rainwater harvesting systems and grey water reuse systems during all investigations at customer properties. However, I **note** that the Company as a result of this event plans to give a specific instruction on such checks to its Operational Scientists dealing with water quality complaints. Anglian Water has also briefed relevant staff on the circumstances of the event and plans to ensure that relevant staff are familiar with the BSI Code of Practice for Rainwater Harvesting (2009) (BSI8515:2009) and the new BSI Code of Practice for Grey Water Reuse Systems (2010). I would be grateful if the Company could provide the Inspectorate with a copy of their instructions and details of the proposed familiarisation training.
- 3.2. During this event the Company undertook Water Fittings Regulations inspections at every household identified as having a rainwater harvesting system. Where infringements of the Water Supply (Water Fittings) Regulations 1999 were identified the Company has scheduled a series of follow up inspections to ensure satisfactory remedial action has been taken. The Company has also carried out a comprehensive sampling programme, sampling every property identified as having a rainwater harvesting system within the Upton Eco-housing development. In total 189 samples were taken between 30 May 2010 and 29 June 2010. I am satisfied that this response and remedial action by the company was comprehensive and provides appropriate reassurance that

remedial action to safeguard public health was taken. However, I would point out that fittings inspections and the disconnection of any cross-connections found is the particular action that secures the safety of drinking water. The purpose of sampling is to provide general reassurance of satisfactory water quality in the area of the Upton estate and whilst important, it cannot be relied upon to establish the presence or absence of an unsafe plumbing arrangement. I **suggest** the Company continues to consider the balance of its relative allocation of resource between inspection and sampling efforts when responding to events and uses the experiences gained during this event to inform its water safety plans and operating procedures.

- 3.3. I **note** that the only property known to contain a rainwater harvesting system that has yet to be inspected on the Upton Eco-housing development is ■ Scribers Drive. The Company has established that the occupants are away on holiday. A number of letters have been left at the property to inform the customer of the problem and the need for a water fittings inspection of their property. The Company have taken further action at the property by installing a double check valve at the boundary box to protect the wider public supply from back siphonage and, by monitoring demand at the property.
- 3.4. I **note** that samples taken at Scribers Drive and ■, ■, and ■ Bristle Street were associated “fruity” odours. The Company has carried out an in depth investigation into the source of these odours, including trace organics analysis of water and soil samples, and enhanced inspections of the rainwater harvesting systems and boundary boxes. Trace organics analysis revealed the presence of diethyleneglycol dimethacrylates and low levels of other hydrocarbons, most of which are commonly used as plasticisers. Concentrations found were below the level considered to be of concern to human health. As a precaution against long term exposure from possible spillages and ground contamination the Company has replaced the boundary boxes and communications pipes at Scribers Drive and ■ Bristle Street with appropriate barrier pipe. An investigation into the presence of trace organics in spot samples from boundary boxes has established a probable link between chlorine dosing before sample collection. I am satisfied that the Company investigation into the presence of these odours has been thorough and informative regarding its operational practices for boundary boxes.
- 3.5. I **am pleased to note** the continued liaison between Anglian Water and all stakeholders including the consumers, the Local Authority environmental health team, the local Health Protection Unit (HPA), the Housing Association, Developers, UK Rainwater Harvesting Association (UKRHA), Institute of Plumbers and Water Regulations Advisory Scheme (WRAS) throughout this event.



- 3.6. Anglian Water has been in contact with the manufacturers of both the Freerain and GRAF rainwater harvesting systems regarding their installation procedures. In both cases the Company has concluded that the systems were installed contrary to specification and after reviewing these procedures I concur with this conclusion.
- 3.7. I **note** that Anglian Water in the course of their investigations has identified that a single company were responsible for the installation of the Freerain rainwater harvesting systems at properties built by Miller Homes. I also **note** that installation of these systems was carried out under the supervision of a Miller Homes contracts manager. In the case of the GRAF rainwater harvesting systems installed in properties built by Barratt Homes, a number of different installers were used.
- 3.8. As a result of the Water Fittings Inspections on the Upton estate, a number of infringements of the Water Supply (Water Fittings) Regulations 1999 were identified including insufficient air gaps and labelling infringements. A summary of the infringements is shown in Table 2.

**Table 2. Summary of Water Fittings Regulations infringements**

Developer	Properties with a cross connection infringement	Properties with a labelling infringement	Properties with an insufficient air gap infringement
Miller Homes	84	84	0
Cornhill	0	21	0
Barratt Homes	3	23	1
MHA	0	6	0
<b>Total No. of infringements at Upton</b>	<b>87</b>	<b>134</b>	<b>1</b>

- 3.9. I **note** that Anglian Water has written to the Chairman of the UK Rainwater Harvesting Association (UKRHA) on 25 June to raise concerns regarding the inappropriate installation of rainwater harvesting systems. Liaison is ongoing with UKRHA, their members and WRAS to ensure members of UKRHA are fully aware of the requirements of the Water Supply (Water Fittings) Regulations 1999 and the BSI Codes of Practice for Rainwater Harvesting (2009) (BSI8515:2009). The Inspectorate **endorses** the need for raising such awareness in the interests of public health.
- 3.10. I **note** that the Company experienced difficulties with identifying the number and location of rainwater harvesting systems on the Upton Eco-Housing Development. The process of identifying properties with rainwater harvesting systems was complicated by the fact that Cornhill (ZeroC) handed over responsibility of their properties to an agent, Miller

Homes. Neither Cornhill (ZeroC) or Miller Homes were then able to confirm whether the properties built by Cornhill (ZeroC) had rainwater harvesting systems. As a result it was necessary for Anglian Water to undertake a widespread letter drop to 352 properties to try to establish which properties had rainwater harvesting systems. By 30 June 2010, the Company had received 35 responses of which 15 were subsequently identified as having Freerain systems in properties built by Cornhill (ZeroC). Following this, further associated properties were inspected, and a total of 26 Cornhill (ZeroC) properties were identified as having Freerain systems. I **conclude** that such problems would not have occurred if following notification under the Water Fittings Regulations 1999, Anglian Water had identified the problem in its routine inspections of the Upton Estate when the properties had been newly constructed. I am **critical** of the company for this failure but I **note** the actions taken since this time and revised procedures for inspection of properties with rainwater systems put in place by the Company as part of its event learning.

3.11. In an attempt to gain a better understanding of the prevalence and location of rainwater harvesting in their area, Anglian Water is reviewing its records for building developments. The Company has also contacted all developers in their area to determine the location of any rainwater harvesting and/or grey water reuse systems and to remind them of their responsibilities and the associated BSI Codes of Practices. The findings of this exercise are informing a programme of Water Fittings Inspections across the region. The Inspectorate **endorses** these actions as being in the interest of public health. A summary of inspections completed by 23 July 2010 are shown in Table 3.

**Table 3. Water Fittings Regulations Inspections following the water quality event at Upton.**

<b>Total number of properties scheduled for inspections</b>	<b>254</b>
Number of properties inspected in total by 23 July 2010	124
Properties under construction	69
Properties where Company was unable to gain access for initial inspection	33
Properties yet to be visited for initial inspection	28

I would be grateful if the Company could inform the Inspectorate when they have completed the scheduled inspections and provide a summary of any water fittings infringements found.

3.12. I **note** that the Company also intends to further raise awareness of good practice with regards to rainwater harvesting and grey water reuse systems installation and maintenance by placing updated guidance on its website (<http://www.anglianwater.co.uk>).



3.13. The Inspectorate **further notes** that there have been two other water quality events (DWI: 2010/2777 and DWI: 2010/2801) in the Anglian Water Services region since the Upton event which involved open cross connections between rainwater harvesting systems and mains water supply . The Inspectorate is satisfied that the Company has acted to protect public health in response to these events. The Inspectorate will be assessing these as separate events and writing to the company with our findings and conclusions in due course.

#### 4. **Contraventions of the Water Supply (Water Quality) Regulations**

- 4.1. The Company took 189 samples between 30 May 2010 and 29 June 2010 in relation to this event. The majority of these samples gave satisfactory results. However, a sample taken from Scribers Drive on 30 May 2010 contravened the standard for *E.coli* with numbers greater than 100 per 100mL. A further 19 samples confirmed unusual odours. Of these, 12 were taken from Scribers Drive and the associated boundary box. The others were found in samples from five different properties.
- 4.2. Rainwater harvesting systems gather water from roofs of premises and, as such, the water will be contaminated by the faeces of birds and other wildlife and as a consequence may contain pathogenic organisms along with other contaminants. I note that in response to this complaint the company did not carry out the full suite of tests for faecal indicator organisms. If this had been done then the presence of rainwater system cross connection may have been identified more quickly. I **recommend** that all consumer complaints of sewage or unexplained odours are tested for *E.coli*, enterococci, clostridia, coliforms and heterotrophic plate counts.
- 4.3. I **conclude** that the contraventions of *E.coli* exceeded the standards specified in Part I Table A of Schedule 1 of the Water Supply (Water Quality) Regulations 2010, for water supplied under Regulation 4(1)(a) and that this does not meet the standard for wholesomeness set out in Regulation 4(2)(c) by virtue of the cross connection between the rainwater harvesting system and the incoming mains supply. This breach of Regulation 4 was due to the domestic distribution system and I am content that remedial action has been taken to prevent a recurrence.
- 4.4. Nevertheless, I remain concerned that had it not been for the fact that the majority of isolation valves on the cross connections were in the “closed” position the risk to public health would have been far greater.
- 4.5. The Company has identified that more than one installer was responsible for the installation of the cross connections and that two further events involving cross connections between rainwater harvesting

systems and the mains water supply have since occurred, therefore the likelihood of a similar cross connection event occurring remains generally high.

- 4.6. Regulation 17(6) requires a water company that has identified that a water quality failure due to the domestic distribution system, or to the maintenance of that system, to notify affected consumers in writing of the nature of the failure and the steps (if any) that the water company advises are desirable for the consumer to take in the interests of their health.
- 4.7. Under Part I of the Water Industry Act 1991, a water undertaker shall enforce the requirements of The Water Supply (Water Fittings) Regulations 1999 in relation to the area for which it holds an appointment. Anglian Water has served improvement notices for infringements under these Regulations on Miller Homes, Barratt Homes and Cornhill (ZeroC) as developers of properties on Upton estate, due to the infringements being present at the time of construction. Improvement notices were served for the following contraventions:
- a) A direct cross connection between the rainwater harvesting system. This is a contravention of Schedule 2 Paragraph 14(2) of the Regulations.
  - b) No clear identification on the rainwater system to readily distinguish it from wholesome water supply. This is a contravention of Schedule 2 Paragraph 14(1) of the Regulations.
  - c) A section of redundant pipe work remained after direct disconnection of the cross connection. This is a contravention of Schedule 2 Paragraph 6 of the Regulations.
- 4.8. I **note** that since then that all major infringements of the Water Supply (Water Fittings) Regulations 1999 have been rectified. I therefore **conclude** that the Company have fulfilled their obligations under regulation 17(6) of the Water Supply (Water Quality) Regulations. I would be grateful if the Company could provide the Inspectorate with written confirmation when all (major and minor) infringements identified on the Upton estate have been remedied.
- 4.9. I note that the Company's Regulation 28 risk assessment report for Ruthamford Supply System (RAR-003-RUT) which includes the Upton Eco Housing Development, does not include the risks associated with cross connections and back siphonage from domestic rainwater harvesting and grey water reuse systems. As a consequence of this event, I **recommend** that the Company reviews its risk assessment for this area and all other areas, where risks have been identified relating to this issue, and resubmits an updated version of each to the Inspectorate.

4.10. I **note** that whilst dealing with this event, the Company has been considering also the wider learning for the water industry as a whole. In particular, the Company has concluded that there would be merit in terms of safeguarding public health if all water companies were to take action by sending information and guidance out to the organisations and individuals on their approved plumbers' lists. The Inspectorate **welcomes** this approach to open sharing and collective industry action and, if helpful, the Inspectorate would be pleased to provide the Company with any necessary assistance with taking forward this and any other national learning initiatives.

## 5. Notification

5.1. The Company notified Mr S Elsey (EHO) of Northampton Borough Council and Dr P Monk of the East Midlands South Health Protection Unit on 1 June 2010. The Company informed the Consumer Council for Water on 2 June 2010. I therefore conclude that the Company met the notification requirements of Regulation 35 of the Water Supply (Water Quality) Regulations 2000 (Amendment) 2007.

5.2. The Company notified the Inspectorate on 2 June 2010 and provided associated reports by the agreed dates. I therefore **conclude** that the Company met the notification and reporting requirements of Paragraph 9 of the Water Industry (Suppliers' Information) Direction 2009.

## 6. Offences

6.1. Water may be regarded as being unfit for human consumption if either, when drunk it would be likely to, or did in fact, cause injury to the consumer or, where by reason of its appearance or smell, it was of such quality that it would cause a reasonable consumer of firm character to refuse to drink it or use it in the preparation of food.

6.2. I consider that there may be evidence to suggest that water unfit for human consumption was supplied by virtue of the detection of *E.coli* at Scribers Drive, however after carefully assessing all the circumstances of the incident including the attribution of the source to be a cross-connection within the domestic distribution system and the action taken by Anglian Water in their duty to enforce The Water Supply (Water Fittings) Regulations 1999, I **conclude** that there are no grounds to recommend proceeding with a prosecution of the Company under Section 70 of the Water Industry Act 1991.

## 7. Other relevant matters

- 7.1. I should be grateful for a response to my recommendation in paragraph 4.2 and 4.9 and requests for information in paragraph 3.1, 3.11 and 4.8 within 20 working days. Please don't hesitate to contact me if you have any queries regarding this letter.
- 7.2. I am copying this letter to Mr S Elsey (EHO) of Northampton Borough Council and Dr P Monk, CCWater and Ofwat.

Yours sincerely,



Dr. Mark Kerwick  
Inspector (Operations)

Please note property numbers have been removed from the letter for data protection purposes.