



guardians of drinking water quality

## DRINKING WATER INSPECTORATE

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[REDACTED]  
Severn Trent Water Ltd  
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Dear [REDACTED]

### **Discolouration event affecting the Chesterfield area in Derbyshire 2011**

This letter sets out the Inspectorate's conclusions and recommendations in relation to the Chesterfield event and subsequent prosecution. It is in the form of an Executive Summary followed by the detailed Event Assessment Letter in the usual format.

#### **Executive Summary**

Severn Trent water received 231 direct water quality complaints and a further, 1,342 contacts to its automated messaging service from consumers in the Chesterfield and west Sheffield areas, in September 2011. This followed operational changes to reinstate a granular activated carbon filter at Ogston Water treatment works (WTW), which supplied the area. The Company pleaded guilty to the offence of supplying water unfit for human consumption, and offences relating to Regulations 26 (1)(a)(b), 26 (3) and 31(2) in Chesterfield Magistrates' court on the 13<sup>th</sup> September 2012. The Court fined the Company £50,000.

#### **Inspectorate's Conclusions:**

- This was an avoidable event that occurred primarily because the Company did not follow best practice and national conditions for use of granular activated carbon filter media. Regulation 31(2) of the Water Supply (water quality) Regulations 2000 as amended prohibits water companies from applying substances and products to water unless they are approved, or are in conformity with national conditions of use.
- The company failed to disinfect the water failing to meet the requirements of

Regulation 26 (1) (a) of the Water Supply (water Quality) Regulations 2000 as amended.

- The company failed to meet the requirements to prepare water for disinfection by reducing the turbidity of the water to less than 1NTU prior to disinfection therefore failing to meet the requirements of Regulation 26 (1) (b) of the aforementioned regulations.
- The company failed to meet the requirements of Regulation 26 (3) which imposes a requirement on water companies to design and continuously operate an adequate treatment process.
- Critically, the Company failed to identify the deterioration in treated water quality and this resulted in consumers being supplied with highly coloured water with an unacceptable taste and odour as a result of the water containing levels of Manganese in excess of the prescribed concentration.
- The Company did not notify stakeholders in accordance with the regulation.
- Repetition of any of these deficiencies will result in further enforcement action by the Inspectorate.

#### **Inspectorate's Recommendations to prevent a reoccurrence**

- The Inspectorate was **minded to recommend** that the company reviews the process for regeneration of carbon (with regard to acid washing) and the acceptance of carbon prior to returning to the filters. However I note that since this event the company has issued a bulletin to staff regarding carbon regeneration and prior to the return to service of GAC filters Manganese will be routinely tested and reviewed.
- The Inspectorate was **minded to recommend** that the company review the treatment process at this work to review its efficacy of treatment of the characteristics of the raw water. However, I note that since this event the company has made changes to pre chlorination of the filters and other aspects of treatment to enhance manganese oxidation and removal. I **recommend** that the company take the learning points from this event to review the removal of manganese during the treatment process at other water treatment sites which bear similar raw water characteristics.  
The Inspectorate **recommends** that the company evaluate its response and risk assessment process for discoloured water events where the supplying works is deemed to be the origin of the discolouration.

## 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 Chesterfield discoloured water event. This was classified using a risk-based approach as a **significant** event (Category three).
- 1.2. When notified of an event, the Inspectorate assesses the information provided by the Company about the circumstances and any actions taken. The Company notified the Inspectorate of this event on 2<sup>nd</sup> September 2011. I have set out my conclusions and recommendations below.

## 2. Overview of the event and Company Actions

2.1



2.2



- 2.3 In early August 2011, the carbon from GAC filters was removed for regeneration by a third party. The company have reported no problems were identified during the regeneration process or in the time that the carbon was returned. However, only a limited investigation was possible as the furnace has now been permanently shut down. It has been reported that the carbon from filter 5 was one of the last batches of carbon to be regenerated at this site.
- 2.4 The company were aware that elevated manganese concentrations occurred in the raw water on occasion and this had previously been identified in raw water risk assessments. On line manganese monitors had been installed on the raw water (when the new works was built). However these monitors were not present at the time of this event and had been subsequently removed due to reliability issues. No routine

onsite testing was undertaken for manganese. Pre chlorination prior to RGF's was not always operable or operated at very low residual. It is therefore likely that due to inadequate treatment Manganese built up on the GAC. When the GAC was removed for regeneration it was not pre acid washed. When the GAC was returned to service it was inadequately backwashed and remained in the vessel over a number of days with no flow passing through the vessel. Limited on site testing was undertaken on return to service (see appendix 4). When the vessel was returned to service elevated pH and depressed chlorine residuals were experienced, therefore the flow was reduced through the vessel. When full flow through the vessel resumed five days later, whilst there appeared to be limited impact on the pH and chlorine residuals it resulted in widespread consumer complaints of green and brown discoloured water.

- 2.5 The regulation 28 risk assessment in place at the time of the event shows that Manganese was identified as an acceptable risk in the raw water. It also notes that a review of on site testing was needed. Regarding the lack on line monitoring, I am **critical** that this risk was identified by the company and no mitigation or effective control measures were in place at the time of the event. However I note that since the time of the event the company has updated its risk assessment and overhauled the process for review. I further note that the company has installed on line monitors to measure Manganese post RGF stage and put in place monitoring, which will mitigate a recurrence and act as a control measure.
- 2.5 I was **minded to recommend** that the company reviews the process for regeneration of carbon (with regard to acid washing) and the acceptance of carbon prior to returning to the filters. However I note that since this event the company has issued a bulletin to staff regarding carbon regeneration and prior to the return to service of GAC filters Manganese will be routinely tested and reviewed.
- 2.6 The investigation by the Inspectorate has determined that on 1<sup>st</sup> August, GAC was removed from filter 4 for regeneration. Whilst this carbon was away for regeneration the GAC from filter 5 was placed into filter 4. Work was then undertaken on the nozzles in filter 5. This work was completed prior to return to service. The carbon, which was originally removed from filter 4 was replaced into the filter 5 on the 19th August, following regeneration. However due to operational restraints this filter was insufficiently backwashed and only returned to supply on the 23<sup>rd</sup> August. Limited testing was undertaken prior to the filter's return to supply. On return to service the filter top water was observed to be cloudy and elevated pH and associated chlorine demand was experienced when the filter was returned to supply on the 23<sup>rd</sup> August. The filter was removed from service and additional backwashing was undertaken and the filter was returned at a lower flow on the 24<sup>th</sup> August (2 M/l/d as opposed to 9 M/l/d) after discussion with the site manager during the comms cell.

I conclude that the failure to acid wash the carbon failed to remove the calcium carbonate deposits prior to regeneration. During regeneration calcium carbonate is converted to calcium oxide. When the media is put back into service the calcium oxide is converted to calcium hydroxide which gives the high pH and milky appearance. Furthermore I **conclude** that it is likely that the manganese was not being adequately removed by the treatment process in the time prior to this event and was building up on the carbon. This was not removed by regeneration and leached back into the water when the filter was returned to service. The action by the company to leave the filter for an extended period is also likely to have caused a build up of ammonia which led to increased chlorine demand when the filter came back into service. I **conclude** the operation of this works in the time prior to this event directly led to this event occurring. I was  **minded to recommend**  that the company review the treatment process at this works and ensures that suitable treatment processes are in place to mitigate the risks posed by the raw water. However, I note that since this event the company has made changes to pre chlorination of the filters and other aspects of treatment to enhance manganese oxidation and removal. I **recommend** that the company take the learning points from this event to review the removal of manganese at other water treatment sites which bear similar raw water characteristics.

- 2.7 On the 26<sup>th</sup> August filter 5 was backwashed as required by the time in service. After the backwash the filter was returned to full flow (8-9 Mld). The pre contact tank chlorine residuals declined and a slight change in pH was experienced. When the operator was unable to recover the chlorine residuals, filter 5 was returned on a reduced flow (2M/d). On the 29<sup>th</sup> August the filter 5 was returned to full flow, the operator reported that no significant changes to the water quality trends were observed. The site log states the operator sought authorisation for this action and permission was given. However when examining the chlorine residual trends there is a significant decline in the post contact chlorine residuals which remains until the 1<sup>st</sup> September (when a backwash of GAC 5 appears to occur).
- 2.8 On the 30<sup>th</sup> August a sample of the final treated water contained 216µg/l of total manganese; this was not analysed and reported until the 2<sup>nd</sup> September. On the 31<sup>st</sup> August a sample from a consumers tap contained 73µg/l manganese, this was analysed and reported on the 5<sup>th</sup> September.
- 2.9 On 1<sup>st</sup> September 2011 the company received 28 calls of brown discoloured water and 5 calls of green discolouration from the Chesterfield area. Technicians were dispatched to the first two consumers who had complained of green discolouration. The technician at the first property confirmed the green tinge to the water when held up to a white background. As complaints continued through the day, technicians were dispatched to [REDACTED] No problems were identified, however it was dark by this stage, although it was later confirmed there was a green tinge to the water in this reservoir. No

samples were taken. As the complaints continued into the evening, an initial assessment of the upstream water treatment works was undertaken. However, no issues were identified based on a review of computer trends (data being received from on line monitors at the supplying works).

2.10 On 2<sup>nd</sup> September consumer complaints continued. A final water sample taken on the 30<sup>th</sup> August from the Ogston new works was reported to contain 216µg/l of total manganese (156 µg/l filtered Manganese). In response, the investigation focused on the Ogston works, and at 1745 approximately GAC filter 5 was removed from service.

2.11 In total, the company received 231 calls which were addressed by the call centre staff, 1,342 calls logged on the messaging system. The company received 7 complaints of illness from consumers in the area supplied from Ogston during this event between August 2011 and September 2011. It should be noted that Severn Trent consider one of these complaints was incorrectly classified and should have been a discoloured water complaint. However the consumer was contacted by the DWI and a statement taken, it is clear from the statement the consumer did consider the water had caused illness in the family.

### **3. Conclusions**

3.1. In order to assess the impact of this event on consumers the Inspectorate contacted consumers. The Inspectorate sent 49 questionnaires to consumers affected by the event and of those who responded 93, % rejected the water for one or more uses (Drinking, cooking, Washing, or Laundry) 93 % rejected this water because of its appearance, taste and/or smell.

3.2. On the 17<sup>th</sup> and 18<sup>th</sup> January 2012, the Inspectorate visited six of these consumers. Key points arising from these visits included :

- Consumers described the water as: dark orangey brown, bright orange, muddy brown, brown / green colour, walnut colour, sand like particles present, pale yellow colour turning mucky brown later in the week, after showering it felt like you had been on a beach, later the water had a strong chlorine smell.
- The discolouration of the supplies lasted between 3 days – 3 weeks.
- All consumers were dissatisfied or very dissatisfied with the customer service provided.
- All consumers were told by Severn Trent the water was safe to drink.
- All consumers brought bottled water or travelled to friends or relatives for water supplies. Bottled water was not

provided by Severn Trent except in one case where the consumer had a baby. Another consumer with a baby requested bottled water and it was refused, with the company saying bottled water was not suitable for babies.

- Several consumers expressed concern regarding the safety of the water and described illness being experienced at the time that the water was discoloured. Two consumers considered the tap water had made their children or their families sick. A third consumer stated her baby had been very sick for several weeks (in and out of hospital with gastroenteritis) which started when the water was discoloured. However she said that no cause for the baby's illness had been definitively identified. The baby is now lactose intolerant

3.3. All consumers stated that they had experienced subsequent discolouration to their water supplies.

3.4. All consumers interviewed provided evidence of the offence of supply water unfit for human consumption as set out in section 70 of the Water Industry Act 1991.

3.5. On the 17<sup>th</sup> January 2012, The Inspectorate visited Severn Trent Water to take statements from six company staff involved in this event and the following points arose:

- No manganese test equipment was available on site at the time of the event.
- No staff had experienced water quality problems at this site of this nature before.
- There is limited capacity on the backwash waste water tanks; hence backwashing is done in stages. The tanks capacity is ok for normal backwashing, but not when extended backwashing is required for regenerated GAC. This issue has been raised with capital expenditure as a risk.

- An operator discussed that during the summer the company had started air scouring the GAC, which had not been done previously. Since the event the air scouring has stopped. He was concerned the air scouring might cause the generation of fines and problems with the nozzles.

It was stated by the works operator "...we pre chlorinate prior to the RGF's, we had a short period where we didn't have dosing on pre RGF. This is for manganese oxidation. The process guys said it needed to back on so this was reinstated, this occurred last year (2011) although not exactly sure when..."

- A water quality advisor stated... "DST confirmed green tinge to water when held up to white background from one

consumer on 1.9.11. on the 2<sup>nd</sup> Sept 2011 he received information that the crypto cartridge from Ogston works was unusually black. Listened into some of the consumer calls to hear firsthand what the consumers were saying. Stated 'COSC got the impression consumers were getting annoyed after a couple of days and then were also saying illness (to the consumer advisors).' Discolouration was also confirmed in Hady service reservoir. 'Mains flushing was considered but because of the scale of event it was very difficult also as there was discoloured water in Hady service reservoir, Higham reservoir was not discoloured but the sample results were over the PCV'. Shaun made a map of the area detailing the health complaints discolouration complaints and where samples had been taken. 'As the manganese results were below the old SNARL level of 400ug/l we were happy it was only an aesthetic issue'.."

- 3.6 I am critical that the company were able to identify discoloured water in [REDACTED] reservoir and furthermore water that did not meet the required standards in [REDACTED] reservoir and that this was considered to be minor as a SNARL level had not been exceeded. I consider that whilst below health levels the impact and concern caused to consumers by this level of discolouration should not be underestimated. I **recommend** that the company evaluate its response and risk assessment process for discoloured water events where the supplying works is deemed to be the origin of the discolouration.
- 3.7 The Inspectorate held an interview under caution with a directing mind of Severn Trent Water on the 26<sup>th</sup> April 2012. The company discussed matters relating to consideration of offences under Regulation 33 of the Water Supply (Water Quality) Regulation 2000 (as amended), (Through breaches of Regulations 26(1) (a), 26 (1)(b), (3) and 31 (2)) as well as offences of supplying unwholesome water in contravention of Regulation 4, and water unfit for human consumption, which could lead to the instituting of prosecution proceedings.

#### 4. Contraventions of the Water Supply (Water Quality) Regulations 2000 as amended

The Company took 105 samples in association with this event and the table below shows the sample results.

Location	Date	Total Manganese (µg/l)	Filtered Manganese (µg/l)	Turbidity (NTU)
Ogston New works Final	30.8.11	216	156	0.27
Ogston New pre contact	2.9.11	73	53	0.14
Ogston New works Final	2.9.11	132	90	0.14
[REDACTED]	2 <sup>nd</sup> – 6 <sup>th</sup> August	Range : 2.2 - 142 Ave : 52.8	Max 85	Max 0.29



	2 <sup>nd</sup> – 6 <sup>th</sup> August	Range : 8.9 - 89 Ave : 50.35	Max 20	Max 0.2
	6.9.11	10	LOD	LOD
	2 <sup>nd</sup> – 6 <sup>th</sup>	Range : 8.9 - 71 Ave : 34.9	Max 40	Max 0.24
	2 <sup>nd</sup> – 6 <sup>th</sup>	Range : 13- 62 Ave : 36.25	Max 35	Max 0.21
	2 <sup>nd</sup> – 6 <sup>th</sup>	Range : 19 - 72 Ave : 49.4	Max 37	Max 0.23
Zonal samples (45 samples, 15 breaches)	31.8.11 –9.9.11	Range : 1.9 - 127 Ave : 34.9	Max 71	Max 0.9

- 4.1. In total thirty samples breached the prescribed value for Manganese detailed in The Water Supply (Water Quality) Regulations 2000 as amended (standard being 50µgMn/l at consumers taps). The highest result, which was recorded in the final water at Ogston works on the 30 August 2011, was 216 µg/l. I do not consider these breaches to be trivial however I conclude that actions have been taken by the company since the time of this event to prevent a recurrence.
- 4.2. The company notified the East Midlands North HPU, and the following Local Authorities (Chesterfield Borough Council, Sheffield County Council and North East Derbyshire Council) on 2 September 2011. The company informed the Consumer Council for Water by email on 2 September 2011. I therefore conclude that the company met the requirements of Regulation 35 of the Water Supply (Water Quality) Regulations 2000 as amended.
- 4.3. The company notified the Inspectorate on 2 September 2011 and provided associated reports by the agreed dates. I therefore **conclude** that the company met the notification and reporting requirements of Section 9 of the Water Undertakers (Information) Direction 2009.

## 5.0 Offences

- 5.1. 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. All of the six consumers that were visited by DWI staff on the 17<sup>th</sup> and 18<sup>th</sup> August 2012 stated that they rejected the water for drinking as it was supplied, because of its appearance, odour and taste
- 5.2. The company failed to disinfect the water and prepare it for disinfection, design and continuously operate an adequate treatment process, and failed to meet the national conditions for use of granular activated carbon. As a result discoloured water was supplied to [REDACTED] Chesterfield [REDACTED] for a prolonged period causing

consumers to reject the water.

These were grounds for my recommending instituting proceedings against the company under Section 70 of the Water Industry Act 1991.

- 5.3. On 13th September 2012 at Chesterfield Magistrates Court the Company pleaded **guilty** to six counts of supplying water unfit for human consumption in breach of Section 70 of the Water Industry Act 1991 to consumers in the Chesterfield area during September 2011 and was fined £5,000 on each of six counts of water unfit for human consumption, fined £5,000 on one count a failure to disinfect water, fined £5,000 on one count of not subjecting water to sufficient preliminary treatment to prepare it for disinfection, fined £5,000 on one count of failure to design and continuously operate an adequate treatment process for the source and fined £5,000 on one count of failing to adhere to the national conditions of use for substances or products applied to or introduced to the water, total £50,000. It settled the costs of £13,558 incurred by the DWI out of court by mutual agreement.

**6. Other relevant matters**

- 6.1 I should be grateful for a response to my recommendations and my suggestions within 20 working days. Please don't hesitate to contact me if you have any queries regarding this letter.
- 6.2 I am copying this letter to those organisations listed in paragraph 4.3 above and [REDACTED].

[REDACTED]

[REDACTED]