



Drinking Water Audit Report

County:	Galway	Date of Audit:	5 th April 2016
Plant visited:	Ahascragh PWS Scheme code 1200PUB1001	Date of issue of Audit Report:	11 th April 2016
		File Reference:	DW2016/55
		Auditors:	Aoife Loughnane Conor Waters (intern)
Audit Criteria:	<ul style="list-style-type: none"> • The <i>European Union (Drinking Water) Regulations 2014 (S.I. 122 of 2014)</i>. • The <i>EPA Handbook on the Implementation of the Regulations for Water Services Authorities for Public Water Supplies (ISBN: 978-1-84095-349-7)</i> • The recommendations specified in the <i>EPA Drinking Water Report 2014</i>. • EPA Drinking Water Advice Notes No.s 1 to 15. 		

MAIN FINDINGS

- i. The cause of the sudden change in raw water quality which gave rise to elevated turbidity at Ahascragh WTP from 31/03/16 to 02/04/16 appears to be an unusual and isolated event not linked to rainfall, but possibly due to rock becoming dislodged underground causing a plug of sediment to enter the spring source. Irish Water has engaged a consultant hydrogeologist to assess the spring source and the report on the findings is awaited.
- ii. While the UV disinfection system operated within its validation range at all times throughout the incident, the concern is the potential shielding of pathogens at turbidity levels > 1 NTU, which could result in the water supply being inadequately disinfected (risk of *Cryptosporidium* in the treated water). Following consultation with the HSE, a precautionary boil water notice was issued by Irish Water to consumers on 01/04/2016.
- iii. The performance of the rapid gravity sand filter needs to be reviewed, in particular the length of time before the filter is brought back into service following a backwash.

1. INTRODUCTION

Under the *European Union (Drinking Water) Regulations 2014* the Environmental Protection Agency is the supervisory authority in relation to Irish Water and its role in the provision of public water supplies. This audit was carried out in response to the notification by Irish Water on 01/04/2016 of the failure to meet the turbidity parametric value of 1 NTU in the final water at the treatment plant, and the subsequent issuing of a precautionary boil water notice on Ahascragh public water supply (PWS).

The source of Ahascragh PWS is a spring located in an area of karstic limestone bedrock. The average abstraction rate is 750 – 800 m³/day. The raw water undergoes treatment by filtration and disinfection using UV treatment and chlorination. The population served by the supply is 841 which includes five group water schemes; Lowville No. 2, Castlegar West, Castlegar/Lissyegan, Cornmucklagh and Ballyglass.

The opening meeting commenced at 10.30 am at Ahascragh water treatment plant. The scope and purpose of the audit were outlined at the opening meeting. The audit process consisted of interviews with staff, review of records and observations made during an inspection of the treatment plant. Photographs taken by Aoife Loughnane during the audit are attached to this report and are referred to in the text where relevant. The audits observations and recommendations are listed in Section 2 and 4 of this report. The following were in attendance during the audit.

Representing Irish Water:

Patrick O’Sullivan, Drinking Water Compliance Analyst, Irish Water
 Ger Greally, Operations & Maintenance, SLA Lead - North West Region, Irish Water
 Diarmuid Croghan, Senior Engineer, Galway County Council
 Adrian Raftery, Area Engineer, Galway County Council
 Ann Dolan, Executive Scientist, Galway County Council
 Pat Lambe, Technician, Galway County Council
 Paul Leonard, Caretaker, Galway County Council
 Christy Mannion, General Service Supervisor, Galway County Council

Representing the HSE:

Paul Hickey, Senior Environmental Health Officer

Representing the EPA:

Aoife Loughnane, Inspector
 Conor Waters, Intern

2. AUDIT OBSERVATIONS

The audit process is a random sample on a particular day of a facility's operation. Where an observation or recommendation against a particular issue has not been reported, this should not be construed to mean that this issue is fully addressed.

1.	<p>Turbidity exceedance – Investigations and actions</p> <p>a. Raw water in the spring source is monitored continuously for turbidity, colour and pH. The plant caretaker stated that the normal levels are 0.1 NTU, 4 - 6 Hazen and 6.7 - 6.8 pH. SCADA data from December 2015 to March 2016 was provided by Irish Water following the audit. The raw water quality remained relatively stable during that period despite a number of heavy storms (average turbidity 0.22 NTU, average colour 7.98 Hazen and average pH 6.6).</p> <p>b. There was a sudden change in raw water quality at the end of March 2016 (see SCADA data in photo 1) which led to a treated water turbidity of 2.8 NTU at the plant, which is an exceedance of the parametric value (1 NTU). The following timeline of events was identified by Irish Water and Galway County Council (GCC):</p> <ul style="list-style-type: none"> • Tuesday 29th March: At 8:30 am the raw water turbidity was 3.9 NTU. The caretaker cleaned the turbidity monitor and the reading dropped to 0.1 NTU. Later that evening it was reading 0.3 NTU. • Wednesday 30th March: At 8:30 am the raw water turbidity was 1.4 NTU, colour was 18 Hazen and treated water was 0.3 NTU. At 11:00 pm the treated water turbidity alarm (1 NTU) was triggered and the plant automatically shut down. The caretaker visited the plant and confirmed that the UV system had stayed in validation. The turbidity monitor was cleaned and turbidity fell to 0.2 NTU. • Thursday 31st March: At 1:00 am the plant was switched back on and stayed operating until 7:00 am when the plant shut-down again on high turbidity alarm in the treated water. The caretaker cleaned the turbidity monitor but there was no significant improvement in turbidity. <p>The incident was escalated within GCC and Irish Water. EPS were called to the site to check instruments and process operations.</p>
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	<p>From 12 noon to 4:00 pm the plant was switched back on but was run to waste through a scour from the contact tank to the river. A number of filter backwashes were carried out. Treated water turbidity was approximately 2 NTU. Samples were taken of the raw water at the plant and the treated water at two locations in the network (Health Centre and tap at Killure Church).</p> <p>Irish Water alerted the EPA to the incident at 3:00 pm and held a teleconference with the HSE at 4:00 pm.</p> <p>By 8:00 pm the raw water turbidity was 3.1 NTU and treated water was 2.2 NTU, meaning the plant was still not able to deliver compliant water quality.</p> <ul style="list-style-type: none"> • Friday 1st April: Irish Water held an early morning teleconference with the HSE. Treated water turbidity remained > 1 NTU but there was a need to restart the plant because the supply was running out of water. <p>Based on HSE advice, Irish Water issued a precautionary boil water notice to consumers on the supply.</p> <p>Irish Water formally notified the EPA of the turbidity exceedance in the final water at the treatment plant (2.8 NTU).</p> <p>Filter backwash frequency was increased from 24 hours to 8 hours, i.e. 3 backwashes per day instead of one.</p> <ul style="list-style-type: none"> • Saturday 2nd April: By 6:00 pm the treated water turbidity dropped to < 1 NTU and has remained in compliance since. • Monday 4th April: A consultant hydrogeologist visited the site to assess the spring source. Irish Water awaits the report on the findings and recommendations. <p>c. Throughout the incident, the UV disinfection system operated within its validated range at all times and the chlorination system was not compromised at any stage.</p> <p>d. During the audit, Irish Water and GCC stated that the cause of the sudden change in raw water quality which gave rise to elevated turbidity appears to be an unusual and isolated event not linked to rainfall, but possibly due to rock becoming dislodged underground causing a plug of sediment to enter the spring source. The report on the hydrogeologist's findings and recommendations is awaited.</p> <p>e. Irish Water stated that they will investigate a number of options to improve the safety and security of the water supply in light of the incident, including the provision of additional storage, or installing a clarification stage in the treatment process, or the possibility of connecting to Ballinasloe PWS in the longer term.</p> <p>f. The HSE confirmed that as of Friday 1st April, there were no reported cases of illness in the community linked to the public water supply. The HSE will now wait until the 12 day <i>Cryptosporidium</i> incubation period has passed before they can determine whether there are any cases of illness arising from this incident.</p>
<p>2.</p>	<p>Communication of the Boil Water Notice</p> <ul style="list-style-type: none"> a. Irish Water issued a precautionary BWN to consumers on the supply on Friday morning 1st April by announcements on local radio, leaflet drops to higher risk premises (including a nursing home, school, crèche and food outlets), notices placed on www.water.ie and www.Galway.ie and by verbal communications with group water scheme representatives. b. The map accompanying the BWN was of a good standard and clearly showed the area affected, including the group water schemes. c. During the audit, the caretaker stated that he was not immediately notified when the BWN was issued and this caused confusion as he received a number of queries from concerned locals on Friday morning 1st April. d. The BWN text stated '<i>Ahascragh public water supply is potentially contaminated</i>' and did not give further explanation of the problem. Following a number of queries, Irish Water issued an updated media statement on 6th April to clarify '<i>Irish Water is continuing to investigate the sudden change in raw water quality that occurred in the raw water springs which supply the water treatment plant in Ahascragh on Thursday night 31st March and lasted until Saturday 2nd April. This sudden decrease in raw water quality meant that the water treatment plant in Ahascragh was no longer able to deliver fully compliant water and this has resulted in the boil water notice being issued....</i>'

<p>3.</p>	<p>Source Protection</p> <ol style="list-style-type: none"> a. The spring source is located adjacent to the Ahascragh River. There was no evidence of surface water ingress into the spring chamber (see photo 2). GCC representatives stated that the spring is not directly connected to the river and that recent flooding in the area in Winter 2015/2016 did not affect the spring water quality. b. The report <i>Water Framework Directive Groundwater Monitoring Report – Site Information Ahascragh PWS, EPA August 2011</i> identifies that; <ul style="list-style-type: none"> • the spring chamber is less than 3 metres deep (depth to bedrock), • the spring may receive water from three potential sources; river (discounted by GCC), bedrock and shallow sediments, • the estimated zone of contribution is 1.14 km² covering Ahascragh village and agricultural lands, • the aquifer classification is Rkc – regionally important karstified bedrock dominated by conduit flow. c. GCC stated that the raw water quality is consistently good, with turbidity usually less than 0.1 NTU. d. The treatment plant’s pre-chlorination facility to remove iron and manganese from the raw water has not been used since the plant was upgraded in June 2011. GCC stated that there have been no issues with elevated iron or manganese concentrations in the supply.
<p>4.</p>	<p>Filtration</p> <ol style="list-style-type: none"> a. A rapid gravity sand filter was installed in June 2011 to remove the solids generated from the oxidation of iron and manganese by pre-chlorination (no longer carried out at the plant). b. The filter contains 1 m of silica sand which includes a layer of manganese dioxide, according to the filter design specification document. c. The maximum filtration rate is 6 m/hr. d. Filter backwashing is triggered by time (normally every 24 hours but currently increased to 8 hour intervals). The backwash sequence consists of: <ul style="list-style-type: none"> • Air scour: 30 m/hr for 5 minutes • Water wash: 20 m/hr for 10 minutes • Settlement: 5 minutes <p>The raw water pumps are then turned back on and take 5 minutes to ramp up to full capacity as they are variable speed drive pumps.</p> e. A backwash was observed during the audit. The air scour was even across the filter bed. There was an uneven flow of backwash water through gaps in the weir wall (see photo 3). f. The post-filter turbidity monitor was reading 0.659 NTU during the audit.
<p>5.</p>	<p>Disinfection – Ultra Violet Treatment & Chlorination</p> <ol style="list-style-type: none"> a. Both the UV and chlorine disinfection systems at Ahascragh WTP meet the criteria set out in <i>EPA Drinking Water Advice Note No. 3: E. coli in Drinking Water</i>. b. Primary disinfection is achieved by UV treatment in Trojan Swift SC D06 duty and standby units. The validated operating range is > 73% UVT for flows up to 66 m³/hr. The UVT was 89% during the audit and flow was 49 m³/hr. c. The UV units are configured to trigger an alarm if UVT drops to 75% and to shut-down at 73%, thereby preventing inadequately disinfected water entering into supply. d. Secondary disinfection is achieved by dosing sodium hypochlorite (14%). The dose is flow proportional and there are duty and standby dosing pumps with auto-switchover arrangements. e. Chlorine monitors are located pre- and post-contact tank. Based on a plant throughput of 49 m³/hr, there is approximately 12 hours storage time in the 600 m³ contact tank. During the audit the chlorine monitors were reading 1.5 mg/l pre-contact tank and 0.8 mg/l post-contact tank. f. The low chlorine alarm is set at 0.4 mg/l and the high alarm is at 1.8 mg/l on the monitor located pre-contact tank. g. The scheme has 3 chlorine monitors located at the extremities of the distribution network (Creggaun, Keave and Lislea) to ensure at least 0.1 mg/l is present at all times.

6.	<p>Treated Water Storage</p> <p>a. Treated water turbidity and residual chlorine are monitored at the outlet of the contact tank. During the audit the readings were 0.488 NTU and 0.8 mg/l residual chlorine.</p> <p>b. Treated water storage is provided by;</p> <ul style="list-style-type: none"> • 600 m³ contact tank at the plant, • 144 m³ water tower in Ahascragh, • 465 m³ at Eglisk reservoir, • 45 m³ at Kingston, • 41 m³ at Lurgan.
7.	<p>Chemical storage</p> <p>a. There were 18 x 25 litre drums of sodium hypochlorite with an expiry date of 11/04/16 on the labels (see photo 4) being stored at the plant. The caretaker confirmed that 4 drums per week are used in the chlorination system and the remaining 14 drums would not be used by their expiry date at this plant. GCC agreed to send the surplus drums to other chlorination systems in Galway for use before the expiry date.</p>
8.	<p>Management and Control</p> <p>a. The caretaker does not have access to SCADA at the plant and there is no facility to observe trended data on the HMI screen.</p> <p>b. There was no documented procedure for filter backwashing.</p> <p>c. The treated water turbidity monitor is alarmed and triggers an automatic shut-down of the plant at > 1 NTU. This monitor is located at the outlet of the contact tank which means that any highly turbid water has already passed through the plant and there is a significant delay before the alarm is triggered. It would be more appropriate to install a turbidity alarm and auto shut-down arrangement on either the raw water (turbidity set-point should be appropriate to the filter capability) or on the filtered water before entering the contact tank (so that the filter can be run to waste if the filtered turbidity level is too high).</p>

3. AUDITORS COMMENTS

The Ahascragh water treatment plant was found to be well run by a dedicated team of staff. A review of SCADA data shows that the plant performed well throughout recent winter storms. However, on 31/03/16 there was a sudden change in raw water quality which gave rise to elevated turbidity at the plant and the subsequent issuing of a BWN on 01/04/16. The cause of this incident appears to be an unusual and isolated event not linked to rainfall, but possibly due to rock becoming dislodged underground causing a plug of sediment to enter the spring source. The report on the hydrogeologist's findings and recommendations is awaited.

While the UV disinfection system operated within its validation range at all times throughout the incident, the concern is the potential shielding of pathogens at turbidity levels greater than 1 NTU, which could result in the water supply being inadequately disinfected (risk of *Cryptosporidium* in the treated water). The precautionary BWN was put in place for this reason, and it will remain in place until the EPA and HSE is satisfied that the cause of the elevated turbidity has been fully investigated and appropriate remedial actions have been taken by Irish Water.

The performance of the rapid gravity sand filter needs to be reviewed, in particular the length of time before the filter is brought back into service following a backwash. An earlier high turbidity alarm / plant shut-down system on either the raw or filtered water would give advance warning to the operator and allow for better control at the treatment plant, thereby improving the safety and security of the water supply.

4. RECOMMENDATIONS

1. Irish Water should complete the investigation into the cause of the sudden change in raw water quality at Ahascragh water treatment plant and submit a report to the Agency, to include the hydrogeologist's findings and recommendations regarding the spring source.
2. Irish Water should take action as necessary to ensure that water with turbidity > 1 NTU does not enter the contact tank at Ahascragh water treatment plant.
3. Irish Water should review the performance of the rapid gravity filter and carry out remedial actions as necessary to ensure that:
 - (i) The levels of turbidity in the filtered water are as low as possible;
 - (ii) The operation of the filter incorporates a slow start or run to waste before the filter is brought back into service following a backwash; and
 - (iii) There is an even flow of backwash water across the top of the weir.
4. Irish Water should ensure there is a documented procedure at the plant for filter backwashing.
5. Irish Water should review the chlorine profile in the water supply to see if chlorine demand has increased since the elevated turbidity incident.
6. Irish Water should inspect the contact tank and storage reservoirs in order to determine if they need to be cleaned out.
7. Irish Water should put a system in place so that stocks of chemicals kept on-site are regularly checked to see if they are in date.
8. Irish Water should ensure that plant operators have full access to the data pertaining to the performance of the plant. Specifically, access should be provided to raw and treated water quality trends.
9. Irish Water should ensure that plant operators are immediately informed when a boil water notice is issued on a water supply.
10. Irish Water should ensure that boil water notices used for public communications are clear and effective in presenting information.

FOLLOW-UP ACTIONS REQUIRED BY IRISH WATER

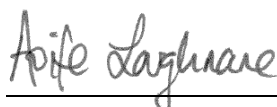
During the audit Irish Water representatives were advised of the audit findings and that action must be taken as a priority by Irish Water to address the issues raised. This report has been reviewed and approved by Mr Darragh Page, Senior Inspector, Drinking Water Team.

Irish Water should submit a report to the Agency within one month of the date of this audit report detailing how it has dealt with the issues of concern identified during this audit. The report should include details on the action taken and planned to address the various recommendations, including timeframe for commencement and completion of any planned work.

The EPA also advises that the findings and recommendations from this audit report should, where relevant, be addressed at all other treatment plants operated and managed by Irish Water.

Please quote the File Reference Number DW2016/55 in any future correspondence in relation to this Report.

Report prepared by:



Inspector

Date:

11th April 2016

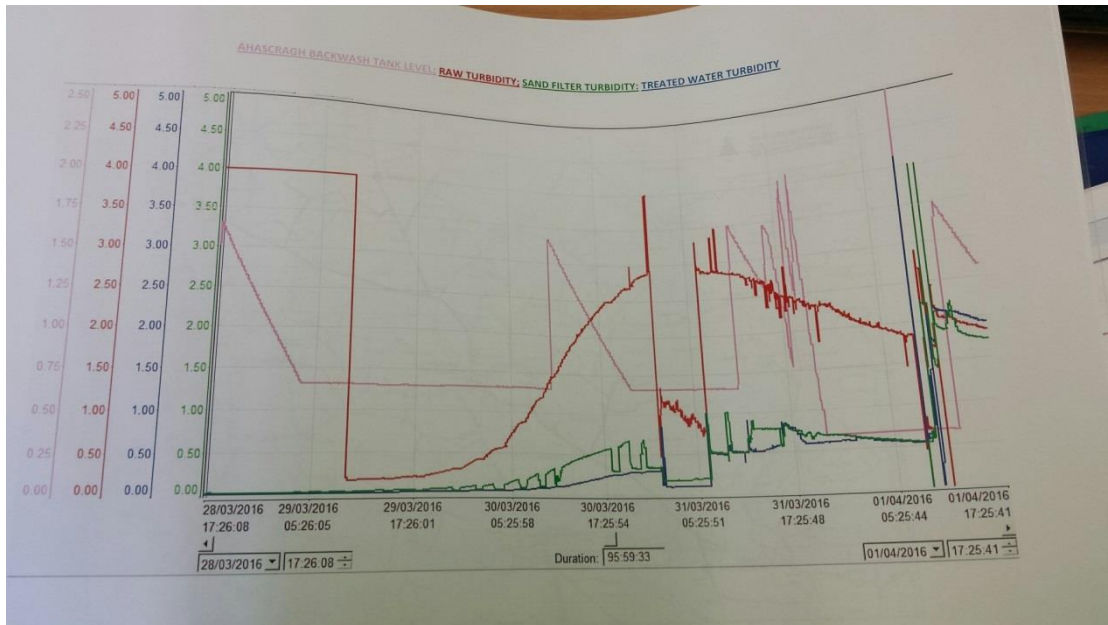


Photo 1: SCADA trend of raw turbidity (red line), filtered turbidity (green line) and treated water turbidity (blue line) from 28th March to 1st April 2016.



Photo 2: Spring abstraction chamber

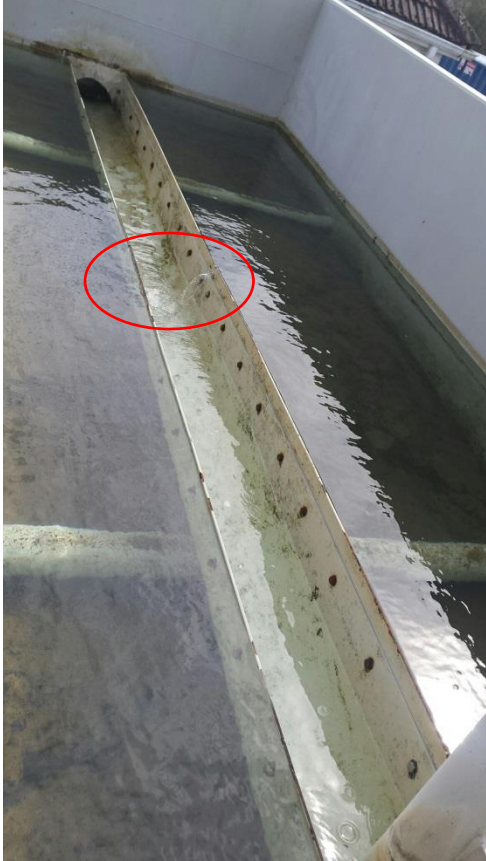


Photo 3: Wash water flowing through gaps in the weir wall.



Photo 4: Sodium hypochlorite drums fast approaching expiry date (11/04/16)