



# Drinking Water Audit Report

<b>County:</b>	Kilkenny	<b>Date of Audit:</b>	21 <sup>st</sup> October 2015
<b>Plant(s) visited:</b>	Graiguenamanagh (Coolroe) Water Treatment Plant (1500PUB1008)	<b>Date of issue of Audit Report:</b>	6 <sup>th</sup> November 2015
		<b>File Reference:</b>	DW2015/182
		<b>Auditors:</b>	Ms Michelle Roche Ms Yvonne Doris
<b>Audit Criteria:</b>	<ul style="list-style-type: none"> <li>• The <i>European Union (Drinking Water) Regulations 2014 (S.I. 122 of 2014)</i>.</li> <li>• 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></li> <li>• The recommendations specified in the <i>EPA Drinking Water Report</i>.</li> <li>• The recommendations in any previous audit reports.</li> </ul>		

## MAIN FINDINGS

- i. **The adequacy of the current treatment system to remove or inactivate *Cryptosporidium*, should it be present in the raw water from either source, should be assessed.**
- ii. **Control monitoring of the current treatment system is inadequate. Items such as individual turbidity monitors on raw water and slow sand filters and accuracy of on-line turbidity and chlorine residual monitors should be investigated.**
- iii. **Multi-locational chlorine residual monitoring and a regular programme of flushing and scouring of the network should be implemented.**

## 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 dated 15<sup>th</sup> October 2015 of the detection of *Cryptosporidium* in the final blended water leaving the Coolroe Water Treatment Plant (WTP) in the Graiguenamanagh public water supply.

The Graiguenamanagh public water supply serves a population of 1,630 people in Graiguenamanagh and Tinnahinch with a volume of approximately 400m<sup>3</sup> of water per day. The supply was developed in the 1950s and much of the infrastructure dates back to that time. Graiguenamanagh is located in County Kilkenny on the border with Kilkenny and Carlow and Tinnahinch is located just across the border in County Carlow. The supply is sourced from two sources located within County Kilkenny, the River Duiske and 2 combined spring sources from Brandon Hill. The spring sources are located within 100m of each other. Raw water abstracted from the River Duiske is fed through three slow sand filters and then pumped to the Coolroe WTP for disinfection. Raw water from the spring source is gravity fed to the Coolroe WTP where both sources are blended and disinfected using chlorine gas. The spring sources are the main source for the supply and filtered water from the River Duiske supplements the supply every 5 hours. At the time of the audit, the plant did not have an adequate barrier to *Cryptosporidium* should it be present in the raw water.

On 13<sup>th</sup> October 2015 *Cryptosporidium* was detected in the final blended water leaving the Coolroe WTP (notified to the EPA on 15<sup>th</sup> October 2015). Subsequent sampling detected *Cryptosporidium* oocysts in both raw water sources and the River Duiske treated water, after the slow sand filters. At the time of the audit the spring source was not in use as there is no *Cryptosporidium* barrier in place. Raw water from the River Duiske is now being fed through a temporary package plant consisting of pressure filter, granular activated carbon and UV disinfection. The package plant was not in-situ at the time of the audit therefore the package plant was not audited by the EPA and will not be dealt with in this audit report.

Photographs taken by Michelle Roche during the audit are attached to this report and are referred to in the text where relevant.

The opening meeting commenced at 9:30am at the raw water intake for the Duiske River. 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. 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: (\* indicates that person was also present for the closing meeting)

Ms. Deirdre O'Loughlin – Water Compliance Analyst, Irish Water\*

Ms. Catherine Rice – Water Compliance Analyst, Irish Water\*

Mr. Jim Fitzgerald – Regional SLA Lead\*

Mr. Joe Scully – Senior Executive Engineer\*

Mr. Eamon Morrissey – Executive Chemist\*

Mr. Frank Croke – Supervisor\*

Mr. Morris Rafter – Caretaker\*

Representing the Environmental Protection Agency:

Ms. Yvonne Doris – Inspector\*

Ms. Michelle Roche – Inspector\*

## 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. Source Protection

- a. The raw water intake on the River Duiske is located adjacent to the three slow sand filters. The intake consists of a locked intake chamber fitted with a coarse and fine intake screen. The intake is inspected daily by the caretaker and the screen cleaned when necessary.
- b. The area around the intake is fenced off from animals and no evidence of animals entering the river upstream has been noted by WTP staff.
- c. Landowners in the catchment were written to in 2011 under the *European Union (Good Agricultural Practice for the Protection of Waters) Regulations 2010 (SI No.610 of 2010)* and Kilkenny County Council will prioritise farm inspections in the River Duiske catchment for 2015/2016.
- d. Raw water from the River Duiske enters the slow sand filters via a raw water sump and weir chamber. The weir chamber is fitted with an overflow pipe that allows raw water to be discharged back into the river without treatment if the sump is full.
- e. In the event of predicted poor weather conditions the caretaker will manually employ the overflow pipe to ensure highly coloured water does not enter the slow sand filters.

	<ul style="list-style-type: none"> <li>f. The spring sources are housed in locked chambers in Coillte owned land on Brandon Hill. No agricultural activities are known to occur in the vicinity of the spring sources.</li> <li>g. The spring sources were not inspected during the audit due to access issues however Kilkenny County Council staff stated that the spring chambers were inspected the day prior to the audit and no evidence of infiltration was observed.</li> </ul>
<p><b>2.</b></p>	<p><b>Slow Sand Filtration</b></p> <ul style="list-style-type: none"> <li>a. Raw water from the River Duiske is treated in three slow sand filters and flow through the filters is at a rate of 0.1m/hr.</li> <li>b. Irish Water stated that the depth of sand in the filters was 700mm, as measured the previous day by Irish Water staff. No level gauge was installed in any of the filters.</li> <li>c. Filters are drained down for cleaning once every two months based on headloss, an increase in the colour of the water or algal growth. The caretaker tops up the sand in the filters by the same volume as was skimmed during cleaning to maintain a fixed level of sand in the filters.</li> <li>d. Following cleaning, filters are brought back in to service after a time period of two days.</li> <li>e. The caretaker keeps a note of filter maintenance in his diary but no maintenance log book is present at the plant.</li> <li>f. A single on-line turbidity monitor is in place on the combined outflow from the three filters. This monitor is connected to SCADA and has an alarm set point of 1 NTU.</li> <li>g. The on-line turbidity monitor is serviced and fully calibrated every six months. It was noted during the audit that the turbidity monitor showed a drift in reading during the last service and full calibration. The caretaker does not have a handheld turbidity monitor with which to check the accuracy of the turbidity monitor between services.</li> </ul>
<p><b>3.</b></p>	<p><b>Chlorination and Disinfection</b></p> <ul style="list-style-type: none"> <li>a. Filtered water from the River Duiske and raw water from the spring sources are blended at the Coolroe WTP prior to disinfection with chlorine gas. The blended water is also dosed with soda ash prior to disinfection to regulate the pH of the water.</li> <li>b. Chlorine gas is dosed flow proportionately using a duty and standby dosing pump arrangement with automatic changeover. The dose is also automatically adjusted based on residual chlorine levels leaving the reservoir.</li> <li>c. Residual chlorine levels leaving the reservoir are measured using an on-line chlorine residual monitor, linked to SCADA. A chlorine residual of 1.58 mg/l was observed at the time of the audit and the plant caretaker stated that a residual of 1.2 mg/l is aimed for.</li> <li>d. The chlorine residual alarm has a set-point of 0.3 mg/l and a cascade response system is in place.</li> <li>e. It was noted during the audit that the chlorine residual monitor showed a drift in reading of 0.53 mg/l during the last service and full calibration. The caretaker stated that he often notes a discrepancy in the chlorine residual monitor readings against the hand held chlorine monitor readings, which are taken daily.</li> <li>f. The supply is fitted with a back-up sodium hypochlorite dosing system in case of failure of the chlorine gas system. The back-up system is automatically activated when the chlorine residual post reservoir falls below 0.4mg/l. The back-up system consists of a fixed dose from a single pump.</li> <li>g. Sodium hypochlorite used in the back-up system is pumped directly from the 5 gallon drum. The drum is held within a bunded area and replaced two months after the manufacture date has been passed.</li> <li>h. Chlorine residual levels in the network are taken once a week from one location on the network and generally range from 0.45 mg/l to 0.8 mg/l. A reading of 0.47 mg/l was recorded on the morning of the audit.</li> </ul>
<p><b>4.</b></p>	<p><b>Treated Water Storage and Distribution Network</b></p> <ul style="list-style-type: none"> <li>a. Treated water is stored in a single celled embankment reservoir constructed in the 1960s.</li> <li>b. The reservoir was fully cleaned out 4-5 years ago. A visual inspection of the integrity of the reservoir was carried out at that time.</li> </ul>

	<ul style="list-style-type: none"> <li>c. It was noted during the audit that the treated water delivery chamber to the reservoir is not sealed and inspection hatches for the reservoir are not adequately sealed.</li> <li>d. Reservoir air vents are not adequately sealed against small animals.</li> <li>e. A regular programme of flushing and scouring in the network has not been established on the Graiguenamanagh supply.</li> </ul>
<b>5.</b>	<p><b>Chemical storage and bunds</b></p> <ul style="list-style-type: none"> <li>a. Fluoride was being dosed at the Coolroe WTP however; it was observed during the audit that the fill point to the hydrofluorosilicic acid storage tank was not adequately bunded (Photograph 1) and delivery of hydrofluorosilicic acid was not supervised at the fill point. Kilkenny County Council have taken the decision to cease the use of hydrofluorosilicic acid at the treatment plant until a suitably bunded delivery point is installed.</li> </ul>

### 3. AUDITORS COMMENTS

The Graiguenamanagh public water supply was developed in the 1950s and much of the infrastructure dates back to that time. Given the age of the infrastructure available the auditor found that the supply was operated competently by conscientious and knowledgeable staff. The treatment systems currently in place at both sources are inadequate to remove or inactivate *Cryptosporidium* should it be present in the raw water. A full review of the appropriateness of the treatment system at the Graiguenamanagh public water supply to adequately treat the raw water to the standards in the Drinking Water Regulations 2014 should be undertaken. The review should include the control monitoring in place on the current treatment system, in particular items such as individual turbidity monitors on raw water and slow sand filters and accuracy of on-line turbidity and chlorine residual monitors.

### 4. RECOMMENDATIONS

#### Source Protection

1. Irish Water should liaise with the relevant local authority in relation to the requirements of the *European Union (Good Agricultural Practice for the Protection of Waters) Regulations 2014 (SI No.31 of 2014)* to ensure that local landowners are written to in order to remind them of the issues potentially impacting on the raw water abstraction from the River Duiske.
2. Irish Water should install a continuous turbidity monitor with automatic shut-off on the raw water entering the slow sand filters, from the River Duiske, to ensure that the slow sand filters are capable of coping with the raw water that is fed to them.

#### Management and Control

3. Irish Water should undertake a review of the adequacy of the current treatment system to remove or inactivate *Cryptosporidium* should it be present in the raw water. Where assessment of the treatment system finds inadequacies Irish Water should prepare an action plan to address these inadequacies.

#### Slow Sand Filtration

Where IW have reviewed the adequacy of the current treatment system and have determined that slow sand filtration will remain part of the treatment process the following actions are recommended;

4. Irish Water should install continuous turbidity monitors on each slow sand filter and the final treated water from slow sand filters. These monitors should be linked to a recording device and generate an alarm in the event of a deviation from the acceptable operating range of the filters.

5. Irish Water should ensure that the turbidity of the filtered water does not exceed 0.25 NTU, as the *Cryptosporidium* risk assessment for the River Duiske is high.
6. Irish Water should ensure that a suitable programme for service and calibration of all turbidity monitors is in place. Irish Water should also ensure that the accuracy of all turbidity monitors is regularly checked between servicing and full calibration to ensure that no drift in turbidity readings has occurred.
7. Irish Water should ensure that a logbook is kept (“the filter logbook”) for each filter containing the following:
  - i. A record of all maintenance work and inspections carried out on the filter;
  - ii. Details of the media depth and the condition of the filter when it is drained down;
  - iii. Details of when media is topped up or replaced; and
  - iv. Details of any trial work carried out on the filters.
8. Irish Water should review procedures for the maintenance of the slow sand filter such that it is in accordance with the recommended procedure as specified in the *Water Treatment Manual: Filtration*. The following actions are required as a priority;
  - i. Ensure that the integrity of the filter is maintained by inspecting the filter for cracks and refinishing filter walls in concrete to enable them to be appropriately cleaned.
  - ii. Ensure that the minimum depth of filter media (excluding the gravel layer) is no less than 300 mm;
  - iii. Ensure that a level gauge is available to determine minimum depth of filter media;
  - iv. Irish Water should establish documented quality criteria to outline when the filter is due to be skimmed or resanded.
  - v. Ensure that, following filter cleaning, the filter is brought back into use based on appropriate turbidity readings or an appropriate period of time based on predetermined water quality criteria specific to the plant.

### **Disinfection**

9. Irish Water should review the current disinfection system at the Coolroe WTP and ensure that Graiguenamanagh PWS is a priority for inclusion in the Irish Water Disinfection Programmes.
10. Irish Water should review the location of the residual chlorine sampling point to ensure that sufficient contact time has been allowed before a chlorine residual measurement is taken.
11. Irish Water should investigate the discrepancy between the residual chlorine readings on the chlorine monitor and the results of the manual residual chlorine test carried out daily at the plant and ensure that the chlorine monitor is reading accurately at all times.

### **Treated Water Storage**

12. Irish Water should ensure the treated water delivery chamber to the reservoir, all inspection hatches and all vents on the reservoir are suitably sealed against ingress of animals and insects or deliberate introduction of any contaminant or acts of vandalism.

### **Distribution System**

13. Irish Water should instigate a regular programme of uni-directional flushing and scouring of the mains.
14. Irish Water should ensure that a programme of chlorine residual monitoring at several locations in the distribution network, particularly the ends of network are regularly sampled and maintained at 0.1mg/l or higher.

### **Chemical Storage and Bunds**

15. Irish Water should review chemical storage arrangements at the treatment plant. Chemicals

must be stored in bunded areas capable of containing at least 110% of the volume of chemicals stored therein. Fill points for storage tanks inside the bunds should be within the bunded area. Refer to EPA guidance document –“*IPC Guidance Note on Storage and Transfer of Materials for Scheduled Activities*”.

16. Irish Water should immediately implement a protocol whereby all chemical deliveries are supervised by the local authority or a designated agent.

### **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 Ms Yvonne Doris, Drinking Water Team Leader.

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 DW2015/182 in any future correspondence in relation to this Report.

**Report prepared by:**



**Date:**

6<sup>th</sup> November 2015

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Inspector



**Photograph 1: Unbunded hydrofluorosilicic acid fill point**