Drinking Water Audit Report

County:	Roscommon	**Date of Audit:**	22nd June 2015
Plant(s) visited:	Castlerea Drinking Water Treatment Plant (serving Castlerea Urban PWS and Castlerea Regional PWS).	**Date of issue of Audit Report:**	25th June 2015
		File Reference:	DW2008/382; DW2008/383
		Auditors:	Ms Yvonne Doris (lead auditor) Ms Michelle Roche
Audit Criteria:	• The *European Union (Drinking Water) Regulations 2014 (S.I. 122 of 2014)*. • *The EPA Handbook on the Implementation of the Regulations for Water Services Authorities for Public Water Supplies (ISBN: 978-1-84095-349-7)* • The recommendations specified in the EPA *Drinking Water Report*. • The recommendations in any previous audit reports.		

MAIN FINDINGS

i. **A temporary treatment plant comprising coagulation, filtration and ultraviolet treatment is in place and has been operating since 5th January 2015. This is an appropriate barrier to *Cryptosporidium* as required by the EPA's 2014 Direction to Irish Water.**

ii. **As a result of the installation of an appropriate *Cryptosporidium* barrier, the Castlerea Urban PWS and Castlerea Regional PWS have been removed from the EPA's Remedial Action List.**

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 to assess compliance with EPA direction issued to Irish Water on 10th June 2014 to install a barrier to *Cryptosporidium* on the Castlerea Regional public supplies. The deadline in the direction was the 30th June 2015. The Direction has been complied with by the deadline set.

The temporary drinking water treatment plant has two sources comprising a spring source and a borehole adjacent to the plant. The borehole is used to augment the supply if required. The treatment plant capacity is 120m^3/hr and operates for about 18 hours per day. Treatment consists of a multi-barrier approach comprising flocculation and coagulation, single media filtration, UV treatment, chlorination and fluoridation. There are two reservoirs in the network. It serves the Castlerea Urban PWS (3,443 people) and Castlerea Regional PWS (1,800 people) which supply water to Castlerea town and surrounding areas. The source spring is highly karstified limestone which is extremely vulnerable. Exceedances of turbidity standards and detections of *Cryptosporidium* and Clostridium perfringens in these supplies have been notified to the EPA in the past. The Castlerea Urban and Castlerea Regional supplies have been on the EPA Remedial Action List for inadequate treatment for *Cryptosporidium* since 2009. A boil water notice has been in place on both supplies; since July 2012 for Castlerea Regional and since February 2014 for Castlerea Urban though both supplies had several boil notices in place for periods since 2008/9. The reservoir in Castlerea town was not inspected as part of this audit as it was out of operation, undergoing integrity assessment. It has been inspected at previous EPA audits.

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

The opening meeting commenced at 12.00am at Castlerea 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. Prior to the audit, the EPA conducted an assessment of extensive plant operational and performance data supplied by Irish Water. 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:

Name – Job Title

Anne Bonner, Compliance Specialist, Irish Water.

Anthony Skeffington, SLA Lead Engineer Roscommon, Irish Water.

Kieran Madden, Senior Engineer, Roscommon County Council.

Vincent Walsh, Acting Senior Executive Engineer, Roscommon County Council.

Gerry Healy, Caretaker, Roscommon County Council.

Michael O'Boyle, Senior Executive Engineer, Roscommon County Council (part of audit)

Peter Brennan, Veolia.

Brenda Mc Mahon, Veolia.

Representing the Health Service Executive:

Name – Job Title

Dr Melissa Canny, Public Health Specialist.

John Hanily, Principal Environmental Health Officer.

Joan Walsh, Environmental Health Officer.

Colette Mc Dermott, Environmental Health Officer.

Representing the Environmental Protection Agency:

Name – Job Title

Ms Yvonne Doris, Inspector (lead auditor).

Ms Michelle Roche, Inspector.

Mr Darragh O'Connor, work placement.

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.	**Management and Control** a. According to Irish Water, commissioning and process-proving is completed for the temporary Castlerea plant. A commissioning report has been prepared by Veolia. A remaining snag to be rectified is both turbidity meters on the outlet of the filters were operating incorrectly. The caretaker attends 7 days per week for about 3 hours. There is one stand-in caretaker.

	b. The plant has the following process controls in place: continuous raw water monitoring of pH, turbidity and SAC; turbidity monitoring of individual filters; UVT monitoring of treated water. Duty-standby is in place on all key process equipment and there is storage capacity to allow for UV and other plant maintenance and repairs. All monitors are linked to SCADA and monitoring information is easily available to the plant operator to facilitate management and operation of the plant. c. There is no generator on site in the event of loss of power. Surge protectors are on control equipment. d. The main caretaker has completed the FETAC Certified Water Training Course run by the Water Services Training Group. The stand-in caretaker is scheduled to complete this training course in 2015 and has completed disinfection training. The main caretaker has received on-the-job training from Veolia personnel. e. The supplementary borehole is automatically flushed once a week if it is not in use.
2.	**Source Protection** a. A Groundwater Protection Scheme for County Roscommon has been prepared. Source Protection Reports have been prepared. b. According to Roscommon County Council (RCC) all 81 farms in the zone of contribution (ZOC) to the source have been inspected by RCC, under the Good Agricultural Practice Regulations (168 inspections). 8 farms have been identified as high risk farms and are being followed up with actions by Roscommon County Council, including re-inspections and cross-reporting to the Department of Agriculture. c. All farmers in the ZOC to the source were written to in the past by RCC making them aware of the presence of the drinking water abstraction and highlighting farmers' responsibilities under the Good Agricultural Practice Regulations. Letters were resent in 2015 advising farmers of the construction of the new treatment plant and reminding them of their responsibilities under the Good Agricultural Practice Regulations. d. 87 septic tanks inspections have been undertaken by RCC within the ZOC. This is not the total number of septic tanks within the ZOC. 70% of septic tanks inspected failed the inspection criteria. Notices have been issued to householders for septic tanks inspected under the National Inspection Plan. e. The Castlerea Urban source was decommissioned on 15 April 2015. Raw water quality has significantly improved since this date and less flushing of the network is required to maintain the network pipework clean. f. The spring source was inspected during the audit and is housed in a locked well chamber. There are two boreholes on the site. One borehole is used to supplement the spring source. This is automatically flushed for 1 minute every week when not it use. The second borehole is sealed and locked and it is not planned to use this as a source unless the supplementary borehole becomes unusable. 120m^3/hr is abstracted from the spring source. There is continuous monitoring of raw water pH, turbidity and SAC.
3.	**Coagulation, Flocculation and Clarification** a. Chemical dosing of coagulants is not continuous at the plant. Jar testing showed a dose of 3mg/l 10% Polyaluminium chloride was sufficient to coagulate the poorest raw water quality observed. Chemical dosing is based on continuously monitored raw water SAC and UVT. If raw water SAC >7.5 (equates to approximately 82-83% UVT) coagulant dosing is automatically triggered. This triggers an alarm to the plant operator who manually adjusts the dosing rates if required. Jar tests are carried out if raw water conditions change and this information informs the dosing chart. Automated chemical dosing can be operated at the plant. b. Dosing is into the source water line as it enters the flash mixing tank which provides 5 minutes of mixing time for flocculation when coagulant is dosed. At the time of the audit coagulant was not being dosed as raw water quality was very good – pH: 7.03, Turbidity: 0.91 and SAC: 4.61 m/-1. Raw water turbidity is normally <1 NTU but in wet weather the raw water turbidity can rise to ~4 NTU. During a recent wet weather event 10% Polyaluminium chloride coagulant

	was dosed and adjusted from 3mg/l to 2mg/l based on SAC and UVT continuous monitoring. Further adjustments to the coagulant dosing regime will be made as coagulant dosing is required in the future.
4.	**Filtration** a. From the flash mixing tank the flow is then split between two rapid gravity single media filters comprising 1000mm sand (effective size 0.85mm). The filtration rate is 9m^3/m^2/hr. b. Backwashing of the rapid gravity filters is based on time (24 hours), turbidity (0.9 NTU) or headloss (1.8m) and can also be initiated manually. A backwash of filter 1 was observed during the audit. The air scour was even and the water wash ran clear. The filter backwash sequence is an air scour at 50m^3/m^2/hr for 60 seconds, a high rate air and water wash for at 50m^3/m^2/hr 180 seconds and low rate air and water wash at 8m^3/m^2/hr and a water rinse at 25m^3/m^2/hr. The filters are run to waste prior to bringing the filter back into service. There is a turbidity monitor on the outlet from each filter. These monitors were not reading accurately at the time of the audit. The filters provide 1-log reduction for *Cryptosporidium*. c. The filters are uncovered and algal growth was observed on the walls of the filters and in the decanting channels (photograph 1). The caretaker has limited access to clean the walls and channels in the filter and cleans them every few days. d. Backwashes of the filters are observed at least monthly. e. Filtered water is piped to a locked filtered water tank.
5.	**Chlorination and Disinfection** **UV disinfection** a. Duty and standby Aquafides 400W Compact T UV reactors (photograph 1) validated to ONORM (Austrian) standard and certified by OVGW are in place to provide a barrier to *Cryptosporidium*. UV disinfection denatures the DNA of *Cryptosporidium* oocysts and prevents its replication[1]. b. The UV reactor is validated to achieve 2-log reduction of *Cryptosporidium*, if operated at an incoming UVT of >80% and turbidity of <1 NTU and flow rate of 120m^3/hr based on the validation certificate document provided by the manufacturer and documentation stating same provided by Irish Water. In the event of a failure of the duty UV reactor the unit will automatically shut down, open and close the appropriate valves, switch on the standby UV unit, allow it to warm up to working conditions and resume production. If no UV unit is available the plant will not operate. The standby UV unit can assist and the flow can be split across the two units. At 85% UVT the unit sends a warning alarm and below 34% UVT (T_{50}) which equates to between 82 and 83% UVT (T_{10}) the UV reactor shuts down and no undisinfected water can enter supply and a manual restart of the plant is required. An alarm is sent to the plant operator who attends the site on a 24 hour/7 day basis. A restart of the treatment plant would take between 30 and 45 minutes. c. Outgoing UVT, UVI in the reactor, flow rate through the reactor and reactor temperature is recorded continuously. The UVT monitor is checked weekly using a portable UVT monitor and is calibrated monthly. Flow and temperature monitors are calibrated monthly. d. Target UV dose is 43 W/cm^2 in order to ensure the minimum required UV dose of 40 W/cm^2 is achieved. e. Flow rate through the reactor is 120m^3/hr. f. The UV reactor houses 8 UV lamps. The lamp life is 8,760 hours (about one year). At the time of the audit lamp hours were 1,932. Lamps reach operating temperature after 300 seconds. No water flows through the UV reactor until the lamps reach operating temperature. All lamps will be replaced at the same time. 8 spare lamps are stored on site. Replacing all 8 lamp takes 2-3 hours and is done when the UV reactor is not operating and when the reservoirs are full.

[1] Further information on UV disinfection is available the EPA disinfection manual that all water suppliers should be familiar with. http://www.epa.ie/pubs/advice/drinkingwater/watertreatmentmanualdisinfection.html

	Lamp coffins are not stored on site in the event that a lamp breaks during replacement. The evacuation procedure if a lamp breaks and mercury is released is unclear and it was not clear to the auditor how long the UV reactor would be out of operation if this was to occur. Manual cleaning of the reactor sleeve is done annually by the caretaker (trained by Veolia). g. The UV reactor has one UVI sensor which is calibrated annually against a spare sensor. UVDGM (USEPA guidance manual on UV disinfection) recommends monthly calibration of UVI sensors. Spare sensors are available from Veolia. h. No water can flow through the reactor when it is not operating. i. The UV reactor is not operating (as the plant is not running) for about six hours each day. This time is available for maintenance and repairs if needed and there is further storage in the network should repairs require additional time. Veolia carries out maintenance of the UV units. 24 hour alarm response is in place. All 8 lamps were replaced in February 2015 and were due to be replaced in 7,800 hours. Veolia carries a spare UVI sensor and ballast cards (for the UV control system). **Chlorine disinfection** j. To provide further and residual disinfection, chlorination using neat 14% sodium hypochlorite is in place at Mullaghadooey reservoir. A day tank with 3-4 days storage is replenished every three days. Dosing level is 1.2mg/l into the line serving the reservoir. Dosing is flow proportional and linked to chlorine residual. Duty and standby chlorine dosing pumps with automatic switchover are in place in the event of the duty pump failing. A chlorine monitor is in place and alarms to the plant operator. Alarm response procedures are in place and alarms are responded to on a 24/7 basis. Effective chlorine contact time is 106mg.min/l. k. Residual chlorine levels leaving the Mullaghadooey reservoir are typically 1.0mg/l and at the time of the audit residual chlorine leaving the Mullaghadooey reservoir was 1.0mg/l. Residual chlorine levels in the network are monitored daily at 6 or 7 points by Roscommon County Council and re typically close to 1.0mg/l. l. One additional chlorine monitor has been installed in the network and is connected to the SCADA.
6.	**Fluoridation** a. Duty and standby hydrofluorosilicic acid dosing pumps with automatic switchover are in place in the event of the duty pump failing.
7.	**Treated Water Storage and Distribution Network** a. Flushing and scouring is ongoing in the network. Each section of the distribution network is flushed and scoured every three weeks. It is intended to carry out a programme of uni-directional flushing and scouring of the distribution network in 2015. b. The Mullaghadooey reservoir was cleaned in February 2015. c. No customers are served between the treatment plant and the reservoirs.
8.	**Chemical storage and bunds** a. Chemicals are delivered directly into the bulk tanks and are supervised by the plant operator. No delivery can be made without access being provided by the plant operator. b. All chemicals (PAC, poly, chlorine, fluoride) in bulk tanks are in bunded bulk tanks and day tanks are bunded. There was some standing water in the bund around the Polyaluminium chloride bulk tank (photograph 2). c. Approximately 1400 litres of Polyaluminium chloride was stored in the bulk tank at the time of the audit. It was not known whether it's effectiveness would be reduced if stored for long periods, as this plant has used very small amounts (less than 200 litres) since January 2015. d. All chemical storage tanks are appropriately labelled and fitted with appropriate health and safety signage.

9.	**Hygiene and Housekeeping** a. Four valves from the spring source had temporary, plastic, unfixed covers in place. b. Tanks, equipment and treatment buildings were well labelled and appropriately signed. c. Preventative vermin bait boxes were observed at the treatment plant and at the reservoir.
10.	**Sludge Management** a. Polymer is dosed at 3mg/l to the backwash water on the outlet from the filters prior to entering two settlement tanks where it is settled for 60 minutes. 15% of the settled water is then decanted and discharged to a stream downstream of the spring source. There is a composite sampler on the discharge point and the decanted water is tested for pH, aluminium, turbidity and TOC. Sludge will be tankered to a local wastewater treatment plant. The destination for sludge has not yet been finalised. No sludge has been removed from the plant since the temporary plant has been operating.

3. AUDITORS COMMENTS

The Castlerea temporary treatment plant has duty-standby on all key process equipment and there is storage capacity to allow for UV and other plant maintenance and repairs. The design and operation of the UV reactor provides a barrier to *Cryptosporidium* for the Castlerea Urban and Castlerea Regional supplies. Documented process controls and continuous monitoring alerts the plant operator to changes in raw water conditions and treated water quality in sufficient time to make relevant adjustments to the treatment process. Treated water leaving the plant currently meets the standards required in the Drinking Water Regulations 2014.

4. RECOMMENDATIONS

Source Protection

1. Roscommon County Council should undertake a programme of septic tank inspections in the zone of contribution to the source and follow up any failures with appropriate enforcement actions.

Coagulation, Flocculation and Clarification

2. Irish Water should continue to develop and refine chemical dosing rates appropriate to the nature of supply and changing conditions. Results should be recorded at the treatment works and used for control of the treatment plant.

Disinfection

3. Irish Water should review the frequency of calibration of the UVI sensors to ensure that the UV disinfection system operates within its validated range at all times.

4. Irish Water should put in place a procedure in the event of the breakage of a UV lamp and the release of mercury.

5. Irish Water should ensure that manual cleaning of the UV reactor sleeve is done by suitably qualified and trained personnel in accordance with manufacturers specifications to ensure that the UV disinfection system operates within its validated range at all times.

Chemical Storage and Bunds

6. Irish Water should ensure that standing water in bunds is removed on a regular basis.

7. Irish Water should investigate the storage of Polyaluminium chloride for long periods and

whether the chemical would degrade or change in nature and take any necessary precautions to prevent degradation of the chemical.

Hygiene and Housekeeping

8. Irish Water should remove vermin bait boxes from the treatment plant and use alternative methods for vermin control as set out in *EPA Advice Note 13: Pesticides in Drinking Water*.

9. Irish Water should ensure that valves from the source pipeline are covered with permanent covers.

Management and Control

10. Irish Water should carry out further TOC sampling of raw and treated water and calculate the rate of TOC removal achieved by the plant on a regular basis.

FOLLOW-UP ACTIONS REQUIRED BY IRISH WATER

During the audit Irish Water representatives were advised of the audit findings and recommendations. This report has been reviewed and approved by Mr David Flynn, Programme Manager, OEE.

Irish Water should now put measures in place to implement the recommendations listed in this report. The actions by Irish Water to address the recommendations taken will be verified by the Agency during any future audits.

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 in any future correspondence in relation to this Report.

Report prepared by: Yvonne Doris **Date:** 25th June 2015

Yvonne Doris

Inspector/ Lead Auditor

Photograph 1: Algae on filter channel and walls.

Photograph 2: Water in PAC bund.