# Drinking Water Audit Report

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| **County:** | Roscommon | **Date of Audit:** | 18th September 2015 |
| **Plant(s) visited:** | Roscommon Central (Ballinagard) Drinking Water Treatment Plant<br>(Roscommon town) | **Date of issue of Audit Report:** | 14th October 2015 |
| | | **File Reference:** | DW2013/41 |
| | | **Auditors:** | Ms Yvonne Doris |
| **Audit Criteria:** | • The *European Union (Drinking Water) Regulations 2014 (S.I. 122 of 2014)*.<br>• *The EPA Handbook on the Implementation of the Regulations for Water Services Authorities for Public Water Supplies (ISBN: 978-1-84095-349-7)*<br>• The recommendations specified in the EPA *Drinking Water Report*.<br>• The recommendations in any previous audit reports. | | |

**MAIN FINDINGS**

i. **A new treatment plant comprising adsorption clarification, filtration and ultraviolet treatment has been constructed and has been operating since 4th May 2015. This is an appropriate barrier to *Cryptosporidium* as required by the EPA's 2013 Direction to Roscommon County Council.**

ii. **As a result of the installation of an appropriate *Cryptosporidium* barrier, the Roscommon Central PWS has 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 remedial works to consider removal of the Roscommon Central supply from the EPA's Remedial Action List.

The new Roscommon Central drinking water treatment plant has multiple sources comprising a spring and six operational boreholes within the treatment plant site. There are a further four capped and sealed boreholes which are not in use. The treatment plant capacity is 250$m^3$/hr but due to old mains which are prone to bursts the plant operates at about 140$m^3$/hr at the moment. A new main will be laid and the plant will be able to operate at capacity. The plant operates for 20 hours per day. The abstraction rate of each borehole is 75$m^3$/hr and typically has been operating two boreholes at a time. The plant can also be run solely from the spring. Treatment consists of a multi-barrier approach comprising flocculation and coagulation in adsorption clarifiers, multimedia filtration, UV treatment, chlorination and fluoridation. There is one reservoir in the network. It serves the Roscommon Central PWS which supplies water to Roscommon town and surrounding areas (4,000 people). The source boreholes are drilled in highly karstified limestone which is extremely vulnerable. Exceedances of turbidity standards and detections of *Cryptosporidium* in these supplies have been notified to the EPA in the past. The Roscommon Central supply been on the EPA Remedial Action List for inadequate treatment for *Cryptosporidium* since July 2013 following an outbreak of Cryptosporidiosis in the population served by the supply. A boil water notice was in place on the supply between April and August 2013.

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 13.30am at Roscommon Central treatment plant. The Site Manager provided a site induction prior to the commencement of the audit. 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: (* indicates that person was also present for the closing meeting)**

Name – Job Title

Anne Bonner, Compliance Specialist, Irish Water.

Justin Doran, DBO Engineer, Irish Water.

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

Kieran Madden, Senior Engineer, Roscommon County Council.

Anne McHugh, Senior Resident Engineer, Roscommon County Council.

Michael Kelly, Network caretaker (attended at Gallowstown reservoir only), Roscommon County Council

Andrew Young, Project Manager 4-Regional Schemes, Glan Agua.

John Fox, Operations Manager 4-Regional Schemes, Glan Agua.

Aine Healy, Glan Agua.

Jimmy Brennan, Plant Operator, Glan Agua.

**Representing the Environmental Protection Agency:**

Name – Job Title

Ms Yvonne Doris, 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.*

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| **1.** | **Management and Control**<br>a. According to Irish Water, commissioning and process-proving is completed for the Roscommon Central plant. It is in the operational phase of the Design-Build-Operate contract. The plant is managed by Glan Agua. The operator attends 7 days per week. Responsibilities and attendance is managed by the Plant Manager.<br>b. The plant has good process controls in place: continuous raw water monitoring; pH monitoring of raw water; turbidity monitoring of raw, individual filters and treated water; UVT monitoring of raw, pre-UV and 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. All monitors are calibrated monthly.<br>c. Two Glan Agua staff completed a 4-day certified UV training course with Wedeco and are Certified Wedeco Technicians available to carry out UV maintenance. The plant operator has completed the FETAC Certified Water Training Course run by the Water Services Training Group and received in-house training from Glan Agua Certified Wedeco Technicians.<br>d. Complaints of increased hardness have been received from consumers since the boreholes |

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| | began to be used exclusively to supply the plant (while the spring source was being developed and protected). It is intended to revert to supplying the plant from the spring as less complaints of hard water were received when this was the sole source of water. |
| **2.** | **Source Protection**<br>a. A Groundwater Protection Scheme for County Roscommon has been prepared. Source Protection Reports have been prepared.<br>b. According to Roscommon County Council (RCC), 39 farm inspections were carried out in 2005. In 2013, 58 farm inspections were carried out - 54 were deemed low risk, 3 medium risk and one high risk. Action was taken in relation to the single high risk farm.<br>c. All farmers in the zone of contribution to the source were written to by RCC in 2015 making them aware of the presence of the drinking water abstraction and highlighting farmers' responsibilities under the Good Agricultural Practice Regulations.<br>d. Septic tank inspections have not been undertaken by RCC within the zone of contribution. The National Inspection Plan did not identify any systems for inspection within the zone of contribution.<br>e. Operational boreholes 8, 8A, 3, 3A, 2 and 2A and one of the capped and sealed boreholes were inspected. All boreholes have locked borehole chambers and all were located in a secure area within the grounds of the treatment plant. The spring has been developed with a stone surround, concrete walkways and railings and covered by a locked shed.<br>f. The source water from the boreholes and/or spring is pumped to a raw water balancing tank which allows mixing of raw water. There was a small amount of algal growth on the sides of this tank. Treatment to prevent algal growth was unsuccessful and it is intended to cover this tank. There is continuous monitoring of pH, turbidity, colour and UVT at the tank. |
| **3.** | **Coagulation, Flocculation and Clarification**<br>a. The coagulation and filtration process is carried out in a purpose built Corex plant that consists of two adsorption clarifiers and four multimedia filters.<br>b. Chemical dosing of coagulants necessary for treatment is continuous at the plant and is based on jar test results and continuously monitored raw water UVT. If raw water UVT drops to 70%, this triggers an alarm to the plant operator who manually adjusts the dosing rates. Jar tests are carried out if raw water conditions change and this information informs the dosing chart. An automated chemical dosing can be operated at the plant.<br>c. Water from the raw water balancing tank is continuously dosed with coagulant. At the time of the audit polyaluminium chloride (PAC) coagulant was being dosed at 3mg/l (100% product). There is facility to dose polymer but this not in use as the raw water quality is very good. The flow is then split between two adsorption clarifiers. The floc is generated in a void space underneath the adsorption bed (composed of 1,050mm of sand, effective size: 2-2.7mm). Water flows upwards through the adsorption bed where floc is filtered out and the clarifier is capable of removing 70% of the turbidity, colour and UVT from the raw water.<br>d. The adsorption beds in the clarifiers are backwashed every 8 hours. The backwash sequence is an air scour at 100$m^3$/hr for 160 seconds followed by a water rinse (using raw water) to waste for 300 seconds. |
| **4.** | **Filtration**<br>a. From the clarifier, water flows to the top of the filter section and is filtered through four rapid gravity multimedia filters comprising a base layer of 550mm depth of quartz sand (effective size 0.54-0.71mm) and a top layer of 450mm anthracite (effective size: 0.9-1.05mm). Filters are cored and tested monthly to check for wear to the media and for mudballing.<br>b. Backwashing of the rapid gravity filters is based on time (24 hours), turbidity (0.4 NTU) or headloss (5 kPa) and can also be initiated manually. The filter backwash sequence is an air scour at 140$m^3$/hr for 190 seconds, a low rate water (70$m^3$/hr) and air scour (140$m^3$/hr) for 180 seconds and a high rate water only rinse at 140$m^3$/hr for 400 seconds. There is a turbidity |

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| | monitor on the outlet from each filter. A backwash of filter 2 was observed during the audit – it was difficult to observe the further side of the filter - of what could be observed the air scour was even and the water wash was clear. The caretaker observes a backwash each week. |
| **5.** | **Chlorination and Disinfection**<br>**UV disinfection**<br>a. A single Xylem/Wedeco Spectrum 900e UV reactor validated to UVDGM (USEPA) standard is in place to provide a barrier to *Cryptosporidium*. The UV reactor is validated to achieve 3-log reduction of *Cryptosporidium*, if operated at an incoming UVT of >69% based on the validation certificate document provided by the manufacturer and documentation stating same provided by Irish Water. Below 69% UVT the reactor shuts down and no undisinfected water can enter supply. An alarm is sent to the plant operator who attends the site on a 24 hour/7 day basis.<br>b. Incoming 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.<br>c. Target UV dose is 14.4mJ/$cm^2$ in order to ensure the minimum required UV dose of 12 mJ/$cm^2$ is achieved. An alarm set-point at 13.2mJ/$cm^2$ alerts the plant operator to a reducing UV dose.<br>d. Flow rate through the reactor is typically around 140$m^3$/hr. The UV reactor is capable of treating multiples of this flow rate based on the calculated dose algorithm of the reactor.<br>e. The UV reactor houses 12 UV lamps. The lamp life is 12,000 hours (about one year). At the time of the audit lamp hours were 2,937. 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. 12 spare lamps are stored on site with a total of 40 available to Glan Agua personnel locally. Replacing a lamp takes 10 minutes and is done when the UV reactor is not operating. Lamp coffins are carried by the technician in the event that a lamp breaks during replacement. An evacuation procedure is in place if a lamp breaks and mercury is released. A mechanical cleaning system cleans the reactor sleeve once a day. No chemicals are used in the cleaning process.<br>f. The UV reactor has 2 UVI sensors which are calibrated monthly against a spare sensor. Spare sensors are stored on site.<br>g. No water can flow through the reactor when it is not operating.<br>h. The UV reactor is not operating (as the plant is not running) for about four hours each day. This time is available for maintenance and repairs if needed. There is also about 20 hours storage in the reservoir should repairs require additional time. Spare ballast cards (for the UV control system) and O-rings (for the mechanical sleeve cleaning system) are stored on site.<br>**Chlorine disinfection**<br>i. To provide further and residual disinfection, chlorination using neat 14% sodium hypochlorite is in place. A day tank with 7 days storage is replenished every few days. Dosing levels are set to achieve 0.8mg/l leaving the plant and 0.5mg/l leaving 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. Sufficient effective chlorine contact time is achieved in the reservoirs (about 20 hours storage).<br>j. Residual chlorine levels in the network are monitored daily by Roscommon County Council and are consistently above 0.1mg/l. On the day of the audit residual chlorine levels ranged from 0.5 to 0.7mg/l. |
| **6.** | **Fluoridation**<br>a. Duty and standby hydrofluorosilicic acid dosing pumps with automatic switchover are in place in the event of the duty pump failing.<br>b. A fluoride 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. |

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| **7.** | **Treated Water Storage and Distribution Network**<br>a. Flushing and scouring of the network is done fortnightly. It is intended to carry out a programme of uni-directional flushing and scouring of the distribution network in 2016.<br>b. The Gallowstown reservoir was constructed in 1980. It was designed as a grass-covered reservoir. It had three locked access hatches and four vents with mesh covers to adequately prevent insect access. It was cleaned in July 2013. |
| **8.** | **Chemical storage and bunds**<br>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.<br>b. All chemicals (chlorine, fluoride) are in double linked bulk tanks and day tanks are bunded. All chemical tanks are fitted with level sensors to indicate when tanks are almost full. Spill kits are carried in the plant operator's vehicle.<br>c. The fillpoints of the bulk tanks are not contained in a bunded area (photograph 1).<br>d. All chemical storage tanks are appropriately labelled and fitted with appropriate health and safety signage. |
| **9.** | **Monitoring and Sampling Programmes for Treated Water**<br>a. Roscommon County Council staff test chlorine residual readings daily in the network and communicate the results of their testing to the Glan Agua staff operating the treatment plant. |
| **10.** | **Sludge Management**<br>a. Backwash water is sent to a sludge holding tank. A mobile dewatering unit dewaters sludge fortnightly. Sludge cake is sent for reuse in brick manufacture.<br>b. Decanted water is discharged to a nearby stream. The discharge water is monitored for turbidity, pH, aluminium and suspended solids. |

## 3. AUDITORS COMMENTS

The Ballinagard treatment plant is well designed with 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 Roscommon Central supply. 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. The plant operators were very familiar with the operation of the plant under the various conditions that may arise. A review of three months of UVT data was carried out prior to the audit, showing the UV reactor was operating within its validated range at all times. Treated water leaving the plant currently meets the standards required in the Drinking Water Regulations 2014. The Roscommon Central supply has been removed from the RAL.

## 4. RECOMMENDATIONS

**Source protection**

1. Irish Water should continue with plans to cover the raw water balancing tank.

**Treated water storage and distribution network**

2. Irish Water should progress plans to replace old mains pipework which are prone to regular bursts.

**Chemical Storage and Bunds**

3. Irish Water should review chemical storage arrangements at the treatment plant. Fill points for storage tanks should be within a bunded area. Refer to EPA guidance document –"*IPC Guidance Note on Storage and Transfer of Materials for Scheduled Activities*".

## 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, Manager, Drinking Water Team.

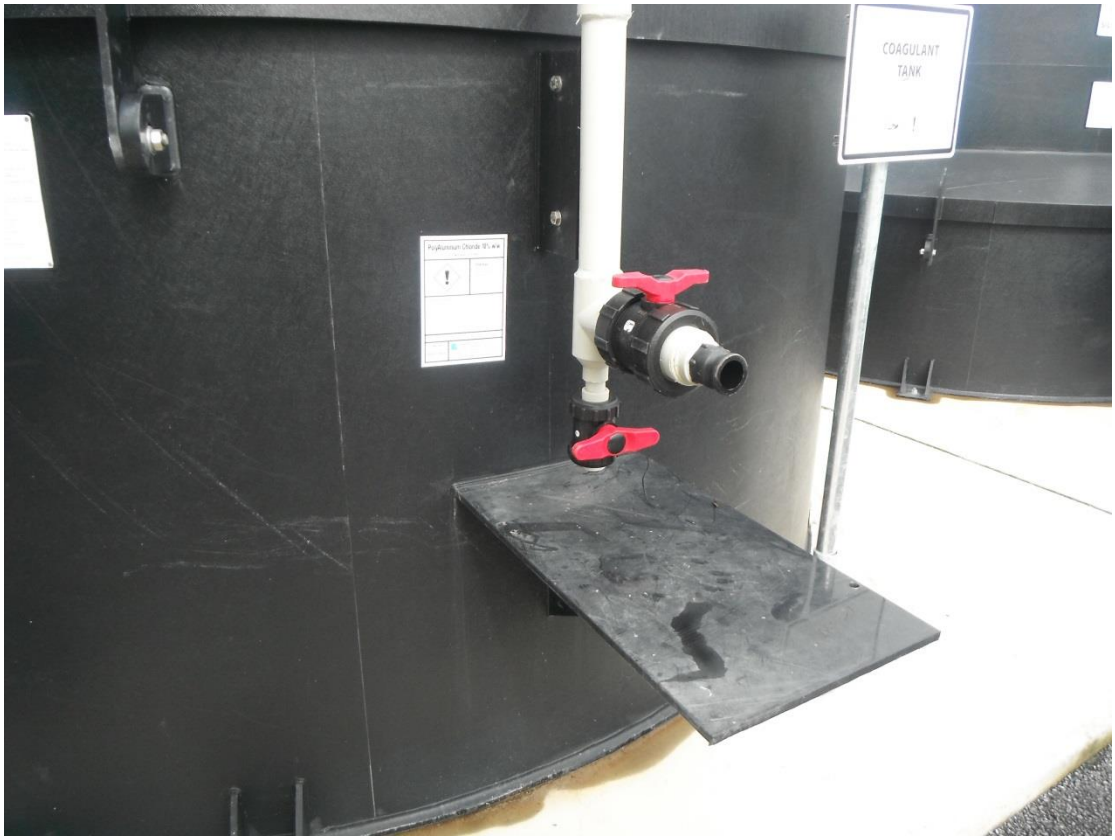
Irish Water is recommended to put such measures in place as are necessary to implement the recommendations listed in this report. The actions by Irish Water to address the recommendations taken will be verified by the Agency during any future audits.

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:** 13th October 2015.

Inspector




**Photograph 1: Example of delivery pipe to bulk storage tank not within bunded area.**