Drinking Water Audit Report

County:	Galway	**Date of Audit:**	20th August 2015
Plant(s) visited:	Inis Mór public water supplies: Kilcarna/Oghill, scheme code 1200PUB1026 Cregacareen, scheme code 1200PUB1053	**Date of issue of Audit Report:**	1st September 2015
		File Reference:	DW2013/99
		Auditors:	Ms Aoife Loughnane
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 Direction under Regulation 10(4) was issued by the EPA to Irish Water on 29th May 2015 requiring a THM action programme for the Cregacareen supply to ensure the formation of disinfection by-products is minimised and does not exceed the parametric value. Irish Water has committed to undertake the following actions:**
   a. **Bypass the Bungowla reservoir (which currently serves 11 houses) by pumping water directly into distribution from the storage reservoir at Cregacareen WTP;**
   b. **Reduce the chlorine dose at Cregacareen WTP whilst maintaining adequate disinfection; and**
   c. **Undertake a THM monitoring programme to verify the effectiveness of these measures.**

   Further clarification of the THM action programme is needed by Irish Water (as requested by email on 31/08/2015) before it can be approved by the EPA.

ii. **The UV disinfection system at each of the three water treatment plants on the island consists of a duty unit only (no standby provision). In the event of a failure or breakdown of the duty UV unit, there is no barrier to *Cryptosporidium* entering the water supplies.**

iii. **There was a failure of the UV disinfection systems at Kilcarna and Cregacareen WTPs in late July 2015 when it was discovered that both units were operating below their UV validated range. Remedial works were carried out, including the installation of an automatic shutdown of the plants when the UV operating conditions fall below the validated range. Irish Water must ensure that the UV disinfection systems are operated within their validated range at all times.**

iv. **Source protection measures need to be improved, in particular the open boreholes should be sealed and capped in order to prevent contamination.**

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 the performance of Irish Water in providing clean and wholesome drinking water on Inis Mór and to review Irish Water's progress with the THM action programme required under a Regulation 10(4) Direction issued by the EPA on 29th May 2015.

Inis Mór is served by three water treatment plants; Kilcarna, Oghill and Cregacareen. The first two plants share the same source (Kilcarna rainwater spring source supplemented by boreholes), while Cregacareen is served by a separate rainwater spring source. The treatment processes at each plant involve pressure filtration, UV disinfection and chlorination. On the day of the audit, the Kilcarna and Oghill plants were operational. The plant at Cregacareen has been shut down since 28th July 2015 due to the UV disinfection system operating outside its validated range. The plant will remain shut-down until works are completed under a THM action programme.

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

The opening meeting commenced at 9.30 am at Oghill 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. 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:

Louise Brennan, Drinking Water Compliance Analyst, Irish Water

Gerard Greally, Operations & Maintenance, SLA Lead – North West Region, Irish Water

Tony Kelly, Senior Executive Engineer, Galway County Council

Christina Ryan, Assistant Scientist, Galway County Council

Enda Gill, Caretaker, Galway County Council

Representing the Health Service Executive:

Shane Keane, Principal Environmental Health Officer, HSE West

Representing the Environmental Protection Agency:

Aoife Loughnane, 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 rainwater spring source at Kilcarna is a covered concrete chamber into which water seeps through cracks in the rock at the rear of the chamber. The source chamber is not fenced-off. This source is vulnerable to contamination from cattle grazing on high ground. b. One of the manhole covers on the Kilcarna source chamber was broken and faecal matter (bird droppings) were observed in the immediate vicinity (see photo 1). c. Three shallow boreholes located in a turlough supplement the Kilcarna rainwater spring source when it runs low (see photo 2). Cattle have access to the turlough for grazing during dry periods. The boreholes are not capped and are vulnerable to contamination by surface water ingress (see photo 3). d. The following parameters are monitored continuously in the raw water; turbidity, pH, ammonium and potassium. e. A barrier to *Cryptosporidium* entering the water supplies is provided by the UV disinfection systems at the three treatment plants.

2. Filtration

a. The first stage of treatment is pressure filtration. There is a single pressure filter containing membrane cartridges at each of the three treatment plants.
b. The caretaker replaces the cartridges when the flow rate through the filter drops to a set-point. A stock of spare filter cartridges is kept at each plant.

3. Disinfection – Ultra Violet Treatment

a. Primary disinfection at each plant is by UV treatment in Trojan Swift units. The UV systems operating criteria is shown in the table below:

Water Treatment Plant	Trojan model	Validated range	Volume flow (up to)	Alarm setting
Kilcarna	B08	19.0 W/m^2 UVI (validated to German standard DVGW)	40 m^3/hr	20.9 W/m^2 UVI
Oghill	D06	40 mJ/cm^2 UV dose (validated to US standard UVDGM)	300 m^3/hr depending on UVT %	40 mJ/cm^2 UV dose
Cregacareen	B03	17 W/m^2 UVI (validated to German standard DVGW)	7 m^3/hr	18.7W/m^2 UVI

b. In late July 2015, there was a failure of the UV disinfection systems at Kilcarna and Cregacareen WTPs, when it was discovered that both units were operating below their validated range. Both plants were immediately shut down and water was supplied to the entire island from Oghill WTP as a contingency arrangement.
c. Irish Water engaged EPS to undertake process investigations. An EPS work report (dated 17/08/2015) was provided by Galway County Council during the audit. The report identifies that the cause of the recent drop in UVT and UVI was due to a deterioration in raw water quality.
d. During the week beginning 10/08/2015, EPS calibrated all instruments and carried out remedial works including;
- installation of an automatic shut-down of the UV units at Kilcarna & Oghill WTPs when the operating conditions drop below the validated range.
- the display and trending of Kilcarna UVI data and Oghill UV dose data on SCADA.
- calibration of all instruments at Cregacareen WTP.
e. Kilcarna WTP was brought back online on 19/08/2015. Cregacareen WPT remains shut-down under further works are completed. The area is being supplied from Oghill WTP in the interim, which has sufficient capacity to continue to serve Cregacareen now that the summer season has come to an end.
f. The UV systems at Kilcarna and Oghill WTPs were operating within their validated ranges on the day of the audit.

4. Disinfection - Chlorination

a. Secondary disinfection is achieved at each plant by dosing ultra-low bromide sodium hypochlorite 10/11% (in order to minimise the risk of THM formation) via duty and standby chlorine dosing pumps.
b. There is a chlorine boosting station at Oghill reservoir.
c. New flow proportional chlorine dosing pumps with auto changeover capabilities have been installed at Oghill reservoir and Cregacareen WTP, and were due to be installed at Kilcarna and Oghill WTPs by end August 2015.
d. The low chlorine alarms are set at 0.5 mg/l and the high chlorine alarms are set at 1.0 mg/l.
e. Calculations provided by Galway County Council show that the required effective chlorine contact time of 15 mg.min/l is achieved on all three supplies.

5.	**Treated Water Storage and Distribution Network** a. The open vents on Kilcarna reservoir pose a risk of entry of vermin (see photo 4). b. There is no regular programme of flushing and scouring of the distribution network.
6.	**Monitoring and Sampling Programme for treated water** a. The following parameters are monitored continuously in the treated water (the results at the time of the audit are also shown): Kilcarna WTP: final turbidity 0.186 NTU, 83.4% UVT, 22.0 W/m^2 UVI, 0.91 mg/l residual chlorine (measured after Kilcarna reservoir). Oghill WTP: final turbidity 0.190 NTU, 82.3% UVT, 58.54 mJ/cm^2 UV dose, 0.32 mg/l residual chlorine (on rising main to Oghill reservoir) and 1.12 mg/l residual chlorine (following boosting after Oghill reservoir). b. The caretaker carries out daily monitoring of residual chlorine in the distribution network. Records are kept in the caretakers diary. c. The east side of the island (past the airport) is the most challenging area of the network in which to maintain the minimum chlorine residual of 0.1 mg/l. This requires close monitoring and management of the chlorine dose by the caretaker to ensure the water supply to approximately 10 houses in that area is adequately disinfected.
7.	**Exceedances of the Parametric Values** a. The parametric value for total THMs has been exceeded in the Cregacareen supply on 29/08/2013 (173.77 µg/l) and 11/05/2015 (108 µg/l). b. A Direction under Regulation 10(4) was issued by the EPA to Irish Water on 29th May 2015 requiring the submission of a THM action programme no later than 4th August 2015. c. Irish Water's initial response to the Direction dated 4th August 2015 was not satisfactory as it set out actions mainly related to the Kilcarna WTP. d. Following the audit, Irish Water submitted a revised response to the Direction on 26th August 2015 which sets out the following actions: - The planned bypass of the Bungowla reservoir (which currently serves 11 houses) by pumping water directly into distribution from the storage reservoir at Cregacareen WTP. This will allow a reduction in the chlorine dose at Cregacareen WTP (from a target chlorine residual of approximately 0.6 to 0.3 mg/l) and minimise the risk of THMs formation. Works are underway to replace the pumps at Cregacareen WTP with variable speed drive pumps which will allow the Bungowla area to be supplied directly. Modifications are also required to the pipework at Bungowla reservoir. Irish Water plans to complete these works by the end of Q3 2015. - A THM monitoring programme will commence once these works are completed. e. Further clarification of the THM action programme is needed by Irish Water (as requested by email on 31/08/2015) before it can be approved by the EPA.
8.	**Chemical storage and bunds** a. Drums of sodium hypochlorite were stored in unbunded locations at Oghill and Cregacareen WTPs (see photo 5).
9.	**Management and Control** a. The Kilcarna and Oghill public water supplies are currently reported in EDEN under a single scheme code 1200PUB1026. Under the definition of a water supply zone "*a geographically defined area within which drinking water comes from one or more sources and water quality in uniform*", these supplies should be regarded as two separate water supply zones and should be reported in EDEN under two scheme codes. b. The caretaker attends the treatment plants on a daily basis. Plant alarms are sent by text to the caretaker. There are no contingency arrangements in place for the management of the plants and investigation of alarms when the caretaker is not available. c. The plants automatically shut-down upon activation of low UV alarms. d. The caretaker has access to the SCADA system for each of the three plants at Oghill WTP.

3. AUDITORS COMMENTS

Inis Mór public water supplies are operated and maintained to a good standard. The caretaker has access to the SCADA system which assists in the management of the plants and investigation of alarms. However due to the island location, there are no contingency arrangements in place when the caretaker is not available.

The recent improvements to the disinfection systems are a positive measure, in particular the automatic shutdown of the treatment plants in the event that the UV validated operating conditions are not met. However, the UV systems at each plant consist of a duty unit only (no standby provision). In the event of a failure or breakdown of the duty UV unit, there is no barrier to *Cryptosporidium* entering the water supplies.

The implementation of a THM action programme to address the exceedances in the Cregacareen supply should minimise the formation of disinfection by-products and ensure compliance with the parametric value. Source protection measures need to be improved, in particular the open boreholes should be sealed and capped in order to prevent contamination.

4. RECOMMENDATIONS

THM Action Programme

1. Irish Water is requested to submit a clarified THM Action Programme as a formal response to the Regulation 10(4) Direction by immediate return so that it can be approved by the EPA at the earliest opportunity.

Source Protection

2. Irish Water should take action should to ensure that the sources are made secure and fenced off to prevent livestock access.

3. Irish Water should ensure that the open boreholes are adequately sealed and capped in order to prevent surface water ingress.

Disinfection

4. Irish Water should ensure that dosing of chlorine is flow proportional or is linked to the residual chlorine monitor. Where the dosing pump in fixed the Water Services Authority should replace the pump(s) with flow proportional pumps or pumps capable of dosing based on the residual chlorine monitor.

5. Irish Water should install automatic changeover over between the duty and standby chlorine pumps in the event of the failure of one of the pumps.

6. Irish Water should ensure that there are duty and standby UV disinfection arrangements with automatic changeover in the event of failure of one of the UV disinfection units.

7. Irish Water should ensure that the UV disinfection systems operate within their validated range at all times.

Treated Water Storage

8. Irish Water should ensure that all vents on the reservoirs are secured against ingress of animals or deliberate introduction of any contaminant or acts of vandalism.

Distribution System

9. Irish Water should instigate a regular programme of flushing and scouring of the mains.

10. Irish Water should ensure that residual chlorine levels at the end of the distribution network are maintained at 0.1mg/l.

Chemical Storage and Bunds

11. Irish Water should ensure that chemicals are 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.

Management and Control

12. From 1st January 2016, Irish Water should report on the Kilcarna and Oghill public water supplies as two separate water supply zones using two separate scheme codes in EDEN.

13. Irish Water should ensure that adequate contingency arrangements are in place for the management of the treatment plants and investigation of alarms when the caretaker is not available.

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 in any future correspondence in relation to this Report.

Report prepared by: Aoife Loughnane **Date:** 1st September 2015

Aoife Loughnane

Inspector

Photo 1: Damaged manhole cover at Kilcarna rainwater spring source (note the bird droppings in the immediate vicinity present a risk of contamination of the raw water source)

Photo 2: Three supplementary boreholes located in a turlough.

Photo 3: Uncapped borehole

Photo 4: Open vents at Kilcarna treated water reservoir

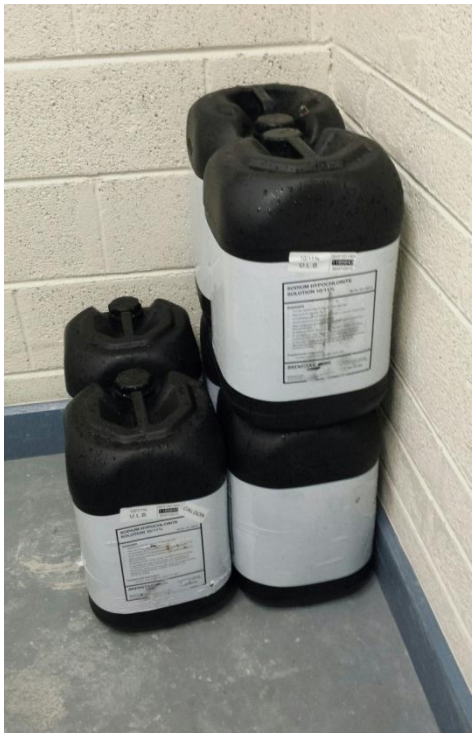

Photo 5: Chemical drums stored in an unbunded area at Oghill WTP