Site Visit Report

Under the European Union (Drinking Water) Regulations 2014 as amended, 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 water to the visited public supply.

The audit process is a sample on a given date of the facility's operation. Where a finding against a particular issue has been reported this should not be construed to mean that this issue is fully addressed.

Water Supply Zone

Name of Installation	Corofin PWS
Organisation	Irish Water
Scheme Code	0300PUB1010
County	Clare
Site Visit Reference No.	SV22200

Report Detail

Issue Date	23/02/2021
Prepared By	Orla Harrington

Site Visit Detail

Date Of Inspection	26/01/2021	**Announced**	Yes
Time In	11:30	**Time Out**	13:30
EPA Inspector(s)	Orla Harrington Regina Campbell		
Additional Visitors	Michelle Minihan		
Company Personnel	Irish Water: Deirdre O'Loughlin, Duane O'Brien, Kian Guihen. Clare County Council: Tony McNamara, Conor Marrinan, Roisin Breheny, Maeve Lait.		

Summary of Key Findings

1. Corofin Water Treatment Plant (WTP) was not performing satisfactorily from 23/11/20 to 15/01/21, when the plant was intermittently producing inadequately treated water with aluminium levels above the 200 ug/l standard in the Drinking Water Regulations. The cause of the plant performance issues has been attributed to operational difficulties with the dissolved air flotation with integrated rapid gravity filtration (DAFF) unit. The audit found that works to address the DAFF issues were completed on 18/01/21. Irish Water are required to provide verification data to ensure that remedial measures implemented to prevent a reoccurrence are adequate.

2. The DAFF and granular activated carbon (GAC) units are not currently being operated in accordance with the turbidity approach or log credit approach as set out in the EPA's Water Treatment Manual: Filtration, therefore the performance of the plant's *Cryptosporidium* barrier cannot be verified. Irish Water should consult with the HSE and inform them of the WTP's inability to verify the *Cryptosporidium* barrier until RAL plant upgrades are complete.

3. Aluminium failures recorded in daily testing at the plant were not escalated by Clare County Council to Irish Water and were not reported to the EPA until 18/12/20 when Irish Water were investigating an aluminium exceedance on the network in a sample taken on 26/11/20. The communication of the incident to relevant persons and parties (Clare Co.Co., Irish Water, HSE, EPA) was not conducted appropriately or in a timely manner to enable an informed response to the incident and to ensure the protection of public health.

4. There have been ongoing slippages in the projected date of completion of RAL upgrade works over the last number of years and the latest submission from Irish Water provides a completion date of June 2022. Irish Water should furnish the EPA with a confirmed detailed work programme of upgrades to be completed under RAL in response to this audit report.

Introduction

The Corofin Public Water Supply (PWS) serves a population of 1,276 and produces 300m3/day of treated water. The plant has a design capacity of 400m3/day. Raw water is abstracted from Inchiquin Lake and treated at the Corofin WTP. Treatment at this plant consists of coagulation using aluminium sulphate, flocculation, clarification by dissolved air flotation combined with rapid gravity filtration followed by granular activated carbon filtration. Disinfection is by chlorination using sodium hypochlorite.

This plant is on the EPA's remedial action list (RAL) since January 2016 as the supply has aluminium failures dating back to 2012. There have been ongoing slippages in the projected date of completion of RAL upgrade works over the last number of years and the latest submission from Irish Water provides a completion date of June 2022.

The purpose of the audit was to review the operation of the Corofin WTP following the notification of exceedances of the aluminium parametric value between 23/11/20 and 15/01/2021.

Supply Zones Areas Inspected

In response to COVID-19 social distancing requirements the audit comprised of a video conference meeting with all the relevant parties on 26/01/2021.

A review was undertaken of the sequence of events surrounding the incidents at the WTP that resulted in exceedances of the aluminium parametric values.

1. Incident Management

		Answer
1.1	Was the incident suitably alerted to the plant operators, escalated and managed in order to maintain water quality and protect public health?	No

Comment

The aluminium failures recorded in daily testing at the plant in November and December 2020 were not escalated by Clare County Council to Irish Water, and were not reported to the EPA until 18/12/20 when Irish Water were investigating the aluminium exceedance on the network in a sample taken on 26/11/2020.

The EPA has been notified of the following aluminium exceedances:

- On 09/12/20 of an exceedance of 209 ug/l in the distribution network from a sample taken on 26/11/20;
- On 18/12/20 of 11 exceedances ranging from 312 - 213 ug/l in the final water from samples taken between 27/11/20 and 14/12/20;
- On 06/01/21 of an exceedance of 385 ug/l in the distribution network from a sample taken on 16/12/20;
- On 11/01/21 of 3 exceedances ranging from 225 - 285 ug/l in the final water from samples taken on 23/11/20, 19/12/20 and 21/12/20;
- On 15/01/21 of 3 exceedances ranging from 213 - 278 ug/l in the final water from samples taken between 13/01/21 and 15/01/21;

Following investigations into the aluminium exceedances in the final water and distribution network, Clare County Council and Irish Water established that sufficient saturated air was not being generated in the DAFF unit to create flocculant and subsequently a sludge layer. The following remedial actions were taken:

- Conductivity probes in the saturated vessel were removed and cleaned to improve air production.
- An earth loop was installed on the saturated vessel, a 2" pinch valve was replaced along with a solenoid serving this valve, a 4" solenoid serving a 4" pinch valve in the DAFF was also replaced.
- Aluminium day tanks and the static mixer were cleaned.
- Jar tests are being carried out by an external contractor to ensure optimum coagulant dosing.
- A handheld turbidity meter is now onsite and readings are being taken at various locations in order to monitor the process more closely.
- The daily record sheet has been modified to include aluminium dosing information.
- Irish Water also proposed to install an air dryer for the compressor to reduce moisture building up on the solenoids by 31/01/21.

Daily aluminium testing on 18/01/21, 19/01/21 and 20/01/2021 following completion of the remedial works indicate that the aluminium levels have been restored to compliance.

The daily log book at the plant also showed that on many days (e.g. 1/12/20, 10/12/20, 18/12/20 & 19/12/20) where aluminium levels at the plant were >200 ug/l, there was also turbidity in the final water >0.3 NTU meaning that Irish Water and Clare County Council cannot verify that on these days the barrier to *Cryptosporidium* was being maintained. At the time of the audit, Irish Water and Clare County Council confirmed that the HSE had not been consulted on the risk to public health from the compromised *Cryptosporidium* barrier as evidenced by the combined aluminium exceedances and high turbidity recorded at the plant in the daily log during December 2020 and January 2021.

2. Coagulation Clarification Flocculation (CFC) Stage

		Answer
2.1	Is the CFC process optimised to respond to changes in raw water quality?	No

Comment

A pH of 6.5 - 7.2 is required for optimum coagulation. The most recent raw water results dated 21/01/21 included a pH of 7.64. There are no raw water alarms or shutdowns in place, thus preventing any forewarning of abnormal operating conditions. There is currently no pH adjustment before coagulation. This means that excess coagulant (aluminium sulphate) must be dosed in order to depress the pH levels to achieve optimum coagulation pH.

Clare County Council stated that the required alum dose is 150mg/l (the previous audit stated that the required alum dose was between 100 mg/l and 120 mg/l). Manual adjustments can be made if required based on jar tests carried out by an external contractor and are also influenced by raw water quality.

The alum dose is added upstream of an inline static mixer to ensure adequate dispersion of the chemical. The raw water contact time with the coagulant is 7 minutes, from where it is injected to the time it takes to travel to the flocculation unit. There is no automatic switchover between duty and standby coagulant dosing pumps in the event of a pump malfunction. The switchover requires manual intervention. There is no alarm to signal to the caretaker when a change in pumps is required. There is no dosing of coagulant aid.

Remedial works are to be carried out under RAL to optimise the coagulation process at the WTP.

3. Filtration

		Answer
3.1	Are the filters designed and managed in accordance with EPA guidance?	No

Comment

Clarification and filtration are achieved using a dissolved air flotation unit which contains an inbuilt rapid gravity filter (DAFF). The DAFF unit was cleaned and refurbished (filter media replenished, backwash pump replaced & electrical issues resolved) in December 2020 and January 2021.

There is a timed automatic backwash on this unit every 3.5 hours. There is no run to waste facilities installed at the plant so the DAFF unit goes back into service immediately after each backwash. Clare County Council confirmed that there is a cleaning down schedule for the DAFF unit and that a visual check of clarified water is undertaken on a daily basis. The sludge accumulates on the surface of the tank and is skimmed off periodically by a skimmer blade from where it is discharged into a sludge holding tank.

Irish Water carried out a full review of plant operations on 15/01/21. It was established that sufficient saturated air was not generated in the DAFF unit to create flocculant and sludge layer, resulting in floc carry over into the GAC unit from the DAFF. An electrical issue between the saturated vessel and solenoids was diagnosed as the root cause for not creating adequate saturated air. All works to resolve the issue were completed on 18/01/21.

There is no turbidity monitor on the outlet of the DAFF unit and therefore its performance as a *Cryptosporidium* barrier cannot be verified.

The filtered water then passes through a GAC filter, which acts as a secondary filtration system. Filtration occurs at a rate of 8.7m3/hr. The filter media was last replaced in December 2020 and now has a total depth of 1.72m (1m pea gravel and 0.72m carbon), which meets the EPA's guidance. The adsorptive capacity of the carbon media is tested annually by an external contractor.

Automatic backwashing using water from the clear water tank is instigated on a timed basis for 10 - 15 minutes daily. There is no run to waste facility and the GAC goes back into service immediately after backwashing. Turbidity of the filtered water post GAC is continuously monitored with an alarm set point of 0.75 NTU, which is considered too high to provide advance warning of filtration issues. There is no automatic backwashing of the GAC or shutdown of the plant linked to monitoring of turbidity. The DAFF is not being operated in accordance with the log credit approach or turbidity approach as per the EPA's Water Treatment Manual: Filtration and this means that the performance of the *Cryptosporidium* barrier cannot be verified.

Intermittent turbidity spikes of >1 NTU were recorded between the dates 20/11/20 to 18/01/21 and were linked to floc carryover from the DAFF unit, the daily GAC backwash process and optimisation works carried out at the plant. Turbidity has remained <1 NTU from 18/01/21 following completion of remedial works to the DAFF unit. The turbidity monitor on the outlet of the GAC was reading 0.086 NTU (18/01/21), 0.126 NTU (19/01/21), 0.093 NTU (20/01/21) and 0.127 NTU (21/01/21).

4. Disinfection

		Answer
4.1	Is the disinfection system verified using monitors and alarms, with trended data recorded and accessible?	Yes

Comment

Chlorination is achieved by dosing chlorine (sodium hypochlorite) via duty and standby pumps with automatic switchover facilities prior to the reservoir. The chlorine dosing (2mg/l) is flow proportional and linked to the residual chlorine monitor. The daily residual chlorine between the dates 1/1/21 and 21/1/21 trended between 1.16mg/l and 2.50mg/ in the final water.

The chlorine alarm setpoints include a high chlorine alarm setpoint of 2.50mg/l and a low level chlorine alarm of 0.20mg/l after 30 minutes delay, which alerts the caretaker. The time delay of 30 minutes is too long and should be reduced to prevent inadequately disinfected water entering the supply.

Regular monitoring for residual chlorine is taking place on the network and levels are >0.1mg/l at the end of the network on all sampling dates.

5. Management and Control

		Answer
5.1	Has the protozoal compliance log treatment requirement been identified for the water treatment plant?	Yes

Comment

Using the current protozoal compliance log credit approach, there is currently a 0.5 log deficit at the Corofin WTP because Inchiquin Lake has a 4 log credit requirement, and the current DAFF and GAC processes provide 3.5 log credits if operated in accordance with EPA guidance.

Irish Water state that there is a monthly monitoring programme in place at the plant for *Cryptosporidium* in the final treated water. There have been no detections of *Cryptosporidium* to date. Irish Water outlined that existing treatment processes at the WTP had yet to be reviewed under the new *Irish Water Source Cryptosporidium Risk Assessment Methodology*.

6. Site Specific Issues

		Answer
6.1	Do the audit findings support progress made with remedial action list completion date?	No

Comment

There have been ongoing slippages in the projected date of completion of RAL upgrade works over the last number of years. The latest submission from Irish Water gave a completion date of June 2022. Irish Water should ensure RAL upgrade works are completed by June 2022. In the interim, Irish Water are required to submit a detailed programme of works to be completed under RAL and confirmation on the appointment of a contractor to carry out these works.

Recommendations

Subject	Corofin Audit Recommendations	Due Date	23/03/2021
Action Text	**Recommendations** 1. Irish Water should submit one month aluminium results and turbidity trends from the final water at the Corofin WTP to verify the effectiveness of the remedial works completed on 18/01/21. 2. Irish Water should consult with the HSE in relation to the plant's inability to verify the *Cryptosporidium* barrier until remedial action upgrades are complete. 3. Irish Water and Clare County Council should ensure that there is a documented communications protocol in place for the reporting of incidents which could potentially impact the quality of water produced at Corofin WTP, so the relevant parties involved (Clare Council, Irish Water, HSE, EPA) are alerted promptly and a timely assessment of the risk to public health can be undertaken. Irish Water and Clare County Council should ensure that the relevant staff are trained in the protocol and understand the instances in which the protocol should be used. 4. Irish Water should confirm the protozoal log treatment requirement for the plant and identify how the log deficit will be addressed. 5. Irish Water should review the turbidity alarm in the final water to ensure the plant operates in accordance with the EPA's Water Treatment Manual: Filtration. 6. Irish Water should review the time delay of 30 minutes on the chlorine alarm to ensure that the plant operator is promptly notified. 7. Irish Water should provide an interim solution to monitor the performance of the DAFF unit until remedial upgrade works are complete. **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 Regina Campbell, Drinking Water Team Leader. Irish Water should submit a report to the Agency on or before 23/03/21 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 time frame 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 Action Reference Number Compliance Plan DW20120017 in any future correspondence in relation to this Report.		