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	Ennis PWS
Organisation	Irish Water
Scheme Code	0300PUB1009
County	Clare
Site Visit Reference No.	SV22458

Report Detail

Issue Date	01/07/2021
Prepared By	Orla Harrington

Site Visit Detail

Date Of Inspection	15/06/2021	**Announced**	Yes
Time In	10:30	**Time Out**	13:40
EPA Inspector(s)	Orla Harrington		
Additional Visitors	Regina Campbell * Criona Doyle ** * attended pre-site meeting 14/06/2021 ** attended site visit 15/06/2021		
Company Personnel	Irish Water: Deirdre O'Loughlin*, Duane O'Brien*, Kian Guihen***, Redmond Burke* and Micheal Byrne *** Clare County Council: Tony McNamara* EPS: Vincent Browne*, Mariusz Galeski ***, Paul Duke**and Ciaran Curran ** *attended pre-site meeting 14/06/2021 ** attended site visit 15/06/2021 *** attended pre-site meeting 14/06/2021 and site visit 15/06/2021.		

Summary of Key Findings

1. *E.coli* and Coliform Bacteria exceedances were detected in a sample taken at the Ennis water treatment plant (WTP) on 20/04/2021. Irish Water confirmed there were no incidents at the WTP which may have contributed to the detections. Resampling results were clear. The audit confirmed that the exceedances had been investigated by Irish Water and appear to be linked to inadequate sterilisation of a sample bottle, rather than a supply issue. The sampling procedure at the WTP has been updated to prevent a reoccurrence and the audit team were satisfied that the disinfection system at Ennis WTP was not compromised in the days leading up to the *E.coli* and Coliform Bacteria exceedances.

2. Under Irish Water's *Cryptosporidium* Monitoring Rationale for Public Water Supplies, the recirculation of supernatant back to the headwork's means there is a 5 log protozoal treatment requirement at the Ennis WTP. Irish Water have stated that the Ennis WTP can provide a protozoal log credit of 2.5. This means the plant has a treatment deficit of -2.5 log. Irish Water need to identify how the protozoal log deficit at the plant will be addressed. In light of the recirculation of supernatant back to the head of the plant, Irish Water should review the frequency of monitoring carried out at the plant in accordance with Irish Water's Rationale for Determining the Frequency of *Cryptosporidium* Monitoring in Public Water Supplies.

Introduction

According to the EPA EDEN portal, the Ennis WTP serves a population of approximately 27,945 and produces 12,097m3/day. The Ennis WTP is operated on behalf of Irish Water by EPS under a Design Build Operate (DBO) contract. The plant operates 24 hours/day within its design capacity of 750m3/hr.

Raw water is abstracted from the Drumcliff spring and treated at the Ennis WTP. Treatment consists of pH correction using sulphuric acid, coagulation with aluminum sulphate, flocculation, dissolved air flotation (DAF), microfiltration, further pH correction using sodium hydroxide, chlorination and fluoride treatment. There is sludge treatment on-site, consisting of a picket fence thickener (PFT) and dewatering units. The supernatant from the PFT is recirculated to the head of the works.

The audit was undertaken to assess Irish Water's performance in producing clean and wholesome water following the notification of *E.coli* and Coliform Bacteria exceedances in a sample taken at the WTP on 20/04/2021. Repeat *E.coli* and Coliform Bacteria sampling was undertaken at the plant and on the network on 21/04/2021, 22/04/2021 and 27/04/2021 and all sampling results were clear.

Supply Zones Areas Inspected

The abstraction point and all areas of the treatment process at the water treatment plant were inspected during the audit, including management of sludge generated on-site.

The audit comprised of a video conference meeting with relevant parties on 14/06/2021 followed by a site visit with essential audit participants on 15/06/2021.

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?	Yes

Comment

E.coli and Coliform Bacteria exceedances in a sample taken on 20/04/2021 were notified to the EPA on 23/04/2021. The sample contained 93.3 *E.coli* (per 100ml) and 1986.3 Coliform Bacteria (per 100ml). The sample contained 0.51mg/ residual chlorine and was taken at the Ennis WTP. Irish Water and Clare County Council consulted with the HSE via the initial notification record (INR) process. Irish Water advised that the information provided to the HSE was as follows:

(a) confirmation from the DBO operator that no mechanical or operational problems existed at the plant before or at the time the sample was taken and their belief that the results are due to a "rogue sample";

(b) chlorine residual in the failing sample was satisfactory at 0.51mg/l;

(c) a sample taken from the Ennis network by Clare County Council on 21/04/202 was clear for both *E.Coli* and Coliform Bacteria and contained a residual chlorine of 0.3mg/l;

(d) repeat samples taken from three locations on the network on 22/04/2021, the results of which were also clear for *E.Coli* and Coliform Bacteria.

Taking this risk assessment carried out by Irish Water into account the HSE deemed that the parametric failure did not pose a risk to human health. The cause of the *E.coli* and Coliform Bacteria exceedances appears to have been an isolated incident linked to sterilisation of a sample bottle and not reflective of the quality of the supply. To prevent a reoccurrence, EPS have updated the sampling procedure and the audit team were satisfied that the disinfection system at the Ennis WTP was not compromised in the days leading up to the *E.Coli* and Coliform Bacteria exceedances.

2. Source Protection

		Answer
2.1	Is the abstraction source(s) adequately protected against contamination?	Yes

Comment

The Ennis PWS is supplied by the Drumcliff spring source which is located in a below ground concrete chamber approximately 4m to 5m deep, <1km from the plant. According to EPS, the raw water quality is generally consistent but is influenced by surface water following heavy rainfall. The abstraction rate on the day of the audit was 486.6m3/hr.

The raw water is monitored continuously for colour, turbidity, pH, oxidation reduction potential (ORP) and conductivity. The monitors read a colour of 20.91 hazen, turbidity of 0.46 NTU, pH of 7.76, ORP of 1.7 mV and a conductivity of 377.2 us/cm on the day of the audit. The raw water is also monitored daily for iron, fluoride and manganese. There is a high high colour alarm of 250 hazen on the raw water and EPS were not aware of this set point ever being reached. All monitors are checked daily, cleaned weekly and have a monthly maintenance programme.

The land use surrounding the source is predominately agriculture and it was confirmed by Clare County Council that the farmers in the vicinity of the source were written to in 2017 in relation to the requirements of the European Union (Good Agricultural Practice for the Protection of Waters) Regulations 2014, as amended.

3. Coagulation Clarification Flocculation (CFC) Stage

		Answer
3.1	Are the CFC processes appropriately controlled?	Yes

Comment

An average dose rate of 27.1l/hr of 8% aluminum sulphate (coagulant) is applied to the raw water. The dose rate is flow proportional and also determined by raw water quality. Jar tests carried out every 6 months and in response to changes in raw water quality are used to confirm the dose rate. The coagulant dosing is combined with pH correction via 96% sulphuric acid to provide a target pH of 6.3 prior to coagulation. Both chemicals are dosed 2 feet apart and mixed by a static mixer prior to entering the flocculation tank.

The flocculation tank has three compartments (tanks 1 - 3) separated by an overflow. To assist with flocculation and particle removal a DAF tank is located in series after tank 2 and before tank 3. EPS stated on the day of the audit that the retention time over the entire flocculation process is approximately 70 minutes. The acid dose rate is controlled by a pH monitor located at the inlet to the flocculation tank, which read pH 6.28 on the day of the audit. This monitor alarms in the event of a deviation from the target pH. The pH is also monitored at the outlet of the flocculation tank, which read pH 6.12 on the day of the audit.

The main parameter used to monitor the performance of the DAF unit is the online turbidity monitor on the return from the DAF unit. On inspection, the DAF unit was found to be producing clarified water with a turbidity of 0.9 NTU verifying satisfactory operation at the time. EPS advised that the typical turbidity range for the DAF is between 0.8 and 0.9 NTU. The alarm on this turbidity monitor is set at 3 NTU. The DAF unit is cleaned once per year and some scraper adjustments were also carried out in 2020. Sludge scrapers skim the sludge off the top of the DAF unit every 30 minutes from where it is fed to a washwater tank.

Duty and standby dosing pumps are present on all chemicals with automatic switchover in the event of pump breakdown. Rotation of pumps is also undertaken to even out pump wear. All pumps and monitors are alarmed and operators are alerted to all alarms at the WTP via text 24 hours/day.

4. Filtration

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

Comment

The filtration provided at the Ennis WTP is a fully automated microfiltration unit comprising of six filter units with 102 filters in each unit. The membrane pore size is 0.1 micron. There were four filters active on the day of the audit, with two on standby and a flow rate of approximately 115m3/hr going through each filter.

From the outlet of the flocculation tank there are two forward feed pumps arranged in duty/standby configuration where feed water enters the microfiltration unit. These pumps operate approximately 20 hours/day and if the pump stop and start above a pre-set number in an hour an alarm will be generated to SCADA. Monitoring for pressure, temperature and colour is carried out before water enters the unit. The raw water turbidity monitoring results are used as an indication of feed turbidity data ahead of the unit.

There is a pressure decay test (PDT) automatically initiated at a preset time on each filter daily. The aim of the PDT is to test the integrity and performance of the membranes. A pressure of 100kPa is applied to the center of the filter during the PDT test and held for 2 minutes. If a pressure drop of >55kPa/min is detected a high alarm is activated and the filter in question will be shutdown. Damage to the fibre can be removed and repaired in-house by a procedure known as 'pinning'. EPS advised that this intervention is carried out when the PDT is >15 kPa. On the day of the audit, the PDT for filter no. 3 was 5.34 kPa. The transmembrane pressure (TMP) of each unit i.e. the pressure gradient across the membrane, is continuously recorded and trended. Any upward trend indicates fouling of the membrane. Resistance and flow are also measured across each filter unit.

Each filter unit is backwashed every 30 minutes for a duration of approximately 6 minutes. A chemical clean in place (CIP) is performed once per week to remove any biological growth that cannot be removed by backwashing. The CIP can also be initiated manually based on elevated TMP or resistance. Typically the CIP regime is sodium hypochlorite, followed by sulphuric acid. Once the CIP is complete the chemicals are neutralised prior to discharge to the washwater tank. The type of neutralising chemicals required to be dosed depend on the pH and ORP of the water.

The microfiltration system is intended as a *Cryptosporidium* barrier. Turbidity is not continuously monitored at each filter outlet. While there is a continuous turbidity monitor on the combined treated water, there is a high high turbidity alarm of 1 NTU and a high turbidity alarm of 0.9 NTU which do not provide an adequate protozoal barrier when applying the log credit approach as set out in the EPA's Water Treatment Manual: Filtration (2020). The online monitor read 0.017 NTU at the audit.

5. Disinfection

		Answer
5.1	Is the chlorine dosed appropriately?	Yes

Comment

Disinfection of the Ennis public water supply is by chlorination using 14% sodium hypochlorite. Duty and standby chlorine dosing pumps are in place with automatic switchover in the event of pump failure. The chlorine dosing point is located on the rising main leading to the reservoir and is flow proportional with residual trim. The residual trim is based on chlorine monitoring post reservoir, which was reading 0.48mg/l during the audit and is linked to SCADA. The residual chlorine target leaving the plant currently aims for 0.4 mg/l.

The alarm set points are 0.25mg/l (low) 0.2mg/l (low low) and 0.53mg/l (high) 0.55mg/l (high high). There is a second chlorine monitor prior to the reservoir but this is not linked to SCADA. There is no automatic shut-off in the event of low or high chlorine. EPS have installed an oxidation reduction potential (ORP) monitor prior to the reservoir, which alarms if the chlorine levels are low. The chlorine pumps then automatically ramp up and pump for 1 hour.

All operators on duty get a remote access alarm via text if low chlorine 24 hours/day. In the event that an alarm is not acknowledged, the alarm will dial out to the plant manager after 10 minutes. An alarm response procedure was provided to the auditor by Irish Water following the audit.

		Answer
5.2	Does the trend in chlorine residual at the treatment plant indicate adequate and stable levels of disinfection?	No

Comment

The contact time (Ct) calculation provided indicates an adequate chlorine contact time of 130.05 mg.min/l at the plant in accordance with the EPA's Water Treatment Manual: Disinfection. The minimum residual chlorine concentration required at the Ct validation point is 0.4 mg/l. The chlorine trend data provided by Irish Water indicates this is not being maintained at all times. The low chlorine alarm setpoints are set too low to notify the plant operator of this issue.

		Answer
5.3	Is there a chlorine residual ≥0.1 mg/l throughout the network?	Yes

Comment

Records show satisfactory residual chlorine levels in the network.

6. Management and Control

		Answer
6.1	Is the plant suitably managed and controlled to maintain the designed log credit on each treatment stage?	No

Comment

Irish Water stated that the treatment processes at the Ennis WTP provide a 2.5 log treatment credit. However, there was no information on the log credits assigned to the microfiltration unit or proof of manufacturers validation for protozoal removal on the day of the audit. The auditors noted that under Irish Water's *Cryptosporidium* Monitoring Rationale for Public Water Supplies, the recirculation back to the headwork's means there is a 5 log protozoal requirement at Ennis WTP, thereby indicating that there is a log deficit of -2.5 at the plant.

7. Drinking Water Quality

		Answer
7.1	Is Cryptosporidium monitoring being carried out in accordance with Irish Water's 'Rationale for Determining the Frequency of Cryptosporidium Monitoring in Public Water Supplies'?	No

Comment

There is a monthly *Cryptosporidium* monitoring programme in place at the Ennis WTP and no detections have been notified to the EPA. However the frequency of monitoring for *Cryptosporidium* should be reviewed in light of the recirculation of supernatant back to the head of the plant. This review should be carried out in accordance with Irish Water's Rationale for Determining the Frequency of *Cryptosporidium* Monitoring in Public Water Supplies and include consultation with the HSE.

8. Site Specific Issues

		Answer
8.1	Is the information reported by Irish Water on the EPA EDEN portal correct?	No

Comment

The supply volume and population reported by Irish Water on the EPA EDEN portal needs to be updated.

		Answer
8.2	Is there a procedure for the management of supernatant recirculation at the plant?	No

Comment

Water from the neutralisation tank, microfiltration backwash cycle, sludge DAF scrapings and supernatant from the plate press dewatering units is sent to a washwater tank. The polyelectrolyte is added and then the water is sent to the PFT. The supernatant from the PFT is then pumped to the head of the works, prior to the flocculation tanks, DAF and microfiltration unit.

There is a turbidity monitor on the supernatant return water. EPS stated that the alarm on the online supernatant turbidity monitor is set at 30 NTU and the monitor read 2.8 NTU on the day of the audit. The supernatant is also monitored for colour on a daily basis (Monday to Friday).

The PFT is dipped daily with a 'sludge judge'. This indicates the level of sludge in the PFT. EPS advised that if the sludge level in the PFT is over 2m then it can be diverted to the sludge holding tank.

The recirculation of supernatant to the head of the works has the potential to recirculate contaminants at the Ennis WTP. There was no procedure submitted in support of the audit for the management of supernatant recirculation at the plant to demonstrate how this element of the process has been included in the calculation of the WTP protozoal log treatment requirement.

Recommendations

Subject	Ennis Audit [15/06/2021]	**Due Date**	02/08/2021
Action Text	**Recommendations:** 1. Irish Water should identify how the protozoal compliance log treatment deficit is to be addressed at the Ennis water treatment plant. 2. Irish Water should consult with the HSE in relation to the plants inability to verify the *Cryptosporidium* barrier. 3. Irish Water should review and implement turbidity alarms and shutdowns on the microfiltration unit to ensure that the plant operates in accordance with the EPA's Water Treatment Manual: Filtration. 4. Irish Water should monitor the supply in accordance with the IW Rationale for Monitoring *Cryptosporidium* in Public Water Supplies. 5. Irish Water should submit a procedure for the management of supernatant recirculation at the plant setting out how the log credits assigned to the treatment process are protected. The procedure should include the volume being recirculated, the rationale for turbidity alarm settings and actions to be taken in response to alarms in order to protect the integrity of the treatment process. 6. Irish Water should review the chlorine alarm settings to ensure that an alarm is triggered in the event of water being inadequately disinfected. This review should include consideration of the maintenance of effective contact time and the minimum residual chlorine concentration required at the Ct validation point. 7. Irish Water should update information on this supply on EDEN to reflect current status (population served and volume of treated water it supplies). **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 02/08/2021 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 DW20210045 in any future correspondence in relation to this Report.		