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	Macroom
Organisation	Irish Water
Scheme Code	0500PUB2307
County	Cork
Site Visit Reference No.	SV22960

Report Detail

Issue Date	26/11/2021
Prepared By	Criona Doyle

Site Visit Detail

Date Of Inspection	18/11/2021	**Announced**	Yes
Time In	11:00	**Time Out**	12:25
EPA Inspector(s) **Additional Visitors**	Criona Doyle Regina Campbell		
Company Personnel	Cork County Council (acting under service level agreement to Irish Water): Jerry Creedon; Gordon O Donovan; Mary Hickey & Ray O Connell. Irish Water: Neil Smyth & Tommy Roche.		

Summary of Key Findings

(1) A BWN (Boil Water Notice) was placed on the Macroom Public Water Supply on 20/10/21. The audit found that there were issues with the operation of the DAFF (Dissolved Air Flotation Filter) for a significant period between 08/10/21 and 19/10/21 prior to the placing of the BWN. Issues with the accuracy and reliability of operational monitoring results for turbidity and aluminium at the treatment plant make it difficult to assess the full impact of the incident on the final treated water quality but the chlorine trends indicate disinfection was adequate between 08/10/21 and 19/10/21.

(2) The current turbidity monitors on Filter 1 and Filter 2 are being affected by air bubbles from the DAFF saturator and trends are not considered to be accurate. In the absence of reliable turbidity trends and appropriate alarm set points it is not possible to verify that the *Cryptosporidium* barrier is being maintained at all times. Cork County Council stated the installation of suitable turbidity monitors to verify barrier performance will be completed by the end of January 2022. Monthly monitoring for *Cryptosporidium* in the final water will take place until the *Cryptosporidium* barrier can be verified. Alarm set points and inhibits will also be required in accordance with the log turbidity performance criteria as set out in the EPA Water Treatment Manual: Filtration to verify the *Cryptosporidium* barrier.

(3) The residual chlorine monitor with alarm is located on the inlet to the reservoir before contact time is being achieved. There is no appropriate alarm set point at the outlet from the reservoir to validate that contact time is being maintained at all times. There is also no automatic switchover of the duty and standby chlorine dosing pumps in place at the plant. The disinfection system at the Macroom treatment plant is due to be upgraded under the Irish Water Disinfection Programme in 2022.

(4) The audit found that there were significant shortcomings in the operation and management of this plant prior to the placing of the BWN. These issues include lack of accurate turbidity monitors on filters, lack of trended turbidity data on final water and delays in reporting of operational parametric failures to the EPA.

Introduction

The Macroom public water supply serves a population of 4,148 and produces on average 1,500m3/d of treated water. Raw water is abstracted from the Sullane River. Treatment includes coagulation, flocculation, clarification, filtration, disinfection and fluoridation. Clarification is undertaken in 2 no. dissolved air flotation chambers which have in built rapid gravity filters (DAFF).

The audit was undertaken at the Macroom water treatment plant to assess the operation and management of the water treatment plant and incident response following the notification of the exceedance of the aluminium parametric value in a sample taken on 12/10/21, following the failure of the DAFF saturation pump, and the subsequent placing of a Boil Water Notice (BWN) on the 20/10/21. At the time of issue of this audit report the BWN remains in place.

Supply Zones Areas Inspected

The audit consisted of a virtual audit only via zoom.

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	

Incident: The sequence of events surrounding the incident is as follows:

- 08/10/21 The duty recycling pump in the DAFF was replaced by the standby pump in response to issues with the air saturation. The standby pump did not have the capacity to create a sufficient air water mix to raise the floc. 11/10/21 Cork County Council (CCC) initiated procurement of a replacement pump. Between 08/10/21 and 16/10/21 the standby pump continued to underperform resulting in inadequate colour removal. Initially one DAFF was shutdown to allow the pump to operate at a reduced rate while a new pump was being procured.
- On 13/10/21 the EPA received a notification from Irish Water that 18 no. complaints had been received from consumers of the Macroom public water supply in relation to discoloured water. On 14/10/21 Irish Water notified the EPA of an aluminium exceedance (207 ug/l) at the Macroom water treatment plant (WTP) in a final water sample taken on the 12/10/21.
- On the weekend of 16/10/21 and 17/10/21 the standby pump failed. A number of shutdowns took place on 17/10/21, 18/10/21 and 19/10/21 while further attempts were made to fix the standby pump but these failed. By 20/10/21 the water level in the reservoir was too low to attempt any further repairs and the supply was put on a BWN following consultation with the HSE.

The issue with the DAFF persisted from 08/10/21 to 19/10/21. CCC outlined that in the days leading up to 13/10/21 there had been an issue with colour due to the under performance of the standby pump but that the chlorine levels had remained compliant at all times. Chlorine trend data and monitoring of chlorine residuals in the network confirmed that an increase in chlorine demand had been responded to by CCC by increasing the chlorine dose rate at the treatment plant on the 13/10/21.

CCC stated there have been issues with the continuous online turbidity monitors in filter 1 and filter 2 since they were originally installed, due to interference from dissolved oxygen, which skews the turbidity trends upwards. There was also an issue with trending of the final water turbidity monitor resulting in no data being recorded from this monitor prior to 19/10/21. There is no reliable and accurate turbidity trend data to assist with an assessment of the filter performance during the incident between the 08/10/21 to 19/10/21 or to assess the ongoing performance of the filters and this is very unsatisfactory. The trend data is discussed further under the filtration section of this report below (Question 3.2).

Subsequent to the audit the operational turbidity monitoring data from the daily plant records for the period of 09/10/21 to 19/10/21 was submitted to the EPA on 22/11/21. This data comprises of readings manually noted from the final water turbidity monitor at various times during the day. The data indicated the final water turbidity was > 0.3 NTU between the 09/10/21 to 19/10/21 with turbidity > 1 NTU (regulatory limit) on 16/10/21, 17/10/21, 18/10/21 and 19/10/21. These turbidity exceedances, which were prior to the BWN being put in place, are above the parametric value of 1 NTU and were not notified to the EPA.

At the audit CCC referred to an investigative aluminium sample result of 389 ug/l from a sample taken on 11/10/21 which had not been notified to the EPA. All parametric failures prior to the placing of the BWN should be notified to the EPA including the results of any investigative and operational monitoring.

During the investigation of the incident CCC identified an issue with the reagents being used on site up to 18/10/21 for the testing of aluminium in operational samples. The reagents were in date but have been identified to be defective with the aluminium concentrations being under reported. The manufacture has been contacted in relation to the issue. No issues have been identified by CCC with reagents at any other treatment plants.

Issues with the accuracy and reliability of operational monitoring for turbidity and aluminium at the treatment plant make it difficult to assess the full impact of the incident on the final treated water quality but the chlorine trends indicate adequate disinfection was maintained.

Remedial Works: A new recycling pump was commissioned on 04/11/21. On 09/11/21 a failure of the backwash valve resulted in damage to the mechanical seals on the pump and new pumps were again installed on 16/11/21. On the day of the audit process proving was underway and was expected to continue for several more days. The criteria agreed between Irish Water, CCC and the HSE for the lifting of the BWN are: 3 days with final water turbidity < 0.5 NTU, 2 clear bacteriological samples and 1 clear *Cryptosporidium* sample. The BWN was still in place when this audit report was issued.

2. Coagulation Clarification Flocculation (CFC) Stage

		Answer
2.1	Are the CFC processes appropriately controlled?	Yes

Comment

Duty / standby pumps are provided for dosing of the coagulant (poly aluminium chlorine PAC) and the coagulant aid (polyelectrolyte). There is automatic switchover of the dosing pumps from duty to standby if the duty pump fails. Routine switch over of the pumps between duty / standby takes place every 7 days.

The coagulant dose rate is determined based on the daily jar tests and the streaming current monitor. On the day of the audit the repairs to the DAFF recycling pump had been completed and process proving was taking place.

3. Filtration

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

Comment

Both DAFF units contain in-built rapid gravity filters. The filter media was last replaced in November 2016 (DAFF Unit No. 2) and January 2017 (DAFF Unit No.1). The current media depth could not be confirmed. The sand depth in the filters was last assessed in 2019 when the sand depth was 750mm in Filter 1 and 710mm in Filter 2. The media depth was less than the 1m minimum recommended in the EPA Water Treatment Manual: Filtration when last measured.

Backwashing is normally automatically triggered on a timed basis daily. This results in both filters being washed every 24 hours. There is no backwashing based on turbidity levels. Backwashing can also be triggered on head loss. In response to the recent issues with the operation of the DAFF backwashing was being instigated manually twice per day until process proving of the new recycling pumps is completed. Visual checks of the condition of the filters are normally done weekly however in response to the recent incident checks are being done every few days.

There is no run to waste after backwashing but there is a delayed start with a 5 minutes delay before the raw water pumps kick in followed by an additional delay after the raw water pump shuts off to allow the saturation vessel to sit idle for a further 10 minutes to ensure coagulation is working prior to filtration commencing.

		Answer
3.2	Does monitoring indicate that the filters are operating effectively?	No

Comment

There are continuous online turbidity monitors on each individual filter (Filter 1 and Filter 2). However, Cork County Council report that there have been issues with these turbidity monitors since they were originally installed, due to interference from dissolved oxygen, which skews the trends upwards. The trend data submitted by Irish Water (08/11/21) for the period 10/10/21 to 20/10/21 indicated an average turbidity of 0.45 NTU for Filter 1 and 0.39 NTU for Filter 2 with a maximum turbidity of 1.00 NTU seen in both filters. The trend submitted for the period 16/10/21 to 12/11/21 indicates turbidity consistently > 0.3 NTU and up to 2.5 NTU in both filters. Debubbling devices have been installed but did not resolve the issue. The proposed remedial action is to install new tappings to ensure the sampling point is located where the pipe is full to avoid air interference. This will require changes to the main pipework and is expected to be completed by end of January 2022.

In January 2020 a turbidity monitor was installed on the combined final filtered water on the outlet from the clear water tank. There was an issue with trending of this monitor which was resolved on 22/10/21. The turbidity trend data for the final filtered water from the SCADA for the period 22/10/21 to 12/11/21 indicates average turbidity of 0.98 NTU and maximum turbidity of 1.99 NTU. The Macroom public water supply was on a boil water notice at this time.

While the issue with the final water turbidity trend was ongoing a visual check of the turbidity level on the monitor was being recorded in the daily log by the caretaker. Subsequent to the audit on 22/11/21 Irish Water submitted daily records of the final water turbidity for the period 09/10/21 to 19/10/21 which indicated turbidity ranged from 0.282 NTU to 2.96 NTU for the period prior to the placing of the boil water notice on 20/10/21. The available operational data for the period from 16/10/21 to 19/10/21 indicate the turbidity in the final water was above the regulatory limit of 1 NTU. These exceedances have not been notified to the EPA.

A cascade system is in place for responding to turbidity alarms which includes the caretaker, cover caretaker and engineer. Cork County Council outlined that following the lifting of the boil water notice the final combined turbidity alarm setpoints will be set to alarm at 0.5 NTU with automatic plant shutdown at 0.7 NTU. These alarm set points do not meet the turbidity performance criteria for rapid gravity filters as set out in the EPA Water Treatment Manual: Filtration for verification of the *Cryptosporidium* barrier.

At the audit Cork County Council confirmed that they have informed the HSE that the *Cryptosporidium* barrier cannot be verified and that the HSE have recommended that monthly monitoring for *Cryptosporidium* should continue until the barrier can be verified.

4. Disinfection

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

Comment

The residual chlorine trend for the monitor located on the inlet to the reservoir was provided in advance of the audit for the period 16/10/21 to 12/11/21. The trend shows regular dips which are reported to be related to periods of no flow to the reservoir. The target level being aimed for on the inlet to the reservoir is > 1 mg/l to maintain residual chlorine levels > 0.1 mg/l at the extremities of the network. Chlorine contact time is achieved in the reservoir, however there is no chlorine alarm at the outlet of the reservoir to verify contact time is being achieved.

The residual chlorine low level alarm set points for the inlet to the reservoir are 0.5 mg/l low alarm level and 0.5 mg/l automatic plant shutdown. There is no high level chlorine alarm level at the WTP.

		Answer
4.2	Is the chlorine dosed appropriately?	No

Comment

Primary disinfection is via chlorination using 15% sodium hyprochlorite. Dosing is flow proportional but is not linked to the residual chlorine monitor. There are duty / standby dosing pumps which are manually switched over in the event of breakdown of the duty pump. The pumps are routinely switched over between duty / standby every 3 days. The Macroom WTP has not been upgraded under the Irish Water Disinfection Programme to date. It was outlined by Irish Water at the audit that the site is to be prioritised in the list of sites to be upgraded under the disinfection programme in 2022.

		Answer
4.3	Is the residual chlorine monitored at a suitable sample location after contact time has been completed?	No

Comment

The chlorine contact time calculation indicated a target contact time of 35.10mg.min/l for the WTP with a total effective contact time of 37.25 mg.min/l being achieved. The contact time calculation is based on a minimum free chlorine concentration of 0.75mg/l. There is a residual chlorine monitor on the outlet from reservoir but the data from the monitor is not being trended and there is no residual chlorine alarm on the reservoir outlet to validate that contact time is being maintained at all times.

		Answer
4.4	Is there a suitable monitoring frequency for residual chlorine in the network with records available?	Yes

Comment

The records submitted prior to the audit indicated that residual chlorine levels in the network are being monitored several times per week at locations at the extremities of the network.

5. Reservoirs and Distribution Networks

		Answer
5.1	Are reservoirs adequately inspected and maintained?	Yes
	Comment	
	Cleaning of the reservoir was completed on 22/09/21. It is proposed that the network will be flushed once the treatment process at the plant has stabilised and the boil water notice is lifted.	

6. Management and Control

		Answer
6.1	Has the protozoal compliance log treatment requirement been identified for the water treatment plant?	No

Comment

A site survey has not yet been completed therefore the calculated protozoal log removal requirement for the Macroom public water supply cannot be confirmed at present. Irish Water outlined that the site survey is to be undertaken as part of the Drinking Water Safety Plan but the expected date for completion was not known on the day of the audit.

		Answer
6.2	Is there a documented alarm response procedure?	Yes

Comment

Cork County Council outlined that staff have completed training (Level 5 Plant Operations for Water Treatment) and undergo refresher training every 5 years. Irish Water have provided water quality refresher training to caretakers in the last month in relation to incident and alarm response procedures. Cork County Council confirmed a copy of the Irish Water Incident Guidance Chart is displayed at the plant office. The chart outlines who is to be contacted in the event of an incident and provides contact details for the relevant personnel.

A copy of the Cork County Council Operational Manual for Macroom WTP was provided in advance of the audit. It outlines the checks required on each stage of the treatment process and outlines the alarms and alarm responses.

7. Drinking Water Quality

		Answer
7.1	Have relevant failures to comply with the requirements of the European Union (Drinking Water) Regulations 2014, as amended, been notified to the EPA?	No

Comment

All parametric failures prior to the placing of the BWN should be notified to the EPA this includes the results of any investigative and operational monitoring. The audit indicated turbidity exceedances above the 1 NTU (regulatory limit) on 16/10/21, 17/10/21, 18/10/21 and 19/10/21 and an investigative aluminium result of 389 ug/l (sample date 11/10/21) which have not been notified to the EPA to date.

Recommendations

Subject	Macroom Audit 2021	Due Date	29/12/2021
Action Text	**Recommendations** **Irish Water is responsible for ensuring a safe and secure supply of drinking water. To address these issues, Irish Water should implement the following recommendations without delay.** 1. Irish Water should inform the HSE that the *Cryptosporidium* barrier cannot be verified until the appropriate turbidity alarms and shutdowns have been put in place on the filtered and final water to ensure that the plant operates in accordance with the turbidity performance criteria outlined in the EPA Water Treatment Manual: Filtration. 2. Irish Water should keep the EPA informed of any changes to the HSE advice. 3. Irish Water should ensure the monitoring programme for *Cryptosporidium* in the final water has regard to the protozoal compliance deficit at Macroom public water supply. 4. Irish Water should confirm the log treatment requirement at the Macroom WTP and confirm how any log treatment deficit will be addressed. 5. Irish Water should (i) install turbidity alarms and inhibits in accordance with the log turbidity performance criteria as set out in the EPA Water Treatment Manual: Filtration; (ii) confirm the turbidity monitors in filter 1 and filter 2 are calibrated and installed at a suitable location to provide accurate and reliable results and submit 1 month of turbidity trend data to demonstrate this issue has been resolved; (iii) examine the feasibility of installing a run to waste after backwashing; (iv) confirm the current depth of the filter media and (v) ensure that the depth of the filter media is increased to the 1m minimum where feasible as per the EPA Water Treatment Manual; Filtration. 6. Irish Water should undertake the following in relation to disinfection (i) install an automatic shutdown of the plant if the final water reaches a critically high or low chlorine setpoint to ensure adequately disinfected water is being supplied to consumers; (ii) provide confirmation of the installation of an appropriate alarm set point at the outlet from the reservoir to validate that contact time is being maintained at all times. The alarm level should reflect the minimum free chlorine concentration required at the Ct validation point as outlined in the site specific contact time calculation. 7. Irish Water and Cork County Council should ensure prompt and timely consultation with the HSE and notification to the EPA of incidents and all parametric failures. **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 29/12/21 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 Compliance Plan DW20210046 in any future correspondence in relation to this Report.		