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	Foynes/Shannon Estuary PWS
Organisation	Irish Water
Scheme Code	1900PUB1027
County	Limerick
Site Visit Reference No.	SV22888

Report Detail

Issue Date	19/11/2021
Prepared By	Orla Harrington

Site Visit Detail

Date Of Inspection	20/10/2021	**Announced**	Yes
Time In	11:00	**Time Out**	15:00
EPA Inspector(s)	Orla Harrington		
Additional Visitors	Regina Campbell * * attended pre-site meeting 19/10/21 only		
Company Personnel	Irish Water: Deirdre O'Loughlin**, Duane O'Brien*, Derek O'Toole**, Tommy Roche* Limerick City and County Council (acting under service level agreement to Irish Water): Anne Peters*, Declan O'Connor**, Kieran Crowley**, Claire Linehan*, Peter McEvoy* *attended pre-site meeting 19/10/21 **attended pre-site meeting 19/10/21 and site visit 20/10/21.		

Summary of Key Findings

1. The Foynes/Shannon Estuary public water supply (PWS) treats water from the River Deel and supplies surrounding areas including a major industry Aughinish Alumina. A Boil Water Notice (BWN) was placed on Aughinish Alumina on 5/10/21, affecting 500 consumers, following detection of low residual chlorine on-site in water storage tanks serving the northern extremities of the Aughinish Alumina plant. The incident was suitably escalated and managed in order to protect public health. A review of plant operations indicated that the water treatment plant (WTP) was operating normally during the time leading up to the low residual chlorine detection and that the low chlorine level at the industry was probably caused by low water usage. The BWN remains in place at the time of issue of this audit report.
2. Irish Water have indicated that they will consult with management at the Aughinish Alumina plant under Regulation 6 of the *Drinking Water Regulations 2014, as amended*, to inform them of their responsibilities relating to water provided as part of a commercial activity.
3. There is no automatic switchover between the duty and standby chlorine dosing pumps at the WTP and no residual chlorine monitor to verify that contact time has been achieved at the plant. This means that the plant does not meet the minimum EPA Disinfection Criteria as set out in EPA Advice Note 3: E.coli in Drinking Water. The auditor noted that the site has been assessed by Irish Water under the Limerick Disinfection Programme and works carried out included the installation of verification chlorine monitors to validate contact time in the network and at the plant. Irish Water advised that the monitors will be commissioned in Quarter 4 2021.
4. There are no turbidity alarms or inhibits on the individual filters. This means that the filters at Foynes/Shannon Estuary WTP are not being operated in accordance with the 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.
5. Remedial works are required on the rapid gravity filters at the Foynes/Shannon Estuary WTP to ensure adequate depth of filter media is provided. Irish Water should ensure this work takes place without delay as the minimum recommended depth of filter media, as per EPA guidance, is not currently being achieved.
6. The Irish Water Incident Communication Response Chart was displayed on the wall of the operations rooms at the Foynes/Shannon Estuary WTP outlining who to contact in the event of an incident and the alarm setpoints. To compliment the Incident Communication Response Chart, a detailed documented procedure should be in place to deal with specific incidents.

Introduction

The Foynes/Shannon Estuary water treatment plant is located between the towns of Askeaton and Foynes in Co. Limerick and supplies water to approximately 7,242 people. The plant currently produces between 20,000 - 23,000m3/day and is operating within its design capacity. Raw water is abstracted from the River Deel and pumped 5km to the water treatment plant. Treatment consists of screening, coagulation using aluminum sulphate with polyelectrolyte, clarification, rapid gravity filtration and chlorination. Treated water is supplied to industry at a rate of 650m3/hr and the balance going to the networks and a reservoir prior to distribution. The site is manned 24 hours a day, 7 days a week.

The Foynes/Shannon Estuary WTP is one of the largest 25 drinking water supplies in Ireland and this audit was undertaken as part of the EPA's assessment of these large supplies, as well as in response to the issuing of a Boil Water Notice on 5th October 2021.

Supply Zones Areas Inspected

The auditor inspected the River Deel and the treatment processes at Foynes/Shannon Estuary water treatment plant.

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

1. On Friday 01/10/21 contractors working on the Foynes/Shannon Estuary PWS tapped the 100mm Morgan's Line and found low residual chlorine levels at this portion of the distribution network, which serves approximately 20 properties. Investigative follow up monitoring on 02/10/21 included monitoring residual chlorine at other parts of the network. Chlorine levels were found to be less than the recommended minimum of 0.1mg/l residual chlorine at the northern extremities of Aughinish Alumina, which is served on-site by two water storage tanks. The issue was immediately escalated by Limerick City and County Council to senior management at Aughinish Alumina and Limerick City and County Council.

2. Following consultation between Irish Water and the HSE on the 04/10/21 regarding risk to public health, a BWN was placed on the supply on 05/10/21. The Boil Water Notice was placed on all customers of Aughinish Alumina, served by the Foynes / Shannon Estuary WTP. At the audit, Irish Water advised that they would consult with management at Aughinish Alumina under Regulation 6 of the *Drinking Water Regulations 2014, as amended,* to inform them of their responsibilities under Regulation 6 relating to water provided as part of a commercial activity. The BWN remains in place at the time of issue of this audit report.

3. Due to an IT technical issue, the EPA were notified by Irish Water of the Boil Water Notice on the 11/10/21. The delay in notifying the EPA of the BWN is unacceptable and prompt notification of incidents to the EPA must be ensured by Irish Water.

4. Corrective action taken on the Morgan's Line includes an ongoing programme of network scouring, which has been successful in restoring residual chlorine levels to >0.1mg/l. Residual chlorine monitoring results were provided, subsequent to the audit, for dates between 6/10/21 and 3/11/21 which confirm this to be the case. Limerick City and County Council stated that an automatic scour valve is to be installed towards the eastern end of Morgan's line within the next few weeks and that residual chlorine will continue to be monitored every second day.

2. Coagulation Clarification Flocculation (CFC) Stage

		Answer
2.1	Are the CFC processes appropriately controlled?	No

Comment

The raw water is dosed with 8% liquid aluminum sulphate (coagulant) by duty and standby dosing pumps, which are rotated on a daily basis. The coagulation process is manually controlled, and the alum and poly dosing rates do not adjust automatically in responses to changes in raw water quality. Daily jar testing is used to determine the optimum coagulant dose. All dose rates are recorded in the daily log book, which was inspected on the day of the audit. Limerick City and County Council advised that when raw water quality deteriorates, flow through the plant is reduced to allow more time for treatment at each stage of the process.

There is an online static mixer in place after the alum is added to aid mixing. There is an injection point for pH correction upstream of the static mixer, however it is not used or maintained for coagulation. Limerick City and County Council advised that reinstating pH correction at the plant would be a significant cost saving measure, reducing the amount of alum currently being used (approximately 100 - 170mg/l). The pH of the raw water on the day of the audit was 7.25, however this can vary significantly according to Limerick City and County Council due to the flashy nature of the river.

Polyelectrolyte is added to the contact tank to assist flocculation and from there water enters a splitter chamber where there is equal flow to four flat bottomed sedimentation tanks. The sedimentation tanks have a turbidity monitor, which is alarmed at 1.8 NTU. On the day of the audit, the settled water turbidity was 0.2 NTU. There is no pH monitor between the contact tank and sedimentation tanks to ensure optimum pH is maintained for coagulation. Poly pumps are rotated on a weekly basis. There is no automatic switchover or alarm in the event of pump failure, however operators can see on SCADA if the pumps are not operating correctly and will then manually replace or switch pumps as required. The plant is manned 24 hours a day, 7 days a week.

Sludge bleeds take place every 13 mins for 90 seconds. This can be manually adjusted by the operator depending on the raw water quality. The sludge discharges to a sludge holding tank onsite. Limerick City and County Council advised that all liquid sludge is sent to the Aughinish Alumina Plant for further treatment. The sludge holding tank is cleaned once per year and all sludge sent to Bunlicky waste water treatment plant, Co. Limerick.

3. Filtration

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

Comment

There are four rapid gravity filters at the plant. A filter assessment was carried out at the plant in May 2021 which advised that the filter media depth was between 860 and 880mm, which is less than the 1000mm depth recommended in the EPA Water Treatment Manual: Filtration (2020). During the audit, Limerick City and County Council could not confirm when the sand media was last fully replenished. However, Limerick City and County Council stated that there is a plan to address this in the short term.

The filters are backwashed based on time (every 72 hours) or head loss, whichever is first, irrespective of turbidity. There is no run to waste facility after backwashing of filters. The filters are brought straight back into service.

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

Comment

Continuous monitoring of turbidity takes place on the final treated water at the outlet from the clear water tank and the current turbidity alarm set points are linked to this monitoring location. There is an alarm at 0.18 NTU and automatic shutdown of the supply at 0.2 NTU. The final turbidity monitor was reading 0.02 NTU on the day of the audit. Turbidity trends were submitted prior to the audit for the period 17/09/21 to 11/10/21 and indicated that turbidity is generally between 0.03 NTU and 0.20 NTU.

Turbidity monitors are installed on each of the individual rapid gravity filters. However there are no turbidity alarm set points or shutdowns in place on the individual filters. On the day of the audit, trend data from the continuous turbidity monitor for Filter No. 3 indicated some spiking with turbidity close to 0.36 NTU between 9.20am and 10am, which was attributed to bringing the filter back into service after backwashing as there is no run to waste facility. On the day of the audit the monitors indicated the following turbidity readings: Filter No. 1 0.04 NTU; Filter No. 2 0.02 NTU; Filter No. 3 0.06 NTU and Filter No 4: 0.03 NTU.

The current alarm and shutdown set points (0.18 NTU / 0.2 NTU) which are just on the final water do not meet the criteria to demonstrate an effective protozoal barrier is being maintained using the log credit approach as set out in the EPA's Water Treatment Manual: Filtration.

4. Disinfection

		Answer
4.1	Is the disinfection system verified using monitors and alarms, with trended data recorded and accessible?	No

Comment

The combined flow from the rapid gravity filters is dosed with 14% sodium hypochlorite prior to entering a 499.5m3 clear water tank (unbaffled) before being supplied to the networks and major industry. This water also feeds the Foynes reservoir which has a capacity of 22,730m3.

The chlorine target is between 0.7 and 0.9mg/l at the outlet of the clear water tank and the chlorine level was reading 0.96mg/l on the day of the audit. There is a low chlorine alarm of 0.4mg/l and plant shutdown is set at 0.3mg/l, with a 10 minute time delay. The low chlorine alarm and shutdown setpoints are below the target of 0.7mg/l chlorine residual concentration in the final water. There are no high chlorine alarm setpoints or shutdowns at this location. A continuous chlorine residual trend, measured from the outlet of the clear water tank from 14/10/21 to 20/10/21, was reviewed on the day of the audit and trended between 0.90mg/l and 1mg/l which is satisfactory.

Irish Water advised that the outflow from the WTP is so large that the clear water storage tank on-site cannot achieve adequate contact time (Ct) before leaving the plant. The residual chlorine monitor at the WTP is located before contact time is achieved. Ct is only achieved by including the pipework beyond the site boundary, before the first connection. Under the Limerick Disinfection Programme, Irish Water have installed verification chlorine monitors to validate Ct on the network and at the WTP to ensure real time effective Ct will be tracked and trended on SCADA. Irish Water advised that these monitors will be commissioned in Q4 2021.

There are chlorine booster stations and monitors on the network. Limerick City and County Council advised that generally the chlorine residual levels range between 0.5 and 1.5mg/l at these locations and if there is a deviation from this range, a text alert is sent to the plant caretaker. A continuous chlorine residual trend, measured from the Foynes - Dernish location on the network, from 13/10/21 to 20/10/21 trended between 0.5 and 1.18mg/l. Limerick City and County Council stated that plant operators carry out daily checks on the network.

		Answer
4.2	Are monitors and alarms operational via dial out and being responded to with a suitable cascade system in place?	Yes

Comment

If the chlorine low alarm is triggered, a beacon goes off in the control room of the plant. This plant is manned 24 hours a day, 7 days a week. If the chlorine residual levels deviate on the network, the caretaker on duty receives a text alert. There are three people on the cascade system; caretaker, foreman and engineer. Alarm process flows and contact lists have been developed and provided to plant operators.

		Answer
4.3	Is the chlorine dosed appropriately?	No

Comment

Duty and standby flow proportional chlorine dosing pumps are in operation at the plant, with manual adjustments, based on raw water quality and operator experience. Chlorine dosing should preferably be linked to the residual chlorine monitor such that any changes in the chlorine demand of the treated water can be responded to automatically by the dosing pumps. There is no automatic switchover between duty and standby chlorine dosing pumps in the event of pump failure. Limerick City and County Council stated that works are in progress to automate switchover of the pumps but no timeline for completion was provided. Plant operators can see on SCADA if chemical pumps are not operating correctly and manually replace or switch the pumps.

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

Comment

Currently there is no residual chlorine monitor after Ct at the plant. Ct is only achieved by including the pipework beyond the site boundary, before the first connection. Under the Limerick Disinfection Programme, Irish Water installed verification chlorine monitors to validate Ct on the network and at the plant, allowing real time effective Ct to be tracked and trended on SCADA. Irish Water advised that these monitors will be commissioned in Q4 2021.

		Answer
4.5	Is there adequate chlorine contact time before the first connection?	Yes

Comment

Irish Water advised that the outflow from the WTP is so large that the clear water storage tank on-site cannot achieve adequate Ct before leaving the plant. Ct is only achieved by including the pipework beyond the site boundary, before the first connection. Therefore Irish Water provided calculations of Ct's at different sections of the network each calculation representing a different section of pipeline and combined demonstrates that adequate Ct is being achieved before the first customer is supplied. Ct is achieved in the clear water tank and 200m of pipeline prior to water entering the first consumer on the Morgan's Line, which supplies approximately 20 properties. At a maximum design flow of 4m3/hr the calculated total effective Ct is 32.16 mg.min/l which meets the site specific target Ct of 24.00mg.min/l and is above the minimum World Health Organisation recommendation of 15 mg.min/l.

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

Comment

The records viewed showed that a chlorine residual of >0.1 mg/l is being maintained throughout the network. There are 11 chlorine monitors and booster stations on the network.

5. Reservoirs and Distribution Networks

		Answer
5.1	Are reservoirs adequately inspected and maintained?	No
	Comment	
	Limerick City and County Council stated at the audit that they were unsure as to when the Foynes reservoir was last cleaned or inspected.	

6. Treatment Process Chemicals

		Answer
6.1	Are treatment process chemicals appropriately managed and stored?	No

Comment

There are alum and poly day tanks situated indoors unbunded and an underground bulk storage tank at the plant. A review of chemical storage arrangements at the plant should be undertaken. All chemicals must be stored in bunded areas capable of containing at least 110% of the volume of the chemicals stored therein.

7. Management and Control

		Answer
7.1	Is the water treatment plant resilient enough to cope with significant variations in raw water quality or demand?	No

Comment

The River Deel is the source of the supply. There is online monitoring of ammonia in the raw water, with automatic shutoff of the transfer pumps in the event the ammonia concentration reaches the high alarm level of 0.3mg/l. An alarm beacon in the WTP control room is triggered at 0.28mg/l to notify the plant caretaker and the alarm response operates on a cascade system. In addition there is automatic shutdown of raw water at 1.50mg/l hydrocarbon oil (5 minutes delay). There is also online monitoring of the raw water for turbidity, pH, conductivity and dissolved oxygen. On the day of the audit the following levels were observed in the raw water: pH 7.21; turbidity 5.98 NTU; ammonia 0.073 mg/l and oil 0.88 mg/l.

Limerick City and County Council stated that the WTP has been shutdown more than half a dozen times in the past 12 months due to high ammonia in the raw water. Once the raw water intake shuts down, the plant stops producing water 1 hour later. The Foynes reservoir (capacity 25,000m3) will then supply water to Aughinish Alumina and the surrounding PWS network. The maximum flow from the Foynes reservoir to Aughinish is 660m3/hr. This flow rate can be maintained for 2 hours. After that time, according to Limerick City and County Council, the decreasing water level in the reservoir will gradually decrease the available flow rate to Aughinish.

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

Comment

Irish Water stated at the audit that the protozoal log treatment requirement has been identified for the plant as Log 3.5, however this is awaiting final sign off and has not been confirmed.

		Answer
7.3	Is there a documented alarm response procedure?	No

Comment

There was a copy of the Irish Water Water Incident Communication Response Chart on display on the wall of the control room at the Foynes/Shannon Estuary WTP. The chart outlines who is to be contacted in the event of an incident that is likely to have an effect on the quality of drinking water and provides contact details for relevant personnel. To compliment the Water Incident Communication Response Chart, confirmation that a detailed documented response procedure is also in place is required.

		Answer
7.4	Are suitable alarm settings in place to alert operators to deteriorating water quality and/or the failure of a critical treatment process?	No

Comment

Turbidity monitors are installed on each of the individual rapid gravity filters however there are no turbidity alarms or shutdowns linked to the operation of the individual filters. The final water turbidity monitor is located on the outlet from the clear water tank and does not provide an early warning of deteriorating water quality or the failure of the critical treatment process as an alarm will not be generated until the water has gone through the complete treatment process.

The chlorine target is between 0.7 and 0.9mg/l on the outlet of the clear water tank. The low chlorine alarm (0.4mg/l) is below the target of 0.7mg/l chlorine residual concentration in the final water. There are no high chlorine alarm setpoints or shutdowns at this location.

8. Drinking Water Quality

		Answer
8.1	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 no *Cryptosporidium* monitoring programme in place in the final treated water. This is not acceptable as the plant is not currently being operated in accordance with the log credit approach as set out in the EPA Water Treatment Manual: Filtration and the protozoal barrier cannot be verified.

9. Site Specific Issues

		Answer
9.1	Have the Drinking Water Safety Plan High Risks and Very High Risks been identified for the supply?	No

Comment

Irish Water stated in information provided in support of the audit that the Drinking Water Safety Plan was not available at this time. These risks were requested to be submitted as part of the information requested in advance of the audit but were not provided.

Recommendations

Subject	Foynes/Shannon Estuary Audit Recommendations [20/10/21]	Due Date	20/12/2021

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 (i) ensure that the turbidity alarm and shutdown setpoints at the plant are reviewed and operated in accordance with turbidity performance criteria as per the EPA Treatment Manual: Filtration, in order to demonstrate an effective *Cryptosporidium* barrier at the water treatment plant (ii) consult with the HSE in relation to the plants inability to verify the *Cryptosporidium* barrier at the plant.

2. Irish Water should (i) replace and refurbish the sand media in the rapid gravity filters to a minimum of 1000m in accordance with the EPA Water Treatment Manual: Filtration (ii) investigate the feasibility of installing a run to waste option or slow start after backwashing of the rapid gravity filters.

3. Irish Water should (i) install automatic switchover of the chlorine dosing pumps (ii) install a high level chlorine alarm (iii) ensure low and low low chlorine setpoints are set at an appropriate level to ensure that the target residual chlorine concentration in the final water is met (iv) confirm that there is continuous residual chlorine monitor in place to verify contact time has been achieved and that appropriate alarms are in place at the verification monitors and (v) notify the EPA when the Disinfection Programme is complete and provide an outline of works completed.

4. Irish Water should (i) provide a copy of the Regulation 6 notice sent to Aughinish Alumina, informing them of their responsibilities under Regulation 6 of the Drinking Water Regulations (ii) inform the EPA of any change to HSE advice.

5. Irish Water should install (i) an automatic scour valve on the Morgan's Line and (ii) automatic changeover between the aluminum sulphate and poly dosing pumps.

6. Irish Water should (i) confirm the protozoal log requirement for the plant (ii) explain how any log deficits will be addressed and (iii) carry out monitoring for *Cryptosporidium* in the treated water in accordance with *Irish Water's Rationale for Determining the Frequency of Cryptosporidium in Public Water Supplies*.

7. Irish Water should investigate the feasibility of introducing pH correction prior to coagulation to reduce the need for excessive levels of coagulant.

8. Irish Water should (i) ensure that there is a documented alarm response procedure in place for the Foynes/Shannon Estuary WTP. This procedure should include the actions to be undertaken in response to low, medium and high (priority) alarms (ii) ensure prompt notification of incidents are received by the EPA.

9. Irish Water should submit the Drinking Water Safety Plan high and very high risks identified for the plant and the plans to address these risks.

10. Irish Water should review the chemical storage arrangements in place at the WTP. Chemicals must be stored in bunded areas capable of containing at least 110% of the volume of chemicals stored therein.

11. Irish Water should take actions to improve the resilience of the Foynes/Shannon Estuary supply to ensure that there is sufficient adequately treated water in the event of poor raw water quality conditions.

12. Irish Water should ensure that the Foynes treated water storage reservoir is inspected and cleaned as a matter of priority.

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 20/12/21 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 the Action Reference Number DW20210167 in any future correspondence in relation to this Report.