Drinking Water Audit Report

County:	Fingal	**Date of Audit:**	24th October 2019
Plant visited:	Leixlip Water Treatment Plant	**Date of issue of Audit Report:**	30th October 2019
		File Reference:	DW2019/188
		Auditors:	Aoife Loughnane Michelle Minihan
Audit Criteria:	• The *European Union (Drinking Water) Regulations 2014 (S.I. 122 of 2014), as amended*. • *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 of the EPA's previous audit at Leixlip water treatment plant on 22nd March 2019.		

MAIN FINDINGS

i. **The failure of Irish Water and Fingal County Council to implement the recommendations of the EPA's previous audit of Leixlip water treatment plant in March 2019 is unacceptable. In particular, the failure to install automatic shutdown when critical plant alarms are not responded to, was a contributory factor to the alum dosing incident on 21/10/19 which resulted in a Boil Water Notice for 615,539 consumers supplied by Leixlip water treatment plant.**

ii. **A blockage in the alum (coagulant) dosing line which occurred at Leixlip water treatment plant on 21/10/19 resulted in operational difficulties with the clarification and filtration processes, and gave rise to elevated turbidity levels in treated water. This indicated a significant risk to the safety of the water supply because the treatment barriers for the removal of *Cryptosporidium*/*Giardia* were compromised, and there was a risk of breakthrough of microscopic parasites into the water supply.**

iii. **The incident began at 15:00 hours on Monday 21/10/19 and ended at 05:00 on Tuesday 22/10/19. The plant's SCADA data demonstrates that the water treatment plant has been operating satisfactorily since 05:00 on Tuesday 22/10/19.**

iv. **There was a failure to respond to multiple process alarms that activated at the plant in response to the elevated turbidity levels in clarified and filtered water. Since the incident, Irish Water and Fingal County Council have implemented automatic plant shutdown on high turbidity levels in clarified & filtered water, and if there is a failure to respond to a turbidity alarm within 15 minutes.**

v. **The level of treatment at Leixlip water treatment plant is currently not proportionate to the risk posed by the River Liffey source water. There is currently a 2-log treatment deficit for protozoa, however filter upgrade works are underway to reduce this to a 1-log deficit. The EPA recommends that ultraviolet disinfection is considered by Irish Water as an additional treatment barrier to inactivate *Cryptosporidium/Giardia* at Leixlip water treatment plant, as an ultimate fail-safe system, to ensure the protection of public health.**

1. INTRODUCTION

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 in response to the notification by Irish Water of a mechanical failure at Leixlip water treatment plant which occurred on Monday 21st October 2019. A Boil Water Notice was subsequently issued by Irish Water on Tuesday 22nd October, following consultation with the HSE, in order to protect the health of consumers, due to the risk of breakthrough of *Cryptosporidium/Giardia* into the water supply.

The purpose of the audit was to establish the full facts of the incident and corrective actions taken, to verify the performance of Leixlip water treatment plant, to assist in gathering the information to facilitate the lifting of the Boil Water Notice, and to review the recommendations of the EPA's previous audit of 22nd March 2019 and assess implementation of the actions taken to address those recommendations.

Leixlip water treatment plant is the second largest water treatment plant in Ireland, supplying drinking water to 615,539 consumers in Dublin, Kildare & Meath (33% of the Greater Dublin Area), including key healthcare facilities and commercial users. Raw water is abstracted from the River Liffey. The treatment plant currently produces 195 ML/d, with a sustainable maximum production of 210 ML/d. The plant consists of three zones, identified by the contractor who built each zone:

- Paterson Candy International (PCI) plant (129 ML/d production capacity, construction completed 1974 and upgraded in 1990s);
- Mahon & McPhillips (MMcP) plant (39 ML/d, construction completed 1988); and
- AECOM/New plant (77 ML/d, construction completed 2014).

Treatment consists of screening, coagulation, flocculation, clarification, rapid gravity filtration, chlorination and fluoridation. Treated water from the three zones is combined before leaving the plant and entering the distribution network.

The opening meeting commenced at 14:00 at Leixlip 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:

Andrew Boylan – Compliance Specialist

Aodhnait Ni Chathasaigh – Compliance Analyst

Tselo Tlou – SLA Water Lead

Agnes Wojdouska – Process Optimisation Specialist

John O'Donoghue – Regional Operations Manager

Katherine Walshe – Head of Environmental Regulation

Representing Fingal County Council:

Paul Graham – Plant Manager

Derek Judge – Assistant Plant Manager

Thomas Brennan – Executive Engineer

John Daly – Acting Director of Water Services

Representing the Health Service Executive:

Deirdre Mulholland – Director of Public Health, HSE East

Helena Murray – Specialist in Public Health Medicine & Medical Officer of Health

Ruth McDermott – Specialist in Public Health Medicine

Sarah Midleton – Principal Environmental Health Officer

Bernice Martin – Senior Environmental Health Officer

Representing the Environmental Protection Agency:

Aoife Loughnane – Inspector

Michelle Minihan – Senior 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.	**Alum dosing incident** a. At 11:00 on 22/10/19, Irish Water notified the EPA of an incident involving the mechanical failure of alum dosing at Leixlip water treatment plant on 21/10/19. This incident occurred at the PCI plant. The MMcP plant and New Plant operated as normal throughout the incident. b. The lack of coagulant dosing into the raw water caused operational difficulties with the clarification and filtration processes at the PCI plant. The SCADA data showed that the filtered water turbidity was above 0.2 NTU from 18:16 on 21/10/19 to 05:00 on 22/10/19 (see photo 1), which compromised the performance of the treatment barriers for the removal of *Cryptosporidium/Giardia* during that 11 hour period. c. There was a failure to respond to multiple process alarms that activated in response to this incident. At 18:16, the alarm for high filtered water turbidity (>0.2 NTU) was activated. At 19:07, the alarm for high turbidity in clarified water (>0.6 NTU) was activated. These alarms were displayed on the operators control screen and also sent by SMS to the operator's phone, however the alarms were not acknowledged or responded to. d. The PCI plant was manually shut down at 22:15 on 21/10/19. The highest filter turbidity at that time was 0.62 NTU. A contractor attended the site and carried out a temporary repair to re-establish alum dosing into the raw water. At 23:30 the PCI plant was brought back into operation at a very slow rate to re-establish the sludge blanket. By 05:00 on 22/10/19 the filter turbidities had reduced below 0.2 NTU and the plant was fully operational. e. At 22:50 on 21/10/19, the cause of the incident was identified as a blockage in the common alum dosing line to the PCI plant, which caused the pump to ramp up to maximum capacity. The increased pressure in the alum dosing line caused the pressure relief valve to blow off, and the alum to be discharged to an overflow tank. The alum pump continued to pump at its maximum rate in an attempt to meet the flow requirement. Fingal County Council advised that approximately 50% of the required alum dose was actually reaching the raw water, the other 50% was being dumped to the overflow tank. f. The blockage was made up of small black particles/debris (see photo 2) which Fingal County Council advised originated from the two alum storage tanks which supply both the MMcP & PCI plants. These alum tanks are approximately 25 years old and it appears that the internal lining material of the tanks has deteriorated, creating small flakes which were drawn into the alum dosing pumps and pumped into the dosing line, where they caused a blockage. g. There is automatic switchover of the alum dosing pumps since 2018 in all three zones of the plant, however as the blockage was on the common dosing line downstream of the alum pumps, a switchover would not have made a difference to the outcome of this incident. h. All areas supplied by Leixlip water treatment plant (Ballycoolin, Peamount and Kildare supply lines) were affected by this incident. i. On 22/10/19, Irish Water and Fingal County Council consulted with the HSE regarding the risk to public health associated with the incident. Because the treatment barriers to remove *Cryptosporidium/Giardia* were compromised and water produced during the 11 hour period of the incident was still likely to be in the distribution system for up to 72 hours, the HSE advised Irish Water to issue a Boil Water Notice to all consumers supplied by Leixlip water treatment plant, in order to protect consumers health. j. Following this incident, the plant managers conducted a thorough investigation and have put corrective actions in place to prevent a reoccurrence, including: • new automatic plant shutdowns were installed on 23rd & 24th October, on high turbidity levels in clarified & filtered water, and if turbidity alarms on clarified & filtered water are not responded to within 15 minutes.

	• Identifying the need for cleaning and repair of alum storage tanks to prevent flakes of lining material causing further blockages. Arrangements are being made to drain down each alum tank to allow for inspection, cleaning & repair. This means that only one alum tank is in use for the PCI & MMcP plants, i.e. two weeks alum storage instead of one month. k. Irish Water confirmed that the main reservoirs supplied by Leixlip water treatment plant, Ballycoolin, Peamount and Ballygoran reservoirs, have not been cleaned recently but will now be added to the Reservoir Cleaning Programme.
2.	***Cryptosporidium*/*Giardia* Monitoring Programme** a. Irish Water has a twice weekly monitoring programme for *Cryptosporidium/Giardia* at Leixlip water treatment plant. There is a sampling rig at the plant and samples are taken over an approximately 24 hour period, then they are sent to Dublin City Council's Central Laboratory for analysis. b. There was continuous sampling of treated water for *Cryptosporidium/Giardia* in the critical period before, during and after this incident. By the time of the audit, the result of the 24 hour sample taken from 12:00 on Monday 21st to 12:00 on Tuesday 22nd was received and was satisfactory. At the time of the audit, Irish Water were awaiting the results of the samples taken on Wednesday 23rd and Thursday 24th October. c. The monitoring programme has detected intermittent low levels of *Cryptosporidium/Giardia* in treated water produced at Leixlip water treatment plant, with 10 *Giardia* detections and 1 *Cryptosporidium* detection in treated water so far in 2019. Irish Water has not been able to conclusively identify the cause(s) of these detections. However, the rapid gravity filters at the PCI plant are currently being upgraded by the complete replacement of the sand media & laterals. The filter upgrade works commenced in Q2 2018 and have been subject to delays, with completion now expected in Q2 2020. These upgrade works are being carried out on a phased basis to avoid impacting on production capacity at the plant.
3.	**Level of Treatment at Leixlip Water Treatment Plant** a. Using the protozoal compliance log credit treatment approach, there is currently a 2-log treatment deficit at Leixlip water treatment plant because the River Liffey is in the highest risk category for a surface water source (*S3 lowland catchment, high concentration of cattle, sheep, horses or humans in immediate vicinity or upstream, or waste water treatment outfall upstream*). An S3 source requires 5-log credit treatment, and the current coagulation, flocculation, clarification and filtration processes provide 3-log credits. Once the filter upgrade works are complete, this will provide an additional log credit for enhanced individual filtration. However, there will still be a 1-log deficit. b. Irish Water's monitoring programme has detected intermittent low levels of *Cryptosporidium/Giardia* in treated water produced at Leixlip water treatment plant. c. During the audit, Irish Water stated that they have not yet considered installing ultraviolet disinfection as an additional treatment barrier to *Cryptosporidium/Giardia* at Leixlip water treatment plant.
4.	**Recommendations of EPA's previous audit** a. The EPA carried out an audit of Leixlip water treatment plant on 22nd March 2019 following a mechanical failure of chemical (polyelectrolyte) dosing pumps at the plant. A number of the EPA recommendations from that audit have yet to be implemented by Irish Water. These include: 1. *Irish Water should ensure there is automatic switchover between the duty and standby polyelectrolyte dosing pumps.* This action has not yet been completed. 2. *Irish Water should ensure that plant operators respond immediately to any alarms generated at Leixlip water treatment plant. If an operator fails to respond to an alarm,*

	Irish Water should ensure that the plant automatically shuts down, to prevent inadequately treated water being supplied to consumers. If the plant automatically shuts down outside of normal working hours, Irish Water should assess the feasibility of alerting another operator via an alarm response cascade system. There was a failure to respond to multiple alarms that activated in response to this incident. The automatic plant shutdown arrangement was implemented at the New Plant in April 2019, and was only implemented at the MMcP & PCI plants on 24th October, the day of the audit. The 3rd element of this recommendation has not been implemented. 3. *Irish Water should install pH correction prior to coagulation at Leixlip water treatment plant, to reduce the need to add excessive levels of coagulant to achieve the optimum coagulation pH.* This action has now been further delayed from the expected completion date of Q4 2020 to Q4 2021. *4. Irish water should ensure the filter upgrade works at Leixlip water treatment plant are completed by Q4 2019.* This action has now been further delayed to Q2 2020. *5. Irish Water should identify how the protozoal compliance log deficit is to be addressed at Leixlip water treatment plant.* This has not yet been addressed by Irish Water.

3. AUDITOR'S COMMENTS

The failure of Irish Water and Fingal County Council to implement the recommendations of the EPA's previous audit of Leixlip water treatment plant in March 2019 is unacceptable. In particular, the failure to install automatic shutdown when critical plant alarms are not responded to, was a contributory factor to the alum dosing incident on 21/10/19 which resulted in a Boil Water Notice for 615,539 consumers supplied by Leixlip water treatment plant.

The audit found that the alum dosing incident which occurred at Leixlip water treatment plant on 21/10/19 and the unacceptable failure to respond to multiple process alarms presented a significant risk to the safety of the water supply. Irish Water and Fingal County Council must ensure there is a system in place to respond adequately and appropriately to process alarms at Leixlip water treatment plant, and cannot rely on human intervention alone. The EPA recommends that Leixlip water treatment plant is connected to Irish Water's National Operational Management Control Centre in Colvill House without delay, to allow centralised oversight and access to SCADA data regarding the operational performance and critical alarms at the plant.

The auditors examined the plant's SCADA data and alarm settings and were satisfied that since the incident ended at 05:00 on Tuesday 22/10/19, the treatment plant has been operating satisfactorily. Once Irish Water can demonstrate satisfactory sample results for treated water quality on Wednesday 23rd & Thursday 24th October, and provides confirmation that any potentially contaminated water has been flushed through the distribution network, the EPA is satisfied from the technical perspective that the Boil Water Notice can be lifted.

Irish Water must reassess the level of treatment provided at Leixlip water treatment plant, given the current protozoal treatment 2-log deficit and the significance of this Boil Water Notice which has caused major disruption to more than 600,000 people and businesses in the affected parts of Dublin, Kildare and Meath. The EPA recommends that ultraviolet disinfection is considered as an additional treatment barrier to inactivate *Cryptosporidium/Giardia* at Leixlip water treatment plant, as an ultimate fail-safe system, to ensure the protection of public health.

4. RECOMMENDATIONS

1. Irish Water and Fingal County Council should review their managerial and operational structures and procedures, to ensure there is a fail-safe system in all critical control situations at Leixlip water treatment plant.

2. Irish Water and Fingal County Council should ensure that plant operators respond immediately to any alarms generated at Leixlip water treatment plant. If an operator fails to respond to an alarm, Irish Water and Fingal County Council should ensure that the plant automatically shuts down, to prevent inadequately treated water being supplied to consumers. If the plant automatically shuts down outside of normal working hours, Irish Water and Fingal County Council should ensure that the on-call manager is alerted.

3. Irish Water should connect Leixlip water treatment plant to the National Operational Management Control Centre in Colvill House without delay, to allow centralised oversight and access to SCADA data regarding the operational performance and critical alarms at the plant.

4. Irish Water and Fingal County Council should conduct a systemwide risk assessment of all elements of Leixlip water treatment plant, to identify vulnerabilities and actions necessary to mitigate the risks identified.

5. Irish Water and Fingal County Council should clean and repair, or completely replace, the alum storage tanks serving the PCI and MMcP plants, in order to prevent a further blockage of the coagulant dosing lines by the disintegrating lining material. Until the tanks are repaired or replaced, Irish Water and Fingal County Council must ensure increased vigilance, to prevent a reoccurrence of the alum dosing incident on 21/10/19.

6. Irish Water should identify how the protozoal compliance log deficit is to be addressed at Leixlip water treatment plant.

7. Irish Water should assess the feasibility of installing ultraviolet disinfection as an additional treatment barrier to *Cryptosporidium/Giardia* at Leixlip water treatment plant, and should submit the outcome of this assessment to the EPA.

8. Irish Water and Fingal County Council should reconsider the recommendations from the EPA's previous audit in March 2019, and identify revised timeframes for the implementation of the outstanding priority actions at Leixlip water treatment plant.

9. Irish Water should ensure that Ballycoolin, Peamount and Ballygoran reservoirs are inspected and cleaned out on a regular basis, and any maintenance and repairs completed as soon as possible after the need has been identified.

FOLLOW-UP ACTIONS REQUIRED BY IRISH WATER

During the audit Irish Water and Fingal County Council representatives were advised of the audit findings, and that action must be taken as a priority by Irish Water and Fingal County Council to address the issues raised. This report has been reviewed and approved by Mr. Andy Fanning, Programme Manager, Office of Environmental Enforcement.

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 Laghnare **Date:** 30th October 2019

Inspector

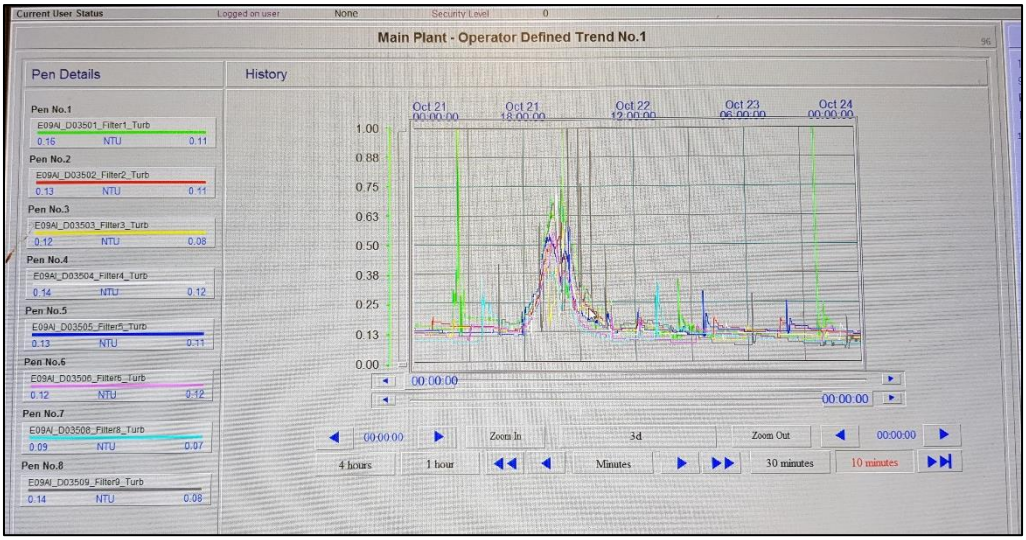

Photo 1: SCADA graph showing the impact on filtered water turbidity levels at the PCI plant following the blockage of the alum dosing line on 21/10/19. The treatment barriers to remove *Cryptosporidium/Giardia* are compromised when the turbidity increases above 0.2 NTU.

Photo 2: Sample of black particles which caused blockage of alum dosing line, which are thought to originate from the disintegrating lining of the alum storage tanks