Drinking Water Audit Report

County:	Fingal	**Date of Audit:**	8th November 2019
Plant visited:	Leixlip Water Treatment Plant	**Date of issue of Audit Report:**	13th November 2019
		File Reference:	DW2019/188
		Auditors:	Aoife Loughnane Michelle Minihan Darragh Page
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 audits at Leixlip water treatment plant on 24th October 2019 and 22nd March 2019.		

MAIN FINDINGS

i. **High turbidity levels in the raw water for a sustained period led to operational difficulties in the 'old plant' at Leixlip water treatment plant from Sunday 3rd to Wednesday 6th November 2019. This resulted in unacceptably high levels of turbidity in treated water, which meant there was a risk of breakthrough of *Cryptosporidium* and *Giardia* into the water supply.**

ii. **The treatment plant appears to have been operating satisfactorily since 16:41 on Wednesday 6th November 2019. Testing is ongoing to verify that the treatment barriers at the plant are fully effective.**

iii. **Irish Water are undertaking filter upgrade works to address the immediate treatment deficit at the plant. However, 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.**

iv. **As an immediate mitigation measure, Irish Water has reduced the throughput at the 'old plant' by 30 million litres per day (ML/day) to relieve hydraulic pressure and allow for acceleration of the filter upgrade works. To compensate for the reduction at Leixlip water treatment plant, Irish Water has increased production levels at Ballymore Eustace water treatment plant.**

v. **Until the filter upgrade works are complete, the EPA has instructed Irish Water to undertake daily monitoring of *Cryptosporidium* and *Giardia* in the treated water at Leixlip water treatment plant. If any oocysts or cysts are detected during the monitoring programme, Irish Water should immediately notify the HSE and EPA.**

vi. **The ability of Leixlip water treatment plant to maintain a satisfactory level of performance remains a concern. Irish Water must notify the EPA and the HSE if the plant does not meet the level of performance required to provide adequate treatment to ensure safe water, and this may necessitate Irish Water issuing further Boil Water Notices in future, in order to protect consumers 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 operational difficulties at the 'old plant' at Leixlip due to high turbidity levels in the raw water for a sustained period. Irish Water issued a Boil Water Notice on Monday 4th November 2019, following consultation with the HSE, in order to protect the health of consumers, due to the risk of breakthrough of *Cryptosporidium* and *Giardia* into the water supply.

Leixlip water treatment plant is the second largest water treatment plant in Ireland, supplying drinking water to Dublin, Kildare & Meath (33% of the Greater Dublin Area), including key healthcare facilities and commercial users. The population affected by the current Boil Water Notice is 657,395 consumers, which reflects a 6.8% increase from the previous Boil Water Notice issued by Irish Water on 22nd October 2019. Irish Water has confirmed the reason for the population increase is the inclusion of an additional 300 metre buffer area because the water supply zone boundaries in the Greater Dublin Area can change on a day-to-day basis due to valve reconfiguration.

Raw water is abstracted from the River Liffey impoundment adjacent to the plant. The normal production levels of 195 ML/d have been reduced by 30 ML/d to throttle back the throughput at the 'old plant'. 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 10:00 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 – Asset Operations Lead

John Leamy – Compliance Lead

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 – Water Quality Engineer

John Daly – Acting Director of Water Services

Representing the Health Service Executive:

Deirdre Mulholland – Director of Public Health & Medical Officer of Health, HSE East

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

Ruth McDermott – Specialist in Public Health Medicine

David Kelly – Department of Public Health, HSE East

Sarah Middleton – Principal Environmental Health Officer

Bernice Martin – Senior Environmental Health Officer

Olive Kehoe – Senior Environmental Health Officer

Representing the Environmental Protection Agency: Aoife Loughnane – Inspector Michelle Minihan – Senior Inspector Darragh Page – Programme Manager

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.	**High Turbidity Event** a. There was an increase in turbidity levels in the raw water at Leixlip water treatment plant for a sustained period following heaving rainfall on Saturday 2nd November 2019, which led to operational difficulties in the 'old plant' (PCI & MMcP plants). During the audit, the timeline of events was outlined as follows: **Sunday 3rd November 2019:** 07:00: raw water turbidity level of 4.6 NTU 11:35: raw water turbidity level of 30 NTU 13:00: Filtered water turbidity at PCI plant > 0.2 NTU. SCADA alarms activated and responded to by the plant operator. PCI plant was shut down. 13:30: Flow at new plant was reduced, and able to handle the elevated turbidity in raw water. 14:00 Flow at MMcP plant was reduced and the plant was shut down at 14:30. Filters at PCI & MMcP plants were backwashed and run to waste throughout the day in an attempt to restore satisfactory performance. 19:45 Fingal County Council notified Irish Water of shutdown of old plant because filter turbidity levels were not improving. At Ballycoolin reservoir, the treated water storage level started to drop to 3 metres. **Monday 4th November 2019:** 07:00 – 08:00: MMcP plant was re-started but shutdown again as filter turbidity levels continued to increase. 08:00: Fingal County Council notified Irish Water that the old plant was still shutdown and unable to cope with the elevated turbidity conditions. At Ballycoolin reservoir, the treated water storage level had dropped to 2.1 metres. 08:45: The PCI plant was re-started at a slow rate, with filter turbidity levels of 0.2 – 0.3 NTU. 10:45: Fingal County Council informed Irish Water that filter turbidity levels were rising above 0.3 NTU. 12:30: PCI plant was shutdown. Kildare County Council notified Leixlip WTP that due to heavy rainfall, the following storm water overflows were activated on the River Liffey upstream of Leixlip drinking water abstraction: - Ballyoulster, 3.2 km upstream - Castletown, 3.4 km upstream - Clane, 20km upstream - Sallins, 24 km upstream 18:00: PCI plant was brought back into service at a slow rate (average filter turbidity of 0.31 NTU) under a Boil Water Notice, following consultation with the HSE & EPA.

19:15: MMcP plant was brought back into service (average filter turbidity 0.32 NTU).

22:37: Filter turbidities dropped below 0.3 NTU in all filters at the old plant.

Tuesday 5th November 2019:

06:15: Filter turbidities at old plant increased above 0.3 NTU following heavy rainfall on Monday 4th November.

17:00: Filter turbidities dropped below 0.3 NTU.

b. There has been intensive backwashing and running to waste of filters since the operational difficulties began at the old plant. By Wednesday 6th November, the raw water quality had improved.

c. Following heavy rainfall on Thursday 7th November, the turbidity levels in raw water began to increase once more. During the audit the raw water turbidity level fluctuated from 21.65 to 19.3 NTU.

d. The following table gives an overview of filter operations at the old plant during the audit. Of the 15 filters, 8 were in service, 1 was in backwash, 4 were out of service and 2 were under refurbishment. One filter (No. 8) was in service and operating above 0.2 NTU, which is the target for effective filtration of *Cryptosporidium* & *Giardia*.

Filters 1 – 12 (PCI Plant) 13 – 15 (MMcP Plant)	Filter turbidity at 10:15	Filter turbidity at 12:53	Status
1	0.13 NTU	0.14 NTU	In service
2	0.26 NTU	0.27 NTU	Out of service
3	0.19 NTU	0.19 NTU	In service
4	0.21 NTU	0.20 NTU	In backwash
5	0.16 NTU	0.15 NTU	In service
6	0.2 NTU	0.19 NTU	In service
7	---	---	Under refurbishment
8	0.22 NTU	0.21 NTU	In service
9	---	---	Out of service
10	---	---	Out of service
11	---	---	Out of service
12	---	---	Under refurbishment
13	0.16 NTU	0.14 NTU	In service
14	0.16 NTU	0.15 NTU	In service
15	0.14 NTU	0.13 NTU	In service

e. Automatic filter backwash is triggered at 0.25 NTU, however the plant operators have been backwashing the filters when turbidity reaches 0.2 NTU, and running the filters to waste for an additional 10 – 20 minutes to see if turbidity will settle. If the filter turbidity does not return below 0.2 NTU, the filter is taken out of service.

f. Leixlip water treatment plant can accommodate a full plant shutdown of up to 4 hours, but anything greater causes operational difficulties in maintaining the sludge blanket in the clarifiers.

g. A review of the plant's SCADA system shows that the high turbidity event which began on Sunday 3rd November 2019, ended at 16:41 on Wednesday 6th November 2019, when the average filtered water turbidity levels at the old plant returned below 0.2 NTU.

2.	**Source Protection** a. Fingal County Council confirmed that the difference between this and previous rainfall events was the extended duration (approximately 20 hours) of the turbidity spike in raw water, which coincided with a rapid increase in water level at the abstraction point. b. The variation in raw water levels in the River Liffey impoundment poses difficulties for maintaining and sustaining the operational performance of Leixlip water treatment plant. c. There are combined sewer overflows into the River Liffey upstream of Leixlip drinking water abstraction point which present a risk of pathogenic microorganisms in raw water. d. There is a weekly monitoring programme of *Cryptosporidium* and *Giardia* in raw water at Leixlip water treatment plant. *Giardia* cysts are more prevalent than *Cryptosporidium* oocysts in the raw water, however Irish Water has been unable to establish a reason for this.
3.	**Coagulation, Flocculation & Clarification** a. The need for pH correction (sulphuric acid dosing) to ensure optimum coagulation was identified in the EPA's audit in March 2019. During this audit, Irish water could not identify the timeframe for this improvement, but stated that it was being re-prioritised. b. The clarifiers at the MMcP plant appeared to be in poor condition, with visibly damaged/collapsed lamella plates (see photo 1) which means the clarification process is not performing optimally. Pin floc was visible rising to the surface of the clarifiers, leading to floc carryover from the clarifiers to the filters.
4.	**Filter Upgrade Works** a. The filters at the MMcP plant (No's 13, 14 & 15) were refurbished in 2016. b. The filters at the PCI plant are approximately 25 years old and the sand filter media and pipework (to allow backwashing) is urgently in need of replacement. The upgrade of filter No. 8 is complete, and filter No.'s 7 & 12 are currently under refurbishment. Nine filters remain to be upgraded; No's 1, 2, 3, 4, 5, 6, 9, 10 & 11. c. Irish Water has accelerated the programme of filter upgrade works to achieve the completion date of Q2 2020. d. As an immediate mitigation measure, production at the PCI plant has been reduced by 30 ML/day to relieve hydraulic pressure and allow for acceleration of the filter upgrade works. To facilitate this, production has been increased at Ballymore Eustace water treatment plant, and the distribution network has been reconfigured to supply more areas with Ballymore Eustace water.
5.	**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 treatment, and the current coagulation, flocculation, clarification and filtration processes provide 3-log credits. Once the filter upgrade works and pH correction prior to coagulation are complete, this will provide an additional log credit for enhanced individual filtration. However, there will still be a 1-log deficit. b. On 7th November 2019, Irish Water submitted a paper '*Leixlip Water Treatment Plant – Implementing the Log Credit Approach to achieve Protozoal Compliance'* to the EPA. The paper outlines Irish Water's methodology for calculating an objective source log requirement of 4-log (i.e. up to 1,000 oocysts per m^3) rather than 5-log (up to 10,000 oocysts per m^3) for Leixlip WTP. The EPA will engage with Irish Water to verify the appropriateness of the proposed model, which should incorporate worst case criteria for pathogenic loading from the catchment.

3. AUDITOR'S COMMENTS

The auditors examined the plant's SCADA system and were satisfied that the high turbidity event which began on Sunday 3rd November 2019, ended at 16:41 on Wednesday 6th November 2019, when the average filtered water turbidity levels at the old plant returned below 0.2 NTU. The treatment plant appears to have been operating satisfactorily since then, with ongoing testing to verify that the treatment barriers at the plant are fully effective.

However, the EPA remains concerned about the ability of Leixlip water treatment plant to maintain and sustain an appropriate level of performance. Until such time as the filter upgrade works are complete, there is a risk of reoccurrence of this type of event where high turbidity levels in the raw water for a sustained period lead to operational difficulties at the old plant. Irish Water must notify the EPA and the HSE if the plant does not meet the level of performance required to provide adequate treatment to ensure safe water, which may necessitate Irish Water issuing further Boil Water Notices in future, in order to protect consumers health.

Whilst the move by Irish Water to supplement the Leixlip supply with water produced at Ballymore Eustace water treatment plant is a welcome measure to allow the acceleration of filter upgrade works at Leixlip, it also means that the available headroom for water supply to the Greater Dublin Area is reduced until these upgrade works have been completed.

The absence of pH correction prior to coagulation and the current condition of the clarifiers means the clarification process is not operating optimally and will reduce the effectiveness of the filter upgrades.

The recommendations from the EPA's previous audit on 24th October 2019 remain to be addressed by Irish Water, with a response due to be submitted by 30th November 2019. Those recommendations have not been repeated in this audit report.

4. RECOMMENDATIONS

1. Irish Water should maintain an operational performance level of ≤ 0.2 NTU for the average filtered water turbidity levels entering into supply at each of the three plants at Leixlip water treatment plant. Irish Water must notify the EPA and the HSE if the plant does not meet the level of performance required to provide adequate treatment to ensure safe water.

2. Irish Water should undertake daily monitoring of *Cryptosporidium* and *Giardia* in the treated water until the filter upgrade works are complete at Leixlip water treatment plant. If any oocysts or cysts are detected during the monitoring programme, Irish Water should immediately notify the HSE and EPA.

3. Irish Water should liaise with the relevant catchment stakeholders to address the variation in raw water levels in the River Liffey impoundment and identify how Irish Water proposes to deal with the difficulties this creates for the operational performance of Leixlip water treatment plant.

4. Irish Water should reprioritise the installation of pH correction prior to coagulation and identify the revised timeframe for this improvement work.

5. Irish Water should review the operation of the clarifiers and replace the damaged lamella plates, to ensure the clarification process is optimised.

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.

Report prepared by: Aoife Laighnare **Date:** 13th November 2019

Inspector

Photo 1: Clarifier in poor condition with visibly damaged/collapsed lamella plates at MMcP plant