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	Lough Talt Regional Water Supply
Organisation	Irish Water
Scheme Code	2700PUB2702
County	Sligo
Site Visit Reference No.	SV21552

Report Detail

Issue Date	23/12/2020
Prepared By	Ruth Barrington

Site Visit Detail

Date Of Inspection	14/12/2020	**Announced**	Yes
Time In	11:30	**Time Out**	13:30
EPA Inspector(s) **Additional Visitors**	Ruth Barrington		
Company Personnel	Present at pre-audit meeting or on site (*) Irish Water: Yvonne McMonagle*, Pat O'Sullivan, John McElwaine*, Des Joyce, Diane Carroll Sligo County Council: Georgina O'Reilly, John Morris*, Finian O'Driscoll, James Melvin* Coffey Water Ltd.: Anne Marie Quirke*, Robert Dillon*		

Summary of Key Findings

1. The new Lough Talt water treatment plant as constructed and operated provides an adequate barrier to *Cryptosporidium* and minimises the formation of THM, based on assessment of the verification data and observations made on the day of the site audit.

2. Irish Water should further review the criteria for dosing coagulant at the treatment plant having regard to maintaining final water turbidity and THM precursors as low as possible, to avoid potential shielding of pathogens from the effects of the UV treatment and the continued minimisation of THM formation.

3. Irish Water should establish a programme of operational monitoring setting out the parameters to be checked and frequency of sampling at the water treatment plant and at locations in the network, to verify ongoing adequate levels of disinfection in the network.

Introduction

The Lough Talt Public Water Supply is on the EPA's Remedial Action List (RAL) since 2008 due to inadequate treatment for *Cryptosporidium* and for elevated levels of trihalomethanes (THM) in the drinking water supply. The supply serves approx. 13,700 people and had been on a Boil Water Notice from 11/01/2019 to 26/11/2020 following the detection of *Cryptosporidium* at the water treatment plant. The Boil Water Notice was lifted after an Irish Water/ HSE consultation on 26/11/2020, considering the *Cryptosporidium* barrier provided by the new UV system. The supply was previously subject to a Boil Water Notice from 06/02/2018 to 25/10/2018, also due to a *Cryptosporidium* detection.

The RAL Action Programme and the provision of suitable treatment for the supply was significantly delayed due to a series of refusals of Planning Permission for the site, however under Irish Water's most recent application to Sligo County Council, planning was granted under the Imperative Reasons of Overriding Public Interest (IROPI) process in May 2019 for a new treatment plant producing up to 8,000 m3/day with a design lifespan of 8-10 years.

The new treatment plant and its associated processes is intended to provide an adequate barrier to *Cryptosporidium* and to minimise THM formation. Construction and commissioning is complete and the plant was in operation at the time of the audit. The plant was built, and is under contract for one year's operation, by Coffey Water Ltd. Treatment comprises coagulation (used when water quality triggers are met), rapid gravity filtration, primary disinfection by way of UV and a virus targeted dose of chlorine, and secondary disinfection for the distribution network using chloramination. The use of chloramination requires a pH adjustment for final water. Ortho-phosphate is also used, to reduce the risk of dissolving lead and other metals from distribution pipework.

This audit was carried out by the EPA to verify the performance of the new treatment plant as the RAL completion date of 31 December 2020 approaches.

Supply Zones Areas Inspected

The audit consisted of (i) a remote pre-audit meeting followed by (ii) an on-site inspection under the EPA's Covid-19 procedures relevant at the time of the audit.

1. Coagulation Clarification Flocculation (CFC) Stage

		Answer
1.1	Is the CFC process optimised to respond to changes in raw water quality?	No

Comment

1. The new Lough Talt Water Treatment Plant has the capability for direct filtration, i.e. coagulation without a clarification stage prior to the rapid gravity filters. The coagulation phase of treatment was not in operation at the time of the audit and has not been activated as yet under normal operations.

2. Poly aluminium chloride (PAC) coagulant and pH adjustment can be dosed on the basis of decreased combined raw water water quality where defined trigger levels are breached. These trigger levels are currently set to protect the statutory turbidity requirement of 1 NTU in final treated water and the validation envelope of the UV treatment.

3. The triggers to bring coagulant into use are on the basis of turbidity and UVT of the combined raw water, which at the Lough Talt water treatment plant comprises raw water abstraction from Lough Talt plus the supernatant return. Part of the planning permission for the plant requires zero discharge, meaning backwash supernatant is recirculated within the treatment plant, back to the raw water balance tank.

4. Since the plant has not operated using coagulant outside commissioning scenarios, the organics removal capacity of the treatment plant has not been demonstrated as optimised. The THM monitoring results are discussed elsewhere in this audit report- the results available to the auditor have been compliant to date since the new treatment plant was brought online. THM results of 70 and 74 ug/l obtained from samples in the network taken on 09/12/2020 show that THM is still being formed to some extent, while compliant with the 100 ug/l parametric value. It is generally expected that winter results may be lower in the event of seasonal patterns of formation. The current trigger levels for the introduction of coagulant, 0.9 NTU and/or UVT <55%, may impact both on THM formation and on the minimisation of turbidity for disinfection processes as set out in Section 3 (Disinfection) of this report.

2. Filtration

		Answer
2.1	Are the filters designed and managed in accordance with EPA guidance?	Yes

Comment

1. When the new Lough Talt water treatment plant was brought online, the decision was taken due to network storage capacity to operate the plant on a 24-hour basis, which means that flows through the plant on a per hour basis are lower than the design capacity which was based on 18-20 hours of operation per day (approx. 250m3/hour rather than 400 m3/hour). This resulted in the possibility of the filters running well below capacity.

2. The water treatment plant includes rapid gravity filtration via six new filters with 0.7 m depth of silica sand and 0.4 m depth of anthracite media. At the time of the audit, four duty filters were in use with the other two in standby mode. The standby filters are brought into use in sequence following the backwash programme. This is done to reduce issues experienced when filters are operated very much below capacity.

3. The rapid gravity filters' operation without continuous coagulant dosing means that no protozoal log credit is being claimed, as referenced in the EPA *Water Treatment Manual: Filtration*. This is as designed, with the UV system to provide the required 4-log credit for protozoal inactivation.

3. Backwash of the filters is initiated on the basis of time every 48 hours, although trigger levels for backwash initiated on turbidity or on headloss are also in place. Return to service post filter backwash is controlled by the turbidity levels achieved after the run to waste stage.

4. At the time of the audit, the four filters in operation were achieving individual outlet turbidities of 0.02 to 0.17 NTU. The final treated water turbidity was 0.21 NTU. These readings were observed at different times during the site tour.

3. Disinfection

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

Comment

1. The new Lough Talt water treatment plant is designed to provide three disinfection processes. The primary disinfection process, and provision of the 4-log *Cryptosporidium* barrier, is the UV system, as referenced in Table 7.2 of the EPA's *Water Treatment Manual: Disinfection*. There is also a chlorine dose to provide a virus barrier with contact time achieved on-site, and finally for the provision of adequate disinfection in the network out to consumers' taps, there is a chloramination system. The audit involved the inspection of each of these elements, with an initial assessment having been done of the systems in November 2020 which enabled the Boil Water Notice to be lifted from the Lough Talt public water supply on 26/11/2020.

2. Each of the disinfection processes is verified using monitors and alarms with the online monitors being linked to the SCADA system. The alarms are dialled out to a cascade system of staff, with procedures in place to outline the required response.

3. The UV system comprises two Wedeco UV reactors which can operate as either duty/standby or duty/assist, enabling a minimum of 4-log *Cryptosporidium* inactivation down to 60% UVT in duty/standby mode and down to 46% UVT in duty/assist mode. The reactors are validated under the US EPA UVDGM protocols for flows as low as 160m3/hour. At the time of the audit, the UV system was operating within the validation envelope in duty/ standby mode at 74% UVT and flow 262 m3/h, at a dose of 56.67 mJ/cm2 RED.

4. The virus barrier is provided by way of a chlorine dose which then enters the baffled contact tank after the UV reactors. The target residual aimed for at the outlet is 0.5 mg/l, providing a virus barrier while minimising the potential for THM formation in the contact tank.

5. The final stage in the disinfection processes is the creation of monochloramine for the maintenance of disinfection within the network. This requires a second stage of chlorine dosing and pH adjustment, with a target residual of 1.5 mg/l and target pH of 8.7, followed by dosing of ammonium sulphate at a weight ratio Cl:NH3 of 4.5:1 to 5:1 (4.7:1 at the time of the audit). At this ratio and pH value, the chloramines formed are predominantly monochloramine, for effective disinfection and minimum taste or odour issues.

6. The use of a chloramination system for network disinfection minimises the formation of THM, as the chlorine is not free to combine with organic THM precursors since it is already combined with ammonia. The verification monitoring results obtained as part of the RAL action programme demonstrate that THM formation is much reduced in the Lough Talt public water supply since the new plant came into operation and the chloramination process started. The THM results available at the time of the audit were all below 75 ug/l as compared with the parametric value of 100 ug/l, which was routinely exceeded prior to the introduction of the new treatment processes.

7. The adequacy of disinfection within the network is indicated by a maintenance of at least 0.4 mg/l monochloramine out to the end of the network. This has been demonstrated at all the monitoring locations through the results of the verification monitoring programme.

4. Management and Control

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

Comment

1. The plant alarm settings and inhibits are in general tightly controlled and set at satisfactory levels. For example, shutdown of the plant on the basis of high raw water turbidity or low UVT, failure of the UV system to operate within the validation envelope, failure to meet the required chlorine residual, high ammonia in the final water are some of the conditions which will trigger emergency shutdown of the plant without untreated water entering the network.

2. The alarm/shutdown setpoints on the final treated water turbidity are considered to be high. There is a warning alarm level of 0.9 NTU and plant shutdown at 1 NTU. This is sufficient to meet the statutory parametric value of 1 NTU in final treated water, but does not incorporate the EPA guidance as provided in the *Water Treatment Manual: Disinfection* and *Advice Note 5: Turbidity*. The recommendation in these guidance documents is that treatment plants should be optimised to obtain a turbidity level of <0.2 NTU in the final water, where there is a high risk of *Cryptosporidium* in the raw water. This will reduce the risk of potential shielding of microorganisms from the effects of disinfection chemicals and UV.

		Answer
4.2	Is the data obtained from sampling and monitoring used to actively inform the processes on site and in the distribution network?	Yes

Comment

1. An extensive verification monitoring programme is being carried out to establish the performance of the new treatment processes at Lough Talt water treatment plant and in the network. This has focused on the RAL action programme verification of the UV Cryptosporidium barrier and THM formation, along with the development of the chloramination process for secondary disinfection at the network.

2. The findings of the verification programme are being incorporated by Irish Water into the development of an operational monitoring programme for chloraminated supplies, which is to be tailored for Lough Talt. This will cover the locations and parameters to be monitored, with a combination of online and hand held analysers used by staff. The use of lead rigs to simulate contact time for lead connections to assess the impact of ortho-phosphate dosing will also be included. The programme is anticipated by Irish Water to start in Q1 2021.

5. Supply on the Remedial Action List

		Answer
5.1	Is further information needed to assess completion of the Remedial Action List upgrade?	Yes

Comment

1. Irish Water has established a comprehensive verification monitoring programme to examine the performance of the water treatment plant in meeting the requirements of the RAL action programme. The available results of this programme were assessed as part of the audit and were compliant, however there are results of an additional 25 samples which have not yet been provided by the contract laboratory. These results form part of the verification monitoring and should be provided as part of the Irish Water submission to the EPA for consideration of removal of the Lough Talt Public Water Supply from the RAL.

Recommendations

Subject	Lough Talt RAL audit	Due Date	25/01/2021
Action Text	**Recommendations** 1. Irish Water should submit the remaining results of THM analysis which were pending from the laboratory at the time of the audit. These results will form part of the EPA RAL Committee's assessment on removal of the Lough Talt public water supply from the Remedial Action List. 2. Irish Water should review the criteria used to bring the coagulation stage of the treatment process online, and the final water turbidity control set points. This review should consider (i) the potential for THM formation, and as such may be linked to process optimisation of the chlorination steps at the treatment plant; and (ii) the minimisation of turbidity in final treated water to reduce the risk of potential shielding of microorganisms from the effects of UV treatment, having regard to EPA guidance on turbidity applicable to final water from high *Cryptosporidium* catchments in the *Water Treatment Manual: Disinfection* and *Advice Note 5: Turbidity*. 3. Irish Water should further develop and provide details to the EPA on the operational programme to be established for the verification of network disinfection in public water supplies using chloramination, as tailored for Lough Talt PWS. This should include locations, parameters, and frequency of monitoring. **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 Aoife Loughnane, Drinking Water Team Leader. Irish Water should submit a report to the Agency on or before 25/01/2021 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.		