Drinking Water Audit Report

County:	Co. Louth	**Date of Audit:**	11/07/2019
Plant(s) visited:	Greenmount Water Treatment Plant Scheme Code 2100PUB1002	**Date of issue of Audit Report:**	25/07/2019
		File Reference:	DW2019/122
		Auditors:	Ruth Barrington Daryl Gunning
Audit Criteria:	• The *European Union (Drinking Water) Regulations 2014 (S.I. 122 of 2014)*, as amended		

MAIN FINDINGS

i. **There were three separate disinfection failures at Greenmount Water Treatment Plant in June 2019. The audit found that undisinfected water can enter the distribution network in the event of a failure of the duty onsite electrochlorination (OSEC) system due to the lack of automatic switchover to the standby disinfection or plant shut down. The EPA has separately issued a Regulation 16(1) Direction to Irish Water which requires an Action Programme to be provided by 12/08/2019 outlining how robust disinfection will be ensured for the Greenmount Public Water Supply to protect public health.**

ii. **Due to the observed lack of control over the plant disinfection, coagulation, flocculation and clarification processes at Greenmount Water Treatment Plant, the EPA will add the Greenmount Public Water Supply to the Remedial Action List.**

iii. **The chlorine contact time and required chlorine residuals were not suitably controlled and managed at the plant. Irish Water should ensure that this is addressed in advance of any other works which are planned under the Disinfection Programme for Co. Louth.**

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 notifications by Irish Water dated 02/07/2019 of the failure of the disinfection system in Greenmount Public Water Supply on three occasions during June 2019. The EPA also has an open file on trihalomethanes (THM) in Greenmount Public Water Supply. There has been no notified THM exceedance since 2016, and a programme of filter refurbishment which was intended to enhance treatment and minimise THM formation was completed in 2018. However sampling carried out following this work returned results at, or very close to, the THM parametric value. Therefore the file remains open and further work is considered necessary to effectively remove natural organic matter from the source water. This work has not yet been carried out by Irish Water.

Greenmount Public Water Supply serves a population of approximately 4,800 people in the area between Castlebellingham and Dunleer, Co. Louth. Water is abstracted from the River Dee and treated at the plant, which comprises two sections, the Old Plant with coagulation, flocculation and

clarification followed by pressure filtration, and the New Plant with coagulation, flocculation and clarification followed by a Trident adsorption clarifier/ filter unit. Both streams are then combined and are disinfected using onsite electrochlorination (OSEC). There is a standby sodium hypochlorite dosing facility which is used in the event of the failure of the OSEC unit. The Phase 1 assessment of Irish Water's Disinfection Programme was recently carried out at Greenmount Water Treatment Plant, along with a separate Irish Water Process Optimisation Review.

The opening meeting commenced at 10.30 a.m. at Greenmount 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 audit observations and recommendations are listed in Section 2 and 4 of this report. Photographs taken by Daryl Gunning during the audit are attached to this report and are referred to in the text where relevant. The following were in attendance during the audit.

Representing Irish Water:
Fran Glancy – Compliance Analyst
Aodhnait Ni Chathasaigh – Compliance Analyst
Darran Killian – Process Optimisation
Michael Cuniffe – Asset Operations
Representing Louth County Council:
John McCooey – Senior Executive Engineer
Chris Tormey – Senior Executive Technician
Linda Lynch – Executive Engineer
Noel Brilley - Caretaker
Representing the Environmental Protection Agency:
Ruth Barrington – Inspector
Daryl Gunning - 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.	**Disinfection Failure Incidents** a. On 2nd July 2019 Irish Water notified the EPA of three separate disinfection failures at Greenmount Water Treatment Plant. These were notified as having occurred on 3rd, 24th and 27th June. In each of these incidents, it was reported that the OSEC system had failed due to problems with the hydrogen gas vent and the air venturi pipe on the OSEC and that the chlorine residuals in final treated water were inadequate following these incidents. The incidents were identified during a review of SCADA data which showed inadequate levels of residual chlorine in final treated water on the relevant dates. b. By the time of the audit, the dates and root cause of each of the failures had been defined as 1st June, failure caused by pressure drop in the water line to the brine pump at the OSEC system, 24th June, caused by problems with hydrogen vent gas flow and 27th June, caused by blockage and reduced flow in the air venturi pipe in the OSEC unit. In each of these cases, undisinfected water left the plant following the failure of the OSEC unit. c. The disinfection on site is via the OSEC as the duty unit, with a sodium hypochlorite dosing facility provided as a standby. The switch over from duty to standby unit must be done manually by staff. There is no automatic switchover facility or automatic shutdown of the treatment plant based on inadequate disinfection. d. Staff mentioned that in addition to the disinfection failures during June there were problems with the chlorine residual monitor (Cl_{17} unit) sample line blocking and that this caused variability in treated water residual chlorine levels due to the residual linked dose

	responding to a perceived drop in chlorine caused by the blocked sample line. This was said to have been fixed on 8th July. As the audit was carried out on 11th July, there was insufficient data available to determine whether the residuals had returned to stability. e. A single low chlorine residual alarm is in place and is set at 0.4 mg/l. There is no warning alarm to indicate that chlorine residuals are decreasing. The low chlorine alarm dials out by a cascade system and during business hours is responded to, as it indicates a need to switch over to the standby chlorination. There is no out of hours alarm/incident response in place for Co. Louth. f. In each of the three incidents, the low chlorine alarm was triggered outside business hours and it was several hours before the dosing was restored by manually switching to the standby unit. During this period the plant continued to operate and water which was not adequately disinfected entered the network. g. The chlorine contact time calculation which was available during the audit was believed by staff to have been prepared when chlorine gas was in use at the site and does not relate to the current set up of OSEC as the duty system and drummed sodium hypochlorite as the standby system. Specifically, there did not appear to be a staff awareness of the minimum chlorine residual required for achieving the calculated C_t of 62.1 mg.min/l (the calculation gave this as 1.5 mg/l, yet the alarm setting was 0.4mg/l). Nor was there an appreciation of the length of time required for the standby drummed sodium hypochlorite system to provide adequate disinfection once it is manually brought online following a failure of the OSEC unit. h. The location of chlorine residual monitoring points (online and manual tests) are not appropriate to verify disinfection in the event of incidents such as those during June. The contact time calculation is based on chlorine contact at the site and in the rising main and reservoir, however the chlorine monitor is located at the clearwater tank. While manual chlorine residual tests are carried out daily, the only location where these tests are recorded is at Kilsaran- the reservoir and network extremities are not routinely tested. i. The investigation of the potential impacts of the disinfection failures in June was not considered by the audit team to be comprehensive. There was no immediate additional assessment of the adequacy of disinfection and the impact of the failures on chlorine residuals beyond the normal daily monitoring at Kilsaran. While the Greenmount Reservoir was not visited as part of the audit, staff reported that there is no facility to take samples at that location. j. In the week of 1st July 2019, sampling was carried out at locations in the network to assess whether there was an ongoing impact from the disinfection failures. In the Castlebellingham area, two of the locations sampled had inadequate free chlorine residual levels less than 0.1 mg/l. The other locations (in Dunleer) for which sample results were available, had adequate levels of free chlorine residual. The cause of the low levels in Castlebellingham was not known at the time of the audit. k. The OSEC unit contractor visited the site on 28/06/2019 to fix the air restriction in the venturi pipe. The service report examined during the audit indicated that air flow was restored following this visit. The air venturi will now be serviced monthly (previously a six month service programme was in place) to maintain the required flow rates.
2.	**Coagulation, Flocculation and Clarification (CFC)** a. There are two CFC streams on-site, at the Old Plant and New Plant. The flocculation tank and clarifier for the Old Plant and the clarifier for the New Plant were examined as part of the audit. b. The flocculation tank was found to have a large amount of floc/ algal build up on the walls (refer to Photo 1. This may indicate that floc is forming and dropping out within the tank rather than remaining in suspension until it reaches the clarifier. The structure of the tank means that routine cleaning is difficult as there is no proper access to all sides of the tank. c. Staff described the chemical dosing processes. There is no mixing mechanism following the addition of the aluminium sulphate dose, other then that which occurs in the pipe. The poly dose is applied along a spreader bar but at the time of the audit it appeared that this was coated with sludge/ algal build up which may affect the dosing process. d. Both clarifiers showed a build up of sludge and algal growth on the walls and channels, the New Plant clarifier being worse, with lumps of material carrying over into the settled water decanting channels (refer to Photos 2-4). Ivy growing on the outside of the New Plant

	clarifier was hanging over the edge of the tank (refer to Photo 2). e. Access to the New Plant clarifier for cleaning was only possible via the gangway across the diameter of the tank. Being a circular elevated tank, much of the tank wall and the extremities of the clarifier channels are inaccessible for cleaning while the tank is in use. Staff stated that material sloughing off the inside of the tank wall leads to the carryover visible into the decanting channels. f. The water treatment plant had been visited in Q1 2019 by an Irish Water Process Optimisation team. The report from this visit will contain recommendations on coagulation and flocculation processes which will need to be implemented as a matter of urgency. While the results of operational analysis relating to the CFC process examined during the audit were compliant, the risk to the safety of the drinking water supply posed by the observations above is unacceptable.
3.	**Filtration** a. Staff stated that the New Plant performs better in terms of turbidity removal than the Old Plant, however only the New Plant has separate turbidity monitoring on filtered water. The operators rely on the continuous combined treated water turbidity to assess Old Plant filter performance. The Old Plant pressure filter outflows are not continuously and individually monitored.

3. AUDITORS' COMMENTS

The process controls and monitoring at Greenmount water treatment plant were inadequate to allow a timely response to the failure of disinfection on three occasions between 1st June and 27th June 2019. The absence of adequate disinfection for periods following the failure of the duty OSEC chlorination unit poses an unacceptable risk to public health. Irish Water should take action to ensure adequate controls and verification of disinfection, with suitable alarms and inhibits to act on any disinfection process failure. The EPA has separately issued a Regulation 16(1) Direction to this effect.

The audit team found serious deficiencies in the appearance, facilities and monitoring of the CFC stages of treatment at Greenmount Water Treatment Plant, together with the deficiencies in the disinfection systems as configured at the time of the audit. The EPA is adding the Greenmount Public Water Supply to the Remedial Action List as a result of the issues identified during the audit.

4. RECOMMENDATIONS

Disinfection Failure Incidents

1. Irish Water should establish a procedure for disinfection incident response and investigation, which sets out the criteria for establishing the impact of a failure. This procedure should include the extent and location of chlorine surveying required and where relevant sampling facilities should be installed to assist in this process (e.g. Greenmount Reservoir).
2. Irish Water should continue the planned monthly maintenance checks on the OSEC unit to maintain the air and water flows free of blockages and within the required ranges. The hydrogen gas vent alignment should also be assessed for the feasibility of installing a vent which is not impacted by wind direction, to minimise OSEC outages.
3. Irish Water should ensure that appropriate warning and action level alarms are set on the disinfection system to allow a suitable and timely response in the event of low chlorine residuals being detected. The target and minimum chlorine levels required for adequate disinfection as specified in the chlorine contact time calculations should be considered in setting these alarms. The alarms should dial out via a cascade system to specific staff for action.
4. Irish Water should carry out a prompt assessment and instigate corrective actions on inadequate residual chlorine levels in parts of Castlebellingham, which were determined during the follow up investigative monitoring carried out during the week of 1st July 2019.

Routine chlorine residual monitoring should be carried out and recorded within the network at locations additional to the Kilsaran point currently used, to verify the maintenance of adequate disinfection throughout the network.

5. Irish Water should provide the following items to the EPA, which were unavailable on the day of the audit, in support of the disinfection failure investigations:

    a. The chlorine contact time C_t calculation updated to reflect the sodium hyprochlorite systems now in place.

    b. The revised table of chlorine residual results with the correct headings for plant (monitor reading), plant (manual test) and Kilsaran (manual test).

    c. The current plant alarm settings for disinfection and turbidity.

    d. Confirmation of the investigation network monitoring points on the Greenmount Public Water Supply located in Castlebellingham.

Coagulation, Flocculation and Clarification (CFC)

6. Irish Water should optimise the CFC processes at Greenmount Water Treatment Plant, including the following considerations:

    a. For coagulant and polyelectrolyte dosing, the dose location, contact time and current lack of mixing post-dosing should be addressed.

    b. For all stages in the CFC processes, the cleaning and maintenance of tanks, channels and working platforms to be addressed, to prevent the build-up of floc, sludge and algae which was being carried over into clarifier channels during the audit.

    c. For both Old and New Plants, the design flow and operational flow through the plants to be optimised to ensure the loadings are appropriate and within the design capacity.

    In carrying out this work Irish Water should have regard to the EPA Water Treatment Manual: Coagulation, Flocculation and Clarification and EPA Advice Note No. 15: Optimisation of Chemical Coagulant Dosing, in addition to the findings of its own Process Optimisation review of the plant.

Filtration

7. Irish Water should install continuous turbidity monitors on each of the pressure filter outflows at the Old Plant. These monitors, along with the monitor in situ at the Trident outflow in the New Plant, should be linked to a recording device and generate alarms in the event of a deviation from the acceptable operating range of the filters.

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 EPA 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:  **Date:** 25/07/2019

Ruth Barrington

Inspector

Photo 1. Flocculation tank at Old Plant showing build up of floc/ algal material on tank walls.

Photo 2. Build-up of sludge/ algal material in New Plant Clarifier and lack of access for cleaning tank and channels. Also shows ivy overhanging the tank edge.

Photo 3. Close up of the sludge/ algal material on water surface and channels at the New Plant clarifier.

Photo 4. Carryover of sludge/ algal material from New Plant clarifier into settled water decanting channel