



Drinking Water Audit Report

County:	Co. Westmeath	Date of Audit:	09/01/2019
Plant(s) visited:	Portloman WTP and Frewin Hill High Level Reservoir Mullingar Regional Water Supply Scheme Code 3200PUB1005	Date of issue of Audit Report:	16/01/2019
		File Reference:	DW2019/1
		Auditor:	Ruth Barrington
Audit Criteria:	<ul style="list-style-type: none"> The <i>European Union (Drinking Water) Regulations 2014 (S.I. 122 of 2014, as amended)</i>. The <i>EPA Handbook on the Implementation of the Regulations for Water Services Authorities for Public Water Supplies (ISBN: 978-1-84095-349-7)</i> 		

MAIN FINDINGS

- i. The process controls over the filtration and disinfection systems at Portloman Water Treatment Plant are inadequate. Irish Water should prioritise actions to ensure adequate filtration and disinfection of water entering the Mullingar Regional Water Supply at all times, to protect public health.
- ii. There was no information available during the audit on the validation of the UV disinfection unit at Portloman Water Treatment Plant which is used in emergency situations in cold weather. This should not be used unless Irish Water can demonstrate that it is an acceptable form of treatment for the source water.
- iii. There was no information available during the audit on the validation of the microfiltration system, and no turbidity monitors on individual filter units to enable verification of satisfactory performance. Irish Water should prioritise an action programme to ensure the ongoing verification of a validated *Cryptosporidium* barrier for the Mullingar Regional Water Supply.

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 on 04/01/2019 of an incident in which undisinfected water entered the Mullingar Regional Water Supply from the Frewin Hill High Level Reservoir, serving an estimated 16,607 people, during the period 31/12/2018 to 02/01/2019.

The Mullingar Regional Water Supply serves a total population of 48,251 people with water sourced from Lough Owel and treated at the Portloman Water Treatment Plant. From the treatment plant the water is piped initially to three separate reservoirs, Frewin Hill High Level, Frewin Hill Low Level, and the Town Reservoir. The disinfection incident was restricted to the network served by the Frewin Hill High Level Reservoir. The existing Portloman Water Treatment Plant incorporating coagulation, microfiltration and chlorination was installed as an emergency measure in 2002 following an outbreak of Cryptosporidiosis. While the capacity of the treatment plant has been expanded in the intervening years, with additional filter units provided, the controls over the plant remain unchanged and rely

largely on manual interventions. The plant is operated on behalf of Irish Water by Murphy Process Engineering under a Design Build Operate (DBO) contract.

The opening meeting commenced at 10.50 a.m. at Portloman 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.

The following were in attendance during the audit.

Representing Irish Water:

Aoife Lambe – Compliance Analyst

Fiona Lane – DBO Lead

John Gavin – SLA Lead

Representing Murphy Process Engineering (MPE)

Darragh Doran – Plant Supervisor

Tony Gavin – MPE Operations

Representing Westmeath County Council (present at Reservoir inspection only)

Alan Farrell – Executive Engineer

Representing the Environmental Protection Agency:

Ruth Barrington – Inspector

Observing:

Patricia Doonan – Senior Environmental Health Officer HSE

Deirdre O'Shea - Principal Environmental Health Officer HSE

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. Filtration

- a. The filtration provided at the Portloman WTP is a microfiltration system comprising eight primary filter units. Six of these units formed the original containerised water treatment plant installed in 2002 and another two units were provided to increase plant capacity in 2010-2011. The membranes have all been replaced in the last 2 years and have a 5-7 year life span.
- b. The microfiltration system is intended as a *Cryptosporidium* barrier, however the log credit (for protozoal removal) to be applied to this system was not available during the audit. There was no information on the specification or manufacturer's requirements for the validation of the filter units available on-site during the audit.
- c. Integrity testing of the membranes is undertaken on a scheduled basis.
- d. The membrane pore size was thought to be 0.3 µm and the maximum capacity of the plant was estimated as 22 Ml/day while the plant operates at 17-18 Ml per day. The microfiltration capacity is severely affected by temperature, and can be much reduced in the event of temperatures below 3-4 °C.
- e. Turbidity is not continuously monitored at each filter outlet. While there is a continuous turbidity monitor on the combined treated water, the sampler/monitor is not maintained and the data is not used for process control. There are no alarms or programmed plant shutdowns based on elevated turbidity being detected in the final water.

	<p>f. The turbidity result used for process control and reporting purposes by MPE is the result of a manual test performed daily. Results of these tests examined during the audit indicated the final water turbidity was in the range 0.07 to 0.1 NTU.</p>
2.	<p>Disinfection</p> <ul style="list-style-type: none"> a. Disinfection of the Mullingar Regional Water Supply is by chlorination using sodium hypochlorite. This is dosed directly from a bulk storage tank on-site (not via day tanks), individually via dosing points on the rising mains leading to each of the three reservoirs. Contact time is achieved within the rising mains to each reservoir. b. The chlorine contact time calculations for each of the three reservoirs was not available during the audit. c. Duty and standby pumps are in place for each chlorine dose location. Automatic switchover occurs if there is a pump failure (e.g. if one of the pumps trips out). However, there is no automatic switchover if a low chlorine residual alarm is triggered. Manual switchover is required if the chlorine residual falls below the alarm level. d. Chlorine is dosed on a flow proportional basis and manually adjusted. e. The residual chlorine monitor which is used by MPE to assess disinfection at Frewin Hill High Level Reservoir is based on a continuous sampler located at the outlet of the Reservoir. A monitor is located at the inlet of the Reservoir but this is not maintained or calibrated. This set up is apparently mirrored at the other reservoirs which were not inspected as part of the audit. f. The chlorine residual at the outlet of the reservoir is not an acceptable basis for control of disinfection due to the time lapse between the dosing point and the reservoir outlet. By the time a failure in chlorine dosing is identified using this monitor, several hours will have passed and a prompt response to the lack of disinfection is not possible, nor is it possible to prevent undisinfected water entering the network. g. Residual free chlorine data is linked, trended and available remotely on SCADA. High and low level chlorine residual alarms are texted via dial out to three staff phones. However, the dial out facility only operates if the alarm is reset manually after each alarm incident. In addition, there is only one dial out per alarm trigger. An alarm continuing due to lack of response will only be picked up visually from SCADA or from the monitor read-out. h. A manual chlorine residual test is undertaken each day by MPE. The sample for this test is taken from the canteen at the water treatment plant, which is fed from a point directly after chlorine dosing and before contact time has been achieved. It can therefore not be compared with the continuous online result which is obtained at the reservoir outlet. i. MPE's "Alarm Response Procedure" was provided to the auditor by Irish Water following the audit. While MPE staff were aware that the procedure existed, it did not appear to be in active use during the incident. The auditor considered that the Procedure was a high level reference to alarm situations, and that the Standard Operating Procedures referred to within the Procedure may be more effective to ensure a quick and comprehensive response to a failure of critical equipment.
3.	<p>Incident Response</p> <ul style="list-style-type: none"> a. At around 13:30 hours on 31/12/2018, the chlorine residual measured at the Frewin Hill High Level Reservoir outlet began to drop, falling below the 0.6 mg/l alarm trigger at about 13:45 hours. b. Chlorine dosing to the Frewin Hill Low Level Reservoir and Town Reservoir was unaffected. c. The alarm failed to dial out, as the alarm had not been reset following a previous alarm. d. MPE personnel attending the site on 01/01/2019 noted the alarm and manually switched the duty pump over to standby. However, as there is no online means of verifying that a dose has been applied, it was not identified that the standby pump was not effective. e. The failure of both pumps serving the Frewin Hill High Level Reservoir to dose sodium hypochlorite was not identified until MPE staff arrived at the plant on the morning of 02/01/2019. f. Air locks were identified on pipework shared by both duty and standby pumps during the investigation of the incident on 02/01/2019. These air locks prevented both duty and

	<p>standby pumps from dosing sodium hypochlorite. Dosing was restored but the chlorine residual at Frewin Hill High Level Reservoir outlet did not return to the MPE specified range (0.6 to 0.8 mg/l) until approx. 21.30 hours on 02/01/2019.</p> <ul style="list-style-type: none"> g. Based on the SCADA trends and information presented to the auditor before and during the audit, undisinfected water entered the network for almost 56 hours during the period 31/12/2018 to 02/01/2019. h. There was an additional delay in the communication of the disinfection failure following the incident between MPE/ Westmeath County Council and Irish Water. According to the notification emails sent to the EPA, the local authority notified Irish Water on 02/01/2019 of an issue with chlorine residuals at the reservoir, which was not confirmed as a failure of disinfection until 4th January. i. A survey of chlorine residuals in the distribution network was not established until 04/01/2019, by which time chlorine levels had re-established. It was therefore not possible to assess the full impact of the incident on the drinking water in the distribution network.
4.	<p>UV Disinfection</p> <ul style="list-style-type: none"> a. There is a UV disinfection unit on-site which was installed in 2010-2011 to treat unfiltered raw water during periods when cold weather reduced the flow rates achievable through the microfilter units, in an effort to maintain a water supply under these conditions. The unit was not in operation during the audit. b. There was no validation or verification information available for the UV unit during the audit. It was not clear whether the UV unit is suitable for the treatment of the raw water abstracted from Lough Owel without treatment steps prior to UV.

3. AUDITOR'S COMMENTS

The process monitoring and controls at the Portloman water treatment plant were inadequate to allow a timely response to the failure of disinfection between 31st December 2018 and 2nd January 2019. The absence of adequate disinfection for an estimated 56 hours poses an unacceptable risk to public health. Irish Water should take action to ensure adequate verification of disinfection, with suitable alarms and controls to act on any disinfection process failure.

There was insufficient information available during the audit to demonstrate the protozoal removal log credit provided by the microfiltration system, and the required verification of this log credit for *Cryptosporidium* removal. Irish Water should review the Protozoal Compliance Requirements for the Mullingar Regional Water Supply and ensure that the process controls are in place to allow the ongoing verification of filtration as a barrier to *Cryptosporidium* entering supply. The EPA is considering the addition of the Mullingar Regional Water Supply to the Remedial Action List as a result of the deficiencies identified during the audit.

The UV disinfection unit on-site should not be used for the treatment of unfiltered raw water until Irish Water is satisfied that the unit meets the validation and verification requirements for such an application.

4. RECOMMENDATIONS

Action Programme

1. Irish Water should prepare and submit to the EPA by 30/01/2018 an Action Programme to ensure a validated *Cryptosporidium* barrier and adequate robust disinfection for the Mullingar Regional Water Supply. The Action Programme should address each of the items identified in Recommendations 2 to 10 below, and should include details on the action taken and planned to address each recommendation, including timeframe for commencement and completion of any planned work.

Filtration

2. Irish Water should install and maintain continuous turbidity monitors on the raw water intake, each filter outlet and on the final treated water at Portloman water treatment plant. These monitors should be linked to a recording device and generate an alarm in the event of a deviation from the acceptable operating range of the filters.
3. Irish Water should ensure the microfilter units are adequately validated for the required protozoal removal log credit and *Cryptosporidium* removal. This validation should be accredited to meet acceptable guidelines for example the USEPA Membrane Guidance Manual (USEPA, 2005) and refer to challenge testing and removal efficiency of the specific membrane product in place at the plant.
4. Irish Water should ensure that the microfilter units are verifiable during operation, referring to manufacturer's operational and maintenance requirements to meet the certified performance specifications such as direct integrity testing and continuous turbidity monitoring on raw water, filter outlets and final water.

Disinfection

5. Irish Water should review the contact time for chlorine disinfection to ensure that the effective contact time achieved for each reservoir is 15mg.min/l and that the first connections (including water supply to the water treatment plant itself) are receiving appropriately disinfected drinking water. Irish Water should submit calculations of the effective contact times to the EPA.
6. Irish Water should ensure continuous chlorine residual monitoring of the treated water at suitable locations after contact time is achieved on each line (e.g. at the reservoir inlets). These monitors should be alarmed with dial out to appropriate staff and linked to a recording device to ensure that if there is insufficient chlorine residual in the final water or a failure of the chlorine dosing system, it is detected and responded to without delay. The requirement in SCADA for an alarm reset should be programmed out so that alarms can always be generated when the trigger level is reached.
7. Irish Water should ensure that the expected response to chlorine residual alarms is set out comprehensively in a procedure available to plant operators for use in an emergency. This procedure should cover both the immediate responses to restore disinfection, the network monitoring requirements, and the channels of communication between the DBO operator, Westmeath County Council and Irish Water.
8. Irish Water should ensure that automatic switch over between duty and standby chlorine dosing pumps is provided for in the event of a low chlorine residual, as per the Irish Water Design Specification: Disinfection.
9. Irish Water should ensure that sample taps are installed to enable manual chlorine residual testing at similar locations to the online monitor sample locations, so that the results are comparable and can be used to inform plant operations and maintenance.

UV Disinfection

10. Irish Water should remove the UV disinfection unit from use until it can be verified that the raw water abstracted from Lough Owel is suitable for UV treatment alone. No blending of microfiltered water with untreated water, or with water treated by unvalidated UV system, should take place until Irish Water is satisfied that the UV disinfection unit meets the validation and verification requirements for such an application.

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.

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:

16/01/2019

Ruth Barrington

Inspector