



Drinking Water Audit Report

County:	Galway	Date of Audit:	21 st August 2015
Plant(s) visited:	Inisboffin PWS, Scheme code 1200PUB1024	Date of issue of Audit Report:	1 st September 2015
		File Reference:	DW2015/125
		Auditors:	Ms Aoife Loughnane
Audit Criteria:	<ul style="list-style-type: none"> • The <i>European Union (Drinking Water) Regulations 2014 (S.I. 122 of 2014)</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> • The recommendations specified in the <i>EPA Drinking Water Report</i>. 		

MAIN FINDINGS

- i. **There is poor control over chemical coagulant dosing at Inisboffin water treatment plant. The main operational issues include:**
 - a. **A fixed coagulant dose regardless of fluctuations in raw water quality.**
 - b. **No routine jar testing to determine the optimum coagulant dose, and**
 - c. **No monitoring of the treated water for aluminium.**
- ii. **Some alarm settings at the plant were not set at appropriate levels. Irish Water should conduct a full review of all alarm settings to ensure that potential issues are quickly detected and promptly brought to the attention of the caretaker.**
- iii. **The UV disinfection system comprises a duty unit only (no standby) and given the island location, Irish Water must ensure prompt response times in the event of a failure or breakdown of the UV unit.**

1. INTRODUCTION

Under the *European Union (Drinking Water) Regulations 2014* 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 dated 13th August 2015 of the failure to meet the aluminium parametric value (as specified in Table C of Part 1 of the Schedule of the Regulations) in Inisboffin public water supply.

Inisboffin water treatment plant serves a population of approximately 169 people during winter and up to 500 people during summer season. The source of the water supply is Lough Fawna. The water treatment plant was upgraded in 2012 from the previous slow sand filtration process. Treatment now consists of coagulation, dissolved air flotation & filtration (DAFF) and disinfection by chlorination and UV treatment. The water treatment plant was producing 233 m³/day on the day of the audit.

Photographs taken by Aoife Loughnane during the audit are attached to this report and are referred to in the text where relevant.

The opening meeting commenced at 1.30 pm at Inisboffin 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: (* indicates that person was also present for the closing meeting)

Louise Brennan, Drinking Water Compliance Analyst, Irish Water*

Tim O'Connor, Operations & Maintenance Engineer, Irish Water*

Eoin Curran, Assistant Engineer, Galway County Council*

Fintan Donnelly, Environmental Technician, Galway County Council*

Aidan Day, Caretaker, Galway County Council*

Representing the Health Service Executive:

Shane Keane, Principal Environmental Health Officer, HSE West*

Paul Hickey, Senior Environmental Health Officer, HSE West

Dr. Aine McNamara, Public Health Specialist, HSE West

Dr. Katherine Harkin, Public Health Registrar, HSE West

Dr. Niamh O'Callaghan, Public Health Registrar, HSE West

Representing the Environmental Protection Agency:

Aoife Loughnane, 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.	<p>Source Protection</p> <ol style="list-style-type: none"> a. Water is abstracted from Lough Fawna located adjacent to the treatment plant. The land surrounding the lake is commonage where sheep are grazed. The lake is partly fenced-off to prevent livestock access. b. The following parameters are monitored continuously in the raw water (the results at the time of the audit are also shown); pH 6.64 and turbidity 1.922 NTU. c. Raw water turbidity is usually in the region of 1 to 2 NTU. The raw water turbidity alarm is set at 50 NTU. This set-point is too high to ensure the caretaker is forewarned of abnormal operating conditions. d. The caretaker stated that raw water quality had been very stable until recently. He attributed the recent variations in raw water quality to the increased rainfall this summer. e. A barrier to <i>Cryptosporidium</i> entering the water supply is provided at the treatment plant by both the coagulation/filtration processes and the UV disinfection system.
2.	<p>Coagulation, Flocculation, Clarification and Filtration</p> <ol style="list-style-type: none"> a. Chemicals added to the raw water during the DAFF process include sodium hydroxide (pH adjustment) and aluminium sulphate (coagulant). b. The coagulant dose is fixed regardless of changes in raw water quality. There is no routine jar testing programme to determine the optimum coagulant dose in response to variations in raw water quality. c. The chemical injection points into the DAFF unit have become corroded due to exposure to the sea air (see photo 1). d. A recent inspection of the DAFF filter media by EPS identified a sand depth of 920 mm and a sand loss of approx. 150 mm since the DAFF commenced operation in 2012. A handwritten level indicator on the outside of the filter unit read "1780" which does not appear to correspond to the 1070 mm filter depth identified by EPS.

3.	<p>Disinfection – Ultra Violet Treatment</p> <ol style="list-style-type: none"> Primary disinfection is by UV treatment in a Trojan UV Swift B04 unit. The UV system is duty only and there is no standby provision in the case of failure or breakdown of the duty unit. Maintenance and servicing of the UV system is carried out by an external contractor (EPS). In the event of a breakdown, the response time could be slow given the island location. The validated range of the UV unit is $> 16 \text{ W/m}^2$ UV intensity for flows up to $11 \text{ m}^3/\text{hr}$ (and $> 20 \text{ W/m}^2$ UV intensity for flows up to $16 \text{ m}^3/\text{hr}$) and $> 85\%$ UV transmissivity. At the time of the audit, the inlet flow was $10.84 \text{ m}^3/\text{hr}$ and the UV monitor was reading 36.52 W/m^2 UVI and 95.3% UVT, which demonstrates that the plant was being operated within its validated range. An alarm and automatic shutdown of the UV system is triggered at $\leq 85\%$ UVT.
4.	<p>Disinfection – Chlorination</p> <ol style="list-style-type: none"> Secondary disinfection is achieved by dosing chlorine (sodium hypochlorite 14%) via duty and standby pumps with auto-switchover facilities. The clear water tank on site provides a chlorine contact time of 25 mg.min/l. At the time of the audit, the residual chlorine concentration leaving the plant was 1.0 mg/l according to the online CL_{17} monitor. A manual test carried out by the caretaker gave a result of 1.09 mg/l which shows good correlation between both measurements. The low chlorine alarm setting is 0.5 mg/l and the high alarm setting is 3 mg/l.
5.	<p>Monitoring and Sampling Programme for treated water</p> <ol style="list-style-type: none"> The following parameters are monitored continuously in the treated water (the results at the time of the audit are also shown); pH 7.18, turbidity 0.151 NTU, free residual chlorine (1.0 mg/l). The treated water high turbidity alarm is set at 1 NTU. There is no operational monitoring of the aluminium residual in the treated water at present. At the time of the audit, a handheld aluminium analyser had been delivered to the plant but the caretaker stated that he did not know how to carry out the test. The caretaker carries out daily monitoring of residual chlorine in the distribution network. No records of network monitoring were available during the audit. Treated water monitoring results submitted in advance of the audit showed an inadequate chlorine residual of 0.06 mg/l measured at the Community Centre on 21st April 2015. This sample was taken and analysed by a contract laboratory. The results were not communicated to the caretaker so no corrective actions were taken.
6.	<p>Exceedances of the Parametric Values</p> <ol style="list-style-type: none"> On 13th August 2015, Irish Water notified the EPA of an aluminium exceedance in the treated water at Inisboffin WTP of $317 \mu\text{g/l}$ compared to the $200 \mu\text{g/l}$ parametric value, indicating that there may be an issue with carryover of aluminium coagulant at the plant. Irish Water engaged EPS to undertake process investigations. The interim works report (dated 20/08/2015) identified the following issues: <ul style="list-style-type: none"> - Alum residuals over allowable limits on the treated water; - Raw water turbidity of 2.2 NTU, a significant increase from 0.97 NTU in May 2015; - Apparent colour of 71 Hazen, increased from 41 Hazen in May 2015; - High turbidity readings on the treated water; - UVT of the treated water dropped from 95% to 88%; - UVI of the UV reactor dropped from 37 W/m^2 to 21.7 W/m^2; - Odour and taste in the raw water (further investigation required). The following remedial works had been carried out by the time of the audit: <ul style="list-style-type: none"> - Optimisation of coagulant dosing by carrying out trials at different alum dosage rates at various pH values in the DAFF unit. - Reduced the aluminium residual to $74 \mu\text{g/l}$ and the DAFF turbidity to 0.12 NTU. - Increased the treated water UVT to 95% and the UVI to 35 W/m^2. - Measurement of sand in the DAFF and identification of 150 mm sand loss. The investigative and remedial works at the plant have yet to be fully completed.

7.	<p>Distribution Network</p> <p>a. There is no regular programme of flushing and scouring of the distribution network.</p>
8.	<p>Management and Control</p> <p>a. The plant caretaker attends the plant on a daily basis. Back-up is provided by the caretaker's brother, an employee of Galway County Council Roads Department. Plant alarms are sent by text to the caretaker and his brother.</p> <p>b. The plant automatically shuts-down upon activation of low UVT and residual chlorine alarms.</p> <p>c. The caretaker does not have access to SCADA on-site to assist in the management of the plant and the investigation of alarms.</p>

3. AUDITORS COMMENTS

Inisboffin water treatment plant is maintained to a high standard and operates within its design capacity. However, there are a number of improvements needed to the operation and control of the plant in order to ensure that it is capable of handling changes in raw water quality. The main operational issues include:

- a) A fixed coagulant dose regardless of fluctuations in raw water quality;
- b) No routine jar testing to determine the optimum coagulant dose; and
- c) No monitoring of the treated water for aluminium.

The caretaker does not have access to the SCADA system at the plant, which would assist in the management of the plant and investigation of alarms. The audit found that some of the alarm settings at the plant were set at very high levels which would not alert the caretaker to the abnormal conditions in sufficient time to allow actions to be taken. Irish Water should conduct a full review of all alarm settings to ensure that potential issues are quickly detected and promptly brought to the attention of the caretaker. Records of daily monitoring checks and activation of alarms should be recorded in the caretaker's log-book and kept at the plant.

4. RECOMMENDATIONS

Source Protection

1. Irish Water should characterise the variability in raw water quality. Trends in raw water quality should be analysed and used to determine the optimum treatment conditions for the water at the plant. Data should be used to identify whether rapid variations in raw water quality give rise to problems with the treatment process.
2. Irish Water should investigate reports of odour and taste in the raw and treated water, and take appropriate actions to ensure the water supply is acceptable to consumers.

Coagulation, Flocculation, Clarification and Filtration

3. Irish Water should implement routine jar testing of the raw and coagulated waters as outlined in Section 3.3.1 and Appendix C of the EPA publication "*Water Treatment Manual: Coagulation, Flocculation and Clarification*" to determine the optimum chemical coagulant dose and pH for the treatment of the water. The frequency of checks should be appropriate to the nature of supply and changing condition. Results should be recorded at the treatment works and used for control of the treatment plant.
4. Irish Water should investigate the setting up of automated coagulant dosing controls at the treatment plant, having regard to *EPA Drinking Water Advice Note 15: Optimisation of Chemical Coagulation Dosing at Water Treatment Works* available online at <http://www.epa.ie/pubs/advice/drinkingwater/dwadvicenote15.html>.
5. Irish Water should ensure that the DAFF filter is inspected regularly, and the filter media (sand) levels are maintained in accordance with the manufacturer's specifications.

6. Irish Water should investigate the feasibility of fully enclosing the DAFF unit to prevent the corrosion of chemical injection points, valves and instruments, in order to safeguard the operational performance of the plant.

Disinfection

7. Irish Water must ensure prompt response times in the event of a failure or breakdown of the UV disinfection unit, given that the UV system comprises a duty unit only (no standby) and considering the island location.
8. Irish Water should ensure that residual chlorine levels at the end of the distribution network are maintained at 0.1mg/l. The monitoring results should be recorded and available for review. Irish Water is requested to submit two months chlorine monitoring results from the extremities of the network, to include measurements taken at the Community Centre.

Management and Control

9. Irish Water should install a continuous aluminium residual monitor on the final water. The monitor should be alarmed and linked to a recording device. In the interim, Irish Water should commence a programme of manual monitoring of the treated water for aluminium. The results should be recorded in a logbook at the plant.
10. Irish Water should submit a report following the completion of the process investigation and remedial works at the plant. The report should include recommendations and timeframes for implementation.
11. Irish Water should ensure that training on all aspects of the treatment process should be provided to caretakers and/or plant operators.
12. Irish Water should ensure that alarms are set at appropriate levels to ensure that the plant operator is promptly notified of elevated readings and forewarned of potential failures. In particular, Irish Water should revise the raw and final water turbidity alarms to more appropriate set-points.
13. Irish Water should ensure that caretakers and/or plant operators have full access to the data pertaining to the performance of the plant. Specifically, access should be provided to raw and treated water quality trends.
14. Irish Water should prepare and instigate a regular programme of flushing and scouring of the distribution system.

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 Mr Darragh Page, Senior Inspector, Drinking Water Team.

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 DW2015/125 in any future correspondence in relation to this Report.

Report prepared by:



Date:

1st September 2015

Aoife Loughnane

Inspector



Photo 1: Corrosion of chemical injection points into the DAFF unit