Drinking Water Audit Report

County:	Wexford	**Date of Audit:**	8th October 2014
Plant(s) visited:	Enniscorthy (Vinegar Hill)	**Date of issue of Audit Report:**	10th November 2014
		File Reference:	DW2014/300
		Auditors:	Ms Yvonne Doris
Audit Criteria:	• The *European Union (Drinking Water) Regulations 2014 (S.I. 122 of 2014).* • *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 specified in the EPA Report on *The Provision and Quality of Drinking Water in Ireland*. • The recommendations in any previous audit reports.		

MAIN FINDINGS

i. **The disinfection controls at the Enniscorthy (Vinegar Hill) treatment plant are insufficient to adequately protect the health of consumers. The low chlorine alarm setpoint is too low and has been triggered 26 times in 2014. A review of procedures in response to chlorine alarms is required.**
ii. **A large housing estate is supplied directly from the Edermine borehole. There is no chlorine monitor or alarm on this section of the supply. The distribution network supplied by the Edermine and Killagooley boreholes should have chlorine monitors and adequate alarms in place.**
iii. **Chemical dosing processes and controls at the Vinegar Hill treatment plant should be reviewed and optimised, in particular, continuous online monitoring of raw water colour, optimisation of coagulation/flocculation processes, and procedures to ensure prompt and effective response to alarms.**

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 22th August 2014 of the failure to meet the Enterococci parametric value (as specified in Table A of Part 1 of the Schedule of the Regulations) in the Enniscorthy public water supply

The Enniscorthy public water supply is sourced from the river Slaney and two boreholes at Edermine and Killagooley. The treatment plant at Vinegar Hill, Enniscorthy is currently operating at 155m^3/hr for 21 hours/day. Plant capacity is 4550m^3/day; therefore the plant is operating well within capacity. Treatment of the Slaney river water includes chemical dosing with aluminium sulphate and polymer, clarification, filtration, disinfection using sodium hypochlorite and fluoridation. There are two treated water reservoirs at the plant (low and high) from where water is distributed to the town of Enniscorthy, which has a population of 11,000.The groundwater from the Edermine and Killagoley boreholes is disinfected using sodium hypochlorite and enters the Vinegar Hill plant at the high level reservoir.

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

The opening meeting commenced at 15.00 at the Enniscorthy drinking 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. During the audit, plant operating information was not available and was subsequently submitted to the EPA on the 10th, 17th, 24th, 28th, 29th October and

7th November and is contained in this report. 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)
Name – Job Title
Kieran Cullinane, Above Ground Level Lead, Irish Water*
Rory O'Mahoney, Area Engineer-Enniscorthy Area, Water Services, Wexford County Council (WCC)
Paul Delahunty, Quality Engineer, Water Services, Wexford County Council*
Nicky Fortune, Acting Caretaker, Wexford County Council*
Representing the Environmental Protection Agency:
Name – Job Title
Yvonne Doris, 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.	**Source Protection** a. There are three sources of the Enniscorthy supply – the River Slaney and two boreholes at Edermine and Killagooley. At the Slaney river intake two of three abstraction pumps operate at one time, abstracting on average 3,250 m^3 per day (21 hours/day at 155 m^3/hr). 500 m^3 per day (10-11 hours/day) is abstracted from the Killagooley borehole and 620 m^3 per day (24 hours/day) from the Edermine borehole. b. Raw water pH, turbidity and ammonia are continuously recorded (Slaney source). Raw water colour is not continuously monitored. c. At the time of the audit here was high turbidity and low chlorine in the treated water. There had been heavy rainfall the previous two nights.
2.	**Coagulation, Flocculation and Clarification** a. Water abstracted from the River Slaney enters a contact tank into which aluminium sulphate is dosed (14.5 litres/hour concentration unknown). Aluminium sulphate mixing time is 8.8 minutes. Polymer is added at 30 strokes per minute. pH correction is done at this point 25kg per day. b. The caretaker monitors the Scada readings for ammonium, pH, turbidity and visually checks the raw water jar in the lab to determine if aluminium sulphate and chlorine dosing needs adjustment. There are no set procedures for the adjustment of dosing - a judgement is made by the caretaker based on experience and a prediction of water quality based upon expected weather conditions. c. There are two hopper-bottomed clarifiers. Algal growth was observed on the walls of the clarification tanks. The channels in the clarifier have uneven flow and holes were observed in one of the channels. The clarifier concentrator is bled every 30 minutes for 2 minutes (this varies with weather conditions). The clarifier channels are cleaned weekly (and more often in summer). The clarifier base is desludged every month (this varies seasonally). The clarifiers were fully cleaned out two years ago. d. pH and turbidity is continuously monitored after the clarifiers.
3.	**Filtration** a. Backwashing of filters is done based on time – normally every 72 hours, but more frequently if the weather is bad. Typically, one filter is backwashed each day. Filter service time between backwashing is three days. The air scour is 167 litres/second for 5 minutes and the water wash is 114 litres/second for 6 minutes. Turbidity is monitored after each of the three filters. b. At the time of the audit the relief caretaker had to leave to attend to a pump failure at the Slaney intake. Backwashing of a filter was not observed during the audit and therefore no observations or recommendations can be made on the condition of the filters or effectiveness of a backwash. c. Information provided by WCC after the audit showed that the turbidity of the final water (combination

	of three filters) and the turbidity of each of the three individual filters was above 1 NTU for at least two days between 4th and 6th August.
4.	**Chlorination and Disinfection** a. Disinfection is using sodium hypochlorite (14.5%) prior to the clear water tank. The chlorine dosing rate is typically 2.6 litres/hour but during river flooding periods the rate is increased to 5 litres/hour. In the event of severe flooding, when raw water quality is poor, the caretaker manually doses additional chlorine into the high reservoir. A rate of 2 litres of neat sodium hypochlorite is added to the pump lift chamber both at 8:30am and 4:30pm. This achieves a rise in the outlet chlorine levels by 0.6 mg/l after 30 minutes. b. Chlorine dosing at the Vinegar Hill plant is at a fixed rate and not dosed proportional to flow or linked to residual chlorine levels. c. There are duty and standby chlorine dosing pumps with automatic switchover at the Vinegar Hill treatment plant. d. The low chlorine alarm setpoint on the high level reservoir is 0.1mg/l and the low chlorine alarm setpoint on the low level reservoir is 0.15mg/l. The low chlorine alarm was triggered 26 times between January and October 2014. e. When the chlorine alarm is triggered the caretaker manually adjusts the stroke setting on the chlorine dosing pump and takes chlorine residual readings until the chlorine residual at the low level reservoir increases to 0.5mg/l free chlorine during dry weather and 1mg/l free chlorine during wet periods. The chlorine residual is tested at the ends of the distribution network. Areas of low chlorine are then flushed and scoured and resampled. f. The calibration sticker on the chlorine pump had a calibration due date of September 2014 and appeared to be overdue calibration. g. Fluoride (5 litres per hour) is dosed prior to the clear water tank. h. Borehole water from Edermine and Killagooley is disinfected with sodium hypochlorite. There is duty and standby chlorine dosing pumps with automatic switchover at Killagooley. There is no chlorine monitor or alarm at Edermine or Killagooley boreholes.
5.	**Treated Water Storage and Distribution Network** **a.** From the clear water tank, some water is directed along an 8 inch line via a low level reservoir ($2700m^3$) and serves part of Enniscorthy town. The low level reservoir has 10-12 hours retention time. The remaining water is pumped to a high level reservoir ($3400m^3$). According to Wexford County Council there is approximately 6 hours storage in the reservoirs. After 6 hours parts of the town experience a loss in pressure. **b.** Chlorine residual and pH is monitored after the high level reservoir. c. Borehole water disinfected with sodium hypochlorite is pumped to the high level reservoir. d. A small round reservoir is fed from the high level reservoir and water from this small round reservoir serves Clonhaston, in the north-east of Enniscorthy town. e. A large housing estate (Gimont) is fed directly from the Edermine borehole. Customers receive adequate effective chorine contact time but there is no residual chlorine monitor on this section of the supply. **f.** Flushing and scouring is done once a year in a uni-directional fashion. WCC stated that it should perhaps be done twice a year. Intermittent flushing is carried out in certain streets, after works are undertaken, in streets with cast-iron mains.
6.	**Exceedances of the Parametric Values** a. On 2nd August 2014 there was a heavy rainfall event. b. On 4th August the first low level chlorine alarm was triggered at the Vinegar Hill plant. c. On 5th August 2014 the caretaker took a raw water turbidity reading of 21.4 NTU. A single audit sample was taken in the network which exceeded the Enterococci parametric value (result was 6 per 100ml). Further sampling was compliant. An increase in aluminium sulphate dosing (to treat highly turbid raw water) resulted in aluminium exceedances of 491 ug/l at the plant and 407 ug/l in the network. Records provided by Wexford County Council showed that free chlorine results at certain locations served by the Enniscorthy supply were below the EPA recommended level of 0.1mg/l at the end of July and on the 7th and 8th October 2014. d. On 22nd August 2014 the enterococci exceedance was notified to the EPA.
7.	**Management and Control** a. During the audit information on the treatment processes and controls were not available to the

	inspector. Information was subsequently submitted to the EPA on the 10th, 17th, 24th, 28th, 29th October and 7th November and is contained in this report

3. AUDITORS COMMENTS

The disinfection controls at the Enniscorthy (Vinegar Hill) treatment plant are insufficient to adequately protect the health of consumers. The low chlorine alarm setpoint is too low and has been triggered 26 times in 2014. A review of procedures in response to chlorine alarms is required.
A large housing estate is supplied directly from the Edermine borehole. There is no chlorine monitor or alarm on this section of the supply. The distribution network supplied by the Edermine and Killagooley boreholes should have chlorine monitors and adequate alarms in place.
Chemical dosing processes and controls at the Vinegar Hill treatment plant should be reviewed and optimised, in particular, continuous online monitoring of raw water colour, optimisation of coagulation/flocculation processes, and procedures to ensure prompt and effective response to alarms.

4. RECOMMENDATIONS

Source Protection

1. The Water Services Authority should install a continuous automatic colour monitor or equivalent, to alert plant operators of any changes in raw water quality.

Coagulation, Flocculation and Clarification

2. The Water Services Authority should ensure that the coagulation / flocculation processes at the water treatment works are regularly inspected. 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.

3. The Water Services Authority should undertake a review of the coagulation / flocculation processes at the water treatment works by way of a review by Irish Water process optimisation personnel. The review should take account of the recently published EPA Advice Note 15: Optimisation of Chemical Coagulation Dosing at Water Treatment Works available online at http://www.epa.ie/pubs/advice/drinkingwater/dwadvicenote15.html.

4. The Water Services Authority should ensure that settled water outlet channels are level, free from blockage and flow into these channels is even. Repairs to the holes in the channels should be carried out.

5. The Water Services Authority should ensure that the settled water outlet channels and the clarifier are cleaned on a regular basis to prevent build up of algae on the weirs and on the walls of the clarifier.

6. The Water Services Authority should investigate the efficiency of the sludge bleeds and should establish the optimum regime of sludge draw-off.

7. The Water Services Authority should review the frequency of fully emptying and cleaning out of the clarifiers.

Filtration

8. The Water Services Authority should review the frequency of backwashing and consider backwashing based on the turbidity of filtered water from each individual filter.

Disinfection

9. The Water Services Authority should ensure that dosing of chlorine at the Vinegar Hill treatment plant is flow proportional or is linked to the residual chlorine monitor.

10. The Water Services Authority should review the low chlorine alarm setpoints at both the high and low reservoirs at the Vinegar Hill treatment plant and ensure that the revised setpoints allow sufficient time to

resolve any issues while maintaining a chlorine residual of 0.1mg/l at the extremities of the network.

11. The Water Services Authority should install a continuous chlorine residual monitor on the disinfected water from both the Edermine and Killagooley boreholes and the monitors should be alarmed and linked to a recording device to ensure that either a sudden increase in chlorine demand or a failure of the chlorine dosing system is immediately detected.

12. The Water Services Authority should review the procedures for response to low chlorine alarms.

Distribution System

13. The Water Services Authority should assess the appropriateness of the current frequency of uni-directional flushing and scouring of the mains.

14. The Water Services Authority should ensure that residual chlorine levels at the end of the distribution network are maintained at 0.1mg/l.

Management and Control

15. The Water Services Authority should ensure that plant operators, including relief caretakers, have access to the relevant information for plant operations and plant controls.

16. The Water Services Authority should consider setting raw water turbidity alarms to assist caretakers in the treatment of high turbidity raw water.

17. The Water Services Authority should ensure that all monitors are linked to recording devices and, where appropriate, alarmed. A procedure should also be put in place defining the actions to be taken in response to the different levels of alarm.

18. The Water Services Authority should ensure that equipment is calibrated according to the manufacturers specifications.

19. The Water Services Authority should ensure that exceedances of the European Union (Drinking Water) Regulations 2014 (S.I. 122 of 2014) are promptly notified to the EPA in accordance with the EPA Handbook on Public Water Supplies available at http://www.epa.ie/pubs/advice/drinkingwater/publicwatersupplieshandbook/.

FOLLOW-UP ACTIONS REQUIRED BY IRISH WATER

During the audit the Water Services Authority representatives were advised of the audit findings and that action must be taken as a priority by the Water Services Authority to address the issues raised. This report has been reviewed and approved by Mr Darragh Page, Drinking Water Team Leader.

The Water Services Authority 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 in any future correspondence in relation to this Report.

Report prepared by: Yvonne Doris **Date:** 10th November 2014

Yvonne Doris

Inspector

Photograph 1: Uneven flow in clarifier channels

Photograph 2: Holes in the clarifier channel