



Drinking Water Audit Report

County:	Cavan	Date of Audit:	13 th June 2018
Plant(s) visited:	Kingscourt Water Treatment Plant	Date of issue of Audit Report:	27 th June 2018
		File Reference:	DW2009/135
		Auditors:	Ms Derval Devaney
Audit Criteria:	<ul style="list-style-type: none"> • The <i>European Union (Drinking Water) Regulations 2014 (S.I. 122 of 2014)</i>, as amended. • <i>The 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>. • EPA Drinking Water Advice Notes No's 1 to 15. • The recommendations in any previous audit reports. 		

MAIN FINDINGS

- i. **The upgrade of Kingscourt water treatment plant has resulted in compliant manganese and iron results in the network which should enable the public water supply to be removed from the EPA's Remedial Action List.**
- ii. **There was a slight discrepancy between validation criteria on the UV disinfection system's certificate and the sticker on the UV Unit.**
- iii. **Residual chlorine results for a section of the network of the water supply were not available for review on the day of the audit. This was because some monitoring is undertaken by a different caretaker in the functional area of Meath County Council.**

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 to assess the performance of the upgraded Kingscourt water treatment plant in providing clean and wholesome drinking water and to determine if the supply can be removed from the EPA's Remedial Action List (RAL). The water supply was added to the RAL in 2009 because the HSE identified that further investigation or improvement may be required to ensure a safe and secure water supply. Subsequent EPA audits recommended that treatment facilities be upgraded or replaced to ensure the Kingscourt Public Water Supply (PWS) complies with the requirements of Drinking Water Regulations.

The Kingscourt PWS supplies 661 m³/day on average of water to a population of approximately 2,718 in Kingscourt and environs. The upgrade now affords the plant a capacity of 1,042 m³/day. Ballinaclose in Co. Meath is also fed from this supply and was a separate scheme until 2017 when it was amalgamated with Kingscourt PWS. The Lough Ervey source is no longer being used due to the high levels of iron and manganese in this source, and instead two boreholes in Co. Monaghan (PW5 and PW10) provide raw water to the water treatment plant. The package plant (pressure filters and backwash tank) has also been made redundant. The newly installed plant consisting of in-line coagulation, 1st stage pressure filtration, pH correction, oxidation, 2nd

stage pressure filtration (for the removal of iron and manganese), disinfection via UV treatment and chlorination, pH correction and fluoridation operates currently 10 hours/day.

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

The opening meeting commenced at 10.00 am at Kingscourt 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:

Pat O’Sullivan, Drinking Water Compliance Specialist; Yvonne McMonagle, Compliance Analyst.

Representing Cavan Co. Co:

Gary Boyd, Project Manager.

Representing Veolia:

Mark Rooney, General Manager; Robert McCann, Engineer; Gary Lee, Engineer; Aidan Loughlin, Process; John Glynn, Project Manager; John Dunne, Automation.

Representing the Environmental Protection Agency:

Derval Devaney, 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> <ul style="list-style-type: none">a. Two groundwater abstraction sources are used for the supply, borehole PW5 and PW10 which are in Co. Monaghan, appropriately a 15 minutes’ drive from the water treatment plant. The sources were visited during the audit.b. The two new boreholes were drilled as part of advance works on the upgrade of the supply. PW5 (borehole at Cabra) was commissioned in 2005/2006 and PW10 (borehole at Descart) was drilled in 2007/2008 and over the last 4- 5 years was developed into a production well that meets Irish Water, the EPA and IGI standards under the charge of a hydrogeologist and was brought into service this year.c. PW10 has a pressure sensor, level sensor, non-return valve at the wellhead and an alarmed online turbidity monitor. A kiosk has yet to be installed to cover PW10. There is also a plug-in point at the wellhead for a generator, should it be required.d. PW5’s pump is to be refurbished and a panel installed to automate the monitoring of the raw water similar, to PW10s controls. PW5 has a chamber that is below ground and rainwater was evident at the bottom of the chamber (see Photo 1). A pump automatically pumps out water when the rainwater reaches a certain level in the chamber and this had been manually turned on during the inspection. In addition, there were loose cables and pieces of plastic on the floor of the chamber. Veolia stated it had yet to seal the wellhead, tidy up the cables and install turbidity, pressure and flow monitors on PW5 so that it is of similar standard to PW10.e. A zone of contribution study was completed for both groundwater sources and the landowners in the vicinity of PW10 were notified of their responsibilities under the
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	<p><i>European Communities (Good Agricultural Practice for the Protection of Waters) Regulations.</i> It was thought that landowners in the vicinity of PW5 were also written to, Irish Water stated it would confirm this.</p> <p>f. In addition to the online monitors on the boreholes, raw water entering the plant is also monitored online for turbidity, pH, temperature and additional monitoring is undertaken on a weekly basis. The online monitors showed pH was 7.35, temperature 16.3 °C, and turbidity 0.188 NTU on the day of the audit.</p>
<p>2.</p>	<p>Coagulation</p> <p>a. A flow of 60 m³/hr, combined from PW5 and PW10, enters the plant and is dosed in line with a small amount of polyaluminium chloride (PAC) at 0.5 litres/hr.</p>
<p>3.</p>	<p>Filtration</p> <p>a. After the coagulant injection, the water enters a multimedia filtration process (see Photo 2). Three new pressure filters were installed as part of the plant upgrade with a diameter of 1.8m. Water is divided between these three 1st stage filters. These filters are dual media filters with 400 mm of anthracite and 600 mm of sand. The anthracite layer removes most of the flocs and larger suspended solids. The silica sand layer removes any finer suspended particles. There is an online turbidity monitor on each pressure filter.</p> <p>b. Backwash is on a timer to backwash every 24 hours. Backwash can also be triggered by head loss, turbidity or manually. The backwash system is a combined air and water process. The backwash water comes from the onsite clearwater tank.</p> <p>c. There is a run to waste facility after the backwash process which generally runs for 10 minutes. It is set to run to waste until the turbidity reaches a predetermined low level of 0.3 NTU. During the backwash of a filter, the incoming raw water is directed to the other pressure filters in service.</p> <p>d. The online turbidity monitors read 0.145 NTU for Filter 1, 0.145 NTU for Filter 2 and 0.053 NTU for Filter 3. There are online monitors on the combined water exiting the 1st stage filters for pH and turbidity. These read 7.69 for pH and 0.094 NTU for turbidity on the day of the audit.</p> <p>e. For the removal of iron and manganese, 3 No. dedicated pressure filters have been installed following an oxidation step.</p> <p>f. Prior to the water entering the oxidation tank it is dosed with sodium hydroxide (at 300 ml/hr) to adjust the pH to provide a slight increase to reach the optimum pH for the required oxidation of manganese. Sodium hypochlorite is dosed (at 300 ml/hr) into the oxidation tank. Water is held in this tank to give a contact time of 20 minutes prior to entering one of the three 2nd stage pressure filters.</p> <p>g. The 2nd stage pressure filters contain two layers of media. The first layer has 500 mm of effective size 0.85 mm sand and the second layer has a minimum depth of 500 mm of manganese dioxide. The manganese dioxide (MnO₂) layer serves to oxidise soluble manganese to insoluble manganese compounds which are then adsorbed on to the surface of the MnO₂.</p> <p>h. For the second stage pressure filters, the same backwash sequence as above allows a complete regeneration of the manganese dioxide layer of the filter media. The turbulent conditions brought by the air scour cause abrasion of the softer manganese oxides (corresponding to the manganese oxides formed as precipitates of the dissolved manganese in the water) which are broken into smaller particles that are removed by the backwash water flush. Turbidity meters at the outlet of the filters control this run to waste process.</p>
<p>4.</p>	<p>Disinfection</p> <p>a. Disinfection is provided by UV treatment (duty and standby) and chlorination using sodium hydroxide.</p> <p>b. The groundwater source serving Kingscourt PWS is classified by Irish Water as G1/G2 and has a maximum protozoan log deficit of 4 which has required the installation of a duty and standby UV system to fully provide for Barrier 3 (protozoan removal by deactivation).</p> <p>c. The UV units are “Best UV Model BetaLine BLE4.250” low pressure mercury lamps and are certified and validated to the ÖNORM Austrian standard M 5873-1:2001 03 01 to provide a reduction Equivalent Fluence (REF) of 40 mJ/cm² and a 3-log reduction barrier to <i>Cryptosporidium</i>. The entire plant provides a 5.5-log reduction.</p>

	<ul style="list-style-type: none"> d. The UV dose is kept constant by varying the lamp output in accordance with variations in flow and UV intensity, as measured by built-in intensity monitors within each UV reactor. e. The ÖNORM project certificate states the units are validated for a maximum flow rate of 68.5m³/hr at 125 W/m² UVI and a minimum of 85 % UVT. However, the sticker on the UV unit differed stating the maximum validated flow rate was 70m³/hr at 86.4 % UVT (see Photo 3). f. The UV unit was not in operation during the audit as the plant was on shut down. The unit monitors and displays UVI, flow, water temperature and lamp run hours. Automatic changeover between the UV Units occur upon each start-up which could be twice per day. There is a 5-minute warm up on the lamps prior to use to ensure adequately disinfected water enters supply. g. The UV unit is alarmed to shut down the plant if it falls outside its validated ranges (e.g. below 125 W/m² UVI). A low UVI or UV unit fault will first switch over to the standby unit and if a fault on the second unit is triggered then the plant will shut down as per the control philosophy. The plant is not alarmed to shut down if the flow exceeds 70 m³/hr as the operators stated it was not possible to exceed this flow to the UV unit. However, it was stated that this will be introduced as a failsafe measure post the audit. h. Sodium hypochlorite 14 % is dosed flow proportionally by duty and standby pumps after the UV unit to the inlet of a baffled contact tank. A CL17 analyser located after the dosing point and prior to the contact tank monitors residual chlorine to ensure the dose set point for residual chlorine of 0.75 mg/l is met. i. pH is also measured at the inlet to the chlorine contact tank and after sodium hypochlorite is dosed. j. Sodium hydroxide at a concentration of 25% w/w and hydrofluorosilic acid is dosed into the feed line between the outlet of the contact tank enroute to the onsite service reservoirs. There is a static mixer on this line to provide mixing for the sodium hydroxide, fluorine and orthophosphate, if the latter is required for use in future. It is currently not envisaged that orthophosphate will be dosed at the plant. k. Water is sampled downstream of the static mixer, prior to entering the onsite reservoir for final water turbidity, chlorine residual 1, chlorine residual 2, treated water pH, colour and fluorine residual. The final water online monitors on the day of the audit read; pH 7.56, temperature 15.5 °C, colour 0.1 Hazen, turbidity 0.205 NTU and residual chlorine 0.61 mg/l on both CL17 analysers.
<p>5.</p>	<p>Treated Water Storage and Distribution Network</p> <ul style="list-style-type: none"> a. Water flows by gravity from the chlorine contact tank to the two on-site covered service reservoirs for water storage after final treatment. The total storage capacity of the reservoirs is circa 1,060 m³. Each reservoir cell (of 530 m³ capacity) is provided with a U-sonic level transmitter and two back-up level switches. Both reservoirs are equalised by an equilibrium balance valve, hence the level should be the same value in both. However, the facility exists to isolate one cell for maintenance and cleaning, etc. There were meshes on the reservoir vents to protect the treated water from potential contamination. The reservoir level dictates when the plant comes into operation or goes into shut-down.
<p>6.</p>	<p>Monitoring and Sampling Programme for treated water</p> <ul style="list-style-type: none"> a. Veolia are the contractors who were involved in the upgrade of Kingscourt PWS. It has just finished the commissioning phase and is starting its 12-month operational phase prior to handing the plant back to Irish Water. b. It was stated during the audit that Veolia provide a monthly report on the operational and any additional monitoring carried out at the plant and that any incident would be reported to Irish Water outside of this report should it occur and that there is good communication between both parties. c. Caretakers from Cavan County Council and Meath County Council take samples for residual chlorine in the network daily and record the results. The chlorine residual results for the supply serving the Ballinaclose area in Co. Meath were unavailable for review during the audit. The chlorine residual results taken in the supply on 6th of June 2018 serving Co. Cavan were reviewed during the audit and were found to be satisfactory and above 0.1 mg/l. A map of the distribution network illustrating where chlorine residual sampling was undertaken on 6th June 2018 was presented during the audit. The map

	<p>showed there were no samples taken at the ends of some parts of the network on that day.</p> <p>d. A sample for THMs, iron and manganese was taken in the network on 31/05/18 and the lab certificate was reviewed during the audit. The THMs result was 10 µg/l (vs. the parametric value of 100 µg/l), manganese 10 µg/l (vs. the parametric value of 50 µg/l) and iron was 5 µg/l (vs. the parametric value of 200 µg/l). The results show that remedial works undertaken have addressed the manganese and iron failures in the Kingscourt PWS.</p>
7.	<p>Management and Control</p> <p>a. The plant shuts down if there is a high fluoride, high and low pH, high turbidity, high and low chlorine and high colour reading on the online monitors. There is a dial out alarm and a cascade system in place.</p> <p>b. The EDEN database does not reflect the current status of this water supply. It refers to Lough Ervey and one groundwater borehole as the source and states there are no turbidity monitors at the plant.</p>
8.	<p>Sludge Management</p> <p>a. Backwash water from the pressure filters is discharged to the filter washout settlement tank. The tank has a minimal working capacity to handle 8 washes per day along with 19 days' sludge storage capacity.</p> <p>b. Only one filter is backwashed at a time, meaning the other filters remain online to continue the production of treated water during a filter wash.</p> <p>c. A polymer is dosed in to the backwash waste water line during the filter backwashing period to increase the ability of the wash water to segregate into floc particles (sludge) and supernatant. After settlement in the tank, the outlet decant pump automatically runs the supernatant to discharge into the local drainage area on site. The remaining sludge is taken off-site for further treatment.</p> <p>d. When the washout tank is in service, and receiving backwash water, it stops its outlet decant pump so that it fills with wash water from the filter backwash and does not allow water to discharge to the drain onsite. When the tank has filled to its capacity, as measured by its level transmitter or a filter backwash has completed, all backwash valves are forced closed to allow water in the tank to settle out into supernatant and sludge. This takes approximately between 2 and 4 hours.</p>

3. AUDITORS COMMENTS

Irish Water made significant investment, of over €7 million, in the Kingscourt Water Supply Scheme, which supplies the town of Kingscourt and Environs. The original water treatment plant, built in the 1950's, was supplied from Lough Ervey and now the water is supplied from two groundwater wells. These wells were developed and a new water treatment works installed to treat groundwater at the existing Kingscourt water treatment works site to cater for an increased capacity, should the need arise, of 1,042 m³/day.

The audit found that iron and manganese levels in Kingscourt PWS are now in compliance with the Drinking Water Regulations and the disinfection at the plant has been upgraded to treat *Cryptosporidium* in the raw water, should it be present. It is envisaged that this supply can be removed from the EPA's Remedial Action List (RAL) in Quarter 2, 2018 because of the successful upgrade works.

4. RECOMMENDATIONS

Source Protection

1. Irish Water should liaise with the relevant local authority to ensure it has contacted the landowners within the zone of contribution for borehole PW5 in relation to the requirements of the *European Union (Good Agricultural Practice for the Protection of Waters) Regulations 2014 (SI No.31 of 2014)* to ensure, unless an alternative setback distance has been set as per Article 17 that:
 - i. Organic fertiliser or soiled water is not applied to land within 200 m of the abstraction point;

- and
- ii. Farmyard manure held in a field prior to land spreading is not placed within 250 m of the abstraction point.
2. Irish Water should complete the works planned for PW5 and PW10 to ensure that the boreholes are maintained in accordance with EPA Advice Note No. 14: Borehole Construction and Wellhead Protection. Such measures include installing a kiosk to cover PW10 and PW5 wellhead is to be sealed, pump refurbished, online monitors installed and other works to ensure the chamber's contents are waterproof and free from contamination.

Disinfection

3. Irish Water should investigate on the discrepancy between the validation criteria set out in the ÖNORM project certificate and that displayed on the sticker on the UV unit and inform the EPA of the outcome.
4. Irish Water should ensure the UV unit is conditioned to alarm and shut down if the water flow to it falls outside the unit's validated range.

Distribution System

5. Irish Water should ensure that free residual chlorine levels are sampled at the ends of the distribution network and are maintained at or above 0.1mg/l. Irish Water should ensure that the plant operator and Cavan County Council's caretaker have access to the results for chlorine residuals sampled in the section of main serving the Ballinaclose area in Co. Meath.

Management and Control

6. Irish Water should ensure that EDEN database is updated to reflect the current source, treatment processes and controls in place at the upgraded Kingscourt water treatment plant.

FOLLOW-UP ACTIONS REQUIRED BY IRISH WATER

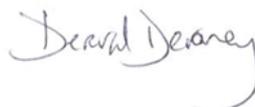
During the audit, Irish Water representatives were advised of the audit findings and that action must be taken as a priority by Irish Water to address the issues raised. This report has been reviewed and approved by Ms Aoife Loughnane, Drinking Water Team Leader.

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 in any future correspondence in relation to this Report.

Report prepared by:



Date:

Derval Devaney

27th June 2018

Inspector



Photo 1 PW5 Borehole with standing water in its chamber



Photo 2 New Pressure Filters (Stage 1 on RHS & Stage 2 on LHS)

Identification plate for irradiation chamber

best UV
experts in ultraviolet light

Manufacturer	bestUV B.V.
Address	De Donge 4, 5684 PX, Best, The Netherlands
Type of UV-system	BLE4.250
Year of production	2017
Type of UV-lamp	E250
Number of lamps installed	4
Type of UV-sensor	UsO
Capacity @ T10	70 [m ³ /h]
Minimum transmission (T10)	86,4 [%]
UVI-min.	125 [W/m ²]
Validation test according to	ÖNORM M5873-1, procedure B



Photo 3 Sticker on UV unit