

# Site Visit Report

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 Irish Water in providing clean and wholesome water to the visited public supply.

The audit process is a sample on a given date of the facility's operation. Where a finding against a particular issue has been reported this should not be construed to mean that this issue is fully addressed.

Water Supply Zone	
<b>Name of Installation</b>	Cork City Water Supply
<b>Organisation</b>	Irish Water
<b>Scheme Code</b>	0400PUB1001
<b>County</b>	Cork
<b>Site Visit Reference No.</b>	SV22861

Report Detail	
<b>Issue Date</b>	11/11/2021
<b>Prepared By</b>	Criona Doyle

Site Visit Detail			
<b>Date Of Inspection</b>	12/10/2021	<b>Announced</b>	Yes
<b>Time In</b>	10:00	<b>Time Out</b>	15:10
<b>EPA Inspector(s)</b>	Criona Doyle Regina Campbell		
<b>Additional Visitors</b>			
<b>Company Personnel</b>	Irish Water: Deirdre O'Loughlin; Robert Kennedy; Oliver Harney; Pat Britton; Phil Elvins.  Cork City Council (acting under service level agreement to Irish Water): James Goulding; Brian Harrington.		

## > Summary of Key Findings

(1) The audit found that while the infrastructure is old and in need of upgrade the water treatment plant was performing well as demonstrated by the low filtered water turbidity levels and stable residual chlorine levels. A temporary UV disinfection system which was commissioned in March 2021 is providing additional security to the supply. The plant is being operated at a significantly lower throughput (28,000m<sup>3</sup>/d) than the design capacity (42,000m<sup>3</sup>/d) and will remain at this lower production rate until the new plant has been commissioned.

(2) The Lee Road water treatment plant (WTP) is an old plant. There are no automatic shutdowns in place at the plant and alarm response is reliant on manual intervention with the plant manned on a 24 hour basis. The existing treatment plant will be replaced by a new water treatment plant which is under construction and due to be commissioned in Quarter 1 2022. The Lee road WTP has been on the EPA's Remedial Action List (RAL) since 2008. The new plant will provide a more resilient supply to ensure a safe and secure supply into the future and allow the supply to be considered for removal from the RAL.

(3) A section of the roof of the High level / Churchfield reservoir is damaged. The roof has been stabilised but a complete roof replacement is required. Irish Water and Cork City Council are undertaking a programme of enhanced monitoring until the remedial works have been completed. Irish Water should submit a programme and timeframe for completion of the remedial works on the reservoir.

(4) A number of audit recommendations have been outlined to improve the resilience of the supply until the new treatment plant has been fully commissioned.

## > Introduction

The Cork City public water supply serves a population of 97,176 (EDEN figure) and currently produces 28,000m<sup>3</sup>/d. Raw water is abstracted from the River Lee. Treatment at the Lee Road Water Treatment Plant (WTP) includes coagulation, flocculation, clarification, filtration, disinfection (chlorination & UV), final pH correction and fluoridation. The site is manned 24 hours a day 365 days a year.

The audit was undertaken at the existing water treatment plant to assess the operation and management of the current plant. The Lee Road WTP has been on the Environmental Protection Agency's (EPA) Remedial Action List (RAL) since 13/10/2008 under the category EPA Audit Observation - Treatment and Management Issues.

Works commenced on the construction of a new water treatment plant adjacent to the existing Lee Road WTP in September 2019. The works are expected to be completed in Quarter 4 2021 with commissioning of the new WTP in Quarter 1 2022.

## > Supply Zones Areas Inspected

The audit consisted of an on-site inspection of the Lee Road WTP on 12/10/21. All areas of the treatment process were inspected during the audit including the abstraction, coagulation, filtration, disinfection and fluoride dosing stages. The high level reservoir at Churchfield was also viewed. The new water treatment plant which is currently under construction was not included in the audit.



## 1. Source Protection

	Answer
1.1	Is the abstraction source(s) adequately protected against contamination?
	Yes
<b>Comment</b>	
<p>There is continuous monitoring of turbidity, pH and ammonia at the raw water inlet. A coarse bar screen is provided at the intake with a floating boom inside and outside the screen. A fine band screen is also provided. A 10mm fish screen is also used during the months of March, April &amp; May.</p> <p>There is no automatic shutdown of the intake linked to the raw water inlet alarm set-points. The plant is manned 24 hours a day and the operators respond to the alarms. The raw water alarm set-points are as follows:</p> <ul style="list-style-type: none"><li>• Ammonia high high alarm 0.20 mg/l and high alarm 0.15 mg/l;</li><li>• pH low alarm 6 pH units;</li><li>• Turbidity high high alarm 25 NTU and high alarm 10 NTU.</li></ul>	



## 2. Coagulation Clarification Flocculation (CFC) Stage

		Answer
2.1	Are the CFC processes appropriately controlled?	Yes
<b>Comment</b>		
<p>Duty and standby coagulant dosing pumps are provided for dosing of the coagulant (mix of aluminium sulphate and ferric sulphate). There is automatic pump switch over if the duty pump breaks down and routine automatic switchover between duty / standby pumps on a 12 hour frequency.</p> <p>The automatic coagulant dosing is controlled by the streaming current monitor with a trim provided based on colour. There is also the option of providing the trim dose based on UVT. pH adjustment is rarely required as the alkalinity is reported to be stable. Jar tests are carried out in response to changing raw water quality conditions as required.</p> <p>Following coagulant dosing the treated water is split into two channels. Each channel supplies a bank of 10 no. settlement tanks (total 20 no.). Polyelectrolyte is used as a coagulant aid. A polyelectrolyte dose point is installed in each channel. Duty and standby polyelectrolyte dosing pumps are provided which require manual switchover in the event of pump breakdown. The plant is manned on a 24 hour basis. The pumps are routinely changed over between duty / standby on a daily frequency. The polyelectrolyte (0.12% strength) was being dosed at a rate of 0.21mg/l on the day of the audit.</p>		

		Answer
2.2	Were the CFC tanks, channels and weirs observed to be clean, level and well maintained during the audit?	No
<b>Comment</b>		
<p>The tanks, channel and weirs were observed to be not well maintained at the audit. The channels are corroded and stained due to their age. Plant material was observed growing on the walls of the settlement tanks at edge of channels. Material was observed (floc algal growth) accumulating on the v notch weirs of the decanting channels. A build-up of sludge was visible on the walls of the settlement tanks. Cork City Council outlined that the tanks and channels were cleaned in the last 6 to 9 months.</p>		

		Answer
2.3	Were the CFC processes visually observed to be operating appropriately during the audit?	No
<b>Comment</b>		
<p>On the day of the audit pin floc was visible on the surface of the settlement tanks and was being carried over into the decanting channels. Irish Water outlined that there is limited coagulation / flocculation time (a few minutes) ahead of the settlement tanks which were built in 1956. This is leading to the pin floc rising according to Irish Water. Irish Water outlined that the carryover of pin floc is to be resolved with the commissioning of the new water treatment plant which is scheduled to take place in Q1 2022.</p> <p>The original design capacity for the WTP was 42,000m<sup>3</sup>/d. On the day of the audit the plant was operating at a reduced daily production rate of 28,000m<sup>3</sup>/d. It is proposed to continue to operate the WTP at this lower production rate until the new water treatment plant is commissioned. As outlined below the turbidity readings after the filtration stage were satisfactory on the day of the audit.</p>		

### > 3. Filtration

3.1

	Answer
Are the filters designed and managed in accordance with EPA guidance?	No
<b>Comment</b>	
<p>There are 14 no. rapid gravity filters at the WTP. Filters 1 to 6 were installed in 1956 while Filters 7 to 14 were installed in 1927. Filter No. 14 has been out of service for the last 5 year and Filter No. 13 for the last 6 months.</p> <p>The filter media depths could not be confirmed at the audit. There are no marker posts to clearly identify the depth of the filter media. Subsequent to the audit (via email on 15/10/21) Irish Water confirmed the following media depths: Filter 1 0.81m; Filter 2 0.88m; Filter 3 0.91m; Filter 4 0.89m; Filter 5 0.85m; Filter 6 0.97m; Filter 7 0.91m; Filter 8 0.87m; Filter 9 0.93m; Filter 10 0.93m; Filter 11 0.91m and Filter 12 0.92m. The media depth is less than the 1m minimum recommended in the EPA Water Treatment Manual: Filtration.</p> <p>The media was changed in 4 of the 12 filters in the last 3 years these being, Filter 4 November 2020, Filter 6 June 2019, Filter 9 August 2020 and Filter 12 December 2019.</p> <p>Backwashing can be triggered on head loss, time and turbidity. Normally each filter is backwashed on a timed basis approximately every 18 hours with all backwashes being manually triggered and observed by the site operator. There is no run to waste after backwashing. An assessment was undertaken by Irish Water in 2018 which indicated it is not feasible to install a run to waste. In the event the turbidity is elevated when a filter returns to service the turbidity alarm will be activated. There is a delayed start (5 minutes) after backwashing before the outlet valve opens.</p> <p>There are continuous online turbidity monitors on each individual filter, a turbidity monitor for combined filters 1 to 6 and a turbidity monitor for combined filters 7 to 12. The turbidity trends for September 2021 indicated an issue with the combined turbidity monitor for filters 1 to 6 which was being investigated. Cork City Council confirmed repairs were underway and due to be completed in a few days. Cork City Council stated there is no final turbidity monitoring for the combined streams due to lime interference from the final water pH correction stage.</p> <p>The filter turbidity alarm setpoints are as follows:</p> <ul style="list-style-type: none"> <li>• High high alarm 0.25 NTU on Combined Filters 1 to 6 &amp; Combined Filters 7 to 12</li> <li>• High alarm 0.2 NTU on Combined Filters 1 to 6 &amp; Combined Filter 7 to 12</li> <li>• High high alarm 0.30 NTU on each individual filter (1 to 12)</li> <li>• High alarm 0.10 NTU on each individual filter (1 to 12)</li> </ul> <p>The alarms result in an audible alert in the plant control room and a visual alert on the display screen. The plant is manned 24 hours /day and in the event of the triggering of the high high turbidity alarm a manual backwash of the filter is undertaken or the filter is manually shutdown.</p>	

3.2

	Answer
Was there visual indication that the filters were operating appropriately?	No
<b>Comment</b>	
<p>A backwash was observed in Filter 2. Floating material was visible on the water surface prior to backwash which drained to waste when the filter was drained down. The walls of the filter were clean. Mud balls and mottling were visible in the filter media. Irish Water outlined that remedial works had been carried out in 2020 including deep jet cleaning and replacement of the nozzles on the base of the filter. The filters will be decommissioned when the new treatment plant comes into production.</p>	

3.3

	Answer
Does monitoring indicate that the filters are operating effectively?	Yes
<b>Comment</b>	
<p>Pin floc was being carried over from the coagulation stage on the day of the audit to the filters however the turbidity for the individual filters was satisfactory (&lt; 0.3 NTU) and ranged from 0.02 to 0.06 NTU. The combined turbidity was 0.056 NTU for filters 1 to 6 and 0.057 NTU for filters 7 to 12. The plant is designed to produce 42,000m<sup>3</sup>/d. The plant is currently being operated at a lower throughput of 28,000m<sup>3</sup>/d until the new WTP is commissioned which is reducing the loading on the plant.</p>	
<p>Turbidity trends for the month of September 2021 were submitted in advance of the audit and indicated satisfactory turbidity (&lt; 0.3 NTU) for all individual filters in accordance with the EPA Water Treatment Manual: Filtration. Spikes were observed on the turbidity trend for combined filters 1 to 6, on the September 2021 trend, which was investigated at the audit and found to be related to an issue with the turbidity monitor.</p>	



4.1

Is the disinfection system verified using monitors and alarms, with trended data recorded and accessible?

Answer

Yes

**Comment**

The existing Lee Road WTP has not been upgraded under the Irish Water National Disinfection Programme as a new WTP is being built. The disinfection stage includes UV treatment and chlorination.

UV Disinfection

A temporary containerised UV system was commissioned in March 2021 to improve the resilience of the supply and provide an additional *Cryptosporidium* barrier. UV disinfection takes place before chlorination and is carried out using 2 no. LBX850 WEDCO reactors. The reactors operate in parallel on a duty / duty basis. There is no standby UV reactor. The system can operate on a single unit and is validated up to a flow of 1,500m<sup>3</sup>/hr @ 75% UVT. The system is validated in accordance with USEPA Ultraviolet Disinfection Guidance Manual (UVDGM). On day of audit the UV dose was 20.7 MJ/cm<sup>2</sup> in both reactors while the UVT was 88.0% UVT.

In the event of an issue with the UV system a text message alarm is automatically sent to the Production Foreman, Engineer, Technician, the share site mobile phone and Irish Water Process Optimisation. The alarms are also displayed on the HMI in the plant control room. There is no automatic shut-down in response to alarms and manual intervention is required by the plant operator. The following alarm setpoints were in place:

- UV dose alarm limit (low low) 12 mJ/cm<sup>2</sup>; UV dose warning alarm (low) 13.20 mJ/cm<sup>2</sup>
- UVT low alarm is set at 75% UVT
- High flow alarm is 1,499m<sup>3</sup>/hr.

Chlorination

Primary disinfection is via chlorination using chlorine gas. There are 2 no. chlorinators which operate on a duty / duty basis. The chlorinators can ramp up to provide the full chlorine dose if one breaks down. Chlorine dosing is flow proportional with a trim dose. The dose rate is set manually based on the dose chart that is displayed on the wall of the chlorine room. The dose rate varies depending on which reservoir is being supplied. The target dose levels are 2.2 mg/l for the high level reservoir and 1.8 mg/l for the intermediate and low level reservoirs. There are also alarms on dose points and final water total chlorine concentration.

A revised contact time calculation was provided by Irish Water subsequent to the audit (email dated 18/10/21) which takes account of contact time in the onsite labyrinth and in the rising main. The calculation demonstrates the target contact time is 24 mg.min/l and 28.97mg.min/l is being achieved at the site based on a minimum target chlorine residual concentration of 1.8mg/l. On the day of the audit the residual chlorine concentration was 1.77 mg/l indicating that contact time was being achieved. The residual chlorine alarm set points for the final water leaving the WTP are 2.5 mg/l high high, 0.6 mg/l low and 0.45 mg/l low low. The low and low low alarm setpoints for the water leaving the WTP are not aligned with the minimum free chlorine concentration of 1.8 mg/l required at the contact time validation point as outlined in the revised contact time calculation. Irish Water did however indicate that additional contact time is provided in each of the reservoirs but details of the calculation of this additional contact time was not included with the revised contact time calculation submitted on 18/10/21.

Subsequent to the audit Irish Water confirmed on 18/10/21 that the chlorine alarm levels have been increased from 0.1 mg/l and reset to 0.4 mg/l for "low" and 0.3 mg/l for "low low" at all reservoirs. On this basis the alarm set points for residual chlorine at the reservoirs are as follows:

- Tower reservoir - high high 1.2 mg/l, high 0.9 mg/l, low 0.4 mg/l and low low 0.3 mg/l.
- High level reservoir (Churchfield) re- high 1.5 mg/l, low 0.4 mg/l and low low 0.3 mg/l.
- Intermediate reservoir (Harbour View) - low 0.4 mg/l and low low 0.3 mg/l.
- Low level reservoir (Shanakiel) low 0.4 mg/l and low low 0.3 mg/l

4.2

Is there a suitable monitoring frequency for residual chlorine in the network with records available?

Answer
No

**Comment**

The records submitted prior to the audit for September 2021 indicated that residual chlorine levels in the network are being monitored once per week. This is not sufficient.



## 5. Reservoirs and Distribution Networks

		Answer
5.1	Is treated water in tanks and reservoirs suitably protected against contamination?	No
<b>Comment</b>		
<p>A section of the roof of the High level / Churchfield reservoir is damaged. The roof has been stabilised but a complete roof replacement is required. Irish Water and Cork City Council are undertaking a programme of enhanced monitoring until the remedial works have been completed. This includes weekly monitoring of the treated water leaving the reservoir for <i>Cryptosporidium</i>, residual chlorine concentration and microbiological quality.</p>		



## 6. Management and Control

		Answer
6.1	Has the protozoal compliance log treatment requirement been identified for the water treatment plant?	Yes
<b>Comment</b>		
Irish Water has calculated the protozoal log removal requirement for the Cork City PWS as 3 log. The log treatment provided by the UV disinfection system is 3 log and the UV unit has been demonstrated to be operating within its validation range indicating no log deficit.		

		Answer
6.2	Is there a documented alarm response procedure?	Yes
<b>Comment</b>		
Cork City Council have a new staff training / induction programme in place. Irish Water have provided training on alarms and incident response to Cork City Council staff. A copy of the Irish Water Incident Guidance Chart was on display on the wall of the operations room at the Lee Road WTP. The chart outlines who is to be contacted in the event of an incident and provides contact details for the relevant personnel. A chart was also on display outlining what constitutes an incident. A copy of the Cork City Council Waterworks Operational Guidance and Checks document also provided detailed information on what to do and who to call.		



## 7. Sludge Management

		Answer
7.1	Is sludge arising from the treatment processes adequately managed?	No
<b>Comment</b>		
There are no sludge holding or treatment facilities at the WTP. The sludge bleeds and used filter backwash water are discharged to the River Lee. The new water treatment plant will include sludge management facilities.		



## 8. Supply on the Remedial Action List

	Answer
8.1 Is the Action Programme on track to meet the Remedial Action List completion date?	Yes
<b>Comment</b>	
<p>The Cork City public water supply has been on the EPA's Remedial Action List since 13/10/2008. The plant has a design capacity of 42,000m<sup>3</sup>/d. EDEN Data pop 97,176 and volume 40,969m<sup>3</sup>/d. On the day of the audit the output from the WTP had been reduced to 28,000m<sup>3</sup>/d with part of the supply area being served by the Glashaboy PWS to allow works to take place on the low level reservoir.</p> <p>It is proposed that the Lee Road WTP will continue to operate at this reduced production volume until the new treatment plant is commissioned in Quarter 1 2022. The construction of a new water treatment plant is at an advanced stage at a site adjacent to the Lee Road WTP. The works are due for completion in Q4 2021. This will be followed by commissioning of the new water treatment plant and the gathering of verification data for consideration for RAL removal.</p>	



		Answer
9.1	Is the fluoridation dosing system appropriately controlled?	No
<b>Comment</b>		
<p>Duty / standby fluoride dosing pumps are provided with automatic switchover. The cover on the day tank is damaged.</p> <p>There is no operational weighing scales at the WTP to monitor the weight of fluoride used daily. The daily dose rate is being calculated based on the volume used. Due to staffing issues daily lab tests were not being undertaken for checking purposes.</p> <p>The continuous fluoride monitor was not operational on the day of the audit. A review of the records at the plant indicate an issue with the continuous fluoride monitor on the 16th, 17th and 19th of September 2021 when levels are seen to be greater than the parametric value of 0.80mg/l on the trend. A lab test on 17/09/21 indicated a fluoride level of 0.89 mg/l which is above the parametric value, however the next available daily lab test was from the 22/09/21 when the fluoride level was 0.67 mg/l at the WTP which is within the acceptable fluoride range of 0.6mg/l to 0.8mg/l. A new monitor has been installed which clears bubbles from the sampling point this monitor was reading 0.79 ppm fluoride on the day of the audit.</p> <p>Details of the fluoride alarm setpoints were submitted prior to the audit. The alarm setpoints were: high high 0.9 mg/l, high 0.85 mg/l, low 0.55 mg/l and low low 0.5 mg/l. These alarms settings are not suitable to provide an early warning of low or high fluoride levels.</p>		



## 10. Site Specific Issues

		Answer
10.1	Have the Drinking Water Safety Plan High Risks and Very High Risks been identified ?	No
<b>Comment</b>		
Irish Water outlined that work is taking place on the identification of the High and Very High risks for the Drinking Water Safety Plan. The risks have been prepared in draft format for review by the working group. The next stage is the undertaking of the risk assessment to identify the high scoring risks.		

## Recommendations

<b>Subject</b>	Cork City PWS - Audit 12/10/21	<b>Due Date</b>	12/12/2021
<b>Action Text</b>	<p><b>Recommendations</b></p> <p><b>Irish Water is responsible for ensuring a safe and secure supply of drinking water. To address these issues, Irish Water should implement the following recommendations without delay.</b></p> <ol style="list-style-type: none"> <li>1. Irish Water should complete the construction and commissioning of the new water treatment plant at the Lee Road Water WTP to (i) improve the resilience of the treatment plant to ensure a safe and secure public water supply and (ii) facilitate removal of the site from the EPA's Remedial Action List.</li> <li>2. Irish Water should undertake the following in relation to fluoride dosing (i) confirm online fluoride monitor has been fixed; (ii) review the high and low fluoride alarm setpoints (iii) submit a copy of the calculation used in the daily checks to determine the fluoride concentration (iv) ensure the daily test is completed 5 days per week (v) ensure any persistent exceedances of fluoride are notified to the EPA.</li> <li>3. Irish Water should (i) submit a timeframe for the completion of works on the high level reservoir and (ii) ensure monitoring of chlorine residuals, weekly microbiological parameters and <i>Cryptosporidium</i> continues until the remedial works are completed at the high level reservoir.</li> <li>4. Irish Water should ensure there is a regular programme of monitoring of residual chlorine levels in the distribution network, ideally several times per week, to verify adequate disinfection of the water supply across the distribution network and at the extremities of the network. The results should be recorded and available for inspection when requested.</li> <li>5. Irish Water should provide confirmation of the installation of an appropriate alarm set point on the outlet from the water treatment plant to validate that contact time is being maintained at all times. The alarm level should reflect the minimum free chlorine concentration required at the Ct validation point as outlined in the contact time calculation.</li> <li>6. Irish Water should ensure regular cleaning of the settlement tanks and decanting channels continues until the plant is decommissioned.</li> <li>7. Irish Water should confirm the date when the issue with the turbidity monitor for combined filters 1 to 6 was resolved.</li> <li>8. Irish Water should review current methods of handling and disposal of water treatment sludge to ensure that the practice is not in contravention of the <i>Waste Management Act, 1996 – 2003</i>. The discharge of water treatment sludge to receiving water, where practiced should cease immediately.</li> <li>9. Irish Water should provide details of the Drinking Water Safety Plan “very high” and “high” risks identified for the Cork City PWS, and the plans in place to address these risks.</li> </ol> <p><b>Follow-Up Actions required by Irish Water</b></p> <p>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 Regina Campbell, Drinking Water Team Leader. Irish Water should submit a report to the Agency on or before 12/12/21 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 time frame 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 Compliance Plan DW20070504 in any future correspondence in relation to this Report.</p>		