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

Name of Installation	Cork Harbour and City
Organisation	Irish Water
Scheme Code	0500PUB3401
County	Cork
Site Visit Reference No.	SV22840

Report Detail

Issue Date	27/10/2021
Prepared By	Criona Doyle

Site Visit Detail

Date Of Inspection	30/09/2021	**Announced**	Yes
Time In	10:55	**Time Out**	14:40
EPA Inspector(s) **Additional Visitors**	Criona Doyle Orla Harrington		
Company Personnel	Cork Co. Co. (acting under service level agreement to Irish Water): Jerry Creedon; Sabrina Tobin; Gavin Falvey; Mary Hickey. Irish Water: Oliver Harney, Deirdre O'Loughlin, Neil Smyth* Note * Attended closing meeting only.		

Summary of Key Findings

(1) The audit indicated that the Inniscarra water treatment plant (WTP) was operating satisfactorily on the day of the audit. A number of recommendations have been outlined to improve the resilience of the WTP.

(2) The Irish Water Disinfection Programme upgrade works have not commenced at the WTP and the proposed completion date could not be confirmed at the audit. Irish Water should provide details of the proposed works and the expected completion date.

(3) The Irish Water Incident Guidance Chart was displayed on the wall of the operations room at the Inniscarra WTP outlining who to contact in the event of an incident and the alarm setpoints, however there is no detailed documented procedure outlining what actions to take in response to low, medium and high level (priority) alarms. A detailed procedure should be documented.

Introduction

The Cork City and Harbour public water supply serves a population of 145,304 and produces 69,631m3/d (EDEN figures). Raw water is abstracted from the River Lee at the Inniscarra Lake. Treatment at the Inniscarra Water Treatment Plant (WTP) includes coagulation, flocculation, clarification, filtration, final pH correction, disinfection, fluoridation and sludge treatment. The site is manned from 8am to 12 midnight.

The audit was undertaken to assess the operation and management of the water treatment plant.

Supply Zones Areas Inspected

The audit consisted of an on-site inspection of the Inniscarra WTP on 30/09/21. All areas of the treatment process were inspected during the audit including the abstraction, coagulation, filtration, disinfection, fluoride dosing and sludge treatment stages.

1. Source Protection

		Answer
1.1	Is the abstraction source(s) adequately protected against contamination?	Yes

Comment

There is continuous monitoring of dissolved oxygen, pH, turbidity, temperature and water level at the raw water inlet tower. There is automatic shutdown of raw water intake in the event the low level dissolved oxygen alarm setpoint of 5.5 mg/l is triggered.

2. Coagulation Clarification Flocculation (CFC) Stage

		Answer
2.1	Is the CFC process optimised to respond to changes in raw water quality?	Yes

Comment

Raw water is obtained from the Inniscarra Lake. Aluminium sulphate (8%) is used as the coagulant. There is little variation in the raw water quality in the lake source and flocculation tests are undertaken in response to changing raw water quality (pH or turbidity) as required. On the day of the audit the aluminium sulphate dose rate was 70 mg/l. Coagulation dosing is controlled by the PLC (SCADA) and is flow proportional based on the selected dose rate. The dose rate is adjusted, based on the flocculation tests, in the event the raw water quality changes (pH or turbidity). The dose rate is recorded on the daily test sheets. A streaming current monitor is installed onsite to gather information but it is not linked to the coagulant dosing system.

Soda ash dosing for pH correction, for optimum coagulation, is required only occasionally due to the stable nature of the lake source. Soda ash dosing was not taking place on the day of the audit. A target pH of 6.3 to 6.5 pH units is aimed for at the splitter chamber after the coagulation stage. Automatic plant shutdown occurs in response to the low pH alarm (5.84 pH units) and high pH alarm (7.15 pH units) which are located at the splitter chamber (2 minute delay). A text alert alarm is also sent to 2 no. Engineering Staff and the Plant Mobile Operator. Plant shutdown involves the shutdown of the raw water inlets prior to the coagulation stage.

Polyelectrolyte is used as a coagulant aid at a dose rate of 0.09mg/l. Carbon dosing is undertaken for manganese removal on a seasonal basis. During 2021 carbon dosing took place from mid-August to mid-September. Carbon dosing was not taking place on the day of the audit.

		Answer
2.2	Are the CFC processes appropriately controlled?	No

Comment

Duty / standby dosing pumps are provided for dosing of the coagulant (8% aluminium sulphate) and the coagulant aid (polyelectrolyte). There is no automatic switchover of the dosing pumps from duty to standby if the duty pump for the coagulant or coagulant aid fails and a manual switchover is required. The water treatment plant is manned from 8am to 12 midnight. A scheduled manual switch over between duty / standby dosing pumps occurs on a monthly frequency.

		Answer
2.3	Were the CFC tanks, channels and weirs observed to be clean, level and well maintained during the audit?	No

Comment

The decanting channels and weirs were level. A build up of material was observed in a number of the V notches in the decanting channels but was not being carried over into the decanting channels at the time of the audit. Cork County Council stated the channels had been brushed down the previous day. Heavy rainfall had occurred the night before the audit which may have contributed to the build up on the v notches.

3. Filtration

		Answer
3.1	Are the filters designed and managed in accordance with EPA guidance?	No

Comment

Filtration is provided via 8 no. rapid gravity filters. The exact age of the filter media was not confirmed but it was estimated to have last been replaced in 2010. The media was last assessed in August 2019 when cores were undertaken in Filter No. 1,3,4,5,6 and 7. A copy of the report for the sand filter assessment, undertaken in August 2019, was provided following the audit (email received on 06/10/21).

The report indicated a sufficient depth of filter media with depths ranging from 1200mm to 1280mm. The filter media includes manganese dioxide for manganese removal. There are no marker posts to clearly identify the current depth of the filter media.

Automatic filter backwashing is undertaken on a timed basis every 2 days. Automatic filter backwashing is not triggered by turbidity or head loss. Cork County Council reported that automatic backwashing on a timed basis results in a shorter time interval between backwashes than would occur based on head loss or turbidity. There is a 30 minute run to waste after filter backwashing.

Each individual filter has a high turbidity alarm set point of 0.15 NTU which generates automatic shutdown of the outlet valve from the affected filter. There is no automatic backwashing of filters linked to turbidity or in response to turbidity alarms. There is no operational turbidity monitor on the combined filtered water and no alarm set point for the combined filtered water.

A backwashing of Filter No. 4 was observed and no problem areas were noted. On the day of the audit the following turbidity levels were recorded: Filter 1 0.049 NTU; Filter 2 0.058 NTU; Filter 3 0.053 NTU; Filter 4 0.167 NTU (outlet valve closed after backwashing); Filter 5 0.047 NTU; Filter 6 0.041 NTU; Filter 7 0.030 NTU and Filter 8 0.044 NTU.

		Answer
3.2	Was there visual indication that the filters were operating appropriately?	Yes

Comment

A backwash was observed on Filter No. 4. The backwashing sequence included 2 minutes air scour, 7 minutes air and low flow water, 7 minutes high rate water. The backwash water is discharged to the sludge treatment plant.

A slight build-up of material was observed on the walls of the filters. Cork County Council stated the filter walls are cleaned every 2 to 3 months and are due to be cleaned in the next 2 to 3 weeks.

		Answer
3.3	Does monitoring indicate that the filters are operating effectively?	Yes

Comment

Turbidity trends were submitted prior to the audit for the period 22/08/21 to 22/09/21. Explanations were provided for a number of spikes which were related to backwashing during which the individual filter outlet valves were shut. The trends indicated the individual filters were operating < 0.3 NTU.

4. Disinfection

		Answer
4.1	Are monitors and alarms operational via dial out and being responded to with a suitable cascade system in place?	No

Comment

There is a low level chlorine alarm setpoint of 0.5 mg/l on the residual chlorine monitors at the inlet to the reservoir (on both residual chlorine monitors) at the Inniscarra WTP. This alarm instigates automatic plant shutdown of the raw water inlet valves (time delay 22 minutes). There is also a text alert alarm sent to the 2 no. Engineers and Plant Mobile Operator (time delay 12 minutes delay).

There is no high level chlorine alarm in operation at the WTP and there is no low level alarm on the outlet from the reservoir which is the contact time validation point.

		Answer
4.2	Is the chlorine dosed appropriately?	Yes

Comment

Chlorine gas is used on site for disinfection. Dosing is flow proportional. There are 2 no. chlorinators which operate on a duty / standby basis and are manually switched over. The chlorinators are routinely switched over from duty / standby on a 2 to 3 month frequency.

		Answer
4.3	Does the trend in chlorine residual at the treatment plant indicate adequate and stable levels of disinfection?	Yes

Comment

Residual chlorine trends for the period 22/08/21 to 22/09/21 were provided in advance of the audit for the chlorine residual measured at the inlet and outlet of the reservoir at Inniscarra WTP. Explanations were provided for a number of dips in the chlorine trends due to (i) drum changes and (ii) interference on monitor due to lime dosing for final pH correction on 07/09/21 with the levels verified using a hand held monitor.

Overall the trends indicated stable residual chlorine trends on both the reservoir inlet and outlet with 1.33 mg/l the average chlorine residual at inlet to reservoir and 1.15 mg/l the average chlorine residual at outlet from reservoir.

		Answer
4.4	Is the residual chlorine monitored at a suitable sample location after contact time has been completed?	No

Comment

The low chlorine alarm is currently located at the inlet to the reservoir at the WTP. While the monitoring of the residual chlorine level is taking place on the outlet of the reservoir there is no alarm linked to this residual chlorine monitor to verify that contact time is being maintained at all times.

The Inniscarra WTP has not undergone the Irish Water Disinfection Programme upgrades to date. The date for the commencement of works at Inniscarra WTP could not be confirmed at the audit. It was outlined by Irish Water that the options for the replacement of chlorine gas are under assessment.

		Answer
4.5	Is there a suitable monitoring frequency for residual chlorine in the network with records available?	No

Comment

The residual chlorine network records provided indicated levels > 0.1 mg/l were being maintained. The records submitted prior to the audit for the period 18/08/21 to 25/09/21 indicate that residual chlorine levels in the network are monitored once per week (18/08/21; 21/08/21; 28/08/21; 04/09/21; 11/09/21; 17/09/21; 25/09/21).

The target residual chlorine level on the outlet of the reservoir at the Inniscarra WTP is 1.1 mg/l to achieve an end of line residual chlorine level of 0.2 mg/l in Ballincollig. Booster chlorination is undertaken at the following reservoirs on the Cork Harbour and City PWS network: Curraleigh, Chetwynd, Carr's Hill, Strawhall and Ballinrea. There are no chlorine alarms at the booster chlorination locations. The residual chlorine SCADA trends from each of the booster chlorination locations are reviewed daily at the Inniscarra WTP. Network curators report any instances of low chlorine residuals measured in the network to Inniscarra WTP.

Residual chlorine trends were provided for Incherra Pumphouse, Carr's Hill Reservoir, Chetwynd Reservoir and Strawhall Reservoir in advance of the audit for the period 22/08/21 to 24/09/21. Cork County Council reported the chlorine level in the Strawhall Reservoir dropped due to a delay with the chlorine delivery. Cork County Council reported the situation was monitored and that the level dropped to a minimum of 0.35 mg/l.

		Answer
4.6	Is there adequate chlorine contact time before the first connection?	Yes

Comment

Irish Water submitted a copy of the contact time calculation prior to the audit. The calculation indicated for a minimum free chlorine concentration of 0.50 mg/l at the contact time validation point (low level chlorine alarm setting) a total effective contact time of 18.82mg. min/l is provided. This is higher than the WHO minimum of 15 mg.min/l but currently falls short of site specific target of 40.95 mg.min/l outlined in the calculation. The chlorine contact time calculation should be updated following completion of the Disinfection Programme Works.

The target residual chlorine concentration on reservoir outlet is 1.1 mg/l. The trend for period 22/08/21 to 22/09/21 indicated the average concentration was 1.15mg/l. Irish Water outlined at the audit that a total effective contact time of 41.404mg.min/l is being achieved compared to target of 40.95 mg.min/l when the target level of 1.1 mg/l is used as the minimum free chlorine concentration. There is no alarm on the reservoir outlet (contact time validation point) to ensure the target level is being maintained at all times.

5. Treatment Process Chemicals

		Answer
5.1	Are treatment process chemicals appropriately managed and stored?	No

Comment

The connection point for the delivery of aluminium sulphate in the bulk storage area is not located within a bunded area. A drip tray is used when deliveries are taking place.

6. Management and Control

		Answer
6.1	Has the protozoal compliance log treatment requirement been identified for the water treatment plant?	Yes

Comment

Irish Water indicated the site has been assessed as having a Log 3 treatment requirement. There is no log deficit as the treatment in place at the Inniscarra WTP provides Log 3 removal if operated in accordance with the EPA Water Treatment Manual: Filtration. Irish Water and Cork County Council undertake monitoring of *Cryptosporidium* 8 times per annum.

		Answer
6.2	Is there a documented alarm response procedure?	No

Comment

There is no detailed documented procedure for response to low, medium and high level (priority) alarms at the WTP contained within the Inniscarra Waterworks Technical Site Specific Operations Manual. However a copy of the Irish Water Water Incident Guidance Chart was on display on the wall of the operations room at the Inniscarra WTP. The chart outlines who is to be contacted in the event of an incident that is likely to have an effect on the quality or quantity of drinking water and provides contact details for the relevant personnel. A chart was also on display with the high priority alarm setpoints for the WTP.

		Answer
6.3	Are suitable plant shutdowns/inhibits in place to prevent the entry of inadequately treated water entering the distribution network?	Yes

Comment

Automatic plant shutdown occurs at the Inniscarra WTP in response to (i) filtered water turbidity alarm of 0.15 NTU on each individual filter which generates automatic shutdown of the outlet valve from the affected filter (time delay 10 minutes) (ii) low chlorine alarm 0.5 mg/l on inlet to reservoir (time delay 22 minutes). This alarm instigates automatic plant shutdown of the raw water inlet valves.

		Answer
6.4	Are suitable alarm settings in place to alert operators to deteriorating water quality and/or the failure of a critical treatment process?	No

Comment

The following alarms are in place:

- Raw water deterioration - dissolved oxygen alarm setpoint 5.5 mg/l closes raw water valve (time delay 2 minutes);
- Coagulation stage issue - pH alarm setpoint at splitter chamber automatic shutdown of raw water inlets occurs in response to the low pH alarm (5.84 pH units) and high pH alarm (7.15 pH units) (time delay 2 minutes);
- Filtration issue - high turbidity alarm individual filter setpoint 0.15 NTU (time delay 10 minutes);
- Disinfection issue - low level chlorine alarm setpoint 0.5 mg/l on inlet to reservoir (time delay 22 minutes).

There is no low chlorine alarm after contact time (outlet of reservoir) and there is no high chlorine alarm at the WTP.

7. Sludge Management

		Answer
7.1	Is sludge arising from the treatment processes adequately managed?	Yes

Comment

The two sludge streams from the WTP (dirty backwash water and sludge bleeds) are mixed in the sludge blending tank at the Sludge Treatment Plant. The sludge passes through the picket fence thickener where poly is added. The sludge is then transferred from the sludge holding tank to the sludge press. The dried sludge is housed in indoor storage bays. Between 4 to 8 loads (30 tonnes per load) with a 25% dry solids content are removed off site per month by a licensed contractor. The operation of the sludge treatment plant has been handed over to Irish Water since 01/04/2021.

Supernatant from the Inniscarra WTP is discharged to the River Lee downstream of the Inniscarra Dam. There is a continuous online turbidity and flow monitor on the supernatant discharge. A limit of 6 NTU has been applied to the supernatant discharge under the DBO contract. Irish Water and Cork County Council were unable to confirm if there is a discharge consent in place for the discharge to the River Lee.

Flow and turbidity of the supernatant discharge are monitored on a continuous basis on SCADA. No regular visual inspection or recording of visual observations at the supernatant discharge point were taking place. The discharge point was inspected on the day of the audit. The discharge of supernatant was not taking place at the time of the inspection and no material was observed in the river bed in the area of the discharge point.

8. Site Specific Issues

		Answer
8.1	Have the Drinking Water Safety Plan High Risks and Very High Risks been identified for the supply ?	Yes

Comment

Irish Water outlined that the very high and high risks have been identified as part of the Drinking Water Safety Plan. These risks were requested to be submitted as part of the information requested in advance of the audit but were not provided.

Recommendations

Subject	Cork Harbour & City - Audit 2021	Due Date	27/11/2021

Action Text

Recommendation(s)

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.

1. Irish Water should undertake the following works on the rapid gravity filters: (i) install a continuous online turbidity monitor with alarm on the combined final filtered water; (ii) install a filter media depth marker in each of the filters.

2. Irish Water should confirm the expected completion date for the disinfection programme upgrades and provide the following information when the works have been completed: (i) details of the works completed; (ii) details of the high and low chlorine alarms and shutdowns in place; (iii) confirmation that the target chlorine contact time for the supply is being achieved; (iv) confirmation of the installation of an appropriate alarm on the outlet of the reservoir to validate contact time is being maintained at all times.

3. Irish Water should (i) monitor residual chlorine in the network, including the extremities, several times a week to ensure that a minimum residual chlorine of > 0.1 mg/l is maintained; (ii) install a high chlorine alarm setpoint with automatic shutdown of the plant if the final water reaches a critically high chlorine setpoint and (iii) assess the feasibility of installing chlorine alarms at key locations in the network.

4. Irish Water should provide the details of the high risks and very high risks identified for the supply as part of the Drinking Water Safety Plan (DWSP).

5. Irish Water should document the alarm response procedure for the Inniscarra WTP to include the actions to be undertaken in response to low, medium and high (priority) alarms.

6. Irish Water should install automatic switchover between duty and standby chemical dosing pumps (coagulant, coagulant aid, pH correction and chlorine) in the event of failure of one of the pumps and undertake regular switchover between duty and standby pumps to ensure pumps are primed.

7. Irish Water should confirm when the cleaning of the raw water tanks, settlement tanks and decanting channels has been completed.

8. Irish Water should ensure the fill point for the aluminium sulphate bulk storage area is suitably bunded. Fill points for storage tanks inside the bunds should be within the bunded area. Refer to EPA guidance document – "*IPC Guidance Note on Storage and Transfer of Materials for Scheduled Activities*".

9. Irish Water should (i) confirm if there is a discharge consent for the supernatant discharge to the River Lee and provide details of any associated emission limit values (ii) ensure the supernatant discharge point to the River Lee is inspected on a weekly basis, when discharge is occurring, and the observations are recorded.

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 Regina Campbell, Drinking Water Team Leader.

Irish Water should submit a report to the Agency on or before 27/11/21 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 Compliance Plan DW20210161 in any future correspondence in relation to this Report.