



Drinking Water Quality Regulator
for Scotland

Incident Summary

Picketlaw WTW Aluminium, Manganese, Iron and Turbidity Failures

DWQR Inspector:
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Event No. 13149

24th December 2022

Event Category: Serious

An alarm for low final water pH at Picketlaw Water Treatment Works (WTW) was received by the Intelligent Control Centre (ICC) at 11:26 on Saturday the 24th December 2022. The Standby Operator was called out, and at 13:33 began to run the plant to waste from the chlorine contact tank (CCT). The Operator found that an outlet valve in a lime slurry tank was not fully opening, impacting on lime dosing to both the final water pH correction and the coagulation processes, so this was fixed and the final water pH set point increased. While pH levels began to recover, the lower pH had impacted on the performance of the clarification and filtration processes, increasing aluminium and turbidity levels in the final water. Once the coagulation pH had been corrected, the plant began to recover. The ICC advised the Public Health Team (PHT), and sampling was arranged from the treatment works and the distribution system. There were concerns for water storage levels in the network following freeze/thaw conditions that had been experienced throughout the country in December, so strategic changes to the network were made to manage storage in service reservoirs (SRs).

Filter washing generated further increases in aluminium levels, but concerns over losing supply to consumers meant that the works was returned to service at 19:23. The Operator remained onsite until 22:45 to monitor the plant and further samples were arranged with the PHT. Bench testing for aluminium was carried out by the Operator.



At 06:08 on the 25th December the ICC received a filtered water aluminium alarm from Picketlaw WTW. The standby Operator was on rest time, so the ICC contacted other Operators to attend site. During this time the automatic works shutdown was triggered for high filtered water aluminium levels and began running to waste from the inlet to the rapid gravity filters at 07:33. There is no storage tank at Picketlaw WTW, and so the flow to the two main network SRs, Bairdsknowe and High Borland, was halted (23 properties are supplied directly from Picketlaw WTW). The situation was escalated to the Standby Team Leader and to the Network team.

Separately, at 08:15 a fault was identified at a pumping station which is used to supplement Bairdsknowe SR when water levels are low, and E&M staff were called to resolve the fault.

At 08:30, an Operator and the Team Leader arrived at Picketlaw WTW, and identified a burst polyelectrolyte coagulant aid dosing pipe; this was repaired, and polyelectrolyte dosing at the correct dose started up at 10:00. The Operator tried to restart the Dissolved Air Flotation (DAF) process at the treatment works, but the DAF compressor and recirculation pumps would not restart. The Escalation Manager and the Standby Emergency Planner were contacted to set up an incident team. The first incident call was held at 11:45, and

deliveries of bottled water were made to the properties fed directly from the treatment works. Storage time at Bairdsknowe SR and the down stream Greenbank SR were estimated as five hours. Tankers were requested, and two tankers were obtained, but further tankers had to be sent from Aberdeenshire due to limited tanker resources in the Central Belt, with an estimated time of arrival of 5 hours.

A second Operator arrived at the site at 11:50, the automatic shutdown was reset and disabled, and a filter was returned to service to allow flow to the DAF units; turbidity and aluminium levels began to improve. A second incident call was held at 12:45. It was assumed that the plant would be returned to supply within the next two to three hours, and samples were arranged for when the plant returned to service. However, clarified and filtered aluminium levels began increasing again, and a further incident call at 16:30 was held. It was concluded that the plant could not be returned to service, as aluminium levels from filtered and final water exceeded the range of the instrument ($1000\mu\text{g/l}$ - the standard for aluminium is $200\mu\text{g/l}$). Further tankering was arranged and emergency bottled water stations were organised for the following morning at 07:00.

Another Operator was called out, and at 16:50, it was found that the coagulation lime pump stroke had dropped from 70 to 20%, as the coagulation pH probe was reading higher than the setpoint and not reacting to the changes in stroke. This resulted in a coagulation pH that was lower than was being measured, solubilising aluminium salts and increasing aluminium concentrations through the treatment processes. The coagulation pH control was adjusted and the standby lime pump was activated to replace the duty pump, and lime dosing was put into manual setting. The triple validated pH monitors controlling the pH of the coagulation process were known to be at the edge of their operating range due to the low conductivity of the raw water. Following regular incident team calls, at 22:08 the plant was returned to



service. Flow in the system was managed to supply the areas most in need, and further sampling of the supply was arranged.

At around 23:30, there were further issues with the coagulation pH probes which were resolved promptly by the Operator, thus avoiding a further significant impact on water quality. The inlet flow was steadily increased and the site was staffed through the night.

Tankering began at 00:00 on the 26th December, with 16 tankers delivering throughout the day and overnight. Low water levels at a pumping station tripped pumps, so repairs had to be carried out and ongoing incident management was needed to monitor the treatment works, and to manage the logistics of making adjustments to the network, the continuing tankering, and bottled water supply to consumers.

Tankering continued until 21:00 on the 27th December, and bottled water stations were open until 17:00. There were 80 consumer contacts for water quality, and 562 contacts for no water, low pressure or bottled water requests. 38 samples were taken during the incident. One sample was found to contain Enterococci at the treatment works, and in the distribution system there were two failures of the aluminium standard, five of iron, nine of manganese and two of the turbidity standard.

There was a loss of supply and subsequent disturbance to sediment in the network which led to discolouration and water quality failures caused by:

- failure of the lime system
- a burst polyelectrolyte coagulant aid hose
- a drop in the dose of coagulation pH caused by a lack of control of the lime dosing system •
an accumulation of sediment in the network.

The situation was significantly exacerbated by low storage levels in the network following a period of cold weather when the network had been subjected to freeze/thaw conditions.



The event has been categorised as Serious. Scottish Water has identified seven actions which DWQR accepts are appropriate and will monitor to ensure they are completed prior to signing off the incident. DWQR made two additional recommendations.

