

Bradan Regulatory Supply Zones Iron failures April 2018 to present

DWQR Inspector:
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Event No. 9501

Event Category: Serious

In November 2014, Scottish Water gave Scottish Ministers an Undertaking to deliver a solution by 30 September 2017 which would provide water to the Bradan Regulatory Supply zones which was compliant with the regulatory standard for Trihalomethanes (THM). Scottish Water's plan was to install ammonium sulphate dosing at Bradan water treatment works and chloramine the supply. This project was not delivered by the committed date of 30 September 2017, and so DWQR served an enforcement notice on Scottish Water in November 2017. This required Scottish Water to minimise the risk of THM formation until the improvement works were complete, and by 30 June 2018 to have commenced chloramination of water into supply to the Bradan regulatory supply zones.

Bradan WTW supplies an extensive network through almost 1,500km of water mains to a population of 214,314. Chloramination at the treatment works commenced on the 9th April 2018. Scottish Water monitored the movement of the chloraminated water through the network and by the 18th April, Scottish Water estimated that the entire supply was receiving chloraminated water. Scottish Water staff had a procedure to follow for the changeover from chlorination to chloramination, and the changeover was managed by a multidisciplinary team of staff. A decision was made not to follow the procedure fully in relation to conditioning of the network prior to starting chloramination, due to the practicalities of flushing such a large distribution system. Instead a targeted flushing exercise was carried out on areas considered more at risk from water quality issues due to mains sediment build up. In total, around 27% of the network was flushed between 2016 and 2018 prior to chloramination starting, through a mains rehabilitation programme and a separate flushing programme.

On the 10th April, there were eleven consumer contacts from the area, all reporting taste and odour issues, and the situation was escalated internally on the 4th June following a total of 20 exceedances of the iron standard and an increase in consumer contacts reporting discolouration. This led to weekly internal updates, monitoring of consumer contacts and enhanced water quality sampling from the treatment works and the network.

Targeted night time flushing commenced on the 25th June; locations of flushing were selected based on consumer contacts and failing iron samples, but this flushing programme did not lead to an



improvement in water quality, and resampling showed that the supply was still failing the iron standard. Bottled water was issued on request.

Scottish Water engaged Sheffield University, who are water industry experts on discolouration research, to assist with understanding the problem and to advise on remediation actions that could be taken. It was proposed that the cause of the issue was the disturbance of biofilm in the network and subsequent disturbance of pipework deposits, and as a result a targeted programme of low velocity flushing was commenced, using purpose designed equipment to limit flow and avoid further stripping of biofilm. Significant monitoring of the supply has been undertaken; this has been achieved by utilising Scottish Water's laboratory, using field tests, and setting up a laboratory with bench test equipment in the area due to the exceptionally high number of samples being taken (reported as up to 560 samples per week). Additionally, turbidity loggers have been installed across the network and targeted flushing is still taking place. The incident is ongoing, with consumer contacts in the area still significantly higher than in previous years, and failures of the iron standard continue to be recorded and investigated. The number of consumer contacts reporting dirty water or particulates in water in the Bradan zones in 2016 and 2017 were 290 and 282 respectively, and in 2018 there were 463.

It is likely that elevated iron, turbidity, and discolouration of the supply were due to the changing water chemistry following the introduction of the chloramination process at Bradan water treatment works. The change in the chemistry of the supply, along with the greater persistence of monochloramine in the network, led to increased corrosion of iron mains and destabilisation of biofilm, thereby increasing the leaching of metals from pipework and mobilising entrapped pipe material deposits. Increased and variable flows through the network due to higher seasonal demand in the summer are likely to have caused a hydraulic disturbance, exacerbating the situation. A further contributory factor may have come from an increase in water temperature over the summer months, which will have increased chemical reactivity and microbiological activity.

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