

Balmichael WTW
Turbidity Failure
15 November 2015

DWQR Inspector:
Moira Malcolm

Event No. 7323

Event Category: Significant

Summary of Incident

Early on 15th November 2015 the standby treatment operator was alerted to a raw water turbidity alarm at Balmichael WTW by the intelligent control centre (ICC). He found the works shutdown due to high raw water turbidity and faults indicated on the ultrafiltration membrane modules, so reset the alarms and initiated a backwash of the membranes. However the membranes started rotating through a sequence of repeated backwashing, generating further alarms that the operator was unable to clear in order to restart the works.

By this time the clear water tank (CWT) was at a low level, with the downstream service reservoirs empty. The standby team leader took the decision to bypass membrane treatment to keep a supply of water to the 2500 properties served by the WTW. This decision was not escalated, as is required by Scottish Water's internal procedures, and the public health team (PHT) were not informed of the bypass for over 4 hours. Once informed, the PHT initiated a sampling programme and ensured that chlorine residuals were being monitored by ICC.

On the 16th November an engineer arrived to investigate the fault and membrane treatment was re-established. The sampling programme continued until the 18th November.

Unfiltered water entered distribution for a total of 29 hours during the incident. No microbiological failures or *Cryptosporidium* detections were recorded during the sampling, however four elevated metal samples were recorded at the treatment works (manganese and iron).

One consumer contact was received directly by operational staff during the incident, and bottled water was provided as requested.

Scottish Water failed to meet the requirements of Regulation 29(1)(a) of The Public Water Supplies (Scotland) Regulations 2014 in that water was not subjected to sufficient preliminary treatment ensuring the turbidity was less than 1NTU prior to disinfection. The decision to bypass preliminary treatment was taken without appropriate risk assessment and approvals and was not confirmed by Scottish Ministers as set out in Regulation 29(3).

DWQR Assessment of Cause of Incident

The incident was caused by an unexplained increase in raw water turbidity that led to the decision to bypass the membrane filtration and therefore supply water inadequately prepared for disinfection to over 2500 consumers on Arran. This decision was not escalated to the appropriate level, preventing appropriate discussion with health professionals.



The membrane filters were unable to process the highly turbid water from the boreholes and this caused them to shut down. The poor raw water quality did not allow the plant to restart, plus the generic alarms made it difficult for the treatment operator to diagnose the issues involved. The limited treated water storage on the island undoubtedly increased pressure on the operator to come to a quick decision and restore the flow of water from the treatment works.

The iron and manganese failures detected at the works were most likely to have originated in the source water from the boreholes, with these parameters not removed at the works because the membrane process was bypassed.

DWQR Assessment of Actions Taken by Scottish Water

While the treatment operator reacted quickly to the event, the actions taken after this point were wholly inadequate and demonstrate obvious procedural failings within Scottish Water that must be addressed.

These include:

1. The decision to bypass treatment was not escalated to the appropriate level for action and discussion. In accordance with Scottish Water's internal TOMs procedure, only the Water Operations Regional Manager is authorised to make this decision, which must be done in writing. If this procedure had been followed, the correct protocols would have been put in place, including communication with the public health team to advise them of the unfolding situation and receive any necessary advice to ensure public health was adequately protected. The lack of escalation highlights major deficiencies in training and compliance with procedures.
2. No contingency plan was in place to anticipate this event. It is recognised as a risk in the Drinking Water Safety Plan (DWSP) (Ref S20117) however the likelihood is categorised as 'most unlikely', and no interventions are given. This was despite the reason for the recent installation of the membrane plant due to the risk of *Cryptosporidium*, which implies that Scottish Water is aware that there is some surface water penetration into the boreholes.
3. Due to the generic nature of the alarms for the membranes, it was not possible for the operator to diagnose the issues involved. In this situation it is likely that the turbidity was so high that it would not have been possible to rectify the problem, however it is important that operators are given the tools to diagnose and correct problems as they occur where appropriate – especially in remote areas and on islands where further assistance is not on hand. These tools should include more specific alarms, detailed procedures and the relevant training to interpret alarms and carry out tasks successfully.
4. There are no individual raw water turbidity monitors. Therefore it is not possible to identify and, where necessary, isolate an individual borehole with a deterioration of raw water quality. There appears to be limited understanding of the characteristics of each borehole and the source of the turbidity issues.
5. The CWT has a limited capacity with storage for approximately 45 minutes, and emptied quickly during this event. Further storage capacity downstream on the Arran system is also limited. The lack of storage capacity was a major factor in the hasty decision to bypass the works, and this should be reviewed (as identified in the DWSP).
6. During the reactive sampling undertaken to ensure that water quality was unaffected, very few chlorine residuals were recorded and Scottish Water have not provided a satisfactory explanation for this. Provision of this information is an important aspect of the evidence submitted to DWQR to confirm whether or not water quality received by consumers was affected.

The event has been categorised as Significant. Scottish Water has identified a number of actions and DWQR accepts that these are appropriate. Additionally, DWQR has made one recommendation and will be monitoring to ensure both it and the actions are completed prior to signing off the incident.

