

Invercannie WTW
Cryptosporidium Detection
5 November 2013

DWQR Inspector:
William Byers

Event No. 5698

Event Category: Serious

Summary of Incident

Cryptosporidium Oocysts were detected in a sample taken from the final water produced at Invercannie Water Treatment Works on 5 November 2013. Sampling over the following days also showed *Cryptosporidium* to be present on dates up to 16 November. Whilst individually these were of low level, the repeating nature of the detections gave DWQR concerns over the robustness of processes at the works and their ability to respond to changing raw water conditions.

Invercannie has large raw water storage reservoirs with coagulation and ultra filtration membrane stages in the process and these, operated to best practice standard, should provide a very good barrier to *Cryptosporidium*. Source water is drawn from the River Dee and delivered to the raw water reservoirs and this, with over 3 days storage, normally provides for a stable quality of water at the inlet to the works. However with heavy and persistent rainfall in the catchment in early autumn, the benefit of this storage was negated and by necessity, a very different quality of water was being presented for treatment. Compounding matters, the sister plant providing the water supply to Aberdeen, Mannofield WTW, was similarly having to adjust to a heavily discoloured raw water supply and production between the two plants had to be varied and re-balanced to ensure consumers continued to receive a supply.

The continuing highly discoloured water coming on to the plant in mid-October, led to a review of the treatment strategy for Invercannie. This resulted in a reduction in the flocculant dose to relieve chemical blinding on the membranes and allow flows through the works to be maintained. Although it would allow a slightly more coloured water to be produced, it was expected to provide a simpler although more frequent filter washing regime. Problems later arose due to the inability to sustain a supply of adequately heated water to the sequential wash cycles which resulted in the membranes not being fully cleaned and leading to a progressively shortening filter run time. A temporary heating boiler was hired to enable a sufficient supply of water for the washing and the process gradually recovered.

DWQR Assessment of Cause of Incident

Scottish Water's Investigations have concluded the reduction in the flocculant dose had a material and deleterious effect on the coagulation process both through the reduction in the amount of chemical dosed and through the associated effect of causing the pH to rise. A compounding factor, of drift occurring in the pH monitoring instrumentation, led to increased lime dosing causing the pH to be too high for optimal coagulation to take place. The quality of water being presented to the membrane filters caused a significant increase in the rate at which fouling occurred necessitating more frequent washing but also more sustained



operation of the filters at higher pressure to maximise production. Scottish Water has identified a concern around the impact of pump start on the membrane performance and the stresses produced may be a contributory cause of the *Cryptosporidium* detections. DWQR considers this to require further investigation.

DWQR Assessment of Actions Taken by Scottish Water

DWQR is concerned that there is a perception within the organisation of a degree of inevitability at low levels of *Cryptosporidium* being present in final water under certain conditions. There is a lack of importance attached to a sequence of low level *Cryptosporidium* detections and DWQR considers there to be a need for wider appreciation through the organisation of the importance of maintaining treatment assets, equipment and processes in an optimum state to address *Cryptosporidium* risk. This has been identified by DWQR in our assessment of a similar *Cryptosporidium* event at Mannofield WTW, occurring around the same time, and Scottish Water must address the issue.

Information from Scottish Water shows the daily membrane integrity testing to be unreliable due to the inability to retain air pressure on the membranes for full testing to take place. The information also shows that there was an inability to carry out the direct integrity testing at all on three of the eight membrane cells in the period leading up to and throughout the incident. This is a fundamental requirement in the operation of membrane filtration units and must be rectified. DWQR is deeply concerned at the level of integrity monitoring carried out by Scottish Water at Invercarnie. Best practice operation of membrane plants require direct integrity monitoring to be carried out daily and also requires indirect monitoring of individual cells: turbidity monitoring; particle monitoring, and this is not in place. Although there is a combined membrane outlet monitor for turbidity, which shows turbidity to be within expected ranges over the period, the case for and importance of the continuous monitoring for each cell is clearly demonstrated in this incident with the failure of the other daily tests. The final water turbidity monitor for the works was also not functioning and DWQR finds this level of observance of best practice to be unacceptable.

Scottish Water has since commenced a programme of replacing or repairing leaking control valves and investigating the possibility of providing a zero pressure shut down of a cell. DWQR considers it essential that robust pressure decay testing can be performed daily on each cell and appropriate response generated when failure occurs.

Both Scottish Water's and DWQRs investigation of this incident have been impaired through the unavailability of process records from the treatment works. Although the SCADA equipment at the site allows full visibility of the live situation within the plant and is entirely adequate to operate processes, it has a limited ability to preserve historical trends and process information. Consequently the ability to analyse, compare and fully understand membrane plant performance across cells and over time is not available. DWQR considers this to be a serious failure of Scottish Water's responsibilities to maintain records.

DWQR welcomes the recent move by Scottish Water to extend the scope of its water quality event root cause investigation process to cover *Cryptosporidium* detections. The process should lead to a better understanding of the issues at treatment works where Oocysts are detected in final water and identify the necessary actions and investment to maintain effective treatment barriers.

The event has been categorised as serious. Scottish Water has identified a number of actions and DWQR accepts that these are appropriate. Additionally, DWQR has made four recommendations following this incident and will be monitoring to ensure all are completed prior to signing off the incident.

