

## Kyle of Lochalsh WTW Loss of ammonium sulphate dosing 12 October 2015

DWQR Inspector:  
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Event No. 7264

### Event Category: Serious

### Summary of Incident

Kyle of Lochalsh WTW adds ammonium sulphate to the chlorinated water as part of the chloramination process. On 12<sup>th</sup> October 2015 the treatment operator conducted a scheduled task to carry out checks on the ammonium sulphate dosing system at Kyle of Lochalsh Water Treatment Works (WTW). To conduct the test the dosing pump was switched to manual so that the pump remained running for the duration of the test.

At 23:30 the WTW shutdown as programmed when the clear water tanks (CWTs) were full. On start-up the duty/standby pump for ammonium dosing should automatically switch over, however as it was still set to manual this did not happen and no ammonium was delivered to the treated water.

The ammonium dosing remained offline until 19<sup>th</sup> October when the sampling officer noted low chlorine readings at Balmacara service reservoir (SR) and Achnandaroch SR downstream of the WTW and alerted the treatment team leader to the issue. On arrival at the WTW, the lack of ammonium dosing was discovered, reinstated and chloramination resumed.

The addition of ammonium sulphate to the treatment process is an integral part of water treatment at Kyle of Lochalsh WTW. The water entering the WTW from the catchment is naturally highly coloured. The ammonium binds with the chlorine disinfectant, which prevents the chlorine reacting with the organic compounds that make the water coloured and forming disinfection by-products such as trihalomethanes. This chloramination process prolongs the disinfectant residual within the extensive distribution system downstream of the WTW as well as limiting the production of disinfection by-products.

During the incident chlorine dosing at the WTW itself was not affected and total chlorine residuals generally remained satisfactory at the treatment works, however very little free chlorine residual was detected in samples taken from the treated water, downstream SRs and at consumers' taps. This is unusual given that no ammonium sulphate was being dosed for a number of days. Scottish Water have been unable to provide an explanation for this.

No customer complaints or microbiological failures were recorded for this event.

### DWQR Assessment of Cause of Incident

The root cause of the incident was the treatment operator not resetting the ammonium dosing system back to automatic after completion of the scheduled maintenance task, however a catalogue of errors compounded this to result in the lack of chloramination at Kyle of Lochalsh WTW not being detected for seven days:



- On start-up the manual switch to the offline pump prevented dosing from resuming, however on the next works shutdown and start-up this should have reset and ammonium dosing continued as normal. This did not occur;
- The ammonium dosing inline flow switches should have detected the lack of dosing and rotated the pumps in an attempt to maintain dosing (despite the manual setting). If a loss of dosing had continued, the site PLC should shut down the WTW. However the flow switches were inexplicably set to show a flow when the pumps were idle/offline, so this fail safe did not occur. Scottish Water has been unable to explain this situation;
- The post ammonium dosing free chlorine monitor, which would normally read zero, should have detected the increased free chlorine residual following the loss of ammonium dosing, causing the PLC to shut down the WTW and send a shutdown alarm to the Intelligent Control Centre (ICC). The monitor had been calibrated incorrectly and not all operators were aware of the correct method of calibration, so this second fail safe did not occur;
- A final water ammonium monitor was installed five months earlier and linked to telemetry. An alarm raised by the low ammonium should have been sent to ICC as a process failure alarm to alert them to the problem. No alarm set points had been entered on the alarm, so this third fail safe did not occur;
- Specific alarms are shown on site at Kyle of Lochalsh WTW, however ICC only receives generic plant shutdown alarms. If the alarms do not cause a shutdown nothing is sent to ICC. This lack of visibility meant that due to the incorrectly set alarms, ICC were unaware of the lack of ammonium dosing and did not pass this to local treatment operators for investigation;
- In addition to the lack of telemetric fail safes, operators attended site over the seven day period but neither conducted all routine scheduled tasks and associated paperwork, nor noted the low flow on the final water ammonium monitor which would have alerted staff to the lack of ammonium dosing. Onsite investigation by DWQR revealed that the operators were short staffed at that time.

## DWQR Assessment of Actions Taken by Scottish Water

When the lack of ammonium dosing was eventually noticed it was quickly rectified by treatment operators, however it is completely unacceptable that the integral step of ammonium dosing was halted for seven days and only discovered due to routine sampling. The incident highlights serious deficiencies in Scottish Water's fail safe procedures at the site and requires Scottish Water to learn significant lessons.

Several issues were noted and are pertinent:

1. Notwithstanding the importance for telemetric fail safes, it is of paramount importance that staff are fully trained and given appropriate time and resources to carry out both routine task scheduling and emergency procedures.
2. It is problematic that only generic shutdown alarms from small WTW are received by ICC. This gives no remote visibility of the nature of WTW issues and little scope for error where set points are incorrect or overwritten, which has been demonstrated in several recent incidents.
3. Due to the lack of chloramination and obvious high chlorine demand of the water, it is likely that there may have been failures for trihalomethane (THMs) disinfection by-products, however these were not tested for. DWQR recently recommended an action following a WTW process failure causing THM failures to ensure timely samples are obtained from consumers' taps in the event of any treatment process failure (Incident 7127 at Tullich WTW).



4. The changeover between duty and standby pumps is critical for all chemical dosing processes throughout WTW in Scottish Water. DWQR is concerned that Scottish Water have not discovered the root cause of the ammonium pump changeover failure which could recur.

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

