DRINKING WATER QUALITY REGULATOR

FOR SCOTLAND

Drinking Water Quality in Scotland 2023 DWQR Annual Report - Public Supplies

dwqr

Drinking Water Quality Regulator for Scotland

SAFEGUARDING YOUR

DRINKING WATER

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FOREWORD

This year marks 22 years since Scottish Water and DWQR were created. I am proud to report that the quality of Scotland's drinking remains amongst the finest in the world, and that great progress has been made in those 22 years.

However, we cannot afford to take such progress for granted. As we travel around Scotland, visiting and inspecting Scottish Water's treatment works and storage points, my team and I are often struck by the deteriorating condition and age of many of these assets. In some cases, good performance is only achieved by the ongoing effort and diligence of Scottish Water's operational staff. In times of challenging source water quality, treatment processes that are nearing the end of (or beyond) their planned lifespan may lack the processes and control systems needed to consistently meet quality requirements. As the effect of climate change introduces additional variability, I am concerned that the current scale and pace of investment in the maintenance and replacement of water assets is simply not sufficient to safeguard the consistently high quality of our drinking water for future generations.

Water that has been treated to a high standard can deteriorate if the storage tanks designed to hold it on its way to consumers are not maintained, allowing the ingress of contamination. In 2023, following several serious incidents, DWQR issued a Scotland-wide enforcement notice to Scottish Water, requiring the company to improve its performance in this respect so that all storage points will be inspected and maintained on a regular basis.

Water quality standards change over time, and 2023 saw the introduction of a number of new parameters as a result of Scotland's alignment with the recast European Drinking Water Directive – the only UK nation to do so to date. I am pleased to report that Scottish Water complied with most of the new standards from the outset, with the exception of two – chlorate and haloacetic acids. Both of these relate to the use of chlorine as a disinfectant, an essential part of the treatment process. Chlorate may be controlled through good housekeeping of chemical stocks, and although 2023 saw twenty-three failures of this standard, the situation has improved considerably so far in

2024. This will however need to be the subject of ongoing efforts by Scottish Water, which will be monitored as part of the DWQR audit programme. There were ten failures of the haloacetic acid standard, and although some optimisation of treatment processes will assist in controlling their formation, there are at least three sites where investment is likely to be required. I have sought a commitment from Scottish Water to ensure that this happens in a timely manner.

I have been especially impressed this year by the calibre and expertise of Scottish Water staff, across the country. Particularly pleasing has been the enthusiasm and knowledge of the younger staff, such as modern apprentices, at an early stage in their career. This is good to see, as the water sector provides a rewarding and varied career, and their expertise will be vital over future years.

Finally, I should like to pay tribute to the professionalism of my team. Although we are small in number, we ensure that we give equal attention to the whole of Scotland. The benefits of strong, but proportionate, regulation are apparent, and there are numerous examples this year of where we have made a difference in driving improvements in the quality and security of Scotland’s drinking water supply.

Matt Bower

Drinking Water Quality Regulator for Scotland

August 2024

EXECUTIVE SUMMARY

In Scotland the public water supply is provided by Scottish Water. All other supplies are known as private water supplies, managed by owners and/or users. The Drinking Water Quality Regulator for Scotland (DWQR) regulates the quality of water supplied by Scottish Water, ensuring that drinking water supplies meet the requirements of The Public Water Supplies (Scotland) Regulations 2014 as Amended ("the Regulations"). This report describes the quality of the public supply provided by Scottish Water and the regulatory actions that DWQR has undertaken in 2023. DWQR publishes a separate report on private water supplies which you can view on our website at https://dwqr.scot/information/annual-report/.

Scottish Water takes and analyses its own samples to demonstrate that the water supplied complies with regulatory requirements. Samples are taken from drinking water as it leaves water treatment works (WTWs), service reservoirs (SR) (also referred to as storage points) and from randomly selected consumers' taps. This sampling and analysis is independently accredited and is consistent with water industry practice in the rest of the UK. DWQR assesses Scottish Water's monitoring programme and results. In 2023, Scottish Water carried out a total of 272,017 regulatory tests (with numerical standards) on Scotland's drinking water and many more for operational reasons such as following a burst main.

In 2023 Scottish Water carried out sufficient water sampling as required by the Regulations, and the data shows a continued high level of compliance with standards. It should be noted that, with the introduction of the amended Regulations, the number of samples which must be taken will vary dependent on Scottish Water's assessment of risk affecting the validity of some between-year comparisons. Of the 113,454 tests taken in 2023 to represent water at consumers' taps, 99.88% complied with the standards. A further 62,253 tests were carried out on water supplied from treatment works and all but 30 of these tests met the required standards, which is a slight deterioration on the previous year's performance. 96,310 tests were also taken from service reservoirs (SR), where treated water is stored. Compliance here was also poorer than in the last few years, due to an increase in detections of coliform bacteria.

The rise in coliform detections is one of the factors leading to DWQR serving an enforcement notice for inspection and maintenance of storage points on Scottish Water.

Scottish Water also reports the numbers of ‘contacts’ received from consumers about the quality of their drinking water. There were 16,552 such contacts during 2023, which is very similar to 2022. There has been an increase in the number of complaints relating to most categories of taste and odour in the water supply. However, there were fewer complaints relating to other categories, such as discolouration.
DWQR carries out formal complaint investigations if consumers are not satisfied with Scottish Water’s own investigations. We carried out two such investigations during 2023; one related to lead, and the other related to taste and odour. Neither complaint was upheld, although some recommendations were made to Scottish Water. Further information on Scottish Water’s monitoring programme, results and consumer contacts can be found in Section 1 of this report.

Scottish Water is required to tell DWQR about any event that could affect water quality or cause consumer concerns. There were 921 water quality events reported in 2023. Events of a more serious nature are categorised as water quality incidents. In 2023, 29 events were declared to be incidents and investigated by DWQR. As in previous years, significant loss of control of the water treatment process and issues causing significant customer concern were the most common cause of incidents. Section 2 of this report gives more details on some of the incidents that we investigated during 2023.

Audit and inspection is a key part of DWQR’s role. We inspect a range of Scottish Water activities and assets that could affect the quality of drinking water every year, auditing against regulatory requirements and industry best practice. Sites are selected for inspection using a risk based process that takes into account sample failures and water quality events and incidents. During 2023, 21 incident and event investigation visits or audits took place. 14 at water treatment works and seven distribution activities. Further information on our audit and inspection work is given in Section 3 of this report.

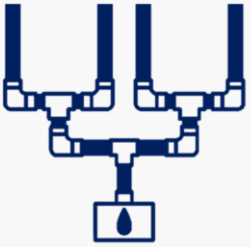
2023 IN REVIEW : PUBLIC SUPPLIES IN SCOTLAND

226 Water Treatment Works

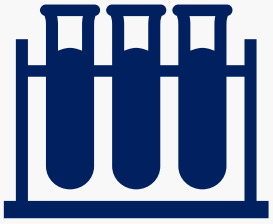
956 Treated Water Storage Points

278 Water Supply Zones

662 Raw Water Sources



49,111 km Of Water Distribution Pipes



272,017 Tests On Water Samples

134 Tests On Consumer Samples Did Not Meet Standards

113,454 Tests On Customers' Tap Samples

DWQR Reviewed 921 Water Quality

DWQR Declared 29 Water Quality Incidents

DWQR Received 118 Consumer Contacts

1 PUBLIC DRINKING WATER SUPPLIES IN SCOTLAND 2023

Risk Based Sampling

1.1 Water Treatment Works

Scottish Water has 226 water treatment works (WTW) that treat water to ensure it is safe to drink and complies with the standards set out in the Regulations. Treatment works in Scotland range from large supplies serving whole cities to very small works that supply small communities consisting of only a few properties. Regardless of their size, DWQR expects Scottish Water to ensure that its WTW are capable of treating a range of raw water qualities found in water sources. 146,051 samples were taken from treatment works. Of these, 38 (0.03%) failed to meet the required standards.

Figure 1 A small water treatment works in the Western Isles.

1.1.1 Microbiological Quality at Water Treatment Works

Coliform bacteria and *Escherichia Coli* (*E. coli)* are measured in water leaving WTW to check that disinfection of the supply has been successful. Coliforms are groups of bacteria widely found in the environment; and *E. coli* is an indicator of faecal contamination. The presence of either parameter shows that the disinfection process may not have been effective at killing potentially harmful bacteria. The standard for

both coliform bacteria and *E. coli* is zero and all sample failures must be fully investigated by Scottish Water and reported to DWQR, the local NHS board and the relevant local authority.

When investigating sample failures at WTW, Scottish Water considers a number of potential contributory factors, such as; changes in the quality of the incoming raw water, issues with treatment processes, sampling conditions, and evidence from samples at both the treatment works and in the distribution system. Further sampling can help establish whether there is a genuine problem and what this is. Data from online monitoring and manual testing of water at WTW for other parameters can also yield useful information. Samples taken at WTW continued to show that supplies in Scotland were of a high microbiological standard in 2023.

Of the 25,969 tests for *E.coli* in 2023, one sample from Kinnesswood WTW failed the *E. coli* standard and this was thought to have been caused by contamination of the sample due to poor weather conditions at the outdoor sample point.

26 tests (0.1%) failed the standard for Coliform bacteria. Turriff WTW, Coulter WTW and Lomond Hills WTW each had more than one failure of the Coliform bacteria standard. At Turriff WTW, the first sample failure, 1 Colony Forming Unit (CFU)/100ml in January 2023, was attributed to an incorrect chemical dose setting on front end treatment, which allowed water to pass through the treatment process without optimal first stage treatment. The second and third failures (2 CFU/100ml and 1 CFU/100ml respectively) in October 2023, were a result of a change in raw water quality following heavy rainfall in the catchment and was attributed to organics not being sufficiently removed from the treatment process. In response to the sample failures, actions were taken to review dose control settings and online water quality monitoring. At Coulter WTW, the first sample failure, 1CFU/100ml in August 2023, was attributed to a temporary chlorine dosing interruption causing treated chlorine levels to drop below target levels. For the second failure, 1 CFU/100ml in November 2023, a cause was not found. Actions have been taken to add level control and alarms to chlorine dosing batching tanks. At Lomond Hills WTW, the first sample failure, 17 CFU/100ml in July 2023, was caused by a failure of the filter beds. The works was taken offline to carry out repairs. The second failure, 1 CFU/100ml in July 2023, was caused by the mixing

of de-chlorinated water with chlorinated water being supplied by tanker in the outlet main from the WTW whilst it was offline.

1.1.2 *Cryptosporidium* at Water Treatment Works

Cryptosporidium are microscopic protozoan parasites that can live in the gut of humans and warm-blooded animals. *Cryptosporidium* oocysts can enter a water supply if faecal material is washed into the source (i.e. raw) water and the oocysts are not removed by the treatment process. *Cryptosporidium* oocysts are not killed by chlorine at the levels used in water treatment, and water treatment processes need to be optimised and well monitored to ensure they are physically removed. Scottish Water tests water supplies for *Cryptosporidium* to verify that these processes are removing oocysts. Ultra Violet (UV) light can be effective at inactivating oocysts. Scottish Water uses this process at a small number of sites where physical removal of oocysts by the original treatment process is not consistently achieved.

Scottish Water took 5,745 samples for *Cryptosporidium* in 2023. Alexandria WTW in West Dunbartonshire had two detections in 2023. It has previously had *Cryptosporidium* detections in 2022, 2020 and 2018. An audit by DWQR in 2023 showed that the filters at the treatment works were not washing efficiently and that the coagulation process was not optimised. Additionally, there was evidence of aluminium concentrations increasing in the water from the secondary filters, which were installed for manganese removal, indicating a further risk from *Cryptosporidium*. A number of recommendations were made as a result of this audit. A second audit to follow up on these recommendations was carried out in February 2024. Improvements to filter backwash efficiency have since been made.

Turriff WTW has had the highest number of *Cryptosporidium* detections in the last five years of any treatment works in Scotland, with another detection in January 2023. Consequently, DWQR served an Enforcement Notice in 2022 requiring upgrades to the WTW to improve performance. The treatment works now has UV treatment to inactivate any oocysts. An Enforcement Notice was also served in 2023 for Mannofield WTW in Aberdeen for a recurring failure to consistently remove *Cryptosporidium.* A further detection was recorded in a sample taken in October 2023. Rosebery WTW

near Gorebridge in Midlothian has had *Cryptosporidium* detections from final water in eight out of the last ten years sampled. A detection in February 2023 was attributed to a failure of the dirty wash water outlet valve and on return to service the remaining backwash water was drained through the filter bed instead of to waste. Significant improvements to treatment are planned, and the works was audited in May 2024.

1.1.3 Chemical Quality at Water Treatment Works

The Regulations require that water is tested for two chemical parameters, turbidity and nitrite, in samples taken from treatment works. Nitrite is a compound of nitrogen that can occur in supplies where ammonia is added to chlorine in a process called chloramination. This process needs to be tightly managed and the presence of nitrite in significant quantities can indicate that it is not as controlled as it should be. There were no exceedances of the nitrite standard at treatment works during 2023.

Turbidity is a measure of the extent to which particulate matter in the water scatters light (i.e. how cloudy the water appears). There is a risk that turbid waters cannot be properly disinfected, so a treatment standard of 1.0 nephelometric turbidity units (NTU) has been set in the Regulations. There were three turbidity tests that failed regulatory standards in 2023. Two of these were at Turriff WTW and one at Black Esk WTW. At Turriff WTW, turbidity fails have been attributed to the capability and performance of the treated water lime dosing and batching systems. Hydrated lime is a turbid chemical and due to the lack of Clear Water Tank (CWT) onsite, which would give time for the lime to dissolve, any significant drop in performance from optimal batching and /or dosing can impact final water quality. The site has transitioned from lime dosing to sodium hydroxide dosing for pH correction to reduce this risk. At Black Esk WTW, low CWT levels and high flows allowed lime sediment deposition to become disturbed and affect final water turbidity samples. The CWTs were cleaned, and lime batching systems were identified as requiring further optimisation to reduce the risk of lime deposition in the CWT.

1.2 Service Reservoirs

Service reservoirs (SRs) (also referred to as storage points) are located at points in the distribution system. They store water to meet the demand for water from consumers throughout the day. If service reservoirs are not maintained they can be prone to inward leakage from contaminated surface water. This needs to be controlled through inspection and maintenance. DWQR inspects a selection of structures each year in order to ensure that they are being maintained and operated in a manner that minimises risk of contamination.

Compliance with microbiological standards at service reservoirs in 2023 showed a continued deterioration in performance since 2021 as Figure 2 below shows. From 48,153 samples, 70 (0.15%) samples did not comply with the Coliform bacteria standard.

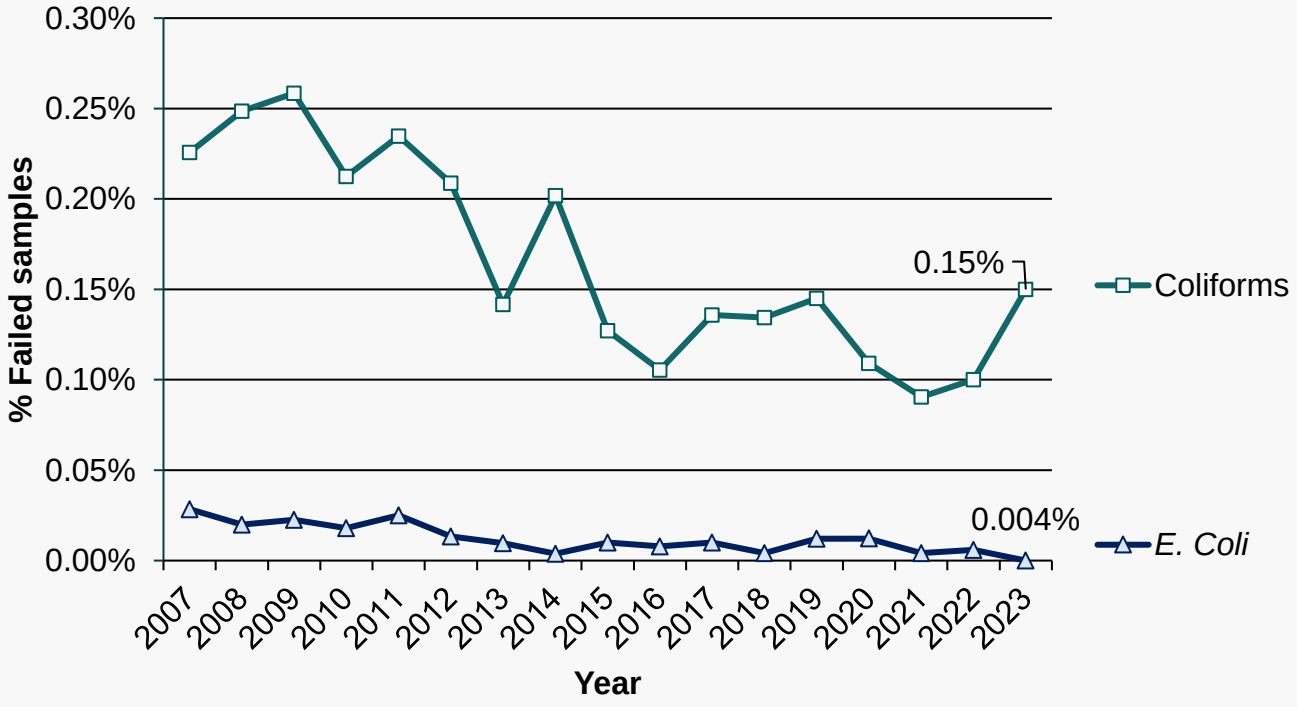


Figure 2 Microbiology failure rate at service reservoirs.

Samples from two service reservoirs, 0.004% of samples, failed the *E. coli* standard – Conisby SR and Dalmacoulter SR. Conisby SR also had one regulatory sample fail for Coliform bacteria in 2023. The failing samples at Conisby SR on Islay were taken from a temporary tank that has been installed in order to bypass the original underground concrete tank due to asset condition. The temporary tank at Conisby SR, which also

had one regulatory sample fail for Coliform bacteria in 2022, was audited by DWQR in June 2022 with the control, hydraulics and exposure to the elements highlighted as potential risks for microbiological growth or ingress into the tank. Scottish Water have since installed a more robust temporary tank with a formal overflow and further investment is progressing to main out or refurbish the original tank.

Figure 3 A temporary tank that was audited by DWQR.

A sample taken from Dalmacoulter SR near Airdrie failed both the Coliform and *E. coli* standard. The failing cell was taken out of supply, drained, cleaned and inspected, along with a neighbouring cell. Investigations at the SR found no issues with the tanks, which had previously had extensive refurbishment carried out within the past 2 years. Resamples and downstream samples from consumer properties were taken, which were all clear of Coliform and *E. coli* bacteria. Scottish Water found the sample points to be non-compliant along with vegetation build up and animal droppings found in the sample kiosk.

In total, 14 service reservoirs had more than one sample taken in 2023 which failed the Coliform bacteria and *E. coli* standards. DWQR issued an Information Letter in January 2023 requesting an annual data return from Scottish Water on all of its service reservoirs and clear water tanks. This data return was provided by Scottish Water in April 2023 and included: dates of last inspection and clean; results of flood tests during

inspections; whether the tank can be bypassed, and details of any secondary chemical dosing. Having assessed the data return provided by Scottish Water, and in light of the downturn in microbiological performance at these assets, DWQR issued Scottish Water with an Enforcement Notice to address the concerns raised. The Enforcement Notice can be viewed on the DWQR website Enforcement (dwqr.scot).

Figure 4 View from the top of a SR.

Figure 5 SR in the North of Scotland.

Figure 6 Sample tap at a SR.

1.3 Water Quality at Consumers' Taps

Risk-based Monitoring

The amendments to The Public Water Supplies (Scotland) Regulations 2014 allow for risk-based monitoring, whereby Scottish Water tests for each parameter at a frequency based on risk. This means that Scottish Water should take the most samples where the risk of failure is highest. It means that the frequency of sampling, which was previously at a fixed rate based on population that was set out in the Regulations, will now vary between supply zones, parameters, and from year to year. This makes a calculation of overall compliance at a national level less meaningful as the rate of sampling is no longer consistent.

DWQR is exploring options for enabling a meaningful comparison of water quality performance between parameters, years and locations. This year, although an overall compliance figure has been calculated, it will not be comparable with those from previous years.

In 2023, 113,454 samples were taken to represent water quality at consumers' taps. Of these, 134 samples failed to meet the standard set out in the Regulations.

Table 1 shows the failing test results of samples taken to represent water at consumers' taps. Compliance for several key parameters is then discussed in more detail. The number of samples taken for each parameter for which Scottish Water is required to test is shown in the Performance Tables which accompany this report and can be found on our website. In addition to these regulatory samples, Scottish Water also takes samples for further investigation where the consumer reports an issue to ensure these are properly investigated.

Table 1 Summary of Failing Tests on Regulatory Samples From Consumers' Taps in 2023

Parameter	Total No. of Samples	No. Failed Samples	No. Zones with Failures	% Compliance in 2023	% Compliance in 2022	% Compliance in 2021
Key Parameters						
Bacteria						
Coliform Bacteria	14,983	38	33	99.75%	99.74%	99.83%
E. coli	14,983	4	4	99.97%	99.97%	99.99%
Enterococci	4,906	1	1	99.98%	100.00%	99.86%
Clostridium perfringens	4,906	1	1	99.98%	99.98%	99.94%
Total bacteria	39,778	44	39	99.89%	99.88%	99.91%
Metals						
Aluminium	4,831	3	3	99.94%	99.98%	99.96%
Copper	585	0	0	100.00%	99.93%	100.00%
Iron	4,831	22	18	99.54%	99.44%	99.58%
Lead	585	2	2	99.66%	99.48%	99.73%
Manganese	4,831	10	7	99.79%	99.67%	99.37%
Nickel	585	0	0	100.00%	99.93%	99.25%
Total metals	16,248	37	30	99.77%	99.72%	99.61%
Other key parameters						
Colour	4,906	0	0	100.00%	100.00%	100.00%
Hydrogen ion (pH)	4,906	1	1	99.98%	99.94%	99.96%
Nitrite	2,000	4	3	99.80%	99.93%	99.96%
Odour	4,906	9	8	99.82%	99.85%	100.00%
Radon	63	0	0	100.00%	N/A	100.00%
Taste	4,907	3	2	99.94%	99.92%	100.00%

Total Trihalomethanes	586	0	0	100.00%	99.93%	99.86%
Turbidity	4,906	3	3	99.94%	100.00%	100.00%
Total Other key parameters	27,180	20	17	99.59%	99.94%	99.98%
Other Parameters						
1,2 Dichloroethane	586	0	0	100.00%	100.00%	100.00%
All Other Individual Pesticides	1,564	0	0	100.00%	100.00%	100.00%
Ammonium	2,000	0	0	100.00%	100.00%	100.00%
Antimony	585	0	0	100.00%	100.00%	100.00%
Arsenic	585	0	0	100.00%	100.00%	100.00%
Benzene	586	0	0	100.00%	100.00%	100.00%
Benzo 3,4 Pyrene	579	0	0	100.00%	100.00%	100.00%
Bisphenol A	588	0	0	100.00%	N/A	N/A
Boron	585	0	0	100.00%	100.00%	100.00%
Bromate	585	0	0	100.00%	100.00%	100.00%
Cadmium	585	0	0	100.00%	100.00%	100.00%
Chlorate	585	23	22	99.53%	N/A	N/A
Chloride	4,907	0	0	100.00%	100.00%	100.00%
Chlorite	585	0	0	100.00%	N/A	N/A
Chromium	585	0	0	100.00%	100.00%	100.00%
Conductivity	4,906	0	0	100.00%	100.00%	100.00%
Cyanide	585	0	0	100.00%	100.00%	100.00%
Fluoride	584	0	0	100.00%	100.00%	100.00%
Haloacetic Acids (Sum of 5 HAA)	576	10	8	98.26%	N/A	N/A

Mercury	585	0	0	100.00%	100.00%	100.00%
Microcystin -LR	584	0	0	100.00%	N/A	N/A
Nitrate	584	0	0	100.00%	100.00%	100.00%
Nitrite/Nitrate formula	584	0	0	100.00%	100.00%	100.00%
PAH - Sum of 4 Substances	579	0	0	100.00%	100.00%	100.00%
Pesticides - Total Substances	391	0	0	100.00%	100.00%	100.00%
Selenium	585	0	0	100.00%	100.00%	100.00%
Sodium	585	0	0	100.00%	100.00%	100.00%
Sulphate	585	0	0	100.00%	100.00%	100.00%
Sum of PFAS	1,290	0	0	100.00%	N/A	N/A
Tetrachloroethene/ Trichloroethene	585	0	0	100.00%	N/A	100.00%
Tetrachloromethane	585	0	0	100.00%	100.00%	100.00%
Uranium	585	0	0	100.00%	N/A	N/A
Total other parameters	30,248	33	30	99.89%	100.00%	100.00%
Scotland Total	**113,454**	**134**	**81**	99.88%	99.91%	99.92%

1.3.1 Microbiological Quality at Consumers' Taps

Coliform Bacteria

Coliform bacteria were detected in 38 samples in 2023, with five zones reporting two failures. Most of these failures were attributed to either localised contamination of the sample, the integrity of the sample tap, or no clear cause when all other factors were considered. When coliform bacteria failures occur, Scottish Water takes further samples from the premises and also from neighbours' taps to determine if there is a local property issue or a wider supply system concern. Scottish Water notifies the consumer of the findings and provides the appropriate advice in each case.

E. coli

E. coli is an extremely important parameter because it is an indicator of faecal contamination and the microbiological safety of the water. The detection of *E.coli* in a water sample may be an indication that either the supply in that area or the tap from which the sample was taken has become contaminated. Some *E. coli* bacteria can cause illness. Scottish Water must investigate each failure thoroughly to try to determine the cause and respond appropriately. Compliance for this parameter is relatively stable with only a few failures occurring each year. Four samples failed across separate zones in 2023. Of these, three were due to poor kitchen tap hygiene and one was reported by Scottish Water in error.

Enterococci

Enterococci is also used as indicator of faecal contamination and the microbiological safety of the water. The numbers of *Enterococci* bacteria found in human faeces are generally much lower than *E. coli*, but they tend to survive for longer in the water environment and are more resistant to chlorination than *E. coli*. Compliance for this parameter is relatively stable with only a few failures occurring each year. One sample failed for *Enterococci* in 2023 and this was attributed to contamination of the sample at

the time of sampling, which when resampled was free from microbiological contamination.

Clostridium perfringens

Clostridium perfringens is also an indicator of faecal pollution. *Clostridium* spores can survive in water much longer than organisms of the coliform group and will resist disinfection by chlorine. Their presence in disinfected waters may indicate deficiencies in treatment. In distribution systems and at consumer taps, they can be an indicator of some historic contamination having occurred. One sample contained *Clostridium* bacteria in 2023 and this was thought to be due to poor tap hygiene, which was satisfactory when resampled.

1.3.2 Chemical Quality at Consumers' Taps

Iron

Iron occurs naturally in some water supplies but should be predominantly removed by the treatment process. It is used as an alternative flocculant to aluminium at a few treatment works in Scotland. The most common cause of failures of the iron standard at consumers' taps is corroding cast iron water mains which can cause sediment to build up in distribution systems. High concentrations of iron can cause discoloured water supplies, greatly inconveniencing consumers. Scottish Water continues with a programme of renovation and cleaning of the water mains that cause the most significant water quality issues. This should have the effect of reducing the number of complaints about discoloured water in the future and is also reflected in the reduction of iron failures over time. Iron compliance in 2023 has improved, with 22 tests failing to meet the standard, compared with 28 failures in 2022. There were however, 391 fewer samples taken for iron in 2023 with Scottish Water returning to minimum sample frequencies which may have also reduced the likelihood of obtaining a failing sample.

Manganese

Manganese occurs naturally in some raw waters, especially in the west of Scotland. If it is not removed effectively by the treatment process it can accumulate as fine black sediment in distribution system pipework and cause severely discoloured water supplies and great inconvenience for consumers. Even a relatively low concentration of manganese in water from a treatment works can build up in pipes and cause problems in distribution pipework. As with iron, manganese compliance in 2023 has significantly improved with only ten samples failing, compared with 17 in 2022. Again, 391 fewer samples were taken for manganese in 2023.

Lead

Lead is a toxic metal that can accumulate in the body. In Scotland, lead generally does not occur naturally in significant concentrations in our water supplies. The problem arises when drinking water comes into contact with lead supply pipes, lead tanks, lead solder joints on copper pipes, or inferior quality brass fittings and taps, particularly for longer periods (e.g. overnight/weekends/holiday periods). This can result in high lead levels in the drinking water supply. Although the majority of lead piping is privately owned and therefore outside Scottish Water's direct control, the company does have a responsibility under the Regulations to minimise the risk from dissolved lead. It does this by treating the water with orthophosphate to reduce the risk of lead dissolving from pipes. The Scottish Government is reviewing the policy in relation to the reduction of exposure to lead in drinking water, especially in light of the recast Drinking Water Directive. The project aims to raise awareness of consumers to the concerns about lead in drinking water and to promote the removal of lead service pipes and plumbing. Scottish Water has an objective to move toward a Lead-Free Scotland with a target date of 2045 for the complete removal of lead from the public water network. DWQR commissioned Scottish Water to carry out a surveillance programme for lead within independent schools and nurseries. At the end of 2023, Scottish Water had mostly completed this project with an aim to close off by summer 2024. Scottish Water has also undertaken a pilot project to remove lead in the Tighnabruaich network, which is nearing completion and have started a second, similar, project within Kyle of

Lochalsh and surrounding areas. In 2023, there were two lead failures detected from regulatory samples compared with six in 2022. The number of samples taken for lead was however down from 1,159 to a baseline of 585. Scottish Water take many more samples for operational reasons such as consumer request or survey work. A greater proportion of these samples fail the standard as they are generally taken from properties known to have lead pipes.

Total Trihalomethanes (THMs)

Total Trihalomethanes (THMs) are a group of disinfection by-products that can form when naturally occurring, harmless organic substances combine with chlorine used to disinfect water. As Scotland's upland waters are often rich in these organic compounds, management of THM formation presents a challenge for Scottish Water. Scottish Water has devoted much effort over a number of years to reducing the formation of THM in its water supplies and has made significant progress on this issue. No exceedances of the THM standard occurred in 2023, although, as for other parameters, the number of samples taken went down from 1,450 to 586. An increase in treated water colour can significantly increase THM formation in the downstream network. Better monitoring at the WTW and tighter thresholds on site for colour removal have been implemented to improve performance. It is expected that with the move toward more risk-based sampling, the failure rate for THMs in some parts of the country may rise.

Nitrite

Nitrite forms when nitrifying bacteria react with the ammonia that is added to chlorine in a process known as chloramination. If the process is not carefully controlled and nitrifying bacteria are allowed to persist in the distribution system, nitrite can build up and cause failures in the standard. Bacteria can persist due to water lying in pipes for long periods, especially in warmer weather. There were four failures of this parameter in 2023 across three supply zones. 731 fewer samples were taken in 2023 compared with 2022.

Nickel

Nickel is not found in high concentrations in Scotland's waters. However, it is used in the production of stainless steel and other metal products. Its presence in drinking water generally arises from contact with plumbing fittings, such as nickel or chromium-plated taps or certain types of kettles. No nickel failures occurred in 2023, although 867 fewer samples were taken.

Taste and Odour

There were three taste failures in 2023 across two supply zones. Two of the taste failures, from samples taken from the Turriff zone, were attributed to low levels of a chemical called Tribromoanisole, which at very low concentrations can be detected by those with sensitive taste palates. The levels detected were not at significant concentrations to affect the health of the consumers. Resamples taken were satisfactory.

Nine samples failed for odour across eight supply zones. Two of these from Turriff zone were, as explained, related to Tribromoanisole. One failure, from Dhu Loch on Bute reported as 'musty', was thought to be related to very low levels of 2-Methylisoborneol, a taste and odour forming compound produced by algae. The cause of the other fails could not be found and resamples were all satisfactory.

Turbidity

Turbidity in water is caused by suspended particles or colloidal matter that obstructs light transmission through it, making it appear cloudy. The standard is primarily an aesthetic one, but high turbidity needs to be investigated, especially in water leaving treatment works. It could indicate a problem with the treatment process and may mean that the effectiveness of disinfection has been compromised. There were three failures of the turbidity standard at consumers' taps in 2023 across three separate supply zones (Craigie, Milngavie C1 and Torridon) related to flow disturbance caused by fire

service hydrant use, possible transient flow disturbance and low turnover of water respectively.

Hydrogen Ion (pH)

The pH of a substance is the measure of how acidic or alkaline the water is. Most waters in Scotland are naturally soft and have a low pH. Such water can be corrosive to metals used in plumbing; therefore, Scottish Water needs to correct this to bring the pH into the required range. High pH values can occur where water is in prolonged contact with water mains containing cement. Waters with a very high pH can have a taste that some consumers find unpleasant. One regulatory sample taken from the Milngavie Gorbals zone failed the standard for pH in 2023. The cause of this failure was found to be related to elevated pH leaving the Gorbals Treated Water Pumping Station prompting further investigation and the DWQR declaration of a significant incident (see Incidents section for further information).

1.4 New Parameters

On 1st January 2023 the Public Water Supplies (Scotland) Amendment Regulations 2002 The Public Water Supplies (Scotland) Amendment Regulations 2022 (legislation.gov.uk) came into force. Some parameters were included for the first time, with the main ones described below.

Chlorate

Chlorate is a disinfection by-product that can arise when sodium hypochlorite or chlorine dioxide are used in the disinfection of drinking water. Chlorate can form if hypochlorite solutions are stored for a long time and at warm temperatures. This has been a particular challenge Scottish Water faced in 2023. The Regulations set the limit for chlorate at 0.25mg/l at the consumers' tap. In 2023 Scottish Water took 585 samples from all around Scotland and of these 23 samples breached the PCV across 22 supply zones. As a result of this new protocols have now been put in place to reduce the number of chlorate failures.

Haloacetic Acids (HAAs)

Haloacetic acids (HAAs) are formed as by-products during the disinfection process of drinking water. It is a result of reactions between chlorine-based disinfection agents (chlorine, chloramine, and chlorine dioxide) and organic molecules in the water. The formation of these compounds is likely to be higher in areas where the treatment process is less successful at removing organic matter. The Regulations set a standard for a sum of 5 HAAs of 60µg/l at customer taps. In 2023 Scottish Water had 10 failures across 8 supply zones. It is likely that some investment may be required at a few sites in order to enable them to consistently meet the standard.

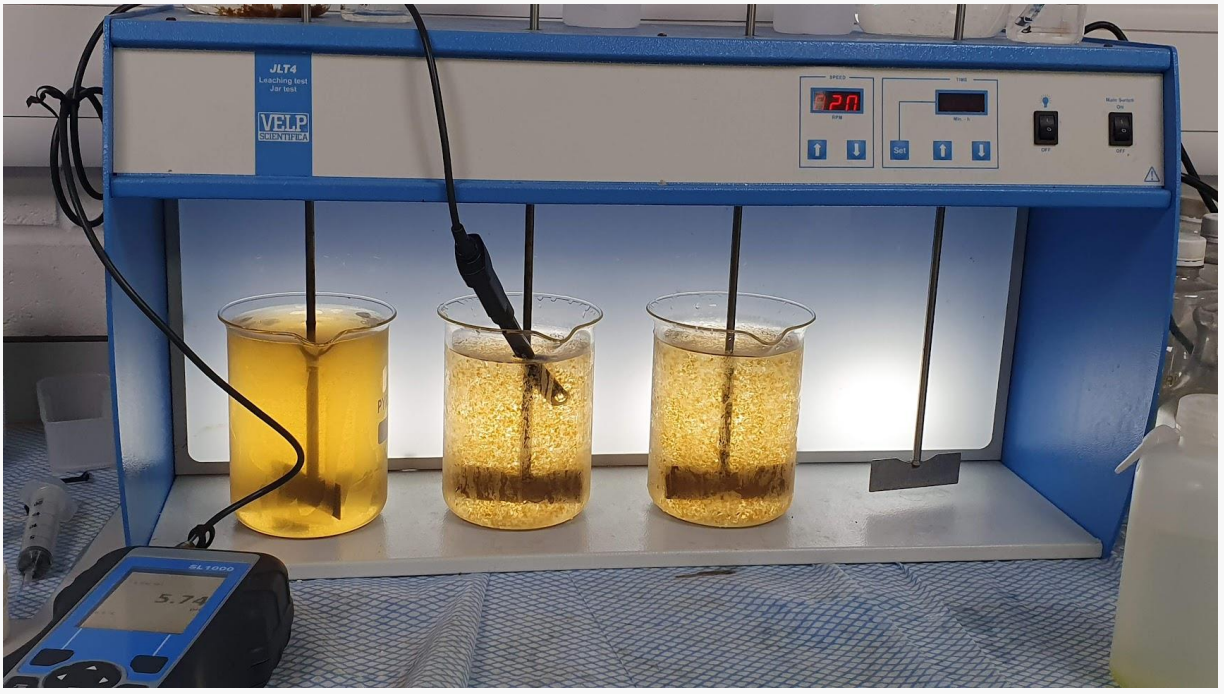


Figure 7 A floc test used to optimise chemical dosing at a WTW.

Bisphenol A

Bisphenol A is a chemical produced used in the production of plastics. It is found in various products including some water bottles and bottle tops. The current Regulations have a new PCV of 2.5µg/l at customer taps. In 2023 Scottish Water took 588 samples, none of which breached the PCV.

Per- and Polyfluoroalkyl substances (PFAS)

Per- and Polyfluoroalkyl substances (PFAS), often called “forever chemicals”, are man-made chemicals that are produced in industry to be heat, pressure, grease, stain, and water resistant. Due to their heat resistance and film-forming in water, some PFAS chemicals have been used as ingredients in fire-fighting foams. Other uses for these chemicals include:

- Stain and water protection for carpets, fabric, furniture and clothing
- Paper coating (including for some food packaging)
- Metal plating
- Photographic materials
- Aviation hydraulic fluid
- Cosmetics and sunscreen
- Medical devices

Unfortunately, the properties that make PFAS useful in many industrial applications, also make them problematic in the environment. PFAS molecules are highly mobile in water, which means they can travel long distances from their source-point. They are also resistant to breaking down naturally in the environment and our waste systems are not built to fully remove them.

The DWQR issued a second Information Letter to Scottish Water in December 2022 on PFAS Information Letter- Risk Assessment and Sampling of PFAS, setting out requirements for drinking water supplies for risk assessment, sampling, analysis and regulatory reporting of PFAS, along with operational requirements. It also sets out action to be taken by Scottish Water where any PFAS samples exceed permitted thresholds set out in the Regulations, including notification to DWQR. Sample locations and sampling frequencies for PFAS have been identified through a risk assessment process, with higher risk supplies sampled more frequently. There is no technology currently available for monitoring PFAS in real time.

Scottish Water is required to monitor for the 20 substances listed in the Regulations, with the result reported as a 'Sum of PFAS' compounds. However, there is also a separate regulatory requirement for Scottish Water to ensure that suitable risk assessment and sampling is carried out if it becomes aware of a risk from any other substance in its supplies, which could include other PFAS compounds not in the list of 20. Regulations set out that the "sum of PFAS" should be less than 0.1µg/l at customer taps. In 2023 Scottish Water took 1,290 from around Scotland. None of these samples breached the PCV however some PFAS compounds were found at very low concentrations.

Microcystin LR

Microcystin-LR is a toxin produced naturally by cyanobacteria, also known as blue-green algae. An algal bloom forms when excess cyanobacteria grow in a body of water such as a reservoir and form a green scum or mat. Not all algal blooms contain the kinds of cyanobacteria that produce microcystin-LR. There are many types of microcystin with microcystin-LR being one of the more relevant from a health perspective. Currently the Regulations set a PCV at 0.1µg/l at consumer taps. In 2023 Scottish Water took 584 samples and none of these breached the PCV.

Figure 8 Bubble curtain used to disrupt algal growth.

1.5 Operational Monitoring

An addition under the amended regulations that came into force at the start of 2023 is the requirement for Scottish Water to undertake operational monitoring at its water treatment works. The extent of this programme is defined by risk assessment. Two parameters are included – turbidity and the group of viruses known as somatic coliphages. Although the specified requirements are not regulatory standards as such, Scottish Water is expected to investigate the treatment process where they are breached to ensure it is operating effectively.

Turbidity

Scottish Water is required to assess readings from its online treated water turbidity monitors and investigate where more than 5% of readings exceed 0.3 NTU. Whereas other regulatory monitoring for turbidity is done through the analysis of samples collected in bottles and sent to the laboratory, Scottish Water has chosen to use an algorithm to analyse readings from its online turbidity monitors, potentially providing a more representative and responsive assessment of trends.

Scottish Water was able to undertake this monitoring at 200 WTW in 2023, with the remaining sites to be included as soon as possible. A total of 17 instances were identified where 0.3 NTU was breached at the 95 percentile, and 11 of these have been investigated to date, with actions identified.

Somatic Coliphages

Somatic coliphages are a group of viruses that live in warm blooded animals and feed on bacteria. They are an alternative indicator of faecal contamination. Scottish Water has been asked to monitor raw waters of supplies that they deem to be at risk of contamination, with the potential for this to be modified as the risk assessment process matures. A detection of more than 50 plaque forming units (PFU) in 100 ml of water, indicating somatic coliphages are present, should be a trigger for interstage monitoring through the treatment process and additional investigation.

In 2023, Scottish Water performed 1161 tests for Somatic Coliphages from 247 different source waters. Of these, 134 samples contained in excess of the 50 PFU/100ml action value, collected from 73 different sources. In accordance with DWQR guidance, Scottish Water investigated these water supplies, including sampling through the water treatment process and at final waters. All but one final water sample was completely clear of somatic coliphages, showing the water treatment process was performing correctly. The one final water sample which did contain somatic coliphages has been investigated with the conclusion that it was not representative of the water supplied.

Figure 9 Member of the Scottish Water Laboratory Team showing a Somatic Coliphage plate contain plaques.

1.6 Consumer Contacts

1.6.1 Consumer Contacts to Scottish Water

When a consumer calls Scottish Water regarding the quality of their water supply, the contact is recorded and classified according to the nature of the issue. Scottish Water received 16,552 consumer contacts relating to water quality in 2023, equating to a contact rate of 30 per 10,000 population served. There has been a slight decrease on 2022's figures, when Scottish Water received 16,618 contacts. Discolouration remains the primary reason that consumers contact Scottish Water, but the figures have decreased over the last two years, from 17,887 in 2021, 12,251 in 2022 to 11,437 in 2023.

There has been an increase in Earthy/Musty taste or smell contacts from consumers. One cause is the presence in tiny quantities of the naturally occurring compound, geosmin, which is found in algae and soils. There was an incident at Invercannie WTW in July where there was an increase in geosmin levels in the raw water from the River Dee, and the treatment process was unable to fully remove it. This is discussed in more detail in the Events and Incidents section of this report (Section 2).

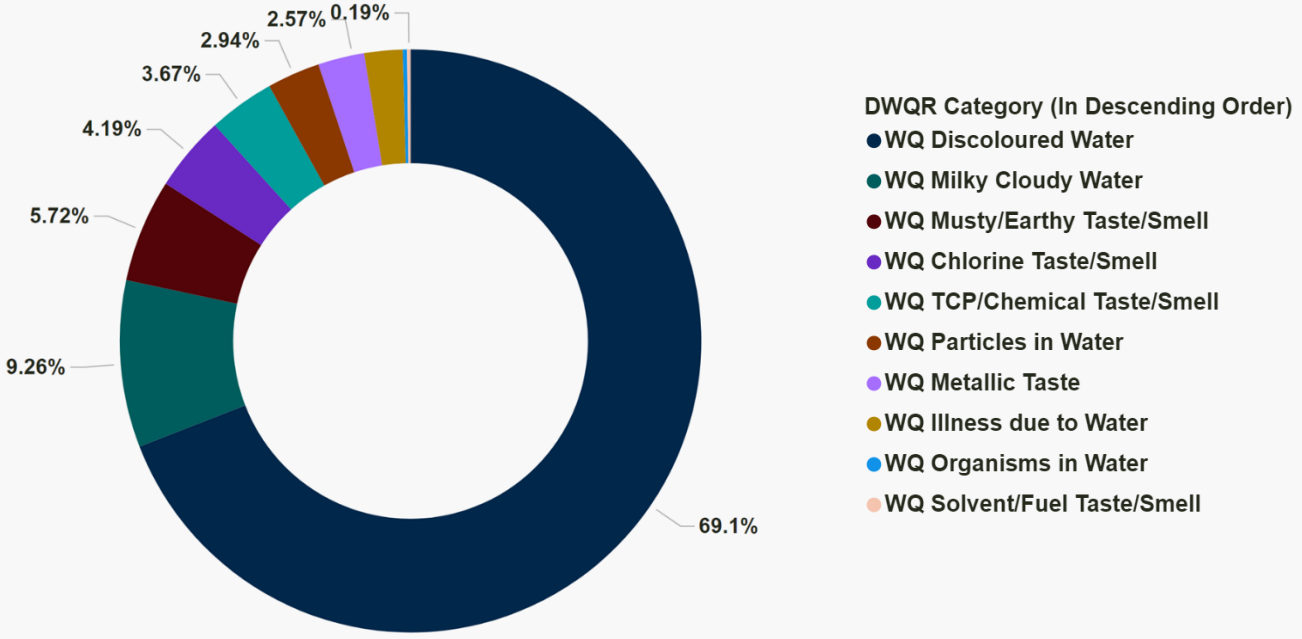


Figure 10 Breakdown of Scottish Water's water quality customer contacts by category.

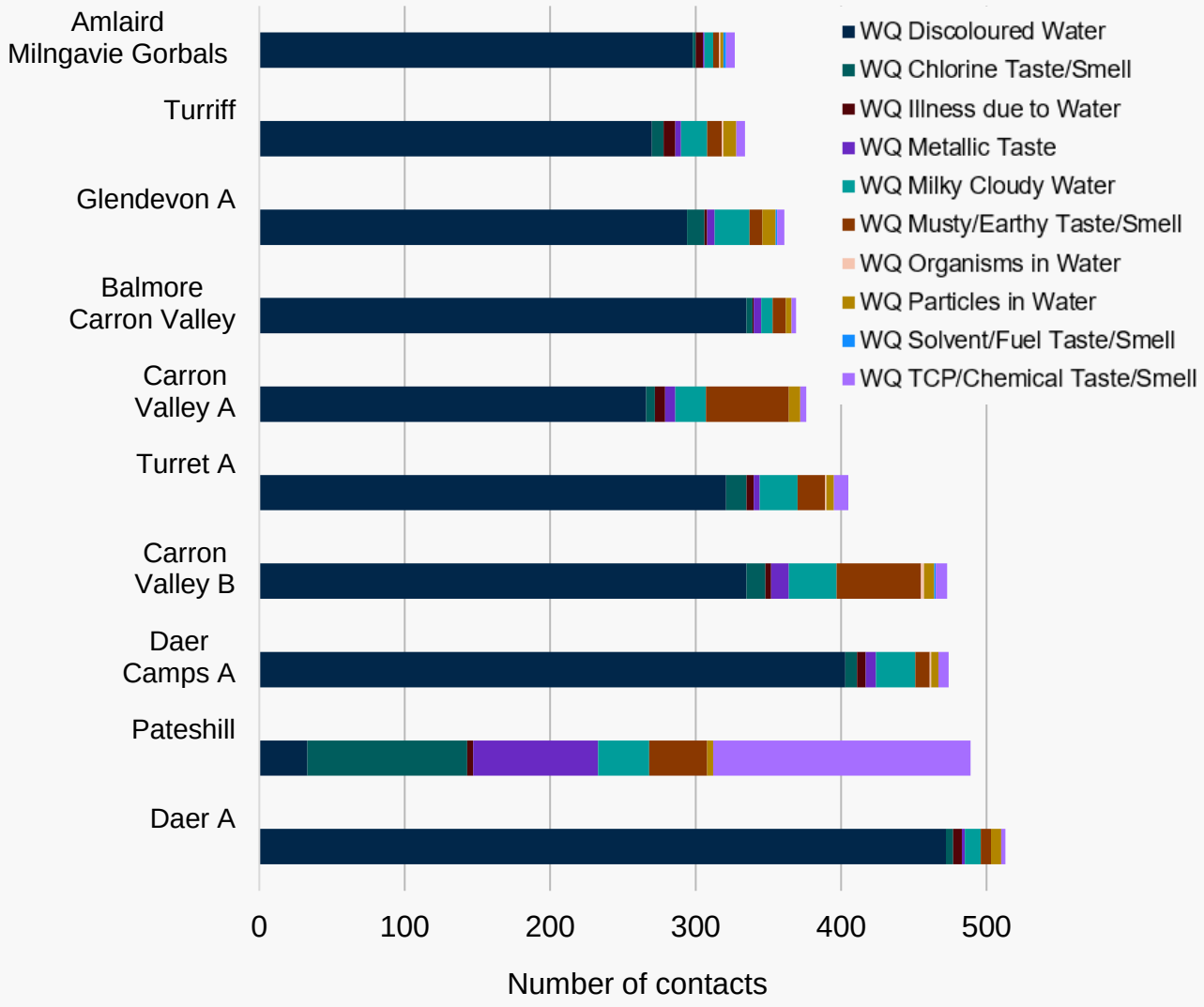


Figure 11 Water Supply Zones with over 300 customer contacts in 2023.

The areas where the most water quality issues were raised by consumers are shown in Figure 10. There are ten zones where more than 300 contacts were received, which is an increase from nine the previous year. The chart above shows the supply zones ranked by consumer contact rate. Discolouration receives the largest percentage of customer contacts across all zones with Daer A Zone continuing to have the largest percentage of contacts in this category.

Pateshill Zone ranked the second highest zone for customer contacts. It received a total of 489 customer contacts. 419 of these contacts were received during an incident

that occurred during December 2023 (See Events and Incident section). Of these 419 contacts, 396 of them were in relation to taste and odour, with chemical or chlorine taste and odour being especially prominent.

An incident in Benbecula, Western Isles in September 2023 was caused by an oil leak into the raw water at the treatment works. 1004 properties supplied by the works were affected and there were 166 contacts related to this incident.

1.6.2 DWQR Consumer Contacts

DWQR received a total of 118 contacts in 2023. 22 were about quality of the public supply and 44 were in relation to Private Water Supplies. There were 47 general enquiries to DWQR.

DWQR also received 12 Environmental Information/Freedom of Information Requests. Out of these only one was in relation to water quality, with the remainder relating to DWQR's resources.

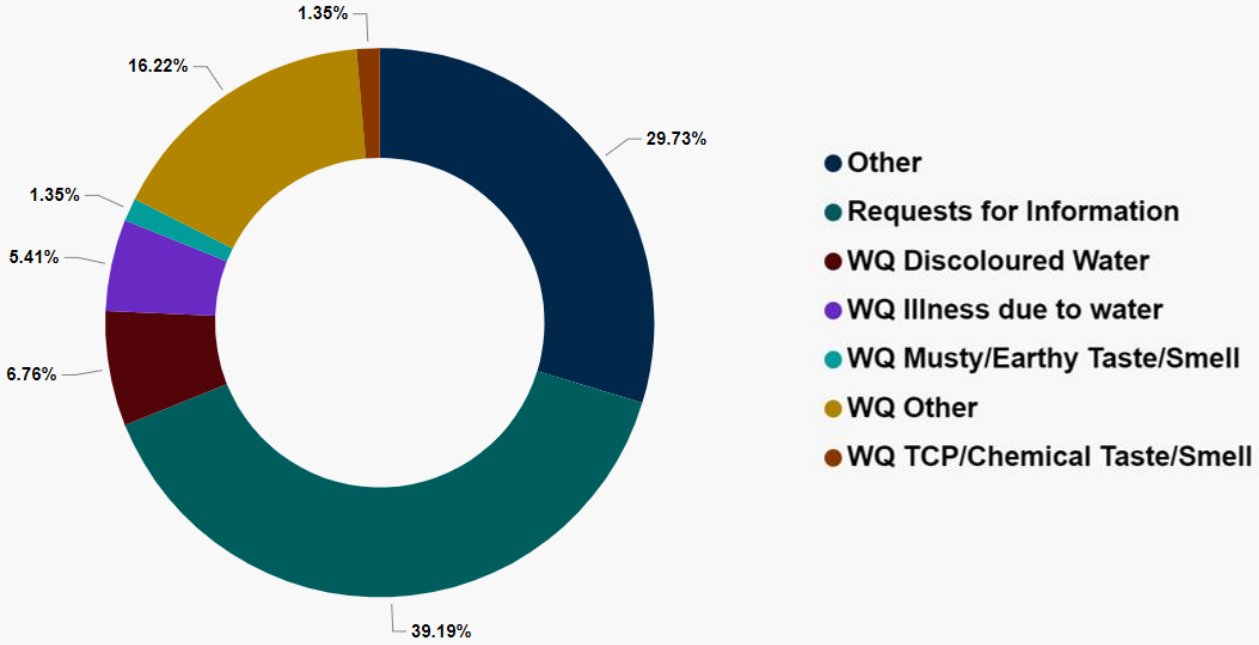


Figure 12 Shows a break down of contacts to DWQR by category.

Table 2 Consumer Contacts Received by DWQR in 2023

Contact Category	Number of Contacts					
Appearance	**2023**	**2022**	**2021**	**2020**	**2019**	**2018**
Discoloured Water	5	5	15	5	4	2
Aerated (Milky) Water	0	0	0	0	0	0
Particles in Water	0	1	0	1	1	1
Organisms in Water	0	0	0	2	0	1
Taste and Odour						
Chlorine	0	4	2	11	5	2
Metallic	0	1	0	1	0	0
Solvent/Fuel	1	1	0	0	0	0
Musty/Earthy	1	1	1	0	2	0
TCP/Chemical	0	1	1	0	2	0
Other contact about Water Quality						
Illness due to Water	4	2	2	5	3	2
Other Contact	11	4	7	5	17	21
Total Public Water Supply Water Quality contacts	**22**	**20**	**28**	**30**	**34**	**29**
Public water supply requests for information	5	17	5	10	6	3
Private water supply issues	44	55	50	66	64	96
General Enquiries to DWQR	47	26	24	25	19	15
Total Consumer Contacts to DWQR	**118**	**138**	**107**	**131**	**123**	**143**

1.6.3 Tier Two Investigations of SW Consumer Complaints

Where a consumer has been through the full Scottish Water complaints process and remains dissatisfied with the way Scottish Water has handled their complaint, they may request that DWQR undertakes a formal investigation. DWQR will look at the case and evidence on both sides before making a determination as to whether or not the complaint is upheld, and may also make recommendations for actions that Scottish Water must take.

DWQR carried out a formal investigation of two complaints against Scottish Water in 2023. We have summarised this below and the full determinations of each the case is available on the DWQR website Consumer Complaint Determinations (dwqr.scot).

In the first case, the consumer contacted the DWQR in October 2023 to complain that following the replacement of the lead supply pipe to their property, Scottish Water had not replaced all the lead pipework in its ownership, had connected the renewed pipework to their neighbour's lead pipework, and that their supply was being contaminated with lead. They also alleged that Scottish Water had given 'false' lead analytical data and that they were being exposed to high levels of lead. Following Scottish Water's completion of its investigation into a formal complaint from the customer, DWQR confirmed in November that it would carry out an independent investigation.

DWQR was satisfied that Scottish Water had fulfilled the requirements set out in the Regulations in relation to lead and the complaint was not upheld, however two recommendations were made to Scottish Water.

In the second case the consumer contacted DWQR in December 2023. They explained that they were unhappy with the taste and smell of their drinking water. They made a taste complaint to Scottish Water in August 2023 and had been through the full Scottish Water's complaints process.

DWQR's assessment of the complaint considered the steps Scottish Water are taking to reduce the levels of taste and odour compounds in the consumer's water supply zone and reviewed two sets of test results taken from the consumer's property, both of which complied with the standards required by the Regulations.

Based on the evidence above, DWQR did not uphold the complaint. Scottish Water had provided current and accurate information regarding taste and odour from their water supply and have also given the correct advice to the consumer, whilst taking steps to improve the taste and smell of the water. DWQR made one additional recommendation that Scottish Water should design and install additional treatment to further improve the taste of this water supply.

Figure 13 A Scottish Water storage area for distribution system fittings.

2. WATER QUALITY EVENTS AND INCIDENTS

Scottish Water is required to tell DWQR about all events that have affected or could affect water quality or cause concern to consumers. This includes: all regulatory sample failures; operational sample failures that are significant or unexpected; any failure of a treatment process; significant numbers of consumer contacts; and issues which attract significant media interest.

Each event is reviewed and classified into one of five categories: not significant, minor, significant, serious or major. Events categorised into one of the latter three categories are classed as incidents, requiring further detailed investigation by DWQR. Where further information is required, a full report may be requested from Scottish Water. It should be noted that where a full report is not requested, this does not suggest in any way that the incident is less serious, simply that sufficient information has been provided.

Incidents are fully investigated by DWQR Drinking Water Specialists who produce a written assessment and make recommendations where appropriate. As part of the investigation, DWQR staff often visit Scottish Water sites to talk to Scottish Water employees and examine equipment failures. A short summary of the incident assessment is published on the DWQR website. For the most serious incidents, enforcement action or prosecution may be considered.

There were 921 events reported to DWQR during 2023, the majority of which were not classified as significant or above. Table 3 shows the numbers of water quality incidents across the Scottish Water operating areas where they occurred. A summary of incidents is available on the DWQR website at https://dwqr.scot/regulator-activity/water-quality-incidents/

Table 3 Drinking water quality incidents assessed by DWQR in 2023.

Region	Significant	Serious	Major
EAST	8	2	0
NORTH	4	0	1
SOUTH	5	1	0
WEST	6	2	0
SCOTLAND	**23**	**5**	**1**

29 of these events were classified by DWQR as incidents, which is six more than 2022. The reasons events were classified as incidents in 2023 are illustrated in the chart in Figure 14.

Sixteen incidents were declared due to a significant loss of control of treatment process, which is a concern given the increase from the seven incidents declared for this reason in 2022, particularly as three incidents occurred at both Picketlaw WTW and Lintrathen WTW in 2023. A further seven incidents were declared due to causing significant customer concern or media interest, with four of these being associated with burst water mains and subsequent discoloured or milky/white water, whilst two of these related to significant numbers of customer taste and odour contacts associated with elevated phenolic compounds and geosmin in the raw water with the supplying water treatment works unable to remove these compounds through the existing treatment process.

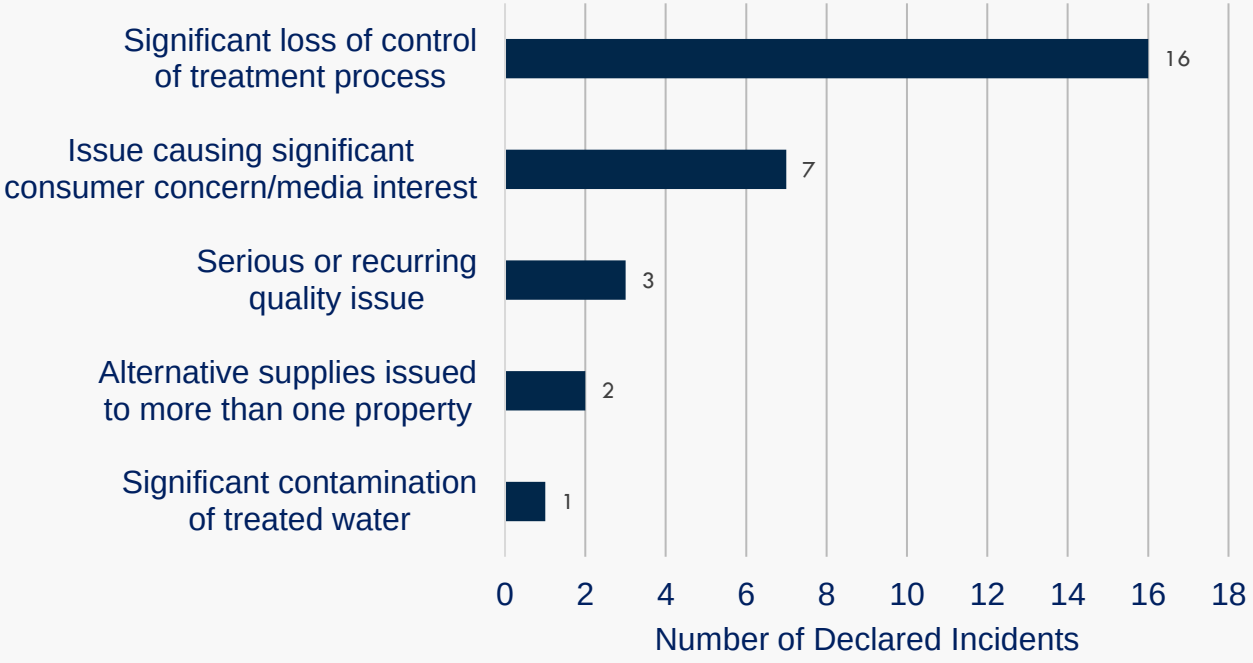


Figure 14 Reason for declaration of an incident in 2023.

It is welcomed that there were no incidents in 2023 that were as a result of a failure of the disinfection process, something which is fundamental to the protection of public health.

A summary of each Incident Assessment can be viewed on the DWQR website 2023 Incidents (dwqr.scot). A number of these are worth highlighting as they illustrate significant consumer issues or present important learning points for Scottish Water. These are set out below.

Figure 15 DWQR staff auditing a WTW

Benbecula WTW

Hydrocarbon Contamination - September 2023 - Major

On 12th September 2023 Scottish Water received a call from a consumer reporting an oily odour from their drinking water in Balivanich, Benbecula. Samples were taken from the reporting property and investigations into the source of the contamination began, which highlighted a spill from a redundant diesel fuel tank sited on top of the raw water wet well supplying Benbecula WTW. In conjunction with NHS Western Isles, a ‘Do not drink, wash, cook’ notice was applied to the entire distribution network covering Benbecula and the northern area of South Uist fed by Benbecula WTW. Consumers were supplied with bottled water whilst contingency plans to remediate the WTW and network were scheduled.

Following the rezoning of South Uist and receipt of satisfactory sampling, the notice was lifted for the South Uist area affected on Thursday 14th September. Remediation continued on Benbecula: the CWTs were cleaned, and a new raw water tank put in place, whilst the WTW and network were flushed using tankered water from other treatment works. The notice serving Benbecula was lifted on 16th September following further clear samples demonstrating that no hydrocarbon contamination was present, in agreement with NHS Western Isles.

Scottish Water’s investigation determined the hydrocarbon contamination originated from a redundant diesel storage tank. This tank was sited above the raw water wet well and had not been emptied and fully decommissioned when it was removed from service in 2017. Since then the bund had been compromised, with holes drilled in the concrete wall surrounding the storage tank. Prior to the incident the tank integrity failed and approximately 20-30 litres of diesel leaked into the raw water wet well, with volatile fractions of diesel being transferred along the raw water supply pipe, through the treatment works and into distribution. Scottish Water identified fourteen actions and DWQR made no additional recommendations. DWQR staff visited the site to investigate the incident and conducted a full site audit in response to the incident.

Figure 16 Top: WTW CWT Bottom: A demonstration of a Dynasand filter

Invercannie and Mannofield RSZ

Taste and Odour Complaints - July 2023 - Serious

Geosmin is a compound formed by naturally present algae in source water which is not harmful to health, but can give water an ‘earthy/musty’ taste and smell. Consumers can smell it in concentrations as low as 5 ng/l. Scottish Water began its seasonal programme of weekly raw and final water geosmin sampling at Invercannie WTW, near Aberdeen, on 5 June 2023, with the first raw water geosmin sample reported at 4.8 ng/l. Levels of raw water geosmin levels continued to rise, peaking at 22.1 ng/l (raw water) and 32.1 ng/l (final water) in samples taken mid-July, which correlated with a further significant increase in customer contacts over the subsequent days. Between 1 June 2023 and 15 August 2023, Scottish Water received 213 Taste & Odour contacts (179 of which were “earthy/musty”) across the operational area supplied by Invercannie WTW.

At the time, Invercannie WTW had no treatment process capable of reducing or removing geosmin from the water supply. Steps were taken by Scottish Water to reduce the output of Invercannie WTW and increase the blend of water from Mannofield WTW which, despite also taking water from the River Dee and not having a treatment process to remove geosmin, showed lower levels of the compound in the raw and final water (max 6.2 ng/l and 1.2 ng/l respectively). Further flow was run to waste through the yet-to-be commissioned Dissolved Air Flotation (DAF) plant in an attempt to increase turnover, after interstage sampling at Invercannie WTW showed that geosmin levels were increasing in the raw water storage on site.

The reason for the increased levels of geosmin in the River Dee in 2023 is not fully understood, however Scottish Water’s assessment was that this was most likely due to microbial activity proliferating during warm, dry weather in June 2023, which was then broken down and washed into the river during heavy rainfall through early July 2023. This was exacerbated by further breakdown of organics within the raw water reservoir at Invercannie WTW.

Scottish Water identified seven actions whilst DWQR made three additional recommendations.

Spynie RSZ

Taste and Odour Complaints - January 2023 - Serious

Consumers in the Thornhill district metered area (DMA) in Elgin reported problems with their water, reporting a ‘diesel’ or ’musty’ taste and odour. As more contacts were reported the situation was escalated and, in conjunction with NHS Grampian, a ‘do not drink’ – then a ‘do not use’ notice was placed on 480 properties in the area, bottled water was delivered and samples taken from affected properties. Flushing was carried out in the area of the complaints and, after a second set of samples were returned with no PCVs or health risk values breached, the water restrictions were lifted.

Scottish Water had earlier undertaken planned work to replace the Thornhill DMA meter, which required a back-feed to maintain supply to consumers. In planning the back-feed, the water main was not fully traced back to identify the trunk main upstream of the boundary valve, and they wrongly determined the direction of flow in the main. This meant a dead leg containing 70m^3 of stagnant water was not identified, and approximately 30m^3 of this entered supply.

Figure 17 Taken at a DWQR network audit.

Analysis of the samples taken showed that some non-regulatory polyaromatic hydrocarbon (PAHs) and semi volatile organic compounds (SVOCs) at levels below health risk standards were detected, indicating that the source of the taste and odour complaints was likely to be a section of deteriorating coal tar or bitumen lined pipe.

Scottish Water identified eleven actions and DWQR made two additional recommendations.

Muirdykes RSZ

Significant Consumer Concern - September 2023 - Serious

In September 2023, a planned CCTV inspection of a 7.5 km section of Treated Water Main (TWM) took place to identify the location of cross connections with an abandoned length of Raw Water Main (RWM) between Muirdykes WTW and Stanely SR. A camera was inserted into the pipe, but the water flow was too low for it to be used effectively. A second, smaller camera, was then inserted, however this was also withdrawn as it was too small to obtain useful footage. Later that day, a further CCTV inspection was carried out on a different section of the main, however, again, the flow was found to be too low. The contractors employed to carry out the survey also found that there was poor visibility in the main due to a large amount of silt and sediment. Two further CCTV inspections were attempted the following day but these were again unsuccessful for the same reasons.

Scottish Water's Customer Engagement Centre had an influx of discoloured water consumer contacts in the PA2 zone which they escalated to operations, and further CCTV operations were ceased. In total, Scottish Water received 163 contacts between the 6th and 12th September 2023, with 160 of these for discoloured water. Sampling was arranged across the most affected areas, with 21 samples failing for manganese and one sample failing for iron.

This incident was caused by the remobilisation of sediment and biofilm build-up within the TWM and the downstream water mains following five separate insertion and withdrawals of camera equipment within a trunk main leading to transient discolouration.

Scottish Water identified eleven actions and DWQR made two additional recommendations.

Balmore WTW

Treatment Issue - January 2023 - Serious

The standby Operator was called out to Balmore WTW in the West of Scotland on Friday 20th January for a high pH alarm. Blockages in the alum dosing lines caused by debris from the alum tanks were cleared and the filters were backwashed. The standby Operator then left site for rest time, to comply with the Working Time Directive. After the standby Operator left site, a tripped treated water sample pump alarm and then a low treated chlorine alarm were received by the Intelligent Control Centre (ICC) – these were passed on to the standby Operator, who was unable to return to site as he was on rest time. The ICC was unable to locate another Operator to attend site and escalated the issue to the Escalation Team Leader. During the call the site residual chlorine trends were checked, and it was agreed that they were healthy and the alarm had been triggered by the tripped sample pumps. The ICC continued to monitor the site and continued to attempt to locate an Operator to attend site, but none could be found. It was agreed to call the standby Operator out when his rest period ended.

A few hours later, a high final water pH alarm was received by the ICC and the pH exceeded 9.5. The option of getting an Operator from a different standby rota was discussed by the ICC and the Escalation Team Leader; this was not progressed as the Balmore standby Operator rest time was due to end.

The standby Operator arrived onsite following his rest time and found that since the treated water sample pumps had tripped, there had been no flow through the treated water pH monitor for an extended period of time. The online treated pH monitor readings had dropped and then frozen at pH 8.3, causing the lime pumps to respond to this low reading to try to achieve the pH target of 8.6, leading to an undetected high treated water pH and a subsequent increase in final water pH.

The treated water sample pumps were reset and restarted and the lime pump speeds manually reduced. Bench testing showed that the final water was pH 10.1. Although samples were requested from the WTW for a suite of parameters in response to the issue, the Sampling Team erroneously assumed that a pH sample would be taken

from the works as part of the daily sampling and so did not supply the correct sample bottles, meaning that pH samples following the event were not taken for laboratory analysis. Sampling in the network showed no failures of the pH standard, thought to be due to downstream dilution from storage tanks and mixed water operational zones in the network.

Figure 18 Final water pH monitors at a WTW in the Highland.

Pateshill WTW

Significant Consumer Concern - December 2023 - Serious

Approval was given through Scottish Water's Treatment Control process to isolate the raw water main from one of the two reservoirs feeding Pateshill WTW, Baddingsgill Reservoir, to allow planned works to the reservoir draw off tower. On completion of the works, the raw water main was returned to service, having been isolated for just over a month. This operation was not submitted to Treatment Control for approval. Five minutes after the main was re-opened, the raw water turbidity at the treatment works increased from 1.4 NTU to between 2 and 7 NTU for around 36 hours. There was a slight increase in turbidity across the processes on the treatment works, but generally the treatment processes responded well to the rapid change in raw water turbidity.

The following day, the first consumer contact for taste and odour within the Pateshill area in West Lothian was received by Scottish Water, and following further contacts the situation was escalated within the organisation. Contacts were monitored, and an Operator was called out to the treatment works to investigate. A Business Alert Team was formed, and incident calls began. The Operator took bench and laboratory samples for chlorine, turbidity and colour, and a Cryptosporidium sample filter was installed. A flushing plan was arranged for the network and the Baddinsgill main was isolated from supply, however complaints continued for some 10 days. In total, there were 419 consumer contacts between the 6th and the 17th December, with 396 reporting a taste or odour in their supply.

Sampling from the treatment works and from the network during this incident showed that there were 35 failures of the manganese standard in the network, as well as 32 samples at the treatment works which exceeded the standard. Additionally, 47 out of 52 samples analysed contained phenol or halogenated phenols.

The cause of the incident was the re-introduction of the Baddingsgill raw water main to supply the WTW. It is likely that there was a build up of sediment in the main, and that the main was scoured when re-opened, disturbing the sediment. It is thought that the sediment contained naturally occurring phenols, from for example vegetation and decomposition of plants and animals in the catchment. These phenols will have been

halogenated during the routine addition of chlorine for disinfection of the water supply at the treatment works; halogenated phenols are known to have very low taste and odour thresholds. Furthermore, the absence of consumer contacts reporting discoloured water despite high levels of manganese suggests that soluble manganese was drawn from the low-oxygen bottom layers of the reservoirs. It is thought that the work carried out at the draw off tower, along with a sudden change in pressure caused by the reintroduction of the Baddingsgill raw water main, had preferentially drawn water from the deeper parts of the reservoirs as the lower draw off points were open.

Scottish Water identified twelve actions and DWQR made three additional recommendations.

Figure 19 Is a WTW in the South of Scotland. Image supplied by Scottish Water.

3. AUDIT AND INSPECTION

3.1 Water Treatment Works and Service Reservoirs

An important part of DWQR's scrutiny role is to audit and inspect activities undertaken by Scottish Water. We can choose to inspect any aspect of Scottish Water's activities that could affect water quality.

Inspections commonly undertaken include WTW, storage points, distribution system activities, response to consumer water quality issues and analytical services. We audit against the requirements of the Regulations, as well as water industry best practice. We also audit the completion of investment projects.

The inspection process provides a number of benefits:

- It enables DWQR to verify that Scottish Water is complying with regulatory requirements at sites across Scotland;
- It allows DWQR to see new initiatives and areas of best practice;
- It is an opportunity for DWQR staff to meet site-based Scottish Water staff and discuss water quality issues with them;
- It raises awareness of DWQR and the Regulations amongst Scottish Water staff;
- It enables verification of the delivery of investment work;
- It enables DWQR to build an awareness of common trends, risks or deficiencies across Scotland and use these to inform future policy and guidance.

We select sites for inspection using a risk-based process that takes into account sample failures and water quality events and incidents. DWQR may also choose to inspect sites randomly or directly following incidents. Other types of inspection may be undertaken in response to a particular issue or concern.

To make sure we are consistent all our inspectors use standard inspection templates and the audit process is subject to an ISO accredited procedure. DWQR also

participates in benchmarking audits with other regulators in the UK and beyond to drive consistency and to spread best practice.

Where issues are noted during an inspection these are recorded as recommendations that are tracked and followed up. Where common themes are identified, these are progressed centrally with senior Scottish Water staff. Elements of best practice are also highlighted. Scottish Water has an opportunity to comment on draft inspection reports and co-operates fully during the technical inspection process.

Once an inspection report has been finalised the completed report is sent to Scottish Water. A table summarising the audits conducted by DWQR can be found on our website at DWQR website. https://dwqr.scot/regulator-activity/audit-and-inspection/

3.1.1 Water Treatment Works

During 2023 fourteen technical audits were carried out at WTW. Our findings highlighted the maintenance and upgrade of ageing assets to maintain quality; the review of *Cryptosporidium* risk; coagulation and filtration performance and ensuring consistent disinfection.

Figure 20 A filter back wash at a WTW

Table 4 DWQR site visits for audits in 2023.

Location	Date	Reason for audit	Number of Findings/ Recommendations
Stronsay	January	Risk Based	21
Alexandria	February	Risk Based	16
Daer	April	Risk Based	5
Tomnavoulin	April	Risk Based	5
Kettleton	May	Risk Based	11
Glencorse	June	Risk Based	4
Stornoway	June	Risk Based	5
Geocrab	June	Risk Based	5
Black Esk	August	Risk Based	12
Muirdykes	August	Risk Based	3
Belmore	September	Risk Based	30
Stronachlachar	October	Risk Based	1
Katrine Pier	October	Risk Based	1
Picketlaw	November	Risk Based	10

In addition to full technical audits we also made 23 other site visits. Some of these were to assist our investigations into events and incidents, to interview staff, and increase our understanding of situations that had arisen. Visits were also made to increase inspector awareness of Scottish Water's activities, to inspect the progress of Enforcement Notices and to works that have had significant investment. These are recorded in Table 5.

Figure 21 Membrane filters at a WTW

Figure 22 Cross section of a membrane filter at a Scottish Water WTW

Table 5 DWQR site visits for incident assessment, investment and performance monitoring during 2023.

Location	Date	Reason for visit
Daer Core Drainage	March	Capital works
Customer Excellence Centre	March	Inspector Awareness
Glendevon	March	Investment
Glencorse	April	Inspector Awareness
Coulter	April	Inspector Awareness
Turriff	April	Enforcement Notice compliance
Forehill	May	Incident assessment
Ballater	June	Investment
Crathie	June	Investment
Achiltiebuie	June	Incident assessment
Torridon	June	Event assessment
Arnisdale	June	Incident assessment
Tomich	June	Incident assessment
Bedersaig	June	Investment
Cliasmoll	June	Inspector awareness
Miavaig	June	Inspector awareness
West Lewis	June	Investment
Clatto	July	Incident assessment
Gorbals	July	Incident assessment
Lomond Hills	September	Event assessment
Strathyre	October	Incident assessment
Lintrathen	December	Incident assessment
Mannofield	December	Enforcement Notice compliance

3.1.2 Distribution Systems

We audited seven distribution systems and service reservoirs (SRs) in 2023. Our findings included recommendations to ensure the hygienic storage of fittings, that steps are taken to ensure the risk of ingress at service reservoirs and during water main repairs is minimised, and that samples are taken in a timely manner.

Table 6 Distribution system audits in 2023.

Location	Date	Reason for Audit	Number of Recommendations
Bridgend Park, Bathgate	March	Operational practices	1
Camptoun Holdings, Drem	March	Operational practices	4
Willowbrae Road, Edinburgh	March	Operational practices	1
Glassford, Strathaven	April	Water Quality Investigation	3
Gartshore SR	July	Risk based	2
Gartmore SR	July	Risk based	3
Abbots Court Falkirk	October	Operational practices	1

3.1.3 Benchmarking Audits

DWQR maintains close contact with the other water quality regulators in the UK and Europe to share knowledge, learning and best practice. These are excellent benchmarking opportunities: both to ensure DWQR inspectors are auditing to a high standard; and to make sure Scottish Water's standards for operations and procedures are of the same standard (or better) than other water providers.

During 2023 Inspectors from Northern Ireland accompanied our inspectors to audit Glencorse WTW. Both parties found the experience rewarding and a good opportunity to share expertise and knowledge. We intend to continue these in future and DWQR has extended the invitation to more colleagues in England and Northern Ireland to accompany DWQR on benchmarking opportunities in Scotland during 2024.

Figure 23 DWQR out auditing raw water source at a WTW in the North of Scotland.

4. WATER SUPPLY RISK MANAGEMENT

The 2014 Regulations require Scottish Water to have, and to maintain, risk assessments for each of their drinking water supply systems. These risk assessments must be carried out in accordance with a method which is approved by the DWQR, and must be based on the general principles of risk assessment set out in international standards. They are also required to take account of sample data.

In 2020, inspection of Scottish Water's risk assessment process by DWQR showed that there were significant deficiencies, and so in November of that year, the DWQR served Scottish Water with an Enforcement Notice requiring improvements. Scottish Water responded by setting up an entirely new risk assessment process along with a new electronic system for managing it, Water Risk Assessment Process, or WRAP. DWQR staff met with Scottish Water at regular intervals thereafter to ensure that progress was being made. Following audits by an external accreditation body and the DWQR in June and December 2023, Scottish Water was given approval by the DWQR for its risk assessment process in December 2023.

The DWQR recognises the significant improvements that Scottish Water has made with risk assessment and risk management, and will continue to monitor Scottish Water's activities in this area.

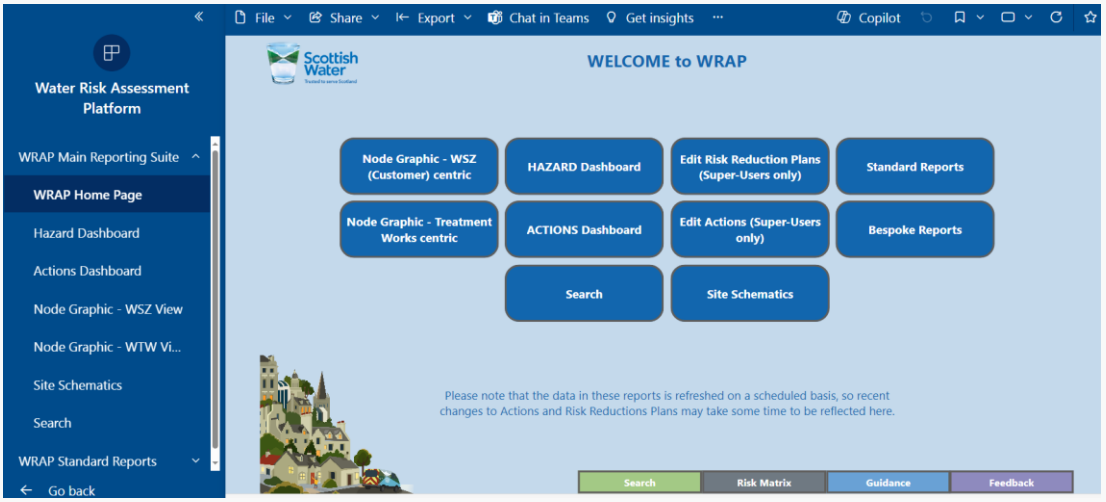


Figure 24 The home page of Scottish Water's WRAP tool

5. OTHER REGULATORY ACTIVITIES

Working with Stakeholders

DWQR liaises with the main water industry stakeholders; WICS, SEPA and Consumer Scotland on a regular basis, both together and individually, especially concerning matters of investment. We also regularly have discussions on water quality issues with health stakeholders such as Public Health Scotland, NHS health boards and local authority environmental health officers, and these stakeholders are routinely invited to comment on incident assessments.

We have a close working relationship with other regulators performing a similar role elsewhere in the UK, namely the Drinking Water Inspectorates in London and Belfast, including six-monthly meetings and benchmarking audits. We also liaise regularly on a range of topics including private water supplies, NIS, product approvals, lead removal and research.

DWQR has been working closely with the Scottish Government on their legislative review of water, wastewater and drainage: contributing to all working groups relating to drinking water quality, scarcity, risk management and catchment management. This work remains ongoing and DWQR shall provide expert advice to the policy team throughout the drafting process.

We work with a range of stakeholders to remove lead pipes to protect public health. This has included participation on the UK Lead Strategy Board; working with Scottish Government on the revised Repairing Standard for rented properties; being a panellist at an industry-wide Lead Knowledge Sharing Event; tracking Scottish Water's progress on removing lead pipes from private schools and nurseries; and consulting on Scottish Water's Lead strategy and longer-term projects on removing lead pipes and customer engagement.

Research

During 2023 DWQR both led on, and contributed to, a number of research projects relating to drinking water quality.

This included projects to explore the treatability of PFAS compounds, developing a methodology for risk assessment of PFAS compounds and developing an approach for strategic monitoring of emerging contaminants of concern.

Team members have worked on catchment management research; including Health Protection Scotland's blue-green algae advisory group, research on cyanotoxins, and contributing to workshops on reservoir management.

Public Engagement

As part of our work at DWQR we feel it is important to educate wider stakeholders about drinking water quality and the role we play in it. We have team members serving on the boards of REHIS and the Institute of Water.

During 2023 we gave talks or were involved with:

- University of West of Scotland – BSc Environmental Health;
- University of Edinburgh – MSc Hydrogeology;
- Clyde College – HNC Water Operations;
- Royal Environmental Health Institute of Scotland – Annual Environmental Health Forum;
- Scottish Water – various teams;
- Institute of Water – IWater Board, Professional Standards Committee and National Conference in Cardiff, Science Conference in Coventry.

It is important that the next generation understand the importance of good water quality and the work needed to achieve it. In October 2023 some of the DWQR team took part in a STEM Day at Dunbar Grammar School in East Lothian. Students were asked to design and build a water filter using a plastic bottle, sand and gravel and then test it using dirty water. The students were also asked to think about what makes a

good filter and what other things they would need to consider making the water safe to drink.

Figure 25 Examples of water filters that were made by a group of students at Dunbar Grammar School as part of a STEM workshop

6. NETWORK INFRASTRUCTURE SECURITY DIRECTIVE

The Network Information Systems (NIS) Directive was introduced to improve the levels of cyber security and resilience of essential services across the EU. It provided the basis of NIS Regulations that were introduced in 2018. These regulations provide legal measures to protect essential services by improving the security of the network and information systems that support the delivery of these services. In line with the NIS Regulations, Scottish Water is identified as an 'Operator of Essential Services' as it supplies water to more than 200,000 people. The DWQR is identified as the relevant Competent Authority in Scotland. The National Cyber Security Centre are the technical authority supporting both Operators of Essential Services and their competent authorities with cyber security advice and guidance. Further information is available at: NIS introduction - National Cyber Security Centre - NCSC.GOV.UK

7. ANNEXES

Annex A

7.1 Information Letters issued during 2023

One Information Letter was issued by DWQR in 2023 and can be viewed on the DWQR website.
Information Letter 2023 01 DWQR Requirements For The Reporting Of Service Reservoirs Contact Tanks And Final Water Storage Tanks Information

Annex B

7.2 Current Letters of Commitment and Enforcement Notices

Two Enforcement Notices were issued by DWQR in 2023 and can be viewed on the DWQR website
Enforcement (dwqr.scot)

7.3 Abbreviations and Glossary

BH - Borehole

Bq/l- Becquerels per litre, a measure of radioactivity

CAF - Cyber Assessment Framework

CWT - Clear Water Tank

DCMS - Department for Digital, Culture, Media and Sport

DOMS - Distribution Operation and Maintenance Strategy

DWSP – Drinking Water Safety Plan

DWQR - Drinking Water Quality Regulator for Scotland

EAL- Emergency Action Levels IAF Impact Assessment Form

ISO - International Standards Organisation

mg/l - Milligrams per litre

NCSC - National Cyber Security Centre

NHS - National Health Service

NIS - Network Infrastructure Security

NRV - Non-Return Valve

NSO - Network Service Operator

NTU - Nephelometric Turbidity unit

PAC - Powdered Activated Carbon

PCV - Prescribed Concentration or Value

PHT - Scottish Water's Public Health Team

PLC - Programmable Logic Controller

RSZ - Regulated Supply Zone

SCADA - Supervisory Control and Data Acquisition

SEPA - Scottish Environment Protection Agency

SR - Service Reservoir

THM- Trihalomethanes

TL- Team Leader

TOMS- Treatment Operation and Maintenance Strategy

TWS- Treated Water Storage

µg/l - Microgrammes per litre

UV – Ultraviolet Light

WTW - Water Treatment Works

8. SUPPORTING INFORMATION

Water Performance Tables

Table 7 Summary of SW assets 2023.

Asset Type	Number
Water Abstraction Point	662
Length of Water Mains (km)	49,111
Service Reservoirs	956
Water Supply Zones	278
Water Treatment Works	226

Table 8 Summary of water quality at WTW.

Parameter	Prescribed Concentration or Value (PCV)	No. of tests	No. of tests failing	% of tests failing	No. of works failing
Coliform Bacteria	0 number/100ml	25,967	26	0.10%	22
Colony Counts After 3 Days At 22°C	No abnormal change	25,933	N/A	N/A	N/A
Cryptosporidium oocysts (per 10L)	N/A - no regulatory standard	5,745	8	0.14%	7
E. coli	0 number/100ml	25,969	1	0.00%	1
Nitrite	0.1mg NO_2/l	3,294	0	0.00%	0
Residual Disinfectant - Free	N/A - no regulatory standard	26,060	N/A	N/A	N/A
Residual Disinfectant - Total	N/A - no regulatory standard	26,060	N/A	N/A	N/A
Turbidity	1NTU	7,023	3	0.04%	2

Table 9 Summary of water quality at storage points.

Parameter	Prescribed Concentration or Value (PCV)	No. of tests	No. of tests failing	% of tests failing	N of SRs with sample failures	No. of SR failing
Coliform Bacteria	0 number/100ml	48,153	70	0.15%	57	2
Colony Counts After 3 Days At 22°C	No abnormal change	48,192	N/A	N/A	N/A	N/A
E. coli	0 number/100ml	48,157	2	0.00%	2	0
Residual Disinfectant - Free	N/A - no regulatory standard	48,263	N/A	N/A	N/A	N/A
Residual Disinfectant - Total	N/A - no regulatory standard	48,254	N/A	N/A	N/A	N/A

Table 10 Water quality at consumers' taps.

Parameter	Total No. of Samples	No. Failed Samples	No. Zones with Failures	% Compliance in 2023	% Compliance in 2022	% Compliance in 2021
Key Parameters						
Bacteria						
Coliform Bacteria	14,983	38	33	99.75%	99.74%	99.83%
E. coli	14,983	4	4	99.97%	99.97%	99.99%
Enterococci	4,906	1	1	99.98%	100.00%	99.86%
Clostridium perfringens	4,906	1	1	99.98%	99.98%	99.94%
Total bacteria	39,778	44	39	99.89%	99.88%	99.91%
Metals						
Aluminium	4,831	3	3	99.94%	99.98%	99.96%
Copper	585	0	0	100.00%	99.93%	100.00%
Iron	4,831	22	18	99.54%	99.44%	99.58%
Lead	585	2	2	99.66%	99.48%	99.73%
Manganese	4,831	10	7	99.79%	99.67%	99.37%
Nickel	585	0	0	100.00%	99.93%	99.25%
Total metals	16,248	37	30	99.77%	99.72%	99.61%
Other key parameters						
Colour	4,906	0	0	100.00%	100.00%	100.00%
Hydrogen ion (pH)	4,906	1	1	99.98%	99.94%	99.96%
Nitrite	2,000	4	3	99.80%	99.93%	99.96%
Odour	4,906	9	8	99.82%	99.85%	100.00%
Radon	63	0	0	100.00%	N/A	100.00%
Taste	4,907	3	2	99.94%	99.92%	100.00%

Total Trihalomethanes	586	0	0	100.00%	99.93%	99.86%
Turbidity	4,906	3	3	99.94%	100.00%	100.00%
Total Other key parameters	27,180	20	17	99.59%	99.94%	99.98%
Other Parameters						
1,2 Dichloroethane	586	0	0	100.00%	100.00%	100.00%
All Other Individual Pesticides	1,564	0	0	100.00%	100.00%	100.00%
Ammonium	2,000	0	0	100.00%	100.00%	100.00%
Antimony	585	0	0	100.00%	100.00%	100.00%
Arsenic	585	0	0	100.00%	100.00%	100.00%
Benzene	586	0	0	100.00%	100.00%	100.00%
Benzo 3,4 Pyrene	579	0	0	100.00%	100.00%	100.00%
Bisphenol A	588	0	0	100.00%	N/A	N/A
Boron	585	0	0	100.00%	100.00%	100.00%
Bromate	585	0	0	100.00%	100.00%	100.00%
Cadmium	585	0	0	100.00%	100.00%	100.00%
Chlorate	585	23	22	99.53%	N/A	N/A
Chloride	4,907	0	0	100.00%	100.00%	100.00%
Chlorite	585	0	0	100.00%	N/A	N/A
Chromium	585	0	0	100.00%	100.00%	100.00%
Conductivity	4906	0	0	100.00%	100.00%	100.00%
Cyanide	585	0	0	100.00%	100.00%	100.00%
Fluoride	584	0	0	100.00%	100.00%	100.00%
Haloacetic Acids (Sum of 5 HAA)	576	10	8	98.26%	N/A	N/A
Mercury	585	0	0	100.00%	100.00%	100.00%

Microcystin -LR	584	0	0	100.00%	NA	N/A
Nitrate	584	0	0	100.00%	100.00%	100.00%
Nitrite/Nitrate formula	584	0	0	100.00%	100.00%	100.00%
PAH - Sum of 4 Substances	579	0	0	100.00%	100.00%	100.00%
Pesticides - Total Substances	391	0	0	100.00%	100.00%	100.00%
Selenium	585	0	0	100.00%	100.00%	100.00%
Sodium	585	0	0	100.00%	100.00%	100.00%
Sulphate	585	0	0	100.00%	100.00%	100.00%
Sum of PFAS	1,290	0	0	100.00%	N/A	N/A
Tetrachloroethene/ Trichloroethene	585	0	0	100.00%	N/A	100.00%
Tetrachloromethane	585	0	0	100.00%	100.00%	100.00%
Uranium	585	0	0	100.00%	N/A	N/A
Total other parameters	30,248	33	30	99.89%	100.00%	100.00%
Scotland Total	**113,454**	**134**	**81**	99.88%	99.91%	99.92%

Table 11 Water quality consumer contacts received by Scottish Water.

Contact Category	Number of Contacts					% Change on 2022
	2023	2022	2021	2020	2019	
Appearance						
Discoloured Water	**11,437**	12,251	17,887	12,989	6,623	-7%
Aerated (Milky) Water	**1,532**	1,563	1,662	1,660	882	-2%
Particles in Water	**487**	469	543	553	365	4%
Organisms in Water	**39**	32	30	40	33	22%
Taste and Odour						
Chlorine	**693**	522	731	985	578	33%
Metallic	**426**	347	602	356	358	23%
Solvent/Fuel Taste/Smell	**32**	13	14	31	21	146%
Musty/Earthy	**946**	725	1,058	621	639	30%
TCP/Chemical Taste/Smell	**608**	381	505	525	302	60%
Other contact about Water Quality						
Illness due to Water	**352**	315	733	286	240	12%
Other Contact	**0**	0	5	96	617	0%
Total Contacts about Water Quality	**16,552**	**16,618**	23,770	18,142	10,124	-0.4%

SUMMARY OF EVENTS AND INCIDENTS 2023

Table 12 Classification of incidents.

	Not Significant or Minor	Significant	Serious	Major	Incident Total
Total	**892**	**23**	**5**	**1**	**29**

Table 13 Summary of 2023 incidents

Month	Area	Class	Pop Affected	Site Name	Hazard	Root Cause
Jan	East	Serious	41, 792	Spynie WSZ	Taste/ Odour	Flow Disturbance (Scottish Water)
Jan	West	Serious	554,081	Balmore WTW	pH	Incorrect Dose Settings
Feb	East	Significant	97,440	Lintrathen WTW	Aluminium	Coagulant Aid Failure
Feb	East	Significant	189,520	Clatto WTW	Aluminium	Coagulation Process
Feb	East	Significant	23,461	Mannofield East RSZ	Discolouration	Burst Main
Feb	West	Serious	217	Strathyre WTW	Microbiology	Incorrect Dose Settings
Mar	West	Significant	114,427	Camphill (Gorbals Pumping Station)	pH	Control Failure
Apr	North	Significant	600	Tomich WTW	Taste/ Odour	Dosing Pump Failure

May	North	Significant	35,700	Assynt WTW	Aluminium	pH Adjustment Batch Fail
Jun	North	Significant	2,053	Ullapool WTW	pH	Control Failure
Jun	North	Significant	333	Ballygrant WTW	Cryptosporidium	Membrane Integrity Lost
Jun	South	Significant	5,412	Winterhope WTW	Pesticides	Inadequate Treatment
Jul	East	Serious	294,159	Invercannie WTW	Taste/Odour	Inadequate Treatment
Jul	South	Significant	7,949	Glengap WTW	pH	pH Adjustment Batch Fail
Jul	East	Significant	1,694	Forehill RSZ	Discolouration	Burst Main
Aug	South	Significant	7,949	Glengap WTW	Aluminium	Dosing Line Blockage
Aug	West	Significant	10,175	Amlaird Milngavie Gorbals RSZ	Colour	Burst Main
Aug	East	Significant	6,410	Turriff RSZ	Discolouration	Burst Main
Sept	East	Significant	97,440	Lintrathen WTW	Turbidity	Coagulant Dosing Pump Failure
Sept	West	Serious	38,125	Muirdykes RSZ	Manganese & Iron	Flow Disturbance (Scottish Water)

Sept	North	Major	1,004	Benbecula WTW	Hydrocarbons	Chemical Spill
Sept	West	Significant	35,376	Picketlaw WTW	Aluminium	Direct Air Filtration Saturator Failure
Oct	East	Serious	97,440	Lintrathen WTW	Turbidity	Coagulant Aid Failure
Oct	South	Significant	18,246	Rawburn WTW	Iron	Failure To Respond To Change In Water Quality
Dec	West	Significant	35,376	Picketlaw WTW	Aluminium	Coagulant Aid Failure
Dec	East	Significant	148,170	Glendevon WTW	Aluminium	Incorrect Dose Settings
Dec	South	Serious	46,827	Pateshill WTW	Taste/Odour & Manganese	Inadequate Treatment
Dec	West	Significant	35,376	Picketlaw WTW	Aluminium	Backwash Failure
Dec	South	Significant	23,114	Hopes WTW	Aluminium, Iron & Manganese	Burst Main

Published for the Drinking Water Quality Regulator for Scotland, August 2024.