Drinking Water Quality Regulator for Scotland

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Dear Mr Millican

Information Letter 1/2022 - Guidance for Risk Assessment and Sampling of Poly and Perfluorinated Alkyl Substances (PFAS)

1 Introduction

This letter supersedes Information Letter 4/2009, and updates the requirements for Scottish Water's risk assessment, sampling and reporting for Poly and Perfluorinated Alkyl Substances (PFAS).

2 Definition of PFAS

2.1 PFAS are a large group of fluorinated organic substances that contain at least one fully fluorinated methyl or methylene carbon atom. They can vary widely in their chemical composition, structure and size, and include high molecular weight fluoropolymers as well as oligomeric and low molecular weight substances.

2.2 The carbon to fluorine bond is extremely strong, making PFAS chemically and thermally stable and very long lasting in the environment. PFAS are used for a wide range of applications, including but not limited to firefighting foams, surfactants, stain and water resistant carpets and fabrics, food packaging and cookware.

3 Requirement - the PFAS Regulatory Standard

3.1 The recast Drinking Water Directive (rDWD) introduced standards for PFAS in January 2021, and the Public Water Supplies (Scotland) Amendment Regulations 2023 will transpose the 'Sum of PFAS' standard of 0.1µg/l at consumers' taps into Scottish legislation on the 1st January 2023.

3.2 The Sum of PFAS standard encompasses a range of perfluoroalkyl carboxylic acids and sulphonic acids, and sampling for all of these substances is required if the risk assessment of drinking water supplies shows that there is a risk of PFAS being present in raw water or final water supplies. The compounds in the Sum of PFAS standard are:

– Perfluorobutanoic acid;
– Perfluoropentanoic acid;
– Perfluorohexanoic acid;
– Perfluoroheptanoic acid;
– Perfluorooctanoic acid;
– Perfluorononanoic acid;
– Perfluorodecanoic acid;
– Perfluoroundecanoic acid;
– Perfluorododecanoic acid;
– Perfluorotridecanoic acid;
– Perfluorobutane sulfonic acid;
– Perfluoropentane sulfonic acid;
– Perfluorohexane sulfonic acid;
– Perfluoroheptane sulfonic acid;
– Perfluorooctane sulfonic acid;
– Perfluorononane sulfonic acid;
– Perfluorodecane sulfonic acid;
– Perfluoroundecane sulfonic acid;
– Perfluorododecane sulfonic acid;
– Perfluorotridecane sulfonic acid.

3.4 In addition to this Sum of PFAS standard, if Scottish Water becomes aware of the risk of any other PFAS compounds contaminating its supplies, in accordance with Regulation 5(2) of the Public Water Supplies (Scotland) Regulations 2014 (as amended), Scottish Water must ensure that suitable risk assessment and monitoring is carried out to determine whether there is a potential danger to health from other PFAS.

4 Requirement - PFAS Risk Assessment

4.1 Routine monitoring of all supplies for PFAS is not a mandatory requirement, but Scottish Water must have a risk assessment methodology to determine the likelihood of the presence of PFAS in water supply systems and ensure sufficient targeted sampling of raw and final water for verification of risk. If there is insufficient information to decisively rule out the risk of presence of PFAS in individual supplies, precautionary monitoring for PFAS must be carried out.

4.2 The risk assessment methodology must be carried out in accordance with a method approved by DWQR, and must be based on the general principles of the European Standard EN 15975-2:2013; in practice it is expected that the PFAS risk assessment will be part of Scottish Water's Risk Assessment Risk Management process.

4.3 Catchment risk assessments must cover the following list of activities and sources as a minimum requirement – Scottish Water must ensure that there is a system in place to identify and assess any potential sources of PFAS that are not on this list:

- Airports and airfields, including landing strips.
- Fire stations and fire training centres.

- Fire locations.
- Wastewater discharges, including sewage works, combined sewer overflows, private discharges including septic tanks.
- Trade effluent.
- Industry (including historic), especially chromium plating, paper and cardboard manufacturing, carpet manufacturing, textile manufacturing, cosmetics manufacturing, food packaging manufacturing, etc.
- Landfill – current and historic
- Biosolids – current or historic
- Sludge to land – current or historic

4.4 Scottish Water is expected to engage with catchment stakeholders and to conduct physical investigations to verify catchment risk. Additionally, Scottish Water should consult with local authorities on their register of contaminated land, including historic land use. There must be a system in place to identify all current and historic sources of PFAS and how these could enter drinking water abstractions, including under all likely hydrological conditions and pumping regimes.

4.5 Risk assessments should include consideration of the proximity of any sources of PFAS to abstraction points, catchment flows, extremes of hydrological conditions and changes in pumping regimes.

4.6 Other potential considerations must be reviewed based on information from operational and catchment staff as well as any relevant desktop or site information.

4.7 It is recognised that risk assessment and sampling of a limited number of Scottish Water's drinking water supplies was completed between 2019 and 2022, and where appropriate, on the condition that the analytical limit of detection is adequate, the data gathered in that exercise may be used to help populate the PFAS risk assessment.

4.8 Where water treatment processes include the return of any process water to the head of treatment works, this process stream must also be considered in risk assessments in case of concentration of PFAS.

4.9 Scottish Water must ensure that its PFAS risk assessment and data pertaining to catchments in which there are private water supplies are proactively be made available to local authorities to assist them with their drinking water quality duties.

5 Requirement – Risk Control

5.1 Any control measures used to manage PFAS concentrations and influence risk scoring must be scientifically proven to reduce levels of PFAS and have suitable, reliable, and regular verification processes. These control measures may include treatment and/or blending of water.

5.2 Controlled risk scores should not be determined solely by sample results - sample results should be used to verify risk. Where sample results do not align with perceived risk, the catchment methodology and information should be reviewed as soon as possible.

5.3 Any treatment process employed to reduce PFAS should be validated and associated with a suitable policy to ensure that appropriate levels of proactive maintenance are

undertaken to maintain the treatment process. This must be verified through appropriate sampling.

5.6 Commonly used drinking water treatment processes such as coagulation, clarification, sand filtration, micro and ultrafiltration, ozonation, and chlorine or UV disinfection are not effective methods for removing PFAS.

5.7 Adsorption techniques, such as activated carbon in the form of granular activated carbon (GAC) or powdered activated carbon (PAC) have been shown to significantly reduce PFAS levels, and selective use of ion exchange resins can also work well.

5.8 The effectiveness of PFAS removal by GAC is influenced by the size and structure of the PFAS molecules being adsorbed, and also by competition from other organic compounds such as natural organic material (NOM). It is therefore important that a site specific risk based approach is taken for the design and operation of GAC plants and the frequency of replacement of GAC.

5.9 If GAC is used as a control measure, Scottish Water must have a policy or procedure in place to ensure that the type of carbon used is suitable for removal of the PFAS in raw water, and that the empty bed contact time required for PFAS removal has been calculated at the maximum flow rate for the works and with the maximum likely number of GAC contactors offline. Any policy should also ensure that GAC treatment stage cannot be bypassed, to maintain suitable control for PFAS at all times. Scottish Water should regularly test to ensure that the carbon remains active for PFAS removal.

5.10 If Scottish Water uses regenerated activated carbon, there should be an established policy or procedure for its proactive regeneration, which includes an understanding of carbon exhaustion rates, consideration of bed volumes, and adsorption capacity for PFAS.

5.11 Nanofiltration and reverse osmosis are likely to be effective at PFAS removal, but this will depend on the molecular weight, chemical structure, relative ionic charge and hydrophobic nature of the molecules. However, PFAS can become concentrated in reject water, and Scottish Water must have suitable techniques and procedures for dealing with this waste stream.

5.12 Ion exchange can be highly effective at removing PFAS from water. It is likely that most PFAS will be anionic in the pH ranges of water being treatment and should respond well to anionic exchange resins. However if cationic PFAS are present, they may need to be specifically targeted with cationic exchange resins; again, an understanding of the molecular characteristics of different PFAS must be considered. Additionally, the molecular weight and functional groups on PFAS and other ions can compete for ion exchange and reduce PFAS removal efficiency, and so a site specific evaluation should be considered before use of ion exchange.

5.13 Where any process streams are recycled in treatment processes, this must also be considered in the PFAS risk assessment, and appropriate testing should be undertaken to understand any impact. Where PFAS is present in the source water, any GAC returned from regeneration should be sampled for PFAS.

5.14 Where treatment for PFAS removal is used, Scottish Water should make reference to how PFAS contaminated products are dealt with once no longer required or suitable for use on its sites as part of its waste management procedures.

5.15 Where blending is employed as a control measure, a policy should be in place documenting the flows needed from other sources to ensure sufficient blending takes place under all potential scenarios that may impact the blending effectiveness. The policy, calculations, and associated water treatment works alarms should be verified, sampled, and audited on a regular basis. Where there is uncertainty in the calculations, a safety margin should be included to ensure that under all conditions the concentration of PFAS in drinking water supplied to consumers remains below 0.1 µg/L.

5.16 The management of blending control measures must be inherently adaptable and suitable for all potential flow, weather and demand conditions, and other variables that may be experienced to ensure that drinking water supplies remain below 0.1 µg/L for PFAS.

6 Requirement - Sampling

6.1 A PFAS sampling programme should be developed for raw and final water, relating sampling to the risk to the raw water source(s) and the representativeness of the sampling point(s) in relation to the water entering the downstream water treatment works.

6.2 Individual raw water abstraction points should be sampled, as well as final water. Scottish Water should also sample combined raw water points to provide information about raw water blending.

6.3 Scottish Water must sample and analyse all required PFAS compounds using fully accredited methods. Where Scottish Water does not have accreditation for any Sum of PFAS compounds, it is expected that accreditation will be achieved by end June 2023. Resampling protocols should also be established to cover raw water sources, blending points, final water, and consumer properties (where applicable).

6.4 Where an analytical method is not fully accredited and an accredited method is not available, results must be flagged as being non-accredited. An accredited method should be used where it is available.

6.5 Where there is no treatment for PFAS and a single raw water source, Scottish Water may sample the final water only.

6.6 Resampling protocols should be established to cover raw water sources, blending points, final water, and consumer properties (where applicable). Where there is treatment in place for PFAS removal, sampling should cover pre and post treatment sample points.

6.7 Attention must be paid to the prevention of sample contamination from clothing, equipment and other sources of PFAS.

7 Requirement – Reporting PFAS Data to DWQR

Scottish Water is required to report all PFAS sample data to DWQR as part of Scottish Water's routine monthly laboratory data return.

8 Requirement – Response to Detection of PFAS in Final Water

The PFAS risk assessment methodology must link risk scoring to one of the three risk levels for PFAS shown below. The PFAS tiers are to be applied to any PFAS compounds detected in

final water and determine the reporting to DWQR, Health Boards and local authorities, and actions to be taken by Scottish Water.

Tier	**Concentration of any PFAS in final water**	**Action**
Tier 1	Less than 0.01 µg/L	• Continue to monitor for PFAS. Initially this may be as frequently as quarterly, until a baseline is established which accounts for temporal variation, and a robust risk assessment is complete, at which point the frequency could be reduced to a level sufficient to periodically validate that risk assessment.
Tier 2	Greater than or equal to 0.01 µg/l and less than 0.1 µg/L	• Continue to monitor for PFAS at a frequency between monthly and quarterly to enable predictive modelling. Frequencies may need to be increased if tier 3 is predicted to be breached. • Review any control measures, including the efficiency, control and monitoring of that measure. • Report as an event if there is an increasing PFAS trend which could lead to a breach of the wholesomeness level (tier 3). • Prepare measures to prevent the supply of water to consumers with >0.1 µg/L PFAS. • Consult/discuss with the Health Board.
Tier 3	Greater than or equal to 0.1 µg/L	• Notify as an event for any results greater than 0.1 µg/L in water supplied to consumers, or any raw water results that are likely to produce results >0.1 µg/L in water supplied to consumers. • Consult/discuss with the Health Board. • Resample as a minimum from raw water sources, blended or combined raw water point, and final water for water treatment works. Resamples should be fast tracked. Frequencies should be established to understand the impact in the specific supply situation, and to inform decision making. • Check and review control measures, including the efficiency, control and monitoring of that measure. • Prepare emergency contingency measures to prevent the supply of water to consumers with >0.1 µg/L PFAS if the control measures employed become inadequate.

		• Fast track sampling at treated water blending point (if applicable) and/or in water quality zones. • Take a minimum of monthly samples in for raw and final water points for a minimum of 12 months, timed to take account of any changes in hydrological conditions, such as droughts, deluges or changes in pumping regimes. • Review catchment and PFAS sources information within 10 working days of receiving result and report to DWQR. • This list of actions is not exhaustive; all necessary actions to investigate the source of the PFAS and reduce concentrations below 0.1 µg/L in water supplied to consumers must be taken.

If you have any enquiries about the matter set out in this letter please do not hesitate to get in touch with me.

Yours sincerely

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