PFAS in food–contact packaging: harmonised sampling and testing

Working document on operational arrangements

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1. Introduction and legal requirements

Per- and polyfluoroalkyl substances (PFAS) are a group of thousands of synthetic chemicals that are used widely in the European Union as well as in the rest of the world in a broad range of applications. Various types of food packaging such as pizza boxes, takeout containers, burger wraps etc. could contain PFAS[1,2,3].

The Packaging and Packaging Waste Regulation (PPWR)[4] harmonises the regulatory framework for packaging and packaging waste across the EU and enhances the smooth functioning of the internal market while reducing the environmental and health impacts linked to packaging. According to Recital 21 of the PPWR, "PFAS in food-contact materials will inevitably lead to the exposure of humans to PFAS. Due to the non-threshold nature of the PFAS hazards, exposure to PFAS from food-contact materials is an unacceptable risk for human health. PFAS should therefore be restricted in food-contact packaging [...]".

According to Article 5.5 of PPWR, from 12 August 2026, food contact packaging shall comply with the following limit values:

- 25 ppb for any PFAS as measured with targeted PFAS analysis (polymeric PFAS excluded from quantification);
- 250 ppb for the sum of PFAS measured as the sum of targeted PFAS analysis, where applicable with prior degradation of precursors (polymeric PFAS excluded from quantification); and
- 50 ppm for PFASs (including polymeric PFAS); if total fluorine exceeds 50 mg/kg the manufacturer, importer or downstream user as defined respectively in Article 3, points (9), (11) and (13) of Regulation (EC) No 1907/2006 shall, upon request, provide to the manufacturer or the importer as defined respectively in Article 3(1), points (13) and (17), of this Regulation proof

[1] Drake W. Phelps, Lindsey V. Parkinson, Justin M. Boucher, Jane Muncke, and Birgit Geueke, Per- and Polyfluoroalkyl Substances in Food Packaging: Migration, Toxicity, and Management Strategies, Environmental Science & Technology 2024 58 (13), 5670-5684, DOI: 10.1021/acs.est.3c03702

[2] Chukwuebuka Gabriel Eze, Emmanuel Sunday Okeke, Chidiebele Emmanuel Nwankwo, Raphael Nyaruaba, Uttpal Anand, Onyekwere Joseph Okoro, Elza Bontempi, Emerging contaminants in food matrices: An overview of the occurrence, pathways, impacts and detection techniques of per- and polyfluoroalkyl substances, Toxicology Reports, Volume 12, 2024, 436-447, https://doi.org/10.1016/j.toxrep.2024.03.012

[3] Shivani Dimri, Bhawna Bisht , Mikhail S. Vlaskin , Anna Kurbatova , Krishna Kumar Jaiswal , Vishal Rajput , Rohit Sharma , P.K. Chauhan , Vinod Kumar, Tracing PFAS from the environment to the food chain: Human health impacts, in vivo toxicological insights, and detection approaches, Food and Humanity 6 (2026), https://doi.org/10.1016/j.foohum.2025.100982

[4] Regulation (EU) 2025/40 of the European Parliament and of the Council of 19 December 2024 on packaging and packaging waste, amending Regulation (EU) 2019/1020 and Directive (EU) 2019/904, and repealing Directive 94/62/EC (Text with EEA relevance)

of the quantity of fluorine measured as content of either PFAS or non-PFAS in order for them to draw up the technical documentation as referred to in Annex VII to this Regulation.

The food contact packaging has to be compliant with all three PFAS limit values.

The PFAS limit values referred to in the PPWR apply only to food contact packaging. The PPWR does not include a definition of food contact packaging. However, it is to be considered that food contact packaging is packaging according to Article 1 of Regulation 1935/2004 on materials and articles intended to come into contact with food. In other words, it is understood that food contact packaging refers to packaging intended to come into contact with food that is place on the market.

Beyond the PFAS limit values in Article 5(5) of the PPWR, the existing EU regulatory framework on PFAS can be summarised as follows:

1) Perfluorooctane sulfonic acid and its derivatives (PFOS) restriction under the Persistent Organic Pollutants Regulation[5];

2) Perfluorocarboxylic acids containing 9 to 14 carbon atoms in the chain (C9-C14 PFCAs), their salts and C9-C14 PFCA-related substances [6]);

3) perfluorohexanoic acid and related substances (PFHxA) restriction under REACH[7];

4) perfluoroalkyl substances in certain foodstuffs [8] etc.

The Commission adopted a proposal amending Annex I to Regulation (EU) 2019/1021 regards perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds[9]. In addition, there is also the forthcoming universal PFAS restriction under Annex XVII of REACH[10,11] where the scope and limit values of the PPWR restriction are identical with the universal PFAS restriction.

Several analytical methods to test the presence of PFAS in different matrices exist.

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[5] REGULATION (EU) 2019/ 1021 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL - of 20 June 2019 - on persistent organic pollutants

[6] COMMISSION REGULATION (EU) 2021/1297

[7] Commission Regulation (EU) 2024/2462 of 17 September 2024 amending Annex XVII to Regulation (EC) No 1907/2006 of the European Parliament and of the Council as regards undecafluorohexanoic acid (PFHxA), its salts and PFHxA-related substances

8 COMMISSION REGULATION (EU) 2022/2388 of 7 December 2022 amending Regulation (EC) No 1881/2006 as regards maximum levels of perfluoroalkyl substances in certain foodstuffs.

[9] Perfluorooctanic acid (PFOA), its salts and PFOA - related compounds

[10] REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006R1907

[11] Per- and polyfluoroalkyl substances (PFAS) - ECHA

A comprehensive inventory of analytical methods is presented in the recent Annex E of the proposal for restriction of per- and polyfluoroalkyl substances (as for Appendix E.4.1. and Appendix E.4.2. on Analytical methods)[12] and more recently in a scientific peer reviewed paper[13]. For packaging in particular, the Nordic Council PFAS report "Analytical methods for PFAS in products and in the environment"[14] from 2022 includes a specific chapter 4.1. on packaging and food contact material (e.g. Liquid Chromatography – Mass Spectrometry, Combustion Ion Chromatography etc). In addition, latest scientific publications include the use of solid-state nuclear magnetic resonance spectroscopy[15] or high-performance liquid chromatography coupled with tandem mass spectrometry[16]. Last but not least, a systematic workflow proposed by Vestergren et al.[17] was recognised by the Committee for Risk Assessment (RAC)'s Opinion on universal restriction of PFAS[18] (March 2026) as a possible way forward but according to RAC may need additional work.

The Commission adopted a Commission Notice [19] at the end of March 2026 providing its legal interpretation of some of the provisions of the PPWR, including a recommendation for the enforcement of the PFAS limit values in food contact packaging. Further clarifications have been provided via the Frequently Asked Questions document, which is published on DG ENV's website and will be regularly updated.

One important element to be noted is that the PPWR does not differentiate between intentionally added and unintentionally present PFAS. Therefore, the provisions in Article 5(5) apply to both. However, preliminary PFAS laboratory analysis results on a range of selected packaging[20] showed that

[12] Annex E to the Background Document to the Opinion on the Annex XV dossier proposing restrictions on Per- and polyfluoroalkyl substances (PFASs)

[13] Ifeoluwa Grace Idowu , Okon Dominic Ekpe, David Megson, Pennante Bruce-Vanderpuije , Courtney D. Sandau A systematic review of methods for the analysis of total per- and polyfluoroalkyl substances (PFAS), Science of the total environment, 2025, 967, 178644, https://doi.org/10.1016/j.scitotenv.2025.178644

[14] "Analytical Methods for PFAS in Products and the Environment", 2022

[15] Thijs M, Laletas E, Quinn CM, Raguraman SV, Carr B, Biergganns P. Total and class-specific determination of fluorinated compounds in consumer and food packaging samples using fluorine-19 solid-state nuclear magnetic resonance spectroscopy. Anal Chem. 2024;96(21):8282–90. https://doi.org/10.1021/acs. analchem.3c04404.

[16] Aßhoff N , Bernsmann T , Esselen M , Stahl T. A sensitive method for the determination of per- and polyfluoroalkyl substances in food and food contact material using high-performance liquid chromatography coupled with tandem mass spectrometry. Journal of Chromatography A 1730 (2024) 465041. https://doi.org/10.1016/j.chroma.2024.465041

[17] Vestergren R, Appelblom A, Balan S. A., Brandsma S.H., Bruton T.A., Cousins I.T., Gauthier J.R., Heggelund A., Ivarsson J., Kärrman A., Melymuk L., Olisah C., Rosen A., Savvidou E.K., Schellenberger S., Skedung L., Talasniemi P., Wickman T., Zweigle J., Zwiener C., Benskin J.P, A Systematic Workflow for Compliance Testing of Emerging International Classwide Restrictions on PFAS, Environ. Sci. Technol. 2024, 58, 14968−14972, https://doi.org/10.1021/acs.est.4c06570

[18] https://www.echa.europa.eu/documents/10162/df5f4b5e-e39e-94b7-031e-5a353d34f230

[19] Commission Notice Guidance document on Packaging and Packaging Waste Regulation (PPWR) - Environment

[20] Skedung L. and Bjarnemark F.: A Harmonized Workflow for PFAS Compliance Testing under EU Packaging and Packaging Waste Regulation and Emerging Universal Restrictions: A Food Contact Packaging Case Study. RISE Research Institutes of Sweden

in practice only packaging where PFAS has been intentionally added is tested as exceeding the PFAS limit values.

Despite the multitude of PFAS restrictions under EU rules and of the range of analytical methods presented above, there is no harmonised methodology for PFAS in food contact packaging at EU level.

In order to support the implementation of Article 5(5), a PFAS task force was established to draft a working document on operational arrangements for the verification of the PFAS limits in food contact packaging. It contains recommendations on sampling and testing for all operators as well as specific recommendations for laboratories involved in the control of substances of concern in food contact packaging, competent authorities as well as economic actors i.e. manufacturer. The working document aims at facilitating an efficient, effective and uniform verification that safeguards public health, the environment and the single market. Moreover, it builds on existing procedures used for compliance with PFAS restrictions under EU legislation e.g. under POPs and REACH Regulations.

The following principles underpin the recommendations in this document:

1. Apply a risk-based approach, taking into account the material type, the supply-chain structure, and the contamination risks.
2. Not each and every packaging has to be tested. If testing is necessary, conduct sampling as far as possible in the supply-chain, and support all testing with appropriate technical documentation.
3. Frequency of testing: whenever substantial changes in the composition or production occur or when new scientific data becomes available (similar to Article 15 Declaration of compliance of the Regulation 10/2011 on plastic materials and articles intended to come into contact with food)
4. Avoid intentional PFAS use in barriers, inks, adhesives, coatings, and processing aids.

These principles support a proportionate, consistent, and technically robust approach to demonstrating compliance.

It should be noted that this document is without prejudice to the responsibility of national competent authorities to verify compliance with the PPWR.

The PPWR and the Commission Notice remain the applicable reference.

This document is not legally binding.

2. Sampling

There are different types of packaging/material on the market e.g. paper - , plastic - , glass – related packaging and care should be taken when preparing the sample for PFAS analysis. The chemical analysis of a unit of packaging composed of different materials[21] - e.g. a glass bottle with a metal cap or an aluminium can consisting of a body, a lid and a key for opening or a PET bottle with the PET cap likely to be produced by different processes/entities etc. - could be more problematic. In addition, different types of plastics such as PE or PET are different materials.

Based on REACH[22,23] , for a unit of packaging:

- if a component has its own shape or function, it is an article. Examples: bottle, cap, lid etc. These would be “articles” under REACH and treated as separate “packaging items” under PPWR
- if a layer does not have its own shape or function, it is not an article. Examples: thin coatings, adhesive layers, barrier layers, printing inks etc. These are not articles under REACH, because they do not have a shape or design that determines their function. They are part of the article (the packaging item), not articles in their own right.

According to REACH, the limits are calculated on the relevant component only, a component being defined through the homogeneity of the material used. This was also confirmed by the Court of Justice of the EU[24]. For example, a glass bottle and metal cap are two different components, therefore PFAS is analysed and quantified per component.

From the practical/laboratory point of view it would also be extremely difficult to ensure that the sample composed of different parts of the unit of packaging is homogenous if it were to consider the

[21] Materials which in their finished state are intended to be brought into contact with food

[22] eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006R1907

[23] An object which during production is given a special shape, surface or design which determines its function to a greater degree than its chemical composition” is defined as an article according to REACH regulation. Therefore, if a product is made up of several articles (e.g., a bicycle with handlebars, pedals, seat), each component is an article in its own right, even after assembly and the restriction must be assessed per component not per finished object. In other words, the limits are calculated on the relevant component only, a component being defined through the homogeneity of the material used. ECHA provided detailed guidance explaining and illustrating the provisions of REACH Regulation that apply to substances in articles. As regards packaging, is to be considered as an article because its shape, surface or design is more important than its chemical composition for the above-mentioned functions.” The packaging is to be considered “as a separate article under REACH and the same requirements apply to it as for any other article”.

[24] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:62014CA0106

unit of packaging as one sample. Moreover, the risk of “dilution effect” is high in case one part of the unit of packaging contains PFAS.

In conclusion:

- where packaging consists of a homogeneous material, it is analysed as one sample.
- where packaging comprises two or more different materials as homogeneity is concern, these should be analysed separately.
- where packaging comprises of components made of the same material but coming from different manufacturers these should be analysed separately.
- for packaging that contains multilayer structures (e.g., cardboard with films or coatings) that cannot be physically separated, the sample is analysed as a single homogeneous fraction.

Care should be taken when sampling recycled materials e.g. plastic, paper. The complexity of recycled materials requires systematic approaches capable of overcoming significant heterogeneity. The recycled-plastic wastes are often blends of products from different sources. Such materials may remain heterogeneous because additives migrate within the plastic samples over their lifetime. In addition, for recycled plastics, the degree of heterogeneity will depend on both the type of plastic and the recycling process used, for example mechanical and chemical recycling. In the case of recycled paper and board, even though the main constituent of paper and board is relatively homogenous, namely cellulose, the contaminants present, including PFAS, can be highly heterogeneous.

Reporting of Results

It is preferable to present the results of the PFAS chemical analysis as given in the test report i.e. per component. The concentrations determined in test samples are either expressed in mg F per kg (ppm) or µg individual PFAS per kg (ppb) of homogeneous material.

3. Materials and methods of analysis

Article 35 of PPWR “Test, measurement and calculation methods” states that “for the purposes of compliance and verification of compliance of packaging with the requirements laid down in or pursuant to Articles 5 …., tests, measurements and calculations shall be made using reliable, accurate

and reproducible methods which take into account the generally recognised state-of-the art methods and whose results are considered to be of low uncertainty".

Methods of analysis should ideally be characterised by the following performance parameters: accuracy (trueness and precision), limit of detection, limit of quantification, repeatability, reproducibility, measurement uncertainty. In addition, quality assurance/quality control measures are essential to ensure that the analytical results are reliable. In practice however this requires validation work according to internationally accepted scientific protocols [e.g.25].

In the absence of methods of analysis fulfilling all criteria as described above, other methods could be used until the validation of the appropriate methods. In the following, short descriptions of the methods of analysis that have been used for analysing PFAS in food contact packaging are provided:

– PFASs including polymeric PFAS – limit value 50 ppm/ Total fluorine (TF) - limit value 50 ppm.

In order to cover all PFAS, measurement of TF is recommended.

1. **Combustion Ion Chromatography** (CIC) - quantifies total combustible fluorine by combusting the sample, collecting the fluoride formed, and detecting it by ion chromatography (IC). Two main CIC approaches are used, depending on the combustion technique i.e. oxidative pyrohydrolytic combustion (CIC) and combustion in a closed oxygen (calorimetric) bomb (bomb-CIC). Pyrohydrolytic CIC generally provides higher sensitivity, while bomb-CIC may be better at detecting inorganic fluorine, depending on the sample matrix. Typical reporting limits are approximately 10 mg F/kg (10 ppm)[26] for pyrohydrolytic CIC and 50–100 mg F/kg for bomb-CIC. Standards based_on pyrohydrolytic combustion include EN 17813 and ASTM D7359, while EN 14582 specifies fluorine quantification following combustion in an oxygen bomb.
   Combustion should be performed directly on the original sample rather than on an extract, in order to ensure inclusion of all fluorinated species, including polymeric PFAS, and thus obtain a true measurement of total fluorine. Limit of detection for CIC[27] is 22 µg F/g.

[25] https://www.eurachem.org/images/stories/Guides/pdf/MV_guide_3rd_ed_V1_EN.pdf
[26] Skedung and Bjarnemark - Extended Abstract - A Harmonized Workflow for PFAS Compliance Testing under EU PPWR and Emerging Universal Restrictions - A Food Contact Packaging Case Study
[27] Skedung L., Savvidou E., Schellenberger S., Reimann A., Cousins I.T., Benskin J.P., Identification and quantification of fluorinated polymers in consumer products by combustion ion chromatography and pyrolysis-gas chromatography-mass spectrometry, *Environ. Sci.: Processes Impacts*, 2024, 26, 82-93, DOI: 10.1039/D3EM00438D

2. **Ion Selective Electrode** (ISE) - is a method[28] that uses fluoride ion – selective electrode combined with oxygen combustion sample preparation. This is a destructive approach requiring careful sample preparation, combustion and the analysis of the solution by a fluoride-specific electrode. The method limit of detection was calculated as 20 ppm while the limit of quantification is not reported. In addition, the so called "instrument limit of detection" is identified to be 0.1 ppm.

Further testing if total fluorine is above 50 ppm to determine if the fluorine is from PFAS or other sources

- **Pyrolysis-gas chromatography mass spectrometry** – (pyrolysis GC/MS)[28] is an analytical technique used to identify and quantify chemical compounds based on gas chromatographic separation followed by quantifying the analytes depending on the mass via mass spectrometry. For the sample preparation no prior extraction is necessary, pyrolising the sample (or part of it) directly. This method is qualitative rather than quantitative
- Determination of Total Organic Fluoride (TOF) can be realized based on **DIN 51723 and EN ISO 10304-1** as proposed by the Danish Ministry[29,30,31]. The total organic fluorine less than 20 µg/g paper is considered to be an unavoidable background level of ToF/PFAS. This is based on test and an assessment from "clean" paper without PFAS performed by the Technical University of Denmark (report in Danish[32]). Limit of quantification for total organic fluorine is reported (2004) to be 1 µg/g paper.
- Total organic fluorine via indirect measure:
    I. **Ion Selective Electrode (ISE)** – using the fluoride ion – selective electrode method described above, the inorganic fluoride in the sample is measured followed by subtracting this value from the initial total fluorine value.
    II. **Combustion Ion Chromatography (CIC) combined with an optimised pre-combustion step** at 525°C for 2 h for the TOF determination in solid matrices. This approach enabled selective quantification of organic fluorine while minimising interference from inorganic fluorides[33] .

[28] Ignacio M.C.C.D., Curtzwiler G.W., Early M.R., Updegraff K.M., Vorst K.L , Ion Selective Electrode (ISE) Method for Determination of Total Fluorine and Total Organic Fluorine in Packaging Substrates, *Methods Protoc.***2023**, *6*(1), 10; https://doi.org/10.3390/mps6010010

[29] Since 2020, a ban of marketing food contact materials of paper and board, if PFAS have been used in the production (with a derogation for PFAS that might be present on the outside of the food contact material and does not migrate into the food) was introduced by the the Danish legislation

[30] Danish Order No 681 of 25 May 2020 on Food Contact Materials.pdf

[31] https://en.foedevarestyrelsen.dk/Media/638210239823191854/Faktaark%20FCM%20(english).pdf

[32] Rapport

[33] Diallo, T., Noblet, C., Dubocq, F., Schelcher, M., Diaz, T., Benismail, N., & Cotton, J. (2026). Assessing reliable measurements of total organic fluorine in food packaging materials. *Food Additives & Contaminants: Part A*, 1-14.

For those national authorities which intend to verify the compliance with the other limits defined by the Regulation, the following testing methods could be used:

– any PFAS excluding polymeric PFAS - limit value 25 ppb

1. **liquid chromatography coupled with tandem mass-spectrometry detection** (LC-MS/MS) is a targeted method of analysis where the analytes are separated via liquid chromatography followed by the mass characterisations with mass spectrometry. The sample preparation is according to ASTM D7968 or EN 15519 i.e. solvent extraction and filtration.

   As an example of how this can be applied in practice: a targeted analytical method for the determination of a set of PFAS in food contact materials (FCMs) by LC-MS/MS can be implemented with satisfactory sensitivity, linearity, repeatability and stability. Samples are extracted using ethanol (95%) (EN 15519 and Testing conditions for kitchenware articles in contact with foodstuffs (Annex 5)[**34]).

   In order to ensure adequate solubility of PFAS with varying perfluorinated chain lengths, particularly short-chain compounds, calibration standards shall be prepared in a mixed solvent system (e.g. methanol/water/acetonitrile), as pure methanol is not suitable for maintaining all analytes in solution. Chromatographic separation is performed using a reversed-phase C18 column operated under gradient conditions (phase A: Water/ammonium acetate and phase B: Methanol/ammonium acetate. An isolator column may be installed upstream of the analytical column to retain PFAS originating from the LC system (e.g. tubing, solvents, PTFE components) and thus prevent interference with target analytes. Detection is carried out using tandem mass spectrometry in negative electrospray ionisation (ESI−) mode with multiple reaction monitoring (MRM), ensuring high selectivity and sensitivity. Quantification shall be performed by isotope dilution using isotopically labelled internal standards to correct for matrix effects and signal variability. Calibration curves should be established using solvent-based or matrix-matched standards over an appropriate concentration range. Quality control measures, including procedural blanks, calibration verification standards and replicate analyses, shall be systematically applied. Particular attention shall be paid to background contamination. The method shall be validated in terms of selectivity, linearity, trueness, precision, limits of detection and quantification, ensuring its suitability for regulatory monitoring purposes.

2. **gas chromatography coupled with mass spectrometry detection** (GC-MS/MS) is a targeted analytical method particularly suitable for the determination of volatile and semi-volatile PFAS,

[34] https://publications.jrc.ec.europa.eu/repository/handle/JRC144375

including fluorotelomer alcohols (FTOHs) and other PFAS that cannot be efficiently analysed by LC-MS/MS. Samples are extracted using ethanol (95%) (EN 15519 and Testing conditions for kitchenware articles in contact with foodstuffs (Annex 5)[26] and analysed by capillary gas chromatography coupled to mass spectrometric detection. Quantification shall be performed using isotopically labelled internal standards to ensure reliable identification and accurate measurement. The method shall be validated for selectivity, linearity, precision and sensitivity, and special attention shall be paid to contamination control and analyte losses during sample handling.

– sum of PFAS measured as the sum of targeted PFAS analysis - limit value 250 ppb

Direct Total oxidizable precursor (TOP) assay is an analytical method[35] based on oxidative conversion followed by LC – MS/MS. TOP accounts for both targeted PFAS and hidden precursors that can be converted into measurable perfluoroalkyl acids during oxidation. The samples are exposed to hydroxyl radicals generated by thermolysis of persulfate under basic pH conditions

4. Recommendations for laboratories

Laboratories as well as the PFAS methods of analysis should be accredited, if possible, according to ISO/IEC 17025[36]. The laboratories should be proficient in the analysis of PFAS at the concentrations of interest and should demonstrate this by e.g. participation to proficiency testing schemes (interlaboratory exercises) organised by accredited bodies according to EN ISO/IEC 17043[37].

Moreover, care should be taken about PFAS contamination.

The analysis of PFAS in food contact packaging requires stringent precautions to prevent background contamination, given the ubiquitous presence of these compounds in laboratory environments. Laboratory consumables and equipment should be carefully selected to avoid fluoropolymer-based materials (e.g., PTFE, FEP), which may leach or adsorb PFAS; wherever possible, polypropylene or high-density polyethylene materials should be preferred. All solvents and reagents must be of high purity and verified as PFAS-free prior to use. Sample preparation should be conducted in clean environments, ideally under controlled air conditions, and procedural blanks should be systematically included to

[35] Houtz E.F., Sedlak, D.L. Oxidative Conversion as a Means of Detecting Precursors to Perfluoroalkyl Acids in Urban Runoff, Environ. Sci. Technol. 2012, 46, 9342−9349, DOI:10.1021/es302274g

[36] ISO - ISO/IEC 17025 — Testing and calibration laboratories

[37] ISO/IEC 17043:2023 - Conformity assessment — General requirements for the competence of proficiency testing providers

monitor background levels. Particular attention should be paid to potential contamination sources such as tubing, seals, vial caps, and LC system components, which may contain fluorinated polymers[38]. The use of dedicated PFAS-free analytical systems or delay columns is recommended to separate instrument-derived PFAS signals from analyte peaks. Additionally, strict laboratory practices, including the avoidance of waterproof clothing, cosmetics, or personal care products containing PFAS, should be enforced for personnel involved in sample handling. Calibration standards and internal standards should be handled separately from samples to minimize cross-contamination. Regular verification of method blanks and instrument background is essential to ensure data reliability, especially at trace-level detection.

These precautions are critical to achieving robust and defensible analytical results for PFAS in food – contact packaging.

5. Recommendations for manufacturers

According to the PPWR in Annex VII, manufacturers should prepare the technical documentation to demonstrate that the packaging in question is complying, amongst other requirements, with the PFAS limit values in Article 5.5 of the PPWR.

Conformity with Article 5(5) should be demonstrated in the technical documentation through a combination of supply chain information, risk-based assessment of PFAS presence, and sampling and analytical testing, where appropriate. These principles are consistent with the conformity-assessment approach used in other EU product legislation, including: EN IEC 63000:2018[39] (technical documentation for restriction of hazardous substances) and Blue Guide (guidance on EU product rules)[40].

The technical documentation should include, if appropriate:

1. A description of the conformity assessment procedure, following approaches like the hazard analysis for critical points[41] and the Good Manufacturing Practice[42], for the production chain focussing on sources PFAS contamination.

[38] EPA Method 8327 (SW-846)

[39] EN IEC 63000:2018 Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

[40] COMMISSION NOTICE The 'Blue Guide' on the implementation of EU product rules 2022 Publications Office

[41] REGULATION (EC) No 852/2004 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 29 April 2004 on the hygiene of foodstuffs

[42] Regulation (EC) No 2023/2006 on good manufacturing practice for materials and articles intended to come into contact with food

Such assessment should at least comprise the following[43]:

- Verification of intentional use (e.g. surface treatments, barriers, inks, adhesives, coatings): Use of supplier declarations confirming that PFAS are not intentionally added at any stage of the value chain.
- Assessment of specific risks of unintentional presence: Consideration of realistic sources of cross contamination (e.g., PFAS containing lubricants or cleaning agents, legacy PFAS in recycled inputs) and process related factors (carry-over from one production to another).
- Assessment of material intrinsic likelihood of PFAS occurrence: Evaluation of whether PFAS would have any known technical function or persistence in a given material category i.e. identify potential high-risk materials e.g. grease- and water-proof paper, PFAS-containing inks or prints, fluoropolymer coatings, mould release agents for polymer production, non-stick coatings on transport rollers used during part production (PTFE – rollers, Teflon coated transport systems).
- Material composition/changes in material composition or supply-chain.

It is important to underline that the competent authority is subject to the obligation to preserve the confidentiality of commercial information, so this information must be shared with the public authority.

2. Supplier documentation including, if available, screening of risk for PFAS contamination at any point of the value chain. Care should be taken about the supply chain transparency and credibility (e.g. supply chain complexity, potential missing information).

3. Sampling records and testing/Analytical reports from laboratories including the analytical method descriptions. The reports should make available the LOD/LOQ, sample size, and sampling points. Preferably, it should be avoided to draw conclusions from a single test. The reports should be tied to the exact packaging batch for traceability reasons.

4. Traceability and record-keeping procedures linking products to the results of testing
5. Other risk mitigating measures, as applicable.

6. Recommendations for the competent authorities

Enforcement of PFAS limits:

The surveillance authorities as referred to in PPWR, based on Regulation (EU) 2019/1020 on market surveillance rules, are competent to verify compliance with the PFAS limits.

Risk to human or animal health:

[43] Development of a Risk Matrix for Assessing PFAS in Food Packaging

Apart from the general verification of the limits established in Article 5(5), according to the PPWR “In case of human health concerns, the market surveillance authority should not evaluate a risk to human or animal health originating from the packaging material, if transferred to the packaged content of the packaging material, but should alert the authorities competent to carry out controls on that risk and appointed pursuant to Regulation (EU) 2017/625 of the European Parliament and of the Council (46), Regulations (EU) 2017/745, (EU) 2017/746, (EU) 2019/6 or Directive 2001/83/EC.”

Member States are free to nominate the market surveillance authorities and could decide that food safety control authorities are the surveillance authorities to verify the PFAS part of the declaration of compliance of food contact packaging. In other words, it is up to the Member States to decide what best works for them in accordance with the principle of subsidiarity.

The activities of the market surveillance authorities are as described in Article 11 of the Regulation (EU) 2019/1020 on market surveillance rules. Accordingly, as part of their activities, they should check the documents provided by the manufacturer in the declaration of conformity and, where appropriate, should do physical and laboratory checks based on adequate samples, prioritising their resources and actions to ensure effective market surveillance.

For packaging in particular, the following should be done:

- a risk-based selection of packaging for which the declaration of conformity (DoC) should be verified. N.B. not each and every batch of packaging needs testing
- a thorough check of the documents provided by the manufacturer in the DoC.

In case of any suspicion, physical analysis should be carried out based on adequate sampling and applying the harmonised operational arrangements.

The methods used for sampling and analysis should be carried out in accordance with the requirements of Article 34 of the Regulation 2017/625 on official controls. At present, due to the lack of laboratory capacities and expertise combined with the fact that there are no harmonised methodologies for PFAS in food contact packaging, it is suggested to use harmonised operational arrangements as described in this document. This could be the start of the verification of the PFAS limit values.

7. Example of verification of the three PFAS limits in food-contact packaging, based on the PARC[44] approach

A stepwise approach to assess compliance

Step 0: Information Collection

Manufacturers (and other economic actors) should begin with a structured information review – see see Chapter 5 Recommendations for manufacturers):

Decision point: Is there any indication of PFAS use or risk of contamination from the supply-chain information?

- **Yes or unclear** → proceed to analytical testing
- **No** → low-risk product

Analytical Testing

Step 1 – Total Fluorine (TF) Quantification in mg F/kg (using Combustion Ion Chromatography)

- **If TF > 50 ppm:** Proceed to Step 2 to verify the origin of the fluorine (PFAS / non-PFAS) through additional analytical testing. Exceeding 50 ppm TF indicates a high likelihood of non-compliance unless the fluorine is demonstrated to originate from non-PFAS sources.

Step 2 – Pyrolysis-GC/MS (Qualitative) or Combustion Ion Chromatography combined with an optimised pre-combustion step

Pyrolysis-GC/MS is used to determine whether the fluorine detected in step 1 is attributable to PFAS.

- **If PFAS is detected** (fragments containing CF_2/CF_3 chemistry): The sample is **non-compliant**.
- **If no PFAS is detected:** The fluorine is expected to originate from inorganic sources or non-PFAS fluorinated materials, indicating no intentional PFAS use. The risk of exceeding any of the PFAS concentration limits is low. The compliance with the third PFAS limit value is proven.
- Pyrolysis-GC/MS can distinguish between different numbers of fluorinated carbons, polymeric PFAS, and fluoropolymers, and can often indicate the type of PFAS used to provide a functional property.

Step 3 – Targeted PFAS Analysis

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Targeted analysis should follow established methods used for assessing compliance with PFAS restrictions under POPs Regulation and REACH.

- **If sum of PFAS > 250 ppb after degradation of precursors (e.g. via the total oxidizable precursor assay (TOP)):** The sample is **non-compliant**.
- **If any individual PFAS > 25 ppb:** The sample is **non-compliant**.
- **If a concentration is close to 25 ppb:** Analyse an additional sample or batch to confirm consistency.
- **If all individual PFAS < 25 ppb and sum of PFAS < 250 ppb:** This indicates no intentional use or significant contamination. The compliance with the corresponding PFAS limit values is proven.