**European Partnership on Metrology**
**Call 2023 –Fundamental Metrology, Industry, Normative and Research Potential**

Selected Research Topic number: **SRT-i12**
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# Title: Metrology for food safety in the circular economy: targeted and screening methods for contaminants in food and recycled packaging


## Abstract

The food industry is globally concerned with harmful effects of chemical food contamination throughout the stages of food production. Food packaging constitutes one potential source of food contamination which may hamper the circular economy goals in the European Union. In addition, using recycled packaging waste to create new food packaging increases the number and concentration levels of chemicals that can migrate from the packaging into foods and environment, eventually affecting human health. Depending on the chemical, harmonised legislation, validated analytical methods, or reference materials are still missing for relevant food and packaging matrices and required by the food industry to implement sustainable packaging strategies in a circular economy. Therefore, the outcomes of the project will contribute to regulatory bodies, NMIs, DIs and EMN for Safe and Sustainable Food), to standards developing organisations (e.g., CEN, ISO, UNI, IOC, Codex Alimentarius), and end users (e.g., reference laboratories, the food industry).



## Keywords

Food safety, sustainable food packaging, food packaging materials, Mineral Oil Saturated Hydrocarbons (MOSH), Mineral Oil Aromatic Hydrocarbons (MOAH), Perfluorinated Alkyl Substances (PFAS), organic/inorganic contaminants.


## Background to the Metrological Challenges

Food contamination as a global issue has been addressed by EU-2017/625, which foresees the need of validated analytical methods for food safety. Food product recalls, resulting disruption of operations, reputational damage, and waning consumer confidence can result in financial losses. For food industries, the quantification of the level of contamination and the identification of the source are of paramount importance but are often hampered by lack of harmonised and validated analytical procedures. Among others, food packaging is a source of food contaminants, and the use of recycled packaging materials may add other sources of contamination. On the other hand, packaging reuse and recycling are declared political goals in the context of European circular economy.

Therefore, progress in these fields is required for two reasons: i) the need for validated methods to quantify contamination levels in relation to the allowed limit ii) the need to support the packaging recycling policy with tools for processes optimisation.

For mineral oil hydrocarbons the standard method EN 16995:2017-08 (E) using LC-GC-FID has been validated and was shown to be applicable at 10 ppm. There is however a need to validate lower limit of quantification (LOQ), such a 4 mg/kg for MOSH and 0.1 mg/kg – 0.5 mg/kg for MOAH depending on the matrix. Further, sample preparation protocols and confirmatory methods (e.g., GC-MS, GCxGC-Tof-MS, GCxGC-FID/MS) especially for MOAH require further harmonisation and validation.

The Guidelines published by EURL-POPs on analytical parameters for determination of PFAS in food and feed of 11 May 2022 clearly states that the required LOQ for the for the four individual PFAS (PFOS, PFOA, PFNA, PFHxS) ranging from ≤ 0.002 µg/kg to ≤ 0.04 µg/kg depending on the analyte and on the food matrix. The Commission Recommendation (EU) 2022/1431 of 24 August 2022 on the monitoring of perfluoroalkyl substances in food suggested to develop increasingly sensitive analytical methods to investigate contamination levels of PFAS in the food chain. The focus, therefore, needs to be on the development and validation of analytical methods for the quantification of PFAS on relevant food and food packaging matrices, for which the contamination of PFAS is known to be a major threat like e.g. drinking water, vegetable oils

and/or blue food (fish, fish liver). Aforementioned methods will be selected considering inputs and needs of industries and relevant stakeholders.

For supporting the harmonisation of analytical methods and the development of international monitoring programs aimed to identify and quantify food contamination, high quality certified reference materials are required. While for some neat contaminants and combination of contaminants, matrices reference materials are already present on the market, for others are still lacking and are urgently required by industries and control bodies.

The use of recycled packaging increases the number and level of chemicals that can migrate from the packaging into foods, and thus can hamper the circular economy. For example, in glass and metal packaging materials, repeated recycling may result in accumulated metals and metalloids. Metal ions from crystal glass can accumulate in recycled glass and migrate into food. Several food packaging industries, have interest in developing screening methods, both laboratory and on-site, for testing recycled packaging production. This need to assess the different type and levels of contamination from recycled packaging compared to virgin ones and to assess if recycled ones are compliant to relevant EU regulations.

Furthermore, the European Metrology Network (EMN) for Safe and Sustainable Food is involved in fostering collaboration and coordination in the measurement science community to meet metrology needs along the food chain, working within the European Union's Farm to Fork Strategy. Therefore, the outcomes of the project will contribute to the EMN activities.

## Objectives

Proposers should address the objectives stated below, which are based on the PRT submissions. Proposers may identify amendments to the objectives or choose to address a subset of them in order to maximise the overall impact, or address budgetary or scientific / technical constraints, but the reasons for this should be clearly stated in the protocol.

The JRP shall focus on the metrology research for food safety in supporting the critical evaluation of established methods and the development of new techniques for the identification and quantification of contaminants in selected food and food packaging matrices.

The specific objectives are

1. To produce protocols for the quantification of Mineral Oil Saturated Hydrocarbons (MOSH) and Mineral Oil Aromatic Hydrocarbons (MOAH) by LC-GC-FID according to EN16995 in relevant food matrices (e.g. vegetable oils and infant formula) to lower limits of quantification (LOQ) down to 4 mg/kg for MOSH and between 0.1 mg/kg and 0.5 mg/kg for MOAH depending on the matrix as well as to develop confirmatory methods (e.g. GCxGC-FID/MS, GCxGC-ToF-MS) as tools for the investigation of the origin of MOSH and MOAH contaminations.
2. To develop sensitive analytical procedures for the detection and quantification of polyfluorinated compounds (PFAS) in selected matrices, according to the Commission Recommendation (EU) 2022/1431 of 24 August 2022 on the monitoring of perfluoroalkyl substances in food. To develop validated methods with targeted limits of quantification (LOQ) ranging from ≤ 0.002 µg/kg to ≤ 0.04 µg/kg for the relevant PFAS groups (PFOS, PFOA, PFNA, PFHxS) in food matrices (drinking water, blue food, and vegetable oils) as well as in food packaging matrices.
3. To develop traceable and high accuracy reference materials to be used in quality control/quality assurance for key contaminants such as MOSH, MOAH and PFAS in relevant food matrices, e.g., vegetable oil and infant formula with relevant MOSH and MOSH trace concentrations.
4. To develop and validate screening methods addressing new/existing organic and inorganic contaminants, e.g., plasticizers, MOAH in virgin and recycled packaging such as bio-based food contact materials and reusable materials. To detect contaminants' migration in food simulants and selected food matrices as well as to foster the research in the discovery of Emerging and Novel PFAS through non-targeted screening. To implement metrological approaches for the determination of total fluorine, total extractable organic fluorine (EOF) or total oxidizable precursor (TOP) in selected matrices as well as to address direct transportable/portable rapid screening methods for performance and comparison to existing laboratory methods.
5. To facilitate the take up of the technology and measurement infrastructure developed in the project by the measurement supply chain (e.g., regulatory bodies, NMIs, DIs and EMN for Safe and Sustainable Food), standards developing organisations (e.g., CEN, ISO, UNI, IOC, Codex Alimentarius), and end users (e.g., reference laboratories, the food industry).

These objectives will require large-scale approaches that are beyond the capabilities of single National Metrology Institutes and Designated Institutes. Proposers shall give priority to work that meets documented industrial needs and include measures to support transfer into industry by cooperation and by standardisation. An active involvement of industrial stakeholders is expected in order to align the project with their needs – both through project steering boards and participation in the research activities.

Proposers should establish the current state of the art and explain how their proposed project goes beyond this.

EURAMET expects the average EU Contribution for the selected JRPs in this TP to be 1.9 M€ and has defined an upper limit of 2.3 M€ for this project.

EURAMET also expects the EU Contribution to the external funded beneficiaries to not exceed 35 % of the total EU Contribution across all selected projects in this TP.

Any industrial beneficiaries that will receive significant benefit from the results of the proposed project are expected to be beneficiaries without receiving funding or associated partners.

## Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the 'end user' community, describing how the project partners will engage with relevant communities during the project to facilitate knowledge transfer and accelerate the uptake of project outputs. Evidence of support from the "end user" community (e.g., letters of support) is also encouraged.

You should detail how your JRP results are going to:

- Address the SRT objectives and deliver solutions to the documented needs,
- Feed into the development of urgent documentary standards through appropriate standards bodies,
- Facilitate improved industrial capability or improved quality of life for European citizens in terms of personal health, protection of the environment and the climate, or energy security,
- Transfer knowledge to the reference laboratories and the food industry sectors.

You should detail other impacts of your proposed JRP as specified in the document "Guide 4: Writing Joint Research Projects (JRPs)"

You should also detail how your approach to realising the objectives will further the aim of the Partnership to develop a coherent approach at the European level in the field of metrology and include the best available contributions from across the metrology community. Specifically, the opportunities for:

- improvement of the efficiency of use of available resources to better meet metrological needs and to assure the traceability of national standards
- the metrology capacity of EURAMET Member States whose metrology programmes are at an early stage of development to be increased
- organisations other than NMIs and DIs to be involved in the work.

## Timescale

The project should be of up to 3 years duration.