PLASTICS RECYCLERS EUROPE
making plastics circular

Brussels, 13 July 2023

Initial Feedback Universal PFAS Restriction

It is with some interest that we have taken note of the Universal PFAS Restriction proposal. While we are still in the process of reviewing the work performed by the 5 Member States, we would like to provide some initial feedback, mainly surrounding the questions raised in the public consultation addressed to the recycling industry:

4: *Impacts on the recycling industry: To get an understanding of the impacts of the proposed restriction on the recycling industry, information is requested on:*
   a. *The impacts that the concentration limits proposed in paragraph 2 of the proposed restriction entry text (see table starting on page 4 of the summary of the Annex XV restriction report) have on the technical and economic feasibility of recycling processes (together with a clear indication on the waste streams to which the described impacts relate).*
   b. *The measures that recyclers would need to take to achieve the proposed concentration limits.*
   c. *The costs associated with these measures.*

The question is an interesting one and requires the review of the proposed concentration limits:

i. *25 ppb for any PFAS as measured with targeted PFAS analysis (polymeric PFASs excluded from quantification)*
ii. *250 ppb for the sum of PFASs measured as sum of targeted PFAS analysis, optionally with prior degradation of precursors (polymeric PFASs excluded from quantification)*
iii. *50 ppm for PFASs (polymeric PFASs included). If total fluorine exceeds 50 mg F/kg the manufacturer, importer or downstream user shall upon request provide to the enforcement authorities a proof for the fluorine measured as content of either PFASs or non-PFASs.*

This then requires us to investigate what is a PFAS:

Per- and polyfluoroalkyl substances (PFASs) defined as: Any substance that contains at least one fully fluorinated methyl (CF3-) or methylene (-CF2-) carbon atom (without any H/Cl/Br/I attached to it).

A substance that only contains the following structural elements is excluded from the scope of the restriction: CF3-X or X-CF2-X', where X = -OR or -NRR' and X' = methyl (-CH3), methylene (-CH2-), an aromatic group, a carbonyl group (-C(O)-), -OR'', -SR'' or –NR''R'''; and where R/R'/R''/R''' is a hydrogen (-H), methyl (-CH3), methylene (-CH2-), an aromatic group or a carbonyl group (-C(O)-).

What is relevant here is that in many of the press releases around this restriction proposal, it is claimed that the proposed restriction would ban more than 10 000 substances. In fact, this is a gross underestimation. With this definition, an **infinite number** of substances will be banned.

The infinite nature of what is being restricted makes the demonstration of compliance to the first two proposed concentration limits practically impossible. In analytical chemistry, one can only quantify those substances that are being targeted.

For example, it is possible to take a known amount of PFOA, run standard dilution series through a LCMS system to establish the elution time, MS spectrum, and relate the concentration to an area under the curve.

PLASTICS RECYCLERS EUROPE
Avenue de Broqueville 12 | 1150 Brussels – Belgium
+32 2 786 39 08

[redacted]@plasticsrecyclers.eu
www.plasticsrecyclers.eu

Then, it would be possible to take a sample with an unknown concentration of PFOA, run it over the LCMS system and determine the PFOA concentration.

Of course, several testing institutes have now already started offering packages with more than just PFOA, but a range of PFAS substances (e.g. PFOA, PFOS, and their metal salts). This can be done analytically by establishing several calibrations on a single LCMS system. However, there are limitations to what is possible here due to the affinity of the LC column for the substances. This needs to be sufficiently bonding the target chemicals to retard their progress under a constant flow of carrier liquid but also not too much to prevent progression entirely[1]. In a chemically infinite space, there will be molecules that have too little affinity to the column and simply fly through at the rate of the carrier fluid and there will be molecules which are having such an affinity to the column that they will be forever binding or having elution times in the hours.

More fundamentally, performing calibration of such a LCMS system is only possible if the substance is available on its own or can be synthesized and this normally takes an amount of time to perform. With a literally infinite number of substances in the scope of the restriction, it would take an infinite amount of time to calibrate the LCMS system. Those that have worked with LCMS know that LCMS systems tend to drift a bit and require periodic cleaning and recalibration.

One possible analytical solution would be to determine the total organic fluorine (TOF) down to the ppb level. If the TOF would be sufficiently below the 25 ppb level, it would not be possible for the individual small PFAS to be present above the 25 ppb level. Of course, such an analytical approach would basically invalidate the last-mentioned concentration limit (50 ppm TOF) and be somewhat against the spirit of the proposed restriction. More importantly, practically this is not possible for plastics materials. Indeed, after inquiring with several laboratories, the best limit of quantification for TOF seems to be around 10 ppm. This is not because the calibration curve was not established for below this level (which would just require a bit of homework on the side of the labs) but is more the result of interference from other constituents of materials that are subjected to such analysis (e.g. under EN 14582 or EN 15408). Since this is a limitation rooted in the laws of physics, improvements in the limit of quantification for TOF should not be expected.

All of the above means that **it will not be possible for recyclers to demonstrate compliance to the limit 25 ppb limit for individual small PFAS or the 250 ppb sum total limit for small PFAS.** The 50 ppm TOF limit is a measurable limit.

The above statement is made despite the section 2.5.3. – 2.5.4. showing a workable strategy for enforcement bodies to enforce the terms of the restriction. We too appreciated this holistic approach shown here. However, it should be noted that this would be an approach for demonstrating non-compliance. After having followed the approach, a conclusion can be drawn in the form that: "the material or product cannot be shown to violate the terms of the universal PFAS restriction". But it would not be possible to conclude from the suggested approach that the material is in compliance with the PFAS Restriction.

[1] Small PFAS molecules with too little affinity for the column and/or a too great affinity for the mobile phase will essentially shoot through the chromatographic column at the same time without separation. This would make identification and certainly quantification impossible. Conversely small PFAS molecules with a too great affinity for the column and/or too little for the mobile phase would just bind the column and either not exit during the run or exit days later in another experiment. The latter is the reason why columns need to be cleaned from time to time to reduce background "noise" in LCMS systems (part of the noise is just material eluting from previous injections).

To give a very practical example, a sometimes-used polymeric PFAS processing aid is "Hexafluoropropylene-tetrafluoroethylene-vinylidene fluoride copolymer" (Cas: 25190-89-0). This processing aid basically is used to prevent the material from sticking to moulds and/or calender. If used outside of the EU or present in a waste stream with long service life, a TOF analysis might result in a value below 50 ppm. These processing aids are used because they are so extremely effective and very little is needed. Furthermore, when articles with such fluoropolymer processing aids are present in certain waste articles in a waste stream, they will be accompanied by waste articles that do not have the substance, thus reducing the concentration in the recyclate.

A targeted analysis of *PFHxS, PFOS, PFHxA (if adopted), PFOA and C9-C14 PFCAs* would then not reveal the presence of individual small PFAS. The material would be in a Kafkaesque position of being non-compliant to the restriction, not being shown to be non-compliant to the restriction, and no company, institute, or authority would be able to say that the material is compliant with the restriction. **Legal certainty would become an unanswered question in such cases.**

For recyclers, the only actionable limit to which compliance could potentially be demonstrated is the third total organic fluorine limit. As such we hereby request an indefinite derogation from the 25 ppb small PFAS and 250 ppb sum total small PFAS limit for plastics recyclates placed on the market as substance or mixture and articles made with plastics recyclates.

Of course, the issue described above is not necessarily unique to recycling. There will be many industries with global supply chains that would face problems with legal certainty. It might be better to forgo the 25 ppb and 250 ppb limit entirely. Alternatively, it would be possible to set up a specific exhaustive list of substances with CAS numbers for which these limits would apply. An exhaustive list of substances could be established based on the substances that would meet the structural definition and have been registered under REACH. We do expect that such a list would probably be quite short (i.e. certainly not 10 000 substances); there will likely be just very few of the molecules being produced at industrial scale. The rest of the to be restricted chemical universe would then still be regulated by the 50 ppm TOF limit.

These derogations are needed because there are no measures that recyclers could take to achieve the proposed limit values. While we appreciate the faith in our industry that the question 4b betrays, we must manage expectations here. Recyclers do not recycle individual articles one by one; recyclers recycle mountains of articles or shredded material batch by batch or even in a continuous fashion. The recycling process allows these materials to be sorted by exploiting differences in material properties that are unique to the specific waste stream.

To give a practical example, PET bottles from deposit collection systems are shredded and put through a washing line. The washing line ensures that the shredded HDPE/PP caps float to the top of the baths while the PET sinks to the bottom of the baths. Here the separation of the material that was originally part of the mountain of PET bottles is separated by density. Other properties/techniques used include:

- Polymer NIR spectrum / NIR sorting where objects are identified and pneumatically shot from the material stream (does not work with plastics containing carbon black)
- Melting point of different materials / extrusion with melt filtration whereby the molten plastics is passed over a metal filter grid in an extruder. Useful to remove polymer particles with higher melting points and residual mineral contamination.
- Washing lines / removes glues, a large amount of mineral (i.e. dirt) contamination, and food residues.

- Density sorting / by adding salt to water baths of varying density can be made to cut material fractions into different density by sink-float.
- Optical sorting / operators (or sometimes experiments are done with robots and AI) sort out based on morphology colour object type. (e.g. an operator knows that all CDs are PC, CD cases are PS, garden furniture is filled PP, etc.)

A piece of material with a few ppm or even a few ppb of PFAS does not change any property of the material to such an extend that would allow for any exploitation of such a property for a separation technology to effectively sort the material to a different (PFAS rich) fraction.

The only way that it would be possible to ensure that the 50 ppm TOF limit would be respected is for the defined input material to have sufficiently low PFAS content to create a recyclate that matches this limit. All plants treating specific input waste streams that give rise to recyclate that exceeds the 50 ppm TOF limit would need to stop operations. To shortly answer question 4c, the cost associated with the evisceration of entire subsectors of the plastics recycling industry would be… not insignificant.

Summary of first key recommendations:

- **To prevent an undefined legal state of recyclate either:**
    - **A general derogation from the 25 ppb 250 ppb limits for small PFAS in recyclate and articles incorporating recyclate; <u>or</u>**
    - **A switch to an exhaustive list of small PFAS to be regulated with the 25 ppb and 250 ppb limits.**

  The latter option would address the general compliance issue highlighted for non-recyclate derived materials and articles, would not create differentiation between the legal requirements for recyclate and virgin material, and therefore has our slight preference. Both options would retain a total regulation of the entire PFAS chemical universe through the 50 ppm TOF limit value.

ABOUT PLASTICS RECYCLERS EUROPE

Plastics Recyclers Europe is an organization representing the voice of the European plastics recyclers who reprocess plastic waste into high quality material destined for production of new articles. Recyclers are important facilitators of the circularity of plastics and the transition towards the circular economy.

Plastics recycling in Europe is a rapidly growing sector representing over €8.7 billion in turnover, 11.3 million tonnes of installed recycling capacity, more than 730 recycling facilities, and over 30,000 employees.

PLASTICS RECYCLERS EUROPE
Avenue de Broqueville 12 | 1150 Brussels – Belgium
+32 2 786 39 08

[redacted]@plasticsrecyclers.eu
www.plasticsrecyclers.eu