# PET Flake Injection

## Novel Technology Development

### Data Monitoring Report

report required by Article 13 of Regulation (EU) 2022/1616

10 October 2025 – updated 20 January 2026

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# Introduction

The novel technology '*PET Flake Injection'* was notified as required under Articles 10(2) and 10(3) of Commission Regulation (EU) 2022/1616 on 17th March 2023.

Article 13 of Commission Regulation (EU) 2022/1616 states the following:

"*a recycler operating a decontamination installation in accordance with Article 11* of the regulation *shall monitor the average contaminant level on the basis of a robust sampling strategy which samples the plastic input batches and the corresponding plastic output batches".*

On 10 October 2023, 10 April 2024, 10 October 2024 and 10 April 2025, four reports discussing the monitoring data and the information as required by Article 13(5) have been published. The enclosed report is based on the latest information from all installations using the novel technology received in accordance with Article 13(3) for the fifth monitoring period and provides the information required by Article 13(5) of the Regulation.

The different subsections (a) to (j) of Article 13(5) are discussed separately.

## a) Brief description of the novel technology – Art 13(5)(a)

The Flake Injection process has the capability to combine depolymerised recycled Polyethylene Terephthalate (rPET) with virgin material at different stages of a conventional PET production process for subsequent food contact use.

The input material of the Flake Injection process is previously processed PET as detailed in Table 2 of ANNEX I of COMMISSION REGULATION (EU) 2022/1616 that is deliberately depolymerized (pre-processed) before it enters the high surface area decontamination polymerisation reactor. Referring to the flow scheme Appendix I: Flake Injection – PET Production Process; previously processed PET may be introduced directly to injection point 1. or partially depolymerised with ethylene glycol, in either a stir-tank reactor or an extruder, to a defined degree of polymerisation to correspond with that of the polymer in the PET production process at the injection points labelled 2 to 6 in the flow scheme *or any points in-between*. This initial depolymerisation process of the previously processed PET allows for filtration of the intermediate polymer to remove solid contaminants before the introduction of the recycled material into a PET production process at a blend rate of up to 100% recycled content. The high surface area decontamination polymerisation technology increases the Intrinsic Viscosity (IV) of the PET polymer and removes polymerisation by-products under high vacuum of less than 20mbar, with a high temperature greater than 260°C and with a residence time greater than 30 minutes. This high surface area polymerisation technology also serves as a Decontamination Technology to efficiently remove vapourised contaminants that may have been introduced into the process further upstream by the addition of previously processed PET. Following the high surface area polymerisation and decontamination, the polymer melt is filtered for either direct use, or granulation, in the manufacture of food contact materials or articles or for introduction into a Solid State Polycondensation (SSP) process or a Conditioning Silo should further processing be needed to meet the material parameters required for its end use.

## b) Summary of the reasoning on the capability of the novel technology and the recycling process(es) to manufacture recycled plastic materials and articles that meet the requirements of Article 3 of Regulation (EC) No 1935/2004 and that are microbiologically safe – Art 13(5)(b)

All references in this section are references to documents available in the dossier submitted in accordance to Articles 10(2) and 10(3) of Commission Regulation (EU) 2022/1616 on 17th March 2023.

### Flake To Resin (FTR)

*Ref. ANNEX II Table 1 (1)* Decontamination efficiencies of the Novel Technology have been determined by Welle (2008).

Table VI. Concentrations (determined using the HFIP extraction method) of the surrogates in the investigated PET samples of Trial 2 (cocktail A at 10 ml $min^{-1}$, 50% PCR flakes).

| | Concentration (ppm) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Toluene | Chloroform | Chlorobenzene | Phenyl cyclohexane | Methyl salicylate | Benzophenone | Lindane |
| Calculated contamination concentration | 3295 | 5194 | 1255 | 327 | 1004 | 885 | 775 |
| Before deep-cleansing | 1999 ± 28 | 3075 ± 47 | 655 ± 9 | 163 ± 2 | <1.0 | 345 ± 1 | 133 ± 1 |
| After deep-cleansing (final product) | <2.7 | <0.8 | <0.9 | <0.2 | <1.0 | <0.2 | <0.8 |

The study concludes that the cleaning efficiencies for the applied surrogates are above or far above 99.9%. The high cleaning efficiencies are due to the high diffusion rates of compounds in the molten PET.

Based on EFSA's criteria for safety evaluation of PET recycling processes - if a recycling process is able to reduce an input reference contamination of 3 mg/kg PET to a Cres (Residual Concentration) not higher than a Cmod (Modelled Concentration) corresponding to the relevant migration criterion, the potential dietary exposure cannot be higher than 0.0025 µg/kg bw/day and recycled PET manufactured with such recycling process is not considered of safety concern.

*Ref. ANNEX II Table 1 (2)* Fraunhofer_*Dossier-FTR_20061109.pdf*

### Reversed Approach

Based on Safety Evaluation of Polyethylene Terephthalate Chemical Re-cycling Processes. Frank Welle. 'Reversed Approach'.

*Ref. ANNEX II Table 1 (3)* *Chemical_recycling_submitted.pdf*

**FTR:** Calculated maximum concentration (Reference Contamination – the level of contamination that the process can remove, i.e. Cmod:Cres =1) corresponding to a migration of 0.1 µg/l after storage for 365 d at 25 °C (EU cube, AP = 3.1, tau 1577 K, bottle wall thickness 200 µm, density of PET 1.4 $g/cm^3$). Decontamination Efficiency of 99.9%.

| mm Hg (25°C) | °C | g.mol$^{-1}$ | FTR | Reference Contamination | Decontamination Efficiency | *Cres* | *Cmod* | |
|---|---|---|---|---|---|---|---|---|
| Vapour Pressure | BP | Mw | Surrogate | mg/kg | % | mg/kg | mg/kg | Cmod:Cres |
| 28.4 | 110.6 | 92.1 | Toluene | **90** | 99.9% | 0.09 | 0.09 | 1.0 |
| 197 | 61.1 | 119.4 | Chloroform | **100** | 99.9% | 0.10 | 0.10 | 1.0 |
| 12 | 131.7 | 112.6 | Chlorobenzene | **90** | 99.9% | 0.09 | 0.09 | 1.0 |
| 0.0343 | 222.9 | 152.2 | Methyl Salicylate | **130** | 99.9% | 0.13 | 0.13 | 1.0 |
| 0.04 | 240.1 | 160.3 | Phenyl Cyclohexane | **140** | 99.9% | 0.14 | 0.14 | 1.0 |
| 0.00193 | 305.4 | 182.2 | Benzophenone | **160** | 99.9% | 0.16 | 0.16 | 1.0 |
| 9.40E-06 | 311.0 | 290.8 | Lindane | **310** | 99.9% | 0.31 | 0.31 | 1.0 |

## Artenius.

EFSA-Q-2011-00969 - EFSA refused to evaluate as out of the scope of Regulation (EC) 282/2008.

*Ref. ANNEX II Table 1 (7)* *EFSA_Letter Related to Artenius Unique Process.pdf*

*Ref. ANNEX II Table 1 (8)* *Fraunhofer Institute. Challenge Test.pdf*

## US FDA Guidance

Use of Recycled Plastics in Food Packaging (Chemistry Considerations): Guidance for Industry.

U.S. Department of Health and Human Services Food and Drug Administration Center for Food Safety and Applied Nutrition July 2021

VIII. Elimination of Data Recommendations for 3° Recycling Processes for PET and PEN

Based on a comprehensive review of all surrogate testing data submitted over the past decade for 3° recycling processes for PET and polyethylene naphthalate (PEN), FDA concludes that 3° recycling of PET or PEN by methanolysis or glycolysis results in the production of monomers or oligomers that are readily purified to produce a finished polymer that is suitable for food-contact use. Both 3° processes will clean the polyester sufficiently to allow it to be considered of suitable purity, even assuming 100% migration of residual surrogate to food. This is a significant difference from the surrogate testing of 2° recycling processes. Secondary recycling processes often produce PET that is insufficiently cleaned to withstand 100% migration calculations for the residual surrogates. Under these circumstances, FDA recommends additional migration tests to demonstrate that the finished PET meets the 1.5 µg/person/day EDI limit.

**Based on a determination that 3° recycling processes produce PET or PEN of suitable purity for food contact use, FDA no longer recommends that such recyclers submit data for agency evaluation.** Because 3° processes for polymers other than PET and PEN were not the subject of FDA reviews, recyclers who wish to engage in 3° recycling of polymers other than PET and PEN are encouraged to submit data for evaluation.

*Ref. ANNEX II Table 1 (9)* *Recycled-Plastics-Food-Packaging-Chemistry-ConsiderationsGuidance-04112022-1321.pdf*

## c) List a list of all substances with a molecular weight below 1000 Dalton found in the plastic inputs and recycled plastic output and 20 first detected incidental contaminants – Art 13(5)(c)

As developer of the Novel Technology, PET EUROPE has coordinated with the recyclers regarding the selection of the sampling strategy, the analysis to be performed and the selection of a third-party laboratory. The choice of the laboratory was based on its experience and expertise in analysing PET samples, the relevance of its analytical equipment and validated methods as well as the capability to identify and to risk assess non-intentionally added substances (NIAS) taking into account the particularity of this specific technology.

Analysis for the detection and quantification of substances in polymer represents a major challenge, especially when they are present at very low levels i.e. ppb levels. Although significant advances are regularly reported in the literature, reliable quantification of these substances to the ppb level and without compromising the integrity of the polymer is rarely feasible and certainly not standardized even for the most qualified laboratories. What is presented in this report has been obtained with the state-of-the-art analytical equipment (Table 6) that allows the detection of minute concentrations of various organic substances present in the input and output materials. The list of substances with a molecular weight below 1000 Dalton detected in the plastic input and its recycled output is given in Appendix II. The substances were sorted in descending order by their relative occurrence in the plastic input. The analytical methods do not distinguish between incidental contaminants and PET reaction products such as PET oligomers. In this report, incidental contaminants were identified by comparing the analytical data of the input samples with virgin PET samples analyzed under the same conditions and by the same analytical methods and literature data (Schreier *et al*., 2023).

Table 1 lists the 20 most frequently detected and identified incidental contaminants in the input material using the different analytical methods specified in section h.

The frequency of detection was determined by dividing the number of samples in which a particular substance was detected by the total number of samples analysed. The average concentration of the incidental contaminants was calculated by taking into account only those samples in which it was detected. If the incidental contaminant was detected but below the quantification limit, the concentration used to calculate the average concentration was the limit of quantification. If the incidental contaminant was not detected in the output (frequency of 0%), the limit of detection is reported in the Table.

This novel technology allows the input material to be introduced into the decontamination process at variable ratios of input material/virgin material. Therefore, the input material is sometimes diluted during the process with virgin material. The concentrations provided in Table 1 are the concentrations of incidental contaminants prior to any possible dilution. However, the dilution with virgin material is taken into account for the evaluation of the decontamination efficiency (section i).

Table 1: List of the first 25 detected incidental contaminants in the input material, their frequency of detection and average amounts in input and output samples.

| Substance | CAS | INPUT | | OUTPUT | |
|---|---|---|---|---|---|
| | | Frequency | Average (µg/kg PET) | Frequency | Average (µg/kg PET) |
| 1-Heptanol | 111-70-6 | 100% | <100 | 0% | <30.3 |
| 1-Nonanol | 143-08-8 | 100% | <100 | 0% | <30.3 |
| 2,5-Hexanediol, 2,5-dimethyl- | 110-03-2 | 100% | 115.88 | 91.67% | <100.00 |
| 2-Nonanone | 821-55-6 | 100% | 364.13 | 91.67% | <18.39 |
| 2-Propyl-1-pentanol | 58175-57-8 | 100% | 229.39 | 91.67% | <100 |
| Azulene | 275-51-4 | 100% | 15.62 | 0% | <3.33 |
| Benzene | 71-43-2 | 100% | <12.94 | 0% | <3.92 |
| Benzene, 4-ethyl-1,2-dimethyl- | 934-80-5 | 100% | <9.08 | 0% | <2.75 |
| Butanedioic acid, dimethyl ester | 106-65-0 | 100% | <18.39 | 91.67% | <18.39 |
| Cyclotetradecane | 295-17-0 | 100% | 17.87 | 91.67% | 26.30 |
| D-Limonene | 5989-27-5 | 100% | 120.64 | 8.33% | 110.17 |
| Dodecanoic acid | 143-07-7 | 100% | <18.39 | 83.33% | 65.37 |
| Ethylbenzene | 100-41-4 | 100% | 264.40 | 0% | <2.75 |
| Hexadecanoic acid, methyl ester | 112-39-0 | 100% | <18.39 | 91.67% | <18.39 |
| Octanal | 124-13-0 | 100% | 106.38 | 8.33% | 22.87 |
| Phenol, 4-(1,1-dimethylpropyl)- | 80-46-6 | 100% | >1000 | 91.67% | 550.99 |
| Propanoic acid, 2,2-dimethyl-, 2-ethylhexyl ester | 16387-18-1 | 100% | <13.7 | 91.67% | 117.36 |
| Propanoic acid, 3-ethoxy-, ethyl ester | 763-69-9 | 100% | 66.435 | 91.67% | 103.95 |
| Styrene | 100-42-5 | 100% | 57.112 | 0% | <2.75 |
| 1-Octanol | 111-87-5 | 90.91% | 103.43 | 0% | <30.3 |
| 2,6,10-Trimethyltridecane | 3891-98-3 | 90.91% | 90.45 | 83.33% | 75.32 |
| Benzene, 1-ethyl-4-methyl- | 622-96-8 | 90.91% | 133.43 | 91.67% | <9.08 |
| Benzene, 2-ethyl-1,4-dimethyl- | 874-41-9 | 90.91% | 26.14 | 0% | <2.75 |
| Benzene, propyl- | 103-65-1 | 90.91% | 29.63 | 0% | <2.75 |
| Hexanal | 66-25-1 | 90.91% | 38.61 | 0% | <7 |

For the inorganic analysis, a summary of the obtained analytical results is given in Table 2.

Table 2. Summary of the analytical results for inorganic elements.

| | INPUT | | OUTPUT | |
|---|---|---|---|---|
| | Frequency | Average (mg/kg PET) | Frequency | Average (mg/kg PET) |
| Al | 0% | <1.602 | 0% | <1.602 |
| Br | 91% | 5.64 | 100% | 5.29 |
| Ca | 100% | 11.88 | 100% | 7.15 |
| Cl | 91% | 11.15 | 100% | 7.49 |
| Co | 91% | 1.07 | 75% | 11.43 |
| Cr | 100% | 1.34 | 100% | 1.25 |
| Cu | 91% | 0.62 | 100% | 0.45 |
| Fe | 91% | 4.82 | 100% | 3.06 |
| K | 73% | 4.25 | 50% | 6.53 |
| Mg | 0% | <6.29 | 0% | <6.29 |
| Mn | 73% | 0.43 | 25% | 0.24 |
| Ni | 91% | 0.49 | 91.7% | 0.27 |
| P | 0% | <0.329 | 8.3% | 11.35 |
| Pb | 100% | 1.06 | 100% | 1.19 |
| Sb | 100% | 254.17 | 100% | 260.70 |
| Ti | 91% | 3.32 | 83.3% | 2.97 |
| Zn | 91% | 1.20 | 100% | 0.87 |

The high average level of cobalt in the output material is due to the intentional addition of a cobalt-containing substance during the production of the output material by one of the members of the consortium.

Apart from the detection of 4,4-Methylenedianiline in 2 input samples below the limit of quantification of 4.55 µg/kg, none of the analysed primary aromatic amines (Table 7) were detected in the input or output samples.

No BPA, BPF or BPS was detected with targeted analysis in the input samples but BPA was detected in one of the output samples in a concentration of 47.1 µg/kg.

## d) List of contaminating materials regularly present in the plastic input - Art 13(5)(d)

Table 3 lists the contaminating materials regularly present in the PET plastic input.

Table 3. Contaminating materials regularly present in the PET plastic input.

| Contaminating material | |
|---|---|
| PVC | <50 mg/kg input |
| Polyolefin (caps/labels) | <20 mg/kg input |
| Other Polymers | <100 mg/kg input |
| Metal | <10 mg/kg input |
| Other Inert Materials | <30 mg/kg input |

## e) Analysis of the most likely origin of the identified contaminants referred to in points (c) and (d) - Art 13(5)(e)

Contaminating materials

Depending on the collection and sorting process, post-consumer PET waste can contain a limited amount of other materials such as polyolefins, polyvinyl Chloride (PVC), polyamide (PA), ethylene vinyl alcohol (EVOH), polystyrene (PS) and fillers. These materials originate from the following sources:

- Polyolefins like polyethylene (PE) and polypropylene (PP) are used to manufacture bottle closures and are present in a wide range of other plastic products.
- PVC is used in the manufacturing of certain labels and sleeves for bottles.
- PS is used in disposable cups and other packaging materials.
- EVOH is used as oxygen barrier in food packaging.
- PA is often used as barrier layer in flexible packaging films.
- Fillers are used in plastic packaging materials to modify their properties and enhance their performance.

Incidental contaminants

The likely origin of the incidental contaminants detected in the input material (Table 1) is as follows:

- 1-heptanol; 1-octanol: used as emulsifiers or surfactants in cosmetics or cleaning agents or can originate from the breakdown of lubricants used in plastic manufacturing mainly during thermal processing.
- 1-nonanol: listed in Annex I of (EU) 10/2011
- 2-nonanone: food flavouring (Regulation (EC) No 1334/2008) and used in washing & cleaning products, cosmetics and personal care products.
- 2-Propyl-1-pentanol: could originate from plasticizers or lubricant additives used in contaminating materials (other plastics).
- azulene: is popular in cosmetic and medical products for sensitive or irritated skin.
- benzene: most probably formed from the breakdown of contaminating PVC material through a heat induced reaction (Thoden van Velzen et al., 2020)
- Dodecanoic acid; Butanedioic acid, dimethyl ester; Hexadecanoic acid, methyl ester, octanal, hexanal: is used as food flavouring (Regulation (EC) No 1334/2008)
- D-limonene: since a large fraction of PET bottles is used to pack flavoured beverages, the flavour substance limonene is found in nearly all post-consumer PET waste streams (Franz *et al*., 2004).
- cyclotetradecane: could originate from fragrances or specialty waxes.
- phenol, 4-(1,1-dimethylpropyl)-: is used in the manufacture of a.o. adhesives and rubber products.
- Propanoic acid, 2,2-dimethyl-, 2-ethylhexyl ester: reported as widely used in the production of cosmetics and personal care products.
- Propanoic acid, 3-ethoxy-, ethyl ester: used in cleaning and degreasing agents and as solvent in inks, paints and coatings.
- styrene: monomer used in the manufacture of thermoplastics used in packaging materials and articles (ECHA, 2025).
- Benzene, 4-ethyl-1,2-dimethyl-benzene, 1-ethyl-4-methyl-; Benzene, 2-ethyl-1,4-dimethyl-; benzene, propyl-; benzene, ethyl-: aromatic hydrocarbons that can originate for example from inks, or the decomposition of certain plastics, antioxidants or plasticizers.

- 2,6,10-trimethyltridecane: isoparaffin used in for example synthetic lubricant.

## f) Measurement or estimation of the migration levels to food of contaminants present in the recycled plastic materials and articles - Art 13(5)(f)

An estimation of the migration levels was made based on the average levels of incidental contaminants in the output samples in which they were detected (Table 1) and assuming a worst case total migration to food using the average weight of 27.2g PET for a one litre PET bottle (Table 4).

Table 4. Worst case migration of the 25 first incidental contaminants present in the output samples.

| Name | CAS | OUTPUT | | TOTAL MIGRATION* Average (µg/kg food) |
|---|---|---|---|---|
| | | Frequency | Average (µg/kg PET) | |
| 1-Heptanol | 111-70-6 | 0% | <30.3 | <0.82 |
| 1-Nonanol | 143-08-8 | 0% | <30.3 | <0.82 |
| 2,5-Hexanediol, 2,5-dimethyl- | 110-03-2 | 91.67% | <100 | <2.72 |
| 2-Nonanone | 821-55-6 | 91.67% | <18.39 | <0.50 |
| 2-Propyl-1-pentanol | 58175-57-8 | 91.67% | <100 | <2.72 |
| Azulene | 275-51-4 | 0% | <3.33 | <0.09 |
| Benzene | 71-43-2 | 0% | <3.92 | <0.11 |
| Benzene, 4-ethyl-1,2-dimethyl- | 934-80-5 | 0.00% | <2.75 | <0.07 |
| Butanedioic acid, dimethyl ester | 106-65-0 | 91.67% | <18.39 | <0.50 |
| Cyclotetradecane | 295-17-0 | 91.67% | 26.30 | 0.72 |
| D-Limonene | 5989-27-5 | 8.33% | 110.17 | 3.00 |
| Dodecanoic acid | 143-07-7 | 83.33% | 65.37 | 1.78 |
| Ethylbenzene | 100-41-4 | 0% | <2.75 | <0.07 |
| Hexadecanoic acid, methyl ester | 112-39-0 | 91.67% | <18.39 | <0.50 |
| Octanal | 124-13-0 | 8.33% | 22.87 | 0.62 |
| Phenol, 4-(1,1-dimethylpropyl)- | 80-46-6 | 91.67% | 550.99 | 14.99 |
| Propanoic acid, 2,2-dimethyl-, 2-ethylhexyl ester | 16387-18-1 | 91.67% | 117.36 | 3.19 |
| Propanoic acid, 3-ethoxy-, ethyl ester | 763-69-9 | 91.67% | 103.95 | 2.83 |
| Styrene | 100-42-5 | 0% | <2.75 | <0.07 |
| 1-Octanol | 111-87-5 | 0% | <30.3 | <0.82 |
| 2,6,10-Trimethyltridecane | 3891-98-3 | 83.33% | 75.32 | 2.05 |
| Benzene, 1-ethyl-4-methyl- | 622-96-8 | 91.67% | <9.08 | <0.25 |
| Benzene, 2-ethyl-1,4-dimethyl- | 874-41-9 | 0% | <2.75 | <0.07 |
| Benzene, propyl- | 103-65-1 | 0% | <2.75 | <0.07 |
| Hexanal | 66-25-1 | 0% | <7 | <0.19 |

*considering 1L beverage filled in a PET bottle of 27.2g

The worst case estimation of the migration levels of the inorganic substances is shown in Table 5.

Table 5. Worst case migration of incidental contaminants present in the output samples.

| | OUTPUT | | TOTAL MIGRATION* Average (mg/kg food) |
|---|---|---|---|
| | Frequency | Average (mg/kg PET) | |
| Al | 0% | <1.602 | <0.044 |
| Br | 100% | 5.29 | 0.14 |
| Ca | 100% | 7.15 | 0.19 |
| Cl | 100% | 7.49 | 0.20 |
| Co | 75% | 11.43 | 0.31 |
| Cr | 100% | 1.25 | 0.03 |
| Cu | 100% | 0.45 | 0.01 |
| Fe | 100% | 3.06 | 0.08 |
| K | 50% | 6.53 | 0.18 |
| Mg | 0% | <6.29 | <0.17 |
| Mn | 25% | 0.24 | 0.01 |
| Ni | 91.7% | 0.27 | 0.01 |
| P | 8.3% | 11.35 | 0.31 |
| Pb | 100% | 1.19 | 0.03 |
| Sb | 100% | 260.70 | 7.09 |
| Ti | 83.3% | 2.97 | 0.08 |
| Zn | 100% | 0.87 | 0.02 |

*considering 1L beverage filled in a PET bottle of 27.2g

## g) Description of the applied sampling strategy - Art 13(5)(g)

The PET Flake Injection recycling technology is a technology that is used for over 10 years to produce PET with recycled content for food contact applications. The individual recyclers using this technology have proven records that the output produced by recycling installation applying this technology is stable and complies with the requirements of Framework Regulation (EC) 1935/2004 and Plastics Regulation (EU) No 10/2011. Therefore, the sampling frequency of the monitoring was reduced to one sample per recycler per monitoring cycle of 6 months.

In total 11 input batches and 12 corresponding output batches (11 pellet samples and 1 film sample) were collected. The samples were analysed for the following substances:

- Volatile substances,
- Semi-volatile substances,
- Non-volatile substances,
- Inorganic substances,
- Primary aromatic amines
- Bisphenols A, F and S
- Common plastic additives.

The analysis was carried out by an independent third-party analytical laboratory.

The laboratory was chosen based on its experience and expertise in analysing PET samples and its relevant analytical equipment and validated methods.

## h) Description of the analytical procedures and methods used - Art 13(5)(h)

Samples of PET input batches and their corresponding output batches were labelled for traceability purposes and shipped in clear and hermetically sealed containers.

The sample preparation methods and analytical procedures and methods used for the analysis of the samples as well as their limits of detection and quantification are summarised in Table 6. In all cases, 3 independent replicates were analysed.

Analysis of organic substances is done through a non-targeted screening of volatile, semi-volatile and non-volatile substances with different methods (Table 6).

Table 6. Applied analytical procedures and methods including their limits of detection and quantification.

| | Sample preparation | Analytical method | LOD | LOQ |
|---|---|---|---|---|
| Non-target screening of volatile and semi-volatile substances | Cryogenic milling 0.5 mm | HS-SPME-GC/MS, extraction 20 min @80°C | Between 2.51 and 30.3 µg/kg PET | Between 8.28 and 100 µg/kg PET |
| Non-target screening of semi and non-volatile substances | Cryogenic milling, dissolution in HFIP followed by precipitation of the polymer in methanol. | UPLC-MS-QTOF | Between 0.43 and 5.3 mg/kg PET | Between 1.44 and 17.6 mg/kg PET |
| Targeted analysis of inorganic substances (Annex II of EU 10/2011) | | TRXRF | Between 0.002 and 6.29 mg/kg PET | / |
| Bisphenols A, S and F | | UPLC-QqQ, negative mode | 38.5 µg/kg PET | / |
| Targeted analysis of common non-volatile additives | | UPLC-MS-MS | Between 50 and 2750 µg/kg PET | / |
| Primary aromatic amines | Migration in 3% acetic acid, 2h@70°C | UPLC-QqQ-MS, positive mode | Between 0.19 and 8.4 µg/kg PET | Between 0.63 and 27.72 µg/kg PET |

HS: Head Space; SPME: Solid phase micro-extraction; GC: Gas chromatography; MS: Mass spectroscopy; QqQ: triple quadrupole; QToF: Quadrupole- time-of-flight; UPLC: ultra-high performance liquid chromatography; TRXRF: Total Reflexion XR Fluorescence; HFIP: 1,1,1,3,3,3-hexafluoroisopropanol
LOD: limit of detection; LOQ: limit of quantification

For volatile substances, a solid phase microextraction in headspace mode connected to GC-MS method (HS-SPME-GC-MS) is used which is a versatile technique employed in a wide range of industries and research areas to identify, quantify, and characterize volatile and semi-volatile compounds in plastic/polymer samples. The concentration of the volatile and semi volatile compounds on the SPME microfibre increases a lot the sensitivity of the method in such a way that most of the volatile substances can be detected at very low concentrations. The adsorption conditions for SPME of 20 mins@80°C specifically allow the exhaustive extraction of volatile substances present in PET without degrading the sample. The detection is done by MS and by using Mass Spectrometry–Data Independent AnaLysis (MS-DIAL), an open-source software platform used for identifying compounds from the MS chromatograms.

Its capabilities include deconvolution of complex MS data, retention time alignment, and identification of a wide range of metabolites, including those present at low concentrations or with unknown structures (Estremera *et al*., 2025). It minimizes subjective human assessment by applying standardized, algorithm-based peak deconvolution and library-driven identification with transparent scoring metrics. Substance identification was performed using the NIST20 database (Match > 850) and retention index values (85% tolerance) which were calculated injecting an alkane solution (C8-40) in the same conditions as the analytes. Substances were (semi-)quantified by injecting known concentrations of commercially available standards corresponding to the detected substances. Calibration curves were prepared from these standards for the quantification. In the absence of a pure standard of the identified substance, the identified substance was semi-quantified with another substance of similar chemical structure.

For semi-volatile and non-volatile substance, the samples were first extracted. The solvent and extraction conditions have been chosen to swell the polymer, without generating new substances (Nerin *et al*., 2022). The extracts were analysed using GC/MS and LC/MS-QToF for semi-volatile and non-volatile substances, respectively. High-resolution MS detectors like the QToF provide accurate masses isotopic patterns and intensities, which can lead to theoretical information about composition of fragments (Peters *et al*. 2019). This allows for the identification of unknown NIAS. The identification of a given substance was based on its retention time, mass spectrum and the comparison of its analysis against commercial standards. PET oligomers were quantified with the commercially available $C_{20}H_{16}O_8$ PET oligomer standard.

The application ranges of the above used non-targeted screening methods overlap but the sensitivity of the methods is different. In case the same substance was detected by different methods, the highest concentration of both analyses was reported.

For the screening for primary aromatic amines a dedicated method was used as the concentration level of interest is so low that general non-target screening methods cannot detect them (Nerin *et al*., 2022). The primary aromatic amines were analysed after migration into 3% acetic acid for 2h at 70°C. Table 7 lists the primary aromatic amines that have been analysed.

Table 7. List of primary aromatic amines analysed.

| Name | CAS | Name | CAS |
|---|---|---|---|
| *p*-Fenilendiamine | 106-50-3 | 3,3'-Dimethylbenzidine | 119-93-7 |
| *m*- Fenilendiamine | 108-45-2 | 2,6-Dimethylaniline | 87-62-7 |
| 2,6-Toluendiamine | 823-40-5 | 4,4'-Thiodianiline | 139-65-1 |
| 4-Methoxy-*m*-phenylenediamine | 615-05-4 | 2,4-Dimethylaniline | 95-68-1 |
| 2,4-Toluendiamine | 95-80-7 | 2-Naphtylamine | 91-59-8 |
| 1,5-Diaminonaphtalene | 2243-62-1 | 4,4-Methylenedi-*o*-toluidine | 838-88-0 |
| Aniline | 62-53-3 | 4-Aminobiphenyl | 92-67-1 |
| Benzidine | 92-87-5 | 4-Aminoazobenzene | 60-09-3 |
| *o*-Anisidine | 90-04-0 | 5-Nitro-o-toluidine | 99-55-8 |
| 4,4-Oxidianiline | 101-80-4 | 2,4,5-Trimethylaniline | 137-17-7 |
| o-Toluidine | 95-53-4 | 4-Chloro-o-toluidine | 95-69-2 |
| 4-Chloroaniline | 106-47-8 | o-Aminoazotoluene | 97-56-3 |
| 4,4-Methylenedianiline | 101-77-9 | 3,3-Dichlorobenzidine | 91-94-1 |
| *o*-Dianisidine | 119-90-4 | 4,4-Methylene-bis-(2-chloroaniline) | 101-14-4 |
| 2-Methoxy-5-m-toluidine | 120-71-8 | | |

The method used to analyse inorganic substances was adapted during the various monitoring periods. For the monitoring reports published on 10 October 2023 and 10 April 2024 , inorganic substances were analysed using ICP-MS after digestion of the samples. However, due to equipment issues, Total Reflexion X-Ray Fluorescence (TRXRF) was used for the subsequent monitoring reports. The previous report, published on 10 April 2025, showed that levels of antimony were generally lower than would have been expected for PET. This lower concentration was attributed to the samples being stored longer than usual after dissolution as part of the sample preparation process, which likely resulted in the precipitation of Sb-glycolate. Precipitation of other metals could not be ruled out. Therefore, for this monitoring period, samples were prepared immediately prior to analysis. Inorganic elements analysed were Al, Br, Ca, Cl, Co, Cr, Cu, Fe, K, Mg, Mn, Ni, P, Pb, Sb, Ti and Zn.

The independent third-party laboratory follows ISO17025 quality control measures and all analytical methods are validated.

## i) Analysis and explanation of any discrepancies observed between contaminant levels expected and decontamination efficiency - Art 13(5)(i).

**Detected contaminant levels**

Overall, the levels of incidental contaminants detected in the input samples are in the µg/kg range and are far below the conservative reference level of incidental contaminants of 3 mg/kg PET, considered by EFSA in its scientific guidance on post-consumer mechanical PET recycling processes (2024). The concentration of the different contaminants in the different input samples are quite similar. The same is true for the output samples with the exception of the film sample that showed a different profile than the pellet output samples for several substances. Unexpected is the presence of D-limonene in the film output sample.

The incidental contaminants detected with a high frequency in the input samples are not unexpected (see section e).

Some of the most frequently detected incidental contaminants or inorganic elements were sometimes also detected in the output samples, but generally at a lower frequency and at a lower concentration. A safety assessment was carried out based on the following considerations:

- Exposure: the worst case migration levels were calculated by making the assumption of no reaction and 100% migration and by applying a beverage/PET bottle ratio of 1L/27.2 g PET and using the concentrations measured in the PET output. In case the substance was not detected in the PET output, the limit of detection (LOD) of the analytical method was used for the calculations.

- Hazard: the following principles were used in order of priority:
    - If the substance is listed in Annex I to Regulation (EU) No 10/2011 and has an SML, the specified limit is applied. If the limit belongs to a group, the group limit is applied to the sum of all the substances in the group. If the substance is listed in Annex I to the Regulation (EU) No 10/2011 with no SML, the 60 mg/kg food limit is applied.

- For the remaining substances, the human exposure threshold values according to the Threshold of Toxicological Concern (TTC) approach were used (EFSA, 2019). The infant exposure scenario A was applied to establish the migration limits (EFSA , 2024) (Table 8).

Table 8. Migration limits for different classes of substances

| | Human exposure threshold value (EFSA, 2019) (µg/kg bw/per day) | Migration limit* (µg/kg food ) | Migration limit* in case of worst case calculation or modelling (µg/kg food) | |
|---|---|---|---|---|
| | | | substances ≤ 150 Da | substances > 150 Da |
| **Genotoxic substances** | 0.0025 | 0.00962 | 0.0481 | 0.0962 |
| **Organophosphates or carbamates** | 0.3 | 1.15 | 5.75 | 11.5 |
| **Cramer class III substances** | 1.5 | 5.8 | 29 | 58 |
| **Cramer class II substances** | 9 | 34.6 | 173 | 346 |
| **Cramer class I** | 30 | 115 | 575 | 1150 |

*EFSA scenario A (infant consuming water) (EFSA, 2024)

The potential for genotoxicity of substances was assessed using EFSA or JECFA evaluations, prepared for example in support of their inclusion in Regulation (EC) 1334/2008 on flavourings and food ingredients with flavouring properties or Regulation (EC) No 1333/2008 on food additives. In the absence of such an evaluation, the Toxtree software[1] is used to predict their genotoxic potential. This software is also used to further assign substances into Cramer classes I, II or III.

- Specific case: For benzene the safety limit/regulatory limit that has been applied is the limit in drinking water.

- Risk assessment: for each substance, the migration limit that was defined based on the hazard assessment, was compared to the worst case exposure levels. If the worst case exposure level is lower than the migration limit, it was concluded that the substance does not give rise to safety concern. In case the worst-case exposure level exceeded the determined migration limit, the following was considered in order of priority:

    1. The application of overestimation factors: Since EFSA (2024) acknowledges that generally recognized diffusion migration models overestimate migration by a factor of 5 for substances ≤ 150 Da and by a factor of 10 for substances > 150 Da, the worst case exposure levels that were calculated using 100% migration can be considered to also overestimate migration by at least these factors.

[1] Toxtree version v3.1.0, May 2018

2. The application of migration modelling applying the modelling parameters used by EFSA (2024): the modelled concentration in PET (Cmod) that corresponds to a migration that is not expected to give rise to a dietary exposure that would exceed the established migration limit was calculated. The Cmod was calculated for the established migration limits for genotoxic substances, Cramer I, II and III substances for different surrogate contaminants. The concentration of the incidental contaminant in the output material (Cres) was compared to the calculated Cmod of a surrogate contaminant that is representative for the incidental contaminant. If the Cres is not higher than the Cmod, it was concluded that the substance does not give rise to a safety concern.

Worst case exposure assessment and hazard assessment for incidental contaminants and inorganic elements are summarised in Table 9 and 10, respectively.

As demonstrated in Table 9, none of the 25 first incidental contaminants do give rise to a safety concern at the concentrations present in the PET output material or, for substances present in the input plastic but not in the PET output, at the LOD levels.

With regard to the inorganic substances detected in the output samples, the worst case migration level would exceed the migration limits established in Regulation (EU) No 10/2011 for cobalt, antimony, chromium and lead.

Regarding antimony, Welle and Franz (2011) showed that, due to the extremely low diffusion coefficients of antimony species in PET, the SML will not be exceeded under standard use of PET at room temperature and/or hotfill conditions with antimony concentrations up to 350 mg/kg. Since antimony levels in the output samples were below these levels, there would be no safety concern.

For cobalt, chromium and lead, no such studies are available. Since the exact molecular identity under which inorganic substances are present in the PET is not known, migration modelling cannot be performed and only migration testing can rule out the risk of exceeding the migration limits. Consortium members have done migration testing on different output batches and confirmed compliance with the migration limits of Annex II of Regulation (EU) No 10/2011. In addition, verification of compliance with migration limits established in Regulation (EU) No 10/2011 is part of the routine compliance work performed by the users of the material.

Table 9. Summary of risk assessment of substances in the output samples

| Name | CAS | Frequency | Concentration Output (µg/kg PET) = Cres | TOTAL MIGRATION* average (µg/kg food) | Hazard | Migration Limit (µg/kg food) | Migration limit applying OF** (µg/kg food) | Cmod EFSA Ap model (µg/kg PET) |
|---|---|---|---|---|---|---|---|---|
| **1-Heptanol** | 111-70-6 | 0% | <30.3 | <0.82 | Toxtree: Cramer I | 115.38 | | |
| **1-Nonanol** | 143-08-8 | 0% | <30.3 | <0.82 | FCM331 w/o SML I | 60000 | | |
| **2,5-Hexanediol, 2,5-dimethyl-** | 110-03-2 | 91.67% | <100 | <2.72 | Toxtree: Cramer I | 115.38 | | |
| **2-Nonanone** | 821-55-6 | 91.67% | <18.39 | <0.50 | JECFA opinion ((EC) No. 1334/2008); Toxtree: Cramer I | 115.38 | | |
| **2-Propyl-1-pentanol** | 58175-57-8 | 91.67% | <100 | <2.72 | Toxtree: Cramer I | 115.38 | | |
| **Azulene** | 275-51-4 | 0% | <3.33 | <0.09 | Toxtree: Structural alert genotox carcinogenicity | 0.0096 | 0.0481 | 40 (toluene as reference) |
| **Benzene** | 71-43-2 | 0% | <3.92 | <0.11 | EU Drinking water limit: 1 µg/L | 1 | | |
| **Benzene, 4-ethyl-1,2-dimethyl-** | 934-80-5 | 0% | <2.75 | <0.07 | Toxtree: Cramer I | 115.38 | | |
| **Butanedioic acid, dimethyl ester** | 106-65-0 | 91.67% | <18.39 | <0.50 | Toxtree: Cramer I | 115.38 | | |
| **Cyclotetradecane** | 295-17-0 | 91.67% | 26.30 | 0.72 | Toxtree: Cramer II | 34.62 | | |
| **D-Limonene** | 5989-27-5 | 8.33% | 110.17 | 3.00 | EFSA opinion ((EC) No. 1334/2008); Toxtree: Cramer I | 115.38 | | |
| **Dodecanoic acid** | 143-07-7 | 83.33% | 65.37 | 1.78 | FCM330 w/o SML | 60000 | | |
| **Ethylbenzene** | 100-41-4 | 0% | <2.75 | <0.07 | Toxtree: Cramer I | 115.38 | | |
| **Hexadecanoic acid, methyl ester** | 112-39-0 | 91.67% | <18.39 | <0.50 | Toxtree: Cramer I | 115.38 | | |
| **Octanal** | 124-13-0 | 8.33% | 22.87 | 0.62 | JECFA opinion ((EC) No. 1334/2008); Toxtree: Cramer I | 115.38 | | |
| **Phenol, 4-(1,1-dimethylpropyl)-** | 80-46-6 | 91.67% | 550.99 | 14.99 | Toxtree: Cramer I | 115.38 | | |
| **Propanoic acid, 2,2-dimethyl-, 2-ethylhexyl ester** | 16387-18-1 | 91.67% | 117.36 | 3.19 | Toxtree: Cramer I | 115.38 | | |
| **Propanoic acid, 3-ethoxy-, ethyl ester** | 763-69-9 | 91.67% | 103.95 | 2.83 | Toxtree: Cramer I | 115.38 | | |
| **Styrene** | 100-42-5 | 0% | <2.75 | <0.07 | Toxtree: Cramer I | 115.38 | | |

Table 9. Summary of risk assessment of substances in the output samples (continued)

| Name | CAS | Frequency | Concentration Output (µg/kg PET) = Cres | TOTAL MIGRATION* average (µg/kg food) | Hazard | Migration Limit (µg/kg food) | Migration limit applying OF** (µg/kg food) | Cmod EFSA Ap model (µg/kg PET) |
|---|---|---|---|---|---|---|---|---|
| **1-Octanol** | 111-87-5 | 0% | <30.3 | <0.82 | Toxtree: Cramer I | 115.38 | | |
| **2,6,10-Trimethyltridecane** | 3891-98-3 | 83.33% | 75.32 | 2.05 | Toxtree: Cramer I | 115.38 | | |
| **Benzene, 1-ethyl-4-methyl-** | 622-96-8 | 91.67% | <9.08 | <0.25 | Toxtree: Cramer I | 115.38 | | |
| **Benzene, 2-ethyl-1,4-dimethyl-** | 874-41-9 | 0% | <2.75 | <0.07 | Toxtree: Cramer I | 115.38 | | |
| **Benzene, propyl-** | 103-65-1 | 0% | <2.75 | <0.07 | Toxtree: Cramer I | 115.38 | | |
| **Hexanal** | 66-25-1 | 0% | <7 | <0.19 | JECFA opinion ((EC) No. 1334/2008); Toxtree: Cramer I | 115.38 | | |

*considering 1L beverage filled in a PET bottle of 27.2g

**OF= overestimation factor (EFSA, 2024)

Table 10. Results of the safety evaluation of the incidental contaminants

| | Frequency | TOTAL MIGRATION* Average (mg/kg food) | EU 10/2011 - Annex II (SML (mg/kg food)) |
|---|---|---|---|
| Al | 0% | <0.044 | 1 |
| Br | 100% | 0.14 | / |
| Ca | 100% | 0.19 | 60 |
| Cl | 100% | 0.20 | / |
| Co | 75% | 0.31 | 0.05 |
| Cr | 100% | 0.03 | ND |
| Cu | 100% | 0.01 | 5 |
| Fe | 100% | 0.08 | 48 |
| K | 50% | 0.18 | 60 |
| Mg | 0% | <0.17 | 60 |
| Mn | 25% | 0.01 | 0.6 |
| Ni | 91.7% | 0.01 | 0.02 |
| P | 8.3% | 0.31 | / |
| Pb | 100% | 0.03 | ND |
| Sb | 100% | 7.09 | 0.04 |
| Ti | 83.3% | 0.08 | / |
| Zn | 100% | 0.02 | 5 |

*considering 1L beverage filled in a PET bottle of 27.2g
ND: not detectable with detection limit of minimum 0.01 mg/kg PET

**Decontamination efficiency**

As indicated in section b, it was determined, based on the results of a challenge study, that the decontamination efficiency of the Flake Injection Novel Technology was above or far above 99.9%.

In this report, the decontamination efficiencies for the different incidental contaminants in the samples were calculated based on the levels of incidental contaminants in the input and output samples. For the calculation, the following rules were applied:

- Whenever the concentration in a sample is below the limit of quantification or the limit of detection, the value of the limit of quantification or the value of the limit of detection, respectively, was used.
- To ensure that the calculated decontamination efficiencies are not artificially increased[2] by a potential dilution with virgin material, the measured concentrations of incidental contaminants in the input material (Table 1) were corrected for the percentage virgin material used to produce the analysed batches of output material, as explained in section c.

As a result, the calculated concentration of incidental contaminants in the input material was frequently below the limit of detection of the substance. In such a case, if the substance was not detectable in the output material, the calculation generates a seemingly negative decontamination efficiency that is not

[2] Article 13 of Regulation (EU) 2022/1616[2] requires that residual contaminant levels in the output are determined before any dilution of the output material

relevant because it is not a real decontamination efficiency. Similarly, if the concentration of the incidental contaminant is below the limit of detection or the limit of quantification in both the input and the output sample, the obtained decontamination efficiency value is also not relevant as it is not the actual value.

There is also not always an explicable correlation between the levels detected in the input samples and those found in the output samples. This is most probably due to the industrial scale of the recycling operations where the input batch is not perfectly homogenous combined with the fact that, in comparison, only relatively small sample sizes are used for the analysis. It is also not possible to completely rule out analytical artefacts, even if this is not the most likely causal explanation.

While high decontamination efficiencies (values up to >99.46%) were found for most incidental contaminants in several input-output sample sets, the average decontamination efficiency cannot be demonstrated for all the incidental contaminants of the sample sets due to the limitations described above.

In addition, it is technically impossible to confirm a decontamination efficiency of 99.9% as reported in the Novel Technology dossier due to the analytical limitations associated with the relatively low levels of incidental contaminants detected in the input materials. Despite the very low analytical detection limits of the applied state-of-the art analytical equipment, the concentration of the incidental contaminants in the input material needs to be 1000 times higher than the detection limit to be able to demonstrate a decontamination efficiency of 99.9%. This was never observed in the analysed input samples.

For some substances negative decontamination efficiencies are obtained in all sample sets with exception of the film sample set. It concerns the following substances:

- dodecanoic acid,
- pentanoic acid,
- propanoic acid, 2,2-dimethyl-, 2-ethylhexyl ester, and
- propanoic acid, 3-ethoxy-, ethyl ester.

These organic acids, that have not been detected during previous monitoring periods, can be used in personal care products and fragrances (see section e). Although unlikely, contamination during sample handling could potentially be at the origin of this.

In conclusion, although there are a number of indications that the Flake Injection Novel Technology can achieve a high decontamination efficiency, a decontamination efficiency of 99.9% cannot be practically confirmed with the current samples and monitoring testing methodology as defined in Article 13 of Regulation (EU) 2022/1616 mainly due to analytical limitations.

## j) a discussion of the differences with previous reports published in accordance with this paragraph, if any - Art 13(5)(j)

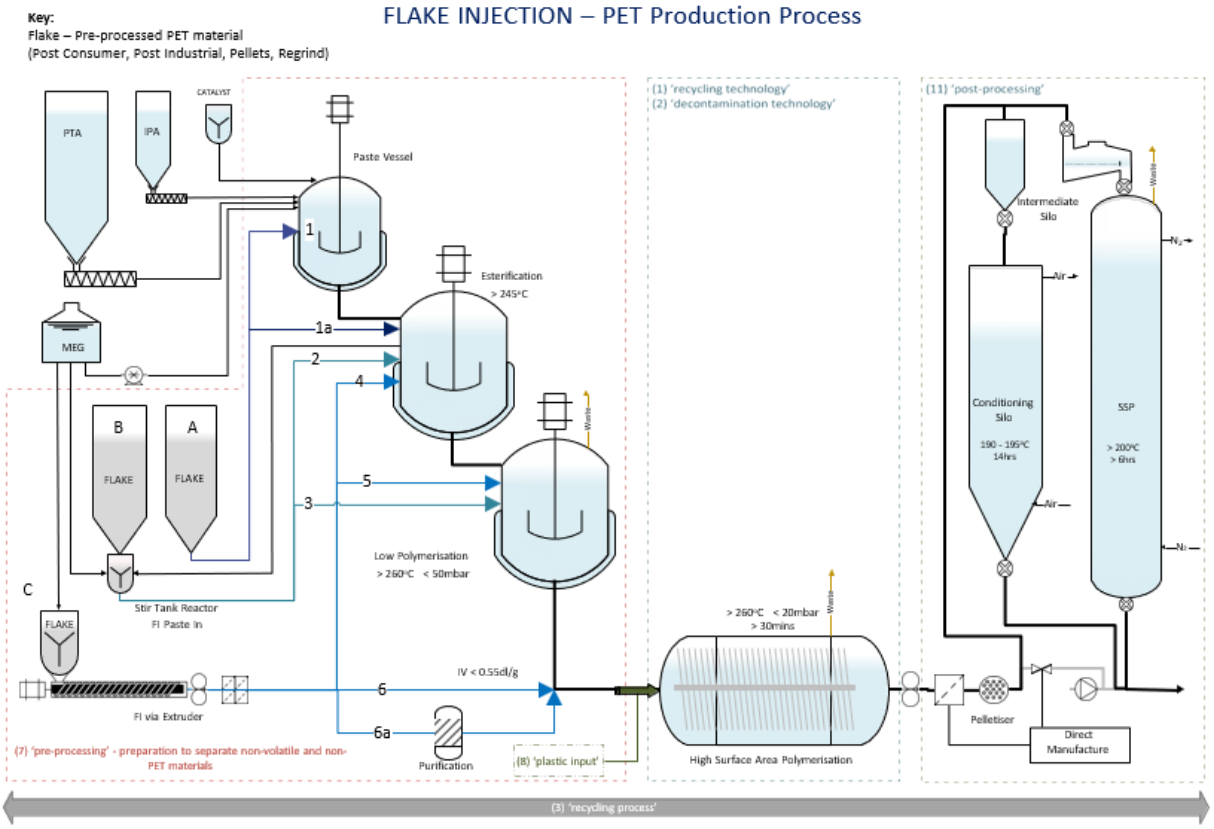
Compared to previous monitoring reports, where high variations in concentrations of the individual contaminants between the different samples were sometimes observed, the concentrations of the different contaminants in the different input samples are quite similar. The same is true for the output samples, except for the film sample, which showed a different profile than the pellet output samples for several substances. The presence of D-limonene in the film output sample was unexpected. In none of the previous monitoring reports, limonene was detected in the output sample.

Due to differences in the analytical methods used for the different monitoring reports, the levels of inorganic substances detected in the samples vary over time. For this monitoring report, the sample

preparation was optimised to prevent the precipitation of inorganic substances. The consistency of the data will be monitored in the next monitoring periods.

For some carboxylic acids, negative decontamination efficiencies have been observed in almost all sample sets. In previous reports, certain carboxylic acid also detected in virgin PET were only occasionally slightly higher in the output than in the input sample.

# Appendix I –.FLAKE INJECTION – PET Production Process



## Appendix II – List of all substances with a molecular weight below 1.000 Dalton found in the plastic inputs to each of the decontamination installations and in the recycled plastic output thereof, sorted in descending order by their relative occurrence

| Name | Formula | CAS | Frequency INPUT | Frequency OUTPUT |
|---|---|---|---|---|
| 1-Heptanol | C7H16O | 111-70-6 | 100% | 0% |
| 1-Nonanol | C9H20O | 143-08-8 | 100% | 0% |
| 2,5-Hexanediol, 2,5-dimethyl- | C8H18O2 | 110-03-2 | 100% | 91.67% |
| 2-Nonanone | C9H18O | 821-55-6 | 100% | 91.67% |
| 2-Propyl-1-pentanol | C8H18O | 58175-57-8 | 100% | 91.67% |
| Azulene | C10H8 | 275-51-4 | 100% | 0% |
| Benzene | C6H6 | 71-43-2 | 100% | 0% |
| Benzene, 4-ethyl-1,2-dimethyl- | C10H14 | 934-80-5 | 100% | 0% |
| Butanedioic acid, dimethyl ester | C6H10O4 | 106-65-0 | 100% | 91.67% |
| Cyclotetradecane | C14H28 | 295-17-0 | 100% | 91.67% |
| D-Limonene | C10H16 | 5989-27-5 | 100% | 8.33% |
| Dodecanoic acid | C12H24O2 | 143-07-7 | 100% | 83.33% |
| Ethylbenzene | C8H10 | 100-41-4 | 100% | 0% |
| Hexadecanoic acid, methyl ester | C17H34O2 | 112-39-0 | 100% | 91.67% |
| Octanal | C8H16O | 124-13-0 | 100% | 8.33% |
| Phenol, 4-(1,1-dimethylpropyl)- | C11H16O | 80-46-6 | 100% | 91.67% |
| Propanoic acid, 2,2-dimethyl-, 2-ethylhexyl ester | C13H26O2 | 16387-18-1 | 100% | 91.67% |
| Propanoic acid, 3-ethoxy-, ethyl ester | C7H14O3 | 763-69-9 | 100% | 91.67% |
| Styrene | C8H8 | 100-42-5 | 100% | 0% |
| Mesitylene | C9H12 | 108-67-8 | 100% | 91.67% |
| Phenol, 2-methyl-5-(1-methylethyl)- | C10H14O | 499-75-2 | 100% | 91.67% |
| p-Xylene | C8H10 | 106-42-3 | 100% | 0% |
| Nonanal | C9H18O | 124-19-6 | 100% | 91.67% |
| L[TPA + EG]3 | C30H26O13 | 16958-96-6 | 100% | 100% |
| Benzene, 1,2,4-trimethyl- | C9H12 | 95-63-6 | 100% | 100% |
| p-Cymene | C10H14 | 99-87-6 | 100% | 91.67% |
| Pentanoic acid | C5H10O2 | 109-52-4 | 100% | 100% |
| 1,3-Dioxolane, 2-methyl- | C4H8O2 | 497-26-7 | 100% | 100% |
| C[TPA + EG] + [TPA + DEG] | C22H20O9 | 29278-57-7 | 100% | 100% |
| C[TPA + DEG]2 | C24H24O10 | 16104-98-6 | 100% | 100% |
| C[TPA + EG]3* | C30H24O12 | 7441-32-9 | 100% | 100% |
| C[TPA + EG]2 + [TPA + DEG] | C32H28O13 | 873422-64-1 | 100% | 100% |
| L[TPA + EG] + [TPA + DEG] | C22H22O10 | | 100% | 83.33% |
| 1-Octanol | C8H18O | 111-87-5 | 90.9% | 0% |

| Name | Formula | CAS | Frequency INPUT | Frequency OUTPUT |
|---|---|---|---|---|
| 2,6,10-Trimethyltridecane | C16H34 | 3891-98-3 | 90.9% | 83.33% |
| Benzene, 1-ethyl-4-methyl- | C9H12 | 622-96-8 | 90.9% | 91.67% |
| Benzene, 2-ethyl-1,4-dimethyl- | C10H14 | 874-41-9 | 90.9% | 0% |
| Benzene, propyl- | C9H12 | 103-65-1 | 90.9% | 0% |
| Hexanal | C6H12O | 66-25-1 | 90.9% | 0% |
| o-Xylene | C8H10 | 95-47-6 | 90.9% | 0% |
| Benzene, 1,3-dimethyl- | C8H10 | 108-38-3 | 90.9% | 0% |
| Toluene | C7H8 | 108-88-3 | 90.9% | 0% |
| C[TPA + EG]3* | C30H24O12 | | 90.9% | 91.67% |
| Benzene, 1-methyl-3-propyl- | C10H14 | 1074-43-7 | 72.7% | 0% |
| C[TPA + EG]4 | C40H32O16 | 16104-96-4 | 54.5% | 50% |
| C[TPA + EG] | C10H8O4 | 7337-79-3 | 54.5% | 50% |
| Ni** | C27H48O8 | | 45.5% | 0% |
| Ni (Absorber UV-234/CAS: 70321-86-7 ) | C30H29N3O | 70321-86-7 | 18.2% | 16.67% |
| Ni (Solvent Blue 104) | C32H30N2O2 | 116-75-6 | 18.2% | 16.67% |
| Bis(2-ethylhexyl) adipate | C22H42O4 | 103-23-1 | 18.2% | 0% |
| Anthranilamide | C7H8NO2 | 88-68-6 | 9.1% | 0% |
| Cyasorb UV 1084 | C32H51NNiO2S | 14516-71-3 | 9.1% | 0% |
| NX8000 | C29H40O6 | 882073-43-0 | 9.1% | 0% |
| Trybutyl o-acetylcitrate | C20H34O8 | 77-90-7 | 9.1% | 0% |
| Ni (Solvent Blue 104 lost of C3H8) | C22H26N2O7 / C29H22N2O2 | | 9.1% | 8.33% |
| 1-Pentadecene | C15H30 | 13360-61-7 | 0% | 8.33% |
| 2-Bromononane | C9H19Br | 5533-87-3 | 0% | 91.67% |
| Benzene, 3-cyclohexen-1-yl- | C12H14 | 690-147-2 | 0% | 8.33% |
| Longifolene | C15H24 | 475-20-7 | 0% | 8.33% |
| Pentadecane, 2,6,10,14-tetramethyl- | C19H40 | 1921-70-6 | 0% | 8.33% |
| C [DPG-PA-PG-PA] | C25H26O9 | | 0% | 8.33% |
| C[NPG-TPA-NPG-TPA] | C26H28O8 | | 0% | 8.33% |
| 3PA+3PG | C33H30O12 | | 0% | 8.33% |
| 3PA+EG+2NPG | C36H36O12 | | 0% | 8.33% |

* The laboratory indicated that one of these two substances is the IPA isomer rather than TPA.

** could be octadecanoic acid, 2,3-bis(acetyloxy)propyl ester or a component used to manufacture compound 36150-63-3 (COMGHA) as plasticizer

## Glossary of Terms

| | |
|---|---|
| Cmod | Modelled concentration |
| DEG | diethylene glycol |
| EG | ethylene glycol |
| GC | gas chromatography |
| HPLC | high performance liquid chromatography |
| ICP-MS | Inductively Coupled Plasma Mass Spectrometry |
| MS | Mass Spectrometry |
| NIAS | non-intentionally added substances |
| PE | polyethylene |
| PET | polyethylene terephthalate |
| PP | polypropylene |
| PVC | polyvinyl chloride |
| TPA | terephthalic acid |
| TTC | Threshold of Toxicological Concern |
| XRF | X-ray fluorescence spectroscopy |

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