	DIVISION:	Rigid Packaging Solutions International	
	TITLE	Regulation EU 2022:1616 **Technical Report 0**	
	COVERING PERIOD	22nd OCTOBER 2025 To 31st Jan 2026	
	ISSUDATE:	18th March 2026	

Executive Summary

The CleanStream® Process has been operational since May 2023, producing high quality recycled Polypropylene (rPP) for the cosmetics and personal care industry. It has always been the target for this process to be suitable to produce rPP materials for direct food-contact applications. This report summarises the data gathered since 22nd October 2025, at which point data gathering was increased to a frequency aligned with the requirements of the regulation. We will report in this document for the period up to the end of January 2026.

It is the intention of the business to formally notify the DG Santé and Local Competent Authority (UK Food Standards Agency) for the facility, based in Leamington Spa, United Kingdom, **no earlier than 1st June 2026**, of the intention to begin supply into direct food use applications.

Following the mandatory notice period the business will be submitting full 6 monthly technical reports, which will follow the format of this initial document. These reports will support the consistency of the process in processing the input material in a way which delivers reliable levels of food safety compliance.

1. Introduction

CleanStream® is a complete recycling process (Figure 1) which takes in kerbside recovered waste PP. Polypropylene is a hydrocarbon, semi-crystalline polymer. Compared to PET it has higher diffusivity, therefore is more likely to acquire residual NIAS through use. This higher level of diffusivity also means that it is more efficient to drive the removal of VOC and SVOC compounds using a solid-state decontamination process, such as the one utilised in the CleanStream® process.

The process is further enhanced by bespoke selective sortation, based on NIR polymer and colour separation, enhanced by state-of-the-art AI object recognition. This removes coloured and non-food-use items, ensuring that intentionally added substances (such as additives and pigments) are limited to those suitable for food-use applications. High temperature chemical washing removes surface contamination and decoration.

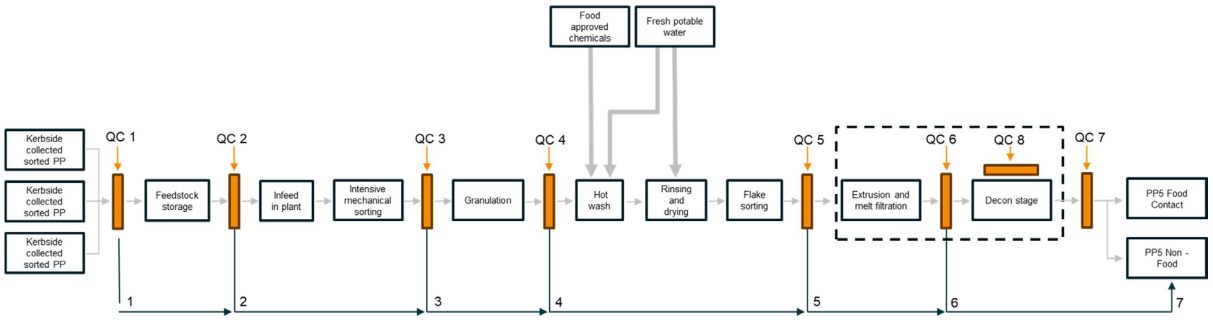


Figure 1: Flow Diagram of the process. (high resolution version is available in the supporting Novel Technology application)

2. Sampling and Monitoring

Sampling and Monitoring of the process is carried out in line with the process parameters laid out in the CMSS.

Input baled material is inspected and analysed for compliance with the agreed quality standards in terms of bale purity and composition. (***QC 1 and QC 2***)

Following NIR and AI based object recognition sorting to remove coloured and non-food items from the target stream, manual sampling is carried out to confirm a minimum of 95% food-use items. (***QC 3***)

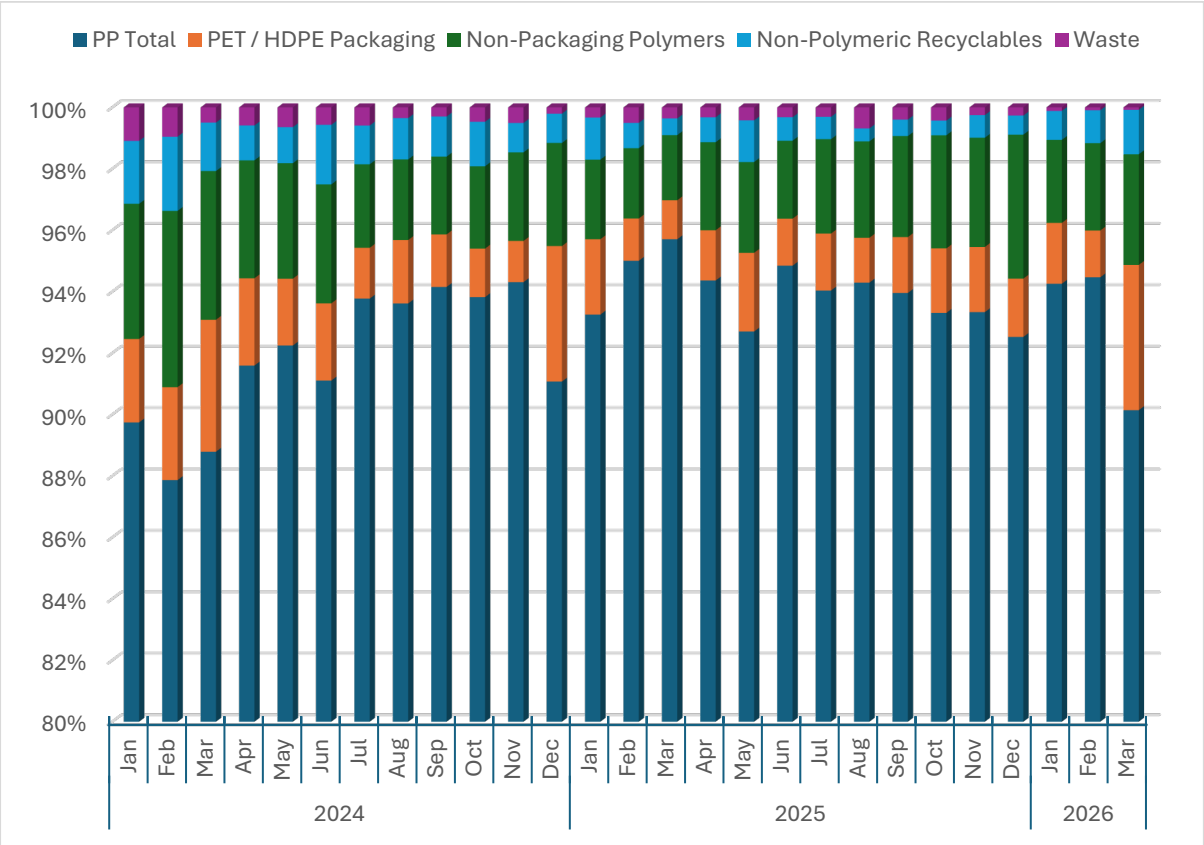
For the determination of IAS and NIAS samples of input material is taken at the first available opportunity, directly after granulation of the input material (***QC 4***), and compared with output from the final decontamination stage during the following 24hr period, depending on the timing of batch completion, so as to most accurately reflect the direct correlation of input to output, within the constraints of a continuous process (***QC 7***).

Flake samples are taken after further NIR and colour sorting (***QC 5***) to check correct operation of the flake sorting and elutriation, and process conditions are monitored in the extrusion and decontamination sections (***QC 6*** and ***QC 8***).

3. Results

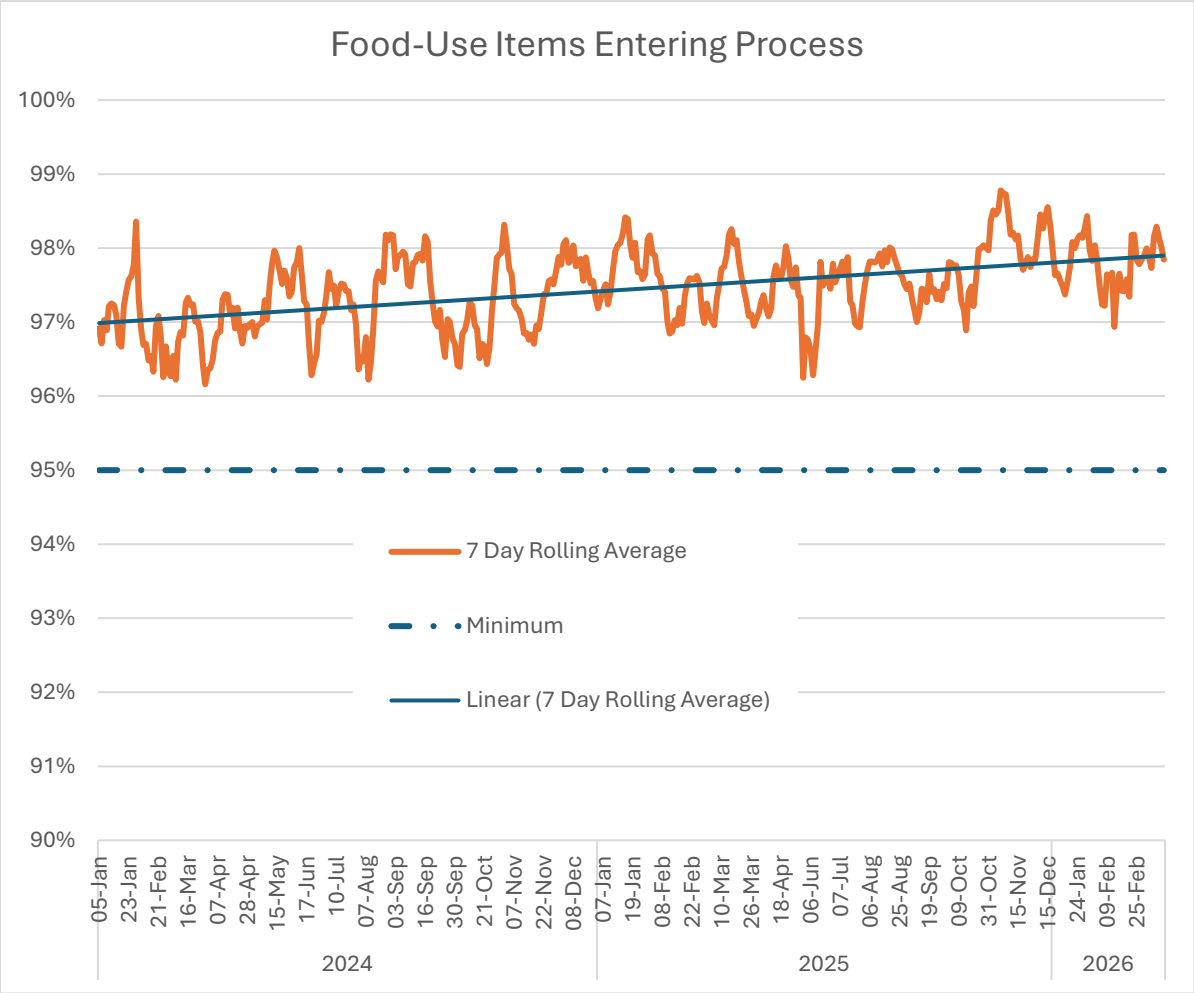
QC2 – Bale Composition

Due to the robust sorting and separation steps in the CleanStream® process, input bale quality has a limited effect on output quality, as non-target contaminants are effectively removed by the cascade of NIR sorting and density separation. However, bale composition is critical to efficient running of the operation and is therefore closely monitored, to support pro-active supplier management and cost control. Detailed breakdown of individual supplier performance is considered proprietary information but aggregated data is shared below.



QC3 – Food-Use Items

Sampling is carried out minimum daily to ensure input composition is compliant with minimum requirements. Included below are data collected over a more than 2 year period which demonstrates the robust, and improving, nature of the selection process and effectiveness of the AI object recognition.



QC4 / QC 7 - NIAS screening in input and output material

The following part of this report is an example of what will be included in the bi-yearly Technical Reports that will be submitted to comply with Regulation (EU) 2022/1616.

Samples of the input material (named Un-Washed Flakes or UWFs) will be taken directly from the feed silo at the input to the washing section, in flake form.

Specific Migration will be carried out on the flakes using a Hexane/Acetone solution 50/50% V/V. 2g of flakes, in 20mL of the solution, will be kept at 40°C for 12h. 10mL of that solution will then be concentrated by a factor of 10, using a rapid evaporation system. The resulting extract is spiked with the appropriate internal standards prior to liquid injection GC-MS and GC-FID analysis.

GC-MS characterisation for VOC screening will be carried out by headspace analysis using vial pressurisation and sampling loop method. Sampling will be carried out after incubation at elevated temperature.

The same NIAS screening for VOCs and SVOCs is carried out on the pellets of final product (defined as Silo in the following section).

Substances of interest

This report covers the time period from the 21st of October 2025 to the 29th of January 2026. All the NIAS that were observed are reported in **Table 1** (Specific migration followed by GC-MS/FID), and **Table 2** (Headspace GC-MS).

A number of those compounds present SMLs, from Regulation (EU) 10/2011. Their concentration across time was plotted together with the SMLs for a final product using 100%, 30%, and 10% of recycled material (rPP) (**Figure 2** to **Figure 6**).

Every compound except Octocrylene (**Figure 2**) is below the threshold for 100% rPP content.

Octocrylene presents an SML of 0.05 mg/Kg of food, which corresponds to 0.3 mg/Kg of polymer (this conversion is done with a worst-case scenario in mind, considering complete migration of the compound to the food).

The output material is always below the threshold for 10% rPP content, but in a few instances, it would have breached the 30% rPP content limit.

To note, what is reported here is not a migration study but an extraction, since the Hexane / Acetone mixture represents and extremely effective extraction medium, giving higher extraction efficiencies than the standard food simulants. Migration studies in food simulants are currently ongoing to assess the migration behaviour of this compound and will inform the specific advice relating to the suitability of each batch of material for specific use-cases and food types.

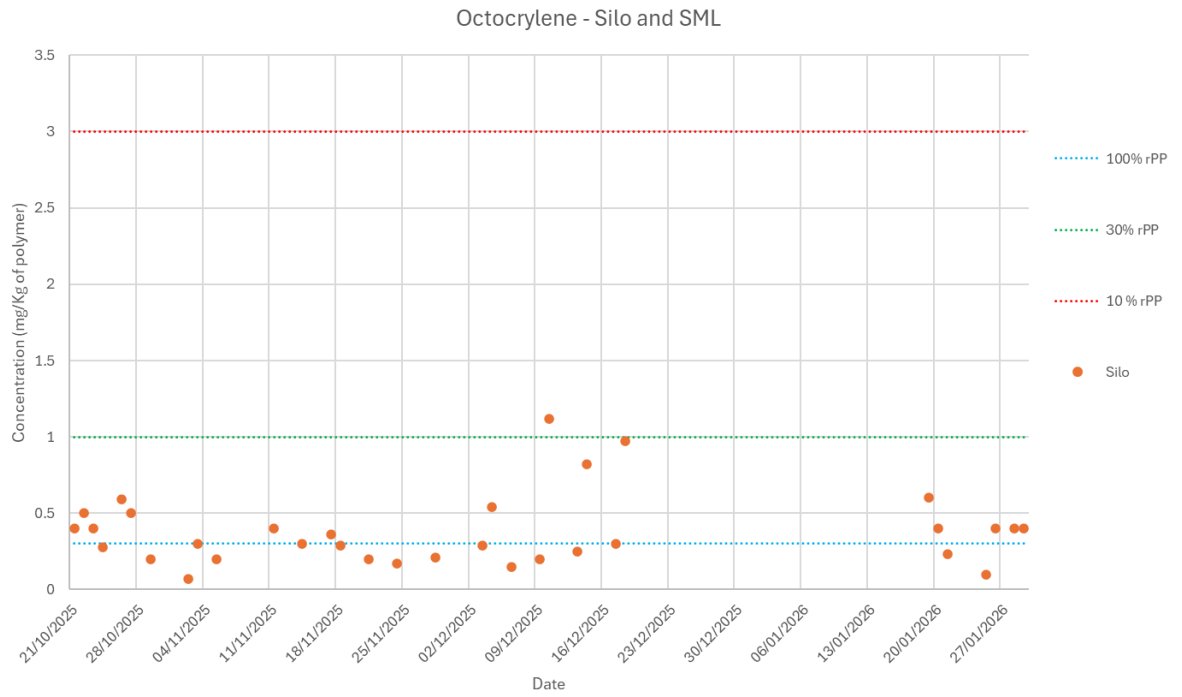


Figure 2. Octocrylene concentrations in the output material, with SML for final product with 100% rPP (blue dotted line), 30% rPP (green dotted line) and 10% rPP (red dotted line).

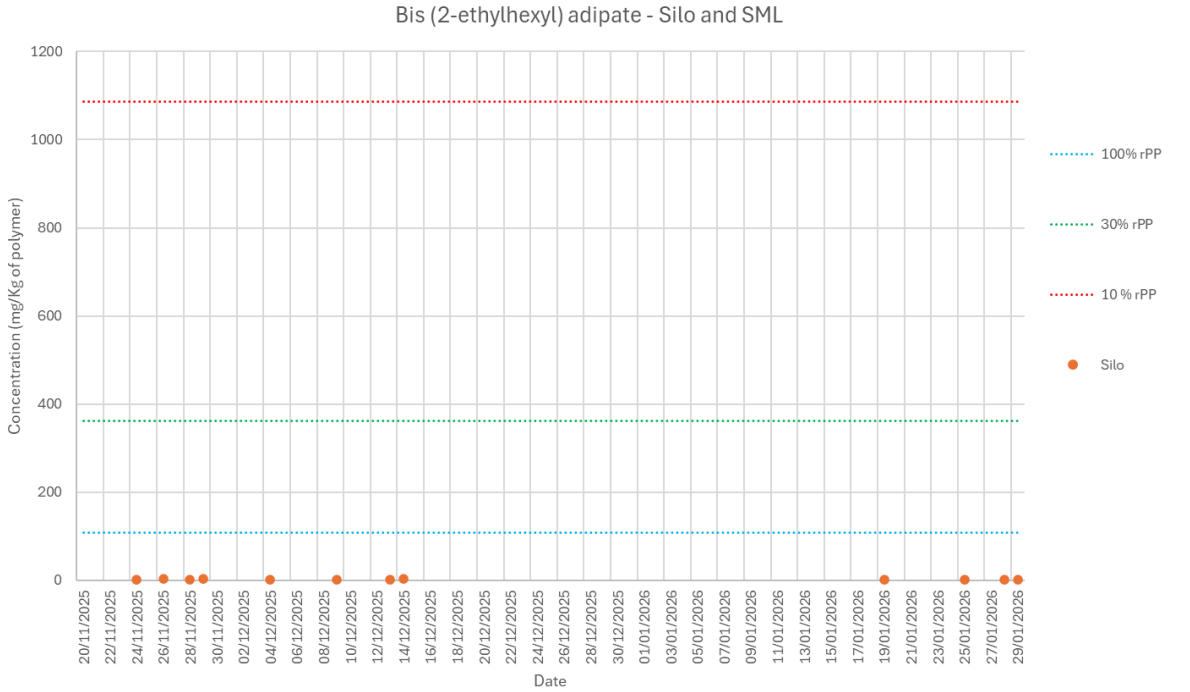


Figure 3. Bis (2-ethylhexyl) adipate concentrations in the output material, with SML for final product with 100% rPP (blue dotted line), 30% rPP (green dotted line) and 10% rPP (red dotted line).

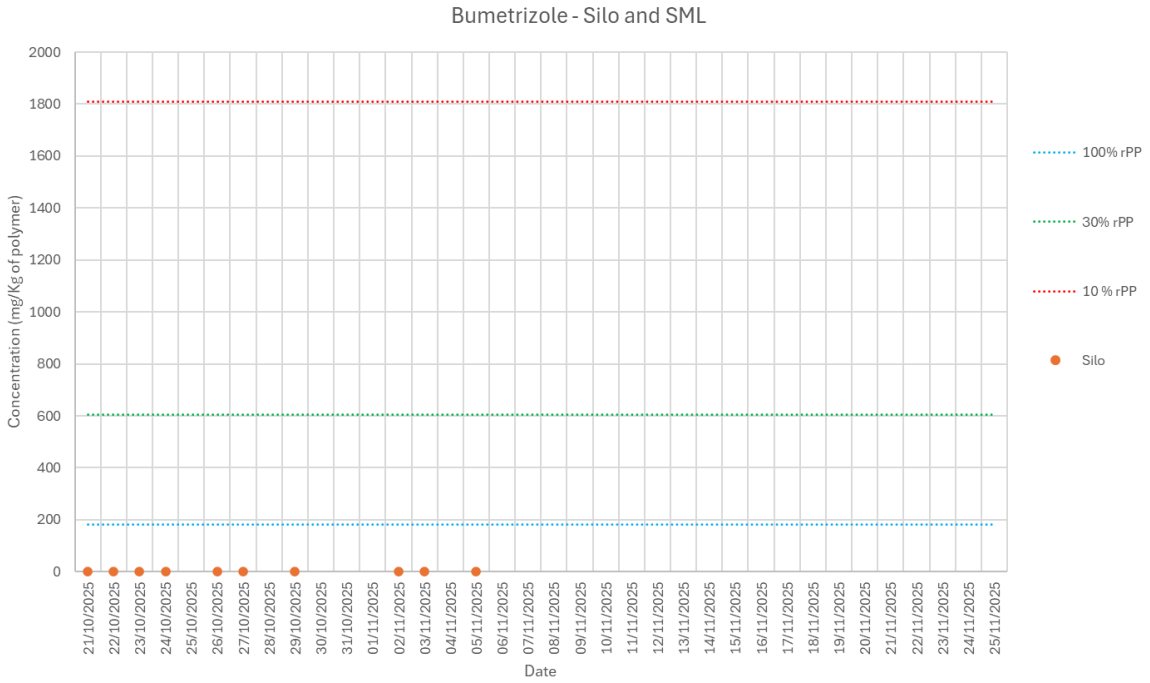


Figure 4. Bumetrizole concentrations in the output material, with SML for final product with 100% rPP (blue dotted line), 30% rPP (green dotted line) and 10% rPP (red dotted line).

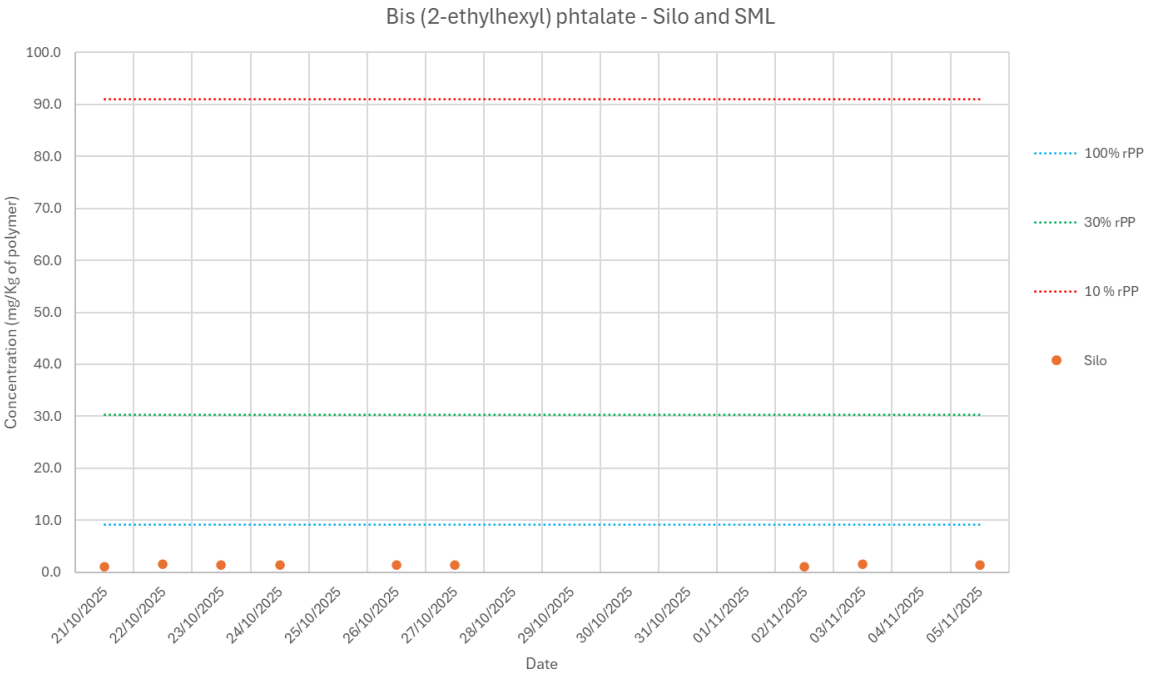


Figure 5. Bis (2-ethylhexyl) phthalate concentrations in the output material, with SML for final product with 100% rPP (blue dotted line), 30% rPP (green dotted line) and 10% rPP (red dotted line).

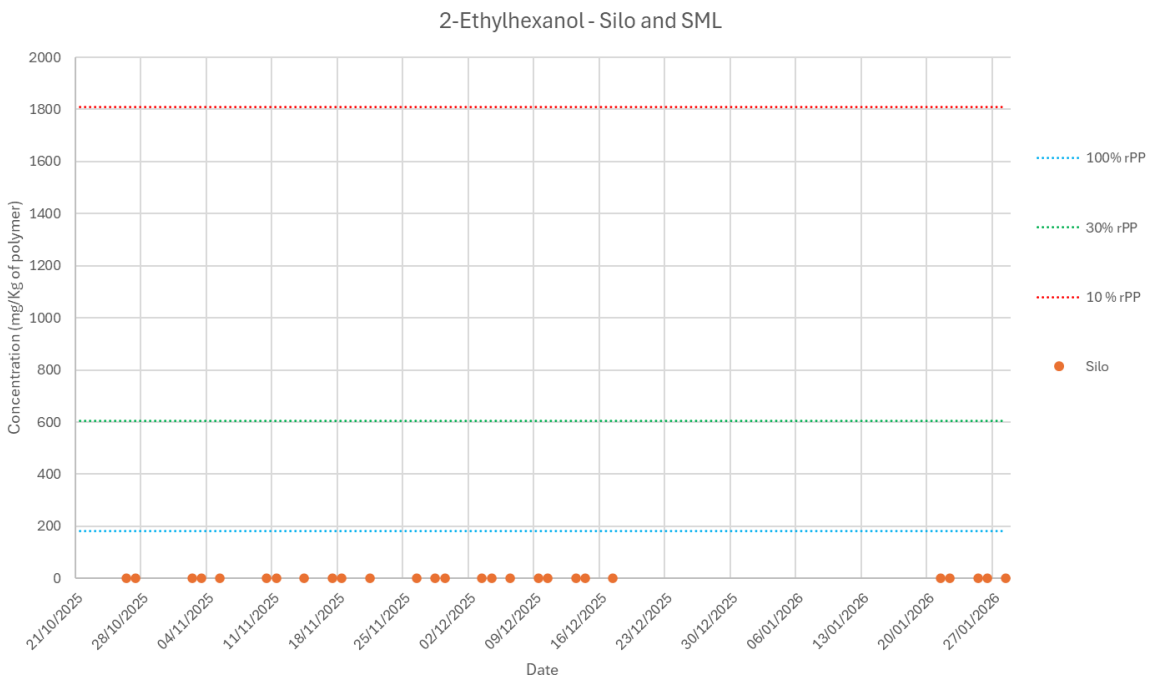


Figure 6. 2-Ethylhexanol concentrations in the output material, with SML for final product with 100% rPP (blue dotted line), 30% rPP (green dotted line) and 10% rPP (red dotted line).

Table 1. Output material compound lists, obtained via specific migration and subsequent GC-MS/FID analysis.

Output material compound list – GC-MS/FID		
Compound	**CAS No**	**Sample count (out of 37)**
Isopropyl myristate	110-27-0	37
Stearic acid	57-11-4	37
Tris(2,4-di-tert-butylphenyl) phosphate	95906-11-9	37
Tris(2,4-di-tert-butylphenyl) phosphite	31570-04-4	37
Isopropyl palmitate	142-91-6	36
Octocrylene	6197-30-4	32
Oleic acid	112-80-1	32
3-(Hexadecyloxy)propan-1-ol	23377-40-4	30
Oleic acid amide	301-02-0	29
Palmitic acid monoglyceride	23470-00-0	28
Stearic acid monoglyceride	123-94-4	28
Oleyl oleate	3687-45-4	27
Palmitic acid	57-10-3	26
13-Docosenamide, (Z)-	112-84-5	24
Butyl oleate	142-77-8	24
Amberonne	54464-57-2	22
Tributyl acetylcitrate	77-90-7	22
3-Hydroxypropyl palmitate	2239-78-3	21
Stearylalcohol	112-92-5	21
Butyl oleate	142-77-8	20
2,4-Di-tert-butylphenol	96-76-4	18
Oleic anhydride	24909-72-6	16
1-Decanol, 2-hexyl-	2425-77-6	15
2,3-Dihydroxypropyl elaidate	25496-72-4	14
7,9-Di-tert-butyl-1-oxaspiro(4,5)deca-6,9-diene-2,8-dione	82304-66-3	14
Decyl oleate	3687-46-5	14
n-Hexyl salicylate	6259-76-3	14
Pentacontanoic acid, ethyl ester	41114-00-5	12
Triacontanoic acid, methyl ester	629-83-4	12
BHT-quinone-methide	10396-80-2	11
Octane, 1,1'-oxybis-	629-82-3	11
Bis(2-ethylhexyl) adipate	103-23-1	11
1,3-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester	137-89-3	10
1-Hexadecanol	36653-82-4	10
Bumetrizole	3896-11-5	10
Oleic Chloride	112-77-6	10
2-Ethylhexyl salicylate	118-60-5	9
Bis(2-ethylhexyl) phthalate	117-81-7	9
γ-Sitosterol	83-47-6	8
1-Octadecanol	112-92-5	7
Hexacosyl nonyl ether	N/A	7
Hexadecanoic acid, dodecyl ester	42232-29-1	7
Octanal, 2-(phenylmethylene)-	101-86-0	7
β-Sitosterol	83-46-5	6
Diisooctyl adipate	1330-86-5	6
Oleic acid monoglyceride	25496-72-4	6
Dodecanoic acid	143-07-7	5
Hexadecanoic acid, methyl ester	112-39-0	5
9,12-Octadecadienoic acid, methyl ester	112-63-0	4
Homosalate	118-56-9	4
3,5-Di-tert-Butyl-4-hydroxyphenylpropionic acid	20170-32-5	4
7-Hexadecenal, (Z)-	56797-40-1	3
9-Octadecenamide, (Z)-	301-02-0	3
Cyclohexane, 1-ethyl-2-propyl-	62238-33-9	3
Docosanoic acid, ethyl ester	5908-87-2	3
Erucic acid amide	112-84-5	3
Ethanol, 2-[2-[(2-ethylhexyl)oxy]ethoxy]-	1559-36-0	3

Ethyl palmitate	628-97-7	3
Hexadecanoic acid, 2-hydroxy-1,3-propanediyl ester	502-52-3	3
3-(Palmitoyloxy)-2-(tetradecanoyloxy)propyl palmitate	N/A	2
9-Octadecenoic acid (Z)-, tetradecyl ester	22393-85-7	2
Behenic acid amide	3061-75-4	2
cis-11-Eicosenamide	10436-08-5	2
Diisodecyl adipate	27178-16-1	2
Diisodecyl phthalate	26761-40-0	2
Dodecanoic acid, 1,2,3-propanetriyl ester	538-24-9	2
Glycerol tricaprylate	538-23-8	2
Triethylene glycol monododecyl ether	3055-94-5	2
cis-13-Octadecenoic acid, methyl ester	13126-39-1	1
1-Monopalmitin	542-44-9	1
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate	6846-50-0	1
2-Nonanol oleate	1096360-61-	1
2-tert-Butyl-benzofuran	4265-11-6	1
7-Acetyl-6-ethyl-1,1,4,4-tetramethyltetralin	88-29-9	1
9,12-Octadecadienoic acid (Z,Z)-	80969-37-5	1
9-Octadecenoic acid (Z)-, octadecyl ester	17673-49-3	1
Benzoic acid, 2-hydroxy-, heptyl ester	6259-77-4	1
Benzoic acid, 2-hydroxy-, phenylmethyl ester	118-58-1	1
cis-13-Octadecenoic acid, methyl ester	56554-47-3	1
Cyclohexane, isocyanato-	3173-53-3	1
Cyclopenta[g]-2-benzopyran	1222-05-5	1
Cyclopentane, 1-pentyl-2-propyl	62199-51-3	1
Cyclopentaneacetic acid, 3-oxo-2-pentyl-, methyl ester	2630-39-9	1
Dodecyl 2-ethylhexanoate	56078-38-7	1
Ethanol, 2-(eicosyloxy)-	2136-73-4	1
Galaxolide	1222-05-5	1
Heptadecanoic acid	506-12-7	1
Hexadecanoic acid, tetradecyl ester	4536-26-9	1
Hexadecyl nonyl ether	4113-12-6	1
Lauryl acetate	112-66-3	1
Linoelaidic acid	506-21-8	1
Linoleic acid ethyl ester	544-35-4	1
Linoleyl acetate	5999-95-1	1
Methyl stearate	112-61-8	1
Octadecanoic acid	57-11-4	1
Octadecanoic acid, 2,3-bis[(1-oxotetradecyl)oxy]propyl ester	56846-96-9	1
Octaethylene glycol monododecyl ether	3055-98-9	1
Octanoic acid, decyl ester	2306-89-0	1
Oleyl alcohol, trifluoroacetate	143-28-2	1
Palmitic acid amide	629-54-9	1
Squalane	111-01-3	1
Stearic acid amide	124-26-5	1
Tetracosanoic acid	557-59-5	1
Tridecyl benzoate	29376-83-8	1
Triisopropyl(ethoxy) silane	6485-79-6	1

Table 2. Output material compound lists, obtained via Headspace GC-MS analysis.

Output material compound list – Headspace GC-MS		
Compound	**CAS No**	**Sample count (out of 37)**
α-Terpineol	98-55-5	37
D-Limonene	5989-27-5	37
Menthol	2216-51-5	34
β-Ocimene	13877-91-3	30
2-Ethylhexanol	104-76-7	27
Nonanal	124-19-6	27
Octanoic acid, 7-oxo	14112-98-2	22
Decamethylcyclopentasiloxane (D5)	541-02-6	13
Decanal	112-31-2	13
Isodecyl methacrylate	29964-84-9	13
γ-Terpinene	99-85-4	12
4-tert-Butylcyclohexyl acetate	32210-23-4	11
(-)-cis-Myrtanol	51152-12-6	10
11-Methyldodecanol	85763-57-1	9
1-Nonanol	143-08-8	8
1-Heptanol, 2-propyl-	10042-59-8	7
ortho tert-Butyl cyclohexyl acetate	88-41-5	7
3-Octanol, 3,7-diemethyl-	78-69-3	6
6-Methyl-1-octanol	38514-05-5	6
L-Menthone	14073-97-3	6
Mesitylene	108-67-8	5
α-Pinene	80-56-8	4
(-)-trans-Myrtanyl acetate	90934-53-5	4
2-Nonanone	821-55-6	4
1-Octanol, 2-butyl-	3913-02-8	3
Bis(2-isopropyl-5-methylcyclohexyl) methylphosphonate	211183-18-5	3
Cyclopentasiloxane, decamethyl-	541-02-6	3
Benzene, (2-methyl-1-propenyl)	768-49-0	2
Cyclodecanol	1502-05-2	2
Cyclohexene, 1-methyl-4-(1-methylethylidene)-	586-62-9	2
Cyclooctyl alcohol	696-71-9	2
Heptanal	111-71-7	2
trans-2-tert-Butylcyclohexanol	13492-07-4	2
1-Decanol, 2-ethyl-	21078-65-9	1
2-Decen-1-ol, (E)-	22104-80-9	1
2-Octanol, 2-butyl-	3913-02-8	1
3-Cyclohexen-1-ol, 5-methylene-6-(1-methylethenyl)-, acetate	54832-23-4	1
Acetic acid	64-19-7	1
cis-2-tert-Butylcyclohexanol	13491-79-7	1
Citronellol Acetate	150-84-5	1
Cyclohexane, 1-methylene-4-(1-methylethenyl)-	499-97-8	1
Dodecyl heptyl ether	2461-18-9	1
γ-Chlorobutyrophenone	939-52-6	1
p-Ethylbenzaldehyde	4748-78-1	1
p-Xylene	106-42-3	1
Shisool	18479-64-6	1

Decontamination efficiency

By comparing the average concentration of a compound in both the UWFs and the Silo we can obtain an average decontamination efficiency for those specific compounds. The compounds reported here were either the more common ones or compounds of interest for food-contact safety.

All the concentrations are reported in mg/Kg of polymer. Both VOCs (quantified via Headspace GC-MS) and SVOCs (quantified via GC-MS/FID) have been included (in order of increasing molecular weight **Figure 7** to **Figure 16**):

- 2-Ethylhexanol: average decontamination efficiency of 96%.
- D-Limonene: average decontamination efficiency of 98%.
- 2,4-Di-*tert*-Butylphenol: average decontamination efficiency of 71%.
- n-Hexyl Salycilate: average decontamination efficiency of 60%
- Isopropyl Myristate: average decontamination efficiency of -313%.
- Oleic acid: average decontamination efficiency of 65%.282
- Isopropyl Palmitate: average decontamination efficiency of -458%.
- Octocrylene: average decontamination efficiency of 64%.
- Igraphos 168: average decontamination efficiency of 53%.
- Igraphos 168 (oxidate): average decontamination efficiency of -39%.

The decontamination efficiency of lighter compounds shows the highest results, with almost complete removal of 2-Ethylhexanol and D-Limonene. The heavier compounds show decreasing decontamination efficiencies with higher MWs.

Three negative results were observed. Igraphos 168 (oxidate) is explained by the fact that the recycling and extrusion process oxidises more of its parent compound (Igraphos 168), leading to an increased concentration in the final product.

The results from Isopropyl Myristate and Isopropyl Palmitate consistently show higher values in the output material than the input. Further investigations are ongoing to establish the reason for this, which is likely linked to the wash process. These compounds do not represent a safety concern.

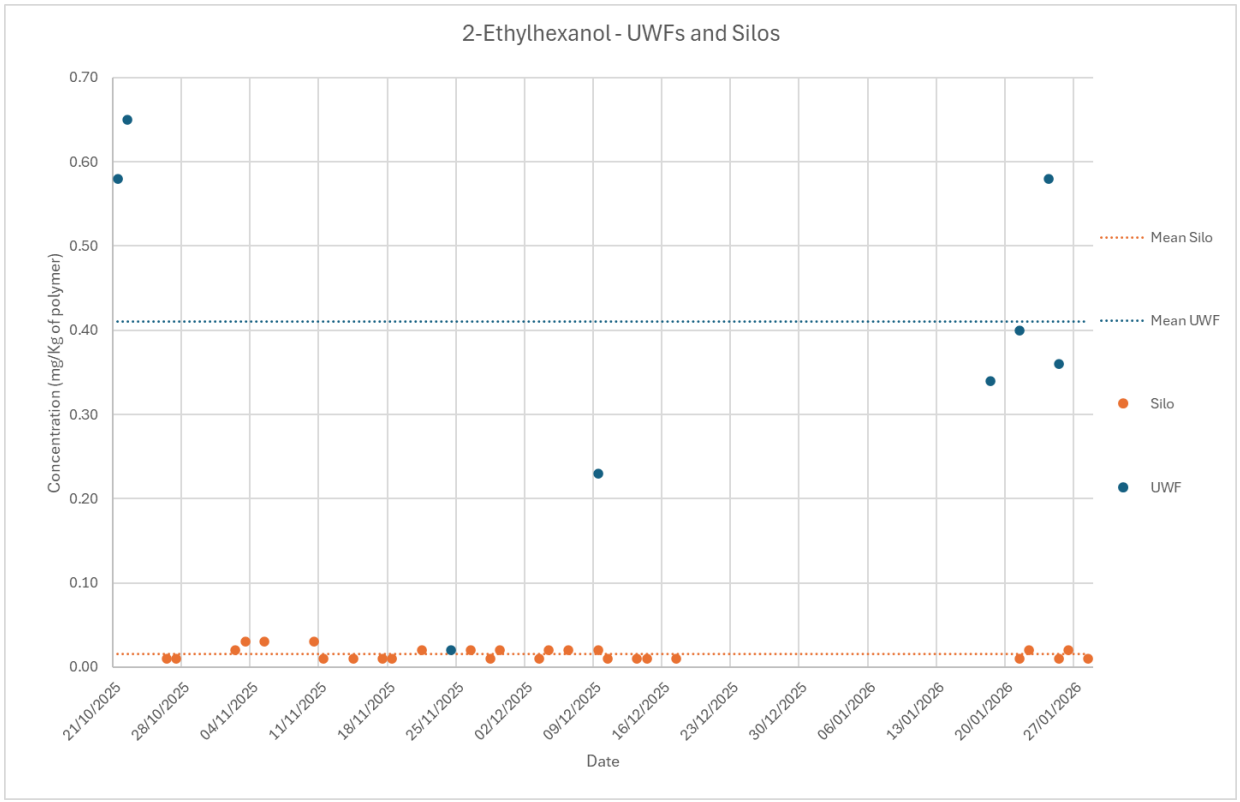


Figure 7. Comparison of the concentration of 2-Ethylhexanol in UWFs and Silos in the period 21/10/2025 to 29/01/2026 (analysed via Headspace GC-MS).

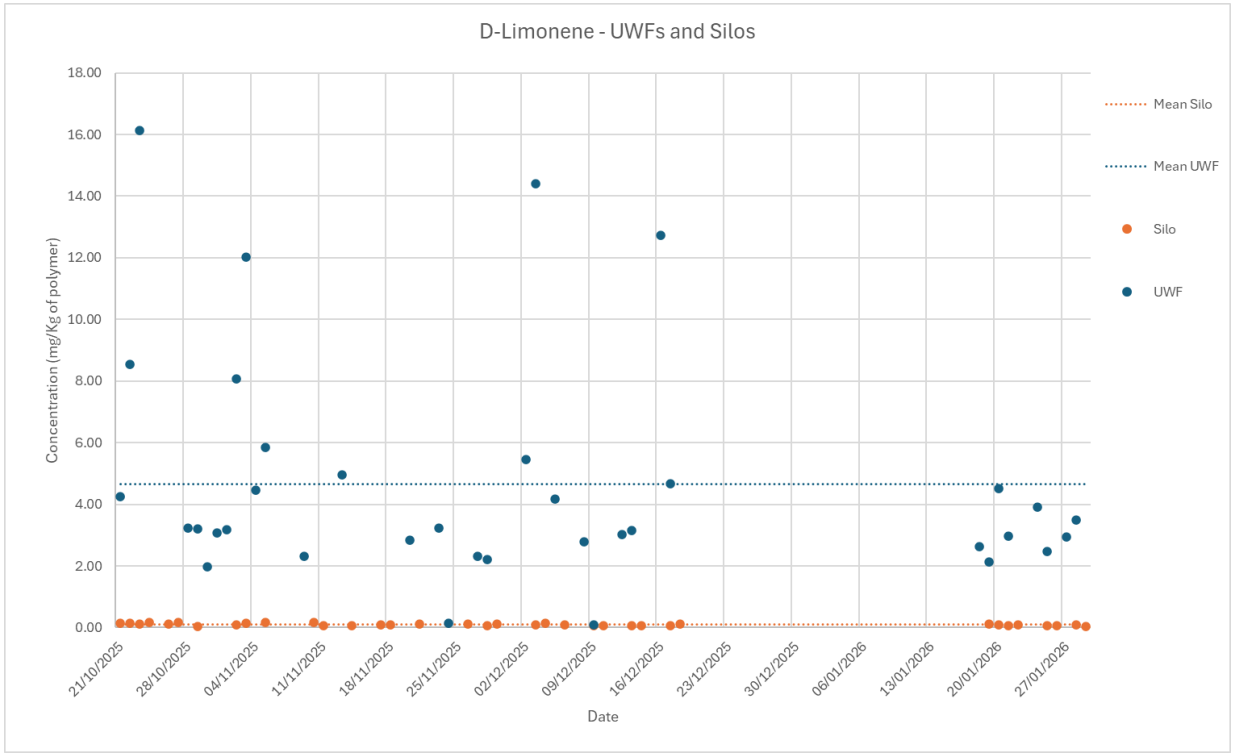


Figure 8. Comparison of the concentration of D-Limonene in UWFs and Silos in the period 21/10/2025 to 29/01/2026 (analysed via Headspace GC-MS).

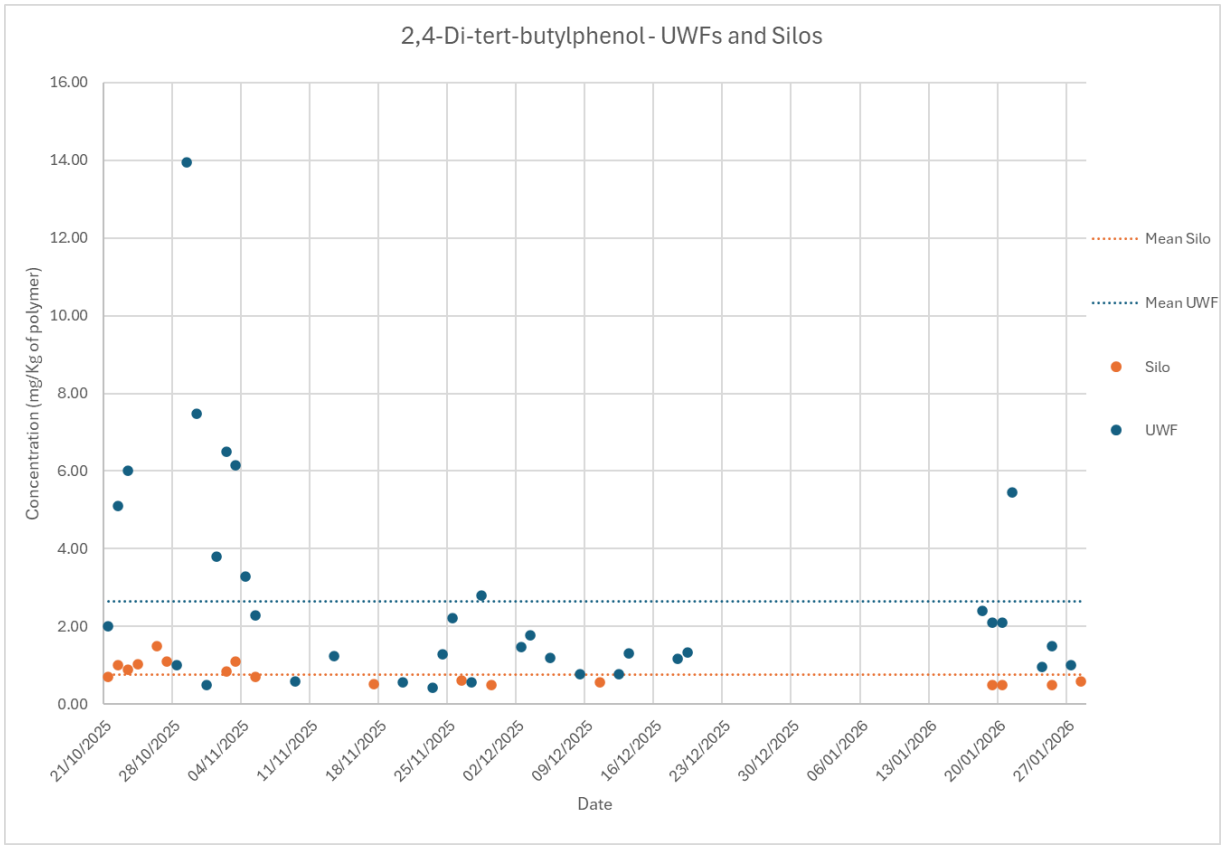


Figure 9. . Comparison of the concentration of 2,4-Di-tert-Butylphenol in UWFs and Silos in the period 21/10/2025 to 29/01/2026 (analysed via GC-MS/FID).

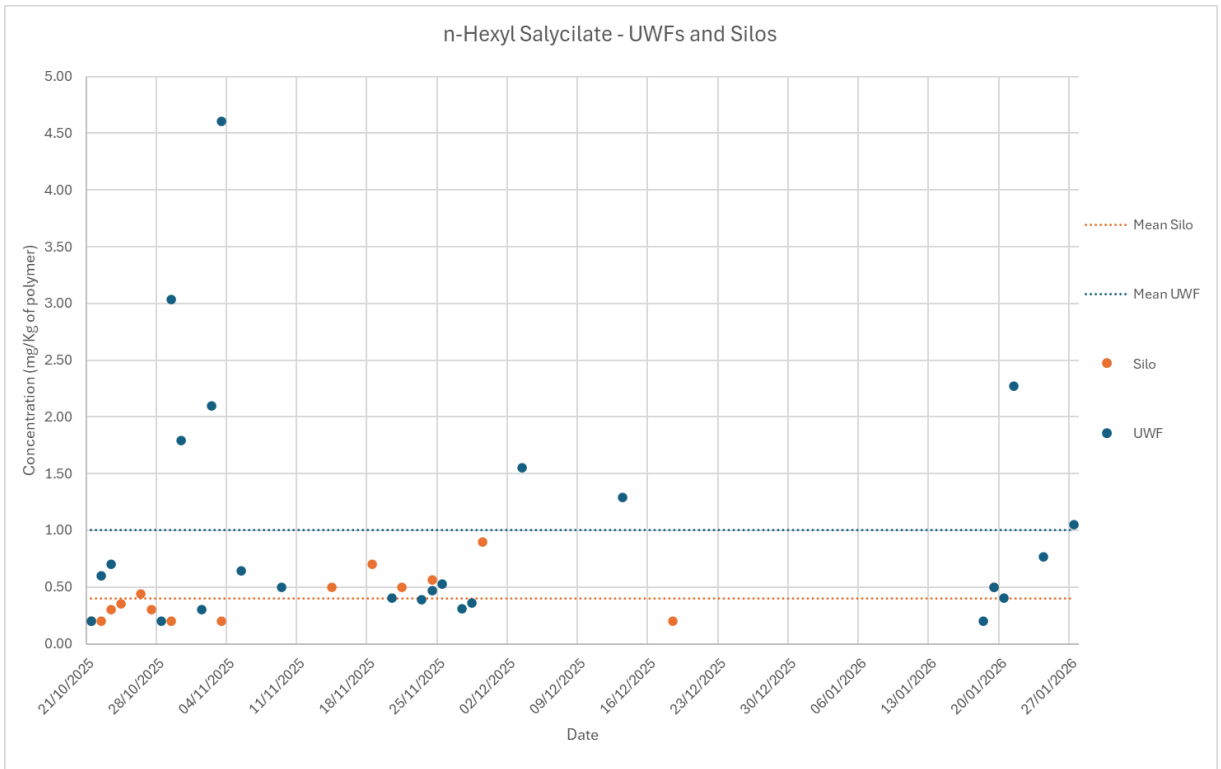


Figure 10. Comparison of the concentration of n-Hexyl Salycilate in UWFs and Silos in the period 21/10/2025 to 29/01/2026 (analysed via GC-MS/FID).

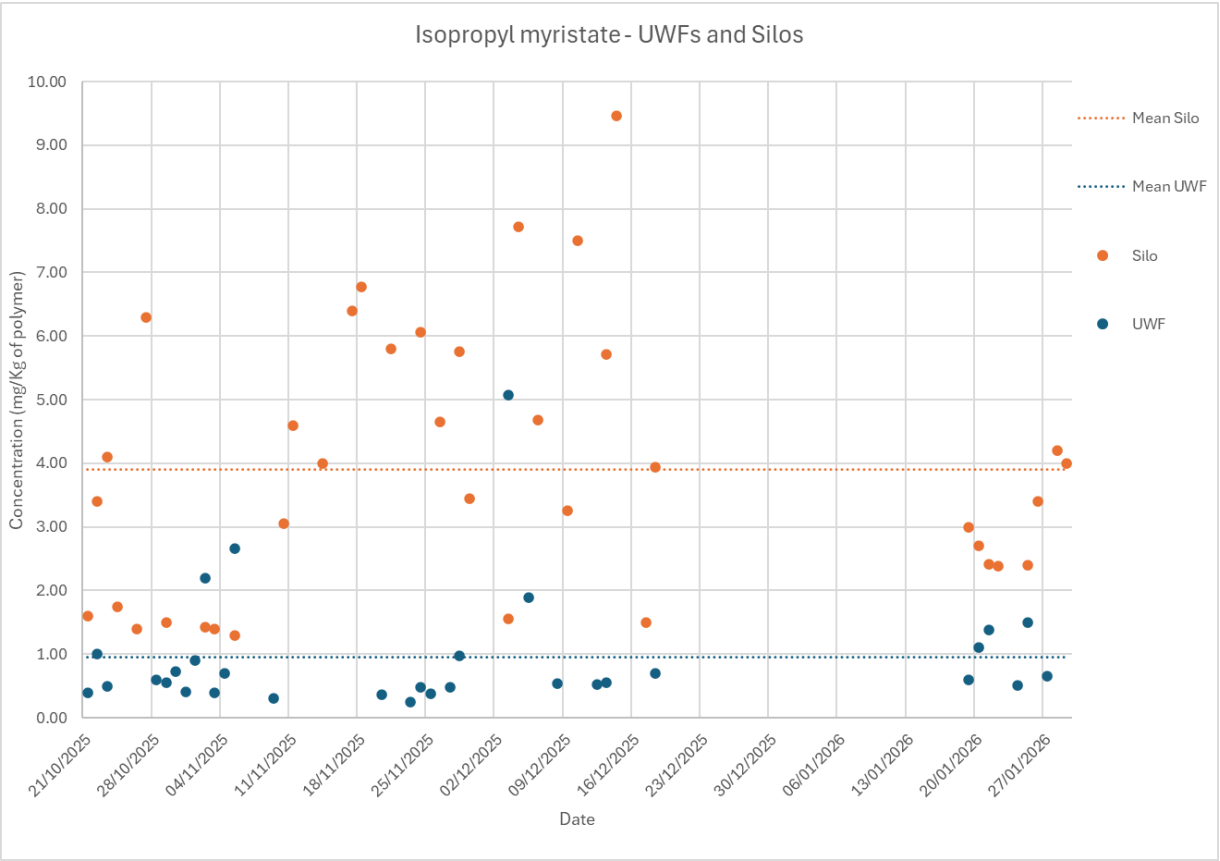


Figure 11. Comparison of the concentration of Isopropyl Myristate in UWFs and Silos in the period 21/10/2025 to 29/01/2026 (analysed via GC-MS/FID).

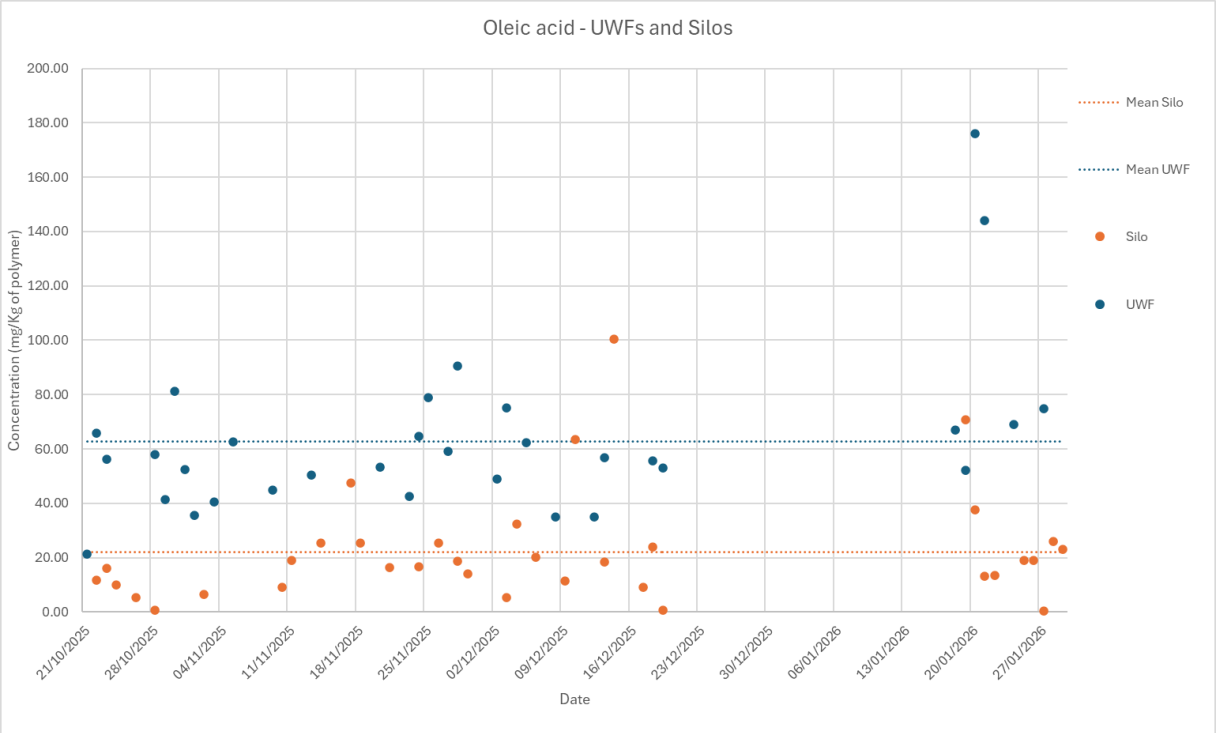


Figure 12. Comparison of the concentration of Oleic acid in UWFs and Silos in the period 21/10/2025 to 29/01/2026 (analysed via GC-MS/FID).

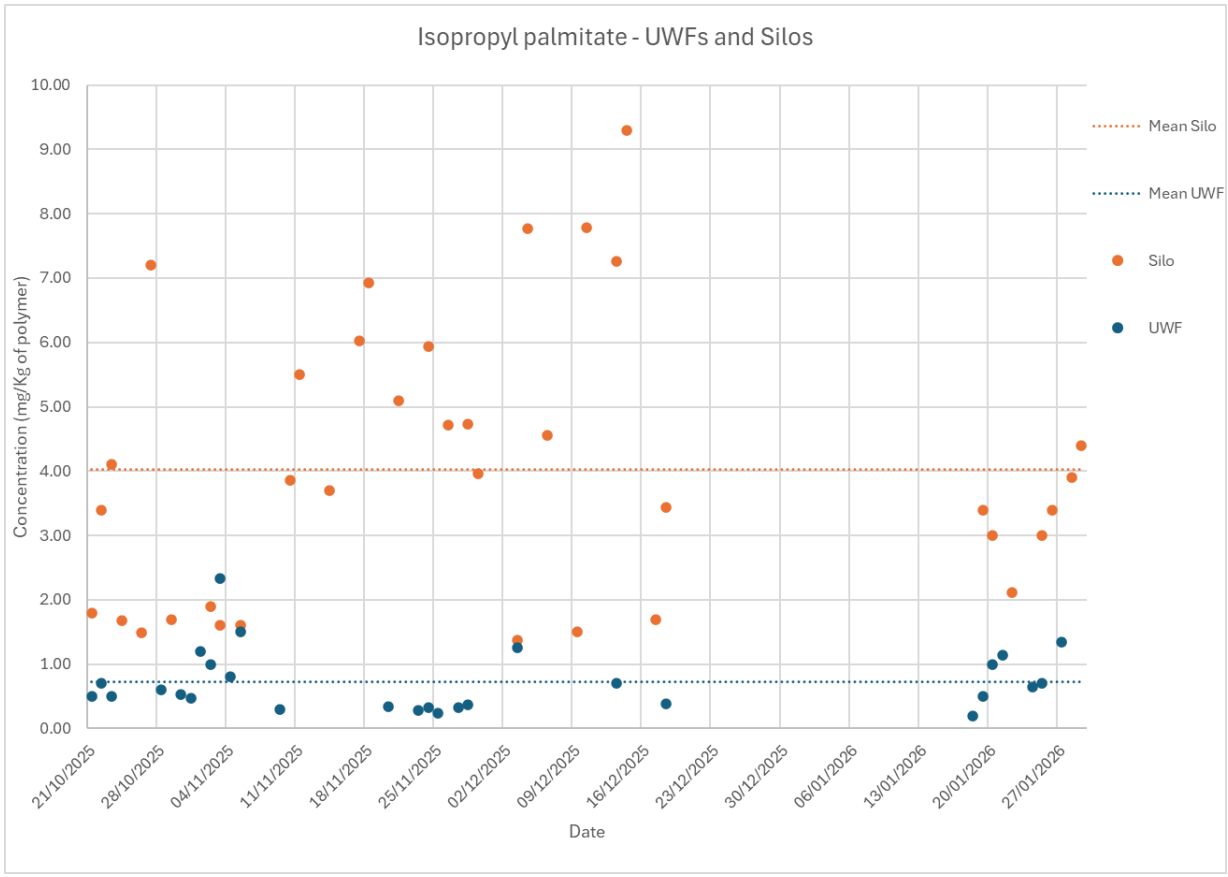


Figure 13. Comparison of the concentration of Isopropyl Palmitate in UWFs and Silos in the period 21/10/2025 to 29/01/2026 (analysed via GC-MS/FID).

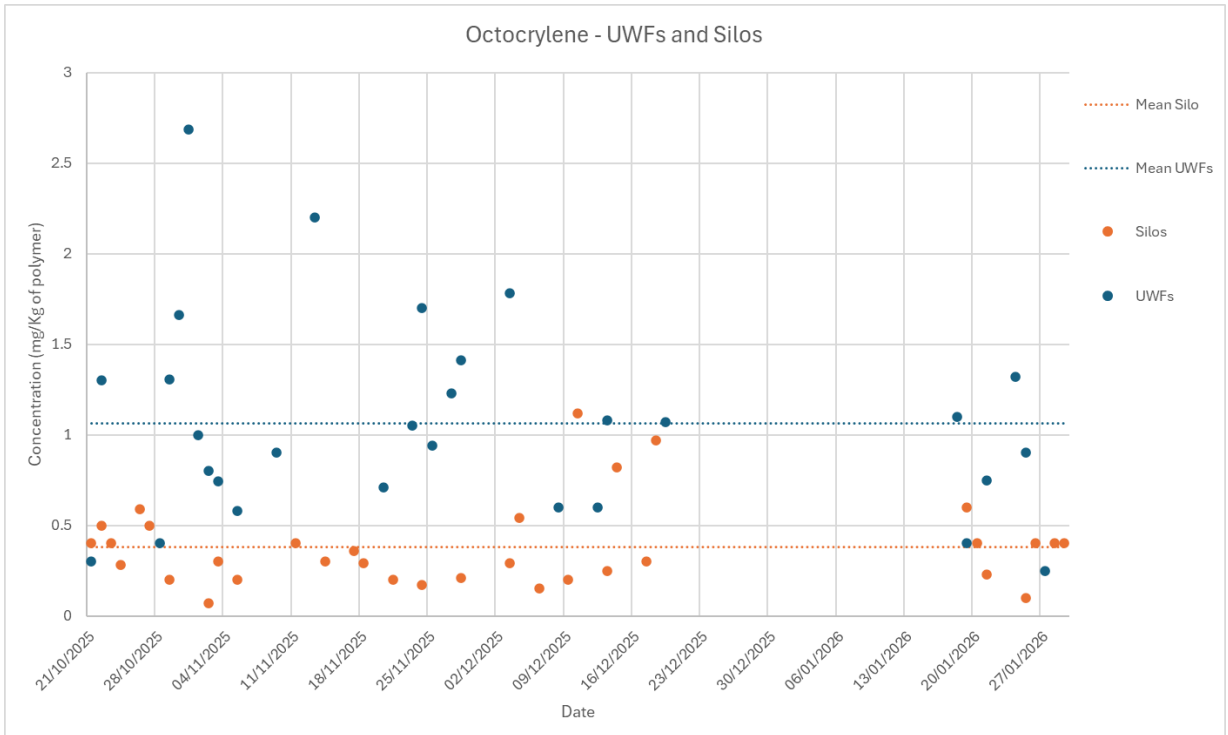


Figure 14. Comparison of the concentration of Octocrylene in UWFs and Silos in the period 21/10/2025 to 29/01/2026 (analysed via GC-MS/FID).

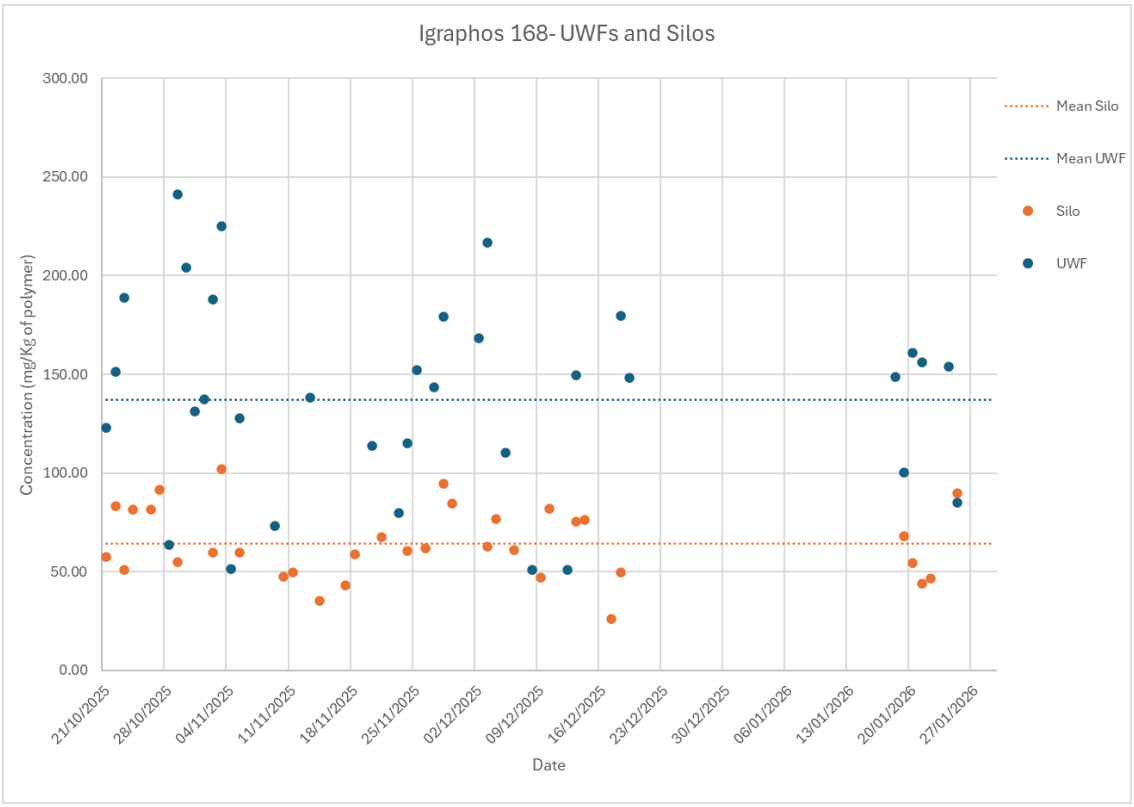


Figure 15. Comparison of the concentration of Igraphos 168 in UWFs and Silos in the period 21/10/2025 to 29/01/2026 (analysed via GC-MS/FID).

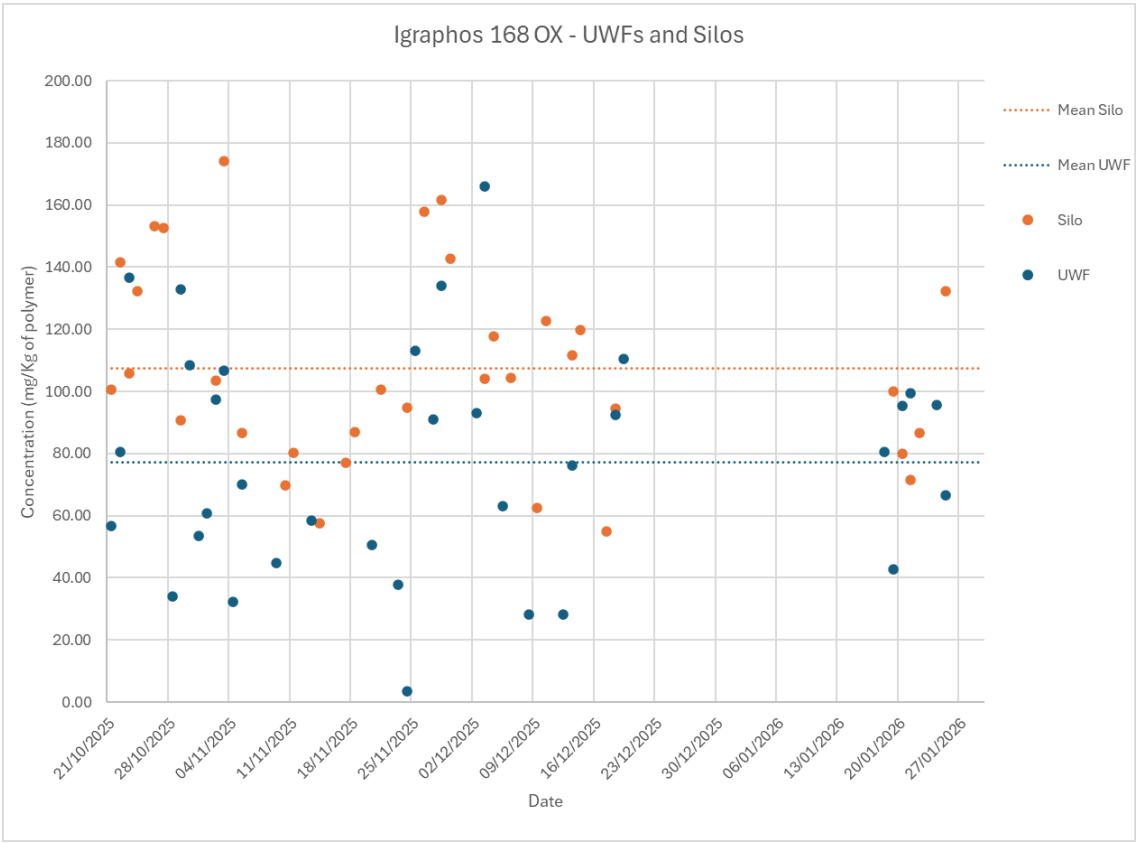


Figure 16. Comparison of the concentration of Igraphos 168 (oxidate) in UWFs and Silos in the period 21/10/2025 to 29/01/2026 (analysed via GC-MS/FID).