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POPs in Waste: Regulatory Review and Capacity Modelling

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Glossary

ABFR	Aromatic Brominated Flame Retardant
ABS	Acrylonitrile Butadiene Styrene
AFFF	Aqueous Film Forming Foam
ASBP	Alliance For Sustainable Building Products
ASR	Automotive Shredder Residue
BFRs	Brominated Flame Retardants
BPF	British Plastics Federation
CE	Circular Economy
CMR	Carcinogenic, Mutagenic or Reprotoxic
BTBPE	1,2-Bis(Tribromophenoxy)Ethane
CPs	Chlorinated Paraffins
D4	Octamethylcyclotetrasiloxane
D5	Decamethylcyclopentasiloxane
D6	Dodecamethylcyclohexasiloxane
DBDPE	Decabromodiphenyl Ethane
DEHP	Bis(2-Ethylhexyl) Phthalate
DEFRA	Department For Environment, Food & Rural Affairs
DP	Dechlorane Plus
DPP	Digital Product Passport
EA	Environment Agency
ECHA	European Chemicals Agency
EEE	Electrical And Electronic Equipment
ELV	End-Of-Life Vehicle
EPD	Environmental Product Declaration
ESPR	Ecodesign For Sustainable Products Regulation
EU	European Union
HBCD	Hexabromocyclododecane
HTI	High Temperature Incineration
LC-PFCAs	Long-Chain Perfluorocarboxylic Acids
MCCPs	Medium-Chain Chlorinated Paraffins
MWI	Municipal Waste Incinerator
OEP	Office for Environmental Protection
OPFR	Organophosphate Flame Retardants

PBDEs	Polybrominated Diphenyl Ethers
PCBs	Polychlorinated Biphenyls
PBT	Persistent, Bioaccumulative and Toxic
PFAS	Per- And Polyfluoroalkyl Substances
PFHxS	Perfluorohexanesulfonic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
PPE	Personal Protective Equipment
POPs	Persistent Organic Pollutants
PVB	Polyvinyl Butyral
PVC	Polyvinyl Chloride
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RoHS	Restriction of Hazardous Substances
RoK	Republic of Korea
SA	South Africa
SCCPs	Short-Chain Chlorinated Paraffins
SVHC / SVHCs	Substance(s) of Very High Concern
tpa	Tonnes Per Annum
TBPH	Bis(2-Ethylhexyl) Tetrabromophthalate
TBBPA	Tetrabromobisphenol A
UK	United Kingdom
UKFT	UK Fashion and Textiles Association
vPvB	Very Persistent and Very Bioaccumulative
WEEE	Waste Electrical and Electronic Equipment
WUDS	Waste Upholstered Domestic Seating
XRF	X-Ray Fluorescence

Summary

As signatories to the Stockholm Convention, the UK is obligated to eliminate or reduce the manufacture and use of persistent organic pollutants (POPs). In addition, waste containing POPs must be treated such that the POPs are destroyed or irreversibly changed. This is typically done via thermal treatment such as incineration. This report has been commissioned by the Office for Environmental Protection to understand two key areas:

- What regulatory and market controls are in place to prevent POPs being added to new products being placed on the market to minimise future POPs waste generation.
- What is the demand for POPs waste treatment and the available capacity, and will there be a gap by 2030.

These issues have been explored though a combination of desk-based reviews, interviews with key industry stakeholders and capacity modelling.

The quantity of POPs waste is directly linked to the addition of POPs in products that are placed on the market. The Stockholm Convention was established to restrict or eliminate the use of substances listed as a POP. In the UK, the Convention is implemented through the POPs regulations[1]. At a high level it could be assumed that this would be sufficient in ensuring substances listed as a POP are no longer used, but there are nuances within the Convention, a time lag between POPs being listed and regulated, as well as other product and waste regulations which may either support or contradict the POPs regulations.

To determine the risks and opportunities associated with ensuring new products do not contain POPs, a review of regulations in the UK (Great Britain (GB) and Northern Ireland (NI)) has been carried out. Much of the regulation and legislation in GB is based on EU versions, which have diverged slightly following Brexit but remain largely the same. EU regulations are followed in NI, and to facilitate export manufacturers in GB will typically look to conform with EU regulations which may be more stringent.

The POPs Convention itself allows for exemptions for the manufacture and use of POPs, which have been adopted by the UK, EU, China and other countries. This effectively extends the period over which POPs are legitimately used and could result in a greater lag between listing and phasing out in the waste stream than would be expected.

Product regulations may support the elimination of POPs, for example through digital product passports (DPPs) which could be used to ensure information on the substances in products is recorded and accessible to inform waste disposal or recovery operations. However, product functionality is key and

[1] The Stockholm Convention is implemented in Great Britain (England, Scotland and Wales) by the assimilated Regulation (EU) 2019/1021 (as amended), and in Northern Ireland by Regulation (EU) 2019/1021, which applies directly under the Windsor Framework.

the requirements for properties such as flame retardancy must still be met, typically using substances which have hazardous or persistent properties. This can lead to “regrettable” substitution, and these “new” substances may be at risk of a future POPs listing as they have many chemical similarities to current POPs.

Regulations which control substances, such as UK REACH (registration, evaluation and authorisation and restriction of chemicals) and RoHS (restriction of hazardous substances) can assist in the phase out of POP by providing a more rapid mechanism to restrict potential future POPs before they are listed under the Convention. However, there is sometimes a conflict, particularly where the limits under one regulation differ from that of the POPs regulation. This is notable in deca-BDE which has a RoHS (restriction of hazardous substances) limit of 1,000 mg/kg but a POPs waste limit of 500 mg/kg.

Waste regulations are largely complimentary to the POPs regulations and support the capture and processing of POPs waste. There is more that could be done through the implementation of circular economy (CE) principles to provide more incentive to effectively separate, sort and recycle non-POPs waste where it has been contaminated with a POPs waste or contains POPs.

Through engagement with some key stakeholders, it is apparent that manufacture and use of POPs in the UK and EU is likely to be minimal if not already eliminated. Typically, alternatives are available, albeit at higher cost and lower efficacy. The main risk identified was from imported products, particularly from Asia where the manufacture and use of POPs far exceeds UK/EU quantities. Ensuring imported products are free of POPs is very challenging due to the cost of analysis and difficulty in auditing production.

It is possible, even likely, that some new products will be placed on the UK market which contain POPs above current thresholds. There are effective controls in the UK and EU, but confidence is low that these are as robust in other countries. Domestic procurement could help reduce this risk.

To understand our ability to handle POPs waste, a review was conducted to assess the UK’s available treatment capacity for waste containing POPs to 2030. Under the Stockholm Convention the UK is required to manage POPs waste in accordance with best available techniques (BAT). The most common treatment is thermal treatment (incineration). This assessment examines three incineration routes:

- Municipal waste incineration (MWI)
- High temperature incineration (HTI)
- Cement kilns

Using published data and primary research, the projected treatment capacity for POPs containing waste was estimated and is summarised in Table 1. Due to various uncertainties, “low” and “high” treatment capacity scenarios have been developed based on planned and potential growth in infrastructure and ability and appetite to accept and destroy POPs waste.

Table 1 Projected POPs waste treatment capacity

Treatment	2030 (ktpa)	
	Low	High
MWI	537	1,108
HTI	8	31
Cement kiln	0	31
Export	10	10
Total	555	1,180

Projecting future POPs waste arisings is challenging. Tolvik and WRc have developed indicative estimates for the main waste streams likely to represent most of the current and potential future POPs waste, as summarised in Table 2. These streams vary in their suitability for different treatment options.

DEFRA's capacity note suggests that POPs waste could reach up to 3.8 Mt per year. However, Tolvik and WRc consider this figure unrealistically high and far beyond any feasible treatment capacity. This high demand scenario has therefore been excluded from the modelling.

Based on the projected treatment capacity and demand, the potential capacity gap by 2030 was evaluated and is presented in Table 3. Positive values indicate surplus capacity, while negative values reflect a shortfall.

Table 2 Projected POPs waste arisings (2030)

Waste stream	Feasible treatment options	Low (ktpa)	Median (ktpa)
Waste upholstered domestic seating (WUDS)	MWI	352	501
Plastic from small mixed waste electrical and electronic equipment (WEEE)	HTI, cement kiln, export	22	59
Plastic from large domestic appliances (LDA)		5	18
Automotive shredder residue (ASR) derived plastics and textiles		0	140
Expanded polystyrene (EPS) insulation foam	HTI, export	22	23
Plastics form construction and demolition (C&D)		20	210
Cable sheathing granulate		30	32
Total		452	984

Table 3 Demand versus capacity gap (2030)

POPs waste	Best case (low demand high capacity)	Worst case (median demand low capacity)
WUDS	756 ktpa	36 ktpa
Other/Hazardous	-31 ktpa	-441 ktpa

The analysis indicates there should be sufficient capacity to treat POPs classified WUDS up to 2030, at an estimated cost of ~£135m per year for Local Authorities. Operator interviews confirm that MWI facilities are suitable only for WUDS, with all other POPs waste types requiring alternative treatment.

A significant proportion of current local authority costs could be reduced through a more pragmatic approach to upstream segregation requirements for WUDS containing POPs. It is recommended that the Environment Agency review the segregation and handling requirements set out in RPS 264 and the December 2024 statutory guidance Manage waste upholstered domestic seating containing POPs, which now consolidates the requirements previously set out in the withdrawn RPS 265 and RPS 266, with a view to assessing whether the upstream segregation requirements are proportionate given that WUDS is subsequently mixed with ordinary waste streams prior to MWI treatment. Any review should consider the cost burden on local authorities against the environmental benefit achieved by upstream segregation.Hazardous and other POPs waste streams, including waste electrical and electronic equipment (WEEE) plastics, automotive shredder residue (ASR) and construction and demolition (C&D) waste arisings, remain poorly quantified in available data sources, with projected demand ranging from 100 and 500 ktpa. Available treatment capacity across cement kilns, HTIs and export routes is estimated at just 18 to 72 ktpa leaving a potential shortfall of up to 441 ktpa (96% of demand). Disposal costs could reach £300m per annum, excluding the substantial investment required for sorting, HTI expansion, or export infrastructure. Actual costs are likely to be considerably higher.

Based on the regulatory review and the apparent gap in capacity, the UK is likely to face considerable challenges in managing POPs waste in the near future.

1. Introduction

The United Kingdom (UK) is a signatory to the Stockholm Convention on persistent organic pollutants (POPs). These are chemicals (substances) which are highly persistent, meaning they will not break down in the natural environment, and have harmful properties. If left uncontrolled, the levels of these chemicals would increase in the environment and would pose a serious risk to human and animal life.

Many substances now listed as POPs under the Stockholm Convention were manufactured and used in a wide range of products at considerable quantities/volumes. At the time this was done to add functionality to the products, notably flame retardancy, water resistance and UV resistance.

As evidence was generated on the persistent, bioaccumulative and harmful properties of these substances, manufacturers and users would often phase them out prior to listing under the Stockholm Convention. In some instances, this was done voluntarily, in others the phase out was driven by regulation, such as REACH (registration, evaluation, authorisation and restriction of chemicals). Once listed as a POP, unless otherwise controlled, the manufacture and use of the substance must be managed through additional regulations. In the case of the UK, these are the POPs regulations.

The aim of the Convention, through the implementation of the regulations, is broadly twofold:

1. To eliminate the manufacture and use of POPs in products.

2. To ensure waste containing POPs is correctly managed. This necessitates the irreversible transformation or destruction of the POPs in waste, most commonly achieved through incineration. A waste is classified as a POPs waste when concentrations exceed the thresholds defined in the UK POPs Regulations.

The use of POPs is controlled, and in most cases prevented, through the POPs regulation. The POPs regulation is however not the only regulation governing substances in products or how waste is managed. Additionally, the POPs Convention allows for exemptions for the manufacture and use of a POP after it is listed. There are therefore possible nuances which could lead to POPs being present in product, despite a perceived “ban”.

Since POPs were used to provide specific functionality to products, manufacturers have had to move to other substances to avoid compromising performance. It is important to understand possible barriers and enablers industry faces with regards to ensuring products containing POPs are not placed on the market.

As a result of this legacy POPs use, there are several established POPs waste streams in the UK, including plastics from waste electrical and electronic equipment (WEEE) and waste upholstered domestic seating (WUDS). The recent listing of medium chained chlorinated paraffins (MCCPs) as a POP is expected to increase the volume of waste exceeding regulatory thresholds. Once this limit is exceeded, the waste must undergo destruction or irreversible transformation, and any thermal treatment route must demonstrate effective POPs destruction.

A Department for Environment, Food and Rural Affairs (DEFRA) commissioned study demonstrated that municipal waste incineration (MWI) could destroy POPs classified brominated flame retardants (BFRs) to an acceptable level.[2] MWI are designed to take waste with a low calorific value (primarily black bag waste) and operate at temperatures of ~850 ºC

However, other POPs, notably per and polyfluoroalkyl substances (PFAS) require higher temperatures than those achievable in MWI facilities making high temperature incineration (HTI) the only proven large-scale PFAS destruction method.[3] HTI is designed to treat a wide range of waste and operate at temperatures over 1,100 ºC. Evidence on the destruction of other POPs, such as short and medium chained chlorinated paraffins (SCCPs and MCCPs) remains limited.

Incineration capacity is finite and subject to technical constraints, calorific value (CV) and the halogen content (especially chlorine). This therefore raises concerns over whether there is and/or will be sufficient thermal treatment capacity in the UK to manage the demand for POPs waste destruction.

There is also the matter of preventing POPs from being present in products placed on the market. If POPs are not effectively eliminated at source, then it will create an ongoing waste management problem.

This report explores what the regulatory and industry barriers and enablers are to ensuring POPs are eliminated from new products (Section A), and what the demand for POPs waste disposal and the capacity for POPs waste destruction are likely to be by 2030 (Section B). An opinion as to the impact the findings of this study will have on the UK Governments Environmental Improvement Plan (EIP) will also be provided.

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[2] Persistent Organic Pollutants Destruction Efficiency in UK Energy from Waste - CX0111. https://sciencesearch.defra.gov.uk/ProjectDetails?ProjectId=21649

[3] Rapid evidence assessment of PFAS incineration and alternative remediation methods, Chief Scientist Group report, Environment Agency, September 2025

Section A – Regulatory Review and Industry Engagement

Signatories to the Stockholm Convention are committed to eliminating or reducing the manufacture and use of POPs. Each signatory will have relevant regulations to implement this in their territory. This may be one of several regulations which govern what substances can be used in products, and those products may also be subject to regulations which dictate certain performance requirements.

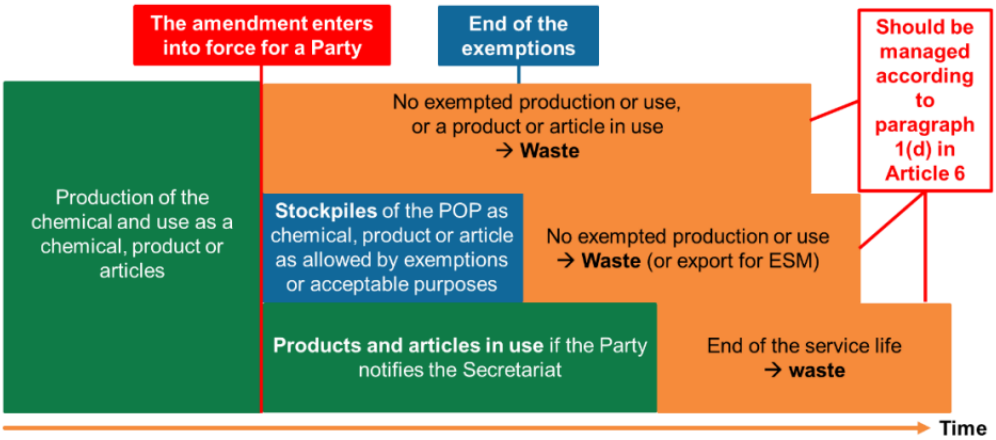
Section A of this report explores how the below points impact the potential for POPs to be present in products placed on the market today, which will result in future POPs waste arisings:

- The POPs Convention and regulations, specifically the issues of exemptions, thresholds and listing of new substances.
- Interaction with other product and waste regulations, and circular economy principles, where there may be synergies or contradictions.
- Barriers and enablers faced by industry, explored through interviews with key sector experts.

2. The POPs Regulation

The use and fate of POPs are primarily managed by the Stockholm Convention, also known as the POPs Convention. The Convention concerns both products and waste, with a further distinction between products, articles in use and stockpiles. This is illustrated in Figure 2.1 below.

Figure 2.1 Products, stockpiles and waste in the context of the POPs Convention[4]



The Convention lists 34 “entries”. Some of these entries are a single substance or compound (e.g. deca-BDE), whereas others may include a range of similar compounds (e.g. Polychlorinated biphenyls (PCBs)) as a single entry. Entries can be divided into three groups according to their mechanism of production and level of restriction. The entries are listed in three annexes of the Convention.

- Annex A (Elimination) – 30 entries
- Annex B (Restriction) – two entries
- Annex C (Unintentional production) – seven entries[5]

The main provisions of the Convention require parties to:

- prohibit and/or eliminate the production and use, as well as the import and export, of the intentionally produced POPs that are listed in Annex A to the Convention (Article 3)

[4] Report on options for identifying persistent organic pollutants in stockpiles, products and articles in use and in waste, Twelth meeting of the Conference of the Parties to the Stockholm, 2025

[5] Some entries appear both in Annex A and C, such as PCBs

- restrict the production and use, as well as the import and export, of the intentionally produced POPs that are listed in Annex B to the Convention (Article 3)
- register for specific exemptions for the production or use of POPs (Article 4)
- reduce or eliminate releases from unintentionally produced POPs (Article 5)
- ensure that stockpiles and wastes consisting of, containing or contaminated with POPs are managed safely and in an environmentally sound manner (Article 6)
- to target additional POPs (i.e. investigate and provide evidence as to which other substances could be listed as a POP) (Article 8).

The Stockholm Convention is implemented in Great Britain (England, Scotland and Wales) by the assimilated Regulation (EU) 2019/1021 (as amended), and in Northern Ireland by Regulation (EU) 2019/1021, which applies directly under the Windsor Framework. This means there are some differences between Great Britian (GB) and Northern Ireland (NI), notably in the POPs waste thresholds (further discussed in section 2.3)

On the face of it the POPs regulation should be sufficient in preventing the continued use of POPs, and therefore ensuring there is a future where there is no "POPs waste". Once a substance is listed in Annex A or B of the Convention, the POPs regulation must be updated accordingly so there is a legal mechanism for the restriction on the substance.

Despite the aims of the Convention there are several ways POPs could continue to be used, and "POPs waste" could still be generated for years to come:

- Exemptions on the use of POPs in new products and articles mean that POPs continue to be produced and used. As many POPs are used in long life applications (e.g. flame retardancy in building materials) this could significantly extend the longevity of POPs waste.
- The concentration threshold of POPs in a waste to trigger a POPs waste classification are subject to change and will likely reduce.
- New substances in current production and use could be listed as a POP.
- Production in less well-regulated countries could still use POPs, especially where stockpiles exist.
- The use of recycled plastics, promoted by circular economy principles, may result in POPs containing materials being recycled in the UK or abroad.

2.1 What is a POPs Waste

It is important to define what a “POPs waste” is in practice. There are (broadly) two types of POPs waste:

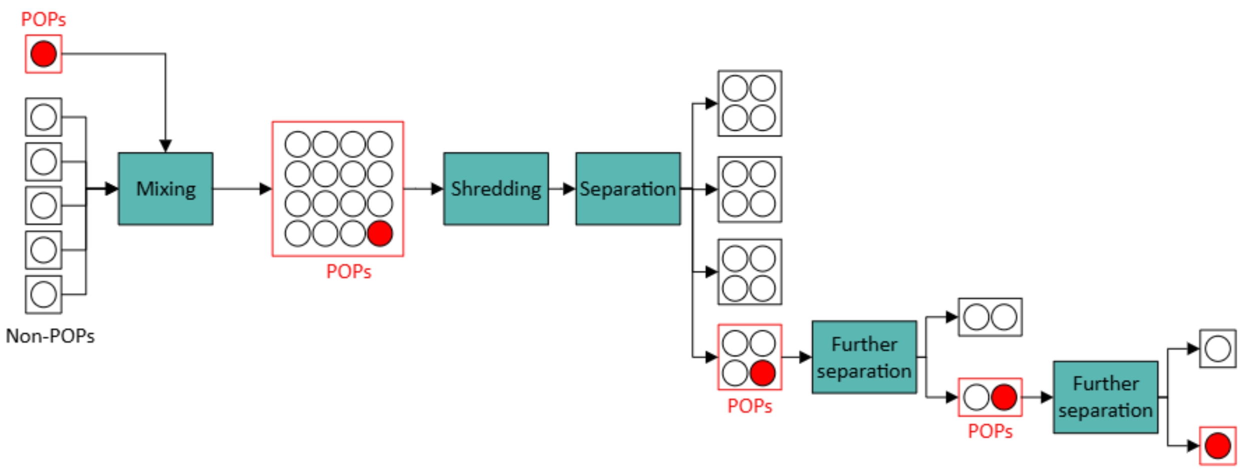
- A discrete item of waste, i.e. a toaster or chair, that as a whole contains POPs above a threshold as defined by the POPs regulation.
- A waste stream from the processing and sorting of a POPs containing non-POPs classified waste (i.e. quantity of POPs is below the threshold but there are POPs present, such as in end of live vehicles), where the sorted fraction on average contains POPs above said threshold.

2.1.1 Discrete POPs waste

Individual items are assessed for their POPs content at the point of disposal. For example, a sofa may contain high levels of POPs in the upholstery, such that even when the weight of wood and foam is considered the concentration of POPs still exceeds the thresholds. This item is therefore considered a POPs waste. As most waste systems are not set up to segregate POPs from non-POPs waste at source, inevitably they are mixed before being processed/recycled. Once the item of POPs waste is mixed with non-POPs, the whole mixed load becomes a POPs waste even though on average the concentration of POPs may be well below the waste threshold. Until the POPs containing material is removed, whatever it is mixed with is also considered a POPs waste.

The result of this approach is the designation of large quantities of waste as POP waste, despite the total concentration in that waste being, in most cases, well below the threshold. This is illustrated in Figure 2.2, where the red dot indicates an item of waste containing POPs over the threshold, and the red box indicating where the waste stream as a whole would be considered a POPs waste.

Figure 2.2 Illustration of a POPs waste being mixed with non-POPs waste



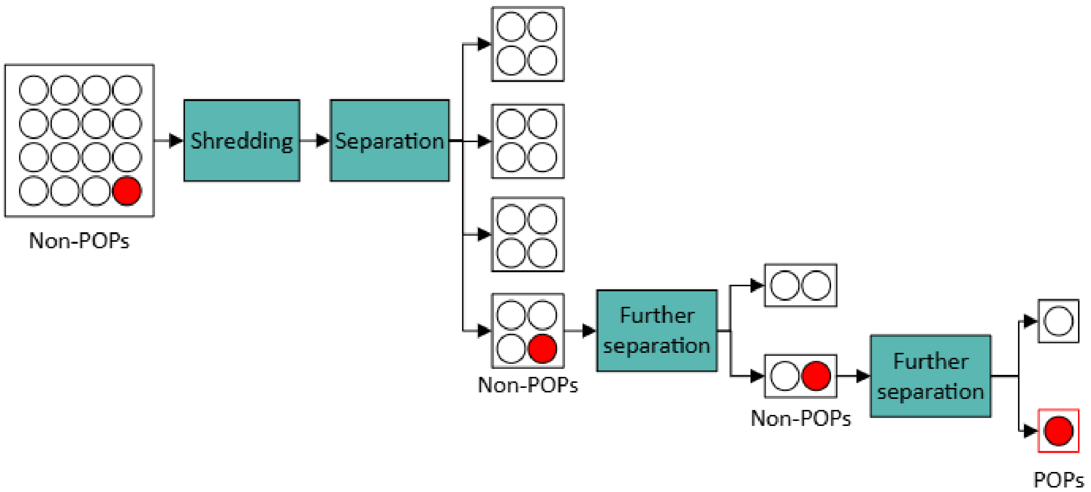
2.1.2 Separated waste fractions

A POPs waste stream may be "generated" from the processing of non-POPs classified waste. This can occur when the level of POPs in the discarded item (e.g. a car) is well below the POPs threshold, but individual elements or components (e.g. car plastics) do contain a significant concentration of POPs. The more the non-POPs waste is sorted and the POPs containing element is concentrated, it can result in some of the outputs exceeding the POPs waste threshold and therefore becoming a POPs waste.

The overall quantity of POPs is no higher than in the original non-POPs waste. If the original waste was disposed of rather than sorted, a POPs classification would be avoided. Disposal of mixed material earlier in the chain can also avoid a POPs classification. This in effect disincentivises the further sorting of POPs containing waste, as the disposal cost for the POPs fraction can outweigh the value from recovering other components. The knock-on effect is valuable secondary raw materials (e.g. non-POPs plastics) become prohibitively expensive to recover.

This is illustrated in Figure 2.3, where the red dot indicates a component in a product which contains POPs and the red box indicates when the waste stream itself would exceed the POPs waste threshold and be labelled as a POPs waste.

Figure 2.3 Illustration of the "generation" of a POPs waste from a POPs containing non-POPs waste



2.2 Exemptions For Manufacture and Use of POPs

The POPs Convention allows for exemptions for the continued production and use of some POPs in specific circumstances. These exemptions are set out in Annex A and B of the POPs Convention, and Parties may apply to use these. Exemptions are only valid for up to five years after a substance is listed as a POP.

It is important to understand how these exemptions could impact on future arisings of POPs waste. These exemptions are set out in detail in the text of the Convention. This includes exemptions (shown as grey text in Annex A) where there are no longer any Parties registered for the exemption, and no new registrations may be made[6].

The Convention website provides details of the registered exemptions for several POPs, although not all POPs with possible exemptions are listed (presumably because no Parties applied for and were granted an exemption). Table 2.1 below provides a summary for some of the POPs most relevant to POPs waste arisings in the UK for which Parties have active or expired exemptions.

[6] These "expired" exemptions do provide insight into the products which may be a POPs waste at end of life and are therefore still a useful source of information.

Table 2.1 Registered active and expired exemptions

POP	Active exemptions	Expired exemptions	Impact on future POPs waste
Deca-BDE	**Production** Several Parties, including the EU and UK have an exemption to produce deca-BDE for the specified use (see below), until the specified use is no longer required. The European Chemicals Agency (ECHA) website shows one active REACH registration for the production of deca-BDE. The company listed shows deca-BDE on their website as a product[7] **Use** The exemption covers parts for use in legacy vehicles (expiring end of service life or 2036) and aircraft parts (expiring end of service life). The UK and EU are both registered for this exemption	Exemptions were in place for the production and use of deca-BDE in certain electronics in the UK, EU and China until December 2023. China also had an exemption for the use in textiles and polyurethane foam building insulation, also until December 2023. The Convention website provides no details on quantities.	The exemption for vehicles offers many opportunities to use deca-BDE, but it only applies to legacy vehicles which have ceased mass production. As a result, the effective quantity entering new products would be minimal compared with the vast quantity of mass-produced legacy vehicles. The presence of deca-BDE in aircraft may be more significant for that specific waste stream. Quantities of deca-BDE produced and used in the UK / EU are likely to be negligible. The Convention website provides no estimate on the quantity produced or used by the EU or UK. Impact is more likely to be due to the recently expired exemptions. These mean that there is a greater chance that “new” products may contain deca-BDE, especially those imported from China. It also means the arisings in waste may continue for far longer than anticipated considering deca-BDE was listed as a POP in 2017.

[7] https://everkem.it/en/prodotto/ap-1210-xf/

POP	Active exemptions	Expired exemptions	Impact on future POPs waste
Dechlorane plus (DP)	**Production** None **Use** The UK has no registered exemption for the use of DP, however the EU (and other counties) have. These are for the manufacture of replacement parts where DP was originally used and limited to the below applications: • Aerospace • Space and defence • Medical imaging and radiotherapy devices and installations • Motor vehicles • Stationary industrial machines • Marine, garden, forestry and outdoor power equipment • Instruments for analysis, measurement, control, monitoring, testing, production and inspection	None	As a recently listed POP, there are a significant number of exemptions for the use of DP, however no exemption for the production. The use must end in 2044 or the end of service life (whichever is sooner). Despite the long list, providing there is no further production, the risk of significant quantities of DP being introduced into new products is low as the use is only for replacement parts.
HBCD	**Production** None **Use** None	There were previous exemptions in the EU (and by default at that time the UK) for the production and use of HBCD in expanded polystyrene insulation foam.	Although there are no active exemptions, these historic ones may result in imports from China having a greater likelihood of containing HBCD than would be expected.

POP	Active exemptions	Expired exemptions	Impact on future POPs waste
		The EU had an exemption for the production and use of 13,000 tpa which expired in 2017. China had an exemption for the production and use of an unknown quantity until December 2021.	
PFOA	**Production** Neither the UK nor the EU have exemptions for production of PFOA. The republic of Korea (RoK) has an exemption for the production for use in textiles (oil and water repellence) until 02/06/2026. **Use** The UK and EU (and several other countries) have active exemptions for the use of perfluorooctyl iodide in pharmaceutical production, mostly expiring in 2036. RoK has wider exemptions including use in firefighting foam and textiles until 02/06/2026.	The UK and EU had an exemption until December 2025 for the production of PFOA for uses other than firefighting foam. Several counties, including the UK and Vietnam (but excluding the EU) also had exemptions on the use of PFOA in firefighting foam and textiles which expired in December 2025.	There were many exemptions for use which expired in December 2025. It is likely therefore there will be some time where products containing PFOA will still be placed on the market. RoK still have an exemption for textiles, which could be imported into the UK. Existing exemptions in the UK and EU are limited to the manufacture of pharmaceuticals.so are very unlikely to impact POPs waste tonnages but highlight the ongoing issue of POPs in wastewater treatment.
SCCPs	**Production** None **Use**	China had an exemption for the production and use of SCCPs which expired on 31/12/2023.	The recently expired exemption means it was very likely imported products in 2024 could have contained significant concentrations of SCCPs.

POP	Active exemptions	Expired exemptions	Impact on future POPs waste
	None	This allowed the production for SCCPs to be used in numerous products, including PVC. No estimated production quantity was given. Both China and Vietnam had exemptions for the use of SCCPs in various products which expired in December 2023.	Stockpiles of SCCPs, production or use may still be ongoing in contradiction to the POPs convention.
UV 328	**Production** None **Use** Both Brazil and South Africa (SA) have exemptions for the use of UV-328 in numerous applications until 2030. These include the use in replacement parts for motor vehicles and in LCD displays. The SA exemptions provide some quantities, expected to be in the order of grams a year.	None	The very limited quantities used by Brazil and SA, in the controlled applications as detailed in Annex A are unlikely to result in any significant quantity of UV-328 being placed on the UK market.

There are no exemptions registered for MCCPs, however this is likely because it has only recently been listed as a POP. Part XIII of Annex A details the possible exemptions on production and use. The use of MCCPs in metal working fluid has not been deemed a high risk. Instead, the use as an additive in PVC or rubber has been focused on.

MCCPs are a more complicated entry than most, due to the fact it is not a single substance but a range of chlorinated paraffins (CPs) with carbon chain length C14 – C17. In China it is common to produce a "wide cut" CP product which contains C10 – C20, therefore this can (and typically does) include significant concentrations of C14 – C17 CPs, i.e. MCCPs. If the wide cut CP contains more than 3% MCCPs, the CPs would be subject to the conditions of Annex A (i.e. it would be treated as MCCPs).

The implication is that a CP with <3% MCCPs would be exempt from the conditions set out in Annex A. A product could therefore be manufactured using a CP with up to 3% MCCPs. If a POPs waste threshold is set as 0.15%, it means if a product contains >5% mixed CPs, the product will contain MCCPs over the POPs waste threshold. It is very possible a PVC cable could contain this level of CPs, creating a situation where products that are continued to be placed on the market would be considered a POPs waste.

Of the possible exemptions listed in Annex A of the Conventions, the uses of most note are in:

- wires and cables in the construction sector
- flexible elastomeric foam for thermal insulation
- adhesives and sealants (including for doors and windows)

This would not allow the use of MCCPs in cables for consumer electronics but would still allow for a significant quantity of products to be imported into the UK which contain this POP. From these listed uses, construction products would be the most likely to contain MCCPs if the exemptions are used.

It is clear that there is a significant lag period between a substance being listed as a POP and the elimination from use. Specifically, China has made use of these exemptions for deca-BDE, HBCE and SCCPs. This will result in a longer transition period than would be expected based on UK and EU phase out of POPs. For example, SCCPs were able to be manufactured and used in PVC cable sheathing up until 31/12/2023. The recent listing of MCCPs means it is likely this will also be manufactured and used for another five years.

2.3 POPs Waste Thresholds

The concentration of POPs required to trigger a POPs waste classification is set out in the POPs regulation. GB has their own POPs waste thresholds, which now differ from the EU (and by extension NI). There are also several "new" POPs, such as MCCPs and dechlorane plus, which are yet to have a POPs waste threshold set. Table 2.2 gives the different thresholds for some of the POPs more commonly associated with solid waste.

Table 2.2 GB and EU/NI POPs waste thresholds for key POPs

POP	GB	EU/NI
PBDEs	500 mg/kg	350 mg/kg (as of 30 December 2025), reducing to 200 mg/kg by 30 December 2027
HBCD	1,000 mg/kg	500 mg/kg reducing to 200 mg/kg by 30 December 2027[8]
SCCPs	10,000 mg/kg	1,500 mg/kg
Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/PCDF) and dioxin-like polychlorinated biphenyls (dl-PCBs) for EU/NI only	15 µg TEQ/kg	5 µg TEQ/kg

2.3.1 Future GB thresholds

The thresholds are constantly under review and are subject to change. In theory the concentration of POPs in waste will reduce over time, as the products they contain are disposed of and the use of the POP in new products is prevented. It is unclear however if the rate of disposal and the reduction in waste matches the lowering of the thresholds.

It is therefore feasible that the lowering of thresholds will result in greater quantities of waste being classified as POPs. Not only may more waste contain concentrations at these levels or above but as the levels reduce, the challenge of accurately quantifying POPs in waste becomes more challenging. Limits of detection for PBDEs for example are typically in the 1 – 10 mg/kg range. This should be sufficient, however when considering possible errors in sampling, sample preparation, sub-sampling and extraction, it becomes difficult to provide conclusive evidence that a waste is below the threshold.

In spring 2023 DEFRA ran a consultation which included questions on POPs waste thresholds. The consultation presented various options for lowering these thresholds. In April 2024 the government response was published. One of the conclusions of this was to not lower the threshold for SCCPs or HBCD, and no limit was proposed for UV 328 or Dechlorane Plus. The response was as follows:

"We are not prioritising amending or adding the existing waste concentration limits for these substances because there are still uncertainties around potential impacts and most appropriate values."

[8] The Commission shall review that concentration limit and shall, where appropriate, adopt a legislative proposal to lower that value to not higher than 200 mg/kg no later than 30 December 2027.

It is fair therefore to assume DEFRA and the EA will be looking to gather further evidence on concentrations of these POPs in waste, such that when a decision is made on amending or adding thresholds the impact will be understood more fully. The threshold for PBDEs was lowered on the 1st April 2025 to 500 mg/kg, but a further reduction plan has not been established.

2.3.2 GB and NI differences

POPs waste limits in NI follow those in the EU, which in some cases differ considerably from GB. Primarily there is a difference in limits for PBDEs and SCCPs, with the EU/NI limit for SCCPs an order of magnitude lower than in GB. It is possible that when limits are set for MCCPs, the EU/NI limit will also be lower than that in GB.

The impact is that the quantities of waste classified as POPs in NI could exceed that (in relative terms) of GB. Notable waste streams are discussed below in Table 2.3.

Table 2.3 Waste streams likely impacted by different GB/NI POPs waste thresholds

Waste stream	Implication
Waste domestic upholstered seating (WUDS)	Both GB and NI treat WUDS as a POPs waste. There is limited if any segregation of POPs from non-POPs WUDS with no cost-effective ways established. If segregation methods are developed, they may be more effective in GB than NI, where due to lower limits for PBDEs and HBCD, proving a non-POPs status will be more challenging.
Waste electrical and electronic equipment (WEEE)	Several types of WEEE are considered POPs waste in England due to PBDEs. The limit for PBDEs is lower in NI and is set to reduce further. This could impact which types of WEEE are considered a POPs waste.
Automotive shredder residue (ASR)	Components used in automotive applications are known to have been made with POPs, notably PBDEs and SCCPs/MCCPs. Current understanding in GB is concentrations are below POPs thresholds, but with the significantly more stringent threshold in NI, there is a greater chance ASR would be classified as a POPs waste. WRc are unaware of NI specific studies on ASR quantity or POPs content.
Construction and demolition (C&D)	There is ongoing work in England looking at POPs in C&D waste. Construction products, such as expanded polystyrene (EPS) insulation are known to have had POPs added to provide fire retardancy. As with ASR, the lower limits in NI may impact significant quantities of waste
Cables and cable sheathing	Studies have shown SCCPs and MCCPs to be present. Most cables are below the GB threshold for SCCPs, and there is no threshold set for MCCPs. However, cables and cable sheathing may contain SCCPs exceeding NI limits.

The website of the Department of Agriculture, Environment and Rural Affairs (DAERA, the NI equivalent of DEFRA) highlights WUDS but none of the other waste streams highlighted in the table above. It would be beneficial to understand if these waste streams are a priority for DAERA, and when data from the level of POPs in GB waste streams is available how this will be used by DAERA.

2.4 Possible Future POPs

Substances are listed under the POPs convention due to their persistent and harmful properties. The listing of substances takes many years. There are no chemicals proposed for listing shown on the Convention website, however substances of very high concern (SVHCs) as listed in the candidate or authorisation lists for REACH could be used as an indicator for future POPs. Some of these SVHCs are listed as persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB). These are substances which may therefore become a POP in the future.

The EU candidate and authorisation lists have been reviewed for potential POPs. The UK has not listed any new substances as SVHCs under UK REACH since 2020 and so reviewing the EU lists gives a more up to date picture. From this review, several substances of interest have been identified. A more comprehensive discussion on REACH, UK REACH and the interaction with the POPs regulation is given in Section 3.1.3. The European Chemicals Agency (ECHA) also has a list of proposed POPs[9] which has been used for this review.

2.4.1 Cyclic siloxanes

The ECHA POPs proposals list includes three cyclic siloxanes: octamethylcyclotetrasiloxane (D4), decamethylcyclopentasiloxane (D5) and dodecamethylcyclohexasiloxane (D6). However, the intention to submit the proposal for listing in the Convention has been withdrawn. All three are SVHCs and included in the UK and EU REACH candidate lists as PBT and vPvB.

These substances were used in personal care products and have been restricted since May 2024. The ECHA profile for D4 suggests between 100,000 and 1,000,000 tonnes is manufactured or imported into the European economic area (EEA) each year[10], although this seems highly unlikely considering its restriction.

Since the proposal for listing has been withdrawn it may be unlikely this would be listed as a POP. If it were to be listed as a POP, its use in short life cosmetics and personal care products would mean there would be less issue with POPs waste. Firstly, these are not typically disposed of and are consumed during use, meaning they instead would enter the water treatment system and so would not create a "POPs waste" (assuming the concentration in any wastewater treatment sludge is below a given

[9] https://chem.echa.europa.eu/activity-lists/popsProcess?searchText=

[10] https://echa.europa.eu/substance-information/-/substanceinfo/100.008.307

threshold). Secondly, if listed as a POP they could be rapidly phased out and would not remain in legacy products.

The greatest risk from these substances is if sewage sludge is applied to land, then there could be an accumulation in the soil, or an uptake by plants and animals leading to a pathway back to human exposure.

2.4.2 Aromatic brominated flame retardants (ABFRs)

A request has been made by the European Commission to ECHA to prepare a restriction proposal for aromatic brominated flame retardants (ABFRs). This class of substances includes polybrominated diphenyl ethers (PBDEs), some of which are POPs classified. It also includes substances listed under EU REACH as substances of very high concern (SVHCs). Although this is not a proposal to list these substances as POPs, due to their chemical similarity with PBDEs they could exhibit similar properties.

The current mandate focuses on three SVHC classified ABFRs, however ECHA is to investigate the vPvB/PBT nature of other BFRs. The current ABFRs in scope for further restriction are given in Table 2.4.

Table 2.4 Substances in scope of ECHA ABFR mandate

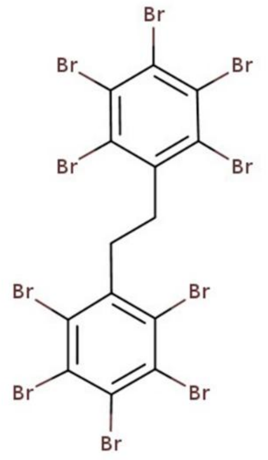
Substance	Acronym	CAS No.
Decabromodiphenyl ethane	DBDPE	84852-53-9
Bis(2-ethylhexyl) tetrabromophthalate	TBPH	26040-51-7
1,2-Bis(tribromophenoxy)ethane	BTBPE	37853-59-1

Decabromodiphenyl ethane (DBDPE)

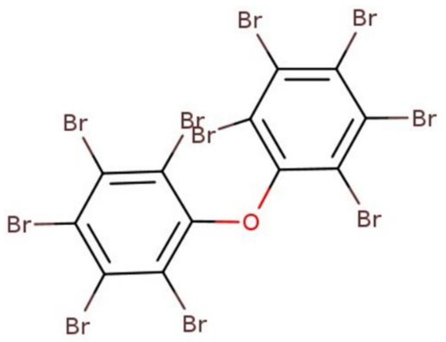
DBDPE was included in the EU REACH candidate list as an SVHC in January 2023 (it is not in the UK REACH candidate list) and is included due to its vPvB properties. DBDPE is an ABFR and chemically similar to deca-BDE in that it has two brominated phenyl rings with 10 bromine atoms, as shown in Figure 2.4. The difference is that deca-BDE has a C-O bond, which is stronger than the C-C bond in DBDPE. DBDPE was/is manufactured and used as a replacement to deca-BDE for flame retardancy in polymers. Between 10,000 and 100,000 tonnes of DBDPE is manufactured in and/or imported into the EEA each year according to ECHA[11].

[11] https://chem.echa.europa.eu/100.076.669/dossier-list/reach/dossiers/active?searchText=DBDPE&pageIndex=1

Figure 2.4 DBDPE and deca-BDE molecules



DBDPE, $C_{14}H_4Br_{10}$



Deca-BDE, $C_{12}Br_{10}O$

The UK does not restrict DBDPE as it is not in UK REACH. There is no evidence this will be listed as a POP, but there is a possibility. The UK would likely be behind other countries, notably those in the EU, in eliminating DBDPE.

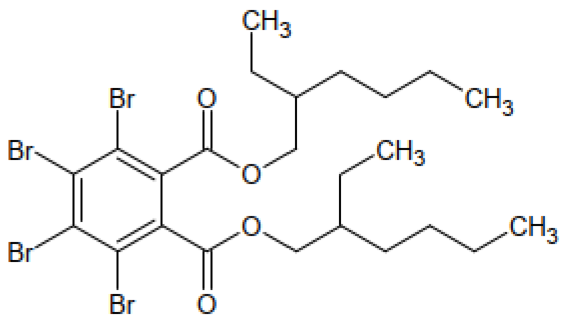
WRc have conducted a number of projects involving the quantitative analysis of brominated flame retardants in plastics and textiles. Through these projects it has been noted that DBDPE is very difficult to quantify, as it is only partially soluble in the solvents used for analysis. This will present a significant challenge to identifying waste and products containing DBDPE in the future.

Bis(2-ethylhexyl) tetrabromophthalate (TBPH)

TBPH is a brominated phthalate, similar in structure to bis(2-ethylhexyl) phthalate (DEHP). TBPH can be used as both a plasticiser and a flame retardant in polymers, adhesives and sealants. ECHA reports its manufacture and/or import into the EEA as 100 to 1,000 tonnes per year. Specific uses include as a flame retardant in polyurethane foam, neoprene and rubber[12], suggesting it was used in construction products. Figure 2.5 shows the chemical structure of TBPH.

[12] https://www.healthvermont.gov/sites/default/files/document/ENV_CDP_26040_51_7_TBPH.pdf

Figure 2.5 Chemical structure of TBPH



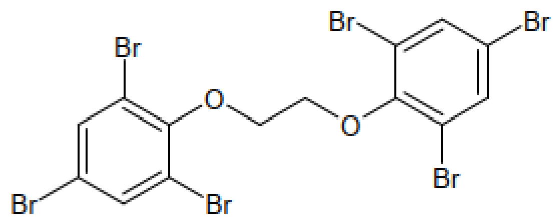
The ECHA proposed POP list shows there is an intention to prepare an EU proposal to list this substance under the Convention. It was added to the EU REACH candidate list as an SVHC in 2023 but is not currently in the UK REACH candidate list.

Current production and use in the EU (and presumably the UK) may be low, but its use in long life products, potentially in construction, could be a significant source of future POPs waste. The lack of inclusion in UK REACH could make phase out more challenging compared to EU countries.

1,2-Bis(tribromophenoxy)ethane (BTBPE)

BTBPE was added to the EU REACH candidate list in January 2023 due to its vPvB properties. The ECHA website does not show any REACH registrations for this substance, and there is little information available online. The ECHA news release notifying its listing as an SVHC acknowledges the lack of registrations, but hopes identification as an SVHC can be seen as a measure to avoid future regrettable substitution.[13]

Figure 2.6 Chemical structure of BTBPE



1.1 [13] ECHA adds nine hazardous chemicals to Candidate List, Helsinki, 17 January 2023. https://echa.europa.eu/nl/-/echa-adds-nine-hazardous-chemicals-to-candidate-list?utm_campaign=Candidate+List+23&utm_source=LinkedIn.com&utm_medium=FaceLift.com

The apparent lack of manufacture or use of BTBPE in the EU (and presumably UK) mean that either a POPs listing is unlikely, or if it is listed as a POP would have little effect on the products placed on the market.

2.4.3 Phenolic benzotriazole UV stabilisers

These chemicals are used UV light stabilisers, typically used at concentrations <1% w/w in coatings or polymer compounds. This class of substances includes UV 328, recently listed under the Stockholm Convention.

The UK and EU REACH authorisation lists also includes UV 320, UV 327 and UV 350. One reason for these being included in the authorisation list is the fact they have not been considered for listing under the Convention[14], and so REACH has been used as a mechanism to restrict their use.

The impact of UV 328 being listed as a POP and the concentrations in waste are relatively unknown. There is suspected use in automotive components (polyvinyl butyral (PVB), is used as a coating on windscreens), but the concentrations in waste are likely to be very low. The listing of additional UV stabilisers is unlikely to change the quantities of POPs waste in the future, although it may impact PVB recycling.

2.4.4 Summary

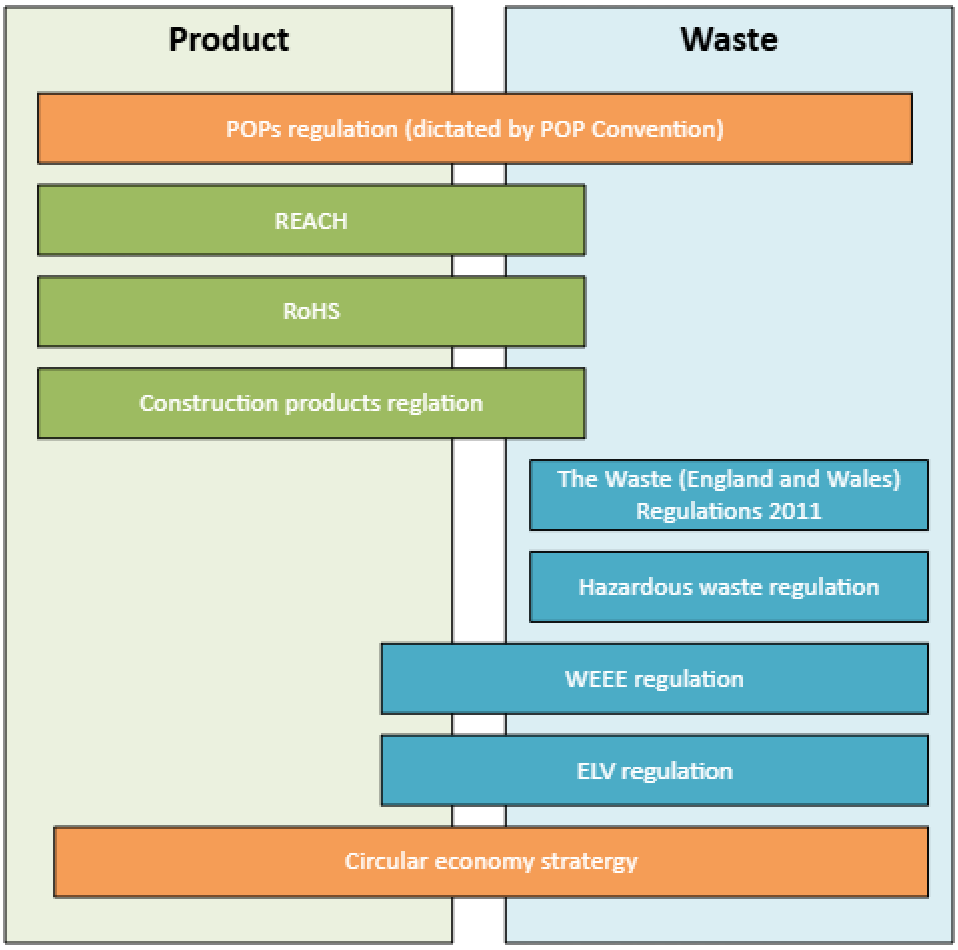
Reviewing the available information shows there is no substance at immediate risk of being listed as a POP under the Stockholm Convention (i.e. not within the next 3 years). The two most likely candidates which would have a significant impact on the arisings of POPs waste would be the ABFRs - TBPH and DBDPE. Neither of these are listed under UK REACH, and phasing out prior to a POPs status would rely on manufacturers looking to comply with EU REACH.

[14] https://www.cirs-group.com/en/chemicals/echa-proposes-to-restrict-three-benzotriazoles-under-reach

3. Interaction With Other Product and Waste Regulation

When considering the lifecycle of materials and products there are two primary areas of regulation - product and waste. Product regulation will typically contain some requirements related to the end of life, and waste regulation will likewise often contain some product requirements. This overlap typically concerns the design of products to encourage or facilitate reuse and recycling, or restrictions on substances to prevent environmental harm at end of life. Figure 3.1 shows some of the relevant regulations considered in this report.

Figure 3.1 Relevant product and waste regulations



Within these regulations there is detail on how products should perform and requirements for how to manage waste. This means there is typically an overlap with the POPs regulation. These overlaps and interactions are discussed below.

It is important to note that much of the regulation and legislation in the UK is based on the EU versions, which were developed pre-Brexit. EU regulation and legislation are also followed in NI. This means in the majority of cases, manufacturers and organisations will comply with both UK/GB regulation and EU regulation as this is still a major export market.

3.1 Product Regulation

To manufacture and place a product on the market, it must conform to various product regulations. Some of these are product specific (e.g. construction products, furniture and food contact products) and dictate what properties the products need and which standards must be met. Others are more generic and cover any articles, substances or mixtures (i.e. REACH).

There are three reasons why a product may contain POPs:

1. The POP has been deliberately added or applied during manufacture to provide a desired function (i.e. flame retardancy).

2. The POP is present in material that is recycled into a new product, either knowingly or unknowingly.

3. The POP is unintentionally present in the raw materials used in the manufacture of the product, for example SCCPs and MCCPs in other chlorinated polymers. Of the three mechanisms this is less likely to occur.

Product regulation will have greatest influence on the first point, where substances are intentionally added. They can also impact where recycled content can be used, and put in place measures to prevent unintentional contamination.

3.1.1 Product requirements

Regulation such as the construction products regulation set out requirements products must meet. This has resulted in the design of products and functional components such as additives and coatings to meet these requirements. Many POPs of relevance to this report were manufactured and used to provide functionality to meet these requirements.

One regulation of particular relevance is the Furniture and Furnishings (Fire) (Safety) Regulations 1988 (FFRs), which sets flammability requirements for domestic upholstered furniture. Within these regulations chemical flame retardants (FRs) are not stipulated but they are acknowledged as a cost-effective way of meeting the product requirements.

Due to the increased understanding of the harmful and persistent nature of some chemical FRs, the Government is currently reviewing the FFRs, and a policy paper was published in January 2025[15]. The policy paper sets out the ambition to reform the FFRs to maintain a high level of fire safety while facilitating a reduction in the use of chemical FRs. Of particular note is the proposal to remove certain baby and children's products from the scope of the regulations to reduce the risk of exposure to chemical FRs of young children at a significant stage in their development, where the fire risk is lower than the chemical exposure risk.

The need to meet product standards has not gone away, and if anything will likely become stricter. This is especially the case in building products in light of incidents such as the Grenfell fire. With a restriction on functional substances (e.g. flame retardants) manufacturers must find alternatives. Where alternatives do not exist, the specific exemptions in the POP Convention may be used for a limited time.

Another likely outcome is chemicals manufacturers will develop new substances. Many of these may have very similar chemical formulations and behaviour to their restricted counterparts. This can lead to the substitution of a POPs with a non-POP substance which is later designated as a POP. It is also possible that there are insufficient analytical methods to quantify novel substances, making it more difficult to determine if an item is free of POPs.

Aside from a potential future POPs status, substitution can still lead to issues with hazardous substances. For example, in some products (such as plastics and insulation) BFRs have been substituted with organophosphate flame retardants (OPFRs). While not POPs, evidence is growing on the hazardous nature of OPFRS, with several now having hazardous properties assigned to them. A POPs classification may be avoided, but these functional chemicals may still lead to a hazardous waste issue.

In general, the essential requirements for products cannot be compromised, and manufacturers must therefore find ways to comply while moving away from harmful substances. However, the exemption of baby and children's products from the FFR is an example of a divergence from this norm, and more of these may follow as the health impacts of certain chemicals are further studied. This is an interesting situation where the risk posed by the chemicals required to reach the performance specification outweighs the risk from not meeting those specifications.

[15] The fire safety of domestic upholstered furniture, January 2025, https://www.gov.uk/government/publications/fire-safety-of-domestic-upholstered-furniture/the-fire-safety-of-domestic-upholstered-furniture

3.1.2 Product passports

A way in which product regulation may assist in managing POPs is though product passports. As part of the EU Ecodesign for Sustainable Products Regulation (ESPR) (June 2024)[16] certain products will require digital product passports (DPPs). The DPPs should enable consumers, manufactures, authorities and others to easily access information on the products materials, origin, recycling methods and environmental impact (e.g. carbon footprint).

It is early days for the DPPs. Several priority products, including textiles and electronics have been identified for initial development as part of a working plan over the next five years (2025 – 2030). The details of DPPs are therefore yet to be decided, including how to mark products such that the information can be accessed.

Nevertheless, it provides an opportunity for being able to make and identify POPs free products at end of life. This could be particularly useful for products such as insulation foam, where large quantities may be present in a building. It may also allow for improved segregation of non-POPs electronics.

There is a significant limitation concerning imported products. Although these may still require a DPP, the confidence in the materials and additives used can be low, and there are numerous examples of products manufactured abroad which have been found to contain SVHCs when they should not. This is also an EU initiative not a UK one. The UK may follow suit, or manufactures may choose to comply with the EU regulation to access the market.

DPPs present an opportunity, but how practical and accurate they will be is uncertain. Major changes in waste collection and management would need to support identification and segregation, and current systems would be wholly inadequate for this. Primarily because it would require more labour to identify products and space for segregation, neither of which are typically available at waste generation, collection or processing sites.

3.1.3 Restriction of substances

There are two regulations concerning the restriction of substances in new products/articles of relevance to this review:

- UK REACH (registration, evaluation, authorisation and restriction of chemicals)
- RoHS (restriction of hazardous substances) – specific to electrical and electronic equipment (EEE)

Both UK REACH and RoHS are regulations originally carried over from the EU versions post Brexit (as with the POPs regulation). It must be noted that EU REACH applies in NI, and UK REACH applies in

[16] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202401781

England, Scotland and Wales. There is little difference between EU and UK REACH, and this section discusses aspects common to both.

This means there are three different regulations all pertaining to the restriction of substances. It is not ideal to have one substance covered by different regulations, and so in some instances to avoid duplication a substance may be removed from one of these if it is suitably covered by another.

POPs – RoHS

RoHS, between the UK and EU, has largely remained aligned, with the difference coming in the product marking (CE in the EU and UKCA in the UK). RoHS specifies the maximum concentration of some substances in EEE placed on the UK market. Of these, PBDEs are specified at a maximum concentration of 1,000 mg/kg.

The POPs regulation specifically exempts EEE covered by RoHS. This is despite the limit for PBDEs as an unintentional trace contaminant in articles being 500 mg/kg under the POPs regulation. This exemption means that EEE can be placed on the market with double the PBDE level of other articles and double the POPs waste threshold.

In effect, EEE can be placed on the market today which would be classified as a POPs waste if disposed of tomorrow. There is therefore an apparent disconnect which enables more “POPs waste” to enter our system. A concentration of 1,000 mg/kg is not functional for PBDEs, and deca-BDE is restricted under UK REACH, but it could allow manufacturers in less well-regulated countries to use stockpiles or recycled polymer. The product would still comply with RoHS and the POPs regulation.

POPs – UK REACH

UK REACH concerns the registration, evaluation, authorisation and restriction of chemicals. This interacts with the POPs regulation in a more direct manner as both can restrict, or in effect ban, specific substances from being used. UK REACH was implemented post Brexit and at the time was equivalent to EU REACH, which the UK was subject to.

When a chemical is placed on the market or used in products over a certain quantity, it must be registered and an evaluation carried out. The authorisation process ensures the risk posed by substances of very high concern (SVHCs) are correctly controlled through their lifecycle. A substance can be classified as an SVHC if one, or more, of the following hazardous properties are exhibited:

1. Carcinogenic, mutagenic or toxic for reproduction (CMR).
2. Persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB).
3. Similar levels of concern to CMR or PBT/vPvB.

Substances identified as SVHCs are included in the UK REACH candidate list, resulting in further requirements on the organisations supplying/using these substances. After further evaluation, these substances may then be included in the authorisation list. Once on the authorisation list, a substance can no longer be used unless express authorisation is given by the regulating authority. The candidate list serves as an early warning signal, and the authorisation list can in effect limit substance use if authorisation is denied.

Substances can also be restricted under UK REACH. This restriction list serve a different purpose to the candidate and authorisation lists, and it is possible that a substance is restricted but remains on the candidate. The restriction list[17] sets out specifics conditions, typically including maximum allowable concentrations in articles. Under UK REACH, there are 94 restricted substances which includes the POPs deca-BDE and PFOA (both also are on the candidate list). The allowable concentration for deca-BDE under UK REACH is 1,000 mg/kg, which is higher than that allowed under the POPs regulation. The limits for PFOA are consistent in the POPs and REACH restrictions.

This provides a direct link to the POPs convention, which also concerns persistent substances. Both the POPs regulation and REACH could be used to control/restrict these substances. The following scenarios can therefore occur:

1. A substance is controlled in the POPs regulation but not restricted by REACH – There is little/no benefit to add the substance to the REACH restriction list as it is already suitably managed by the POPs regulation.
2. A substance which is restricted under REACH is then listed as a POPs – Typically to avoid duplication the POPs regulation is updated with the new substance, and the listing under REACH is removed. Most POPs are not restricted under REACH despite their PBT/vPvB properties[18].
3. A substance suspected or known to be PBT/vPvB is not listed under POPs or REACH – The use of REACH to restrict a substance is typically quicker than listing a substance under the POPs convention. It may be preferable to use REACH to restrict the substance initially, and then once added as a POP remove it from REACH (if listed as a POP).

As a product (or article) must comply with both POPs regulations and REACH restrictions, if a substance is present on both lists with different limits (i.e. as is the case for deca-BDE), the lower limit must be complied with.

Therefore, it can be surmised that REACH and the POPs regulation should not interact in a way which results in possible continued use of POPs. What REACH does offer is possible early indications as to which substances could be listed as a POPs in the future, and through REACH the quantity of these substances and their usage should be known.

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[17] https://www.hse.gov.uk/reach/restrictions.htm

[18] Notable exceptions are HBCD and UV 328 which are in both

REACH can also be used pre-emptively to begin the restriction and phase out of possible POPs. The timescales to restrict a substance under REACH are quicker than to list a substance as a POP under the Stockholm Convention.

The divergence of UK REACH and EU REACH should be noted. Since Brexit, the UK has been focused on the practical implementation of UK REACH, and no new SVHCs have been listed. There are ~219[19] SVHCs listed in UK REACH, whereas EU REACH now lists 247[20]. The EU SVHC list is likely of more use when looking at future potential POPs. Additionally, due to the levels of trade between the UK and EU, many products will be compliant with EU REACH.

There seems therefore to be little material impact from the divergence, other than the UK potentially being further behind when it comes to the restriction of substances which may be a POP in the future. If an EU SVHC is listed as a POP, EU companies may be more prepared for the restriction than UK, although as mentioned in practice UK manufactures and users of chemicals would still be looking to comply with both UK and EU REACH.

3.2 Waste Regulation

The POPs regulation also concerns waste. It sets out POPs waste concentration limits and mandates how POPs waste must be managed. The main requirement is to destroy or irreversibly transform the POPs within the waste, which in practice means the waste must be incinerated.

Waste is primarily regulated through The Waste Regulations, with specific regulations such as the hazardous, waste electrical and electronic equipment (WEEE) and end of life vehicle (ELV) regulations. The Waste Regulations are high level, and although they are applicable to POPs waste there is little to discuss in terms of synergies and conflicts. The below sections outline how the specific regulations impact on the management of POPs waste.

3.2.1 Hazardous waste regulations

Many POPs have additional hazardous properties (and associated hazard statement codes). Therefore, it is usually necessary to determine if the waste is POPs and hazardous, or POPs and non-hazardous. The POPs waste thresholds are typically much lower than the thresholds for hazardous classification, so it is not unusual for a waste to be POPs and non-hazardous. The other way this can happen is if the waste falls under an absolute non-hazardous waste code, such as 19 12 04 (plastic and rubber wastes from the mechanical treatment of waste). The use of this code is for very pure waste streams, and in some cases (such as WEEE) the EA have mandated the use of an absolute hazardous waste code for

[19] https://www.sunstreamglobal.com/know-the-difference-between-eu-reach-and-uk-reach/

[20] https://echa.europa.eu/-/echa-adds-five-hazardous-chemicals-to-the-candidate-list-and-updates-one-entry

POPs waste (such as 19 02 04 - premixed wastes from physico/chemical treatments of waste composed of at least one hazardous waste).

If a waste does contain a POP, or another hazardous substance which exceeds a hazardous property threshold the waste would be classified as both POPs and hazardous. This causes a significant issue for waste operators as it means the waste must go to hazardous waste incineration. This is significantly more expensive than conventional waste incineration, and there is a very limited capacity for this in the UK. Therefore, avoiding a POPs and hazardous classification, though additional sorting or segregation is usually a priority.

3.2.2 WEEE regulations

The WEEE regulations are based on the WEEE directive, an EU directive which previously included the UK. The regulations are broad and set out the requirements that manufacturers, importers, distributors and retailers must meet. This includes ensuring that WEEE is collected and correctly handled at the end of life.

The WEEE regulations compliment and assist the POPs regulations, and the overall aim of capturing and destroying POPs. The main way it does this is it makes the producer/manufacturer/retailer financially responsible for the collection and treatment of WEEE. This means that the waste managers and recyclers are able to effectively pass the cost incurred from disposing of POPs waste to the producers / manufacturers / retailers.

It therefore helps to alleviate that financial burden associated with POPs and encourages the waste managers and recyclers to correctly manage the waste.

3.2.3 ELV regulations

The ELV regulations are similar to the WEEE regulations in that it puts (some of) the responsibility of end of life onto the manufacturers. This is done in an arguably less prescriptive way than the WEEE regulations. It should also be stressed that ELV is not a POPs waste, in contrast to some types of WEEE which are POPs waste. Some components in ELV (such as plastics and textiles) are likely to contain POPs, although the levels present are not well studied or quantified. The substances used, and their concentration are typically considered confidential information manufacturers are unlikely to willingly disclose.

The regulations require that manufacturers must ensure that 95% of a vehicle by weight is recovered, and that 85% is reused or recycled. This allows for 5% to be disposed of (e.g. landfill) and 10% to be recovered (i.e. sent to incineration). The regulations also include the requirement for the collection of vehicles and the recycling at an approved treatment facility.

The difference for ELV and WEEE is that the majority of recovery is in metals, and components which may contain POPs, such as fabrics and plastics, can still be incinerated. ELV is also a complicated waste stream in that it is typically co-processed with other metal waste including domestic metal waste (e.g. furniture and leisure equipment).

There are likely to be amendments to the regulations in coming years. The EU have already proposed updates to their ELV directive, which includes the use of recycled polymer in automotive components. The EU proposal is for some of this recycled content to be derived from ELV. This will encourage the processing of automotive shredder residue (ASR) and the recovery of recyclable plastics. To recover these recyclable polymers, it is possible a POPs waste stream will be generated, as the POPs will be concentrated into a dense, non-recyclable polymer fraction.

The ELV regulations may therefore result in more POPs waste being “generated” as an unforeseen consequence. Further testing and evidence would be needed to determine how likely this may be depending on the levels of POPs present.

3.2.4 Appropriate measures and BAT

In the UK, waste treatment sites require an environmental permit, issued by the relevant authority (e.g. the Environment Agency in England). Depending on the complexity of these processes, and the potential for environmental harm, some sites will have relatively strict requirements. These sites, such as WEEE processing sites and waste incineration plants, will be subject to the Industrial Emissions Directive (IED) and will need to conform to best available techniques (BAT). These requirements go far beyond POPs, however there are some relevant requirements. The main one being that a POPs waste must be correctly stored and cannot be mixed with a non-POPs waste (much like for hazardous waste). Having these permit requirements which can be audited by the relevant authority should help to minimise unnecessary creation of POPs waste. The impact of other measures are unlikely to impact on POPs waste arising.

3.3 Interaction With Circular Economy Principles

The English Circular Economy Strategy (also known as the Circular Economy Growth Plan) was expected to be published in 2025 but has been delayed to an as yet unspecified date, expected to be sometime in 2026. The taskforce leading the strategy/plan have identified five key priority sectors. These include electronics, construction products, and chemicals and plastics. These three sectors are of relevance to POPs.

3.3.1 Waste management

In lieu of the strategy or plan, this section considers circular economy (CE) principles in a broader sense. The fundamental aim of the POPs Convention is to capture and destroy POPs. A way of doing this is to capture and destroy waste that contains POPs. This drive to destroy is in contrast with CE principles, which seek to keep materials and products in the economy at their highest possible value for the longest time. A plastic which contains POPs may be fully recyclable (e.g. ABS from TV casings), but the POPs Convention and subsequent regulation prohibit this.

When considering the interaction with CE principles, the two types of POPs waste as described in section 2.1 can be considered separately.

In the case of a single item of waste (i.e. a toaster) containing POPs over the waste threshold, which is then mixed with non-POP containing items of the same type, CE principles can be used. By focusing on segregating POPs from non-POPs items at the point of disposal, the total quantity of “POPs waste” can be significantly reduced, allowing for effective reuse of recycling of the non-POP material. This is rather idealistic however, as typical disposal sites (i.e. household waste recycling centres) do not have the ability to identify and segregate POPs from non-POPs. Methods such as using portable handheld x-ray fluorescence (XRF) analysers to identify bromine free products are being explored, but there are many barriers including cost, safety and accuracy of analysis. The efficacy of XRF is also questionable as it cannot distinguish between POPs and non-POPs BFRs and cannot be used to identify chlorinated POPs.

Another way CE principles can support reducing POPs waste in this case is when separating POPs from non-POP components post collection (i.e. accepting the waste will initially be mixed). CE should promote the recovery of recyclable non-POPs fractions, such as POPs free plastics which can be effectively separated. By encouraging the up-take of recycled polymers and creating a pull effect for this market, it means the economics of further sorting can be justified. This will result in reduced quantities of POPs waste and value recovery from non-POPs fractions.

In the case of a POPs waste stream which is generated from a non-POPs waste, the interaction is not so favourable. CE principles and drivers may encourage the sorting of the non-POPs waste, for example automotive shredder residue (ASR) to recovery metals and plastics. However, the unsorted ASR may be below POPs thresholds, but sorted fractions (such as the dense polymer) may exceed thresholds. The operator has therefore “created” a POPs waste, which brings significant regulatory and cost burdens. In this instance, the operator may decide not to sort the non-POPs waste, resulting in limited recovery of materials.

3.3.2 Product design and manufacturing

One key area of legislation will be extended producer responsibility (EPR). The concept of EPR is to make the producers responsible for the entire life cycle of the product, including facilitating recycling. This is already in place to an extent with the WEEE regulations, which put this responsibility onto producers who need to purchase recycling evidence based on their market share. Packaging EPR (pEPR) is being implemented in England, and will include a £ per tonne fee for packaging places on the market. This fee is due to be modulated based on how recyclable the packaging is.

Extension of EPR to other products is possible, with textiles the most likely next area for focus. By making producers responsible for the financial burden of recycling and disposal, they are encouraged to make products which will have higher value at end of life or cost less to treat. One way is to ensure that products will not be classified as a POP in years to come, and so more care may be taken over which substances are used.

The challenge is that many of these products are long life and so changes today will not be felt for many years. Long term strategy may not extend to possible EPR fees in the future, and so the strength of EPR to have an impact above and beyond REACH and the POPs regulations is questionable. Manufacturers would look to REACH and the POPs Convention to inform choices on substances to use to meet their obligations.

Aside from EPR, future regulation will likely encourage or even mandate the use of recycled polymers. This would seem a positive intervention, as it would increase the value of recycled polymer and improve the business case for collecting, sorting and recycling more product. It can also however become problematic, as manufacturers may face a financial penalty or tax, similar to the plastics packaging tax. When this economic incentive is introduced, without very rigorous checks and audits, it could lead to increased use of recycled polymer from the UK and abroad which could contain POPs.

The need to show full destruction of POPs waste in the POPs regulation can be harmonious with CE principles, but the realities of economic drivers and regulatory burdens may limit the full potential of the CE. It may be that the cost of sorting, or the risk of using recycled content with POPs will result in compromises for numerous products and waste streams.

4. Industry Barriers and Enablers

4.1 Stakeholder Interviews

Interviews have been conducted with several relevant stakeholders to understand key barriers and potential enablers to ensuring products containing POPs are no longer manufactured and placed on the market. This is a snapshot of the intelligence gained, and the use of POPs extends beyond the responses below, however it provides valuable insight into how some key industries are approaching the issue. The below is the interpretation of WRc from the discussions with the various organisations, and views and opinions may change over time.

Organisation	British Plastics Federation (BPF) (vinyl group)
POP(s)	SCCPs and MCCPs, UV-328, dechlorane plus
Product(s)	PVC products

Historic use of POPs in the products:

SCCPs and MCCPs have been used as a flame retardant in plasticised PVC, typically as a mixture because SCCPs are too volatile to be used on their own. PVC itself is naturally a flame retardant, however when plasticisers are used it effectively reduces the level of chlorination. CPs have therefore been added as a cost-effective way of mitigating this. UV-328 and dechlorane plus are unlikely to have been used in PVC products.

SCCPs were also used in metal working fluids, although since this is a short life product used in a highly specialised application it is unlikely to impact on POPs waste.

Phase out of POPs and POPs replacements:

The function provided by SCCPs and MCCPs is not unique, and this has allowed for UK and EU users to move away from them with relative ease. Flame retardance can be achieved using non-halogenated flame retardants such as organophosphates (although these do have hazardous waste implications). These alternatives are more costly than CPs.

The production and use in the UK and EU has always been far less than in Asia. For example, the peak production of MCCPs in the EU was ~70,000 tonnes, whereas in China it was 1.3 million tonnes.

Pathways for products containing POPs to continue being placed on the market:

Domestic use (UK and EU) is likely to be very limited if it has not been eliminated. The major issue is with the import of products. Production in China is primarily for “wide cut” CPs with a carbon chain length of C10 – C20, which includes the chain lengths of SCCPs and MCCPs. There is therefore less control on these substances, and with such major production they are likely to be used for many years. This will result in a high likelihood of imported products from China containing MCCPs.

The UK is reliant on import of electronics and cable, so there is a particular risk in this area.

Separation and capture at end of life:

CPs are most prominent in cable sheathing. Since cables typically contain copper which has a high value and is easily recycled, there is effective capture and recycling of cables. Cables are stripped / granulated to recover the copper, and the resulting sheathing is disposed of. Not all cables are PVC, and not all will contain CPs, however there are no effective methods to screen for POPs and non-POPs containing PVC cables.

The resulting cable sheathing granulate is often recycled into "low grade" products such as traffic cones using compression moulding.

As well as containing CPs, legacy PVC cables typically contain high levels of lead, used as a stabiliser. Lead was phased out of UK/EU manufacture by 2015 but was and could still be used in imported products. The EU have introduced restrictions on lead in recycled products, which itself may prevent or limit the use of cable sheathing granulate in recycled products. The UK has not implemented restrictions yet, but it is likely they will follow the EU in the near future.

Key risks/barriers:

- MCCPs is a newly listed POP, and it is likely that exemptions will be applied for extending production and use for another five years.
- Vast majority of production and use has been in China/Asia, meaning import is a significant risk.
- High value of copper in cables may facilitate illegal export/processing of CPs containing sheathing.
- Cables are a very long life product so it is likely this waste stream will be POPs classified for a prolonged period, well after use of POPs in manufacture ends.

Key enablers:

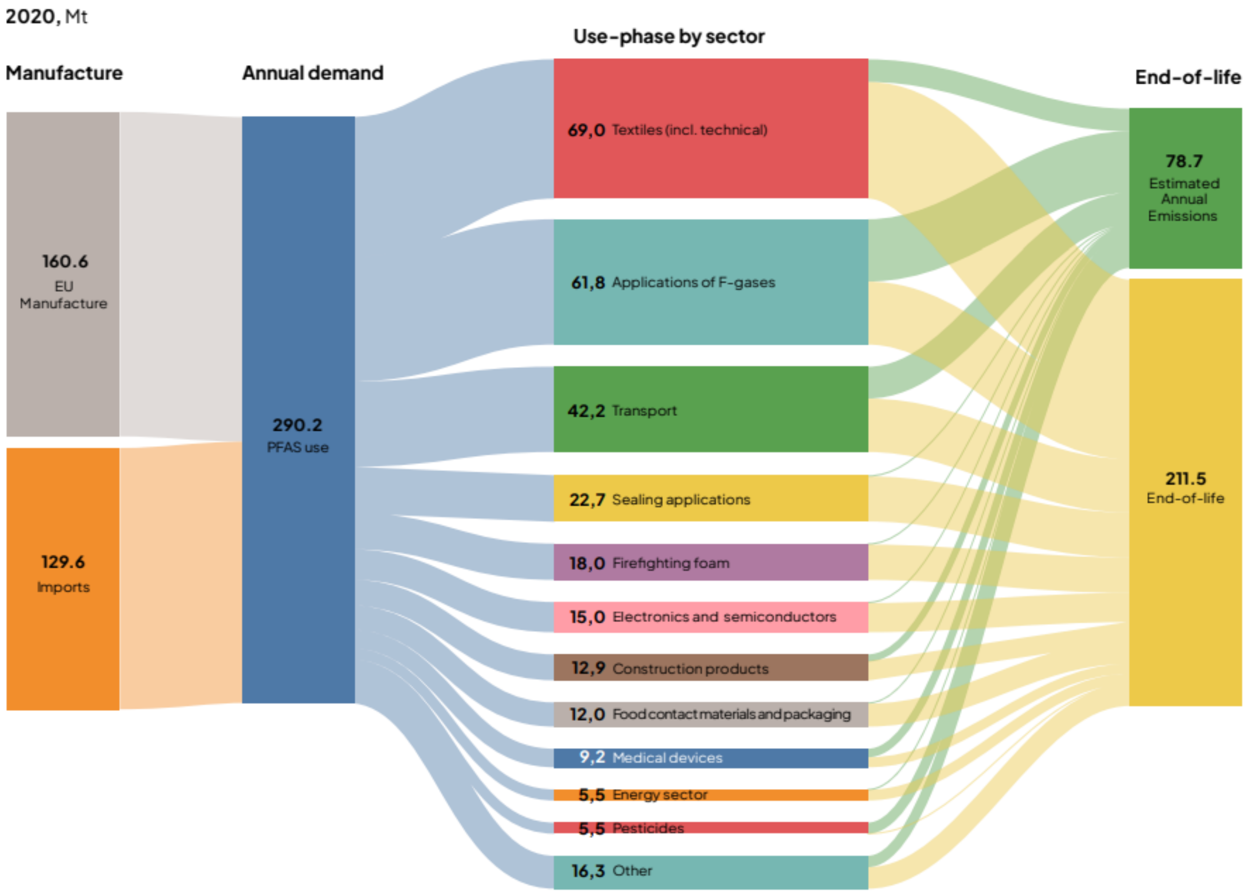
- Properties of CPs are not unique and there are viable alternatives.
- UK / EU production and use in manufacturing have been phased out.
- Majority of cable waste is captured and recycled due to the high value of the copper, creating a segregated possible POPs waste stream.
- Restrictions on lead likely to prevent/limit use of cable sheathing granulate in new products.

Organisation	UK Fashion and Textiles Association (UKFT)
POP(s)	PFAS
Product(s)	Textiles and garments

Historic use of POPs in the products:

PFAS are used to provide water proofing and anti-stain to garments and textiles, with waterproofing being the major reason. Textiles represent the greatest use of PFAS in the EU, as shown in Figure 4.1.

Figure 4.1 PFAS use in the EU (2020)[21]



PFAS is a vast range of substances, with four groups now listed as POPs (PFOS, PFOA, PFHxS and the newly listed LC-PFCAs). The industry often refers to "C8" PFAS (denoting the number of carbon atoms) which includes PFOA and PFOS.

[21] Systemiq. (2025). Invisible ingredients: Tackling toxic chemicals in the food system

Phase out of POPs and POPs replacements:

PFAS have properties that can be challenging to replicate and are used in applications where functionality is paramount. There is a move towards a universal PFAS ban in Europe, and this has led many manufacturers, such as 3M, to phase out all PFAS manufacture, not just those listed as POPs.

Due to their unique function, the textiles industry has found it a challenge to eliminate / replace PFAS, particularly in personal protective equipment (PPE) such as firefighters' uniforms. No other chemical has been found that can be used alongside other coatings to impart the required function.

As a result, manufacturers of PPE have moved from "C8" to "C6", non-POPs PFAS (similar to what has been seen in firefighting foam production). The performance of these shorter chained PFAS is not equal to the C8 PFAS, and therefore manufacturers have typically had to double or triple the quantity used to obtain the same results. Since many chemical manufacturers are stopping PFAS manufacture, it can be difficult and expensive to purchase C6 PFAS.

Use of POPs PFAS has, as far as can be determined, been eliminated in UK/EU manufacture.

Pathways for products containing POPs to continue being placed on the market:

POPs PFAS have been substituted in some cases for non-POPs PFAS, which creates a potential future issue if there is either a universal PFAS ban or if more PFAS are listed as POPs.

Import is a major potential pathway for POPs containing product to enter the UK. Much of the POP-free PPE manufactured in the UK is exported, meaning what is used is imported. Exemptions for the use of PFOA were in place for several countries but have all ended in 2025. Being confident imported products contain no POPs PFAS is difficult. Analysis is costly and there are two methods used, one lacks sensitivity and the other is very sensitive so will flag even low concentrations of PFAS. If an approach is taken where any PFAS detected is problematic, these sensitive methods would lead to more material being classed as PFAS containing.

Separation and capture at end of life:

Legacy products sold to consumers, such as waterproof clothing and tents, is unlikely to exceed any POPs waste thresholds and will be disposed of as general waste. PPE and specialist products are more likely to be captured and can then be destroyed if known to contain POPs.

Key risks/barriers:

- Performance of PFAS in textiles can be difficult/impossible to match with non-PFAS alternatives in some special cases (e.g. firefighting uniforms).
- Substitution of C8 for C6 PFAS may result in a future POPs issue.
- Imported products may still contain PFAS and testing is challenging/expensive.

Key enablers: • Major chemical suppliers moving away from PFAS – may force development of alternatives. • Universal PFAS ban in the EU may further force movement out of PFAS for all but the critical applications.

Organisation	The Alliance for Sustainable Building Products (ASBP)
POP(s)	BFRs, CPs
Product(s)	Construction products
Historic use of POPs in the products: The ASBP are active in the waste management and circularity aspect of construction products. Regarding the use of POPs in manufacturing, the primary focus has been on BFRs (including PBDEs and HBCD) in: • insulation foam, • electrical fixtures and fittings/EEE, • soft furnishings. Cables are also used in construction, which are known to contain SCCPs/MCCPs. **Phase out of POPs and POPs replacements:** UK and EU manufacture is likely to have phased out POPs BFRs with limited issue, as other substances such as organophosphate flame retardants can provide the same function. Other BFRs will have been / will still be used such as TBBPA and DBDPE, with the latter being identified as vPvB and an EU REACH SVHC. Within insulation, there is a move towards mineral wool products rather than polymer based products, which do not require chemical additives to impart flame retardancy. **Pathways for products containing POPs to continue being placed on the market:** As with other sectors, the import of product remains a concern. Insulation foam is less likely to be imported due to the low density (although it is still possible), so the primary risk will be in electrical fixtures and fittings / EEE. These products can be made with recycled content which could contain POPs or may be old stock produced when POPs were permitted. Exemptions for deca-BDE were in place in the UK, EU and China until the end of 2023 which suggest there could still be significant concentrations in recently manufactured products.	

The construction products sector is highly regulated, particularly with regards to safety (e.g. flammability). There are requirements for "higher risk" buildings to have digital information on the design and construction (known as the golden thread). Construction companies also often seek data on the environmental "credentials" of products, which has resulted in the development and implementation of environmental product declarations (EPD). The EPD online library[22] lists over 18,000 products. Digital product passports are also likely to become mandatory for construction products in the EU.

The above examples do not currently include information on substances used in the manufacture of products, and therefore currently do not necessarily facilitate the elimination of POPs or information on substitute substances. What they do provide is an existing information system which could be expanded to include this information, which may assist in reducing POPs or future POPs from being used.

Separation and capture at end of life:

Management of C&D waste is challenging. It is a highly heterogenous waste stream, typically with several different companies involved in removal and disposal of waste. High value materials (e.g. metals) are likely to be recovered and recycled, with other waste mixed and disposed of as "general waste".

There is also limited understanding of what products may contain POPs. Pre-demolition audits can be carried out to identify potential POPs containing products, but these are not mandatory and the resulting information may not be used. There are also limitations in being able to fully identify any POPs waste, for example cavity wall insulation which is unlikely to be accessible before demolition begins. Screening tools, such as XRF are unlikely to be practical due to cost, safety concerns and lack of trained individuals. In addition, they can only indicate the presence of bromine and would not detect any chlorinated or fluorinated POPs.

Identifying POPs containing waste in a building is one challenge, but ensuring it is removed, segregated and sent for appropriate disposal is another issue. There is limited resource (labour and space) which make this a real challenge

DPPs and digital building information may be beneficial in the future but will be needed alongside a shift in how C&D waste is managed.

Key risks/barriers:

- Imported products and recently expired exemptions (e.g. deca-BDE) may result in POPs containing products still being put on the market.
- The difficulties of managing C&D waste, and the current lack of data on the substances in the products make segregation and correct disposal challenging.

[22] https://www.environdec.com/home

Key enablers:
• There are various existing and future digital information systems for building products, which could be adapted to include information on substances in the products.

Organisation	Furniture Industry Research Association (FIRA)
POP(s)	BFRs
Product(s)	Soft furnishings

Historic use of POPs in the products:

The use of chemical FRs has been driven in the UK by the fire safety regulations, which have strict fire retardancy requirements. BFRs were and still are a commonly used chemical FR, and prior to restrictions and bans the industry were using substances now classified as POPs (particularly deca-BDE). Chlorinated paraffins (CPs) may be used in some textiles but are less common than BFRs.

The approach in the UK has been to use chemical FRs to pass the flammability tests. The test requirements therefore dictate which substances and how much are required. The tests themselves are thought to be too onerous, for example each component (fabric, foam etc) must pass individually rather than being based on the composite product which may overall have better flame retardancy.

The Furniture and Furnishings (Fire) (Safety) Regulations are being reviewed, with discussions on alternative requirements and testing methods, although nothing in this regard has been concluded. Removal of children's products from the regulations is an example of the UK moving towards a balance of flammability requirements and the use of chemical FRs.

The flame-retardant requirements are significantly lower in the EU, and as a result products sold in the EU may not need chemical FRs. The approach is that the risk posed by the chemical FRs is greater than that posed by fire. EU REACH also restricts more chemical FRs (e.g. DBDPE) than UK REACH.

Phase out of POPs and POPs replacements:

As restrictions have been imposed, manufacturers have moved away from certain substances to others. The issue is that in order to meet the flammability requirements, manufacturers have kept to certain groups of chemically similar substances. For example, as lower brominated PBDEs were restricted (e.g. hepta-BDE), manufacturers moved to unrestricted PBDEs (e.g. deca-DBE). Over time these substances would also be restricted, and manufacturers would move on again to similar substances.

Alternatives to BFRs do exist, notably organophosphate FRs and inorganic FRs such as aluminium trihydroxide. These all work in a different way, and in some cases the performance or properties of BFRs means they are still preferred. Organophosphate FRs have their own issues with regards to hazardous properties, and many are classified with hazard statement codes

Pathways for products containing POPs to continue being placed on the market:

Since it is a bulky product that is hard to ship, there is less of a risk from the import of furniture. The risk is not zero, and aside from possible POPs content there is also a concern that imported products do not meet UK product safety standards.

In some cases, manufacturers have fabrics coated by a third party to meet flame retardancy requirements. The system can be quite opaque with the exact substance used not always being disclosed. In the UK and EU its very unlikely a POP substance would be used due to restrictions, but it may lead to issues in the future with unknown substances present.

A greater risk is in the substituted chemical FRs being listed as a POP in the future, for example DBDPE. Unlike the situation with PFAS where the move is totally away from the substance group, within furniture the flammability requirements are still driving the use of BFRs.

This risk will remain while the current requirements and tests are in place. Once these are revised it may allow manufacturers to move away or significantly reduce chemical FRs, in the same way as in the EU. There is an abundance of evidence in the EU that the chemical FRs are not required to the degree they are used in the UK.

Separation and capture at end of life:

Domestic soft furnishings are considered a POPs waste in the UK, and as such councils and waste managers must separate and treat these accordingly. One issue is that many items will not contain POPs, especially newer products, but there is no reliable way to sort the POPs from non-POPs items.

Improved labelling, and initiatives like product passports could enable more efficient segregation at end of life and facilitate re-use. As furniture is a large discrete item, unlike something like flooring, it is more feasible to label products with the substances they contain in a useful manner.

Key enablers:

- Revisions of the Furniture and Furnishings (Fire) (Safety) Regulations to amend requirements and test methods could enable reduction, or even elimination, of chemical FRs from soft furnishing.
- There are lower relative product imports than for some other product categories (e.g. electronics), so greater controls and certainty of chemicals could be achieved.

Key risks/barriers:

- Existing fire safety requirements and existing test methodologies will necessitate the use of chemical FRs, including BFRs which are chemically similar to POPs.
- UK REACH is “behind” EU REACH, and BFRs used today without restriction may be classified as a POP in the future.
- Labelling and digital product passports would be more effective for furniture than construction products and enable identification and segregation of non-POPs furniture for recycling and re-use.

4.2 Summary

From the interviews it appears that UK and EU manufacture and use have been able to move in line with the POPs regulations. In some instances, this may lead to “regrettable” substitutions of other hazardous or potentially vPvB/PBT substance. It is also the case that the cost of alternatives, and the quantity required is higher than the POPs equivalent.

The recovery and destruction of POPs waste is not well established in areas such as C&D, and in other areas such as PVC cable sheathing granulate there are risks from mismanagement of the POPs waste to recover more valuable components such as copper. However, adhering to existing regulations should prevent the recycling of POPs waste into new products in the UK and EU.

Where there is an apparent risk is in the import of products. The manufacture and use of POPs, such as MCCPs, was and is far more prevalent in Asia where the UK imports many of their goods from. In the case of textiles, the UK exports all the PPE manufactured in the UK, which naturally means the PPE we use is imported.

Not all imported goods will contain POPs, but the difficultly is in ensuring none of the goods contain POPs. Although goods should conform with domestic regulatory requirements, testing of all products is not feasible, and importers must rely on the declarations from the manufacturer.

5. Section A Conclusions

This report has investigated how regulation and real-world barriers and enablers may impact the presence of POPs in new products. The key outcomes are summarised below and categorised as a risk or opportunity.

Risks:

- Exemptions to the POPs Convention will in some cases result in the extended use of POPs beyond a perceived phase out.
- POPs waste limits in NI follow those of the EU, which are considerably lower in some cases than those set in GB. This could result in a greater volume of POPs waste in NI, especially where PBDEs, HBCD, SCCPs and MCCPs are present.
- There is intention from ECHA to prepare a submission for TBPH (used as a plasticiser and a flame retardant in polymers). This is restricted by EU REACH but not UK REACH.
- Substitution of POPs for chemically similar substances (such as deca-BDE being substituted for DBDPE) may result in future POPs classifications.
- Regulation or economic drivers that encourage the use of recycled polymer content may lead to more POPs containing waste being recycled, either legally or illegally.
- Imported products may still contain POPs, as the controls and checks on these are limited and there cannot be total confidence they are not being used outside of the UK and EU.

Opportunities

- Improved product regulations, such as product passports and labelling, may facilitate higher quality data on products being recorded, which can then be accessed at end of life. Furniture is an example where labelling could have a significant impact on ensuring POPs free products can be reused or recycled. Labels would needs to reflect what chemicals are present and which concentrations to account for changes in POPs regulations, and there would still be questions over the accuracy of labelling on imported products.
- There are some changes in products regulations, such as the furniture and furnishings regulations which may take a risk-based approach to balance the product requirements with the risk of the chemicals used to reach the requirements.
- Product regulations such as REACH or RoHS provide a mechanism to restrict possible future POPs substances in a shorter time frame than listing them under the Stockholm Convention. The UK could look to use UK REACH more effectively to pre-emptively phase out potential POPs, such as TBPH.
- Waste regulations and circular economy principles may mandate, encourage or facilitate the sorting and processing of POPs waste to minimise the quantity of material which must be destroyed.

- The UK and EU manufacturing sectors have been able to adapt to POPs regulations and eliminate the use of POPs. Increased domestic procurement could help ensure higher confidence that POPs free products are placed on the market.

- The circular economy plan could support the phase out of POPs, especially through initiatives such as extended responsibility which has been somewhat effective in the WEEE sector. Designing products so that they can be effectively recycled should help to reduce quantities of POPs classified waste requiring destruction.

- Improvements in identification and sorting technologies could be developed to reduce quantities of POPs classified waste requiring destruction. For example, x-ray sorting of WEEE plastics. There are limitations to current technologies, especially when it comes to identifying waste containing SCCPs and MCCPs.

Section B – POPs Waste Treatment Demand and Capacity Modelling

Section A has explored what POPs waste is, and the requirement to destroy the POPs present in waste as required by the Stockholm Convention. Currently, this relies on thermal treatment where the waste is incinerated. This report assesses the UK's available POPs waste incineration capacity and compares it with projected POPs waste arisings (demand) to identify potential capacity gaps from 2025 to 2030. The analysis is based on published data and primary research to provide a real-world evaluation. The analysis also considers devolved differences across England, Scotland, Wales and Northern Ireland, recognising regional variations in waste composition and infrastructure availability.

6. Objective and Scope

The objectives of this study are to:

- Assess current and projected UK thermal treatment capacity for waste to 2030
- Determine the available POPs destruction capacity, taking account of the total capacity and technical, economic and practical operational constraints
- Estimate future POPs waste arisings
- Compare "high- and low-case" treatment capacity against projected arisings to estimate the potential shortfall in capacity
- Determine the cost of POPs waste disposal and treatment in the UK

The Basel Convention Technical Guidelines on the treatment of POPs waste[23] provides a summary of technologies suitable for different POPs (Table 6.1). Many of these are niche or not available at scale. The assessment therefore covers the following commercially operational thermal treatment routes, including export where relevant:

- Municipal waste incineration (MWI)
- High temperature incineration (HTI)
- Cement kilns

[23] https://www.basel.int/Implementation/TechnicalMatters/DevelopmentofTechnicalGuidelines/TechnicalGuidelines/tabid/8025/Default.aspx

Table 6.1 Overview of technologies for the destruction and irreversible transformation of POPs in

Technology	HBB	HBCD	HCB, HCBD, PeCB	PCB	PCDDs/ PCDFs	PCN	PCP	Pesticides POPs	POP-PFAS	POP-BDEs	SCCPs	DP	UV- 328
Alkali metal reduction	ND*	ND	ND	Yes	ND	ND	ND	Yes (1)	ND	ND	Yes	ND	ND
Advanced solid waste incineration	ND	Yes	ND	ND	ND	ND	Yes	ND	ND	Yes	Yes	ND	ND
Base catalysed decomposition	ND	ND	ND	Yes	Yes	ND	Yes	Yes	ND	ND	ND	ND	ND
Cement kiln co-incineration	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	ND	ND
Gas phase chemical reduction	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	ND	ND
Hazardous waste incineration	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	ND	ND
Plasma arc	ND	ND	ND	Yes	ND	ND	ND	Yes (2)	ND	ND	ND	ND	ND
Plasma melting decomposition method	ND	ND	ND	Yes	ND	ND	ND	ND	ND	ND	ND	ND	ND
Supercritical and subcritical water oxidation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	ND	ND
Thermal and metallurgical production of metals	ND	ND	ND	ND	Yes	ND	ND	ND	ND	Yes	ND	ND	ND

ND = stands for “not determined” and indicates that information is not available in the literature referred to in this document to confirm the use of the technology for certain POPs.
(1) Yes for Chlordane, HCH, (2) Yes, for most pesticides, including chlordane, chlordecone, DDT, endosulfan, heptachlor

The waste streams included in this study are listed in Table 6.2 and were selected based on known or likely exceedance of current or potential future POPs waste thresholds. Acronyms used throughout are provided in Table 6.3.

Table 6.2 POPs waste streams included in study

Waste stream	Current status	Possible POPs present
Waste upholstered domestic seating (WUDS)	POPs waste.	HBCD PBDEs
Waste electrical and electronic equipment (WEEE)	Small mixed WEEE (SMW) and television (TV) casings are classified as POPs waste. Large domestic appliances (LDA) are not a POPs waste, but their components can contain POPs.	PBDEs SCCP MCCP
Automotive shredder residue (ASR)	End of life vehicles (ELV) are not a POPs waste, and untreated ASR does not exceed existing thresholds. The plastics and fabric present are believed to contain POPs but the quantities are not well established.	PBDEs SCCP MCCP
Expanded polystyrene (EPS) insulation foam	HBCD was used extensively in EPS insulation foam but there is no blanket classification.	HBCD
Plastics form construction and demolition (C&D) waste	Ongoing work into C&D waste shows potential for products to contain POPs.	PBDEs SCCP MCCP
Cable sheathing granulate	MCCPs were used extensively in cable sheathing. MCCP was listed as a POP in 2025, but no POPs waste limit has been set.	SCCP MCCP

Table 6.3 Table of POPs acronyms

Acronym	Name
HBCD	Hexabromocyclododecane
MCCP	Medium chained chlorinated paraffins
PBDE	Polybrominated diphenyl ethers
PFAS	Per and polyfluoroalkyl substances
SCCP	Short chained chlorinated paraffins

Certain waste streams have been considered outside of the scope of the study, and these are provided in Table 6.4.

Table 6.4 Out of scope waste

Waste stream	Rational for exclusion	Possible POPs present
Aqueous film forming foam (AFFF)	AFFF containing POPs classified PFAS should have been disposed of by July 2025. Since use is no longer permitted, there should be no further waste arisings.	PFAS
Digested sewage sludge	Digested sewage sludge is known to contain low levels of PFAS. These are well below any POPs waste limit. Treatment of this waste may be required in the future even if remains below the limit, but this would likely require bespoke infrastructure investment.	PFAS
Landfill leachate	Landfill leachate may contain POPs classified PFAS at low levels. Further capture may be required, but this would be through bespoke treatment such as adsorption into activated carbon.	PFAS

7. Data Sources

This report has been prepared from a range of data sources – the key ones being:

- Tolvik's in-house Market Analysis Model, developed from extensive publicly available data sources and industry intelligence
- DEFRA's 2024 Annual Municipal Waste Management Statistics
- DEFRA's Residual Waste Treatment Capacity Note (2024)
- Environment Agency's Waste Data Interrogator 2024 ("WDI Data") and equivalent datasets from SEPA (Scotland), NRW (Wales), and NIEA (Northern Ireland)
- WasteDataFlow local authority reporting system
- MWI, HTI and cement kiln annual returns for 2024 as provided by the Environment Agency under Freedom of Information requests
- WSP's "Socioeconomic Research into the Impacts of Low POP Content Limits for SCCPs and MCCPs in Waste" (March 2024)
- Information and analysis provided by WRc to support this report
- Primary research with facility operators, local authorities, and waste management companies
- Publicly available procurement data and tender documentation.

The core deliverable includes mapping current thermal treatment capacity across MWI and HTI, Cement Kilns and other suitable plants, establishing baseline operational capacity for 2025 and projecting forward to 2035. The assessment also includes POPs waste currently exported to understand total capacity and UK dependency on cross-border routes.

Tolvik and WRc have developed projections for waste streams expected to generate significant POPs tonnages, drawing on DEFRA's December 2024 POPs predictions and working with Local Authority representatives, thermal treatment operators and waste management companies. Projections cover WUDS, WEEE, construction and demolition waste, cable granules and automotive shredder residue, and are tested against evolving capacity constraints.

Gate fee analysis, gate fees being the charges paid by waste producers or Local Authorities to have their waste accepted for treatment, draws on publicly available data, primary research with local authorities, MWI and HTI operators, and waste management companies, combined with an evaluation of factors likely to influence future pricing. This includes the impact from the UKs Trading Scheme (ETS).

Primary research with operators provides insight into the practical availability of capacity, identifying commercial, technical and reputational constraints that limit the extent to which theoretically suitable infrastructure can be utilised for POPs wastes. Primary research interviews have been undertaken with the following organisations and management levels (Table 7.1).

Table 7.1 Primary Research interviews undertaken by Tolvik

Company	Brief profile	Management level	Experience with POPs
Encyclis	Operates 3 MWI facilities and 2 under construction	Director	MWI
Enfinium	Operates 4 MWI facilities, 1 in commissioning and 1 under construction	Commercial Director	MWI
Grundons	Waste management company, operates 1 MWI (jointly) and 1 HTI under construction	Technical Director	MWI HTI Waste Management
MVV	Operates 2 MWIs and 1 under construction	UK Country Director	MWI
Suez	Waste management company and operates 8 MWIs	Executive Committee	MWI Waste Management
Veolia	Waste management company, operates 10 MWIs and 1 HTI	Haz. Division Senior Management	MWI HTI Waste Management
Viridor	Waste management company, operates 10 MWIs and 2 under construction	Director	MWI Waste Management
Augean	Hazardous waste management including 2 hazardous landfill sites	Technical Director(s)	Waste Management (inc. Hazardous)
EMR	European Metal Recycling including hazardous materials	ESG Director	Waste Management (inc. Hazardous)
Panda	Waste management including a POPs processing facility	Commercial Director	Local Authority / Commercial Waste Management
NAWDO	National Association of Waste Disposal Officers - professional network for senior waste managers at local authorities with statutory waste disposal responsibilities	Committee	Local Authority
ADEPT	Association of Directors of Environment, Economy, Planning & Transport – network of local authority directors across England	Committee	Local Authority
Local Government	Statutory bodies responsible for the disposal of municipal waste collected within their areas	~10 Local Authority Representatives	Waste Disposal Authority representatives

8. Capacity for POPs Waste Incineration

This section of the report provides the projected capacity for POPs waste incineration/treatment in the UK. These treatment options are MWI, HTI, cement kilns and export.

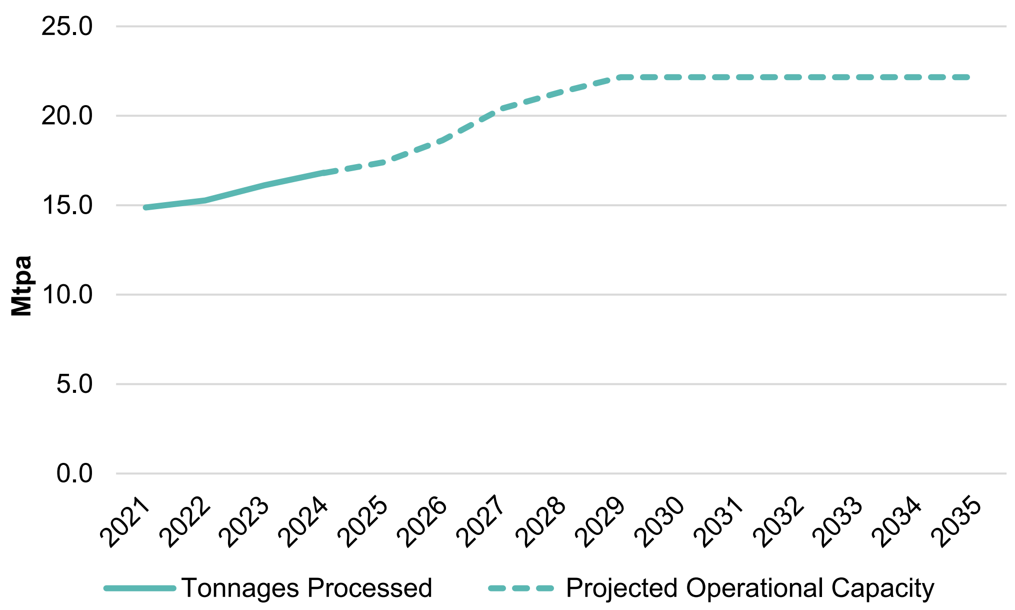
8.1 Municipal waste Incineration (MWI)

8.1.1 Current and planned capacity

Completion of new MWI facilities has led to significant increases in residual waste processing capacity across the UK. The latest data for 2024 shows 16.9 Mt of residual waste was processed at 58 UK MWIs, up 4% (0.6 Mt) on 2023 inputs (Figure 8.1). This capacity was expected to have increased to 17.4 Mt in 2025. This operational capacity, i.e. the quantity that is actually treated at the facilities is commonly lower than the permitted capacity which should not be used to assess realistic capacity projections as it is highly unlikely to be realised.

As of January 2026, the projected operational capacity of MWIs in the UK by 2030, either operational or under construction, is 22.0 Mt. This represents capacity which Tolvik consider is certain to be realised, based on 90 – 95% permitted capacity for MWI under construction. With MWIs typically taking at least three years to construct, there is good forward visibility of UK operational capacity to 2030 as shown in Figure 8.1, which represents a significant 30% growth in inputs over 2024 - 2028. The capacity plateaus at 2030 to represent the conservative assumption of no further MWI infrastructure. In reality more MWI may be built, but this is not possible to predict with any accuracy.

Figure 8.1 Residual Waste tonnages processed at UK MWIs (Source: Tolvik EfW Statistics)



The operational capacity represents the tonnage of residual waste expected to be processed, reflecting that MWIs are not available 100% of the time due to planned and unplanned outages. The 22.2 Mt figure for 2030 remains a reasonably robust projection.

8.1.2 POPs wastes suitable for destruction in MWI

MWI facilities face several constraints in accepting POPs waste streams including permit conditions, technical limitations, and commercial considerations. Permitting and regulatory barriers include:

- POPs wastes are not assigned discrete waste codes, but are classified within broader codes covering both POPs and non-POPs materials. This creates uncertainty for operators about their obligations when accepting such waste streams, and may require engagement with the Environment Agency to confirm whether existing permit conditions are sufficient.Facilities typically permitted only for non-hazardous waste, preclude many POPs wastes which are classified as hazardous.
- Acceptance of explicitly POPs-contaminated waste increases regulatory scrutiny and enforcement attention.
- Operators face strong commercial and reputational incentives to avoid explicit POPs waste acceptance.

Technical limitations include:

- POPs wastes will have significantly higher calorific values (CV) (>12 MJ/kg) than municipal waste 8 to 12 MJ/kg), potentially disrupting combustion stability.
- EfW facilities have a design range for waste types, typically 8 to 12 MJ/kg, therefore an increase in higher CV waste could cause overheating or exceed the plant's thermal design capacity.
- POPs waste is typically halogenated, with chlorine being a particular concern due to potential formation of hydrogen chloride and subsequently dioxin/furan generation during combustion. These emissions can damage equipment and may lead to exceedances for emissions limits set out in the operators permit.
- Some POPs wastes, for example PFAS, require combustion temperatures exceeding 1,100°C, which MWIs are neither designed nor permitted to achieve.

Some Waste Upholstered and Domestic Seating (WUDS) falls under POPs regulations but is currently classified as non-hazardous and can be processed through MWI facilities. This waste stream comprises bulky household items collected through civic amenity sites or organised doorstep collections, and MWIs can effectively destroy the contained POPs at 850 °C when blended with other residual waste.

The relatively low CV of upholstered furniture (compared to polymer rich POPs waste such as WEEE plastics with a CV of >25 MJ/kg), typically 12 to18 MJ/kg due to foam, fabric and wood content, is considered compatible with existing MWI feedstocks. Critically, existing environmental permits typically already include waste codes covering household bulky waste, which means that WUDS acceptance does not require permit variations provided the material arrives as part of normal municipal waste streams rather than as segregated POPs waste.

Primary research with MWI operators and owners reveals consistent limitations on WUDS acceptance. These limitations reflect both the technical parameters waste must meet to remain within the operational envelope of the facility, and the practical arrangements operators have developed to manage these constraints.

Technical and operational constraints:

- Blending limits typically restrict WUDS to 3–5% of total feedstock. Above this threshold, the concentration of dioxins and furans in flue gases risks breaching emissions permit conditions.

- Other POPs-containing waste types — including WEEE, ASR, and construction foams and cables — fall outside the operational envelope of most MWI facilities due to their excessively high calorific value or chlorine content, or because the facility does not hold the necessary permit to accept these waste types.

Practical arrangements to manage these constraints:

- As on-site blending capability is limited, WUDS must be pre-mixed with other residual waste prior to arrival at the MWI facility. This introduces additional handling and logistics requirements upstream of the facility.

- Acceptance is typically restricted to existing local authority customers or as part of broader waste service contracts, reflecting operators' preference to manage WUDS within established and predictable waste streams.

- Discrete or segregated POPs waste loads are not accepted.

The practical reality is that small WEEE plastics containing POPs are already being processed through MWI facilities as part of the heterogenous mix within household and/or commercial residual waste. This is a result of no other outlet for this material, and the industry has adapted to handle this to a degree. Like WUDS, this occurs under the regulatory ambiguity of household waste codes rather than as explicit POPs waste treatment.

Table 8.1 provides some of the feedback given by operators during the primary research.

Table 8.1 Selection of primary research feedback

Feedback
Operator A states they can technically accept POPs waste but require it to be properly segregated and adopts strict blending limits (no more than 5% inputs being WUDS) to maintain emissions compliance. The high CV presents combustion management challenges that are controlled through limited acceptance rates.
Operator B will accept WUDS from existing Local Authority customers, and from new clients only as part of a broader waste service package. However, they actively avoid other POPs waste types (WEEE, ASR, construction foams/cables) due to excessively high CV. They do not accept POPs-only waste streams under any circumstances - POPs must be blended with general municipal waste and form less than 3% of the total waste.
Operators C and D do not accept discrete/separate POPs waste loads. WUDS is acceptable from customers but must be pre-mixed with other waste before arrival at the EfW facility. They cannot accept hazardous POPs (not permitted for hazardous waste). WEEE plastics are not accepted due to excessively high CV.

Based on this review, the only waste stream considered suitable for MWIs is non-hazardous WUDS.

8.1.3 MWI operational capacity for POPs wastes

Two scenarios have been developed to assess MWI capacity suitable for WUDS POPs waste:

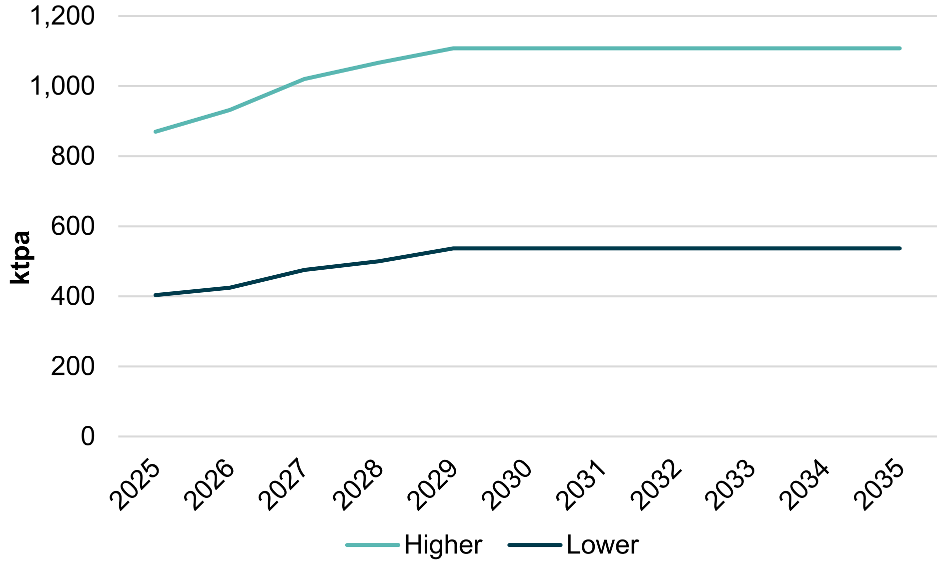
- **High-capacity scenario** - Based on operator interviews, this assumes 5% of the total MWI capacity may be available to treat POPs waste across all facilities willing to accept WUDS within blended municipal waste streams.

- **Low-capacity Scenario** - Recognises that many MWIs are dedicated to core household waste contracts and are unlikely to accept POPs wastes unless contractually required. This scenario applies the 5% proportion only to larger merchant-based MWIs that have greater discretion over feedstock blends and may accept higher proportions of POPs waste.

The assessment only considers the capacity for WUDS in MWI. All discussions with MWI operators/owners identified that none of them were able and/or willing to accept discrete loads of POPs (including hazardous POPs) from the commercial, industrial, construction, demolition and/or end of life vehicle sector(s). These wastes are considered further in subsequent sections of the report.

MWI facilities will provide 404 - 870 ktpa of WUDS containing POPs treatment capacity in 2025, rising to 537 - 1,108ktpa by 2030 (Figure 8.2). This capacity is delivered through the household waste pathway, with WUDS blended into other residual waste at limited percentages to maintain operational stability and emissions compliance. The plateau at 2030 reflects the conservative assumption there will be no new MWI infrastructure beyond what is already planned.

Figure 8.2 MWI Capacity Available for POPs Wastes (WUDS only)



As shown in Table 8.2 the available MWI capacity for WUDS treatment is heavily concentrated in England, which accounts for approximately ~90% of total UK capacity in both scenarios (368 – 762 ktpa in 2025 rising to 501 - 971 ktpa by 2030). This reflects England's dominant share of overall MWI infrastructure and population.

Table 8.2 MWI Capacity Available for POPs Wastes (WUDS only) by Country

Scenario	Country	Capacity (ktpa)										
		2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
High	England	762	817	901	930	971	971	971	971	971	971	971
	N Ireland	6	6	6	6	6	6	6	6	6	6	6
	Scotland	73	80	85	102	102	102	102	102	102	102	102
	Wales	29	29	29	29	29	29	29	29	29	29	29
	Total	**870**	**932**	**1,020**	**1,067**	**1,108**	**1,108**	**1,108**	**1,108**	**1,108**	**1,108**	**1,108**
Low	England	368	389	439	464	501	501	501	501	501	501	501
	N Ireland	0	0	0	0	0	0	0	0	0	0	0
	Scotland	17	17	17	17	17	17	17	17	17	17	17
	Wales	19	19	19	19	19	19	19	19	19	19	19
	Total	**404**	**425**	**475**	**500**	**537**	**537**	**537**	**537**	**537**	**537**	**537**

Scotland provides the second-largest capacity contribution with 17 – 73 ktpa depending on the scenario, representing ~8% of UK capacity. The higher scenario assumes greater merchant MWI participation in Scotland, particularly as new capacity comes online through the mid-2020s.

Wales offers more limited capacity at approximately 29 ktpa (3% of UK total), with minimal difference between high and low scenarios suggesting most Welsh MWI capacity is tied to dedicated local authority contracts with limited flexibility for additional POPs waste acceptance.

Northern Ireland presents the most constrained position. Under the high scenario, only 6ktpa of WUDS capacity is available (less than 1% of UK total), while the low scenario assumes zero practical capacity, reflecting the region's limited MWI infrastructure.

This geographic imbalance creates significant implications for waste collection authorities outside England, who may face higher transport costs to access treatment capacity or increased competition for limited regional facilities.

8.2 High Temperature Incineration (HTI)

HTI represents the gold standard technology for POPs waste destruction, operating at temperatures exceeding 1,100°C with extended residence times to achieve a 99.9999% destruction and removal efficiency. It is identified as the best available technique (BAT) in POPs waste treatment technical guidance.

HTIs are purpose-built facilities operating under stringent Industrial Emissions Directive (IED) requirements for hazardous waste treatment. They are designed to accept concentrated hazardous waste streams, without the need for dilution within a larger non-hazardous waste input, and to operate at temperatures and residence times sufficient to ensure complete destruction of POPs.

There is very limited HTI Capacity in the UK currently and typical waste streams include halogenated organic wastes, pharmaceutical and healthcare wastes, chemical manufacturing residues, high CV wastes, contaminated soils and sediments, wastes requiring destruction certificates, and complex mixed wastes.

8.2.1 Current and planned HTI capacity

The total permitted capacity of the 5 UK HTIs currently in operation is 218 ktpa (Table 8.3). However, Lianhetech only offers a small proportion of its capacity available to external customers, with the majority of capacity dedicated to chemical liquid wastes produced on site. The permitted capacity for MWI is not considered a realistic assessment of available capacity.

Table 8.3 Current and Planned HTI Capacity

Facility	Operator	Location	Region	Permitted Capacity (ktpa)
Fawley HTI	Tradebe	Southampton	South East	48
Avonmouth Treatment Centre	PackCare	Avonmouth	South West	9
Ellesmere Port HTI	Veolia	Ellesmere Port	North West	100
East Kent Waste Recovery Facility	WasteCare	Sandwich	South East	13
Lianhetech	Fine Environmental	Middlesbrough	North East	48
Avonmouth HTI	*Grundons*	*Avonmouth*	*South West*	*20 (Operational 2027)*
Newton Aycliffe HTI	*Fornax*	*Newton Aycliffe*	*North East*	*11 (In permitting)*
Teesside HTI	*CSG*	*Middlesbrough*	*North East*	*20 (Planning approved)*

The five operational HTIs incinerated ~130 kt of waste in 2024. Tonnages incinerated have been broadly the same over the last few years, between 118 and 130ktpa (Table 8.4).

Table 8.4 Current and Planned HTI Capacity

Facility	Operator	Capacity (ktpa)			
		2021	2022	2023	2024
Fawley HTI	Tradebe	33	33	30	33
Avonmouth Treatment Centre	PackCare	6	6	5	5
Ellesmere Port HTI	Veolia	57	67	71	68
East Kent Waste Recovery Facility	WasteCare	5	5	5	4
Lianhetech	Fine Environmental	19	8	11	20
Total		**120**	**118**	**122**	**130**

The primary operational facilities are Tradebe's Fawley HTI and Veolia's Ellesmere Port both of which have consistently operated at ~70% utilisation of the permitted capacity.

Tradebe Fawley is capable of processing liquid and semi-solid hazardous wastes at temperatures suitable for POPs destruction. Capacity is constrained and primarily the HTI serves the needs of the oil industry and the chemical industry, with limited availability for POPs waste streams.

Veolia Ellesmere Port operates hazardous waste incineration capability but capacity available for POPs waste is limited by competing waste streams including clinical waste, pharmaceutical waste, and chemical industry residues.

There are three planned HTI developments in the UK, two of which could be operational by 2030:

- Grundon Avonmouth received planning permission and an environmental permit approval for a high temperature incinerator at Avonmouth, Bristol, with hot commissioning expected in late 2026. The facility will provide approximately 20 ktpa of dedicated high temperature incineration capacity for POPs and other hazardous and clinical wastes.
- Fornax Newton Aycliffe completed construction of the building fabric in spring 2025 and is awaiting an environmental permit to commence operations. The 10.5 ktpa facility will process 70% clinical waste with the remaining 30% comprising hazardous industrial waste. While designed for hazardous waste incineration, publicly available information does not specifically confirm whether POPs waste streams are to be accepted. As a newly constructed facility that has not yet commenced operations, it has no established operational track record with respect to POPs waste streams.
- CSG Teesside was granted planning permission on appeal in 2026 for a 24 ktpa hazardous waste incinerator. The facility will process high calorific value hazardous chemical waste, but it is unlikely to be operational until at least 2032.

8.2.2 POPs wastes suitable for destruction in HTI

High temperature incinerators are technically capable of accepting and destroying virtually all POPs waste streams due to their superior operating conditions. The combustion temperatures exceed 1,100°C with extended residence times ensuring complete destruction of even the most thermally stable POPs compounds. Unlike MWIs, HTIs face no technical barriers related to waste calorific value incompatibility since the facilities are specifically designed to handle wastes with much higher CV ranges.

HTIs represent the only viable domestic thermal treatment route for several critical POPs waste categories that cannot be processed through MWI. Currently they are used for the destruction of POPs-containing AFFF. As regulatory classifications evolve, additional waste streams may be identified as requiring HTI or other proven high-temperature treatment technologies, potentially increasing demand on this limited capacity. These include:

- WEEE Plastics
- Cable sheathing granulate
- Plastics and fabrics from ASR
- C&D waste including EPS insulation foam and other plastics

The critical limitation for HTI is not waste type suitability but rather the fundamental mismatch between available capacity and waste volumes requiring treatment. WUDS, despite being POPs-contaminated, are deliberately excluded from HTI routes due to their very large volumes (projected hundreds of thousands of tonnes annually – see Section 5) relative to total UK HTI capacity. Processing WUDS through HTI would be both economically prohibitive and would completely exhaust available capacity, leaving no room for hazardous POPs wastes that have no alternative treatment route.

8.2.3 HTI Operational Capacity for POPs Wastes

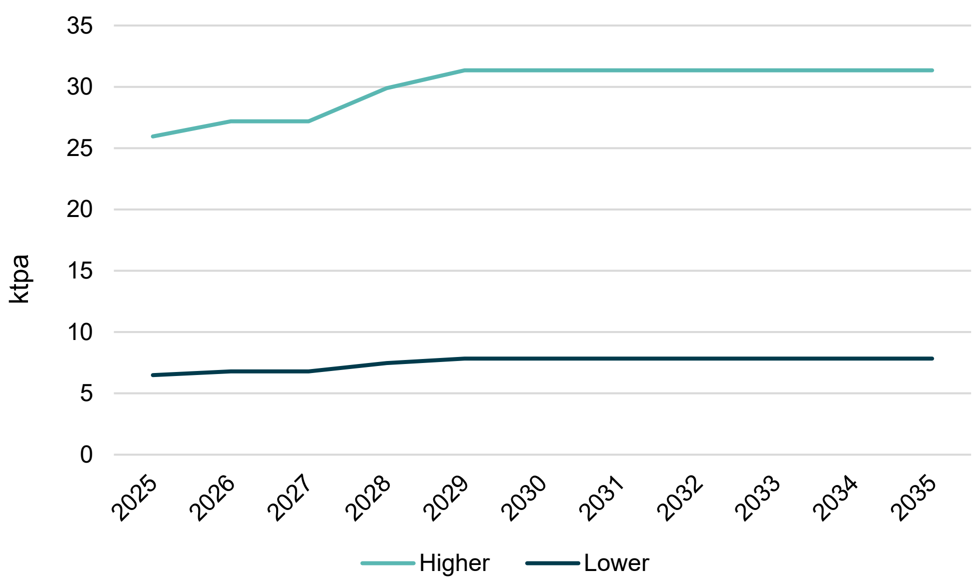
Tolvik has developed two scenarios to assess HTI capacity suitable for POPs waste:

- **High capacity scenario** - Based on operator interviews, this assumes up to 20% of HTI capacity may be available to treat POPs waste, reflecting optimistic assumptions about operator willingness and waste stream compatibility.

- **Low capacity scenario** - Assumes only 5% of HTI capacity may be available to treat POPs waste, recognizing that facilities must balance diverse hazardous waste streams and may face technical or commercial constraints in accepting POPs materials.

Future HTI capacity availability to treat hazardous / other POPs waste is projected at 6 - 26ktpa in 2025, rising to 8 - 31ktpa by 2030 (Figure 8.3). The 2025 range reflects uncertainty around Veolia Ellesmere Port and Tradebe Fawley's ability to accept POPs wastes alongside existing feedstocks. The capacity increase by 2030 is driven by Grundon Avonmouth (20ktpa) and potentially Fornax Newton Aycliffe (10.5ktpa) coming online during the forecast period, though timing and operational parameters remain uncertain. As with MWI capacity, the plateau at 2030 is a conservative estimate assuming no further HTI infrastructure is built.

Figure 8.3 HTI Capacity Available for POPs Wastes



HTI capacity for POPs waste is entirely concentrated in England, reflecting the complete absence of high temperature incineration infrastructure in Scotland, Wales, and Northern Ireland (Table 8.5). This geographic concentration creates significant challenges for waste producers in devolved nations, who must either export POPs waste to England at additional transport cost, seek international treatment routes, or pursue alternative disposal options where permitted.

The lack of regional HTI capacity represents a structural constraint that cannot be addressed within the 2030 timeframe given typical facility development timescales of five to seven years from planning to operation

Table 8.5 HTI Capacity Available for POPs Wastes by Country

Scenario	Country	Capacity (ktpa)										
		2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
High	England	26	27	27	30	31	31	31	31	31	31	31
	N Ireland	0	0	0	0	0	0	0	0	0	0	0
	Scotland	0	0	0	0	0	0	0	0	0	0	0
	Wales	0	0	0	0	0	0	0	0	0	0	0
	Total	**26**	**27**	**27**	**30**	**31**	**31**	**31**	**31**	**31**	**31**	**31**
Low	England	6	7	7	7	8	8	8	8	8	8	8
	N Ireland	0	0	0	0	0	0	0	0	0	0	0
	Scotland	0	0	0	0	0	0	0	0	0	0	0
	Wales	0	0	0	0	0	0	0	0	0	0	0
	Total	**6**	**7**	**7**	**7**	**8**	**8**	**8**	**8**	**8**	**8**	**8**

8.3 Cement Kilns

Cement kilns represent a potential alternative thermal treatment route for certain POPs waste streams, leveraging the extreme operating conditions inherent to cement manufacturing. Modern rotary kilns operate at temperatures exceeding 1,400°C, theoretically providing conditions superior to dedicated incinerators for POPs destruction.

Internationally, cement kiln co-processing of hazardous wastes including POPs materials is established practice, particularly in continental Europe where facilities process contaminated soils, industrial sludges, and waste-derived fuels under stringent permitting frameworks. However, UK cement kilns have historically focused on conventional alternative fuels rather than hazardous waste co-processing to avoid product quality implications, either real or perceived, in cement products.

Cement kilns are first and foremost a production facility, and their primary aim is to produce a product to a strict specification. Therefore, although they may take POPs waste, they would not accept anything which negatively impacted the process or product quality.

8.3.1 UK cement kiln infrastructure

The UK operates 12 cement kilns across England, Scotland, Wales, and Northern Ireland, with total Solid Recovered Fuel (SRF) consumption of 584 kt in 2024, up from 393 kt in 2021 (Table 8.6). This represents significant alternative fuel capacity already integrated into cement production, demonstrating the sector's capability to handle non-traditional feedstocks.

Table 8.6 SRF Inputs to UK Cement Kilns (tonnes)

Cement Kiln	Operator	Country	2021	2022	2023	2024
Cauldon	Holcim	England	1,093	4,265	45,073	35,182
Hope	Breedon	England	30,278	36,763	34,380	29,869
Ketton	Hanson	England	90,114	96,275	96,392	96,075
Ribblesdale	Hanson	England	47,579	47,847	47,337	58,010
Rugby	Cemex	England	165,757	218,148	182,899	199,385
South Ferriby	Cemex	England	*Mothballed*			
Tunstead	Tarmac	England	33,244	42,744	80,939	86,137
Whitwell	Lhoist	England	*Unsuitable for SRF*			
Aberthaw	Tarmac	Wales	1,313	6,430	7,974	12,144
Dunbar	Tarmac	Scotland		7,378	9,886	8,000
Padeswood	Hanson	Wales	14,714	29,608	38,232	58,789
Cookstown	Lafarge	Northern Ireland	8,506	3,267	1,292	256
Total SRF			**392,599**	**492,725**	**544,404**	**583,847**

The growth in SRF acceptance demonstrates technical capability to integrate alternative fuels, though current environmental permits authorise specific waste-derived fuel types (tyres, SRF, meat and bone meal, and sewage sludge) but do not explicitly include POPs-contaminated materials.

8.3.2 POPs wastes suitable for cement kilns

Cement kilns could theoretically process some solid POPs waste streams with controlled calorific values and appropriate physical characteristics. The primary characteristics that need to be considered are:

- Calorific value – Cement kilns look to maximise the energy within the waste (in contrast to MWI). They typically look for waste with a CV >20 MJ/kg. If a waste has a CV below this, it may require more coal to be burnt to make up for the shortfall. If the CV is too high, or too variable it may disrupt the thermal stability in the kiln.

- Metals and halogen content – As the cement kiln is a production process, they need to operate to avoid any impact on the quality of the product. Certain metals can be problematic, and halogens (namely chlorine) can cause process and product issues. Most kilns have strict chlorine limits of <1% in their fuel.

- Format and shape – Cement kilns have adapted their processes to take in more waste derived fuels but still have limitations. Some kilns may not be able to feed in liquid wastes, and light/fluffy material can be problematic for feeding systems. Dense material (e.g. dense plastic) may not fully combust in the flame of the kiln and can drop into the product as it exits the kiln.

Some POPs waste could be compatible with cement kilns. Notably plastics and textiles from WEEE and ASR, if properly prepared, could be suitable. Other POPs waste, in particular cable sheathing granulate, contains high levels of chlorine and would not be accepted by cement kilns. Waste with high variability, such as C&D waste, may also be unsuitable.

PFAS containing waste is a potential future feedstock, due to the high temperatures in cement kilns. In this project, these have not been included in the POPs waste demand estimates. There are very few wastes that contain POPs classified PFAS above POPs waste thresholds, with the only known one being aqueous film forming foam (AFFF). The use of POPs containing AFFF was banned in June 2025 and the industry is in the process of disposing of this waste and it is largely already accounted for.

Despite theoretical technical capability, multiple barriers prevent UK cement kilns from accepting POPs waste. Cement kilns are first and foremost a production facility and use waste derived fuels to provide a more "sustainable" fuel than conventionally used coal. Barriers include:

- **Permitting Constraints** - Industrial Emissions Directive permits for cement kilns typically specify approved waste fuel types and do not currently include hazardous POPs materials. While cement kilns are used for POPs waste co-processing in other EU member states, this application remains novel in the UK context. Permit variations would require demonstration of BAT compliance, extensive waste characterisation data, and public consultation. These are established regulatory processes, but as this would represent a new application for UK cement kilns, the process is likely to be time-intensive and subject to procedural delays.

- **Emission and Product Quality Concerns** – Technical guidelines published by the Basel Convention recommend cement kilns as an appropriate treatment option to destroy POPs waste. There is no existing evidence for POPs destruction in cement kilns and this will be needed to ensure sufficient destruction efficiency, and no harmful breakdown products (e.g. dioxins and furans) are created. Certain components of POPs waste, such as chlorine, can impact product quality.

- **Economic and Reputational Factors** - POPs waste gate fees may not offset the regulatory complexity, reputational risk, and operational adjustments required. The cement sector has limited financial incentive to pursue this market without regulatory drivers or carbon credit mechanisms that recognise the emissions benefit of displacing fossil fuels. Major cement producers are risk-averse regarding waste streams that could attract negative public attention or customer concerns linked to product quality.

8.3.3 Cement Kiln Operational Capacity for POPs Wastes

Two scenarios have been developed to assess cement kiln capacity suitable for POPs waste:

- **High-capacity scenario** - Assumes 1% of total SRF capacity (approximately 6 ktpa) in 2025 - 2026 rising to 5% by 2030 (approximately 31 ktpa) could be made available for POPs-contaminated WEEE plastics and/or ASR if permitting barriers were addressed and operators willing to accept regulatory and reputational risks.

- **Low-capacity scenario** - Assumes 0% capacity availability, reflecting current operator reluctance and the absence of any UK cement kilns actively pursuing POPs or hazardous waste.

Future cement kiln capacity for POPs waste is projected at 0 – 6 ktpa in 2025 rising to 0 – 31 ktpa by 2030 (Table 8.7). The lower bound assumes cement kilns maintain current reluctance driven by permitting complexity, product quality concerns, and limited commercial incentive. The upper bound represents an optimistic scenario requiring successful permit variations, acceptance of reputational risk, and development of appropriate pre-treatment and quality control systems for POPs feedstocks -specifically WEEE plastics.

Table 8.7 Cement Kiln Capacity Available for POPs Wastes, ktpa

Scenario	Country	2025	2026	2027	2028	2029	2030
High	England	5	5	11	16	21	27
	N Ireland	0	0	0	0	0	0
	Scotland	0	0	0	0	0	0
	Wales	1	1	1	2	3	4
	Total	**6**	**6**	**12**	**19**	**25**	**31**
Low	England	0	0	0	0	0	0
	N Ireland	0	0	0	0	0	0
	Scotland	0	0	0	0	0	0
	Wales	0	0	0	0	0	0
	Total	**0**	**0**	**0**	**0**	**0**	**0**

Under the high-capacity scenario, POPs treatment potential is concentrated in England (27 ktpa by 2030) and Wales (4 ktpa), reflecting the distribution of larger cement kilns with established alternative fuel programmes.

Scotland's Dunbar facility and Northern Ireland's Cookstown kiln are assumed to have zero POPs capacity due to smaller scale and limited alternative fuel experience. The geographic pattern differs from HTI distribution (England-only) but similarly creates regional capacity imbalances.

While the high scenario shows cement kiln POPs capacity increasing from 6 ktpa in 2025 - 2026 to 31 ktpa by 2030, this growth relies entirely on existing operators accepting POPs waste within current permits - an outcome that appears unlikely without significant regulatory drivers or policy interventions. No new cement kiln capacity is projected, with all potential growth dependent on voluntary uptake by incumbent operators.

More fundamentally, cement kilns are more likely to only accept WEEE or ASR derived POPs waste, requiring extensive pre-sorting and quality control. At 30 ktpa maximum capacity with feedstock-specific constraints and associated pre-treatment costs, cement kilns represent a niche solution rather than a material contributor to the UK's overall POPs treatment capacity deficit.

8.4 Alternative Thermal Treatment Technologies

Beyond MWI, HTI, and cement kiln co-processing, several alternative thermal treatment technologies exist internationally that could theoretically provide POPs destruction capability. These include plasma arc treatment (operating at 3,000 - 10,000 °C), gasification and pyrolysis processes, and various novel thermal desorption systems.

However, none of these alternative technologies currently operate at commercial scale for POPs waste treatment in the UK, nor are there credible development proposals that would deliver capacity within the 2030 timeframe of this assessment. The closure of EMR's Oldbury gasification facility (~2018), which previously processed hazardous waste, exemplifies the commercial and technical challenges in establishing such facilities under the UK regulatory framework.

Capital requirements typically exceeding £50-100 million per facility, combined with limited UK track record and regulatory uncertainty around novel treatment processes, present substantial barriers to deployment.

For the purposes of this capacity assessment, alternative thermal treatment technologies contribute zero practical capacity for POPs waste destruction through 2035 and are therefore excluded from the supply-capacity balance analysis.

8.5 Exports of POPs Waste

The UK exports POPs waste to continental Europe where domestic treatment capacity is insufficient or economically unviable, predominantly to high-temperature incineration facilities. These transfrontier waste shipments operate under notification procedures governed by the Transfrontier Shipment of Waste Regulations, requiring pre-authorisation from competent authorities in both exporting and receiving countries. Major destination countries and facilities include:

- Netherlands: AVR Rozenburg and other specialized high-temperature incinerators handle UK hazardous/other POPs wastes, particularly WEEE plastics;

- Belgium: Indaver's facilities at Antwerp and other sites process hazardous/other POPs streams including contaminated oils and electrical equipment;

- Germany: Currenta's Leverkusen chemical park and other facilities accept UK POPs waste, though capacity is increasingly constrained by domestic demand.

Export volumes of specific POPs waste are not comprehensively reported in publicly available Environment Agency International Waste Shipment statistics. Industry sources suggest approximately 10 ktpa of POPs waste, primarily WEEE plastics from electronics recycling operations, is currently exported under notification, though this figure lacks official verification and may understate total volumes if certain shipments are not explicitly identified as POPs waste.

Comparing this export volume to domestic capacity reveals the UK's structural dependence on continental treatment infrastructure. With UK HTI capacity for POPs waste projected at only 6 – 31 ktpa through 2030, and that capacity required for domestic hazardous POPs arisings that cannot use MWI routes, export capacity of approximately 10 ktpa represents a significant proportion of total available treatment infrastructure. Any disruption to export routes would immediately create disposal bottlenecks for waste streams with no viable UK alternative.

8.5.1 UK exposure to European capacity risks

European hazardous waste disposal demand remains high despite chemical industry decline. Europe operates over 90 hazardous waste incinerators with >4 Mtpa capacity, distributed unevenly across member states. Germany and France maintain substantial infrastructure while some countries operate none. Over 1.6 Mt were exported cross-border for treatment in 2022.

Several countries are planning capacity expansion to reduce export dependency. Established markets face modernisation pressures - average plant age exceeds 30 years. Current new capacity totals ~0.4 Mtpa of additional capacity.

UK reliance on European POPs treatment capacity creates several material risks through the forecast period:

- **Capacity constraints:** Continental facilities are likely increasingly prioritising domestic waste streams as European POPs waste arisings increase under expanded substance listings and lower concentration limits.
- **Cost volatility**: Costs including notification, transport and gate fees are anecdotally reported to be in the region of £1,000 - £1,500 per tonne to European HTI. Operators may be able to reach agreements for lower cost routes, for example as a “high quality” SRF into a cement kiln.
- **Trade and access risk:** Post-Brexit, the UK no longer benefits from intra-EU waste shipment arrangements. European operators and regulators may increasingly prioritise EU-origin waste, and member states retain discretion to refuse third-country waste imports. Any future tightening of the EU's transboundary waste shipment regulations could further restrict UK access to continental treatment capacity.

- **Regulatory divergence:** The EU Circular Economy Action Plan[24] includes measures to restrict waste exports and promote self-sufficiency in hazardous waste treatment. Future EU policy could impose restrictions on POPs waste imports, directly impacting UK access to continental capacity.

Without adequate UK-based HTI capacity, the UK remains structurally dependent on European treatment infrastructure.

8.6 Long Term Storage as Capacity Relief

The thermal treatment capacity assessment presented in preceding sections reveals a substantial gap between projected POPs waste arisings and available incineration capacity through 2030.

MWI facilities can accommodate WUDS streams within blended municipal waste (404 - 1,108 ktpa), but HTI capacity for hazardous/other POPs wastes remains severely constrained at 6 – 31 ktpa, with cement kilns contributing minimal additional capacity (0 – 31 ktpa). Export routes provide approximately 10 ktpa but face commercial and regulatory vulnerabilities.

With combined POPs waste arisings projected to significantly exceed available thermal treatment capacity, particularly when expanded substance listings and lower concentration limits are fully implemented, alternative management routes warrant consideration. Concerned stakeholders suggest long-term engineered storage represents a viable interim solution for certain POPs waste streams providing capacity relief for thermal destruction.

Modern hazardous landfill facilities operate under stringent containment requirements. These engineered barriers are designed to prevent environmental release of persistent contaminants over extended timeframes, potentially offering comparable environmental protection to thermal destruction for certain waste types. There may however be issues with POPs present in leachate, which may then be very challenging to further treat and destroy. More work is required to understand how this could work in practice and what the risk and opportunities are.

Salt formations and other deep geological repositories offer high-containment options with natural impermeability, geological stability, and isolation from groundwater systems. European facilities have demonstrated long-term storage efficacy for hazardous and radioactive wastes in such formations, though no UK facilities currently accept POPs waste under this model.

Detailed evaluation of long-term storage capacity, technical feasibility, regulatory frameworks, comparative environmental impacts, and economic viability falls outside the scope of this thermal treatment capacity assessment. However, given the structural mismatch between POPs waste volumes

[24] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN

and available incineration capacity identified in this report, long-term engineered storage merits comprehensive investigation as a complementary or alternative management pathway.

The strategic question facing policymakers is whether long-term containment - pending development of more effective destruction technologies or expanded thermal treatment infrastructure - represents a more environmentally sound approach than attempting to force limited incineration capacity to process rapidly expanding waste volumes. This question requires careful consideration of relative environmental risks, long-term liability, and the practical constraints on near-term capacity development.

8.7 Capacity Summary

Table 4.8 gives a summary of the projected available capacity to treat POPs waste in the UK. Long-term engineered storage options, including salt formations, are not included in this capacity assessment as no such facilities are permitted to accept POPs waste in the UK.

Table 8.8 Summary of capacity used in subsequent modelling

Treatment	2025 (ktpa)		2030 (ktpa)	
	Low	High	Low	High
MWI	404	870	537	1,108
HTI	6	26	8	31
Cement kiln	0	6	0	31
Export	10	10	10	10
Total	420	912	555	1,180

9. Demand for POPs waste incineration

This section presents demand projections for POPs waste requiring thermal treatment through 2035, developed through two distinct methodological approaches that bound the range of potential outcomes. The high demand scenario relies on government preliminary estimates. The low and median capacity scenarios use bottom-up analysis of specific waste streams based on primary data collection and the sector-specific expertise of WRc and Tolvik.

The scenarios are not probabilistic forecasts, but rather planning tools designed to test treatment capacity under different trajectories. Actual POPs waste arisings will depend heavily on factors including the pace of Stockholm Convention POPs listings, domestic legislative implementation timescales, waste producer compliance with segregation requirements, manufacturer compliance, and regulatory enforcement intensity.

Not all treatment options are suited to all types of POPs waste, with various constraints as discussed in Section 4. This is summarised as a matrix in Table 9.1.

Table 9.1 Suitability matrix

	MWI	HTI	Cement kiln
WUDS	✓	✓	✓
WEEE (plastics)	X*	✓	✓
ASR (plastics and textiles)	X	✓	✓
EPS insulation foam	X	✓	X
C&D plastics	X	✓	X
Cable sheathing granulate	X	✓	X

*WEEE plastics are highlighted red, as although some processed WEEE plastics may be being disposed of through this route, it is not targeted by the MWI operators. For the consideration of future capacity, the approach of excluding this from MWI has been taken based on operator feedback.

Cement kiln capacity has been highlighted in orange, as although the POPs waste could be suited, these wastes are not being processed at scale and evidence of destruction efficiency in UK facilities has not yet been obtained.

To evaluate the demand, three scenarios have been assessed, as outlined in Table 9.2.

Table 9.2 Demand scenario descriptions

Scenario	Description
High demand	Based on DEFRA Residual Waste Infrastructure Capacity Note.
Median demand	Based on industry knowledge and published waste data. Assumes where POPs are suspected to be present, but waste is not yet considered a POPs waste (e.g. ASR and C&D waste) that a reasonable proportion of this will be classified as a POPs waste and will require destruction. Assumes a "medium growth" in these waste streams from 2025 to 2035.
Low demand	Based on waste streams currently classified as POPs, and those highly likely to be classified as POPs (e.g. EPS insulation and cable sheathing granulate). Assumes a "low growth" in these waste streams from 2025 to 2035.

9.1 High Demand Scenario: DEFRA Capacity Note Estimates

According to the government's December 2024 Residual Waste Infrastructure Capacity Note, waste streams containing POPs currently amount to approximately 200 – 300 ktpa in England, including WUDS and plastic from WEEE in the residual waste stream. However, the government's preliminary analysis suggests POPs arisings are likely to increase significantly as waste producers and regulators identify more wastes containing POPs and as legislation is updated following new POPs listings agreed under the UN Stockholm Convention.

IT was projected that by 2025, a further 106-158 ktpa of plastic and construction waste could require incineration beyond the 2024 baseline. More significantly, there is up to 2.5 Mt per annum of waste containing chlorinated paraffins that may require incineration depending on regulatory determinations around concentration thresholds and treatment requirements. If all chlorinated paraffin-containing waste requires destruction, total POPs waste arisings could reach 2.8 Mt per annum.

The government acknowledges this preliminary analysis carries substantial uncertainty due to limited literature on POPs presence across waste streams, uncertainty about current waste destinations, ongoing international debate on 'low POPs' threshold levels that may not require destruction, and unknown timing of domestic legislation updates.

For projection purposes, the high scenario assumes strict limits are placed on chlorinated paraffin concentrations by 2028, creating a stepped increase in POPs waste volumes (Table 9.3). Medium chained chlorinated paraffins (MCCPs), listed as a POP in 2025 do not yet have a waste threshold, however are present in many products such as PVC cables and adhesives and sealants.

Table 9.3 High scenario POPs Waste 2025 – 2035 based upon DEFRA's 2024 Capacity Note and WSP 2024

Period	England POPs Waste (ktpa)	Estimated UK Total (ktpa)	Key Drivers
2025 - 2027	310 - 460	340 - 500	Current WUDS, WEEE plastics, and additional plastics/construction waste identification
2028 - 2035	3,000 – 3,500	3,400 – 3,800	Full implementation of chlorinated paraffin treatment requirements

The High-Capacity DEFRA scenario creates a dramatic step-change in 2028 if chlorinated paraffin regulations require thermal treatment of the full 2.7 – 3.0 Mt waste stream.

However, Tolvik and WRc consider this figure represents the total tonnage of waste streams potentially containing chlorinated paraffins rather than the actual POPs waste requiring treatment after accounting for concentration thresholds, source segregation, material recycling, and dilution effects. In practice, enhanced sorting and recovery processes, combined with regulatory thresholds excluding lower-concentration materials, would substantially reduce the tonnage requiring thermal destruction.

Given this likely overstatement of actual treatment demand, the DEFRA high demand scenario is excluded from the detailed demand-capacity balance analysis in Section 6, though it remains useful for illustrating the scale of regulatory uncertainty around chlorinated paraffin management.

9.2 Low and Median Demand Scenarios: Waste Stream Analysis

9.2.1 Non-hazardous WUDS POPs

WUDS POPs waste projections are based on actual data received from 11 Waste Disposal Authorities (WDA), some covering 2024 and all 2025. Each WDA was assigned a rurality classification (rural, mixed, or urban) and corresponding percentages representing WUDS POPs waste as a proportion of total residual waste. These locality-specific percentages were then applied to all UK WDAs based on their respective classifications to calculate total WUDS POPs arisings in 2025. Table 9.4 gives the % of residual waste which was WUDS.

Table 9.4 WUDS as % of residual waste by locality

Rurality	WUDS as % of Residual Waste
Rural	1.3%
Urban	2.3%
Mixed urban/rural	1.8%

Growth trajectories were derived from year-on-year data (2024 to 2025) provided by three WDAs, revealing significant variation in observed growth rates ranging from 2% to 17% annually (Table 9.5).

Table 9.5 Local Authority growth rates of POPs wastes

Local authority	Growth Rate 2024 to 2025
Local authority A	2%
Local authority B	9%
Local authority C	17%

Two scenarios were developed to bound this uncertainty, as shown in Table 9.6. Tonnages are estimated up to 2035.

- **Low growth scenario**: WUDS POPs waste increases by 2.5% per annum between 2025-2030, then declines to 1.3% per annum from 2030 onwards. This assumes continued growth in POPs identification and segregation compliance but at a moderating rate as the stock of legacy POPs-containing waste gradually depletes.

- **Medium growth scenario**: WUDS POPs waste increases by 10% per annum between 2025-2030, then declines to 5% per annum from 2030 onwards. This assumes accelerated POPs identification driven by enhanced regulatory enforcement, increased public awareness, improved waste producer compliance, and potentially extended POPs listings identifying additional substances.

Table 9.6 Growth trajectory rates of POPs wastes

Growth Trajectory	Annual Increase 2025-2030	Annual Increase 2030+
Low	2.5%	1.3%
Medium	10.0%	5.0%

The WUDS POPs demand projection is shown in Figure 9.1 and given in Table 9.7.

Figure 9.1 WUDS POPs Waste Projections

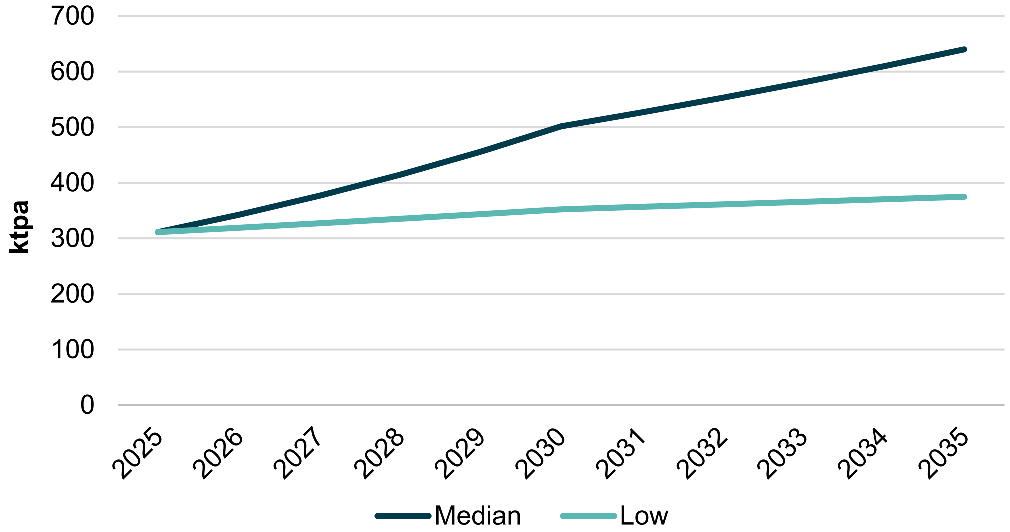


Table 9.7 WUDS POPs Waste Projections

UK	WUDS (ktpa)										
	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Median	311	343	377	414	456	501	527	553	581	610	640
Low	311	319	327	335	344	352	357	361	366	370	375

This approach assumes the 11 WDAs providing data are representative of broader UK waste management practices and that rurality is the primary determinant of WUDS arisings. The methodology does not account for regional variations in furniture consumption patterns, local authority enforcement intensity, or differences in bulky waste collection services.

Growth trajectories are based on only three WDAs' year-on-year data, creating uncertainty around whether observed 2024-2025 trends will persist through 2030. The projections do not explicitly model the declining stock of WUDS POPs, which may cause actual growth rates to plateau or decline earlier than assumed.

9.2.2 Hazardous/Other POPs waste streams

Hazardous/Other POPs waste projections encompass six key waste streams: automotive shredder residue (ASR), large domestic appliances (LDA), small WEEE, cable granules, construction and demolition expanded polystyrene (EPS), and construction and demolition plastics.

Automotive Shredder Residue (ASR)

ASR comprises the non-metallic fraction remaining after end-of-life vehicles (ELV) are shredded for metal recovery, including plastics, foams, textiles, and rubber containing legacy flame retardants. ELV is not considered a POPs waste as the level of POPs in the vehicle is well below any threshold due to the quantities of steel. However, it is known that POPs have been used in the manufacture of the textile and plastics components. Work carried out on behalf of the British Metals Recycling Association (BMRA) to determine the hazardous classification of unprocessed ASR showed that POPs concentrations (at the time focusing on PBDEs and SCCPs) were below the POPs waste threshold.

ASR can be further processed to recover recyclable components such as non-ferrous metals and plastics. As a result, there are streams which are more concentrated in textiles and/or plastics which could exceed future POPs waste thresholds. The recent listing of MCCPs may also impact a POPs classification.

Total ASR coming out of ELV shredding sites in 2024 was 880 kt, of which 534 kt was hazardous. It is unlikely this would all be POPs containing, and WRc estimate that further sorting using existing methods may result in 134 ktpa in 2025 growing gradually to 148 ktpa by 2035. This reflects increasing vehicle end-of-life volumes and declining metal content in modern vehicles, which increases ASR production per vehicle processed.

The low scenario assumes zero ASR requires POPs treatment due to the determinations that mixed ASR with diluted POPs concentrations may be landfilled rather than requiring thermal treatment. This represents an optimistic assumption that the sector successfully implements source segregation and material recovery strategies that effectively eliminate ASR from the POPs waste requiring incineration.

Large Domestic Appliances (LDA)

Large domestic appliances (e.g. washing machines, tumble dryer, cooker and dishwasher) may have POPs containing components. As with ELV, the items at the point of disposal are not considered a POPs waste, but once shredded and the metal is removed, the residual plastic rich fraction may exceed current of future POPs waste thresholds. Typically, LDA is processed alongside ELV and other metal rich waste and so there is not a discrete LDA residue. This may change in the future so has been considered separately for this mode.

In 2024 167 kt of LDA was collected for recycling[25]. Only a proportion of this would be a plastic/rubber fraction which may contain POPs, which is estimated by WRc to be ~10% by weight. The median scenario therefore projects 17 – 19 ktpa reflecting steady replacement cycles, while the low scenario assumes 5 ktpa representing only appliances where POPs removal is impractical, and the remainder successfully depolluted during WEEE processing.

[25] DEFRA, https://www.data.gov.uk/dataset/e5db0558-d389-457a-893f-af5b97bdb123/2013-weee-regulations-proposed-household-weee-collection-targets

Small mixed WEEE (SMW)

SMW, which is mainly comprised of consumer electronics and small appliances is a designated POPs waste. When SMW is processed, the plastic fraction undergoes density separation to recover recyclable polymers. The dense plastics fraction contains the concentrated POPs (notably PBDEs and SCCPs/MCCPs) and this is sent for destruction.

In 2024 ~140,000 tonnes of SMW was collected for recycling. WRc estimate that ~40% by weight of SMW is plastic, meaning a median scenario of 56 ktpa in 2025 rising to 62 ktpa in 2035 has been set. In practice much of the plastic from SWM is sent for density separation, where ~40% of the plastic is recovered as a dense, POPs containing output which is sent for destruction. The low scenario assumes 22 ktpa, reflecting enhanced plastics separation at WEEE treatment facilities and successful diversion of non-POPs plastic fractions to recycling.

Cable sheathing granulate

There is a very strong domestic cable recycling industry in the UK, partly due to restrictions on the export of coated cables (i.e. cables with plastic sheathing), the relatively simple and cost-effective recycling process and the high value and demand for copper. To recover the copper, the cable is typically granulated to ~2 mm and a dry density separation is carried out to separate the copper from the cable sheathing granulate. The sheathing is mostly made from plasticised polyvinyl chloride (PVC), although some is made from polyethylene.

Cable sheathing is known to contain SCCPs and MCCPs. Although no POPs waste limit has been set for MCCPs to date, it is possible that cable sheathing granulate will be considered a POPs waste in the near future. The total quantity of cable sheathing granulate processing in the UK is believed to be around 30 ktpa based on data collected by Recovinyl[26]. An assumption has been made that this will increase to 33 ktpa by 2035.

The low scenario is considered to be the same as the median, as there is no effective method of sorting POPs containing cable from non-POPs containing. It must also be noted that by its nature cable sheathing granulate is high in chlorine and is likely to be ~50% by weight chlorine.

Construction and demolition – EPS insulation

Expanded polystyrene (EPS) insulation was manufactured using hexabromocyclododecane (HBCD) to provide flame retardancy. This insulation was used in flooring, walls and ceilings in domestic, industrial and commercial properties. It is believed that much of the EPS being removed currently is not being

[26] https://www.recovinyl.com/post/recovinyl-recycling-results-807-568-tonnes-recycled-in-2021

segregated and is being disposed as general waste from the C&D sector. As such, there is very little information available to estimate the quantity of EPS insulation foam arising as waste.

A high-level estimate using market data from Plastics Europe in 2011 has been carried out to determine the quantity of EPS insulation which may be arising as waste in 2025. In 2011, ~750 ktpa of EPS was used in construction in the EU. Assuming 10% of this was used in the UK, this equates to ~75 ktpa EPS placed on the market. EPS is a very long-life product, and therefore it has been assumed 30% may be arising as waste in one year, resulting in a disposal estimate of 22 ktpa EPS insulation. It has been assumed this will rise to 24 ktpa by 2035. It is very unlikely that POPs and non-POPs EPS insulation could be separated, and therefore the low scenario has been set as 22 ktpa.

Construction and demolition - Plastics

Aside from EPS insulation, POPs have been used in various plastic construction products such as electrical fixtures and fittings, sealants and adhesives and non-EPS insulation. C&D waste is highly heterogenous, and there is very limited data on the composition and tonnages of plastics within the waste stream. It is also unclear how many of these products will contain POPs above relevant thresholds, and how such waste could be segregated.

Using the Plastics Europe 2011 data, it is estimated that the demand for polymer into construction products was 9,200 kt. Assuming the UK market accounted for 8% of this figure, it suggests a demand of 736 kt. This will cover a vast range of products, including PVC windows and doors, and is considered to be a reasonable estimate in lieu of more accurate data.

As a more realistic figure the median scenario projects 200 – 221 ktpa assuming broad identification of POPs in construction plastics. The low scenario assumes 20ktpa, reflecting successful implementation of pre-demolition POPs audits, selective dismantling practices that segregate non-POPs materials, and regulatory guidance allowing lower-concentration construction plastics to be managed through alternative routes rather than requiring HTI treatment.

Summary

Across all hazardous/other POPs waste streams, the medium growth trajectory assumes a 1% annual increase whereas the low scenario assumes no growth. The hazardous/other POPs demand projection is shown in Figure 9.2 and Table 9.8

Figure 9.2 Hazardous/Other POPs waste projections

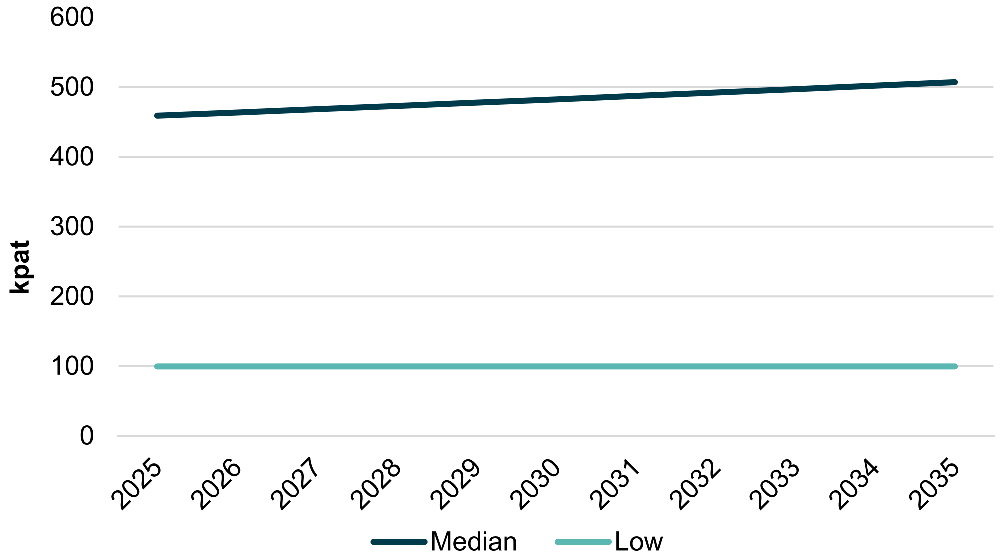


Table 9.8 Hazardous/Other POPs waste projections

Scenario	Waste Type	Demand (ktpa)										
		2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Median	ASR	134	135	136	138	139	140	142	143	145	146	148
	LDA	17	18	18	18	18	18	18	19	19	19	19
	Small WEEE	56	57	57	58	58	59	59	60	61	61	62
	Cable granule	30	30	31	31	31	32	32	32	32	33	33
	C&D EPS	22	22	22	23	23	23	23	24	24	24	24
	C&D Plastic	200	202	204	206	208	210	212	214	217	219	221
	Total	**459**	**464**	**468**	**473**	**478**	**482**	**487**	**492**	**497**	**502**	**507**
Low	ASR	0	0	0	0	0	0	0	0	0	0	0
	LDA	5	5	5	5	5	5	5	5	5	5	5
	Small WEEE	22	22	22	22	22	22	22	22	22	22	22
	Cable granule	30	30	30	30	30	30	30	30	30	30	30
	C&D EPS	22	22	22	22	22	22	22	22	22	22	22
	C&D Plastic	20	20	20	20	20	20	20	20	20	20	20
	Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

9.3 Total POPs Waste Demand Summary

Combining non-hazardous WUDS and hazardous/other POPs waste streams provides total demand projections across the two bottom-up scenarios (Table 9.9)

Table 9.9 Total Hazardous / Other POPs Waste Projections

Scenario	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Median	770	806	845	887	933	984	1,014	1,045	1,078	1,112	1,147
Low	411	419	427	435	443	452	456	461	465	470	475

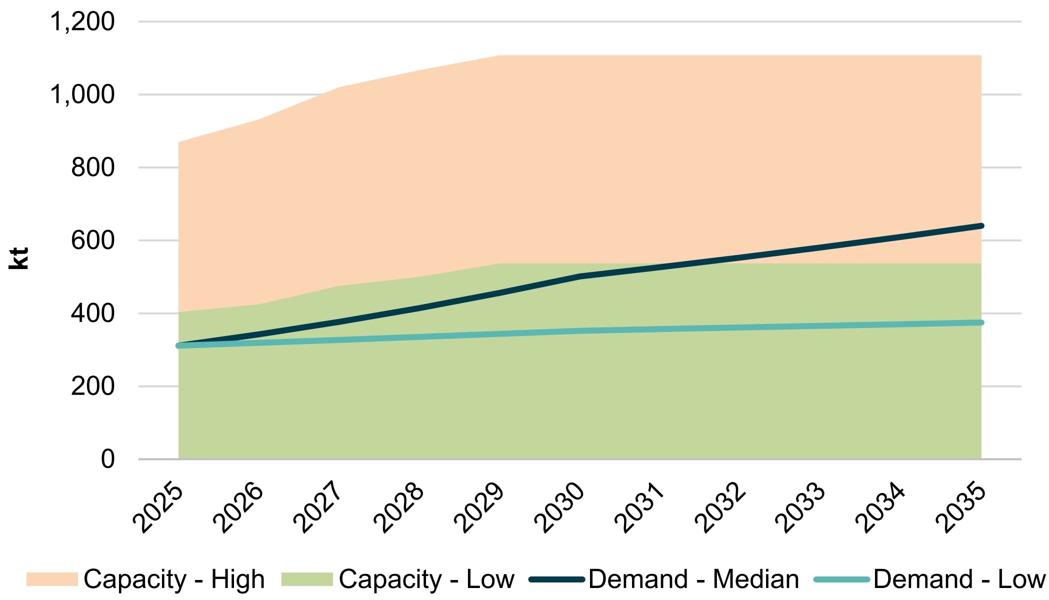
The median and low scenarios provide a more granular view of specific waste streams and potential intervention points. The median scenario (770 - 1,147 ktpa) reflects continued identification of POPs in existing waste streams with limited source reduction, while the low scenario (411- 475 ktpa) assumes successful implementation of pre-treatment segregation, material recovery, and regulatory flexibility around lower-concentration wastes.

10. Demand vs Capacity Balance

10.1 Non-Hazardous WUDS Treatment

WUDS demand projections of 311 – 640 ktpa through 2035 must be assessed against MWI capacity identified in Section 4.1 of 404 - 1,108 ktpa. Under the low demand scenario, available MWI capacity comfortably exceeds demand throughout the projection period, with 2030 capacity of 537 - 1,108 ktpa against demand of 352 ktpa representing capacity utilisation of only 33-65%.

Figure 10.1 WUDS POPs capacity demand balance



Under the high demand WUDS scenario, demand reaches 640 ktpa by 2035 while capacity would plateau at 537 - 1,108 ktpa from 2030 onwards. In the low-capacity case (537 ktpa), demand (using both low and median estimates) is projected to reach or exceed available capacity by the mid-2030s, assuming no further MWI development beyond current commitments and no increase in operator willingness to accept higher WUDS blending ratios.

Table 10.1 summarises the demand and capacity for WUDS treatment, and Table 10.2 shows the gap for the low and high scenarios. A positive number in Table 10.2 indicates a surplus of capacity, with the percentage showing the excess percentage of WUDS which could be treated.

Table 10.1 WUDS Demand vs MWI Capacity (2030)

Metric	Low (ktpa)	Median demand/ High capacity(ktpa)
WUDS Demand	352	501
MWI Capacity	537	1,108

Table 10.2 WUDS - Demand versus capacity gap

		Capacity (ktpa)	
		Low	High
Demand (ktpa)	Low	185 (53%)	756 (215%)
	Median	36 (7%)	607 (121%)

The analysis suggests WUDS treatment capacity by MWI is generally adequate through 2030 under most scenarios, though the combination of median demand and low MWI capacity creates a narrow margin by decade end.

The primary constraint is not absolute MWI tonnage capacity, but rather operator willingness to accept WUDS at higher blending percentages and commercial terms that make acceptance economically attractive.

10.2 Hazardous/Other POPs Treatment

For hazardous/other POPs waste, this must be processed through HTI or cement kilns. All waste could be processed though HTI, but cement kilns would only be suitable for chlorine free, consistent, high CV waste such as WEEE plastics and ASR.

As such, the demand vs capacity balance has been modelled for HTI and cement kilns separately with the projected quantities shown in Table 10.3. The projected capacity for the two treatment methods to take POPs is presented in Table 10.4.

Table 10.3 Projected demand for cement kilns and HTI

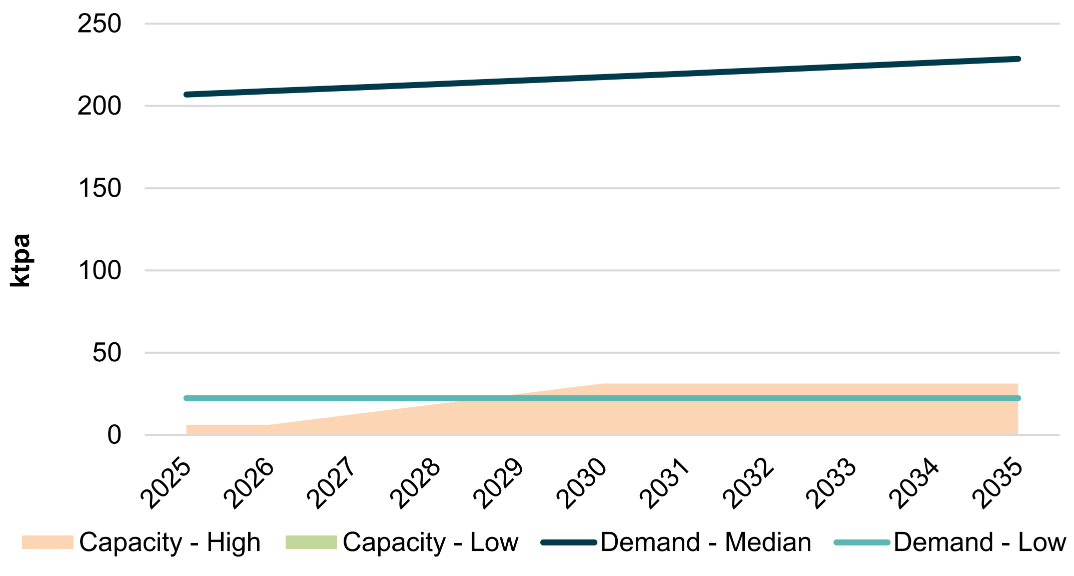
	2025		2030	
Treatment method	Low	Median	Low	Median
Cement Kiln	28	207	28	207
HTI	72	252	72	252
Total	100	459	100	459

Table 10.4 Projected capacity in cement kilns and HTI

	2025		2030	
Treatment method	**Low**	**High**	**Low**	**High**
Cement Kiln	0	6	0	31
HTI	6	26	8	31
Export	10	10	10	10
Total	16	42	18	72

Comparing the demand and capacity for cement kilns, as shown in Figure 10.2, it can be concluded that if the kilns are able to take POPs waste at the rate estimated in the high capacity scenario, it would meet the low demand projections for POPs waste (with 3 ktpa spare). However, if the median demand scenario was achieved (based on ASR fractions being classified as POPs) the capacity of cement kilns would fall short by 176 ktpa by 2030. Any POPs waste beyond existing levels of WEEE plastics would therefore need to be treated in HTI or exported.

Figure 10.2 Hazardous/Other POPs - Capacity demand balance of cement kilns



Note: Low capacity is zero

Comparing the demand and capacity for HTI, as shown in Figure 10.3, there is a drastic and severe shortage of capacity. Even with the low demand estimates for POPs waste destruction and high capacity estimates, there is still a shortfall of 41 ktpa. Some of this could be met with export capacity of 10 ktpa, but there would still be a shortfall of 31 ktpa. If the median POPs waste arising estimates were to be realised, by 2035 it is projected HTI capacity for non-WEEE/ASR would be in deficit by 237 to 260 ktpa (once 10 ktpa export is accounted for).

Figure 10.3 Hazardous/Other POPs - Capacity demand balance of HTI

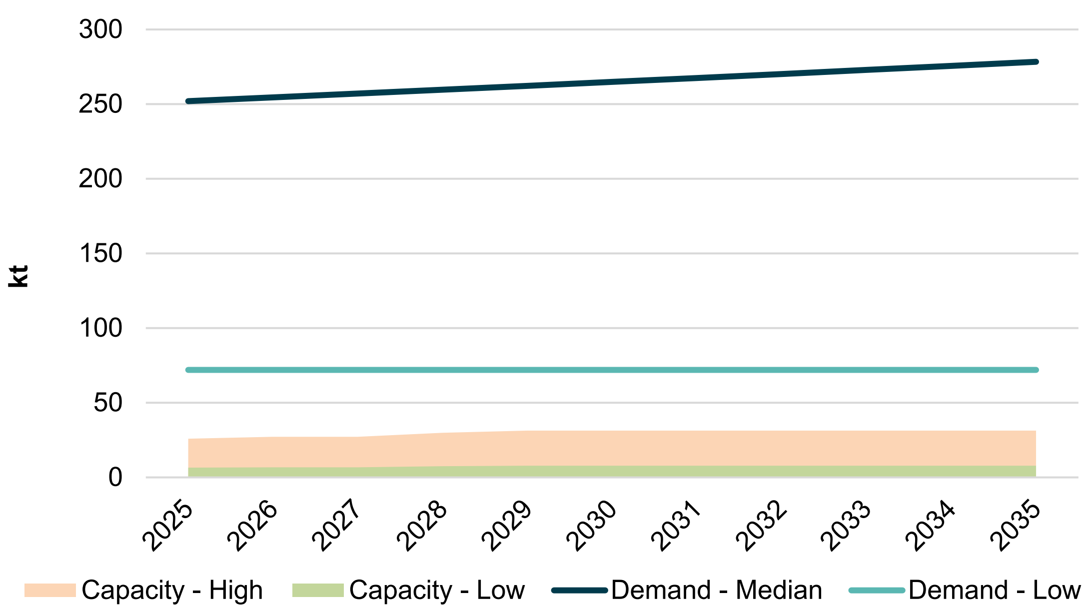
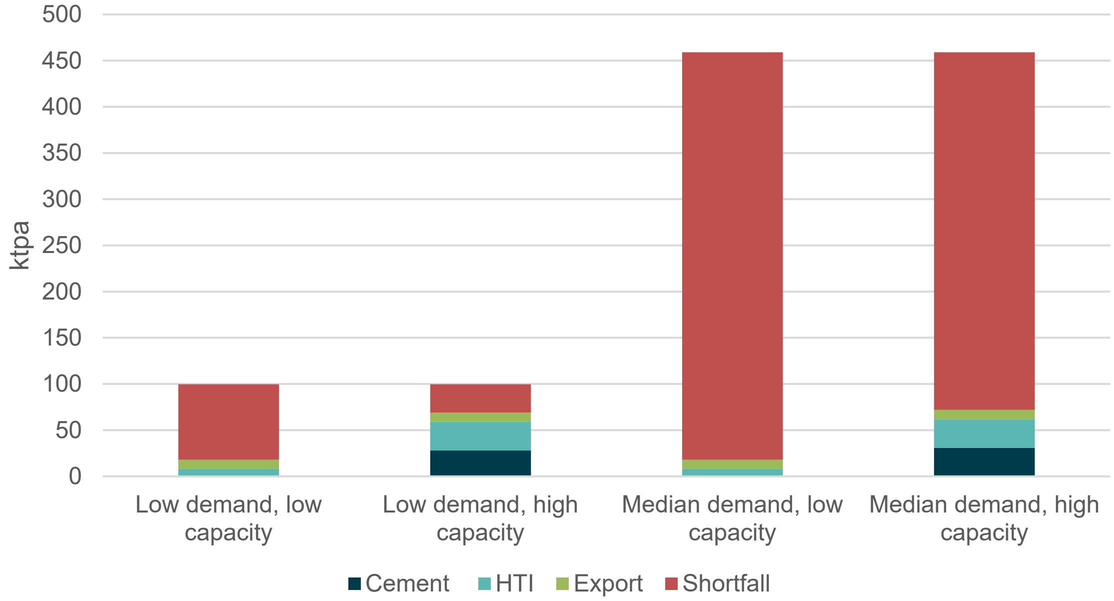


Table 10.5 shows the total demand versus capacity gap for all hazardous/other POPs waste streams and treatment methods by 2030. Negative values in red show a shortfall in capacity, and the percentage shows the quantity of demand that is unmet. Even under the most optimistic assumptions (i.e. low demand and high capacity) there is a shortfall of 31 ktpa (31% demand unmet). This can only be met with increasing export or HTI capacity, as cement kilns are not suited to handle the excess POPs waste. Figure 10.4 illustrates the capacity shortfall.

Table 10.5 Hazardous/Other POPs - Demand versus capacity gap (2030)

		Capacity (ktpa)	
		Low	High
Demand (ktpa)	Low	-82 (-82%)	-31 (-31%)
	Median	-441 (-96%)	-387 (-84%)

Figure 10.4 Hazardous/Other POPs - Demand versus capacity gap (2030)



When considering the worst-case scenario (i.e. median demand, low capacity), the shortfall could be as high as 441 ktpa (96% demand unmet). This capacity gap cannot be closed through incremental improvements in operator acceptance or modest facility expansions. This will likely require a combination of the below actions:

- Substantial new HTI capacity beyond currently proposed projects (Grundon Avonmouth, Fornax Newton Aycliffe), requiring multiple additional 20 - 50ktpa facilities with development timescales of 5 - 7 years making 2030 delivery impossible

- Successful activation of cement kiln co-processing at scale significantly beyond the 0 – 31 ktpa assumed, requiring resolution of industry concerns around product quality, permitting complexity, and reputational risk. Note that this additional capacity would only be required/useful for treating WEEE and ASR derived POPs waste and cannot be used to meet the shortfall in capacity for cable and C&D wastes.

- Major expansion of export capacity to continental Europe, increasing vulnerability to regulatory restrictions and market access constraints.

- Regulatory flexibility allowing certain hazardous POPs waste streams to be reclassified or managed through alternative routes including long-term engineered storage.

- Source reduction interventions achieving the low scenario assumptions around ASR elimination, enhanced WEEE depollution, and construction waste segregation, effectively preventing waste from requiring thermal treatment in the first place.

10.3 High scenario (DEFRA) Capacity Implications

The DEFRA high scenario projecting 3.2 - 3.4 Mt of POPs waste by 2028 - 2030 if chlorinated paraffin regulations require thermal treatment represents a capacity challenge of entirely different magnitude.

Total UK thermal treatment capacity across all routes (MWI + HTI + cement kilns) amounts to approximately 560-1,161 ktpa for POPs waste under optimistic assumptions. This provides capacity for only 16-36% of projected demand, leaving 2.0 - 3.2 Mt per annum without viable treatment routes.

Under this scenario, thermal destruction of all chlorinated paraffin-containing waste is simply not feasible within any realistic infrastructure development timeframe. Policy responses would necessarily include the following:

- Establishing concentration thresholds below which chlorinated paraffin waste does not require thermal treatment.
- Developing alternative treatment technologies or management routes.
- Implementing extensive long-term engineered storage capacity for materials pending future treatment.
- Accepting extended transition periods (potentially decades) for full chlorinated paraffin waste treatment implementation.

The High DEFRA scenario effectively illustrates why regulatory decisions around concentration thresholds, waste classification, and treatment requirements carry such profound implications for infrastructure planning and policy feasibility.

10.4 Critical Factors Affecting Demand Projections

Several factors will fundamentally shape actual POPs waste arisings and their alignment with these projection scenarios:

- **Identification and classification of waste streams**

  There remains significant uncertainty in projected POPs waste arisings due to the limited identification and classification of several waste streams, particularly construction and demolition (C&D) waste, for which publicly available robust data on POPs content and composition is still lacking.

- **Regulatory implementation pace**

  The timing and scope of POPs listings under the Stockholm Convention, transposition into UK domestic law, and enforcement of segregation requirements will directly determine waste identification rates. Delayed implementation would keep arisings closer to low demand scenarios, while accelerated regulatory action could drive outcomes toward the median scenario or beyond.

Delay of implementation may however carry risks of not meeting obligations under the Stockholm convention or may lead to further releases of POPs in the environment.

- **Waste producer compliance**

Current practice of masking POPs within generic waste codes undermines proper routing to thermal treatment facilities. Enhanced EA enforcement of segregation requirements, combined with waste producer education and clear guidance, would increase identified POPs tonnages substantially. Conversely, continued non-compliance and regulatory tolerance of misclassification would suppress reported arisings even as actual POPs content in waste streams remains high. As with the above, this could lead to not meeting obligations and further releases of POPs in the environment

- **Source reduction success**

The low demand scenario assumptions around ASR elimination, enhanced WEEE segregation, and construction waste segregation represent optimistic outcomes requiring significant investment in pre-treatment infrastructure and operational practice changes. Failure to achieve these source reduction interventions would push actual demand towards the Median scenario outcomes regardless of other factors.

The manufacture and use of POPs is also controlled through the Stockholm Convention. Product design and product regulation will play an important role in reducing future POPs waste arisings, as outlined in Section A. However, due to the long life of these products, and because of imports, exemptions in using POPs, listing of new POPs, and reducing POPs waste thresholds it has been assumed there will be no reduction in POPs waste tonnage as a result of these factors.

- **Generation of a POPs waste through the sorting of non-POPs waste**

Circular economy initiatives or market forces may encourage or even mandate the sorting of non-POPs waste (e.g. automotive shredder residue) which may result in the "creation" of POPs waste due to concentrating POPs present in low concentration in the original waste (e.g. automotive shredder residue) (see section 3.3.1 for more detail).

- **Classification boundary determinations**

Regulatory decisions on hazardous vs non-hazardous classification thresholds, particularly for WUDS and construction materials, will fundamentally alter the split between waste streams accessing MWI capacity versus those requiring HTI treatment. Given the stark capacity differential (537 - 1,108 ktpa MWI vs 8 - 31ktpa HTI for POPs), classification decisions carry profound implications for capacity adequacy.

- **MCCP regulatory approach**

The single largest uncertainty in demand projections relates to regulatory treatment of chlorinated paraffin-containing waste. Concentration thresholds, exemptions for specific use categories, and determinations around acceptable treatment routes will determine whether this waste stream adds 0 ktpa, 500 ktpa, or 2,500 ktpa to thermal treatment demand, overwhelming all other waste streams combined.

11. POPs Waste Disposal Costs

This section examines the financial costs of POPs waste disposal, focusing primarily on WUDS gate fees at municipal EfW facilities as the dominant treatment route by volume. The analysis draws on WRAP's annual local authority waste management cost survey for 2024/25, recent procurement outcomes from standalone POPs waste tenders, and operator feedback on pricing mechanisms and cost drivers. Hazardous POPs disposal costs through HTI facilities are addressed briefly for context, though detailed HTI cost analysis is limited by commercial sensitivity and the relatively small number of facilities and transactions.

Understanding disposal cost trends is critical for local authority budget planning, for assessing the financial implications of increased POPs waste identification and segregation requirements, and for evaluating the economic viability of alternative management pathways including long-term storage versus thermal treatment.

Costs presented in this section are not adjusted for future inflation, and so all costs are in terms of 2025 costs.

11.1 WUDS Gate Fees at MWI

WRAP's 2024/25 survey of local authority waste management costs reveals significant premiums for POPs-containing bulky waste compared to standard residual waste streams. As shown in Table 11.1, UK average gate fees for bulky waste containing POPs reached £168 per tonne in 2024/25, representing an 11% increase from £151 per tonne in 2023/24. This compares to £126 per tonne for residual waste mixed with bulky waste containing POPs (8% annual increase) and £117 per tonne for residual waste excluding POPs bulky waste (6% increase).

Table 11.1 WRAP Local Authority Gate Fees at EfW for WUDS POPs Waste (excl. upstream treatment and segregation costs)

Material Collected	Mean EfW Gate Fees £/t		
	2023/24	2024/25	Increase
Residual waste excluding bulky waste containing POPs - £/tonne	£110	£117	6%
Residual waste mixed with bulky waste containing POPs - £/tonne	£117	£126	8%
Bulky waste containing POPs only - £/tonne	£151	£168	11%

The escalating premium for segregated POPs bulky waste (11% annual increase versus 6% for standard residual waste) reflects growing operator reluctance to accept discrete POPs loads and the administrative burden associated with separate tracking, reporting, and compliance requirements. The reluctance is for a range of reasons outlined previously in the report, including challenges in blending material on site and possible issues with high CV and halogen concentrations.

Where POPs bulky waste was once viewed as useful fill capacity for MWI facilities, the hassle factor is increasingly perceived as outweighing revenue opportunity, particularly when core municipal waste contracts provide more straightforward business with fewer regulatory complications.

Significant geographic variation exists in POPs bulky waste gate fees across the UK nations and regions as shown in Table 11.2.

Table 11.2 WRAP local authority gate fees at MWI for WUDS pops waste by country / region

Country	2024/25 Mean Gate Fees £/t
UK	£168
England (including London)	£160
London	£196
Wales	£153
Scotland	£223

Scotland's substantially higher gate fees (£223 per tonne, 40% above the England average) reflect limited MWI capacity in Scotland, greater transport distances to facilities, and reduced competition among operators willing to accept POPs materials. Wales shows the most competitive pricing (£153 per tonne), potentially reflecting newer MWI infrastructure and merchant capacity seeking to secure long-term waste supply contracts.

WRAP's survey asked local authorities to identify reasons given by operators for gate fee increases in 2024/25. The most frequently cited factors are shown in Table 11.3.

Table 11.3 WRAP Cost Drivers Reported by Operators

Reason given for the potential change in future EfW gate fee	Response rate (%)
Inflation increase/price review under current contract terms	69
Impact of Emissions Trading Scheme (ETS)	33
Contractual changes, other than an inflation increase	21
EfW operating costs	21
Cost of dealing with POPs waste	10
Change in value of energy generated	8
Increased compliance/administrative costs	8
Investment/capital costs	6
Emerging national policy: potential landfill bans	5
Amount of material supplied to facility	5

The prominence of ETS impacts (cited by one-third of respondents) signals the growing significance of carbon pricing in waste management costs. The relatively low citation rate for "cost of dealing with POPs waste" (10%) likely reflects the prevalence of bundled contracts where POPs costs are absorbed into general gate fee structures rather than separately identified.

11.2 Upstream Costs for Local Authorities of handling WUDS

Primary research with local authorities and WUDS processors has identified substantial costs associated with implementing the Environment Agency's requirements for handling WUDS containing POPs. These requirements were previously set out across RPS 264, 265, and 266, and are now consolidated within RPS 264 and the EA's statutory guidance Manage waste upholstered domestic seating containing POPs (December 2024), following the withdrawal of RPS 265 and RPS 266 in December 2024. The requirements include the segregation of POPs-containing WUDS in bays and skips, shredding under negative pressure air control systems, and separate transport arrangements for inbound loads. These requirements impose significant operational and financial burdens, and stakeholders have questioned whether the upstream segregation requirements are proportionate given that the waste is subsequently mixed with ordinary wastes for outbound loads to MWI.

These additional costs are understood to range from £50 to £150/t depending upon the scale and complexity of the interim treatment and processing sites, A reasonably prudent average cost would be £100/t.

11.3 Indicative Total Costs to Local Government for WUDS

Table 11.4 shows the indicative annual cost of processing WUDS as POPs waste in 2030 as between £134m to £94m from the low demand to median demand scenario. This is a cost primarily borne by local authorities (waste disposal authorities in particular) across the UK.

Table 11.4 Potential UK WUDS Cost by 2030

Scenario	2030 ktpa	WUDS POPs, Gate Fee, £/t	Upstream handling and treatment, £/t	Total Cost, £ m/pa	Cost if WUDS not considered POPs, £/pa
Low demand	352	£168	£100	£94m	£41m
Median demand	501			£134m	£59m

If such wastes were not categorised as WUDS to be processed in accordance with RPS 264 and the EA's statutory guidance Manage waste upholstered domestic seating containing POPs (December 2024), and any possible future regulation, but were still sent to MWI for treatment, then the cost for treatment in the same facility type is likely to be £41 to £59m per annum. This is £53 to £75m per annum lower than where a POPs classification is applied, even though the same environmental outcome is achieved.

For a significant saving to be realised whilst still complying with the legal requirement to destroy POPs, it is recommended that the Environment Agency review the upstream handling and segregation requirements set out in RPS 264 and the statutory guidance Manage waste upholstered domestic seating containing POPs (December 2024), with a view to assessing whether all requirements are proportionate to the environmental risks they are designed to address. Whilst many stakeholders in the waste sector regard the upstream reprocessing requirements as imposing disproportionate costs relative to the environmental benefit achieved, it is acknowledged that the segregation and negative pressure shredding requirements serve a distinct purpose from final treatment, namely preventing the release of POPs as particulates or contaminated leachate during handling and transport prior to MWI. Any review should therefore be evidence based, considering both the cost burden on local authorities and the environmental protection afforded by current upstream requirements, before concluding whether simplification is appropriate.

11.4 Recent Procurement Outcomes for WUDS

Local authorities and waste partnerships have increasingly restructured procurement to isolate POPs bulky waste into separate contract lots, moving away from traditional bundled approaches. This provides greater transparency on true POPs treatment costs but reveals substantial price variation depending on contract duration, tonnage commitment, and local market conditions (Table 11.5).

Table 11.5 Recent Standalone POPs Waste Contracts

Contracting Authority	Annual Tonnage	Contract Period	Total Value	Est. MWI Gate Fee (£/t)
West of England Waste Partnership	7,000	4 yrs	£3.5m	£125
Lincolnshire County Council	9,000 – 15,000	2 yrs	£2.2m	£124
Essex County Council	6,500	1 yr	£0.9m	£140
Bristol Waste Company	7,000	1 yr	£1.3m	£189
Lancashire County Council	Not stated	4 yrs	£5.5m	-

These procurement outcomes reveal considerable price variation ranging from £124 - £125 per tonne for larger multi-year contracts (West of England, Lincolnshire) to £140 - £189 per tonne for shorter-term arrangements (Essex, Bristol). The differential reflects several factors:

- **Contract duration effects:** Longer-term commitments (4 years for West of England, 2 years for Lincolnshire) enable operators to secure more competitive pricing through guaranteed throughput and reduced commercial risk, whereas one-year contracts (Essex, Bristol) command premiums to compensate for uncertainty and limit operator downside exposure.

- **Tonnage scale**: Larger annual tonnages (9,000 - 15,000 tpa for Lincolnshire) justify dedicated operational procedures and administrative systems, enabling lower per-tonne costs, while smaller or medium contracts face proportionally higher fixed cost allocation.

- **Operator appetite:** Facilities with established POPs handling experience and appropriate permits can offer more competitive pricing than operators entering the market for the first time or accepting POPs reluctantly to secure broader waste management contracts.

A critical tension exists between the regulatory framework and industry practice in the management of WUDS containing POPs. The EA's statutory guidance “Manage waste upholstered domestic seating containing POPs” requires segregation of POPs containing WUDS, and local authorities incur significant premiums for separate collection and contracting arrangements to comply with this requirement. However, MWI operators require POPs containing materials to arrive pre-mixed and blended within broader residual waste streams to maintain safe and efficient plant operation, as MWI facilities are designed to process mixed residual household waste rather than discrete or concentrated waste loads. In practice this means blending must occur either at transfer stations or through coordinated vehicle scheduling prior to delivery. This raises a fundamental question about the purpose and proportionality of upstream segregation requirements: if the waste must be mixed before it can be accepted at the MWI, the environmental protection afforded by segregated collection and transport warrants explicit assessment against the significant costs it imposes on local authorities.

11.5 Hazardous/Other POPs Disposal Costs

Gate fees for high temperature incineration of hazardous/other POPs waste are reported by industry sources to range from £250 - £500 per tonne depending on waste characteristics, handling requirements, and competitive market conditions. These figures are based on operator feedback and market intelligence rather than published price lists, as HTI operators negotiate fees case-by-case based on specific waste properties. Pricing transparency is limited due to the small number of facilities, commercial sensitivity, and the highly variable nature of hazardous waste streams requiring individual technical assessment and waste acceptance procedures.

The cost differential between HTI treatment (£250 - £500 per tonne) and MWI treatment of WUDS fundamentally shapes waste management strategies. Waste producers seek to minimize HTI use wherever technically acceptable alternatives exist, creating strong commercial incentives for:

- Waste classification assessments to determine whether materials qualify as non-hazardous and can access cheaper MWI routes.
- Source segregation and depollution to separate POPs components from bulk waste requiring disposal.
- Material recovery and recycling to divert non-POPs fractions from disposal entirely.
- Blending and dilution strategies (where compliant) to reduce POPs concentrations below hazardous waste thresholds.

Export costs for hazardous POPs waste to continental European HTI facilities add further expense, with reported all-in costs (gate fee plus transport, customs, and administration) of £1,000-1,500 per tonne for UK waste producers. This creates vulnerability to exchange rate fluctuations, continental capacity availability, and potential future EU restrictions on waste imports from third countries.

The HTI cost premium concentrates demand on waste streams with no viable alternative - highly contaminated oils or contaminated soils, while creating powerful economic drivers for any interventions that enable waste streams to avoid HTI routes entirely. This cost structure explains why the low hazardous POPs demand scenario projects substantially lower tonnages than the high scenario: aggressive source reduction, enhanced recycling, and careful waste classification can divert significant volumes from costly HTI treatment, generating both environmental and economic benefits.

The HTI cost premium concentrates demand on waste streams with no viable alternative while creating powerful economic drivers for any interventions that enable waste streams to avoid HTI routes entirely.

Treatment of POPs waste in cement kilns is likely to be at a lower cost, more in line with MWI gate fees. This is because the POPs waste can be a useful fuel to the cement kiln, displacing costly fossil fuel. However, the use of waste derived fuel brings with it greater monitoring requirements and risks to product quality and production. Subsequently cement kiln operators will look to provide a competitive rate for waste derived fuels, but the operator will likely need to carry out additional sorting and processing to meet strict feed requirements. For high level modelling purposes, a consolidated cost assumption of £150 per tonne (including pre-sorting/shredding) is considered appropriate.

Table 11.6 gives a high-level estimate for the three treatment options, with Table 11.7 showing an estimate for the total cost of treatment (assuming 50% of the shortfall is met using new HTI capacity and 50% is met with export).

Table 11.6 High level cost estimated for disposal of hazardous/other POPs

	Cost (£/t)
HTI	£375
Cement kiln	£150
Export	£1,000

Table 11.7 Total high level estimated cost for treatment of hazardous/other POPs (£/year) (2030)

		Capacity	
		Low	High
Demand	Low	£69M	£47M
	Median	£316M	£292M

This high-level estimate shows the cost could be as high as £300m. It must be noted this would be the disposal cost, and significant additional sorting and treatment infrastructure would be required, the costs for which would be considerable.

If the DEFRA high demand estimate of 3.4 Mt of POPs waste by 2030 is used, using these same assumptions, the disposal cost would be £2.3 billion a year. This scenario is unrealistic however, as there is no feasible way of building enough HTI capacity or exporting this much POPs waste.

12. Section B Conclusions

A combination of primary research, review of publicly available data and industry knowledge based on the experience of WRc and Tolvik was used to model the demand for POPs waste treatment and the available capacity in the UK.

The scenario modelling suggests that there should be sufficient capacity to treat POPs classified WUDS up to 2030 through MWI, at a cost of ~£135M per year to local authorities. Through interviews with operators, it has been concluded that MWI is only suited to WUDS, and other POPs wastes will require alternative treatment.

The quantity of hazardous/other POPs waste, such as WEEE, ASR and C&D waste arisings are less well known, with an estimated demand of between 100 and 500 ktpa. Estimates for treatment capacity through incineration in cement kilns, HTI and export amount to between 18 and 72 ktpa. This results in potentially significant shortfalls in treatment capacity, with a worst-case estimate of 441 ktpa (96% of demand). The cost of disposal is estimated to be up to ~£300m per year, although this does not account for the substantial investment in sorting, HTI or export infrastructure that will be required to close the gap. The true cost will therefore be much greater.

A high quantity scenario based on a DEFRA estimate of 3.4 Mt POPs waste leads to an unsustainable situation, with no realistic way of treating this quantity of POPs waste. It will therefore be vital to implement effective identification, segregation and sorting of POPs-containing waste to minimise the quantities which need to be thermally treated. Alternative options, such as long-term storage may be needed to meet the possible demand for POPs waste disposal.

Based on the evidence reviewed in this project, the UK is likely to encounter significant challenges in managing and treating POPs waste in the near future. In relation to treatment capacity, the assessment demonstrates a significant need for additional HTI infrastructure to treat POPs waste that is hazardous and/or unsuited to MWI or cement kilns.

13. Environmental Improvement Plan

The UK Government has published the 2025 Environmental Improvement Plan (EIP). The EIP sets out the government's goals, each with a set of specific commitments to help achieve those goals. With regards to POPs, the most relevant goal is Goal 4: Chemicals and pesticides. Using the information gathered in this study, commentary has been provided on key commitments as to how much impact they may have and whether they are achievable.

Commitment 40: Reform UK Registration, Evaluation, Authorisation, and Restriction of Chemicals (REACH) to enable protections that address chemical pollution to be applied more quickly, efficiently and in a way that is more aligned with our closest trading partners, especially the EU, by December 2028

Through this study it is apparent that UK REACH is less extensive than EU REACH, with no new SVHCs added to UK REACH since Brexit. This effectively results in a situation where certain substances, including those which may be at risk of being listed as a POP in the future such as DBDPE, are restricted in the EU but not in the UK.

In practice, most manufacturers will look to align and comply with EU REACH as it is more extensive, and if exporting to EU countries must be met. It does however mean the UK is on the back foot in terms of pre-emptively phasing out chemicals at risk of becoming a POP, and so greater alignment and faster application can be seen as a positive move. The commitment includes a specific action to assess and, where appropriate, add substances to the authorisation list.

Due to the pace of implementation of REACH relative to the Stockholm Convention, it is a critical tool for early restriction of potential POPs and the inclusion in the EIP and this commitment should help to reduce future POPs wastes arisings.

Commitment 41: Take action on PFAS through a new PFAS plan.

In terms of POPs waste, PFAS remains an unknown quantity. With current limits, there are relatively few wastes that would be classified as POPs due to PFAS concentrations, with the main one being AFFF which is largely already being managed. For this reason, this report has not focused on PFAS as a target POP in the timeframe of 2025 – 2030 when looking at demand and capacity. Through industry engagement, the move away from POPs-PFAS in the UK appears to have been largely achieved, though non-POPs PFAS are still in use. The drive for a universal PFAS ban in the EU will also likely drive behaviour in the UK.

DEFRA published their PFAS plan in February 2026. A detailed review of this document has not been carried out in this project. At a high level there is relatively little detail given in the plan. The main aspects of relevance to this report are the use of the POPs regulation to control POPs-PFAS, but also further refence to the addition of more PFAS as SVHCs in UK REACH.

More work is likely going to be needed to understand which waste streams are at risk of being classified as a POPs waste, and whether waste containing non-POPs PFAS will also require high temperature incineration. This could result in greater competition for already constrained HTI infrastructure.

Commitment 43: Substantially increase the destruction of POPs found in waste by 2030.

This commitment is the most relevant to this study. As detailed in Section B, WRc and Tolvik project a substantial shortfall in POPs waste treatment capacity. The primary conclusion of Section A is that there is a significant risk POPs will continue to be present in new products, extending the demand period.

The following actions are detailed in the EIP:

- *Deliver a series of compliance campaigns related to the sampling and testing of waste for POPs to identify which waste streams are affected on an ongoing basis. This includes providing industry with practical guidance as necessary relating to the identification, classification and disposal of waste containing POPs.* ***Responsible:*** *EA, industry*

- *Deliver audits, sampling and testing at waste treatment sites on an ongoing basis to support the effective regulation of waste management facilities treating waste streams which have been identified as including POPs. This should ensure that POPs are destroyed and that appropriate monitoring and control of releases are in place.* ***Responsible:*** *EA*

Both actions focus solely on the identification and testing of waste streams. While this is a critical task, there is no mention of treatment capacity. The actions implicitly assume that once waste streams are identified as containing POPs, sufficient capacity will exist to destroy them. This is in stark contrast to the findings of this report, which estimates by 2030 there could be as much as 440 ktpa of POPs waste which cannot be treated.

To achieve this commitment, either HTI capacity needs to be increased drastically, and/or long-term storage and alternative treatment methods need to be considered. In addition, effective segregation and sorting could be implemented to reduce POPs waste tonnages, though this is subject to technical, practical and commercial constraints that would need to be assessed on a case-by-case basis.

14. Conclusion and Recommendations

The conclusions from Section A and B have been presented separately to provide further evaluation of the key points from the two aspects covered by this report, namely Section A – A Regulatory Review and Industry Engagement and Section B - POPs Waste Treatment Demand and Capacity Modelling . There are many conclusions that can be drawn from this study, however there are several critical points which can be raised:

1. POPs waste is likely to remain an issue for many years due to product imports, the POPs listing of new substances and reducing thresholds. It's likely therefore that the demand for POPs waste destruction will increase rather than decrease.

2. MCCPs are an area for major concern for the following reasons:

    a. As a newly listed POP, it is likely manufacture and use will continue in Asia, possibly under exemptions for several years to come (projected to be up to 5 years of continued use).

    b. This could lead to cable sheathing granulate and some C&D products being classified as a POPs waste.

    c. The disposal of these waste streams will require HTI, as MWI and cement kilns are not able to treat waste with high levels of chlorine

3. It is very likely there will be insufficient thermal treatment capacity for POPs, and the only way to meet the demand will be to increase HTI capacity. Many POPs wastes are only suited to HTI due to their hazardous properties or high levels of halogens.

4. With a substantial shortfall in POPs waste treatment capacity, alternatives such as long-term storage need to be considered. Export of POPs waste is costly and complicated, and it is not optimal to rely on this to meet the gap of tens of thousands of tonnes. Cement kilns are likely to remain a limited outlet due to fuel specifications, and they are not intended to be a waste treatment process. Other novel thermal treatment (e.g. pyrolysis) could be developed further, but historically these technologies have failed to become viable at commercial scale.

5. The designation of WUDS as POPs and the subsequent RPS requirements has resulted in a significant increase in cost to LAs despite the fact there is no difference in end treatment. A review of these requirements and the RPS to ensure destruction of POPs at a reasonable cost could be carried out.

6. The EIP does not seems to appreciate this lack of treatment infrastructure and instead focuses on identifying and testing waste streams. A plan for how to increase treatment or storage capacity (until that is available) is needed.

7. Effective segregation and sorting of POPs waste will be critical in reducing the quantity that needs to be destroyed. Current regulations go part way to supporting this (such as the WEEE Directive), and the Circular Economy Plan may also encourage further sorting and segregation. However, it largely remains a technical and commercial issue, and operators may be restrained by existing infrastructure.

8. PFAS could be a significant future issue. There are relatively few wastes classified as POPs waste due to PFAS, but if there is a greater drive to send PFAS containing waste (even non-POPs PFAS) for HTI, this will create a huge additional demand on the already severely constrained infrastructure.

In order to help address some of these uncertainties and challenges, further work could be considered. There is already a programme of work under the EIP to identify and analyse waste streams which may contain POPs, and so further studies could be carried out to focus on the areas identified below.

1. **Understand the possible impact of a PFAS ban**

   A universal ban on PFAS is being progressed in the EU. The UK has a PFAS plan, but it is at an early stage where there are still many unknowns. Further work is needed to understand if waste streams with low levels of PFAS (such as wastewater sludge) would require destruction, with HTI the only commercially available option. A clear map of waste containing PFAS, levels of PFAS and treatment options would help to understand what will be needed in terms of treatment capacity.

2. **Further understand the barriers and opportunities to increasing HTI capacity in the UK**

   This report clearly outlines the future role which HTI will need to play in POPs waste treatment. Current and projected capacity in the UK is estimated to be inadequate. Construction of HTI faces many barriers including planning and local opposition. Understanding these barriers and identifying opportunities to increase HTI capacity is required if the UK is to treat all POPs waste arisings.

3. **Further understand alternative treatment or long-term storage options**

   Current best practice dictates the need for HTI. However, the Stockholm Convention does allow for alternatives, such as long-term storage. There is a need to further understand what is technically and practically possible in the UK while adhering to the Convention. Additionally, there may be other treatment technologies which could be deployed at small scale to treat POPs containing waste, for example microwave pyrolysis for PVC.

4. **Investigate and evaluate opportunities for reducing POPs waste tonnages**

   A significant proportion of the POPs waste in the UK, such as WEEE and WUDS, is created when one item containing POPs over the waste threshold is disposed of and mixed with other non-POPs containing items. Being able to effectively segregate or separate the POPs from non-POPs items could result in a drastic reduction in POPs waste tonnages. There are many barriers to this, both technical and practical. However, with the constraints on HTI, and the cost of POPs waste disposal, it could be highly beneficial to invest in more segregation and sorting. Possible solutions, implemented at household waste recycling centres, waste transfer sites or waste treatment sites could be investigated.

As it stands, the UK will encounter issues with growing POPs waste quantities, which are likely to continue far beyond what would be expected.