Department for Environment Food & Rural Affairs

Annex A - Supplementary evidence for amendment and/or addition of waste concentration limits (or ‘low POP content limit’) for several POPs

To be viewed alongside ‘Consultation on potential amendments to the Persistent Organic Pollutants (POPs) Regulation’

Date: 2 March 2023

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Introduction

This document provides evidence to be used when responding to Defra's 'Consultation on potential amendments to the Persistent Organic Pollutants (POPs) Regulation', launched from 02 March to 27 April 2023. Specifically, this provides supplementary evidence on proposed amendments and/or additions of waste concentration limits for several POPs.

This document provides an introduction to the proposed amendments and then evidence for eight of the proposed changes (numbered i – viii). Please see the main consultation document for more information on the specific proposals and the consultation questions, including information on how to respond to the consultation.

Changes to POPs waste limits

The Stockholm Convention (Article 6) requires parties to take certain measures to reduce or eliminate the release of POPs from waste. This includes a requirement to destroy or irreversibly transform the POP content of waste. This is not required where destruction or irreversible transformation does not represent the environmentally preferable option, and/or where POP content is low. Guidance issued under the Basel Convention is available to aid implementation and this guidance is updated from time to time. This includes guidance on how to assess whether the POP content of waste is low, which we must take into account. This includes suggested suitable values for Low POP Content Limits (LPCL); sometimes also referred to as 'waste concentration limits' or simply 'waste limits') for a given POP. As the Stockholm Convention aims to eliminate most POPs, negotiations strive to reduce the waste limits set out in the guidance.

In Great Britain the requirements that apply to POPs waste are implemented through Article 7 and Annex IV and V of the POPs Regulation. Article 7 of the POPs Regulation sets out the handling and processing requirements of waste that contains POPs, stating that the POPs content of waste consisting of, containing or contaminated by any substance listed in Annex IV of the Regulation must usually be destroyed or irreversibly transformed rather than deposited in landfill or recycled. Article 7.4(a) states a derogation (I.e. exemption) from these requirements for any waste containing a listed POP below a certain threshold concentration (hereafter the 'waste concentration limit').

In this consultation we propose new waste concentration limits for PFOA, dicofol, PCP, and PFHxS. We also propose options for reducing limits for PBDEs, HBCDD, SCCPs, and dioxins and furans. Lowering the waste concentration limit may result in more waste exceeding the limit such that the POP content needs to be destroyed or irreversibly transformed.

There is also a 'Maximum Concentration Limit' derogation that allows for an application to permanently store certain wastes (listed in Annex V of the POPs Regulation) containing POPs in hazardous waste landfills, where it can be demonstrated that destruction is not the environmentally preferred option. Proposed changes to these derogations in Annex V are set out in a separate section of this consultation. These add the new POPs, align with proposed Annex IV changes for dioxins and furans, and add additional waste types.

We must keep Annex IV of the POPs Regulation up to date to reflect any changes made to the Stockholm Convention and may also update this annex to reflect technical and scientific progress. At recent meetings of the Conference of the Parties (COP) for the Basel, Rotterdam and Stockholm (BRS) Conventions, Parties agreed new guideline waste concentration limits for two POPs that do not currently have limits stated in the POPs Regulation – namely, Dicofol and PCP – and were also close to agreeing guideline waste concentration limits for another, PFOA.

At the next meeting of Conference of the Parties of the Basel, Rotterdam and Stockholm (BRS) Conventions, which is scheduled to take place in May 2023, Parties may agree new waste concentration limits for a newly listed POP, PFHxS. An expert working group is also reviewing the guidance with the aim of agreeing and in some cases reducing the low POP content levels for existing substances, and attendees at the next COP meeting (May 2023) will strive to adopt updated guidelines. Negotiations will be based on proposals put forward by Parties and these are particularly likely to reflect legislation in force or in preparation by Parties. This includes proposals recently adopted by the EU, which updated waste concentration limits in their EU POPs Regulations for SCCPs, Dioxins and furans, PBDEs and HBCDD.

As a Party to the Stockholm Convention, the UK is committed to review and update the waste concentration limits as listed in our domestic Regulation (the POPs Regulation), and to consider the internationally agreed guidelines under the Basel and Stockholm Conventions (on environmentally sound management of wastes consisting of, containing or contaminated with persistent organic pollutants) when doing so. The UK is able to influence or contribute to discussions on guideline limits before they are adopted, especially where there is sufficient evidence or uncertainty as to the impact on the UK and our priorities. However, in general, Parties to the Conventions work together towards reducing limits in the spirit of the Convention's missions. It is also possible for the UK to adopt more stringent waste concentration limits than have been adopted by the Basel and Stockholm Conventions, where there are good reasons to do so. This could result in a requirement to destroy a larger volume of POPs-containing waste.

This consultation invites your views on a range of options for waste concentration limits that reflect the ongoing international negotiations and our understanding of the impact on GB waste management and emissions of POPs. We indicate if a proposed value is the existing limit in the POPs Regulation, a new value that has been adopted into international guidelines, or a value that has been proposed – or we anticipate will be proposed – for consideration upcoming (May 2023) or future BRS COPs.

When assessing limits, we have considered the methodology developed by the EU and applied when setting waste concentration limits under the 2004 POPs Regulations when the UK was a Member State. This method was applied by the EU in developing the waste limits it recently adopted in Regulation (EU) 2022/2400. We have supplemented UK evidence and UK-specific considerations with other evidence, including EU impact assessments and policy proposals where appropriate.

We are also taking this opportunity to seek further evidence and information regarding potential amendments to existing waste concentration limits for all other listed POPs, as well as identification of potentially suitable waste concentration limits for UV-328,

methoxychlor, and dechlorane plus: three substances which are not yet POPs, but might be listed as POPs at the next BRS COP in May 2023, or subsequent BRS COPs.

Evidence on low POP content limits (or 'waste concentration limits')

Waste limits (i) - Perfluorooctanoic acid (PFOA)

See the consultation document for information on the substance, the proposed amendment, and the specific consultation questions.

Evidence summary

A desk-based assessment by WSP (formerly Wood Group Ltd)[1] on behalf of the Environment Agency assessed what waste streams are likely to exceed different **waste concentration limits** for PFOA and PFHxS. Their assessment considered the following:

- Quantity of articles or material sold per year (tonnes).
- Proportion of items thought to contain PFHxS/PFOA (%) (market splits).
- The working concentration at time of sale (mg/kg)
- Average product lifetime.
- Percentage of PFHxS/PFOA lost to environment throughout product lifetime.

Different types of waste streams were investigated and characterised. This included building upon the work completed to date in development of the POPs emission inventories on behalf of Defra and assessing studies, including those outlined in the EU commission assessment to arrive at concentrations. The following waste streams were assessed:

- Clothing and shoes
- Carpets
- Fabric and upholstery
- Non-woven PPE waste
- Firefighting foams
- Electrical and electronic products

[1] Persistent Organic Pollutants (POPs) – Cost Benefit Analysis POPs Annex IV for PFOA and PFHxS, Wood Group UK Ltd on behalf of the UK Environment Agency [Unpublished]

All the waste streams (excluding firefighting foams) were found to contain PFOA below 1 mg/kg, which means that these waste streams would not be subject to the requirement to destroy the POP content if a waste concentration limit were set at this level. However, many of these wastes would be captured for destruction in very significant quantities if the waste concentration limit were set at a lower level.

We recognise that PFOA may be found in other waste (e.g. waste cookware, sewage sludge). A recent, currently unpublished, study indicates that concentrations of PFOA in untreated landfill leachate are below the proposed waste limits. The Chemical Investigation Programme gathered data on sewage sludge, and Municipal Waste Incinerator operators monitor bottom ash for residual persistent organic pollutants. Our understanding is that levels of PFOA in other wastes are likely to be below all the options we are considering, so we have not considered them further.

Clothing - evidence suggests that a number of waterproof clothing products imported from China, Vietnam and Bangladesh contained quantities of PFOA in 2016 at point of sale (Greenpeace, 2016)[2]. The PFOA concentrations were well below 1 mg/kg.

Carpets - PFOA had been identified as being used in carpets primarily as stain repellents from 3M's Scotchguard® line of products (European Chemicals Agency, 2019). The highest concentration of PFOA identified in 68 composite samples of carpet waste by regulators and industry is 1.1 mg/kg, with an average of 0.2 mg/kg. It is therefore possible some carpets may exceed the waste concentration limit of 1 mg/kg although this is likely to be in low quantities. We would expect regulators to work with industry to come up with proportionate strategies to manage these small proportions.

Fabric and upholstery Fabric and upholstery have been historically identified to contain PFOA within the UK. The assessment by WSP assumed that concentrations of these wastes would not exceed a waste concentration limit of 1 mg/kg. Testing undertaken for the Norwegian Environment Agency examined a composite sample made of 14 UK waste seating covers and found levels well below this (0.028 mg/kg, or 0.219 mg/kg after TOP assay, which is the test used when considering PFOA related compound).

Non-woven PPE waste- PFOA has been found to be present as a droplet repellent on non-woven PPE from sources imported from outside of the EU, Liu et al (Annex XV dossier)[3]. Nine surgical gowns sampled from 2007 to 2011 were analysed. Of these, 7 contained concentrations of PFOA ranging between 0.0184 - 0.369 mg/kg. It is likely that

[2] Greenpeace Research Laboratories 2016, Hazardous chemicals in branded textile products on sale in 25 countries/regions during 2013 Technical report 01-2016.pdf (greenpeace.to)

[3] ECHA 2018 - Restriction background document to the opinion on the Annex XV dossier, Available at: https://echa.europa.eu/documents/10162/61e81035-e0c5-44f5-94c5-2f53554255a8

PFOA continues to be imported into the UK for use in PPE, although these are likely to fall well below the proposed waste concentration limit of 1 mg/kg.

Firefighting foams - PFOA has been found in significant quantities, between 1.8 mg/kg and 7.3 mg/kg in some samples according to some studies (Annex XV dossier[4]). However, information on stockpiles of fire fighting foams in England held by the EA indicates that PFOA may be present above 0.025 mg/kg but below 1 mg/kg in some foams. A report by Eftec[5] (2019) suggests there were stocks of PFOA-containing foam estimated to be in the range of 1.5 to 1.8 million litres[6], providing guidance for the quantities needing to be disposed of. Further investigation and testing of current stocks would be required to accurately determine the quantity of foams containing PFOA. From January 2023, uses of fire-fighting foam that contains or may contain PFOA, its salts and/or PFOA-related compounds are no longer allowed in sites unless releases can be contained, which triggers the need for disposal of stockpiles under article 5 of the POPs Regulation. This means much of the PFOA containing firefighting foams may already have been disposed of, with the remaining needing to be taken out of use by July 2025. At most, Eftec estimate that 1.8 million litres or 1,800 tonnes[7] of firefighting foams will need to be directed to high temperature incineration after being taken out of use (although in reality, we expect much of this to have been disposed of already). Eftec estimated a range for the gate fee of high temperature incineration at between £400-700/tonne (£433/t on average). This results in an overall cost of £0.5m-£1.2m.

Electrical and Electronic products - The presence of PFOA in waste electricals was based on a study that assessed residual amounts of PFAS within electricals which was presumed to be negligible (ICER, 2020) (Garge, S. et al, 2020)[8].

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[4] ECHA 2014 – PFOA Annex XV Restriction Report Proposal for a Restriction, Available at: https://echa.europa.eu/documents/10162/e9cddee6-3164-473d-b590-8fcf9caa50e7

[5] Eftec 2019 - Costs of phasing out PFOA-containing firefighting foams in the UK, and availability of suitable alternatives (unpublised)

[6] Poly- and perfluoroalkyl substances (PFAS): sources, pathways and environmental data 2021, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1012230/Poly-_and_perfluoroalkyl_substances_-sources_pathways_and_environmental_data_-_report.pdf

[7] Assuming a litre of foams have the same density as water

[8] ICER, Wrc, 2020, An assessment of the levels of persistent organic pollutants (POPs) in waste electronic and electrical equipment in England and Wales and (Garge, S. et al). Available at: https://icer.org.uk/wp-content/uploads/2020/03/UC14161.3-An-assessment-of-the-levels-of-persistent-organic-pollutants-POPs-in-waste-electronic-and-electrical-equipment-in-England-and-Wales-FINAL-REPORT.pdf

Hydraulic Fluids - The WSP study highlighted that PFAS including PFOA are known to have been used in significant quantities in aviation hydraulic fluids [9]. However, there is limited concentration data. It is unlikely that PFOA is currently present at end of life although there are questions on whether some legacy hydraulic fluids remain in use.

The EU Impact Assessment assessed a waste concentration limit of 0.025 mg/kg and 50 mg/kg for PFOA waste which is different to the proposed waste concentration limit of 1 mg/kg. The related compounds were assessed at 1mg/kg and 2,000mg/kg which differs to the proposed waste concentration limit of 40mg/kg. The Impact Assessment assessed various studies and concluded that PFOA and related compounds are present in various wastes including waste electrical and electronic equipment (WEEE), textiles and leather (comprising of furniture and clothing), firefighting foams and carpets. At 0.025 mg/kg some textiles and carpets were assumed to exceed the waste concentration limit, although these waste streams were very unlikely to be affected at a waste concentration limit of 50 mg/kg.

For each 'PFOA and its salt' limit considered, a factor of 40 was applied to obtain an accompanying limit for 'related compounds', an approach that was proposed by ECHA's Committee for Risk Assessment (RAC).[10]

In conclusion, we think that our lead option would result in up to 1,800 tonnes of firefighting foam needing to be redirected to high temperature incineration and it is possible that some hydraulic fluids may require the same treatment. All other waste streams are unlikely to be impacted based on our assessment. The costs we expect some organisations may face include time taken to familiarise themselves with the regulation, administration costs associated with sourcing appropriate disposal, and costs associated with testing and segregation of waste, and redirecting wastes to incineration.

[9] KEMI (Swedish Chemicals Agency). 2015. Occurrence and use of highly fluorinated substances and alternatives.

[10] Ramboll 2019 for EU commission. Study to support the review of waste related issues in annexes IV and V of regulation (EC) 850/2004. Available at:: https://op.europa.eu/en/publication-detail/-/publication/8ea39ec6-4479-11e9-a8ed-01aa75ed71a1/language-en/format-PDF

Waste limits (ii) - Perfluorohexane sulfonate (PFHxS)

See the consultation document for information on the substance, the proposed amendment, and the specific consultation questions.

Evidence summary

The WSP study also assessed what waste streams are likely to exceed different waste concentration limits for PFHxS. The same waste streams were assessed as for PFOA, and none were found to exceed the waste concentration limit of 1 mg/kg, although this was not the case at lower waste concentration limits.

As with PFOA, a factor of 40 has been applied to the 'compound and its salts' limit to obtain an accompanying limit for 'related compounds', as proposed by ECHA's Committee for Risk Assessment (RAC).

Firefighting foams - PFHxS has been identified in the formulation of 3M's Light Water® line of foams (IPEN Expert Panel, 2019)[11]. PFHxS may not have been deliberately added into the formulation but was present as a "helpful by-product" of the Electrochemical fluorination (ECF) process. After PFOS was phased out, PFHxS may have been used as a step-in product though there doesn't appear to be data to support this. The EU Impact Assessment study assessed data from the German Petroleum Industry Association on the content of substances including PFHxS in a selection of legacy fire-fighting foams that are part of stockpiles in Germany. This data suggests a range of 0.031 mg/kg to 0.098 mg/kg of PFHxS and an average of 0.059 mg/kg PFHxS in foam concentrates which is well below 1 mg/kg[12].

Clothing - In 1999, 'apparel & leather' represented 20% of PFHxS-related products entering the UK market by 3M (European Chemicals Agency, 2019). In 2013, the Greenpeace Research Laboratories conducted several studies analysing the presence of PFAS in outdoor gear. PFHxS was detected in six of the ten waterproof clothing samples, all manufactured in China. In five of the samples, PFHxS was detected at levels of 20-2,260 µg/kg (an average 520 µg/kg across all samples containing PFHxS).

Carpets – Carpets made up the largest proportion of PFHxS use, accounting for over 60% of 3M's sales in 1999. By 2004, it was assumed that PFHxS, was no longer used in carpets or aftermarket formulations (European Chemicals Agency, 2019). The EU Impact Assessment suggested that the only available data for carpets for PFHxS was as an impurity of PFOS. This data suggests a PFOS concentration in carpets of 0.000063

[11] IPEN expert panel, 2019 - PFHxS—Socioeconomic impact, exposure, and the precautionary principle, Available at: https://ipen.org/sites/default/files/documents/pfhxs_socio-economic_impact_final_oct.2019.pdf

[12] EU IA - German Petroleum Industry Association quoted in ECHA (2017)

mg/kg, of which 4-14% may be PFHxS[13]. [14]. PFHxS was not detected in any of the 68 composite samples of UK waste carpet tested by industry.

Hydraulic Fluids - PFHxS has been known to be used as an additive in aviation hydraulic fluids in significant quantities. However, there is limited concentration data available in literature due to confidentiality (KEMI, 2015). PFHxS is not currently used in the EU (KEMI, 2015). Before 2013, 10 tonnes of hydraulic fluids and 6 kg PFOS were used each year in Sweden. The equivalent figure for the EU was 600 kg (KEMI, 2015)15. The working concentration of PFOS was 600 mg/kg although concentrations for PFHxS are not known. WSP assumed that hydraulic fluids are replaced at least every 15,000 hours of flight. Assuming planes spend half their time in the air, the fluid is replaced approximately every 3 years. Therefore, it is unlikely that PFHxS is currently present at end of life, although this will need testing within the aviation sector.

In conclusion, we think that most waste streams will not be affected by the proposed limit, although it is possible that some hydraulic fluids may need to be directed to high temperature incineration. The costs we expect some organisations may face include time taken to familiarise themselves with the regulation, admin costs associated with sourcing appropriate disposal, and costs associated with testing and segregation of waste, and redirecting wastes to incineration.

Waste limits (iii) - Short Chain Chlorinated Paraffins (SCCPs)

See the consultation document for information on the substance, the proposed amendment, and the specific consultation questions.

Evidence summary

The following waste streams have been assessed for SCCPs based on historical use and available information. Defra also commissioned WSP consultants to carry out a desk-based study on what waste streams are likely to exceed different waste concentration limits for SCCPs.

PVC products - Data on SCCP concentrations for PVC consumer and non-consumer products vary. The EU Impact Assessment references a UNEP study that assessed plastic/polymer products placed on the EU market made from ethylene-vinyl acetate (EVA)

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[13] Sanchez et al 2019 Pilot screening of perluoroalkyl substances (PFASS) in consumer products from Spanish markets: preliminary results, referenced in EU IA

[14] Sanchez et al 2019 Pilot screening of perluoroalkyl substances (PFASS) in consumer products from Spanish markets: preliminary results, referenced in EU IA

[15] KEMI 2015, Occurrence and use of highly fluorinated substances and alternatives. Available at: https://www.enviro.wiki/images/d/df/KEMI2015.pdf

foam which were contaminated with SCCP above the limit of 1,500 mg/kg and a range of products exceeded 10,000 mg/kg.[16] Responses to the EU consultation, however, suggest that SCCPs have not been used in large quantities as plastic additives in the EU. Although it is uncertain what fraction of PVC products are imported from outside and may contain SCCPs at those concentrations. A sampling study conducted in Belgium of 19 PVC consumer products and toy samples, the majority of which were imported from China, found minimal concentrations of SCCPs (most samples were below limits of detection).[17] Research by WSP estimated that no PVC films and sheeting waste exceed the waste concentration limit of 10,000 mg/kg although 2% of this waste exceeds 1,500 mg/kg. This is likely a result of imports from Asia.

Flooring – Research by Natural Resources Wales (NRW) identified the presence of SCCP at 41,815 mg/kg in one plastic backed carpet tile of nine samples analysed for this substance. This exceeds the existing limit of 10,000 mg/kg. SCCP was detected in other samples but not above 395 mg/kg, meaning there would be no impact of lowering the waste limit to 1,500 mg/kg on the management of this waste stream. Another recent European field study sampled post-consumer plastic of various types for SCCPs. They analysed 21 composite samples and reported a maximum concentration of 140 mg/kg[18]. Research by WSP concluded that less than 1% of the PVC flooring waste would be impacted by a change in the waste concentration limit from 10,000 mg/kg to 1,500 mg/kg. The lack of available recent real-world data on the composition of this waste stream means that there is significant uncertainty about the impact of lowering the limit. However, the recent field data suggest that there would be no significant impact. We invite stakeholders to commission further research and submit any evidence they already hold on the composition of waste flooring types that are more likely to contain SCCPs (e.g. PVC or rubber-backed flooring) and the impacts of managing the affected parts of this waste stream as POPs waste, should that be required.

WEEE - The EU Impact Assessment refers to a study by Andersson et al (2019) which assessed 54 samples of plastic waste originating from WEEE and ELV collected in Europe[19]. It showed that SCCP additives and plasticisers could not be detected (no samples above 50 mg/kg and 100 mg/kg detection limit). In the UK, WEEE is generally shredded as whole devices, and various fractions are separated. WEEE cable plastic is already treated as hazardous and POPs waste. Rigid rich plastics are unlikely to contain SCCPs and the denser polymers such as PVC are separated during density separation. In principle, there should be no impact on WEEE from changing the limit for SCCPs.

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[16] UNEP (2019): Detailed guidance on preparing inventories of short-chain chlorinated paraffins (SCCPs), *Draft of 2019*, available at: http://www.pops.int/Implementation/NationalImplementationPlans/Guidance/tabid/7730/ctl/Download/mid/20996/Default.aspx?id=20&ObjID=27061

[17] Mcgrath TJ, Poma G, Matsukami H, Malarvannan G, Kajiwara N, Covaci A. (2021). Short- and Medium-Chain Chlorinated Paraffins in Polyvinylchloride and Rubber Consumer Products and Toys Purchased on the Belgian Market, Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7908593/

[18] Ramboll, Franhofer 2021, Environmental Pollutants in Post-Consumer Plastics for Norwegian Environment Agency, available at: https://www.miljodirektoratet.no/sharepoint/downloaditem?id=01FM3LD2RGJ3TG4CATRFEKDGYMULDQ27X7

[19] Andersson.M, Oxfall.H Nilsson.C, 2019, Mapping and evaluation of some restricted chemicals in recycled plastics originating from ELV and WEEE collected in Europe, RISE IVF ISBN 978-91-88907-54-7, available at: https://www.diva-portal.org/smash/get/diva2:1295690/FULLTEXT02

Non WEEE cables – A study by BMRA sampled whole non-WEEE cables in the UK and found that the likely concentration of SCCPs was between 500-1200mg/kg. This is below the proposed threshold of 1500mg/kg. A small number of cables contained multiple SCCP components for the outer sheath and inner cable, where the whole cable may exceed the current waste concentration limit. It is assumed that non-WEEE cables wouldn't be affected by change in the waste concentration limit to 1,500mg/kg.

Automotive shredder residue – A study by BMRA suggests that ASR are unlikely to have SCCPs in them although where found, they exceed the current waste concentration limit of 10,000 mg/kg. Changing the limit to 1,500 mg/kg is therefore unlikely to significantly alter disposal activity to comply with the existing requirements. Research by WSP estimates that piping, hoses, connectors, gaskets & seals in the automotive sector contain SCCPs at high concentrations (over 10,000 mg/kg) representing 13.3% of the entire waste stream that is contaminated at those levels. An additional 1.7% of this waste is captured between a waste concentration limit of 1,500 mg/kg -10,000 mg/kg. They also estimated that around 1% of cabling waste from the automotive sector could be captured between the waste concentration limit from 1,500 mg/kg to 10,000 mg/kg.

Piping, hoses, connectors, gaskets & seals used in plumbing - Analysis by WSP found that plumbing waste does not contain SCCPs at a waste concentration limit of 10,000 mg/kg although up to 2% of this waste could be impacted at a waste concentration limit of 1,500 mg/kg.

Rubber waste from end-of-life conveyor belts used for underground mining – SCCPs were historically added to rubber products as flame retardants and/or plasticisers. The British Rubber Manufacturers' Association (BMRA) carried out a survey of its members in 2001 which suggested the use of SCCPs in Conveyor belting. The EU Impact Assessment estimates an SCCP concentration of 8,260 mg/kg from rubber conveyor belts which are mixed with non SCCPs contaminated rubber conveyor belts. It should be noted that this waste stream should be collected separately at the point of disposal, and so is likely to exceed the existing limit of 10,000 mg/kg. The EU study estimates that some rubber conveyor belts produced before 2013 will need to be redirected from recycling to incineration which amounts to 7000-70000 tonnes per annum between 2021-2035. The lower estimate reflects testing and separation whereas the upper estimate assumes all rubber conveyor belts are incinerated. This is dependent on whether field screening using XRF scanning can play a role in this particular application and whether laboratory tests are feasible. Ongoing analysis by WSP suggests that no rubber conveyor belts used for mining would exceed a limit of 10,000 mg/kg, although 12% of the waste stream would exceed the waste concentration limit of 1,500 mg.

Adhesives sealants, and paints – The EU Impact Assessment suggests that the **c**oncentration of SCCPs in some sealants and adhesives is assumed to be between 5-20% by weight or 50,000 mg/kg -200,000 mg/kg (concentration reported by BRE et al, 2008). A study in China sampled 9 adhesives and found concentrations at a range of between 43 mg/kg – 202,000 mg/kg. Sealants and adhesives are used in building materials and other types of construction products, which have long service lives (around 50 years). Approximately 2,430 tonnes of SCCP containing sealants and adhesives waste are estimated to be subjected to waste management in the EU in 2020. BiPRO (2015a) suggests that one third of SCCP containing sealants and adhesives used in the construction sector can be successfully separated from the building materials, although it's

not clear how[20]. This separated fraction of sealants and adhesives is assumed to be incinerated. The EU study assumes the remaining two thirds that cannot be successfully separated from the surface of building materials (i.e. concrete, tiles, bricks), are managed together with other mineral construction and demolition waste resulting in concentrations well below a waste concentration limit of 1,500mg/kg.

Treated clothing & Textiles (e.g. backpacks, picnic bags, mittens) – Analysis by WSP found that various miscellaneous textile items do not contain chlorinated paraffins above the current waste concentration limit of 10,000mg.kg although up to 5% of this waste could be impacted at an waste concentration limit of 1,500mg/kg. These figures were based on a study by the Norwegian Climate and Pollution Agency, and are highly uncertain due to the sample size.

The EU Impact Assessment suggested that other waste streams such as paints and coatings (typical applications included road marking paints, anticorrosive coatings for metal surfaces, decorative paints), textile waste and metal working fluids and lubricants do not contain SCCPs above the proposed waste concentration limit. In summary, the amount of waste exceeding a waste concentration limit of 1500 mg/kg and below 10,000 mg/kg for SCCP appears to only affect a small % of waste streams where the tonnage of SCCPs is low. However, this is highly uncertain due to few field samples for certain wastes. We invite stakeholders to commission further research and submit any evidence they already hold on the composition and concentration of wastes that may contain SCCPs. In particular, we have identified flooring, PVC film and sheeting, automotive wastes, plumbing wastes, rubber conveyor belts, and some treated textiles to contain some SCCPs above the proposed waste concentration limit. The costs we expect some organisations may face include time taken to familiarise themselves with the regulation, administration costs associated with sourcing appropriate disposal, and costs associated with testing and segregation of waste, and redirecting wastes to incineration.

We expect regulators to work with industry to come up with proportionate strategies to manage these small proportions.

[20] BiPRO, 2015a, available at: https://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/texte_35_2015_identification_of_potentially_pop-containing_wastes.pdf

Waste limits (iv) - Polybrominated diphenyl ethers (PBDE)

See the consultation document for information on the substance, the proposed amendment, and the specific consultation questions.

Evidence summary

The EU impact assessment and the study to support the Impact Assessment considers the impacts of lowering the PBDE waste limits on waste streams that are likely to contain PBDE. Two lower waste limit values were considered: 500 mg/kg and 200 mg/kg. These limits are consistent with the upper and lower limit in the UK's Option 2 of i) 500 mg/kg (ii) drop to 350 mg/kg 3 years after entry into force (iii) drop to 200 mg/kg 5 years after entry into force. EU Impact Assessment and Environment agency evidence has been used to understand the possible impacts of Option 2 and our Lead Option, on relevant waste streams.

Key wastes streams identified are:

- Plastics in waste electrical and electronic equipment (WEEE)
- Plastics and textiles in end-of-life vehicles (ELVs)
- Textiles & furniture
- Plastic fraction of construction and demolition waste (CDW)

The EU Impact Assessment includes evidence taken from separate studies and consolidated by Hennebert (2020) (see table A), indicating the proportion of waste samples that could meet different concentration levels. It concluded that there would be no impact on WEEE/ELV plastic recyclers under a waste concentration limit of 500mg/kg, as this limit value is already being achieved. Under a waste concentration limit of 200mg/kg, it was estimated that some waste would need diverting from recycling and landfill to incineration, due to higher concentrations of PBDE in some WEEE (for example, cathode ray tubes). Based on analysis from Sofies (2020)[21], the EU Impact Assessment assumed that a waste limit of 350 mg/kg was achievable for WEEE/ELV recyclers at the time of the study.

Table A: Concentrations of PBDEs in plastics of WEEE, ELV, construction and demolition waste (CDW)[22]

[21] Sofies (2020): Study on the Impacts of Brominated Flame Retardants on the Recycling of WEEE plastics in Europe, study for the Bromine Science and Environmental Forum (BSEF). Available at: https://www.bsef.com/wp-content/uploads/2020/11/Study-on-the-impact-of-Brominated-Flame-Retardants-BFRs-on-WEEE-plastics-recycling-by-Sofies-Nov-2020.pdf

		Concentration mg/kg			% of samples < than the waste concentration limit		
Waste stream	N	Median	Mean	Max	1000 mg/kg	500 mg/kg	200 mg/kg
EEE/WEEE	781	7	2,663	154,000	90%	87%	85%
Vehicles/ELV	215	6	1,623	85,000	92%	88%	84%
CDW	716	0	1,713	300,000	99%	99%	99%
Textile & upholstery	437	0	2,080	130,000	95%	94%	94%

Source: Hennebert, 2020[23]

WEEE/ELV plastic sorting processes focus on separating high and low bromine (Br) fractions based on the average Br content being above or below 2,000 mg/kg (as per the EN/TS 50625 series) to meet the current waste limit. This separation threshold is not sufficient to ensure that PBDE levels in the low-Br fraction are below 200 mg/kg. Under a waste limit of 200mg/kg, a hypothetical scenario was assumed whereby 50% of specialised WEEE/ELV plastic recyclers in the EU may need to upgrade their sorting equipment with a one-off capital expenditure of €0.5m – €1m per company.[24]

Evidence taken from samples at UK WEEE treatment plants consistently found that a limit of 200 mg/kg could be achieved and feasibly analysed using existing testing equipment (Environment Agency, 2022). However, some samples were close to this limit and it is statistically likely that that some samples will exceed 200 mg/kg given the sample size. PBDE is understood to be more prevalent in WEEE than ELV and as such, lowering the PBDE waste limit 200 mg/kg is expected to have no impacts on ELV and minimal impacts

[23] Hennebert, P (2020): Concentrations of brominated flame retardants in plastics of electrical and electronic equipment, vehicles, construction, textiles and non-food packaging: a review of occurrence and management. Volume 12 - September 2020 34–50.) [as cited by RPA, 2021]. Available at: https://digital.detritusjournal.com/articles/concentrations-of-brominated-flame-retardants-in-plastics-of-electrical-and-electronic-equipment-vehicles-construction-textiles-and-non-food-packaging-a-review-of-occurrence-and-management/350

[24] European Commission, Directorate-General for Environment, Upson, S., Footitt, A., Biaudet, H., et al (2021): Study to support the assessment of impacts associated with the review of limit values in waste for POPs listed in Annexes IV and V of Regulation (EU) 2019/1021 : final report for DG Environment, Publications Office of the European Union. Available at: https://data.europa.eu/doi/10.2779/63162

on WEEE waste treatment. Impacts on WEEE waste treatment will reduce further as more of the items arising in waste will be largely free from PBDEs due to bans on use in force at the time of manufacture.

Based on evidence from existing studies, the majority (99%) of CDW plastics are estimated to contain PBDE concentrations of below 200mg/kg, as seen in Table A. PBDE use in construction started in the 1970s and increased throughout the 1990s and 2000s. There is some uncertainty about future CDW concentration levels, particularly when buildings built in the 1990s-2000s become waste. In the EU Impact Assessment it was identified that most CDW plastics containing PBDE are already incinerated, indicating that waste diversion as a result of lower waste limits could be limited.

DecaBDE in textiles was largely phased out when it was designated as a substance of very high concern (SVHC) in 2014. Based on evidence from existing studies, 94% of textiles waste is estimated to contain PBDE concentrations of below 200mg/kg, as seen in Table A. Further, it is expected that the quantity of PBDE in textile waste is expected to decline significantly between 2020 and 2030, due to its short average lifetime of between 5[25] and 10[26] years. It is important to note that the evidence in Table X is mainly relevant to the waste stream as a whole, and concentration levels for specific textile products in waste might vary. For example, a study by the EA on domestic seating suggests PBDEs are typically in excess of the existing limit (average 4000 mg/kg). However, as the existing waste limit is typically exceeded, a reduction in limit would only have a minimal effect where XRF scanning was in use. Taken together, the impact of lowering the PBDE waste limit is considered to be low.

Based on this evidence, the impact of lowering the PBDE waste limit on ELV, CDW plastics and textile waste streams to 200 mg/kg is considered to be low. However, we are proposing an interim limit of 350 mg/kg to ensure that WEEE plastic treatment facilities are able to comply. The proposed 350 mg/kg limit is still low enough that all relevant WEEE plastic will require treatment in a well-designed and maintained plastics separation facility.

[25] BIR (2020): Recycling Plastics 2020, available at: https://www.bir.org/publications/facts-figures/download/737/1000000832/36

[26] European Commission, Directorate-General for Environment, de Brujine, E., Schöpel, M., Zotz, F., et al (2019): Study to support the review of waste related issues in annexes IV and V of Regulation (EC) 850/2004: final report, Publications Office. Available at: https://data.europa.eu/doi/10.2779/500330

Waste Limits (v) - Pentachlorophenol (PCP)

See the consultation document for information on the substance, the proposed amendment, and the specific consultation questions.

Evidence summary

The EU Impact Assessment considers the impacts of introducing a waste limit for PCP. One waste limit value 100 mg/kg was considered. This limit is consistent with the limit in the UK's lead option, so EU Impact Assessment evidence has been used to understand the possible impacts of this limit on relevant waste streams.

Wood waste containing PCP was identified as the main relevant waste stream in the EU Impact Assessment study, as historic applications of PCP were mainly in wood treatment. In the EU and UK PCP wood waste is classified as hazardous waste and almost always incinerated[27] so introducing a waste limit is not expected to have an impact on final waste treatment. Stakeholder responses also indicated that this limit could be achieved without making any changes to waste treatment.

Textiles containing PCP was identified as another relevant waste stream. Under the proposed limit all PCP treated textiles in the EU would exceed the limit and the waste would need to be diverted to incineration. It was projected that 80 tonnes of textile waste would contain 2 tonnes of PCP in the EU in 2021.[27] Application of pentachlorophenyl laurate (PCPL) on military and industrial textiles was allowed until 2002 or 2008, depending on the Member State. Given that PCPL has an estimated product service life of 15-20 years, it was estimated that the waste stream will have ceased in most Member States by 2022. Where application of PCPL was allowed until 2008, including in the UK, the waste stream was expected to cease by 2028.

Overall, it is expected that a 100 mg/kg waste limit value, is unlikely to have any impact on the disposal and recovery methods of wood, given current practices. The impact on waste treatment of textiles, is also expected to be low, given the low quantities of waste.

[27] ESWI (2011) Study on waste related issues of newly listed POPs and candidate POPs. Available at: European Commission, Brussels (europa.eu)

Waste limits (vi) – Dioxins, Furans, and dioxin-like PCBs

See the consultation document for information on the substance, the proposed amendment, and the specific consultation questions.

Evidence summary – Dioxins and Furans (PCDD/F)

The Environment Agency has collected and analysed data from approximately 60 incinerators. The findings are that incinerator bottom ash, the primary output, will not be affected by the proposed waste limit values. Data suggests that a small proportion of Air pollution control residues (APCR), particularly from Biomass Incinerators, may exceed the proposed limits. APCR is typically sent to hazardous waste landfill already. Where this is the case, the impact is likely to be administrative and require the operator to apply under the article 7(4) procedure to continue landfilling. Although the impact of lowering the waste limit is expected to be limited, there is a degree of uncertainty as PCDD/Fs can be produced by any combustion activities and there is potential for it to be found in several waste streams. Not all waste streams have been tested by the EA for PCDD/F, notably other thermal processes such as power plants and steel works. EA analysis of data on the composition of sewage sludge samples is in progress and early results indicated that concentration of PCDD/F are well below proposed waste limits.

The EU Impact Assessment considers the impacts of decreasing the waste limit for PCDD/Fs to 0.005 TEQ/kg, which is consistent with the UK's lead option. EU Impact Assessment and Environment Agency evidence has been used to understand the possible impacts of the lead limit on relevant waste streams.

In the EU Impact Assessment the following relevant waste streams were identified:

- Waste incineration (Hazardous, health, municipal)
- Power production (coal, biomass)
- Coking processes
- Ethylene dichloride production
- Sinter plants
- Steel production (electric arc 40% and blast furnaces 60%)
- Iron smelting
- Primary and secondary copper smelting
- Secondary aluminium smelting
- Secondary lead smelting
- Secondary zinc production
- Construction and demolition waste
- Compost/digestate
- Sewage sludge
- Domestic burning - (burning or wood or coal in home burners, chimneys or boilers) (of wood and coal)

Based on a range of typical concentration levels taken from existing studies, the EU Impact Assessment study assessed that biomass power plant fly ash and other residues

would also be impacted by lowering the waste limit to 0.005 TEQ/kg.[28] Waste was expected to be diverted to hazardous landfill/underground storage from non-hazardous landfills (70%), and from agriculture, construction, and geotechnical applications (10% respectively).

For each waste stream where the typical waste PCDD/F concentrations are above 0.05 TEQ/kg, the EU Impact Assessment study assumed that the waste limit will lead to a 5-20% reduction in non-hazardous landfill and applications on land. This would cost an additional €210/tonne in gate fees for waste diverted from non-hazardous landfill to hazardous landfill.[29]

Elsewhere in the EU assessment, one potential anticipated impact of a 0.005 TEQ/kg EU waste limit was that soot and ashes from the domestic burning of wood and coal would need to be diverted from use in agriculture and silviculture or from treatment as household waste[30]. In the EU, there is a requirement to separately collect hazardous waste produced by households by January 2025: in this case, lowering the waste limit could require households to segregate domestic soot and ash waste from other household waste so that it can be treated as hazardous waste. This is because there is a direct link between POPs Regulations and hazardous waste regulations for PCDD/F; if a waste exceeds POPs waste concentration limits for PCDD/F it is also hazardous waste. The extent of the impact in the EU will vary significantly depending on the fuel type, appliance used for fuel burning, and the disposal practices. It is worth noting that the UK does not have the same requirement for hazardous waste produced by households to be separately collected and we have no plans to implement such a requirement in England. As such, PCDD/F from domestic waste would not arise as a separate waste stream from households; it can continue to be mixed with residual household waste and the concentration of PCDD/F in waste is anticipated to be below the waste concentration limit. This means that the diversion required and associated costs will not arise.

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[28] European Commission, Directorate-General for Environment, Upson, S., Footitt, A., Biaudet, H., et al (2021): Study to support the assessment of impacts associated with the review of limit values in waste for POPs listed in Annexes IV and V of Regulation (EU) 2019/1021: final report for DG Environment, Publications Office of the European Union. Available at: https://data.europa.eu/doi/10.2779/63162

[29] European Commission, Directorate-General for Environment, de Brujine, E., Schöpel, M., Zotz, F., et al., Study to support the review of waste related issues in annexes IV and V of Regulation (EC) 850/2004 : final report, Publications Office, 2019, https://data.europa.eu/doi/10.2779/500330

[30] European Commission, Directorate-General for Environment, Upson, S., Footitt, A., Biaudet, H., et al (2021): Study to support the assessment of impacts associated with the review of limit values in waste for POPs listed in Annexes IV and V of Regulation (EU) 2019/1021: final report for DG Environment, Publications Office of the European Union. Available at: https://data.europa.eu/doi/10.2779/63162

Evidence summary - Dioxin-like PCBs

The EU Impact Assessment supporting study was unable to identify sufficient concentration data for dl-PCBs in relevant waste streams (listed below). The preferred policy option was to include dioxin-like PCBs in the PCDD/F limit value, so that that there is one limit for the sum of the two substances. This can also be justified on the basis of similar toxicology and is consistent with the UK's lead option. The impacts outlined in the PCDD/F evidence summary are expected to only be marginally impacted by addressing dioxin-like PCBs in the same waste limit.

The EU Impact Assessment identifies that the following waste streams where dioxin-like PCBs may be present:

- WEEE
- Waste oils
- ELV
- CDW hazardous waste
- CDW non- hazardous waste
- Incineration thermal residues
- Compost
- Sewage sludge
- Municipal solid waste
- Unintentional generation of PCBs
- Hazardous waste incinerator ashes
- Non-hazardous combustion waste

Waste limits (vii) - Dicofol

See the consultation document for information on the substance, the proposed amendment, and the specific consultation questions.

Evidence Summary

The waste limit for Dicofol of 50mg/kg has been agreed by Basel and Stockholm Conventions and this limit will therefore progress into international guidelines. As this process is already developed, we are proposing to follow these internationally agreed guidelines.

The EU Impact Assessment considers the impacts of introducing a waste limit for dicofol. One waste limit value of 50 mg/kg was considered. This limit is consistent with the limit in the UK's lead option. EU Impact Assessment evidence has been used to understand the possible impacts of this limit on relevant waste streams.

Dicofol is a pesticide that was used in agriculture up until 2010 in the EU. Recent evidence indicates that dicofol in waste has already been managed or exported. As part of the consultation to support the review of waste related issues in Annexes IV and V of Regulation (EC) No 850/2004 on POPs, 16 out of 20 members of the European Crop Care Association confirmed that they do not hold stockpiles of products containing dicofol and dicofol waste.[31]

The EU Impact Assessment did not identify any relevant waste streams containing dicofol and concluded that the introduction of a waste limit would have none/minimal impacts.[30] Dicofol is also not a chemical that is expected to be found in UK waste.

[31]European Commission, Directorate-General for Environment, de Brujine, E., Schöpel, M., Zotz, F., et al (2019): Study to support the review of waste related issues in annexes IV and V of Regulation (EC) 850/2004 : final report, Publications Office. Available at: https://data.europa.eu/doi/10.2779/500330

Waste limits (viii) – Hexabromocyclododecane (HBCDD)

See the consultation document for information on the substance, the proposed amendment, and the specific consultation questions.

Evidence summary

The EU Impact Assessment considers the impacts of decreasing the waste limit for HBCDD to 500mg/kg, which is consistent with the UK's lead option. EU Impact Assessment evidence has been used to understand the possible impacts of the lead limit on relevant waste streams.

In the EU Impact Assessment study expanded polystyrene and extruded polystyrene (EPS/XPS) insulation panels in CDW and EPS/XPS packaging were identified as the two main waste streams.

EPS/XPS packaging containing HBCDD has an estimated concentration of 10mg/kg in waste. This estimate is based on samples taken from a recycling centre in Germany, with results between 0.165 mg/kg and 42 mg/kg, and median concentration of 9.7 mg/kg.[32] In the UK and Ireland, HBCDD was found in 90% of 70 HBCDD polystyrene packaging samples collected from 2015 to 2016. Four samples from Ireland contained concentrations exceeding 1,000 mg/kg and two samples exceeded 100 mg/kg, the source of HBCDD in packaging was recycled insulation foam.[33]

Use of HBCDD in packaging was restricted under EU REACH Annex XIV in 2015 and, due to its short lifetime, EPS/XPS packaging containing HBCDD is no longer expected in waste streams.[34] Any HBCD found in EPS/XPS packaging waste streams after 2015 in the EU is likely to come from EPS/XPS packaging imported from outside of the EU, cross-

[32] BiPRO GmbH on behalf of the German Environment Agency (UBA) (2015): Identification of potentially POP-containing Wastes and Recyclates – Derivation of Limit Values, Texte 35/2015. Available at: https://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/texte_35_2015_identification_of_potentially_pop-containing_wastes.pdf

[33] Mohamed Abou-Elwafa Abdallah, Martin Sharkey, Harald Berresheim, Stuart Harrad, Hexabromocyclododecane in polystyrene packaging (2018): A downside of recycling?,Chemosphere, Volume 199, 2018, Pages 612-616, ISSN 0045-6535. Available at: https://doi.org/10.1016/j.chemosphere.2018.02.084.

[34] BiPRO GmbH on behalf of the German Environment Agency (UBA) (2015): Identification of potentially POP-containing Wastes and Recyclates – Derivation of Limit Values, Texte 35/2015. Available at: https://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/texte_35_2015_identification_of_potentially_pop-containing_wastes.pdf

contamination with waste mixed with CDW insulation panels or recyclates containing HBCDD.[35]

HBCDD was primarily used in EPS/XPS insulation panels. The concentration ranges for separately collected EPS and XPS insulation panels are 1,000-10,000mg/kg and 6,000-29,000 mg/kg respectively, both exceeding the current waste limit.[36] This means that CDW EPS and XPS insulation panels must already be managed as POPs waste, i.e. kept separate from other waste streams and sent for destruction. We consider that it is likely that this requirement is not widely understood and there may be non-compliance with this existing requirement. We would welcome views, through this consultation, on whether this is understood and what more could be done to raise awareness and support compliance. We would also welcome evidence and views on the extent to which EPS/XPS waste arises in waste streams that are collected by Local Authorities, for example DIY waste received at HWRCs.

Mixed CDW containing EPS/XPS insulation panels could be impacted by this proposal to amend the waste concentration limit, depending on how the waste is generated and on how much HBCDD containing EPS/XPS material is present in the mixed load. Where HBCDD is present in an item that arises as a separate item of waste, then the threshold will be applied to that item. Where the HBCDD arises in waste as an adhesive or coating or that is bonded to another item, it would normally be considered to be part of that other item and the threshold would be applied to the whole item. Items that are over the threshold would need to be segregated from other waste and sent for destruction.

There was insufficient data in the EU assessment to quantify actual impacts and we do not hold information on how mixed loads of waste containing EPS/XPS are managed in the UK, or on the composition of those loads. Using an average HBCDD concentration in EPS/XPS panels of 9,400 mg/kg, it was estimated that under a waste limit of 500 mg/kg panels would have to account for 5% by weight of this fraction to exceed the waste limits. The quantity of waste diverted couldn't be assessed but under a hypothetical scenario whereby 0.2% (0.6m tonnes in 2017) of mixed non-hazardous CDW is diverted from non-hazardous landfill to hazardous landfill, a 500 mg/kg waste limit could cost an additional

[35] European Commission, Directorate-General for Environment, Upson, S., Footitt, A., Biaudet, H., et al (2021): Study to support the assessment of impacts associated with the review of limit values in waste for POPs listed in Annexes IV and V of Regulation (EU) 2019/1021: final report for DG Environment, Publications Office of the European Union. Available at: https://data.europa.eu/doi/10.2779/63162

[36] The EU IA cites several sources for concentration ranges in insulation panels in Table 10-2: Overview of the relevant waste streams for HBCDD. European Commission, Directorate-General for Environment, Upson, S., Footitt, A., Biaudet, H., et al (2021): Study to support the assessment of impacts associated with the review of limit values in waste for POPs listed in Annexes IV and V of Regulation (EU) 2019/1021: final report for DG Environment, Publications Office of the European Union. Available at: https://data.europa.eu/doi/10.2779/63162

€210/tonne in gate fees, or €135m/year in total.[37] The likelihood of mixed CDW exceeding waste limit values was uncertain, given the weight of EPS/XPS insulation panels relative to other CDW.

WEEE and textiles were identified as relevant waste streams in the EU Impact Assessment but not considered in detail as concentration levels in waste are low. HBCDD also can occur in products made from recycled plastics however, in the EU Impact Assessment consumer product waste was not expected to be impacted by the policy options and it was expected that it would be more effectively addressed through UTC enforcement.

HBCDD was also used as a flame retardant in furniture and a UK government funded study on POPs in Waste Upholstered Domestic Seating (WUDS) found HBCDD to be the second most common POP in covers and foam, and at levels that exceeded existing limits. We are already taking action on this waste stream and any WUDS where HBCDD is present are currently already being managed as POPs waste for incineration. Therefore, the proposed HBCDD limit will have no additional impact on the management of this waste stream. Environmental regulators are currently assessing compliance with this requirement.

Waste limits (ix) – UV328, Dechlorane Plus, and Methoxychlor

See the consultation document for information on the substance, the proposed amendment, and the specific consultation questions. We have no additional evidence to present on these potential changes at this stage.

[37] European Commission, Directorate-General for Environment, Upson, S., Footitt, A., Biaudet, H., et al (2021): Study to support the assessment of impacts associated with the review of limit values in waste for POPs listed in Annexes IV and V of Regulation (EU) 2019/1021: final report for DG Environment, Publications Office of the European Union. Available at: https://data.europa.eu/doi/10.2779/63162