February 2018

QUESTIONNAIRE

"*Study to Support the Review of Waste-related issues in Annexes IV and V of Regulation (EC) 850/2004*"[1]

1) Aim of the questionnaire

The following questionnaire has been prepared by BiPRO GmbH (part of Ramboll)[2] in close coordination with the European Commission. The questionnaire aims at gathering up-to-date information and quantitative data on Persistent Organic Pollutants (POPs) and more specifically on waste related issues of certain "new POPs", "candidate POPs" and "already listed POPs". The information will provide the EU Commission with the necessary scientific basis to propose amendments to the POP Regulation (EC) 850/2004 (hereafter called "POP Regulation"), due to the listing of new substances and to the review of concentration limits for substances already listed. In addition, the study shall provide guidance on how wastes containing the new POPs may be managed.

2) Background information

POPs are a group of organic compounds that possess toxic properties, persist in the environment, bioaccumulate through the food web and pose a risk to human health and the environment. POPs are transported across international boundaries far from their sources through air, water and migratory species.

The "Protocol to the regional UNECE Convention on Long-Range Transboundary Air Pollution" (CLRTAP) and the Global "Stockholm Convention" on POPs are international, legally binding instruments aiming to reduce and eliminate the production, use and releases of POPs in the territories of all participating parties. Both contain provisions on the environmentally sound management of wastes consisting of, containing or contaminated by POPs (hereafter called "POP waste").

Although substantial progress has been achieved in limiting the use and application of POPs and reduce their emission into the environment, there are ongoing releases into the environment as well as a constant cycling of substances released in the past. For an optimised approach to elimination, all sectors in the life cycle of a product and of anthropogenic emission sources need to be considered. In this framework, proper waste management can contribute substantially to the reduction of POP releases into the environment, and a comprehensive legislation on POP waste is a necessary pre-requisite.

The Stockholm Convention was implemented into EU Community law in 2004 by the POP Regulation. It foresees an obligation to generally destroy or irreversible transform the POP content

[1] Information related to this project on behalf of the European Commission is provided on a dedicated project website at http://pops-and-waste.bipro.de.

[2] BiPRO GmbH (part of Ramboll), Munich, Germany (www.bipro.de), has been contracted by the European Commission to carry out the "Study to support the review of waste-related issues in Annexes IV and V of Regulation (EC) 850/2004"

of waste above certain concentration limits (the 'low POP content'). In addition, in exceptional cases, waste above the limits may be otherwise managed with defined operations for specified waste types if destruction or irreversible transformation do not represent the environmentally preferable option and the concentration in such wastes are below another threshold (the 'high POP content').[3]

In 2017, the Conference of the Parties of the Stockholm Convention (SC) decided to add three new substances to the relevant Annexes. Every time a substance is listed as a POP by the SC, the parties have to reflect the listing in domestic legislation. The EU as a party to the Convention is requested to amend the POP Regulation by May 2018 to include these 'new POPs'.

In addition, three substances are currently under review procedures and are likely to be added to the list of POPs under the SC in the next years (the so- called “candidate POPs”). For the new POPs and the candidate POPs, there is a need to improve the knowledge basis regarding quantities that were used in the past, their concentrations and sources, as well as regarding aspects related to waste management in terms of disposal and recycling paths. This information is needed to assess possible disposal options and to establish concentration limits for waste[4]. Consequently, further analysis is needed for the following substances:

- **“new POPs”:** Decabromodiphenylether (decaBDE), short-chain chlorinated paraffins (SCCPs) and Hexachlorobutadiene (HCBD)

- **“candidate POPs”:** Dicofol, Pentadecafluorooctanoic acid (PFOA, perfluorooctanoic acid) and its salts and PFOA-related compounds, Perfluorohexanoic acid (PFHxS) and its salts and PFHxS-related compounds

Furthermore, new scientific information on three substances already listed in the annexes of the SC has raised the necessity of reviewing already established concentration limits. Therefore, the following substances require renewed analysis and, potentially adjustment of the concentration limits:

- **“already listed POPs”:** Hexabromocyclododecane (HBCD), Polychlorinated Biphenyls (PCB), Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/PCDF)

4) Instructions on using the questionnaire

Please note that some of the relevant questions might have already been addressed in requests for information under the SC or the Basel Convention (BC). Submissions from EU member states related to these requests for information will be reviewed and considered as appropriate for the purpose of the actual study.

The present questionnaire is provided as an MS-Word-file and it would be much appreciated to receive your responses using this electronic version. All questions are numbered and highlighted

[3] Article 7 of Regulation EC (No) 850/2004

[4] Note that for SCCPs and HCBD concentration limits are already established in the Annexes IV and V of the POP Regulation. Only for decaBDE new concentration limits need to be established.

in grey. All fields where input is desired are blue.

The questionnaire is structured in three main sections.

- **Section I – "new POPs":** decaBDE, SCCPs and HCBD
- **Section II – "candidate POPs":** dicofol, PFOA and PFHxS
- **Section III – "already listed POPs":** HBCD, PCB and PCDD/PCDF

Please only fill in the sections that you consider relevant and where you can provide specific information. Please provide specific references wherever possible and do not hesitate to also send us additional background information in form of documents, reports, data sets or as links to websites.

We recommend to quickly screen all questions of a section before starting to fill in the information. If a question is unclear or if you desire to discuss a certain aspect, please do not hesitate to contact one of the following contact persons of the project team:

Contact person	E-mail address	Telephone
Mr Alexander Potrykus	apot@ramboll.com	+49 89 978970-100
Mr Milos Milunov	mo@ramboll.com	

All information provided will be used in a transparent and traceable way for the present study. Provided that your agreement is expressed below, submitted non-confidential information will be published on the dedicated project related website[5]. If you wish to submit information on a confidential basis, please indicate this in your response. Any confidential information will only be used in anonymous or aggregated form.

Please indicate in the following table whether you agree with the publication of your answers to the Questionnaires:

Section		Y/N
I.I	Occurrence of "new POPs" decaBDE, SCCPs and HCBD	Y
I.II	Recycling Operations/Waste Management Options for "new POPs"	Y
I.III	Concentration Limits for decaBDE, SCCPs and HCBD	Y
II.I	Occurrence of "candidate POPs" Dicofol, PFOA and PFHxS	Y
II.II	Recycling Operations/Waste Management Options for "candidate POPs"	Y
II.III.	Concentration Limits for dicofol, PFOA and PFHxS	Y

[5] http://pops-and-waste.bipro.de

III	Already listed POPs	Y

Please return the completed questionnaire and any related documents to popwaste2018@ramboll.com before 29 March 2018.

In case you are rather interested to discuss with us by telephone, please let us know when we could reach you.

Name of Institution: _IPEN – Dioxin, PCBs and Waste Working Group / Arnika – Toxics and Waste Programme_
Country: _ Global / Czech Republic_____
City/ CIP Code: _Prague / CZ170 00 _____
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Section I – "new POPs"

Decabromodiphenylether (decaBDE); short-chain chlorinated paraffins (SCCPs); Hexachlorobutadiene (HCBD)

I. Occurrence of "new POPs" decaBDE, SCCPs and HCBD (articles in use, waste, recycled articles as well as (production) processes and unintentional releases)

1. *a) Please indicate whether your country /company has* ***stockpiles of decaBDE, SCCPs or HCBD.***

b) ***If yes,*** *please provide information on types, quantity, concentrations, etc.*

a)

b)

2. *Please indicate any known* ***occurrence and concentration of the "new POPs" decaBDE****,* ***SCCPs and HCBD*** *in different* ***articles in use, waste*** *categories* ***and recycled articles****.*

decaBDE	Specification of waste/article	Concentration [mg/kg]
Articles in use		
Wastes		
Recycled articles	Carpet paddings (obtained in Hungary, Canada, USA, Kyrgyzstan, Nepal and Thailand); (DiGangi, Strakova et al. 2011)	1 - 166
	Plastic roofing (recycled PVC, produced in Czech Republic)	21.06 (sum of PBDEs 34.5)
	Rubik's and Rubik's like cubes (26 countries, worldwide range); (DiGangi and Strakova 2016, DiGangi, Strakova et al. 2017)	0 - 672
	Rubik's and Rubik's like cubes (7 EU countries); (DiGangi, Strakova et al. 2017)	0 - 400
	Other plastic toys (Czech Republic, Netherlands); (DiGangi, Strakova et al. 2017)	1 - 145
	Thermo cup (Czech Republic); (DiGangi, Strakova et al. 2017)	6
	Combs and headdress (Czech Republic, Slovakia); (DiGangi, Strakova et al. 2017)	0 - 195
	Toys (obtained in Czech Republic); (Strakova and Petrlik 2017a, Straková and Petrlík 2017b)	7.03 – 2,234 (sum PBDEs 8.14 – 2,614.34)
	Hair accessories (obtained in Czech Republic); (Strakova and Petrlik 2017a, Straková and Petrlík 2017c)	6.43 – 1,402.6 (sum PBDEs 7.94 - 1,623.44)

	Black plastic kitchen utensils (obtained in UK, date of purchase 2001 – 2015); (Kuang, Abdallah et al. 2018)	<0.0026 – 140
	Different toys (Italy, Czech Republic, Germany); (Guzzonato, Puype et al. 2017)	210.5 – 9,225.8
	Thermal cups (EU); (Guzzonato, Puype et al. 2017)	775.2 – 778.8
SCCPs	Specification of waste/article	Concentration [mg/kg]
Articles in use	Toy - Plastic spaghetti ropes from soft PVC (obtained in Czech Republic, made in China)	13
	Wallpaper with pattern from PVC (obtained in the Czech Republic) Not labeled (country of origin: Germany)	56.6
	Gym ball from PVC (Tesco) (obtained in the Czech Republic; made in China)	9,715
	Different products from markets in countries outside of EU (toys and children care products by majority); (Miller and DiGangi 2017)	8.4 – 19,808
Wastes		
Recycled articles		
HCBD	Specification of waste/article	Concentration [mg/kg]
Articles in use		
Wastes		
Recycled articles		

Remarks:

3. *Please provide i****nformation on quantities of waste containing "new POPs" that are currently generated, then disposed of or recycled***

"new POPs"	Specification of waste	Waste generated (in kt)	Waste disposed of (in kt)	Waste recycled (in kt)
decaBDE				
SCCPs				
HCBD	Hexa- residues from chlorinated solvents (tetrachloroethylene) production in chemical plant; these residues contain also	Total content of HCBD in waste (reported to PRTR in 2004 – 2010) between 66	Whole volume of this waste was disposed of either at hazardous waste landfill or in	

	hexachlorobenzene and pentachlorobenzene (Czech Republic)	– 194 metric tons of HCBD in waste transfers from one facility; since 2011 reporting of HCBD in waste is not required anymore (MŽP 2017)	hazardous waste incinerator	

4. *Please provide i**nformation on wastes containing "new POPs" that are currently recycled** (now or in the near future) and on the extent of recycling. If possible, please specify the types of new articles produced from the recycled material.*

"new POPs"	Types of waste recycled	Recycling rate [%]	New articles produced from recycled material
decaBDE			
SCCPs			
HCBD			

Remarks:

5. *Please indicate up-to-date (reference) **measurement (analytical) methods** for identifying the presence and levels of the listed "new POPs" in waste.*

PBDEs:
Method for Plastic products from recyclates analyses is described as follows:
Brominated flame retardants were extracted by n-hexane and the leachate transferred into isooctane. Identification and quantification of flame retardants was accessed via gas chromatography/mass spektrometry in the mode of electron ionization (GC-MS/MS-EI). (DiGangi, Strakova et al. 2017)

SCCPs:
The instrumental measurement performed on an Agilent 7890B gas chromatograph coupled with a 7200 QTOF mass spectrometer (both Agilent Technologies, USA) in negative chemical ionization (NCI). More detailed description see Miller, DiGangi et al. (2017).

6. *Please indicate known inexpensive* ***screening methods*** *for identifying wastes containing "new POPs"*

For PBDEs and BFRs in general it is screening by using XRF (DiGangi and Strakova 2016, Guzzonato, Puype et al. 2016, Guzzonato, Puype et al. 2017).
Sink and float separation is probably most simple method (Haarman and Gasser 2016).

7. *Please indicate any known* ***(production) processes using decaBDE, SCCPs and HCBD*** *as well as options for the environmental management of their operation and potential related* ***unintentional releases of these POPs*** *into the environment.*

II. Waste Management Options/Recycling Operations for "new POPs"

8. *Waste separation for decaBDE, SCCPs and/or HCBD containing wastes:*
a) How can be ***distinguished*** *between* ***contaminated and non-contaminated waste****?*
b) Which ***separation operations*** *should preferably be used* ***in practice to separate*** *contaminated from non-contaminated waste (please provide further details if available)?*
c) What should be the preferred ***waste management options for the contaminated waste fraction*** *(please provide justification and further details if available e.g. related costs)?*

a) Sink and float separation method is most simple way how to distinguish between waste containing BFRs and non-BFRs waste.
Contamination of waste by HCBD relates mostly to process where it is generated, and it is quite common that it is accompanied by other U-POPs such as HCB and/or PeCBz. Such example from the Czech Republic is described above. So it might be practical to have a list of technologies where HCBD can be formed and it can emerge in the wastes from the processes.

b)

Preferable separation operations	Relevant waste / new POP	Possible health risks for workers during separation of waste	Separation costs / ton of waste	Explanation / further information
1.				
2.				
3.				

Remarks:

c)

Preferable waste management operations	Relevant waste / new POP	Possible health risks for workers during waste management (e.g. recycling)	Management costs / ton of waste	Explanation / further information
1.				
2.				
3.				

Remarks: It should be useful to look at supercritical water oxidation and/or supercritical fluids based technologies as potential option for decaBDE and other POPs destruction (Marrone 2013, Goto 2016).

III. Concentration Limits for decaBDE, SCCPs and HCBD

9. *Are you aware of* ***any existing concentration limits for decaBDE in waste?***

10. *Which* ***concentration limits for decaBDE in*** *waste according to the POP Regulation would you recommend? Please justify.*

We suggest to include decaBDE under common concentration limit for sum of PBDEs listed under Stockholm Convention, which should be 50 ppm. Suggestion of this limit value is based on

11. *At which lower concentration limits for decaBDE in waste would you* ***expect relevant impacts*** *(e.g. on recycling industry)? Please justify.*

12. *Is there a* ***continued need for the derogation provided for POP-PBDEs in articles*** *produced from recycled materials in the POPs Regulation (i.e. level of 1,000 mg/kg or 0.1% by weight) of POP-PBDEs allowed in articles produced partially or fully from recycled materials?*[6] *Please justify.*

We don't think this was needed at all. To end recycling derogation for POP-PBDEs is suggested by many studies and was requested also by some Parties to Stockholm Convention at last COP.

- The POPRC examination of the recycling exemption for the COP recommended to, *"eliminate brominated diphenyl ethers from the recycling streams as swiftly as possible"* noting that, "*Failure to do so will inevitably result in wider human and environmental contamination and the dispersal of brominated diphenyl ethers into matrices from which recovery is not technically or economically feasible and in the loss of the long-term credibility of recycling.*" (Stockholm Convention on Persistent Organic Pollutants 2011)
- Updated information presented in UNEP/POPS/COP.8/7 indicated that *"developing countries also receive articles that may contain POP-BDEs in the form of second-hand/used goods or as wastes, originating mainly from developed countries…It is estimated that at least 50 % of WEEE is collected outside of the official take-back systems in the EU, part of which is then exported to developing countries as used equipment or illegally. Illegal shipments originate mainly from Europe, North America, Japan and Australia the USA with common destinations in Asia (including China, Hong Kong, India, Pakistan and Vietnam) and Africa (including Ghana, Nigeria, and Benin). In addition to WEEE, plastics from WEEE are also reported to be exported to developing countries in Asia."* (Stockholm Convention on Persistent Organic Pollutants 2016)

13. *Is an* ***adjustment of existing POP limit values for SCCPs[7] and HCBD[8], as specified in Annex IV and V of the EU POP Regulation,*** *and/or* ***additional measures required*** *(e.g. due to any notable developments)? Please justify.*

Concentration limit referred to in Article 7(4)(a) for SCCPs as it is set now is far too high. IPEN suggests LPCL 100 ppm in accordance with previous study by BiPRO (German Federal Environment Agency 2015).

[6] See Annex I Regulation (EC) No 850/2004

[7] Regulation (EC) 850/2004, Annex IV, concentration limit referred to in Article 7(4)(a): 10 000 mg/kg; Maximum concentration limits of substance listed in Annex IV: 10 000 mg/kg

[8] Regulation (EC) 850/2004, Annex IV, concentration limit referred to in Article 7(4)(a): 100 mg/kg; Maximum concentration limits of substance listed in Annex IV: 1000 mg/kg

14. *Please indicate if, beyond the EU POP Regulation, there are any adjustments to EU legislation needed, resulting from the listing of the "new POPs" decaBDE, SCCPs and HCBD under the Stockholm Convention.*

15. *Can you provide any other information or information sources relevant to Section I of this questionnaire on the "new POPs"?*

Section II – "candidate POPs"

Dicofol, Pentadecafluorooctanoic acid (PFOA, perfluorooctanoic acid), its salts and PFOA-related compounds, Perfluorohexanoic acid (PFHxS), its salts and PFHxS-related compounds

I. Occurrence of "candidate POPs" Dicofol, PFOA and PFHxS (articles in use, waste, recycled articles as well as production processes and unintentional releases)

16. *a) Please indicate whether your country /company has* ***stockpiles*** *of "candidate POPs" listed.*

b) If ***yes****, please provide information on types, quantity, concentrations, etc.*

a)

b)

17. *Please indicate any known* ***occurrence and concentration of the "candidate POPs****", in different* ***articles in use, waste*** *categories* ***and recycled articles****.*

a) Dicofol	Specification of waste/article	Concentration [mg/kg]
Articles in use	Pesticides in Australia - 4 products registered.	150g/litre
Wastes		
Recycled articles		
b) PFOA, its salts and PFOA-related compounds	Specification of waste/article	Concentration [mg/kg]
Articles in use	Fire fighting foams	MSDS sheets note 'trade secret' or 'commercial in confidence' for fluorinated compound concentrations
	Grease resistant food packaging Example- popcorn bags (range of contamination at right column)	6-290 µg/kg
	Fabric and textile treatment (stain-resistant carpeting and textiles)	Approx 3.5% (Norwegian Pollution Control Authority. 2007, PFOA in Norway. Survey of National Sources)
	Cooking applications (non-stick pans and utensils)	4-75 µg/kg (Begley et. al. 2005)

	Paper treatments	<0.1% (Norwegian Pollution Control Authority. 2007, PFOA in Norway. Survey of National Sources)
	Aviation hydraulic fluid	Approx. 0.1% (Seppälä 2015)
Wastes	Large volumes of contaminated soils	
	End of life products listed above including AFFF – carpets have high concentrations followed by textiles (garments, tents etc treated with PFOA and other PFAS)	
Recycled articles	Textiles impacted with PFOA are potentially recycled. *Ref: Persistent Organic Pollutants Review Committee (2016) Pentadecafluorooctanoic acid (PFOA, Perfluorooctanoic acid), its salts and PFOA-related compounds. Intersessional working group on PFOA, its salts and PFOA-related compounds. P.13* Potentially some coated papers (although the treated paper is not commonly recycled but may contaminate non-impacted recycling streams during the collection and stockpiling process.)	
c) PFHxS, its salts and PFHxS-related compounds	Specification of waste/article	Concentration [mg/kg]
Articles in use	plasticisers, lubricants, surfactants, wetting agents, corrosion inhibitors and firefighting foams.	unknown
Wastes	Articles listed above in disposal phase	
	Contaminated soil as a result of AFFF use in firefighting and training for firefighting.	
Recycled articles	Potential recycling of impacted lubricants.	

Remarks:

18. *Please provide* ***information on quantities of waste containing "candidate POPs" that are currently generated, then disposed of or recycled***

"candidate POPs"	Specification of waste	Waste generated (in kt)	Waste disposed of (in kt)	Waste recycled (in kt)
Dicofol	Waste pesticides	?	?	NA
PFOA, its salts and PFOA-related compounds	Example outside of EU: In Australia the contaminated soils subject to disposal due to contamination would exceed 10,000 tonnes in untreated state.			
PFHxS, its salts and PFHxS-related compounds				

19. *Please provide* ***information on wastes containing "candidate POPs" that are currently recycled*** *(or possibly in the future) and the extent of recycling. If possible, please specify the types of new articles produced from the recycled material?*

"candidate POPs"	Types of waste recycled currently (or in the future)	Recycling rate [%]	New articles produced from recycled material
Dicofol			
PFOA, its salts and PFOA-related compounds	There is some evidence of textile recycling and reuse. This is usually conducted in developing countries using exported waste textiles from developed countries.	?	Presumably new textiles but also rags and cleaning cloth for industrial and mechanical cleaning uses.
PFHxS, its salts and PFHxS-related compounds			

Remarks:

20. *Please indicate up-to-date (reference)* ***measurement (analytical) methods*** *for identifying the presence and levels of the listed "candidate POPs" in waste.*

Guidance on Sampling and Analysis for PFAS at Disposal Sites Regulated under the Massachusetts Contingency Plan. (p 6-7):

In relation to contaminated soils:
Chemical and physical properties of PFAS prevent the use of conventional analysis (e.g., gas chromatography/mass spectrometry [GC/MS]) to measure them in the environment. EPA's Method 537, Rev. 1.14, published in September 2009, is a liquid chromatography and tandem mass-spectrometry (LC/MS-MS) method that has been proven to be the most reliable approach for analyzing PFAS in environmental and biological samples. This type of analysis has allowed for more sensitive determination of PFAS in different matrices. The method, as written, is intended for analyzing selected perfluorinated alkyl acids in drinking water using solid phase extraction with LC/MS-MS; however, this method has been modified by analytical laboratories to accommodate other matrices. This method has been validated for 14 different perfluorinated alkyl acids and has minimum reporting limits of 2.9 ppt to 14 ppt in drinking water. The EPA method and the September 2016 *Technical Advisory - Laboratory Analysis of Drinking Water Samples for Perfluorooctanoic Acid (PFOA) Using EPA Method 537 Rev. 1.15* provide guidance to ensure that both branched and linear isomers of select PFAS are properly quantified during analysis. (MassDEP 2017)

21. *Please indicate known inexpensive screening methods for identifying waste to be classified as POPs wastes due to their content of the listed "candidate POPs".*

The XRF device may have applications for rapid screening of PFOA and potntially other PFAS and related chemicals in waste screening. An example is cited for the carpet industry. (Gullayanon, Michaels et al. 2013)

22. *Please indicate any known* ***(production) processes using dicofol, PFOA and PFHxS*** *as well as options for the environmental management of their operation and potential related* ***unintentional releases of these POPs*** *into the environment.*

Carpets, fibre, leather, packaging, paper, and textile manufacturing processes may use PFOA and PFHxS. Quantification of environmental releases during production processes, during consumer use and disposal phases are included in this citation in relation to China. (Meng, Lu et al. 2017)

II. Waste Management Options/Recycling Operations/for "candidate POPs"

23. *Waste separation for dicofol, PFOA and PFHxS containing waste:*
a) How can be ***distinguished*** *between* ***contaminated and non-contaminated waste?***
b) Which ***separation operations*** *should preferably be used* ***in practice to separate*** *contaminated from non-contaminated waste (please provide further details if available)?*
c) What should be the preferred ***waste management option for the contaminated waste fraction*** *(please provide justification and further details if available e.g. related costs)?*

a) Screening methods such as XRF noted at question 21 may apply.

b)

Preferable separation operation	Relevant waste/candidate POP	Possible health risks for workers during separation of waste	Separation costs /ton of waste	Explanation / further information
1.XRF screening (waste textiles carpets etc)	PFOA PFHxS	Dermal contact, particle inhalation, gas phase inhalation.	?	
2. Lab analysis for contaminated soils	PFOA PFHxS	As above	NA	Methods such as Total Oxidisable Precursor Assay (TOPA) and the determination of Total Organic Fluorine (TOF) can be used to assess PFAS concentrations on a contaminated site (soil). Ref: *Draft PFAS National Environmental Management Plan (2017) Heads of EPAs Australia and New Zealand (HEPA)*
3. Lab analysis for consumer products (see citation). TOF determination.	PFAS	As above	?	(Borg and Ivarsson 2017)

Remarks:

c)

Preferable waste management operation	Relevant waste/candidate POP	Possible health risks for workers during waste management (e.g. recycling)	Management costs / ton of waste	Explanation / further information
1.Removal of PFAS by Surface Activation Foam Fractionation (SAFF) (for contaminated water) and then concentrate destruction by Gas Phase chemical reduction (GPCR)	PFOA PFHxS	Dermal exposure, gas phase inhalation, particulate inhalation if environment includes contaminated soils.		https://opecsystems.com/shop/category/pfas-solutions
2. For Contaminated soil – indirect thermal desorption of PFAS and then concentrate destruction by GPCR	PFOA PFHxS	As above		For GPCR treatment see Table 4 of the Basel Convention: *General technical guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with persistent organic pollutants.* GPCR is preferred over incineration as it does not generate UPOPs.
3.				

Remarks: GPCR costs for processing POPs contminated soils estaimated at approx $500 (US) tonne.
Pure strength POPs or high concentrations may cost more to process but GPCR eliminated toxic ash residues and UPOPs emissions.

III. Concentration Limits for dicofol, PFOA and PFHxS

24. *Are you aware of* ***any existing concentration limits for dicofol, PFOA and PFHxS in waste****? (please list limits individually)*

PFOA: For contaminated soil waste 0.5 mg/kg (residential) and 4.3 mg/kg (maintenance worker) see ref; *State of New Hampshire Direct Contact Risk-Based Soil Concentration (correspondence) at https://www.des.nh.gov/organization/commissioner/documents/pfoa-soil-standard.pdf*

25. *Which* ***concentration limits for dicofol, PFOA and PFHxS in waste*** *according to the POP Regulation would you recommend? Please justify.*

10 mg/kg for combined PFOA/PFHxS as this allows for a health based precautionary approach given that other fluorinated compounds and precursors are likely to be present in the same waste (as demonstrated in studies cited earlier in this questionnaire), and may be as harmful as PFOA and PFHxS, may not be detected during standard screening and increase the overall toxicity of the waste. This limit is also within the same magnitude of order as many other Low POPs Content limits for POPs such as PCB and PFOS.

26. *At which lower concentration limits* ***for dicofol, PFOA and PFHxS*** *in waste would you* ***expect relevant impacts*** *(e.g. on recycling industry)? Please justify.*

Given that Norway has effectively banned PFOA in consumer products and textiles production then the recycling industry should not be affected. Legacy textiles may be affected but export of PFOA contaminated textiles to developing countries for recycling usually results in landfill of the treated textiles at destination. (Ref: The Danish Environmental Protection Agency (2015) Polyfluoroalkyl substances (PFASs) in textiles for children. Survey of chemical substances in consumer products No. 136, 2015). Given that limited recycling may take place a 10 mg/kg LPCL for combined PFOA PFHxS should not impact the recycling industry. Recycling of POPs is not permitted under the Stockholm Convention text.

27. *Please indicate if, beyond the EU POP Regulation, there are any adjustments to EU legislation needed, resulting from the listing of the candidate POPs under the Stockholm Convention.*

28. *Can you provide any other information or information sources relevant to Section II of this questionnaire on the "candidate POPs"?*

Section III – "already listed POPs"

Hexabromocyclododecane (HBCD), Polychlorinated Biphenyls (PCB), Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/PCDF)

29. *Are the existing concentration limits in Annex IV and V of the EU POP Regulation* ***for HBCD, PCB and PCDD/F*** *appropriate to ensure a sufficient level of environmental and health protection or is it necessary to adjust* ***them*** *(e.g. due to any notable developments such as new scientific data and technical progress, etc.)? Please justify.*

Concentrations established in Annex IV referred to in Article 7 (4)(a) used also as Low POPs Content Levels (LPCL) according Article 6 of the Stockholm Convention are far too high for HBCD, PCB and PCDD/F. There were published several studies demonstrating the need of adjustment of these levels for PCDD/Fs. Level for Dioxin-like PCB sis missing at all. So PCBs as they are listed in Annex C to Stockholm Convention are not covered by current Regulation 850/2004.

A recent Swedish EPA study demonstrated that PCDD/Fs levels of 30 pg TEQ g^{-1} fat in an egg will be exceeded at soil concentrations of approximately 4 to 75 ng TEQ kg^{-1} d.m. (Swedish EPA 2011). Another exposure scenario showing that e.g. wood impregnated by PCP contaminated by PCDD/Fs even below current LPCL can lead to serious food chain contamination was documented by scientists in Poland (Piskorska-Pliszczynska, Strucinski et al. 2016).

Question of different scenarios is discussed in report prepared by IPEN, Arnika and NTN and published before last COP of the Stockholm Convention held in 2017. There are specific chapters discussing that topic in that report – see chapters 10 and 11 in particular (Petrlik and Bell 2017). The brief abstract of the report was also presented at DIOXIN 2017 conference (Petrlik and Bell 2017a).

There are more recent studies and articles suggesting that LPCL for PCDD/Fs is far too high (Weber 2014, Weber, Watson et al. 2015, Bell, Weber et al. 2016). Following citation is from one example of those:

"Residual ashes with contamination levels as low as 50 ng TEQ/kg can be a risk sources. Even if such ash is "diluted" on soils the PCDD/F can re-accumulate over time with repeated applications. In this respect it needs to be highlighted that the current provisional low POPs limit established by the Basel Convention for dioxin contaminated waste of 15,000 ng TEQ/kg is much too high and needs urgently to be re-evaluated and reduced. A single kilogram of ash meeting the Basel "low POPs" level could contaminate 7 tonnes of soil to a level where eggs would not meet EU regulatory limits if laying chickens were kept on it (Weber, Watson et al. 2015).

Studies by Diletti, Ceci et al. (2005) and Brambilla, Fochi et al. (2009) demonstrated that contaminated waste wood shavings used as animal bedding resulted in egg and meat concentrations as high as 88.1 and 45.2 pg WHO-TEQ g^{-1} fat for PCDD/Fs. This is despite the wood waste reporting only 40 - 50 ng WHO-TEQ kg^{-1}.

Use of the concept of maximum concentration limits is not in the line with requirements of the Stockholm Convention as it does not establish any „maximum" POPs content levels for wastes.

30. *If the existing limit values need to be adjusted, which* ***concentration limits for HBCD, PCB and PCDD/F in waste*** *would you recommend and why?*

For **PCDD/F** we recommend more stringend LPCL (in Annex IV) should be used – **1 ppb (1 ng g^{-1})**, and it should include also **DL PCBs**. An additional suggestion is to ban the use/application of wastes to soil or on terrain surface (without stabilization) with a level of PCDD/Fs and DL PCBs above **0.05 ppb**. Justification can be found in scenarios described above and in more details in IPEN/Arnika/NTN study (Petrlik and Bell 2017).
For **HBCD** we suggest to establish more stringent level for LPCL – **100 ppm**. This is based on significantly high levels of HBCD found in children toys, food packaging and other daily use products produced from recycled plastics (Rani, Shim et al. 2014, Pivnenko, Granby et al. 2017, Strakova, Bell et al. 2017, Abdallah, Sharkey et al. 2018). Establishment of more stringent limit value is supported also by recently found high levels of HBCD in free range chicken eggs where polystyrene and/or car upholstery with HBCD as flame retardants was found as most likely source of contamination in Kazakhstan (Petrlik, Kalmykov et al. 2017). This case relates to EU as the used cars from developed European countries are often sold and transported to Kazakhstan.

31. *What would be the* ***major impacts from a possible adjustment of existing limit values of Annex IV or V of the EU POP Regulation****? Please justify.*

PCDD/Fs and DL PCBs:
Major impact would be better prevention of PCDD/Fs and DL PCBs releases into environment and potential contamination of food chains by these chemicals. With regards to total amounts of wastes that need to be treated by special technologies (e.g. such as they are listed in IPEN/Arnika/NTN report) they might be different in comparison with previous inventories as PCDD/Fs levels in fly ash and APC residues from municipal waste incineration (including WtE plants) decreased and they are mostly in the range of hundreds $pg.g^{-1}$ (=0.1 – 0.9 ppb), what means that not such high volumes of wastes should be processed by technologies for destruction of irreversible transformation of POPs. In order to avoid still the contamination of the environment from these wastes we suggest additional limit for use/application of wastes to soil or on terrain surface (see above).
HBCD:
Establishment of more stringent LPCL would lead to prevention of entering of this chemical into uncontrolled processes of plastic waste recycling. Recently HBCD was found even in polystyrene packaging for food (Rani, Shim et al. 2014, Abdallah, Sharkey et al. 2018). This flow of HBCD should be stopped. HBCD can be removed from polystyrene before its recycling (Schlummer, Mäurer et al. 2017).

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