Priority List of PCN congeners

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Background and Rationale for the prioritisation of specific PCN congeners in food

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Authorship

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1. Description and Scope

This document summarizes background information and synthesises of supporting information on the outcome of the discussion of the EURL CWG "BCons & PCNs" meeting held on November 22, 2022. The aim was to provide a priority list of PCN congeners to assist laboratories in method development and also to support future assessments with relevant as well as harmonised data. The guidance in this document is intended for laboratories involved in the official control of contaminants in food.

2. Background

Polychlorinated naphthalenes (PCNs) are a group of 75 individual congeners that are classified as persistent organic pollutants (POPs) under the Stockholm Convention [1]. They are confirmed contaminants in foodstuffs and also occur in human tissues. At high levels of human and animal exposure, PCNs cause serious and sometimes fatal liver damage as well as dermal, neurological and endocrine effects [2,3]. Following awareness of these adverse health effects, PCN global production (estimated at ~ 1.5 m tonnes [2,4]) was phased out around three to four decades ago, but as stable chemicals, the legacy of this production endures to the present time. Current human exposure has been reported to occur mainly through dietary intake and in order to evaluate this risk, surveillance of the food supply for PCN content would be a necessary first step. The 75 congeners show varying degrees of toxicity [2,5] so prioritising the more toxicologically significant and more abundantly occurring congeners would allow a pragmatic approach to the monitoring of food.

3. Synthesis of the supporting information

There are a number of independent studies from different global locations that have reported on the occurrence of PCNs in food over the last decade [2,6-9]. These studies have reported data for a varying number of PCN congeners due to the limited availability of reliable analytical standards. Nevertheless, most studies were able to include the more toxicologically significant congeners. More analytical standards have since become available. However, there is no structured monitoring in any country that would allow a current estimate of the background content in food or the visualisation of a trend in occurrence levels, which is essential for reliable risk assessment. In order to support future assessments with relevant as well as harmonised data, the EURL CWG for BCons and PCNs has focussed on developing a priority list of congeners for the monitoring of PCNs in food. This process considered the available occurrence data as well as recent reports on the toxic effects of PCNs [2,5,10]. These describe a range of effects, some occurring at higher levels of PCN dosing that would be expected from occupational exposure. However, as most current exposure is expected to result from chronic low-level dietary intake, it may be more appropriate to consider health effects that correspond to these levels. Thus, the CWG's evaluation focussed on effects arising from interaction with the aryl hydrocarbon receptor (dioxin-like effects). Based on the available congener relative potency (REP) data (derived mostly from in vitro studies and one in silico study) [2,5,11] and the occurrence distribution of PCNs in foods and in human milk, it was possible to prioritise a set of 19 PCN congeners for food monitoring studies (Table 1). If the concentrations of these congeners were converted to toxic equivalents (TEQs) using the available REP data [2], the summed TEQ of the 19 congeners would represent >98% of the toxic equivalence of PCNs in

the foods (>99% in human milk). It was not possible to establish a similar set of priority congeners for the monitoring of animal feeds – the PCN database for these materials is very limited and also shows variability in occurrence, an aspect that was not prominent in the food data. However, the CWG will investigate additional PCN congeners (particularly some tri- to penta-chlorinated congeners) that may be more relevant to feed monitoring. Currently, it is very clear that substantially more data on the PCN content of animal feeds is required before a similar priority list for feed can be proposed.

The PCN congener patterns from the available occurrence data on food and human tissues [8,9,12] indicate that the dominant source is likely to be associated with the legacy of PCN manufacture and widespread use in Europe and North America. However, some regions (e.g., some parts of East Asia) where PCNs have not been manufactured or used to any significant extent may show different patterns of occurrence [11], such as those associated with combustion sources.

Table 1: PCN congener priority list for monitoring of food of the network of EURL and NRLs for halogenated POPs in feed and food

Chlorination degree	Name	Congener No.
Tetra (Te)	1,2,3,5 - TeCN	28
	1,2,5,6 - TeCN	36
	1,3,5,7 - TeCN	42
	2,3,6,7 - TeCN	48
Penta (Pe)	1,2,3,5,7 – PeCN	52
	1,2,3,5,8 – PeCN	53
	1,2,4,5,8 – PeCN	59
	1,2,4,6,7 – PeCN	60
Hexa (Hx)	1,2,3,4,5,6 – HxCN	63
	1,2,3,4,6,7 – HxCN	66
	1,2,3,5,6,7 – HxCN	67
	1,2,3,5,6,8 – HxCN	68
	1,2,3,5,7,8 – HxCN	69
	1,2,3,6,7,8 – HxCN	70
	1,2,4,5,6,8 – HxCN	71
	1,2,4,5,7,8 – HxCN	72
Hepta (Hp)	1,2,3,4,5,6,7 – HpCN	73
	1,2,3,4,5,6,8 – HpCN	74
Octa (O)	1,2,3,4,5,6,7,8 – OCN	75

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