

# Risk ranking of carcinogenic and/or genotoxic environmental contaminants in food in Belgium\*

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\* paper published in Food additives and contaminants, Volume 31, Issue 5, 2014

## Introduction

- Many of man-made chemicals present in the environment may contaminate food.
- It is difficult to advice on potential risks for human health when compounds are both genotoxic and carcinogenic.

**Objective:** Establish priority for well-known carcinogenic and/or genotoxic environmental contaminants in food in order to formulate recommendations for risk managers.

## Methodology

### 1. List of relevant environmental contaminants in food studied

Metals	Hydrocarbons	Forbidden pesticides	
Arsenic	Polybrominated biphenyls (PBBs)	Chlordane	Hexachlorobenzene (HCB)
Cadmium	Dioxins and dioxin-like polychlorinated biphenyls (DL-PCBs)	Heptachlor	Hexachlorohexane (HCH) & lindane
Mercury and methylmercury	Non dioxin-like polychlorinated biphenyls (NDL-PCBs)	Dichlorodiphenyltrichloroethane (DDT) and metabolites	Poychlorophenols and their salts
Lead			Toxaphene

### 2. Risk assessment for each contaminant according to the Codex Alimentarius

#### Hazard identification and characterisation

##### Non genotoxic substances

→threshold

NOAEL\*Uncertainty factor = Tolerable dose

##### Genotoxic substances

→no threshold

BMDL

#### Exposure assessment

Chronic dietary intake = Concentration contaminant X food consumption

#### Risk characterisation

##### Non genotoxic substances

Exposure compared to tolerable dose

##### Genotoxic substances

MOE = BMDL / exposure

### 3. Classification – Risk ranking priority

#### First priority (high concern)

Exposure > tolerable dose or MOE < 100

#### Second priority (medium concern)

Exposure < Tolerable dose but above 15% or 100 < MOE < 10,000

#### Third priority (low concern)

Exposure < than 15% of the Tolerable dose or MOE >10,000

## Results

Table 1: Risk ranking priority of carcinogenic and/or genotoxic environmental contaminants

Substance	IARC classification	Toxicity			Exposure (µg/kg bw/day)			Risk characterisation		
		TDI (µg/kg bw/day)	BMDL (µg/kg bw/day)	Genotoxic	Mean/P50	P95	Population	Reference point	MOE or % TDI	Remarks
<b>FIRST PRIORITY ('HIGH CONCERN')</b>										
Arsenic (inorganic)	1		BMDL <sub>01</sub> = 0.3 to 8		0.11 0.5	3.21	Adults, Belgium Children, EU	MOE	2.7 - 73 0.1 - 16	BMDL based on human data
Lead	2A		BMDL <sub>01</sub> = 1.50 for cardiovascular effects & BMDL <sub>10</sub> = 0.63 for renal effects BMDL <sub>01</sub> = 0.50 for developmental neurotoxicity	x	0.13 (P50) 0.42 (P50)	0.36 1.07	Adults, Belgium Children, Belgium	MOE	1.8 - 11.5 0.5 - 1.2	BMDL based on human data; others effects considered than carcinogenicity
<b>SECOND PRIORITY ('MEDIUM CONCERN')</b>										
Cadmium	1	0.36			0.14 / 0.12 0.58 / 0.42	0.29 1.04	Adults, Belgium Children, Belgium	TWI	34 - 81% 118 - 292%	
Dioxins and dioxins like polychlorinated byphenyls (DL-PCBs)	1	0.000002			0.0000072	0.0000137	Adults, Belgium	TWI	36 - 68.5%	Endocrine disruptor
Methylmercury	2B	0.19			0.043 0.017	0.126 0.073	Adults, Flanders, Belgium Adolescents, Flanders, Belgium	PTWI	23 - 68% 9 - 39%	
Non dioxins like polychlorinated biphenyls (NDL-PCBs)	2A	0.01 (indicative)			0.0053 - 0.0061	0.0108 - 0.0122	Adults, Belgium	TWI	53 - 122 %	Endocrine disruptor; indicative evaluation there is no health based guidance value
Toxaphene	2B	0.1			0.005 0.025	0.062 0.07	Adults, Europa Infants, Europa	TDI	5 - 62% 25 - 70%	Endocrine disruptor
<b>THIRD PRIORITY ('LOW CONCERN')</b>										
Chlordane	2B	0.5			0.0015 0.0025	0.0032 0.0057	Adults, Denmark Children, Denmark	PTDI	0.3 - 0.64% 0.5 - 1.14%	
Dichlorodiphenyltrichloroethane (DDT) and metabolites	2B	10			0.0037 0.0067	0.0084 0.0157	Adults, Denmark Children, Denmark	TDI	0.037 - 0.084% 0.067 - 0.16%	Endocrine disruptor
Heptachlor	2B	0.1			0.0002	0.0010	Adults, Belgium	TDI	0.21 - 1%	
Hexachlorobenzene (HCB)	2B		TD <sub>5</sub> = 810	x little evidence	0.0013 0.0026	0.0023 0.0048	Adults, Denmark Children, Denmark	MOE	1.7 - 6.2 x 10 <sup>5</sup>	TD <sub>5</sub> based on animal data
Hexachlorocyclohexane (HCH) & lindane	2B	5			0.0008 0.0015	0.0014 0.0027	Adults, Denmark Children, Denmark	TDI	0.02 - 0.03% 0.03 - 0.05%	Lindane
Polychlorinated biphenyls (PBB)	2B							NOEL	5 to 6 orders below NOEL	No concern
Polychlorophenols and their salts	2B	5	400 (slope factor)		0.015 0.025		Adults France Children, France	TDI	0 - 0.3% 0 - 0.5%	Pentachlorophenol

Legend: bw: body weight; BMDL: BenchMark Dose Lower confidence Limit; IARC: International Agency for Research on Cancer; MOE: Margin Of Exposure; NOEL: No Observed Effect Level, P: Percentile; PTDI: Provisional Tolerable Daily Intake; PTWI: Provisional Tolerable Weekly Intake; TD<sub>5</sub>: Tumorigenic Dose 5; TDI: Tolerable Daily Intake; TWI: Tolerable Weekly Intake.

## Conclusions

- Given the low MOE values for arsenic and lead, these two compounds are considered to be of high concern for food safety and as a first priority to take action in order to reduce exposure.
- Cadmium, methylmercury, dioxins and DL-PCBs, NDL-PCBs and toxaphene are of medium concern.
- PBB, chlordane, heptachlor, DDT and metabolites, HCB, HCH and lindane, polychlorophenols and there salts are of low concern.
- Regarding that most of contaminants are POPs, it is highly recommended to maintain efforts to further reduce the exposure.

This study is the result of a self-tasking activity of the Scientific Committee of the Belgian FASFC (Advice 01-2013) and have been treated during the symposium of the Scientific Committee on Risk ranking in the food chain in 2013 (<http://www.favv-afscs.fgov.be/scientificcommittee/symposiums/>).