



Dioxins in poultry

Virtual Training school Risk-based Meat Safety Assurance Systems focusing on risk categorisation of farms and abattoirs

June 13th – 16th, 2023



What are dioxins?

- Dioxins are **unwanted toxic chemicals** that persist in the environment and **accumulate in the food chain**.
- «Dioxins» include:
 - Two groups of compounds
 - **PCDDs** and **PCDFs** (polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans)
 - **PCBs** (dioxin like (DL)-polychlorinated biphenyls)



What are dioxins?

- PCDD/Fs have **never been produced** on an industrial scale and have **no technological use**. They are formed unintentionally in a number of industrial and thermal processes.
- PCBs had widespread use in numerous **industrial applications** until 1970s, when their production was abandoned due to their high persistence in the environment.



Toxicity of dioxins



Short-term exposure **ACUTE TOXICITY**

- Skin lesions (chloracne)
- Darkening of the skin
- Dermatitis
- Impairment of the liver
function
- Your company name Gastrointestinal problems



Long-term exposure **CHRONIC TOXICITY**

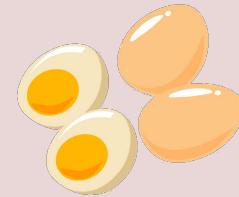
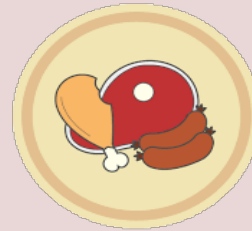
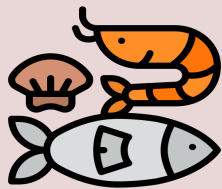
- Endocrine system toxicity
- Immune system toxicity
- Reproductive system toxicity
- Nervous system toxicity
- Cardiovascular system toxicity
- Carcinogenicity



Exposure to dioxins

- The diet accounts for **over 95%** of the total human exposure to dioxins.

Fish, milk, dairy products, meat, and eggs are the primary sources



The **lipophilic** nature and the **low degradability** of these compounds are the main reasons underlying their tendency to:

- be absorbed and stored in the fat and in the liver of animals
(**BIOACCUMULATION**) and excreted through milk and eggs.
- undergo **BIOMAGNIFICATION** along the food chain .



Dioxins in the food chain

Sum of PCDD/Fs and DL-PCB levels (expressed in pg TEQ_{WHO2005}/g across different food/feed group

Food / Feed group	Upper bound estimate			
	Mean ^(c)	P50 ^(d)	P95 ^(d)	P99 ^(d)
Fat of pig	0.20	0.16	0.42	0.88
Fat of poultry	0.49	0.26	1.59	2.64
Fat ruminants	0.91	0.66	2.37	3.51
Fish liver and derived products	28.28	16.99	81.36	118.83
Fruits, vegetables and cereals	0.05	0.02	0.22	0.64
Hen eggs and egg products	1.62	0.61	5.16	11.96
Infant and baby foods	0.03	0.02	0.08	0.13
Liver terrestrial animals	10.98	3.41	57.41	113.04
Marine oil	1.40	0.78	4.91	7.88
Meat bovine animals and sheep	2.01	1.36	5.54	11.43
Meat pigs	0.31	0.11	0.79	5.58
Meat poultry	0.99	0.56	2.79	11.75
Muscle meat eel	9.76	5.76	33.94	44.04
Muscle meat fish	2.50	0.95	10.68	19.41
Other food products	2.57	0.75	8.30	31.13
Raw milk and dairy products	1.91	0.77	4.36	10.11
Vegetable oils and fats	0.18	0.13	0.50	0.61
Additives binders and anti-caking agents	0.38	0.33	0.82	0.82
Additives compounds of trace elements	0.09	0.05	0.20	0.37
Animal fat	0.65	0.51	1.89	2.03
Compound feed, excl. Fur animals, pets and fish	0.17	0.05	0.62	2.57
Feed for fur animals, pets and fish	1.24	1.02	3.03	4.43
Feed materials of mineral origin	0.09	0.06	0.30	0.71
Feed materials of plant origin, oils excluded	0.30	0.10	0.52	2.96
Feed not specified	0.97	0.83	2.15	3.75
Fish oil	8.61	7.28	23.17	32.73
Fish, other aquatic animals, their product	1.00	0.85	2.24	4.33
Other feed additives	0.73	0.12	1.12	18.58
Other land animal products	0.12	0.11	0.26	0.46
Premixtures	0.15	0.08	0.27	2.39
Vegetable oils and their by-products	0.74	0.37	6.41	7.73



In Europe, 4.3 % meat and product of poultry exceed on average the maximum limits of dioxins established at European level

	PCDD/Fs	PCDD/Fs + DL-PCBs	NDL-PCBs
	pg WHO-TEQ/g fat	pg WHO-TEQ/g fat	ng/g fat
Meat and meat products of poultry	1.75	3.0	40



Dioxins in the food chain

...Despite that:

PCDD/Fs and DL-PCBs were ranked as being of **high potential concern in food-producing animals** due to their **rapid accumulation** potential, the **risk of exceedance of maximum levels**, and their **toxicological profile**.



High risk of exceeding the currently established
tolerable weekly intake (TWI) set by EFSA of

2 pg TEQ/kg bw/ week



Your company name

through the whole diet...

...where consumption of poultry meat has its contribution.

Dioxins in poultry

Risk Factors



**Contaminants occurring in poultry
mainly derive from farm practices**

Poultry
species, age,
weight at
slaughter

Farm location

Housing
system (indoor
vs outdoor)

Feeding

Farm
management
practices

SOURCES:

- Point source
(controlled e.g.
industry)
- Non-point source
(uncontrolled e.g.
volcanoes, fires)



Sources of dioxins



POINT SOURCES

COMBUSTION	ENERGY PRODUCTION	PRODUCTION OF CHEMICALS	METAL INDUSTRY
Urban waste	Oil combustion	Paper manufacturing (Cl bleaching)	Steel and iron production
Medical waste	Coal combustion	Pharmaceutical	Metal foundries
Biogas	Wood combustion	Dyes, pigments, paints	Ferrous and non-ferrous metal processing
Industrial furnaces		Pesticides	



NON-POINT SOURCES

COMBUSTION	ENERGY PRODUCTION	PRODUCTION OF CHEMICALS
Open fires	Automotive fuel burning	Leaking/spilling of PCBs
Forest waste	Waste wood	Sodium hypochlorite
Volcanism		
Cigarette smoking		

Farm categorisation

[illegible]

Abattoir categorisation

Contaminants occurring in poultry mainly derive from farm practices

- Abattoir 1: 15.25 **HIGH**
 - Improved FCI, risk-based flock categorisation, logistic slaughter, multiple interventions, frequent testing.**Best practice**
- Abattoir 2: 5.96 **LOW**
 - Poor HACCP implementation (box-ticking only), no training, poor hygiene practices, disorganised and inadequate control and audit.**Non compliant**
- Abattoir 3: 9.58 **MEDIUM**
 - Occasional risk-based categorisation, FCI is legislation compliant only, farm follow-up on request only, occasional, non-compliances.**Legislation-compliant**

Summary

- Contaminants occurring in poultry mainly derive from farm practices **(not abattoir practices)**.
- Improved FCI is necessary to provide appropriate risk management of Dioxins in poultry:
 - Farm location
 - History of natural disasters (e.g. open fires)
- Recommendations:
 - Include risk-based monitoring of Dioxins on a primary production level.
 - Include monitoring results in FCI.