



**Meetings of the conferences of the Parties to
the Basel, Rotterdam and Stockholm
conventions in 2023**

Transfer of persistent organic pollutants in food of animal origin

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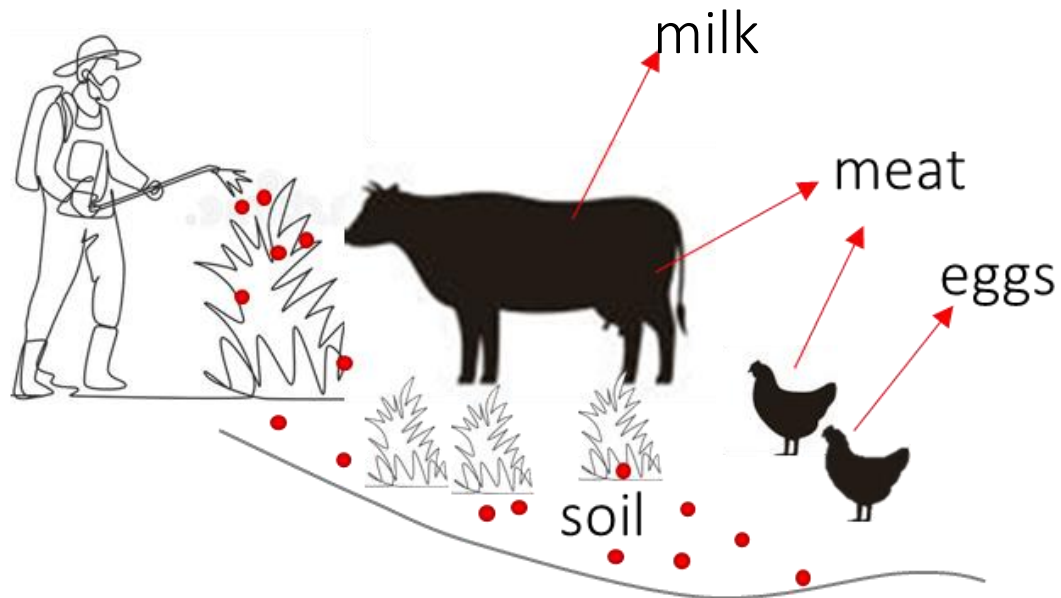
Persistent organic pollutants (POPs)

Highly toxic substances

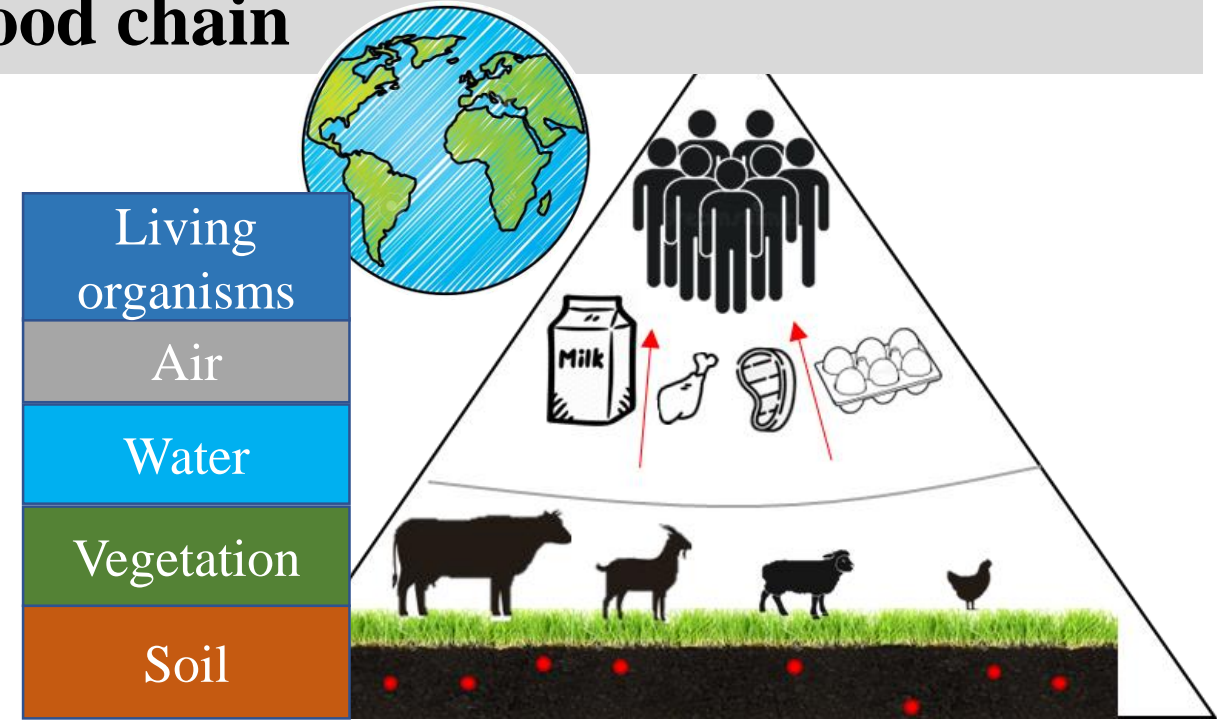


High stability in environment (soil)

Easily bioaccumulated



Widely spread in environment and food chain



International Agency for Research on Cancer (IARC)
US Environmental Protection Agency (EPA)
Agency for Toxic Substances and Disease Registry (ATSDR)

Persistent organic pollutants (POPs)

Stockholm Convention, 17 May 2004

Agrochemicals (OCPs)



DDT, Aldrin, Dieldrin, Endrin,
Chlordecone, Heptachlor,
Toxaphene, Mirex, Lindane,
Hexachlorbenzene

Industrial chemicals



Polychlorobiphenyls (PCBs)
Hexachlorobenzene
Brominated compounds

Unintentionally generated by-products



Dioxins and Furans (PCDD/Fs)



Food of animal origin



Livestock



Soil

Persistent Organic Pollutants

- Environmental contaminants (PCDD/Fs, OCPs, PCBs) can be stored during decades in soil = a powerful reservoir
- All free ranged food producing animals ingest soil at different levels
- Therefore, soil is one of the main vector for contaminants in animals and then in food

POPs transfer

Livestock daily soil ingestion

Ruminants	Soil DM kg/day	Consumption, %	Conditions	Source
Dairy cows	0.88	Up to 10%	winter period	Healy, 1968
	0.85		intensive grazing during wet autumn	Jurjanz et al., 2012
Growing cattle (160 kg BW)	0,10	-	Tropical post tethering	Collas et al., 2019
Sheep	0.2	Up to 30%	normal grazing	Healy & Ludwig, 1965
	1.0		winter-spring grazing period	McDonald et al., 1995, Abrahams et al., 2003 Thornton, 1983
Laying hens (3,5 kg BW)	0,032	Up to 23	unbalanced feeding	J. van der Meulen et al., 2006 Jondreville et al., 2010

Aim of the study

Estimation the transfer of POPs into food of animal origin using summarizing published knowledge on POP transfer by a meta-analysis

These outcomes could be used to assess the risk and, if necessary, to manage using a remediation strategy to limit their transfer.

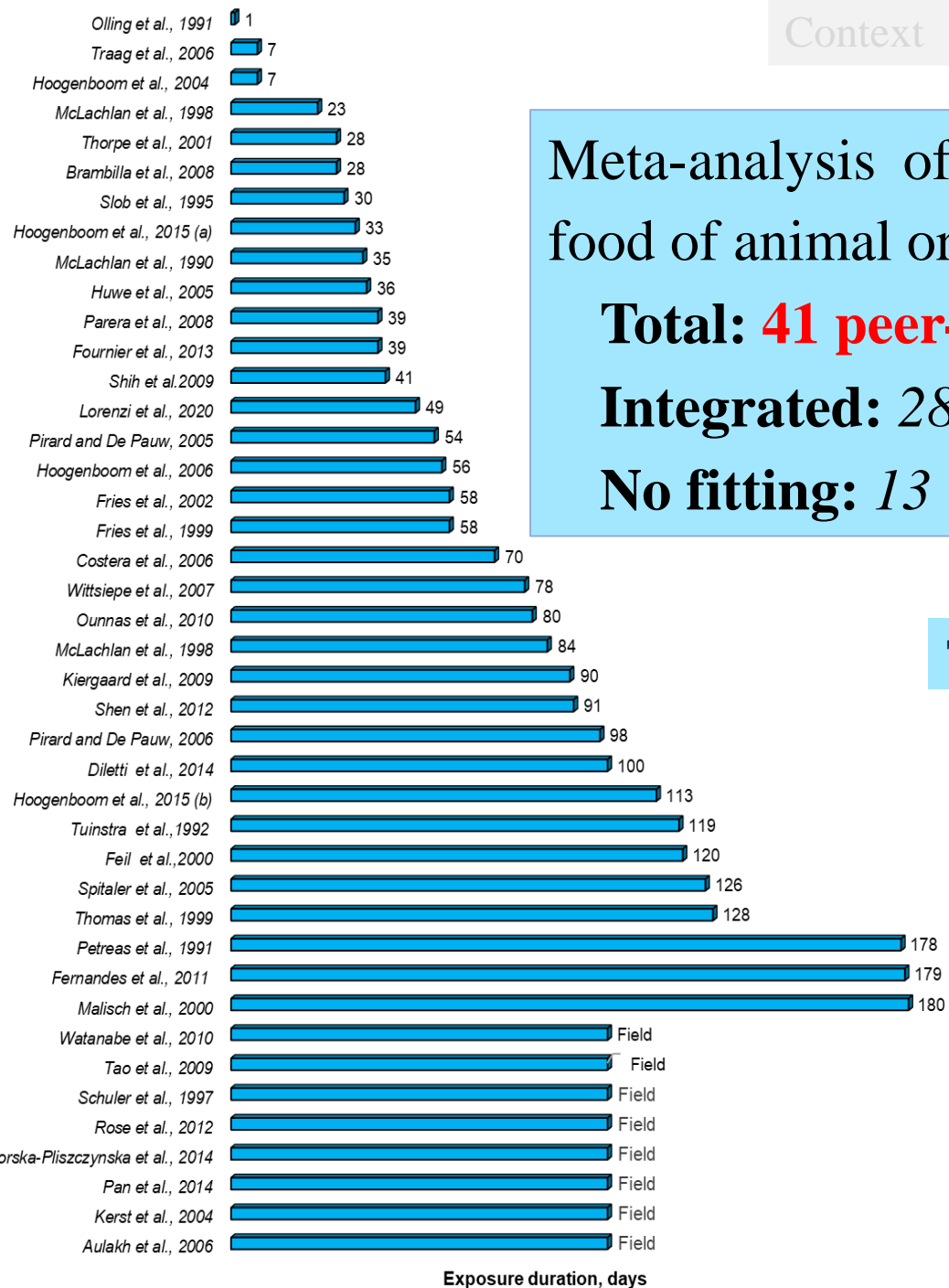
*Amutova F., Delannoy M., Baubekova A., Konuspayeva G., Jurjanz S.
Transfer of persistent organic pollutants in food of animal origin - Meta-analysis of published data.
Chemosphere. 2021. DOI: 10.1016/j.chemosphere.2020.128351*

Meta-analysis of reported transfer data of PCDD/Fs, PCBs, OCPs to food of animal origin (milk, eggs, and edible tissues as liver, muscles and adipose fat)

Total: 41 peer-reviewed articles

Integrated: 28 (20 – PCDD/Fs, 12 – PCBs, 3 – OCPs, 1 – PBDEs)

No fitting: 13



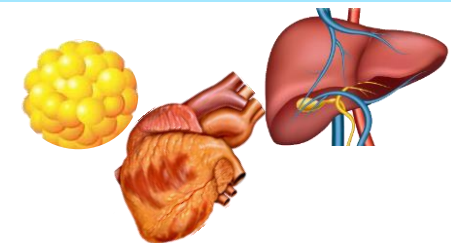
Transfer rate (TR)



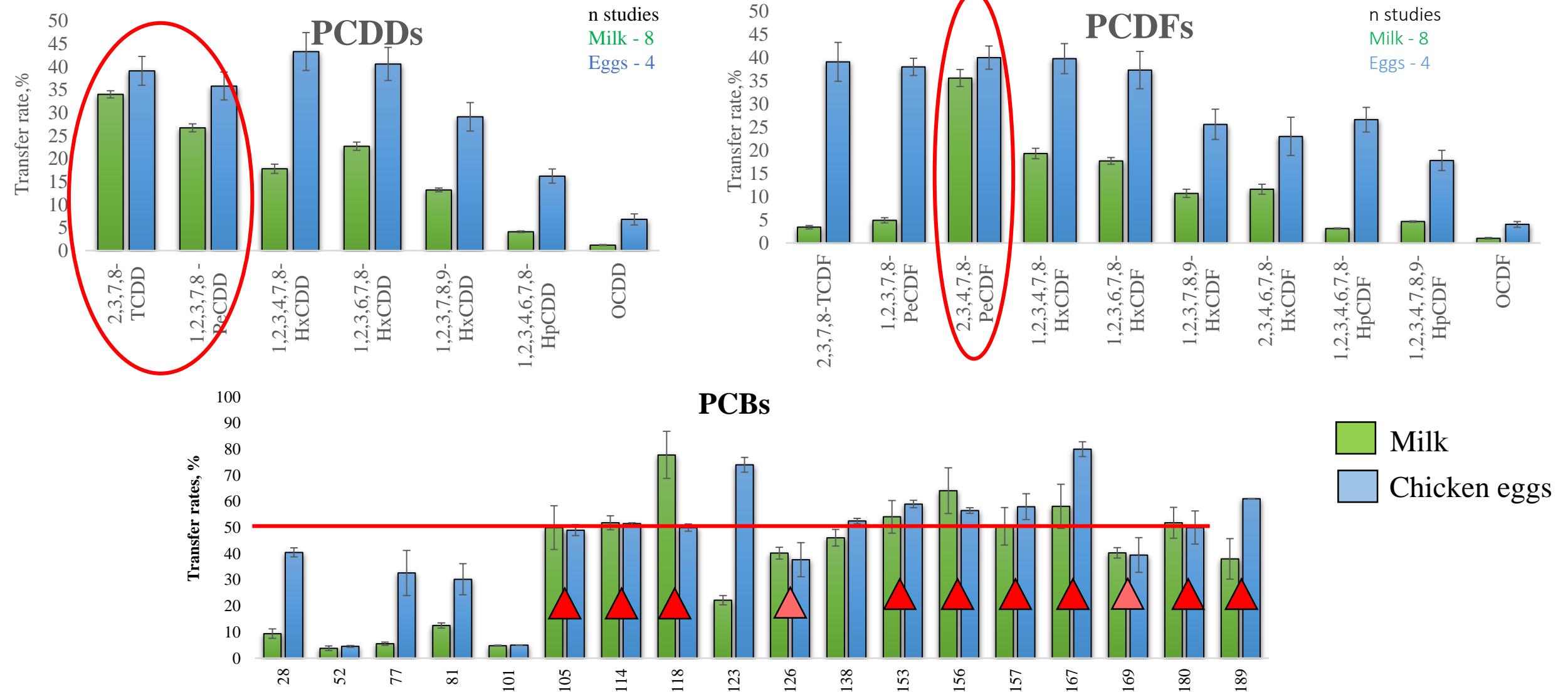
$$TR_{\text{product}} = \frac{[\text{pollutant}]_{\text{Fat of product}} * \text{Daily fat excretion}}{[\text{pollutant}]_{\text{Diet}} * \text{Diet Intake}} * 100\%$$

$$BCF = \frac{[\text{pollutant}]_{\text{tissue}}}{[\text{pollutant}]_{\text{intake}}}$$

Bioconcentration factor (BCF)



Transfer of PCDD/Fs and PCBs to milk and eggs



Mean BCFs of PCDD/Fs, PCB, OCPs to liver, fat and muscle tissues

Animals with stable BW
(milk-eggs excreted animals)



Rapidly growing animals
(Meat-producing animals)



Liver

Fat

Muscle

15	36	-	PCDDs	14	15	-
31	21	-	PCDFs	13	31	-
7	3	6	PCBs	-	19	-
-	15	-	DDTs	-	-	-
-	16	-	HCHs	-	-	-
-	11	-	PCDDs	2	1,2	0,9
-	7	-	PCDFs	1	0,5	0,6
-	4	1	PCBs	3	4	0,5
-	17	-	PCDDs	-	1	-
-	7	-	PCDFs	-	0,5	-
-	9	-	PCBs	-	3	-
-	5	-	DDTs	-	-	-
-	16	-	HCHs	-	-	-

Conclusions

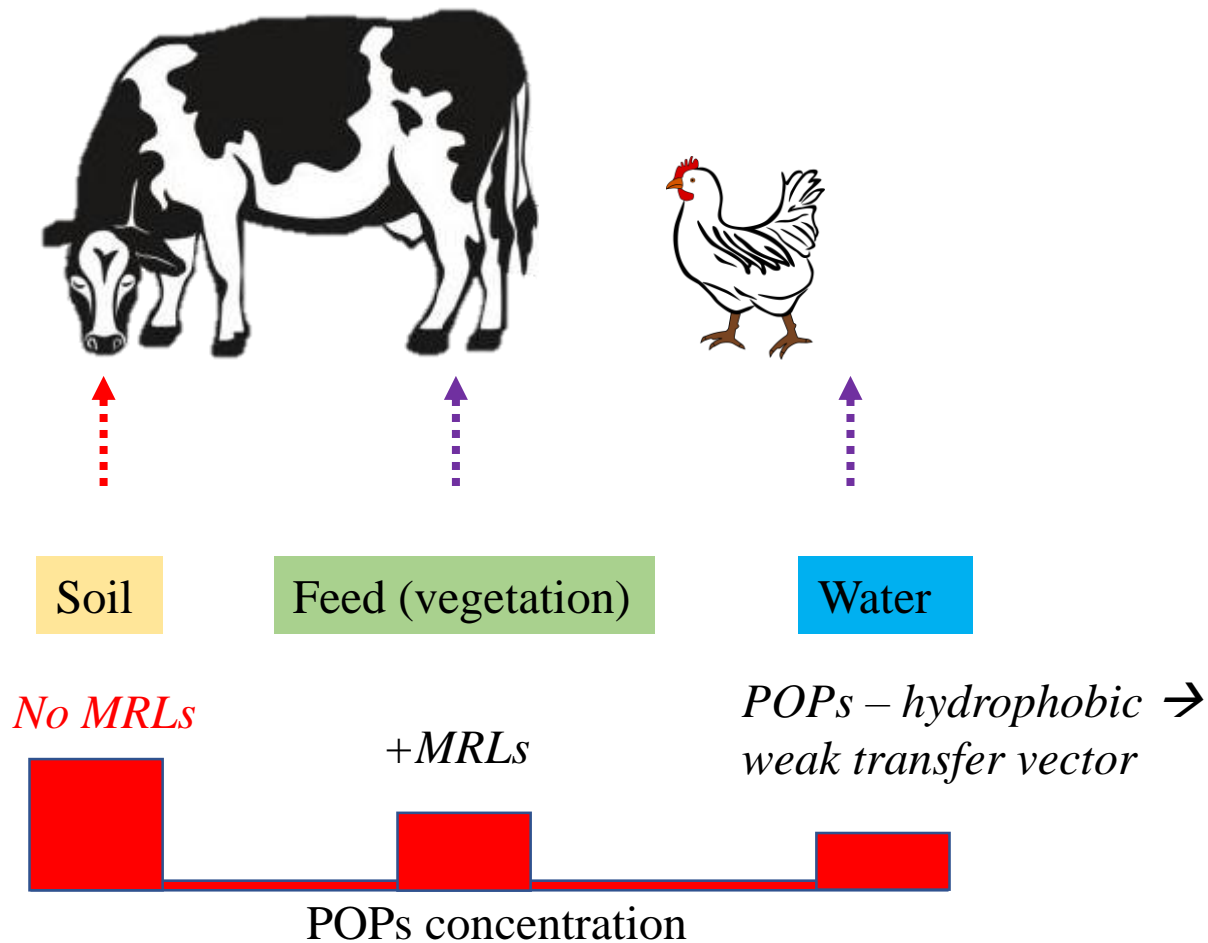


The most toxic POPs (tetra-to hexachlorinated dioxins and furans, highly chlorinated PCBs, especially congener 126, as well as DDT) are generally highly transferred to food producing animals (dairy cows, goats and chicken) especially when they are raised on contaminated soils.



Meta-analysis showed that specific methodologies such as TR and BCF allow to quantify and ranking the risk focusing on food safety.

Perspectives



Soil should be considered as the main POPs carrier in the case of contamination situation in a farms:

- No restricted by MRLs
- Contain much higher concentrations compare to feed and water
- Hardly possible to be removed from the areas

Thank you for attention