



Quality and **SA**fety of **F**eeds and **F**ood for **E**urope

Carry-over of dioxins and PCBs in food- producing animals

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Dioxins in the news (2011)

Delhaize withdraws organic eggs

Fri 26/08/2011 - 12:11



Source: The Sydney Morning Herald



Source: FlanderNews.be

Egg scare shuts 4700 farms in Germany January 8, 2011.

Dioxin cause in German beet pulp found

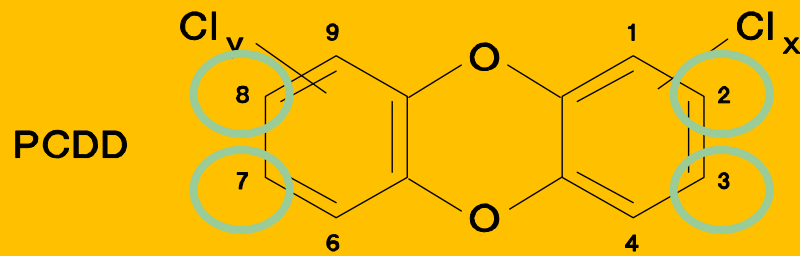
Animal feed news

18 Nov 2011

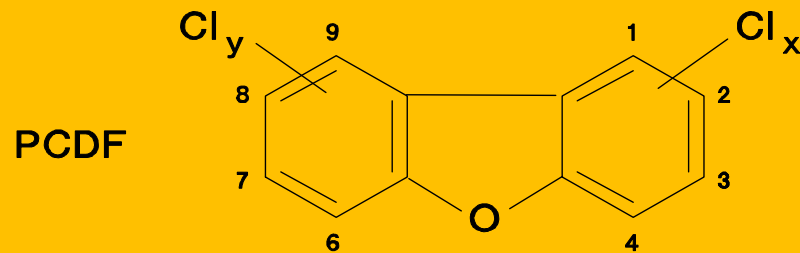


AllAbouFeed.net

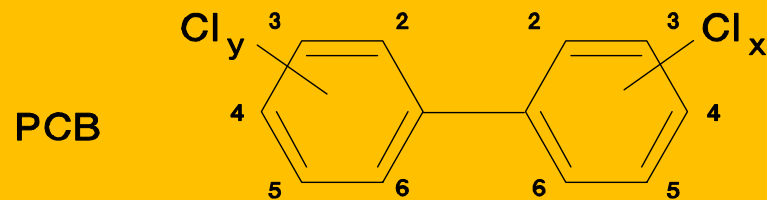
What are dioxins and dl-PCBs?



7 out of 75



10 out of 135



12 out of 209

Same effects but with different toxic potencies: TEFs

Calculation TEQ level: Belgian feed 1999

congener	WHO	Level	
	TEF (2005)	ng/kg	ng TEQ/kg
2,3,7,8-TCDF	0.1	363	36
2,3,7,8-TCDD	1	23	23
1,2,3,7,8-PeCDF	0.03	274	8
2,3,4,7,8-PeCDF	0.3	1136	341
1,2,3,7,8-PeCDD	1	59	59
1,2,3,4,7,8-HxCDF	0.1	473	47
1,2,3,6,7,8-HxCDF	0.1	78	8
2,3,4,6,7,8-HxCDF	0.1	175	18
1,2,3,7,8,9-HxCDF	0.1	23	2
1,2,3,4,7,8-HxCDD	0.1	42	4
1,2,3,6,7,8-HxCDD	0.1	0	0
1,2,3,7,8,9-HxCDD	0.1	9	1
1,2,3,4,6,7,8-HpCDF	0.01	163	2
1,2,3,4,7,8,9-HpCDF	0.01	0	0
1,2,3,4,6,7,8-HpCDD	0.01	11	0
OCDF	0.0003	41	0
OCDD	0.0003	13	0
		2883	548

Sources of dioxins and PCBs

■ Dioxins

- Present as contaminants in e.g.:
 - PCB mixtures
 - Pentachlorophenol
 - 2,4,5-T (agent Orange)
 - Kaolinic clay and other clays (ball clay, Mabele clay)
- Formed during incineration of (plastic) waste

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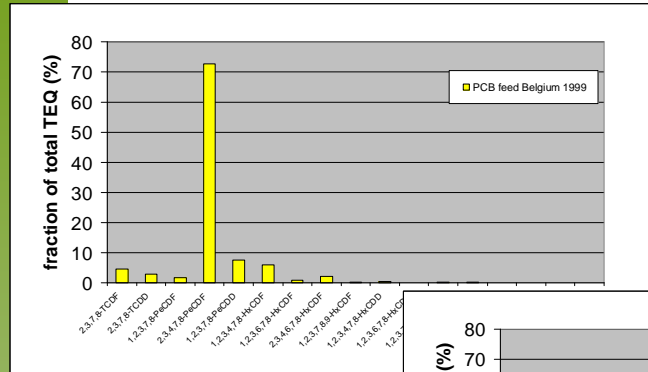
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■ PCBs

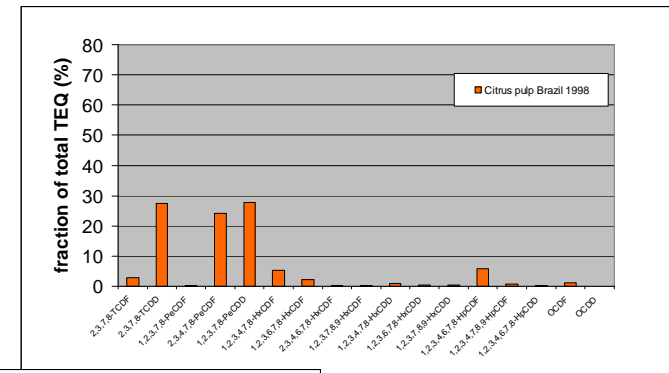
- Used as technical mixtures and maybe still present in old equipment
- Also used in paints and sealants (older buildings)

Pattern typical for the source

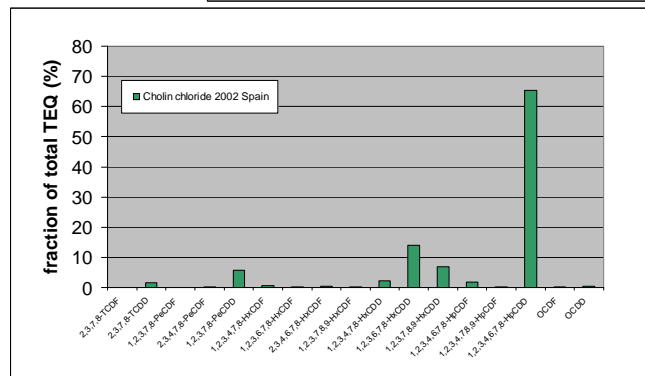
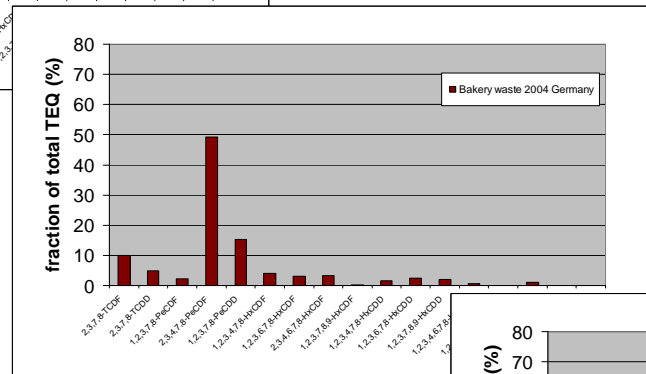


PCB-feed

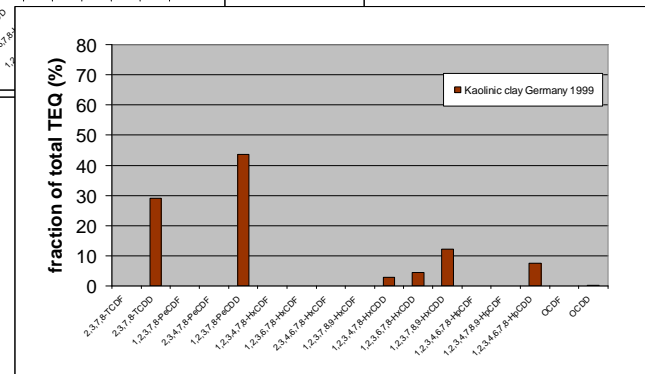
Citrus pulp 1998



Bakery waste 2004



PCP-cholin chloride 2003



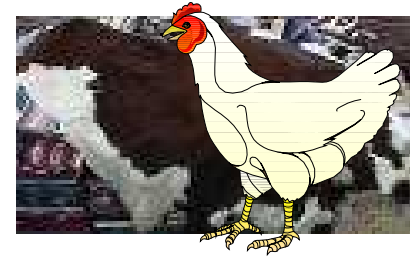
Kaolinic clay 1998, 2004



Food and feed incidents

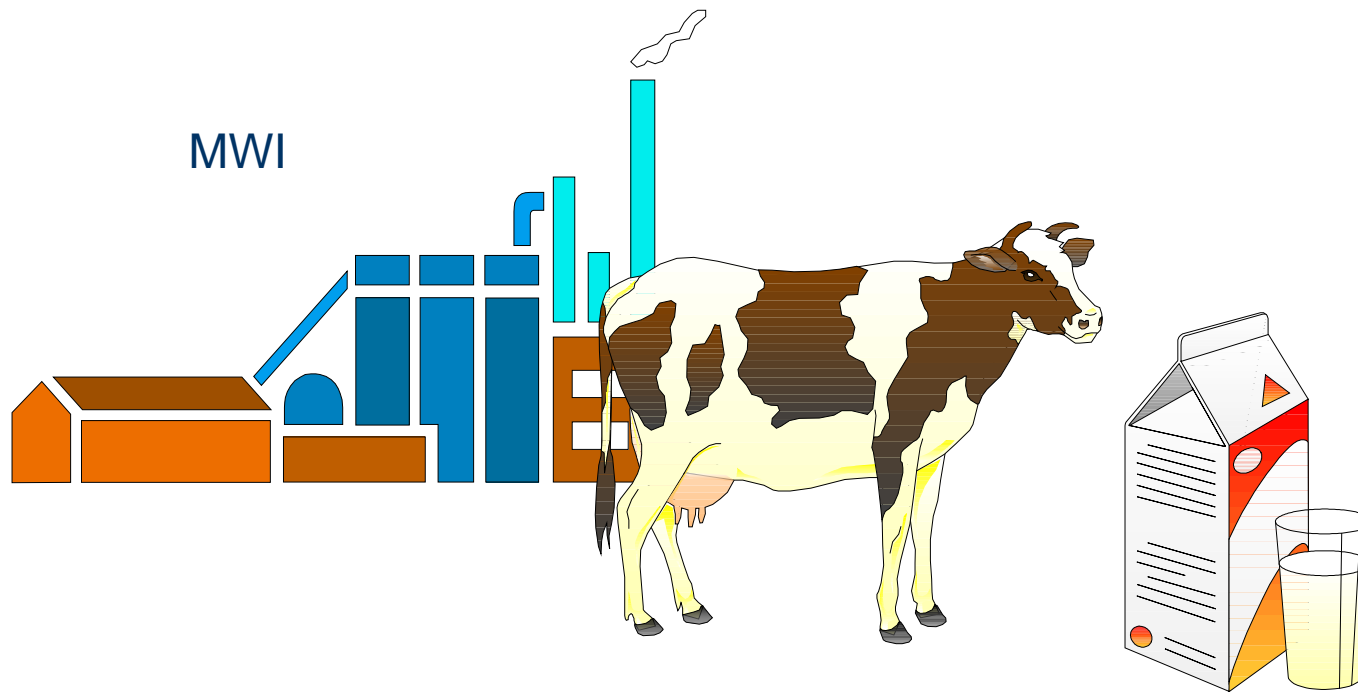


1957: chickens discover dioxins



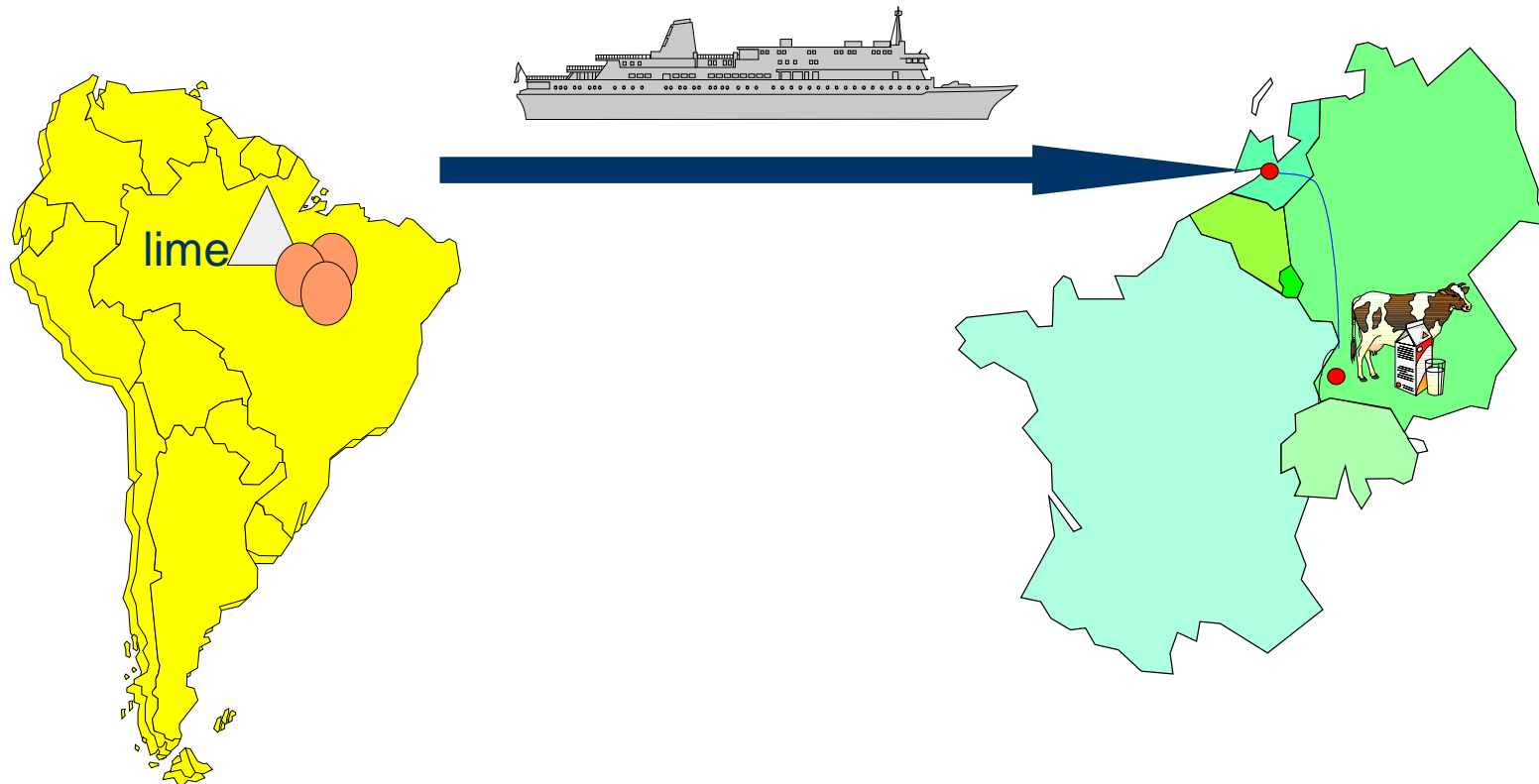
- Millions of dead and diseased chickens in US
 - Chicken oedema disease
 - After ten years dioxins identified as toxic agent
- Source: fat scrapings from cow hides that were treated with polychlorophenols

Dioxins in Dutch milk: waste incineration (1989)



Sharp decline of milk levels after improvement incinerators

Dioxins in Brazilian citrus pulp (1998)



The Belgian dioxin crisis in 1999



200 litres of PCB-oil in 60 ton fat,
used for chicken and pig feed

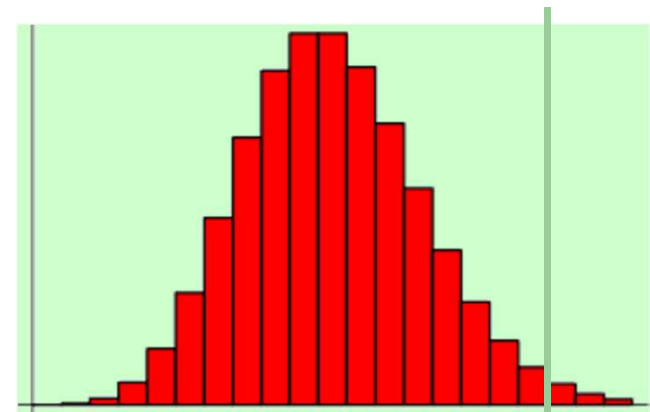


EU limits for food and feed

- **Current exposure around exposure limit**
 - (TWI=14 pg TEQ/kg bw/week)
 - Aim is reduction of exposure below TWI
- **Food levels should be further reduced**
 - Limits should not result in high non-compliance rates: “strict but feasible”

Establishment of EU-limits

- **Inventory of existing levels**
 - First dioxins (limits 2002)
 - Later dioxin-like PCBs (limits 2006)
 - Limit around 95th percentile; so 5% above limit
- **No direct relation between feed and food limits**



Analysis and control

- Reference method is GC/HRMS
 - Increase in laboratories analysing dioxins
- Due to changed legislation:
 - More control by authorities
 - More self-control by companies
- More (discovery of) incidents

Food and feed incidents

Brazilian citrus pulp 1998

Belgian PCB fat 1999

German kaolinic clay 1999

Belgian cholin chloride 2002

German bakery waste 2003

Potato peels/kaolinic clay 2004

Gelatin fat/Hydrochloric acid 2006

Minerals (Zinc) Chile 2008

Bakery waste Ireland 2008

Organic corn Ukraine 2010

Fatty acids Germany 2011

Fish from contaminated rivers

Eggs from free-range hens

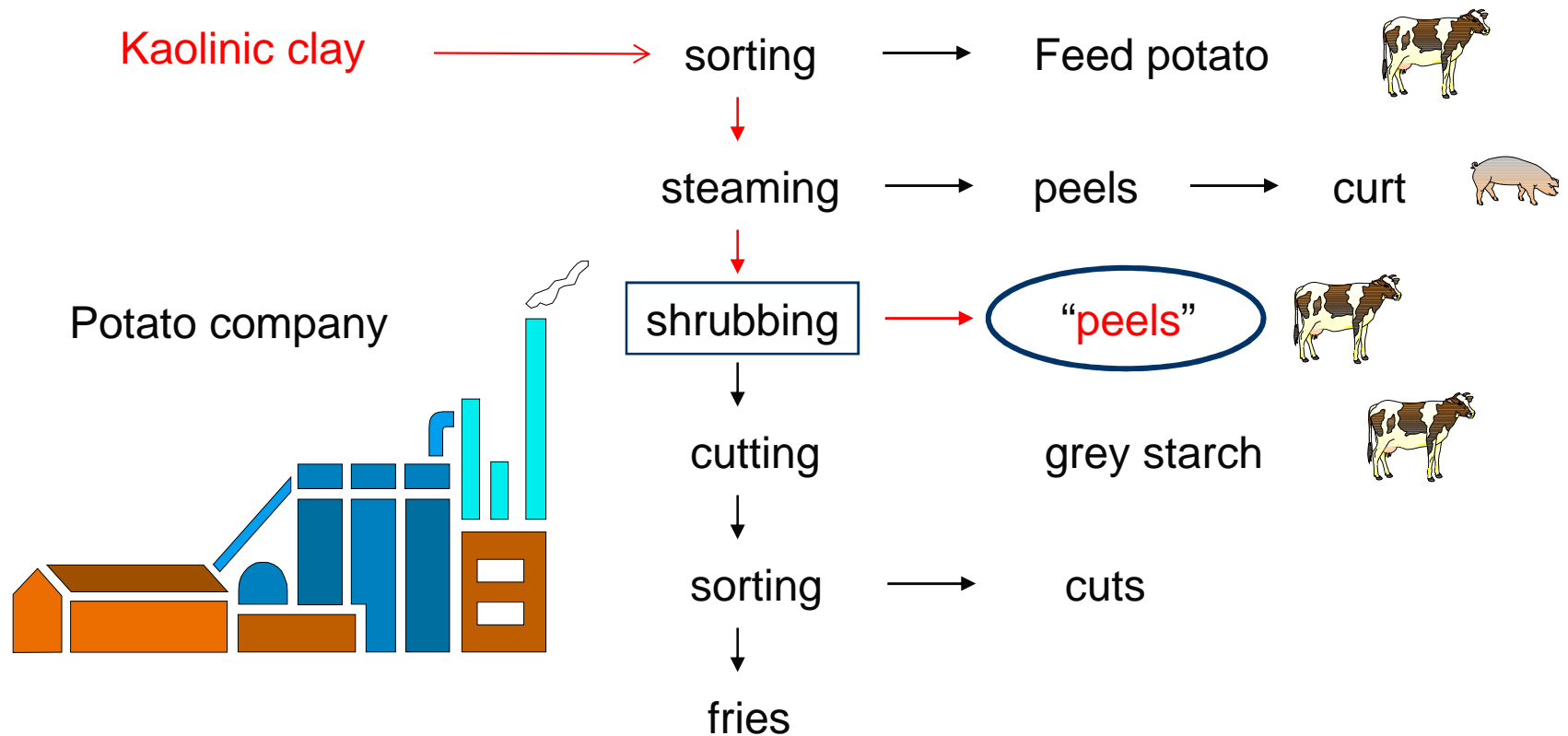


Potato peel incident 2004

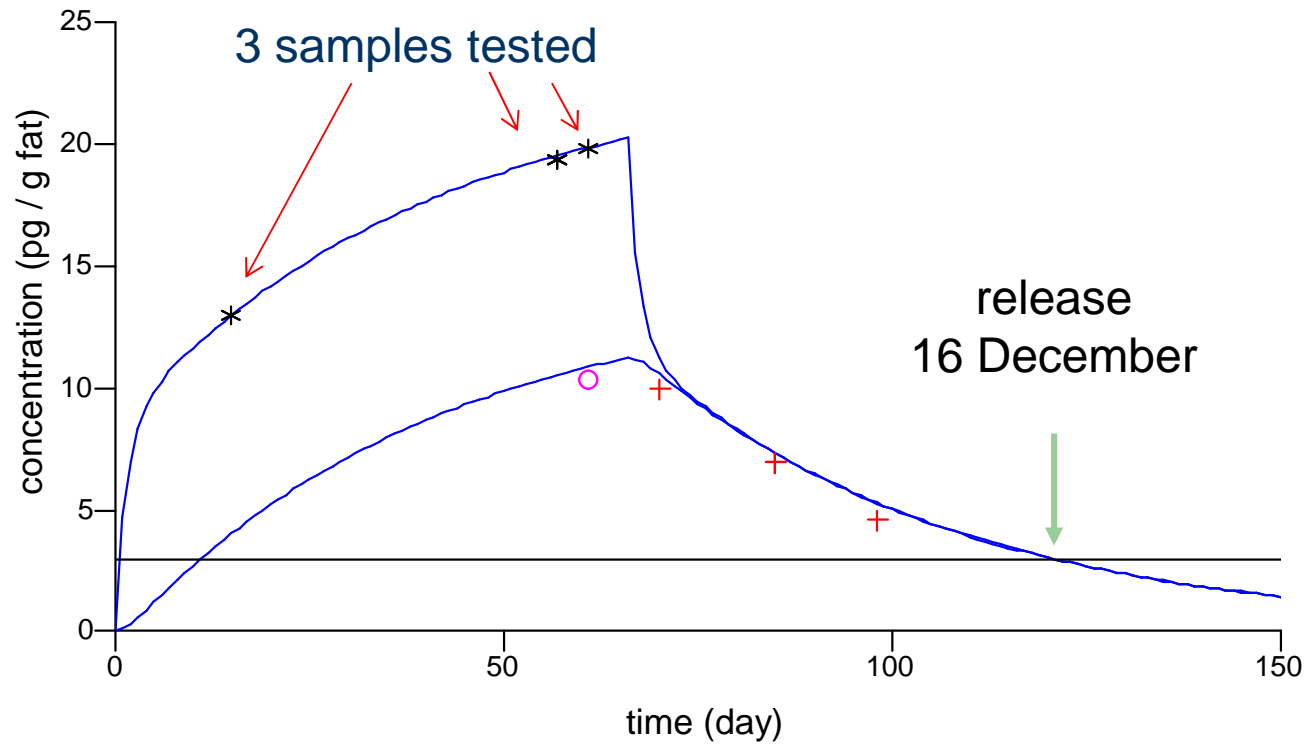
- Routine testing by dairy industry
 - Pooled samples from milk trucks
- First pooled sample with elevated level (<ML)
- Resampling of individual farms
 - High level at one farm (20 pg TEQ/g fat, 7x ML)
- Farm blocked
 - Source? (Pattern used)
 - Onset?
 - Duration: what to do with the cows?



Source: dioxins in potato rest product



Dioxin levels in milk from farm Lelystad



Accurate prediction of onset and duration using model

Model RIVM



Incidents with egg farms

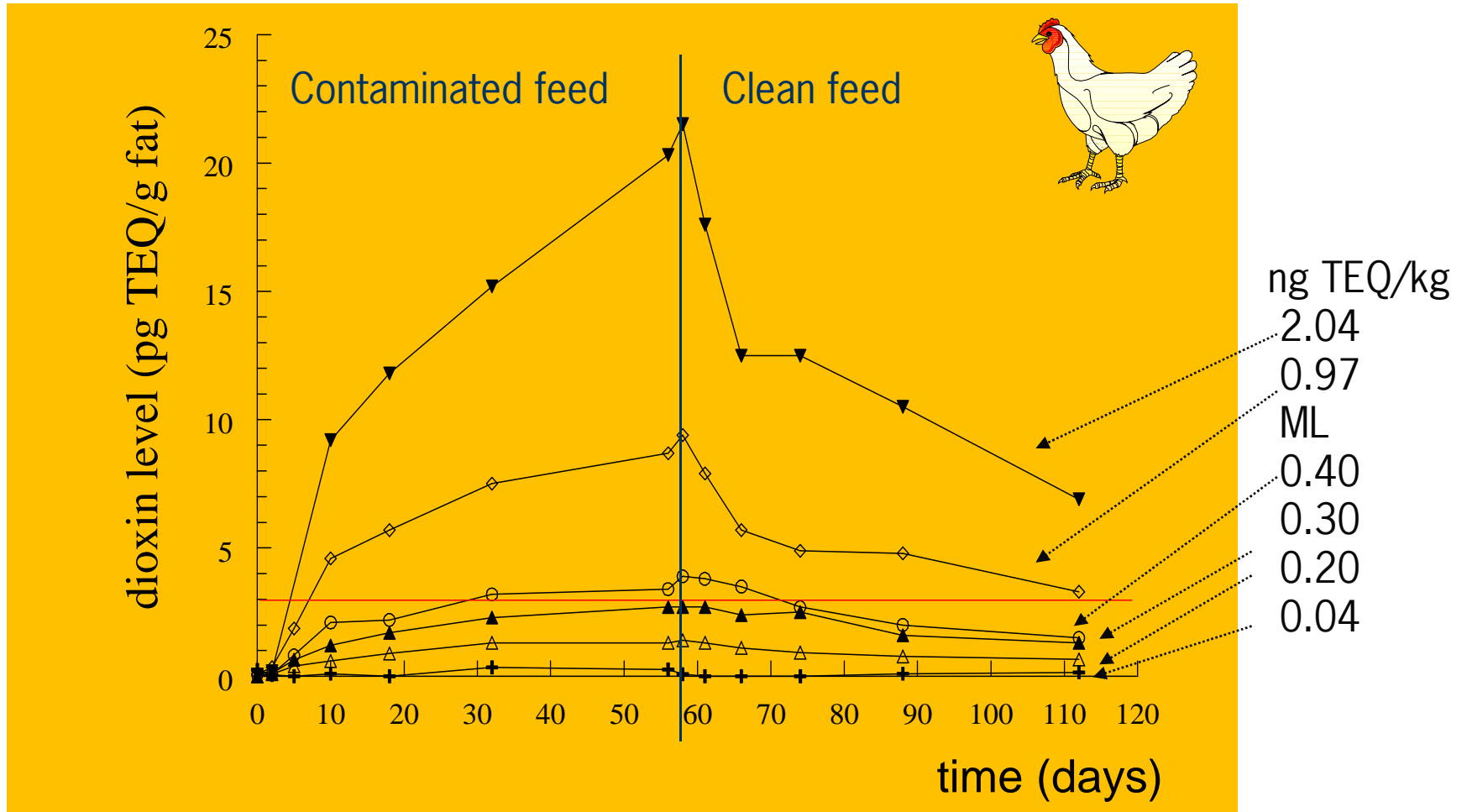


- In 2011 and 2012 various farms with elevated dioxin and PCB levels in eggs
- Many questions
 - Source?
 - Onset of the contamination?
 - Duration of the contamination (i.e. levels < ML)?
- Need for pattern databank and models

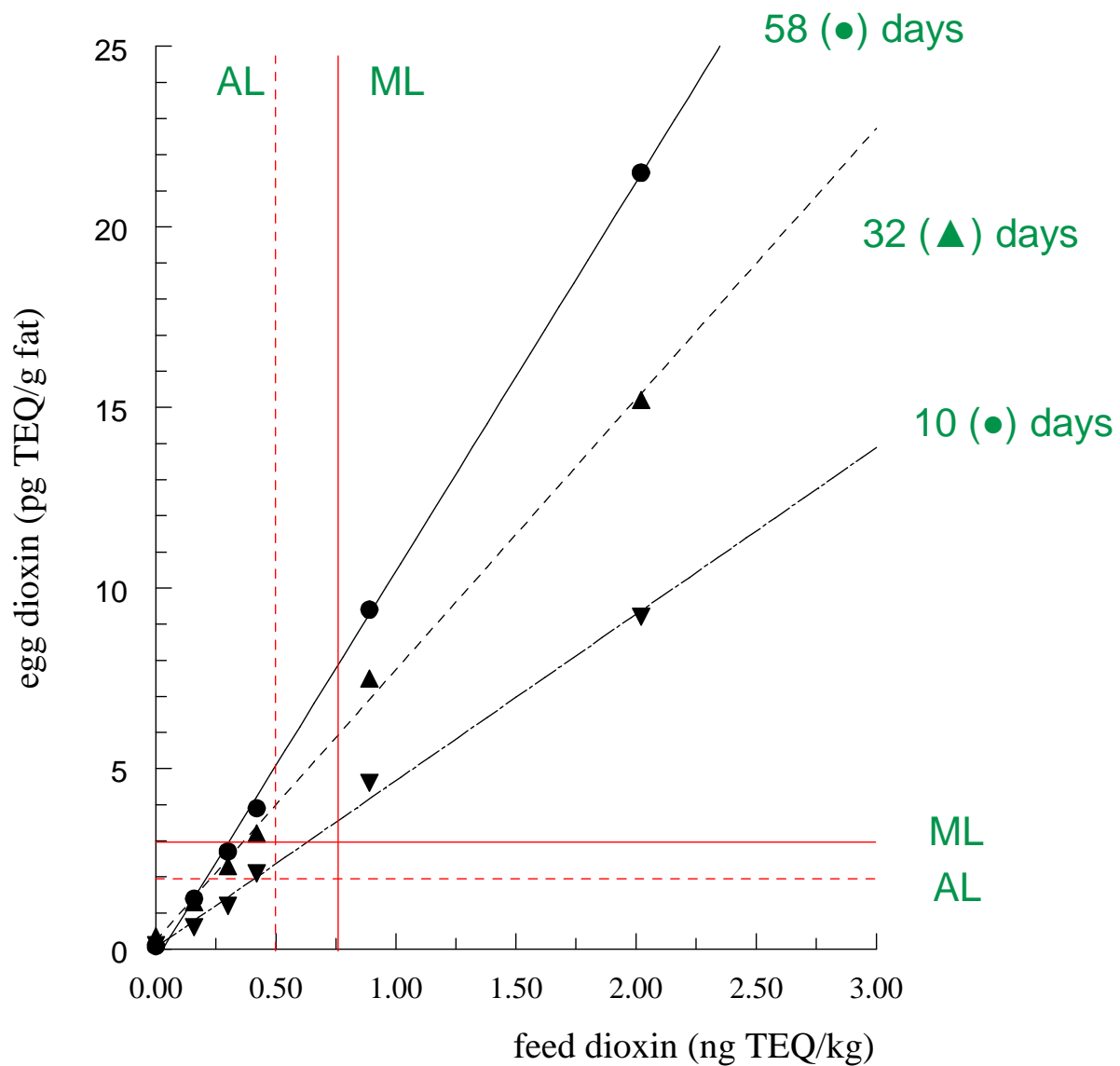
Dioxins in free-range eggs

- First Dutch case discovered in 2001
 - Soil most likely source
- Carry-over study laying hens
 - Feed to egg

Dioxins in eggs at different feed levels



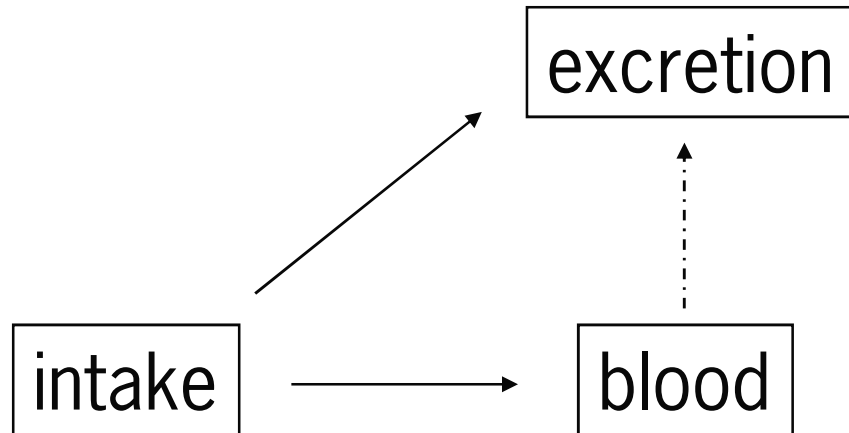
Feed egg limits relationship



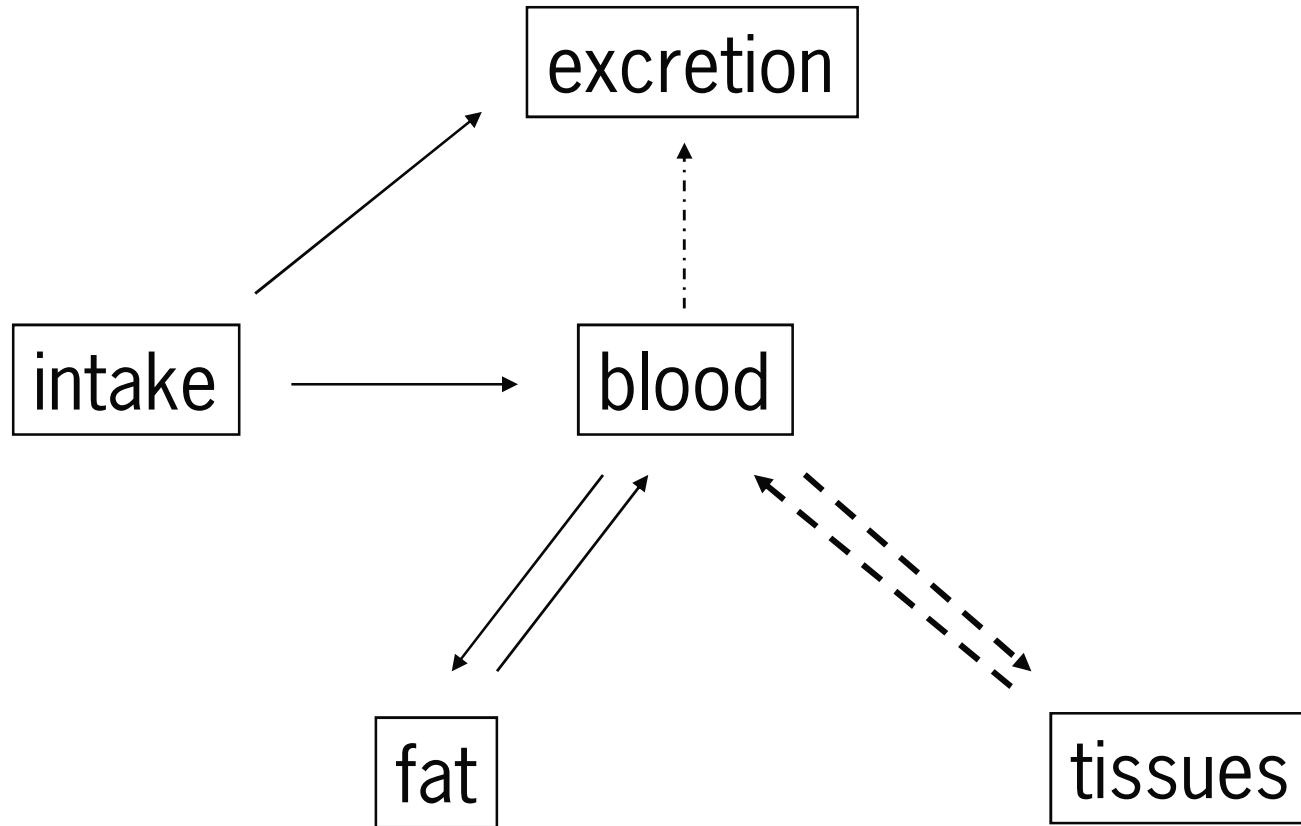
PBPK-modelling

- Based on physiology in the animal
 - Absorption, excretion
 - Exchange between blood and tissues
 - Excretion in eggs
 - Only relevant tissues modelled
- Modelled on TEQ (as if only one compound)

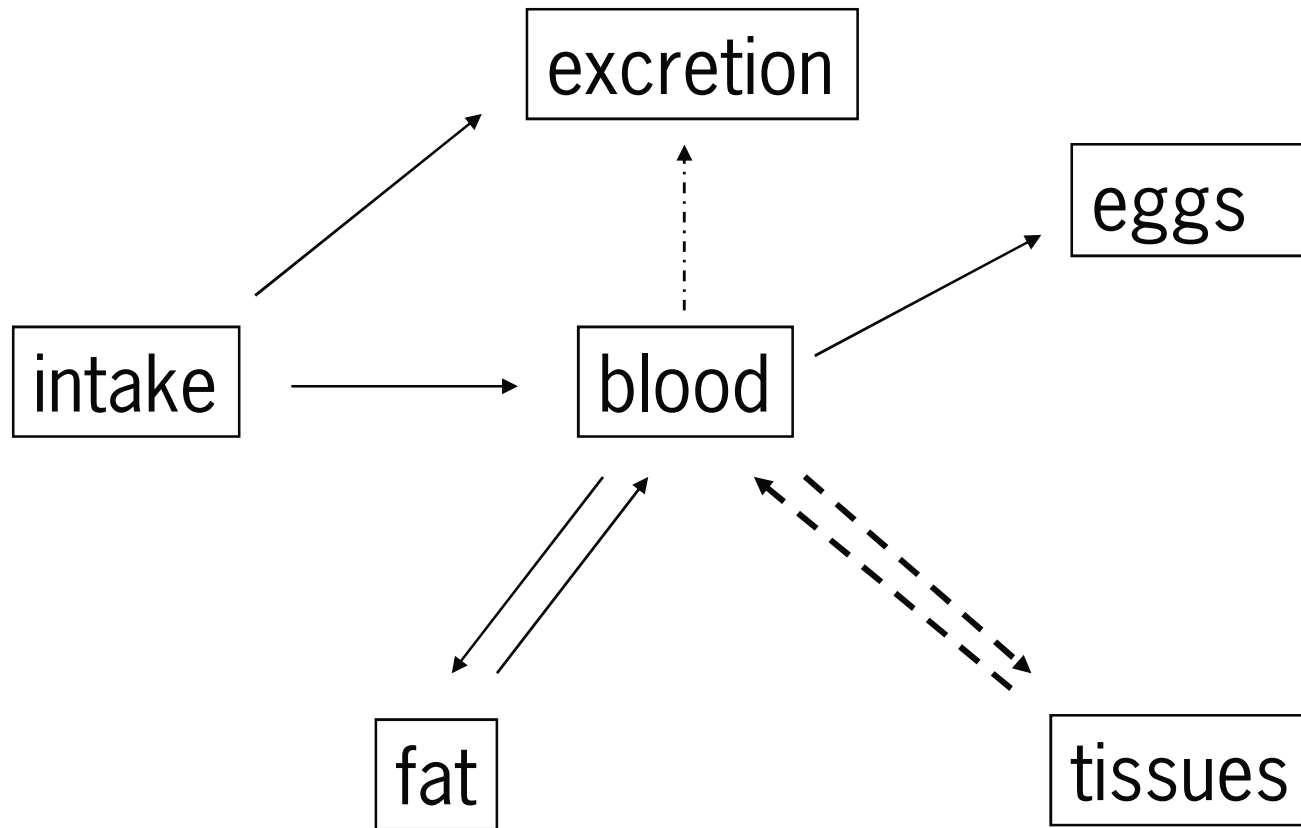
Kinetics in laying hens



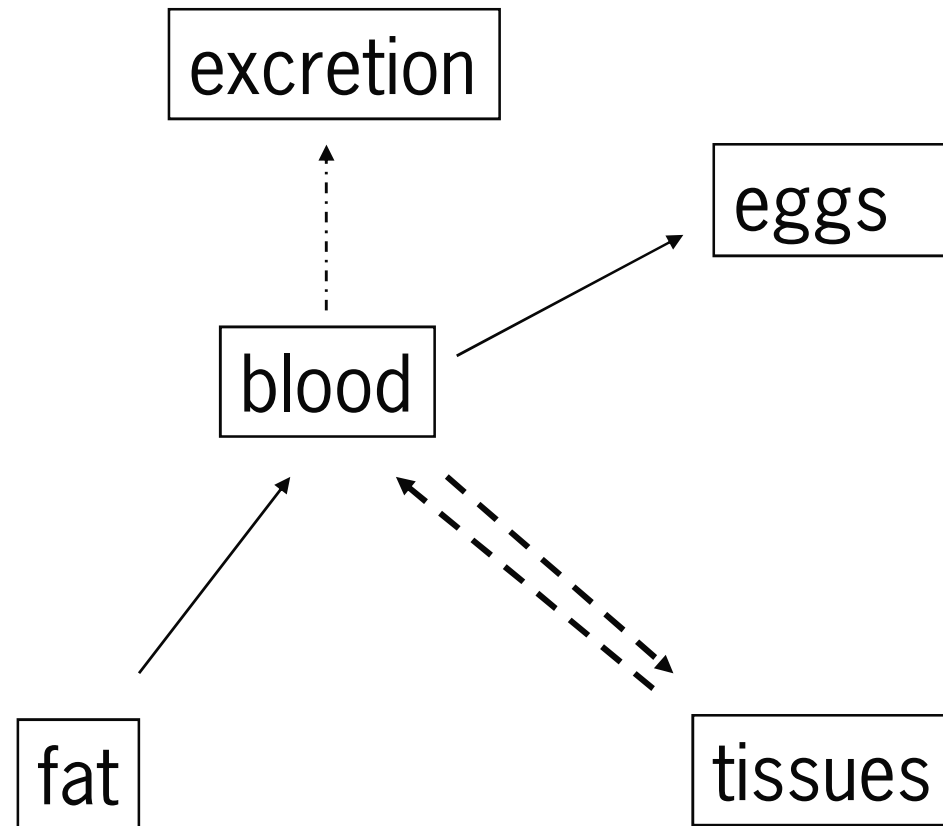
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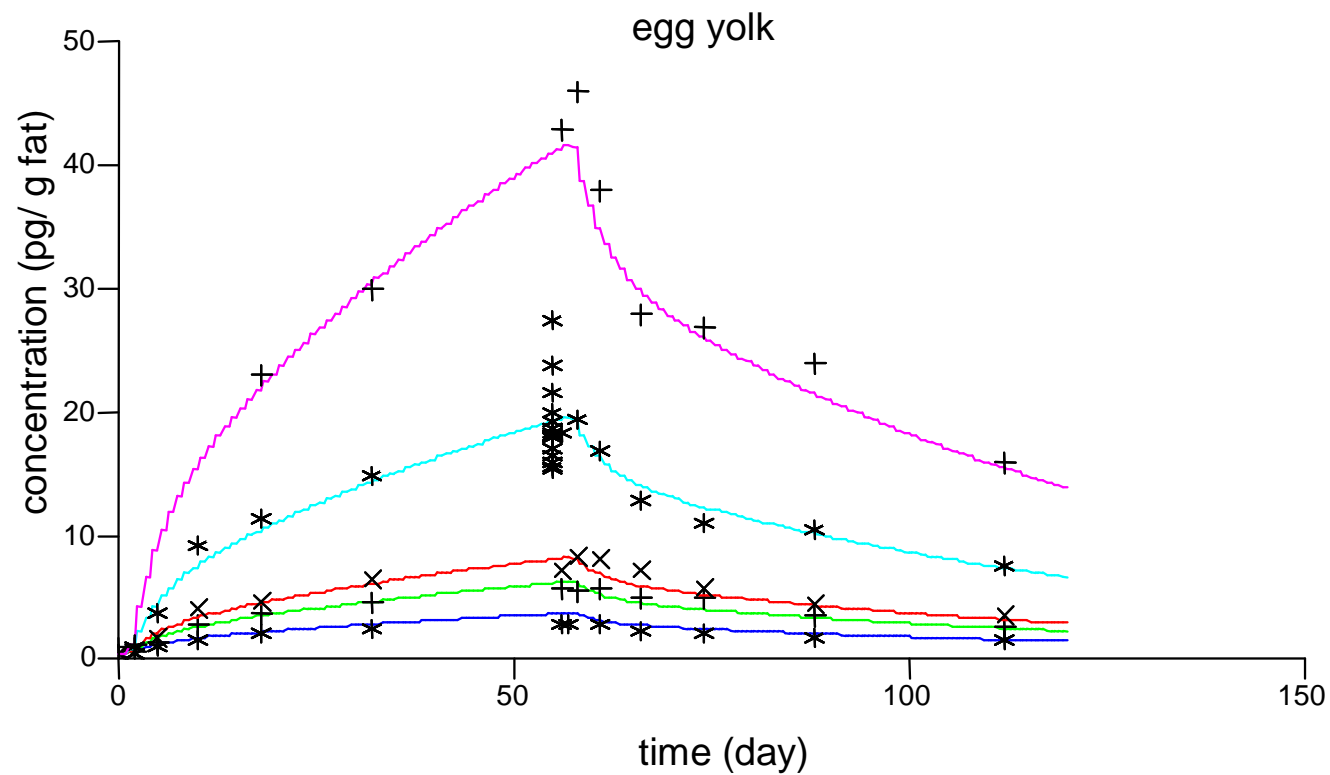
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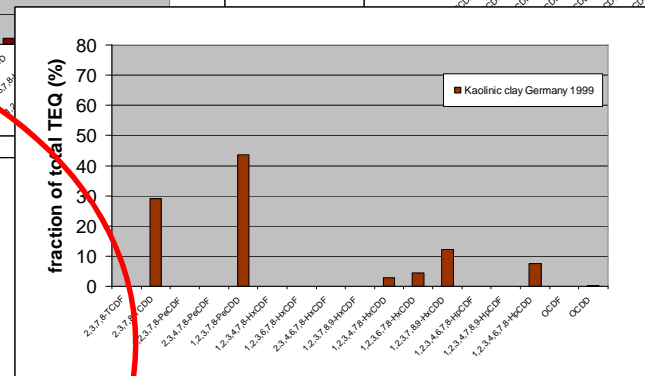
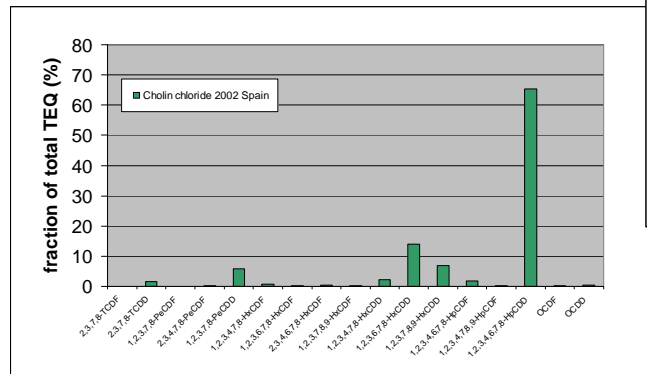
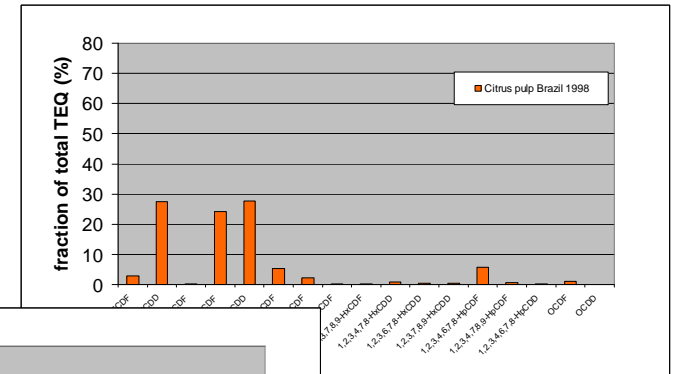
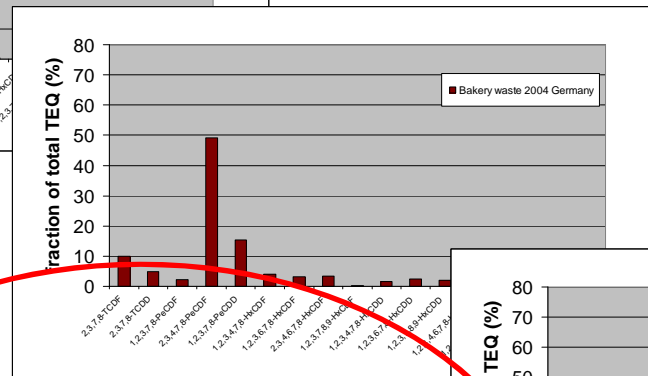
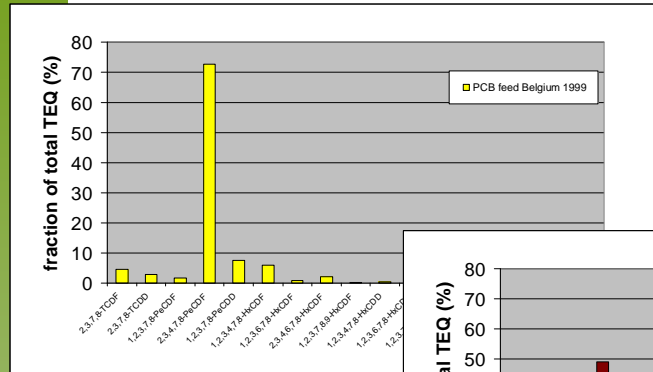
Kinetics in laying hens (wash out)



TEQ-based modelling (sum dioxins, dl-PCBs)



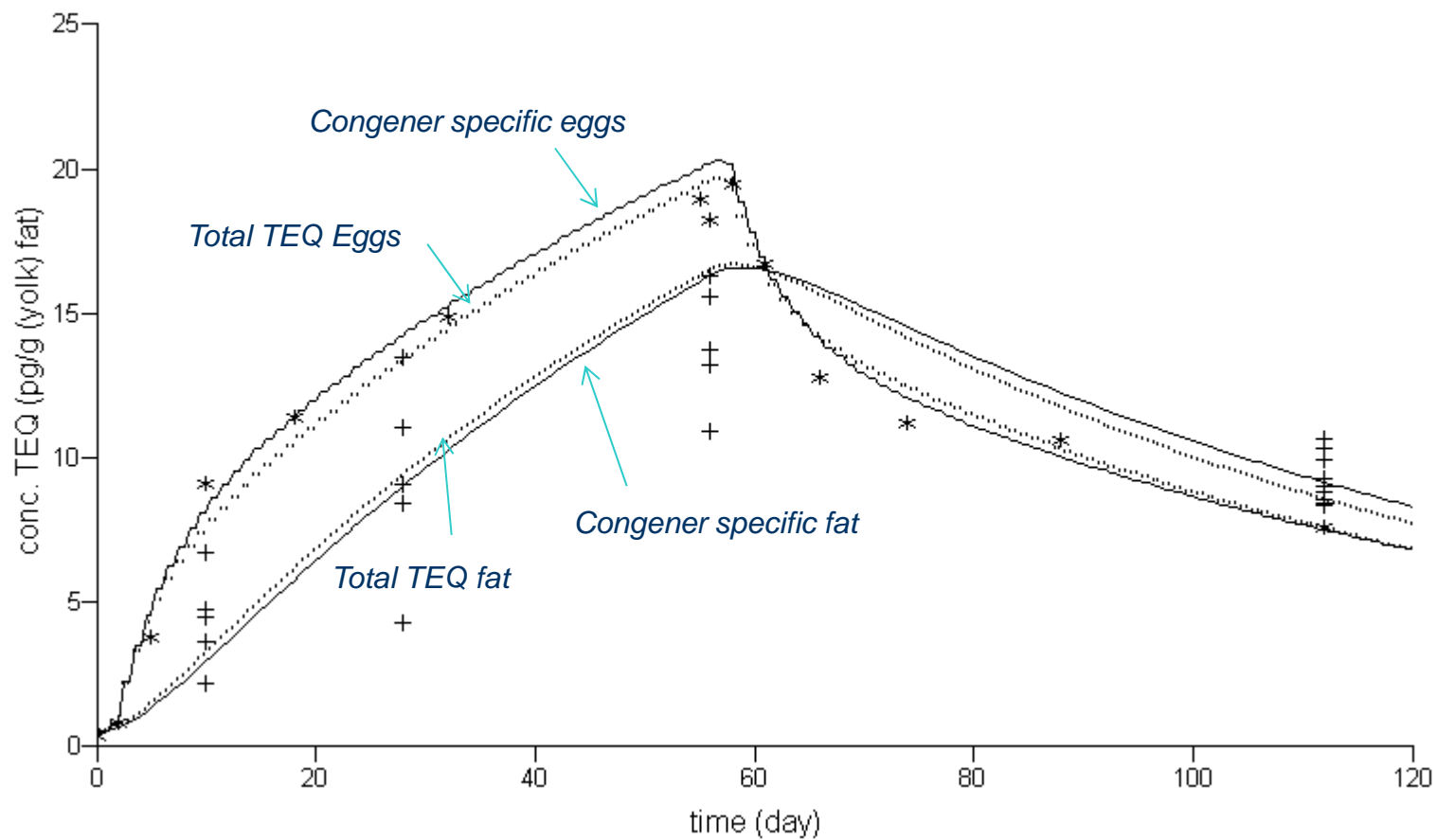
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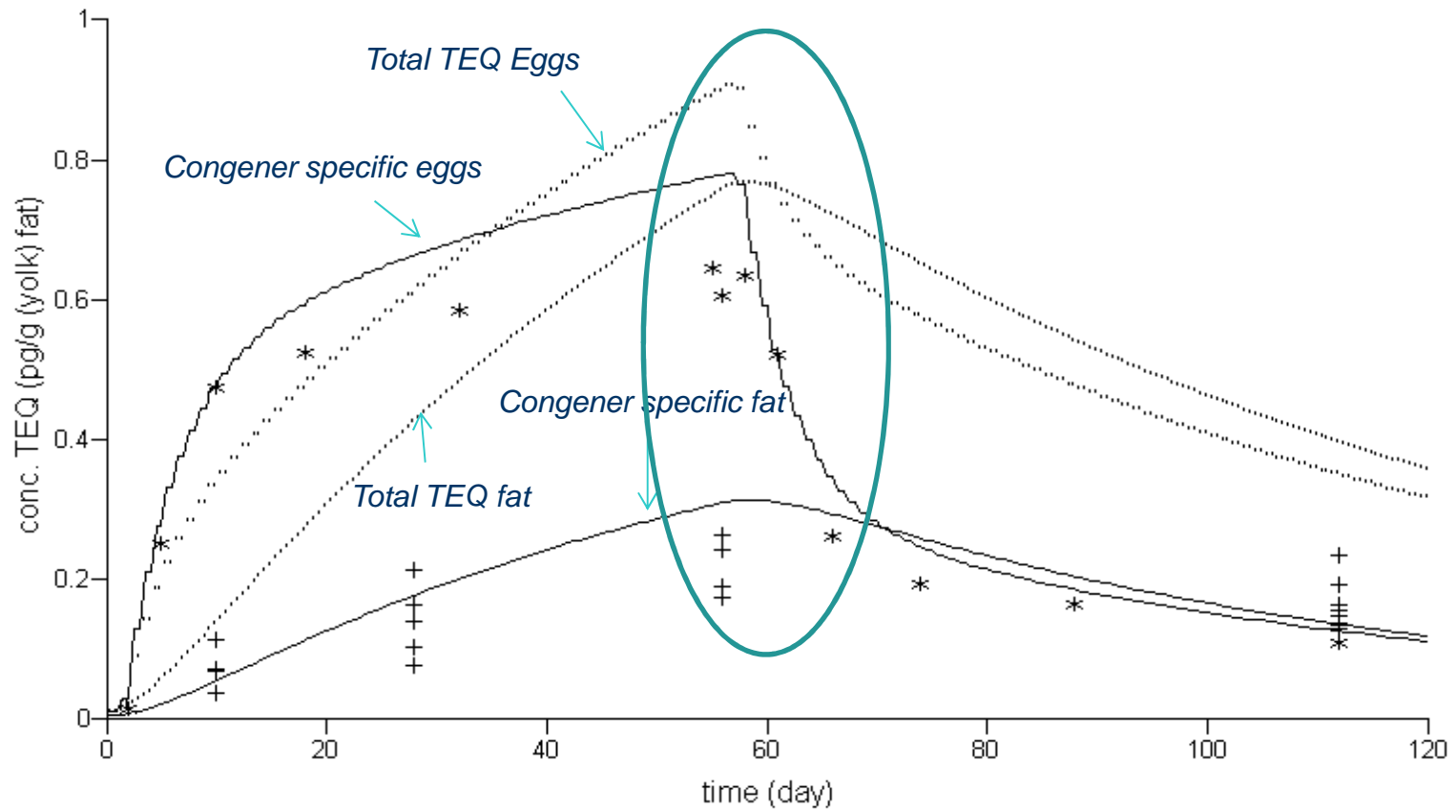
QSAFFE: congener specific modeling of dioxins and dl-PCBs

- Carry-over of congeners is different
 - Data first modeled again on individual congeners
 - Than summed to TEQ
 - Effect on various dioxin mixtures evaluated





Lower chlorinated congeners drive TEQ: no big differences



Higher chlorinated congeners drive TEQ: big differences

Conclusions

- PBPK-models very helpful to describe and understand fate of contaminants in animals
- But also to predict onset and duration
- And to harmonize feed and food limits

www.qsafe.eu

The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 265702.

