FEEDING FATS SAFETY

12 December 2007 – Florence

WP-4: Levels of contamination in meat and other animal tissues, and rate of transfer from feed

Analysis of PCDD/Fs and DL-PCBs

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Toxic equivalent factors assigned by The World Health Organisation (WHO-TEFs) to PCDD/Fs and DL-PCBs

Compound	WHO-TEF	Compound	WHO-TEF
Dioxins		Non-ortho PCBs	
2378-TCDD	1	33'44'-TeCB (# 77)	0.0001
12378-PeCDD	1	344'5-TeCB (# 81)	0.0001
123478-, 123678-, 123789-HxCDD	0.1	33'44'5-PeCB (#126)	0.1
1234678-HpCDD	0.01	33'44'55'-HxCB (# 169)	0.01
OCDD	0.0001	Mono-ortho PCBs	
Furans		233'44'-PeCB (# 105)	0.0001
2378-TCDF	0.1	2344'5-PeCB (# 114)	0.0005
12378-PeCDF	0.05	23'44'5-, 2344'5'- PeCB (#118, 123)	0.0001
23478-PeCDF	0.5	233'44'5-, 233'44'5'-HxCB (# 156, 157)	0.0005
123478-, 123678-, 123789-, 234678-HxCDF	0.1	23'44'55'-HxCB (# 167)	0.00001
1234678-, 1234789-HpCDF	0.01	233'44'55'-HpCB (# 189)	0.0001
OCDF	0.0001		

Expression of the results:

$$\text{WHO-TEQ} = \sum_{i=1}^{N} C_i \times TEF_i$$

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4.1. Effect of feeding selected fats (recycled ones) on the contamination of rabbit and poultry meat and other tissues

pg WHO-TEQ/g oil "upperbound"	Fish oil A	Fish oil B "spiked"
PCDD/Fs	1,95	9,78
DL-PCBs	7,69	19,02
PCDD/Fs + DL-PCBs	9,64	28,80

Maximum levels for fish oil samples (COMMISSION DIRECTIVE 2006/13/EC 3 February 2006):

- 6 pg WHO-TEQ/g oil PCDD/Fs
- 24 pg WHO-TEQ/g oil PCDD/Fs + DL-PCBs

Maximum levels for compound feedingstuffs (COMMISSION DIRECTIVE 2006/13/EC 3 February 2006): 0,75 pg WHO-TEQ/g PCDD/Fs
1,5 pg WHO-TEQ/g PCDD/Fs + DL-PCBs

Broilers - Treatment 1: 6% Fish oil A

Broilers - Treatment 2: 3% Fish oil A + 3% Fish oil B

Broilers - Treatment 3: 6% Fish oil B

pg WHO-TEQ/g feed "upperbound"	Treatment 1	Treatment 2	Treatment 3
PCDD/Fs	0,11	0,39	0,54
DL-PCBs	0,48	0,73	1,21
PCDD/Fs + DL-PCBs	0,59	1,11	1,75

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Rabbits - Treatment 1: 3% Fish oil A

Rabbits - Treatment 2: 1.5% Fish oil A + 1.5% Fish oil B

Rabbits - Treatment 3: 3% Fish oil B

pg WHO-TEQ/g feed "upperbound"	Treatment 1	Treatment 2	Treatment 3
PCDD/Fs	0,10	0,15	0,27
DL-PCBs	0,23	0,38	0,59
PCDD/Fs + DL-PCBs	0,33	0,53	0,86

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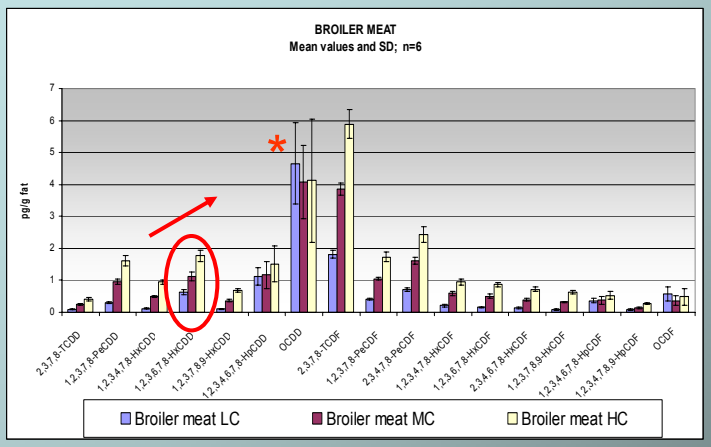
Poultry Meat:



Conc (pg/g fat) HC n=6	MEAN	RSD(%)
2,3,7,8-TCDD	0,407	12
1,2,3,7,8-PeCDD	1,617	10
1,2,3,4,7,8-HxCDD	0,945	7
1,2,3,6,7,8-HxCDD	1,765	10
1,2,3,7,8,9-HxCDD	0,690	8
1,2,3,4,6,7,8-HpCDD	1,510	37
OCDD	4,118	47
2,3,7,8-TCDF	5,892	8
1,2,3,7,8-PeCDF	1,733	9
2,3,4,7,8-PeCDF	2,436	10
1,2,3,4,7,8-HxCDF	0,948	9
1,2,3,6,7,8-HxCDF	0,863	7
2,3,4,6,7,8-HxCDF	0,719	9
1,2,3,7,8,9-HxCDF	0,628	8
1,2,3,4,6,7,8-HpCDF	0,530	23
1,2,3,4,7,8,9-HpCDF	0,285	9
OCDF	0,480	54

pg WHO-TEQ/g fat "upperbound" (n=6)	Broilers Treatment 1	Broilers Treatment 2	Broilers Treatment 3
PCDD/Fs	1,11 (RSD 6%)	2,85 (RSD 5%)	4,60 (RSD 8%)
DL-PCBs	4,92 (RSD 7%)	8,40 (RSD 5%)	12,11 (RSD 8%)
Total (PCDD/Fs + DL-PCBs)	6,03 (RSD 7%)	11,24 (RSD 4%)	16,71 (RSD 8%)

Maximum levels for meat and meat products of poultry and farmed game (COMMISSION REGULATION (EC) N° 199/2006 3 February 2006):

- 2 pg WHO-TEQ/g fat PCDD/Fs
- 4 pg WHO-TEQ/g fat PCDD/Fs + DL-PCBs

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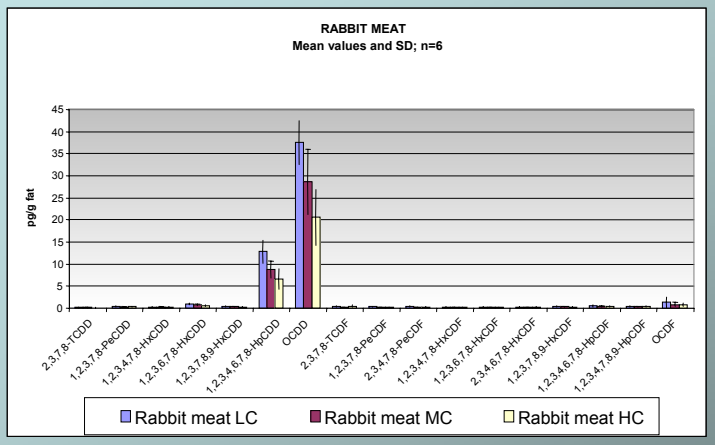
Rabbit Meat:



Conc (pg/g fat) LC n=6	MEAN	RSD(%)
2,3,7,8-TCDD	0,115	57
1,2,3,7,8-PeCDD	0,353	50
1,2,3,4,7,8-HxCDD	0,287	47
1,2,3,6,7,8-HxCDD	0,969	20
1,2,3,7,8,9-HxCDD	0,388	59
1,2,3,4,6,7,8-HpCDD	12,791	21
OCDD	37,501	13
2,3,7,8-TCDF	0,381	61
1,2,3,7,8-PeCDF	0,296	50
2,3,4,7,8-PeCDF	0,357	41
1,2,3,4,7,8-HxCDF	0,269	53
1,2,3,6,7,8-HxCDF	0,264	55
2,3,4,6,7,8-HxCDF	0,291	53
1,2,3,7,8,9-HxCDF	0,369	49
1,2,3,4,6,7,8-HpCDF	0,510	51
1,2,3,4,7,8,9-HpCDF	0,425	50
OCDF	1,277	99

Underlined values indicate 3 or more replicates below de LOD!!!

pg WHO-TEQ/g fat "upperbound" (n=6)	Rabbits Treatment 1	Rabbits Treatment 2	Rabbits Treatment 3
PCDD/Fs	1,12 (RSD 36%)	0,86 (RSD 15%)	0,75 (RSD 19%)
DL-PCBs	1,56 (RSD 18%)	1,69 (RSD 11%)	2,51 (RSD 15%)
Total (PCDD/Fs + DL-PCBs)	2,68 (RSD 22%)	2,55 (RSD 7%)	3,54 (RSD 22%)

Maximum levels for meat and meat products of poultry and farmed game (COMMISSION REGULATION (EC) N° 199/2006 3 February 2006):

- 2 pg WHO-TEQ/g fat PCDD/Fs
- 4 pg WHO-TEQ/g fat PCDD/Fs + DL-PCBs

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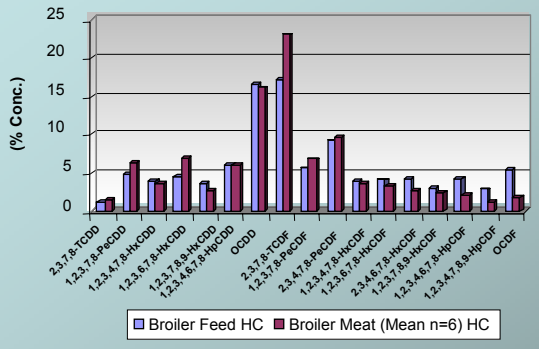
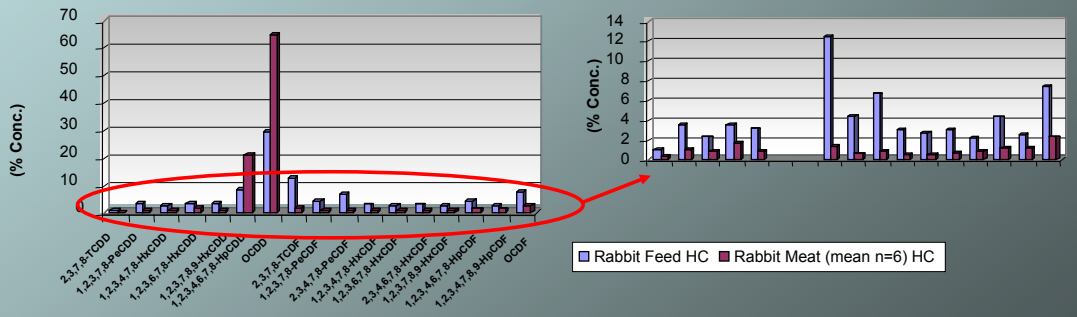


Comparison
PCDD/F congener contribution in feed
vs.
PCDD/F congener contribution in meat



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Main Conclusions

✓ Remarkable differencies in individual concentrations of PCDD/Fs in meat between broilers and rabbits.

✓ The experiment with broilers allowed us to achieve higher sensitivity and acceptable RSD(%) for PCDD/F and DL-PCB analysis.

✓ Good correlation between congener distribution profiles in the feeds and in the meat samples in the case of broilers.

✓ Meat broiler samples from some of the experiments would exceed the maximum PCDD/F and DL-PCB levels established at the European Commission Regulation (EC) Nº 199/2006 3 February 2006.

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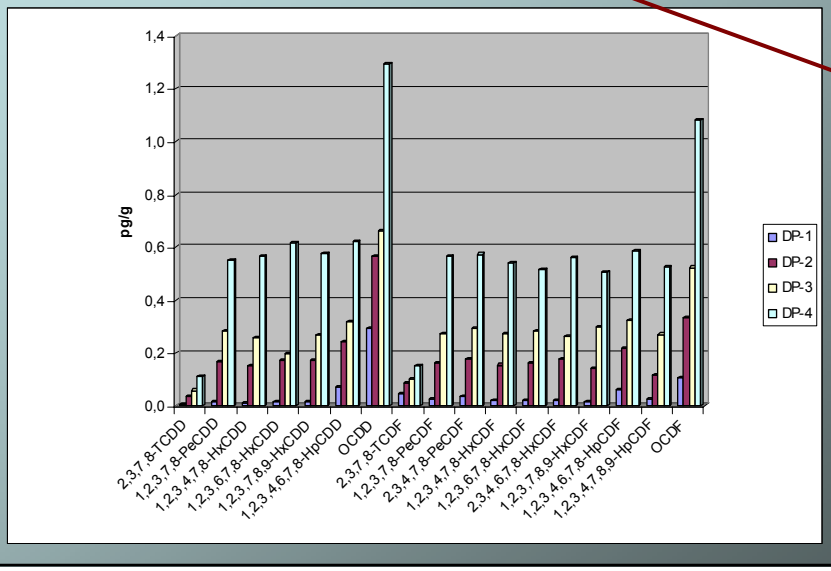
4.2. Rate of transfer of selected contaminants from spiked feed to poultry meat and other tissues

4 Experimental Feeds

DP-1:	**Background**	
DP-2:	**½ max:**	**0.38 pg WHO-TEQ/g (PCDD/Fs) and 0.38 pg WHO-TEQ/g (DL-PCBs)**
DP-3:	**max:**	**0.75 pg WHO-TEQ/g (PCDD/Fs) and 0.75 pg WHO-TEQ/g (DL-PCBs)**
DP-4:	**2 max:**	**1.5 pg WHO-TEQ/g (PCDD/Fs) and 1.5 pg WHO-TEQ/g (DL-PCBs)**



0,06 pg WHO-TEQ/g (PCDD/Fs)

0,03 pg WHO-TEQ/g (DL-PCBs)

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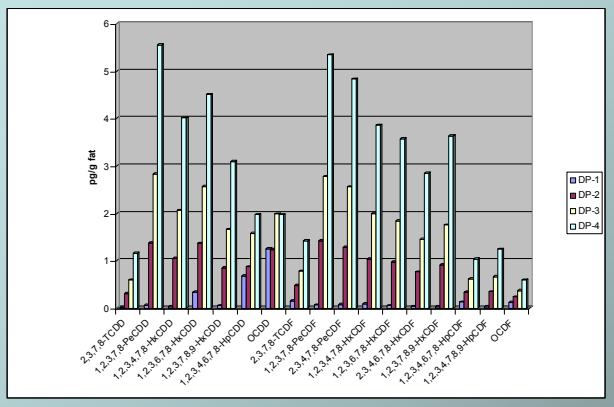
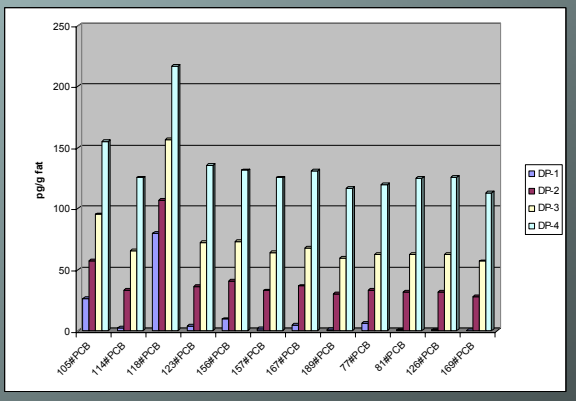
- **Poultry Meat:**



PCDD/Fs

4 REPLICATES x TREATMENT

DL-PCBs



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❑ Meat (mean values):

Maximum levels for meat and meat products of poultry and farmed game (COMMISSION REGULATION (EC) Nº 199/2006 3 February 2006):

2 pg WHO-TEQ/g fat PCDD/Fs
4 pg WHO-TEQ/g fat PCDD/Fs + DL-PCBs

pg WHO-TEQ/g fat "upperbound" (n=4)	Meat DP-1	Meat DP-2	Meat DP-3	Meat DP-4
PCDD/Fs	0.21	3.16	6.50	12.57
Total (PCDD/Fs + DL-PCBs)	0.29	6.79	13.80	27.02

❑ Liver (mean values):

Maximum levels for meat and meat products of poultry and farmed game (COMMISSION REGULATION (EC) Nº 199/2006 3 February 2006):

6 pg WHO-TEQ/g fat PCDD/Fs
12 pg WHO-TEQ/g fat PCDD/Fs + DL-PCBs

pg WHO-TEQ/g fat "upperbound" (n=4)	Liver DP-1	Liver DP-2	Liver DP-3	Liver DP-4
PCDD/Fs	0.72	7.24	12.99	26.53
Total (PCDD/Fs + DL-PCBs)	1.13	10.64	19.24	39.14

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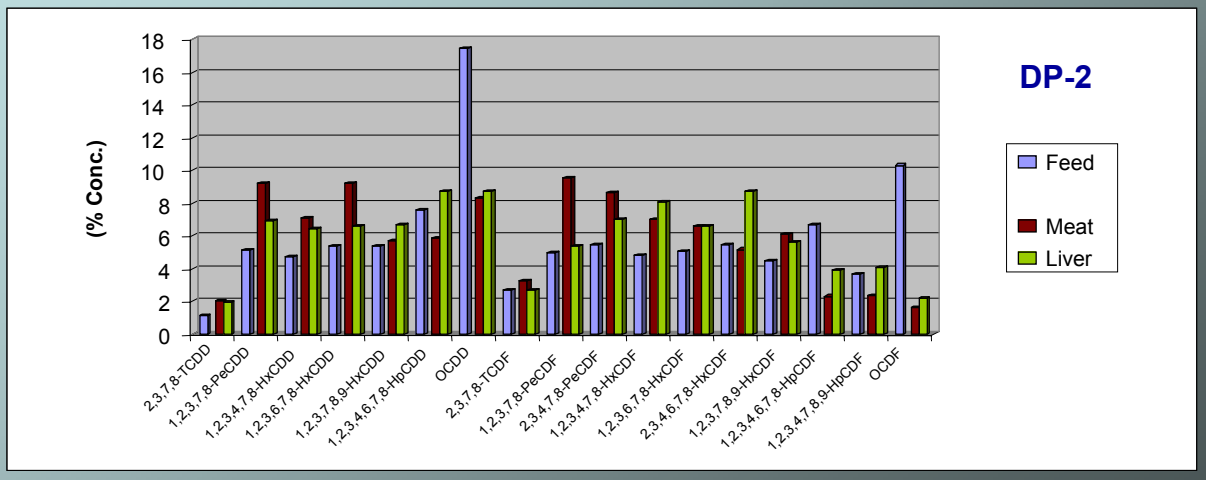
Comparison
PCDD/F congener contribution in feed
vs.
PCDD/F congener contribution in meat and liver



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Main Conclusions

✓ Good correlation between congener distribution profiles in the feeds and in the meat and liver samples.

✓ Meat samples from DP-2 to DP-4 experiments exceed the maximum PCDD/F and DL-PCB levels established at the European Commission Regulation (EC) Nº 199/2006 3 February 2006.

✓ Liver samples from DP-3 and DP-4 experiments exceed the maximum PCDD/F and DL-PCB levels established at the European Commission Regulation (EC) Nº 199/2006 3 February 2006.