

### CONTAMINATION OF CHICKEN EGGS FROM DIFFERENT RUSSIAN REGIONS BY PCBs AND CHLORINATED PESTICIDES

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#### Introduction

Pesticides such as DDT, Lindane, HCB as well as PCBs were produced and wide used in Russia for a long period of time. At the same time works concerning to risk assessment for areas surrounding chemical plants are few. Very often these areas are used for food producing at personal farms of citizens. Food is known to be the main source of these contaminants exposure for humans, accounting for 98% of the total intake<sup>1</sup>. IPEN proposed to analyze chicken eggs from personal farms as one of the most versatile and accessible object for investigations. This approach was used for determination of Persistent organic pollutants (POPs) levels in lot of countries in different part of our planet<sup>4</sup>. Our study included determination of dioxin-like and indicator PCBs, DDT/DDE, lindane and HCB levels in chicken eggs from personal farms that are located at areas surrounding PCBs or pesticides producing plants.

#### Materials and Methods

Eggs were boiled in distilled water directly after sampling and send to the laboratory were stored refrigerated till analysis. After removing of shell, eggs were mixed with anhydrous magnesium sulfate; subsample (~10 g) was spiked with <sup>13</sup>C<sub>12</sub>-labeled standard and extracted by 150 ml acetone:hexane (20:80 v:v) at in high-performance solvent extraction system<sup>2</sup>. Extracts was cleared by acid silica and on alumina column, if needed. Each analytical run contained a method blank. All solvents, sorbent and reusable glassware were tested to ensure the absence of contaminants and interference. Both pesticide and PCB's analysis were performed in single injection using GC-HRMS technique (Hewlett Packard HP 6890 Plus, Finnigan MAT 95XP) at resolution 10000.

#### Results and Discussion

Samples for the given study were obtained from following four locations:

- Novomoskovsk (Tula region), located nearby PCB producing plant "Orgsintez" (closed in 1995);
- Chapaevsk (Samara region), located nearby chlorinated pesticides producing plant;
- Saratov region;
- Poultry farms from different Russian regions: Kostroma, Tyumen, Chelyabinsk, Orenburg and Ulyanovsk.

Results are given in tables 1 and 2. Comparison of total dioxin-like PCBs and DDT/DDE levels between eggs from personal farms and poultry farms is shown at fig. 1 and 2.

It can be seen that POPs levels are quite high in chicken eggs from personal farms which are located nearby PCBs producing plant in Novomoskovsk (tab. 1). TEQ levels of WHO-PCBs were about 100 times higher than those for eggs samples from Chapaevsk food market and 60 times higher than in eggs samples from Saratov region (fig. 1). DDT/DDE levels for Novomoskovsk eggs samples are also rather high.

WHO-PCBs levels in Chapaevsk eggs samples are significantly lower than those in Novomoskovsk and in the same time it appeared to be higher than in Saratov region. DDT/DDE levels are bit higher than in Saratov region, where DDT was widely used. HCB levels in Chapaevsk eggs are higher than those in Saratov region.

Chapaevsk chicken eggs samples may be divided on two groups depending on distance of personal farms from chemical plant: closer and further than 3 km. In table 2 average concentrations of analyzed compounds are given. Gray column of table 2 indicates extremely high POPs levels of one egg sample from personal farm located it 7 km far from chemical plant – Gubashevo district (these data excluded from average mean calculations).

## Levels in feed and food

Total PCB TEQ levels as well as HCB levels are correspondingly 3,5 and 3,7 times higher in eggs samples taken nearby chemical plant. Difference in DDT/DDE and lindane levels is minimal.

Data of POPs levels in poultry farms eggs samples from different regions of Russia were at the same with those for personal farms Marxovskiy district of Saratov region. In eggs from other districts of Saratov region PCBs and DDT/DDE levels are higher (tab.1).

It can be seen that all poultry farms eggs demonstrate PCBs levels within latest EU regulations<sup>3</sup> and not exceed 6 ng TEQ/g lipid weight. But it must be noted that PCDD/Fs didn't determine in these samples.

All other samples (except those from Marxovskiy and Volskiy districts of Saratov region) showed high levels of WHO-PCBs which are significantly exceeding EU regulations.

Comparison the results under discussion to data of IPEN egg study<sup>4</sup> shows that PCBs levels in Novomoskovsk and Chapayevsk eggs samples from Novomoskovsk personal farms are higher than in eggs from Dzerzhinsk (which is known to be one of the most polluted areas in Russia) and some other countries (Helwan in Egypt, Lyuknov in India, Bolshoi Trostenek in Belorussia, Kovachevo in Bulgaria).

DDT/DDE levels in most of the eggs samples are not exceeded maximum allowed levels for Russia which is set as 0,1 mg/kg wet weight<sup>5</sup>. Noticeable overvaluation of this level was found only in eggs samples from Novomoskovsk personal farms.

HCB and lindane levels in Chapayevsk eggs samples are not exceeded Russian regulations normative but its 1-2 orders higher than concentrations found in egg samples from other regions.

Analysis of egg samples from five poultry farms from different regions of Russia didn't show its significant contamination by pesticides. But in the same time noticeable pollution by PCBs is found.

Table 1. PCBs and pesticides levels in chicken eggs samples from Novomoskovsk and Saratov region (pg/g lipid weight).

	Novomoskovsk, Tula region		Saratov region		
	nearby plant, n=3	2 km from plant, n=2	Marxovskiy district, N=3	Volskiy district N=3	Engelskiy district, N=4
PCB-77	1 774	4 506	95,4	70,80	121,1
PCB-81	673,6	122,1	5,93	6,9	10,03
PCB-105	389 229	102 004	5 509	2 454	6 461
PCB-114	18 355	5 384	423,5	163,5	476,1
PCB-118	820 604	219 410	11 910	5 628	14 467
PCB-123	15 992	3 551	611,0	233,8	603,4
PCB-126	899,1	118	17,6	22,2	36,22
PCB-156	116 579	28 523	1 399	401,2	1 885
PCB-157	35 338	6 099	326,2	98,23	473,1
PCB-167	32 263	9 163	642,5	226,3	936,7
PCB-169	2 549	460,1	25,06	66,90	37,70
PCB-189	4 913	888,9	32,26	63,50	56,45
<b>WHO-TEQ (PCB)</b>	<b>324,17</b>	<b>69,58</b>	<b>4,44</b>	<b>3,87</b>	<b>7,40</b>
PCB-28/31	n.a.	n.a.	2 733	3 362	2 732
PCB-52	n.a.	n.a.	1 907	1 816	1 906
HCB	n.a.	n.a.	3 797	4 850	3 797
o,p'-DDE	5 837	6 651	1 335	747,6	1 335
p,p'-DDE	2 610 342	2 017 247	164 816	126 078	164 816
o,p'-DDT	680 79	55 567	2 007	565,9	2 007
p,p'-DDT	1 647 497	1 226 308	25 386	17 383	25 386
<b>Σ DDT and DDE</b>	<b>4 331 756</b>	<b>3 305 773</b>	<b>193 544</b>	<b>144 774</b>	<b>193 543</b>

## Levels in feed and food

Table 2. POPs levels in chicken eggs samples from Chapaevsk city (Samara region), (pg/g lipid weight)

	food market, n=4	Samples form personal farms			
		All samples, n=11	< 3 km from plant, n=5	> 3 km from plant	
				n=5 <sup>1</sup>	n=1
PCB-77	362,2	15 325	852,3	540,8	161 612
PCB-81	77,40	2 432	68,14	9,13	26 372
PCB-105	2 311	67 444	43 939	14 635	449 024
PCB-114	196,2	4 727	3 028	1 275	30 488
PCB-118	4 485	108 225	86 176	34 253	588 337
PCB-123	123,57	4 278	1 831	978,2	33 010
PCB-126	< d.l. (15)	648,6	400,2	66,35	4 801
PCB-156	468,5	13 023	11 184	8151	46 582
PCB-157	109,8	2 650	2 304	1424	10 509
PCB-167	169,9	5 760	4766	3 297	23 052
PCB-169	< d.l. (15)	136,9	10,55	24,17	1 332
PCB-189	7,63	1 353	739,5	1700	2 692
<b>WHO-TEQ (PCB)</b>	<b>1,13</b>	<b>96,39</b>	<b>61,79</b>	<b>17,55</b>	<b>663,62</b>
PCB-28/31	31 746	939 233	47 118	11 501	10 038 464
PCB-52	1 828	72 502	6 929	4 564	740 054
PCB-153	3 122	93 686	69 225	97 189	198 472
PCB-138	3 418	138 692	129 758	127 110	241 267
PCB-180	918,6	147 595	118 823	192 529	66 791
HCB	912,5	66 417	113 615	30 728	8 868
Lindane	4 651	252 183	259 106	268 721	134 886
o,p'-DDE	382,6	4 720	6 315	3 291	3 890
p,p'-DDE	3 632	372 393	366 527	427 059	128 395
o,p'-DDT	4 567	5 098	8 317	2 064	4 168
p,p'-DDT	92 225	120 639	143 837	72 753	244 076
<b>Σ DDT and DDE</b>	<b>100 808</b>	<b>502 850</b>	<b>524 996</b>	<b>505 167</b>	<b>380 530</b>

### References.

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3. COMMISSION REGULATION (EC) No 199/2006, 3 February 2006.
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<sup>1</sup> Excluding data in grey column.

## Levels in feed and food

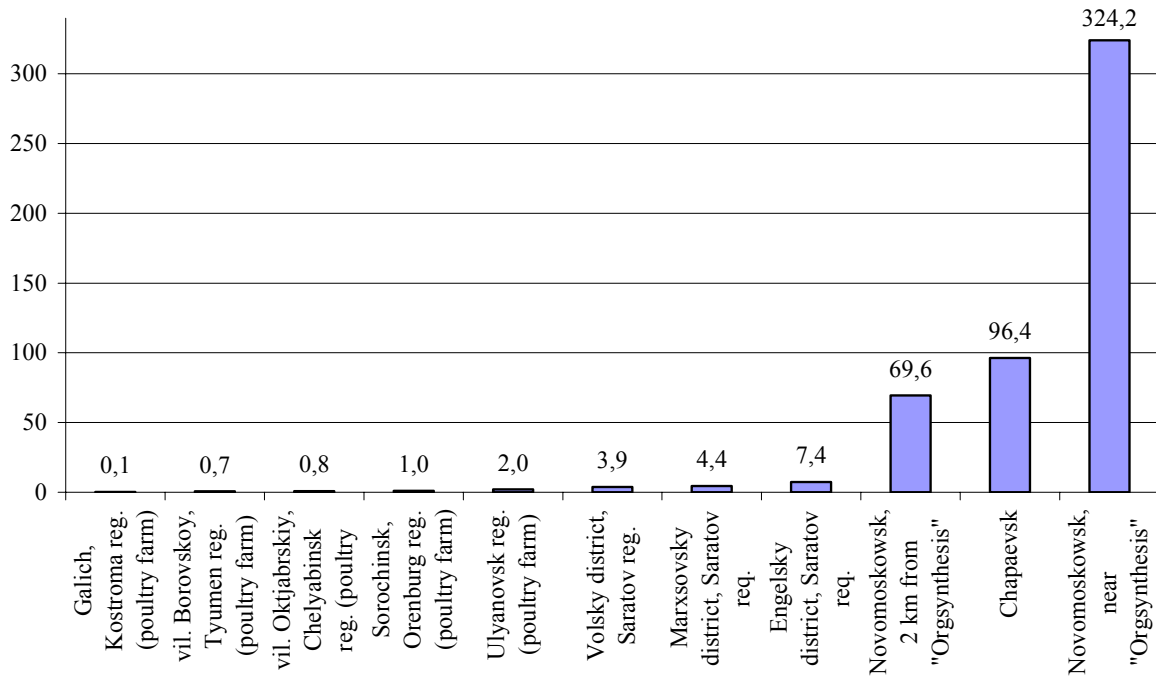


Fig.1. Concentration of dioxin-like PCBs in chicken eggs samples from different regions of Russia (pg/g lipids WHO-TEQ).

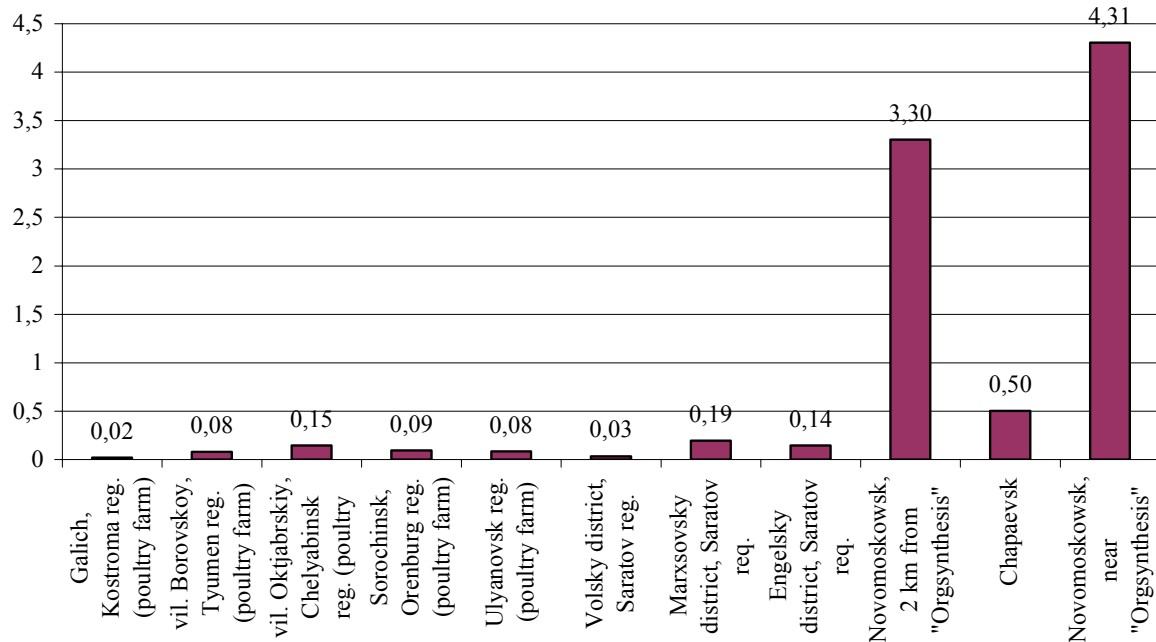


Fig.2. Total concentration of DDT and DDE isomers in chicken eggs samples from different regions of Russia (mg/kg lipids).