

Annex 8.2: Human Tissues (milk and/or blood)(March 2015)

Individual research studies

Numerous studies measuring persistent organic pollutants in blood samples or mother's milk in the WEOG region have been published and can add valuable information about the levels of these compounds. However, the study designs, populations, analytical methods and reported statistics vary, thus direct comparison between individual analyse data is not possible. These studies are presented mainly to provide data when other data are scarce.

A literature search covering data between 2000 and 2013 was performed. A comprehensive summary of the study findings is presented. The studies were rated by their use of external and internal quality controls and studies with insufficient quality information were not included in the summary. Note that the studies that applied external quality controls (e.g. AMAP ringtest or G-EQUAS) are indicated by asterisks. The results are reported as median and/or range unless stated otherwise by markings a-e. When the population is defined as adults, both men and women are included and when the population is defined as children, both girls and boys are included.

Table 1. Levels of aldrin and dieldrin in mother's milk and blood in individual research studies.

ALDRIN/DIELDRIN (ng/g lipid)					
MOTHER'S MILK					
Year	Substance	Median (range)	Location	Population/No of samples	Reference
2009-2010	Aldrin	ND ^a	Belgium	84 women	(Croes et al., 2012)*
2009	Aldrin	0.002 (ND-0.022) ^b	Turkey	47 women	(Cok et al., 2012)
2007-2008	Dieldrin	<2 (<2-16)	Germany	516 women	(Raab et al., 2013)
2009	Dieldrin	8.56 (1.19-36.5) ^b	Turkey	47 women	(Cok et al., 2012)
2009-2010	Dieldrin	7.2 ^a	Belgium	84 women	(Croes et al., 2012)*
MATERNAL PLASMA					
2005-2007	Aldrin	All <LOD	Canada	123 pregnant women	(Foster et al., 2012)*
BLOOD SERUM					
2009-2010	Dieldrin	All <LOD	Russia, 3 regions	209 persons (6-77 years)	(Rylander et al., 2011)*
BLOOD PLASMA					
2005-2010	Aldrin	1.53 (ND-5.0) ^c	Greenland	1614 adults (18-88 years)	(Valera et al., 2013)
2006-2008	Aldrin	All <LOD	Canada, Nunavik	126 children (11-54 months)	(Turgeon O'Brien et al., 2012)*

Table 2. Levels of chlordane in mother's milk and blood in individual research studies.

CHLORDANE (ng/g lipid)					
MOTHER'S MILK					
Year	Substance	Median (range)	Location	Population/No of samples	Reference
2007-2008	oxychlordane	ND (ND-6)	Germany	516 women	(Raab et al., 2013)
2009	oxychlordane	(ND-4.89)	Turkey	47 women	(Cok et al., 2012)
2009-2010	oxychlordane	5.6 ^a	Belgium	84 women	(Croes et al., 2012)*
2009	trans-chlordane	(ND-0.058)	Turkey	47 women	(Cok et al., 2012)
2009-2010	trans-nonachlor	3.3 ^a	Belgium	84 women	(Croes et al., 2012)*
2007-2008	cis-chlordane	All <LOD	Germany	516 women	(Raab et al., 2013)
2009	cis-chlordane	(ND-0.021)	Turkey	47 women	(Cok et al., 2012)
2001-2003	a-chlordane	ND (ND-1.4)	UK	54 women	(Kalantzi et al., 2004)
MATERNAL PLASMA					
2005-2007	oxychlordane	2.2 (0.8-12) ^c	Canada	123 pregnant women	(Foster et al., 2012)*
2005-2007	trans-nonachlor	2.7 (ND-27) ^c	Canada	123 pregnant women	(Foster et al., 2012)*
BLOOD SERUM					
2003	a-chlordane	All <LOD	UK	154 adults (22-80 years)	(Thomas et al., 2006)
2003	γ-chlordane	All <LOD	UK	154 adults (22-80 years)	(Thomas et al., 2006)
2003	oxychlordane	11 (0.73-76)	Finland	1988 elderly (57-70 years)	(Airaksinen et al., 2011)*
2003	trans-nonachlor	28 (0.012-190)	Finland	1988 elderly (57-70 years)	(Airaksinen et al., 2011)*
2005-2007	trans-nonachlor	6.0 (1.1-66.1)	US	618 girls (6-8 years)	(Windham et al., 2010)*
BLOOD PLASMA					
2007	oxychlordane	2.74 (0.72-10.9)	Greece	61 adults (20-65 years)	(Kalantzi et al., 2011)*
2009-2010	oxychlordane	<LOD	Russia, 3 regions	209 persons (6-77 years)	(Rylander et al., 2011)*
2010-2011	oxychlordane (pg/mL)	17.3 (3.8-135)	Sweden	246 adults (18-80 years)	(Bjeremo et al., 2013)
2001-2004	trans-chlordane	ND	Sweden	1016 elderly (70-years)	(Salihovic et al., 2012)
2001-2004	trans-nonachlor	20.0	Sweden	1016 women (70-year olds)	(Salihovic et al., 2012)
2001-2004	trans-nonachlor	25.0	Sweden	1016 men (70-year olds)	(Salihovic et al., 2012)
2007	trans-nonachlor	2.64 (0.45-20.4)	Greece	61 adults (20-65 years)	(Kalantzi et al., 2011)*
2009-2010	trans-chlordane	<LOD	Russia, 3 regions	209 persons (6-77 years)	(Rylander et al., 2011)*

2009-2010	trans-nonachlor	<LOD	Russia, Nelmin-Nos	87 women (6-77 years)	(Rylander et al., 2011)*
2009-2010	trans-nonachlor	<LOD	Russia, Nelmin-Nos	22 men (6-77 years)	(Rylander et al., 2011)*
2009-2010	trans-nonachlor	<LOD	Russia, Izhma	25 women (15-55 years)	(Rylander et al., 2011)*
2009-2010	trans-nonachlor	<LOD	Russia, Izhma	25 men (15-55 years)	(Rylander et al., 2011)*
2009-2010	trans-nonachlor	1.3 (LOD-21)	Russia, Usinsk	25 women (19-62 years)	(Rylander et al., 2011)*
2009-2010	trans-nonachlor	4.6 (3.1-26)	Russia, Usinsk	25 men (19-62 years)	(Rylander et al., 2011)*
2010-2011	trans-nonachlor (pg/mL)	35.7 (2.2-267)	Sweden	246 adults (18-80 years)	(Bjeremo et al., 2013)
2001-2004	cis-chlordane	ND	Sweden	1016 elderly (70-years)	(Salihovic et al., 2012)
2009-2010	cis-chlordane	<LOD	Russia, 3 regions	209 persons (6-77 years)	(Rylander et al., 2011)*
2009-2010	cis-nonachlor	<LOD	Russia, 3 regions	209 persons (6-77 years)	(Rylander et al., 2011)*
BLOOD PLASMA					
2005-2010	oxychlordane	187 (2.0-3500) ^c	Greenland	1614 adults (18-88 years)	(Valera et al., 2013)
2006-2008	oxychlordane	9.6 (0.4-345) ^c	Nunavik, Canada	126 children (11-54 months)	(Turgeon O'Brien et al., 2012)*
2004	trans-nonachlor	9 (<LOD-48)	Norway	311 women (48-62 years)	(Rylander et al., 2012)*
2005-2010	trans-nonachlor	335 (5.0-5000) ^c	Greenland	1614 adults (18-88 years)	(Valera et al., 2013)
2006-2008	trans-nonachlor	16.1 (0.7-517) ^c	Nunavik, Canada	126 children (11-54 months)	(Turgeon O'Brien et al., 2012)*
2004	cis-nonachlor	2 (<LOD-14)	Norway	311 women (48-62 years)	(Rylander et al., 2012)*
2005-2010	cis-nonachlor	62.1 (1.0-970) ^c	Greenland	1614 adults (18-88 years)	(Valera et al., 2013)
2006-2008	cis-nonachlor	2.8 (0.3-81.0) ^c	Nunavik, Canada	126 children (11-54 months)	(Turgeon O'Brien et al., 2012)*
2005-2010	a-chlordane	1.50 (ND-5.7) ^c	Greenland	1614 adults (18-88 years)	(Valera et al., 2013)
2006-2008	a-chlordane	All <LOD	Nunavik, Canada	126 children (11-54 months)	(Turgeon O'Brien et al., 2012)*
2005-2010	γ-chlordane	0.78 (ND-13.0) ^c	Greenland	1614 adults (18-88 years)	(Valera et al., 2013)
2006-2008	γ-chlordane	All <LOD	Nunavik, Canada	126 children (11-54 months)	(Turgeon O'Brien et al., 2012)*
2007-2008	Sum chlordane	150 (1.5-6600) ^c	Canada, Nunavut	2172 adults (>18 years)	(Laird et al., 2013)*

Table 3. Levels of DDE/DDT in mother's milk and blood in individual research studies.

DDE/DDT (ng/g lipid)					
MOTHER'S MILK					
Year	Substance	Median (range)	Location	Population/ No of samples	Reference
2001-2003	o,p'-DDE	0.1 (ND-5.8)	UK	54 women	(Kalantzi et al., 2004)
2009	o,p'-DDE	0.27 (<LOD-1.25) ^b	Turkey	47 women	(Cok et al., 2012)
2009-10	p,p'-DDE	162 ^a	Belgium	84 women	(Croes et al., 2012)*
2001-2003	p,p'-DDE	150 (22-1600)	UK	54 women	(Kalantzi et al., 2004)
2007-2008	p,p'-DDE	63 (8-2330)	Germany	516 women	(Raab et al., 2013)
2009	p,p'-DDE	325 (16.8-1071) ^b	Turkey	47 women	(Cok et al., 2012)
2001-2003	o,p'-DDT	0.6 (ND-55)	UK	54 women	(Kalantzi et al., 2004)
2009	o,p'-DDT	1.39 (0.068-32.4) ^b	Turkey	47 women	(Cok et al., 2012)
2001-2003	p,p'-DDT	6.2 (1.1-760)	UK	54 women	(Kalantzi et al., 2004)
2007-2008	p,p'-DDT	<2 (<2-300)	Germany	516 women	(Raab et al., 2013)
2009	p,p'-DDT	10.5 (0.41-63.7) ^b	Turkey	47 women	(Cok et al., 2012)
2009-2010	p,p'-DDT	11.0 ^a	Belgium	84 women	(Croes et al., 2012)*
MATERNAL SERUM					
2001-2002	p,p'-DDE	89 (18-380)	Netherlands	90 pregnant women	(Meijer et al., 2008)
2004-2006	p,p'-DDE	168.69	Spain, Valencia	541 pregnant women	(Llop et al., 2010)*

2004-2008	p,p'-DDE	110 (105-115) ^e	Spain, Sabadell + Gipuzkoa	1259 pregnant women	(Ibarluzea et al., 2011)
2006	p,p'-DDE	112.3	Italy (Polluted area!)	70 pregnant women	(Bergonzi et al., 2009)*
2004-2006	p,p'-DDT	7.70	Spain, valencia	541 pregnant women	(Llop et al., 2010)*
MATERNAL PLASMA					
2005-2007	p,p'-DDE	63 (15-1705) ^c	Canada	123 pregnant women	(Foster et al., 2012)*
2005-2007	p,p'-DDT	ND (ND-58)	Canada	123 pregnant women	(Foster et al., 2012)*
BLOOD SERUM					
2003	o,p'-DDE	<0.48 (<0.48-3.9)	UK	154 adults (22-80 years)	(Thomas et al., 2006)
2009-2010	o,p'-DDE	All <LOD	Russia, 3 regions	209 samples (6-77 years)	(Rylander et al., 2011)*
2002	p,p'-DDE	399.3 (1.2-9036.0)	Spain, Catalonia	919 adults (18-74 years)	(Porta et al., 2010)
2003	p,p'-DDE	100 (<11-2600)	UK	154 adults (22-80 years)	(Thomas et al., 2006)
2003	p,p'-DDE	470 (9.1-10000)	Finland	1988 elderly (57-70 years)	(Airaksinen et al., 2011)*
2005-2007	p,p'-DDE	101.5 (11.0-8010)	US	618 girls (6-8 years)	(Windham et al., 2010)*
2006	p,p'-DDE	219.1 (6.9-8227)	Spain, Barcelona	231 adults (>18years)	(Porta et al., 2012)
2007	p,p'-DDE	268 (53.8-1650)	Greece	61 adults	(Kalantzi et al., 2011)*
2009-2010	p,p'-DDE	163 (<LOD-1342)	Russia, Nelmin-Nos	87 women (6-77 years)	(Rylander et al., 2011)*
2009-2010	p,p'-DDE	176 (51-732)	Russia, Nelmin-Nos	22 men (6-77 years)	(Rylander et al., 2011)*
2009-2010	p,p'-DDE	107 (41-517)	Russia, Izhma	25 women (15-55 years)	(Rylander et al., 2011)*
2009-2010	p,p'-DDE	138 (20-428)	Russia, Izhma	25 men (15-55 years)	(Rylander et al., 2011)*
2009-2010	p,p'-DDE	203 (91-600)	Russia, Usinsk	25 women (19-62 years)	(Rylander et al., 2011)*
2009-2010	p,p'-DDE	190 (53-782)	Russia, Usinsk	25 men (19-62 years)	(Rylander et al., 2011)*
2010-2011	p,p'-DDE (pg/mL)	451.5 (48.8-7420)	Sweden	246 adults	(Bjeremo et al., 2013)
2003	o,p'-DDT	<0.51 (<0.51-8.4)	UK	154 adults (22-80 years)	(Thomas et al., 2006)
2009-2010	o,p'-DDT	All <LOD	Russia, 3 regions	209 samples (6-77 years)	(Rylander et al., 2011)*
2002	p,p'-DDT	29.3 (0.8-1253)	Spain, Catalonia	919 adults (18-74 years)	(Porta et al., 2010)
2003	p,p'-DDT	2.9 (<0.64-73)	UK	154 adults (22-80 years)	(Thomas et al., 2006)
2006	p,p'-DDT	22.0 (1.16-341.9)	Spain, Barcelona	231 adults (>18 years)	(Porta et al., 2012)
2007	p,p'-DDT	6.32 (2.41-47.7)	Greece	61 adults (20-65 years)	(Kalantzi et al., 2011)*
2009-2010	p,p'-DDT	<LOD	Russia, 3 regions	209 samples (6-77 years)	(Rylander et al., 2011)*
2010-2011	p,p'-DDT (pg/mL)	All <LOD	Sweden	246 adults (18-80 years)	(Bjeremo et al., 2013)
BLOOD PLASMA					
2004	p,p'-DDE	159 (<LOD-833)	Norway	272 women (48-62 years)	(Rylander et al., 2012)*
2005-2010	p,p'-DDE	1017 (ND-16000) ^c	Greenland	1614 adults (18-88 years)	(Valera et al., 2013)
2006-2008	p,p'-DDE	79.7 (ND-1864) ^c	Canada, Nunavik	126 children (11-54 months)	(Turgeon O'Brien et al., 2012)*
2007-2008	p,p'-DDE+ p,p'-DDT	311 (292-323) ^e	Canada, Nunavut	2172 adults (>18)	(Laird et al., 2013)*
2005-2010	p,p'-DDT	25.5 (4.0-410) ^c	Greenland	1614 adults (18-88 years)	(Valera et al., 2013)
2006-2008	p,p'-DDT	<LOD (<LOD-62.7)	Nunavik, Canada	126 children (11-54 months)	(Turgeon O'Brien et al., 2012)*

Table 4. Levels of endrin in mother's milk and blood in individual research studies.

ENDRIN (ng/g lipid)					
MOTHERS MILK					
Year	Substance	Median (range)	Location	Population/No of samples	Reference
2009	Endrin	0.048 (ND-0.605) ^b	Turkey	47 women	(Cok et al., 2012)
2009-2010	Endrin	ND ^a	Belgium	84 women	(Croes et al., 2012)*
2009-2010	Endrin	ND ^a	Belgium	84 women	(Croes et al., 2012)*

Table 5. Levels of endosulfan in mother's milk and blood in individual research studies.

ENDOSULFAN (ng/g lipid)					
MOTHER'S MILK					
Year	Substance	Median (range)	Location	Population/No of samples	Reference
2009	Endosulfan-I	0.028 (ND-1.30) ^b	Turkey	47 women	(Cok et al., 2012)
2009	Endosulfan-II	0.17 (ND-1.60) ^b	Turkey	47 women	(Cok et al., 2012)

Table 6. Levels of HBCD in mother's milk and blood in individual research studies.

HBCD (ng/g lipid)					
MOTHER'S MILK					
Year	Substance	Median (range)	Location	Population/No of samples	Reference
2003-2005	HBCD	0.86 (<LOQ-31)	Norway	310 women	(Thomsen et al., 2010)
2004-2005	HBCD	1.02 (0.36-8.10) ^c	US	43 women	(Carignan et al., 2012)
2006	HBCD	1.5 ^a	Belgium	197 women (pools)	(Colles et al., 2008)*
2009-2010	HBCD	3.80 ^a	Belgium	84 women	(Croes et al., 2012)*
MATERNAL SERUM					
2001-2002	HBCD	0.7 (nd-7.4)	Netherlands	69 pregnant women	(Meijer et al., 2008)
BLOOD SERUM					
2007	HBCD	1.32 (nd-38.8)	Greece	61 adults	(Kalantzi et al., 2011)*

Table 7. Levels of HCB in mother's milk and blood in individual research studies.

HCB (ng/g lipid – unless otherwise is stated)					
MOTHER'S MILK					
Year	Substance	Median (range)	Location	Population/No of samples	Reference
2001-2003	HCB	18 (ND-180)	UK	54 women	(Kalantzi et al., 2004)
2007-2008	HCB	16 (3-140)	Germany	516 women	(Raab et al., 2013)
2009	HCB	5.45 (1.10-12.9) ^b	Turkey	47 women	(Cok et al., 2012)
2009-10	HCB	9.6 ^a	Belgium	84 women	(Croes et al., 2012)*
MATERNAL SERUM					
2004-2006	HCB	68.8	Spain	541 pregnant women	(Llop et al., 2010)*
2004-2008	HCB	33.54 (32.06-35.10) ^e	Spain	1297 pregnant women	(Ibarluzea et al., 2011)
2006	HCB	19.4	Italy	70 pregnant women	(Bergonzi et al., 2009)*
BLOOD SERUM					
2002	HCB	159 (0.8-4799)	Spain	919 adults (18-74 years)	(Porta et al., 2012)
2003	HCB	11 (<4.8-72)	UK	154 adults (22-80 years)	(Thomas et al., 2006)
2005-2007	HCB	8.7 (2.6-62.4)	US	618 girls (6-8 years)	(Windham et al., 2010)*
2006	HCB	109.0 (1.41-1210.5)	Spain	231 adults (>18 years)	(Porta et al., 2012)
2007	HCB	23.1 (5.97-192)	Greece	61 adults (20-65 years)	(Kalantzi et al., 2011)*
2009-2010	HCB	110 (<LOD-373)	Russia, Nelmin-Nos	87 women (6-77 years)	(Rylander et al., 2011)*

2009-2010	HCB	86 (<LOD-203)	Russia, Nelmin-Nos	22 men (6-77 years)	(Rylander et al., 2011)*
2009-2010	HCB	102 (32-297)	Russia, Izhma	25 women (15-55 years)	(Rylander et al., 2011)*
2009-2010	HCB	160 (46-361)	Russia, Izhma	25 men (15-55 years)	(Rylander et al., 2011)*
2009-2010	HCB	103 (35-320)	Russia, Usinsk	25 women (19-62 years)	(Rylander et al., 2011)*
2009-2010	HCB	107 (53-427)	Russia, Usinsk	25 men (19-62 years)	(Rylander et al., 2011)*
2010-2011	HCB (pg/mL)	78.5 (14.6-780)	Sweden	246 adults (18-80 years)	(Bjeremo et al., 2013)
BLOOD PLASMA					
2001-2004	HCB	43.8	Sweden	497 women (70-year olds)	(Salihovic et al., 2012)
2001-2004	HCB	37.3	Sweden	495 men (70-year olds)	(Salihovic et al., 2012)
2004	HCB	27	Norway	311 women (48-62 years)	(Rylander et al., 2012)*
2005-2010	HCB	177.5 (6.0-2300) ^c	Greenland	1614 adults (18-88 years)	(Valera et al., 2013)
2006-2008	HCB	12.3 (2.1-241.4) ^c	Canada, Nunavik	126 children (11-54 months)	(Turgeon O'Brien et al., 2012)*

Table 8. Levels of α -, β - and γ -HCH in mother's milk and blood in individual research studies.

α-HCH, β-HCH and γ-HCH (ng/g lipid-ig nothing else is stated)					
MOTHER'S MILK					
Year	Substance	Median (range)	Location	Population/No of samples	Reference
2001-2003	α -HCH	ND (ND-2)	UK	54 women	(Kalantzi et al., 2004)
2007-2008	α -HCH	<2 (<2-12)	Germany	516 women	(Raab et al., 2013)
2009	α -HCH	0.23 (0.059-1.86) ^b	Turkey	47 women	(Cok et al., 2012)
2009-2010	α -HCH	ND ^a	Belgium	84 women	(Croes et al., 2012)*
2001-2003	β -HCH	17 (1.2-1500)	UK	54 women	(Kalantzi et al., 2004)
2007-2008	β -HCH	6 (<2-1520)	Germany	516 women	(Raab et al., 2013)
2009	β -HCH	36.3 (4.88-367) ^b	Turkey	47 women	(Cok et al., 2012)
2009-2010	β -HCH	8.9 ^a	Belgium	84 women	(Croes et al., 2012)*
2001-2003	γ -HCH	0.6 (ND-7.7)	UK	54 women	(Kalantzi et al., 2004)
2007-2008	γ -HCH	<1 (<1-34)	Germany	516 women	(Raab et al., 2013)
2009	γ -HCH	0.34 (0.089-1.94) ^b	Turkey	47 women	(Cok et al., 2012)
2009-2010	γ -HCH	ND ^a	Belgium	84 women	(Croes et al., 2012)*
MATERNAL SERUM					
2004-2006	β -HCH	22.75	Spain	541 pregnant women	(Llop et al., 2010)*
2004-2008	β -HCH	19.14 (18.17-20.16) ^e	Spain	1297 pregnant women	(Ibarluzea et al., 2011)
MATERNAL PLASMA					
2005-2007	β -HCH	2.6 (ND-989) ^c	Canada	123 pregnant women	(Foster et al., 2012)*
2005-2007	γ -HCH	All <LOD	Canada	123 pregnant women	(Foster et al., 2012)*
MATERNAL WHOLE BLOOD					
2000-2002	α -HCH (ng/L)	0.00095 (0.00009-0.04)	Germany	226 pregnant women	(Wittsiepe et al., 2008)*
2000-2002	β -HCH (ng/L)	0.067 (0.0045-1.3)	Germany	226 pregnant women	(Wittsiepe et al., 2008)*
2000-2002	γ -HCH (ng/L)	0.0016 (0.0002-0.037)	Germany	226 pregnant women	(Wittsiepe et al., 2008)*
BLOOD SERUM					
2003	α -HCH	<0.48 (<0.48-23)	UK	154 adults (22-80 years)	(Thomas et al., 2006)
2007	α -HCH	ND (ND-1.64)	Greece	61 adults (20-65 years)	(Kalantzi et al., 2011)
2009-2010	α -HCH	All <LOD	Russia, 3 regions	209 samples (6-77 years)	(Rylander et al., 2011)*
2002	β -HCH	91.9 (1.4-2716)	Spain, Catalonia	919 adults (18-74 years)	(Porta et al., 2010)
2003	β -HCH	12 (<0.68-80)	UK	154 adults (22-80 years)	(Thomas et al., 2006)
2006	β -HCH	64.2 (1.5-898)	Spain, Barcelona	231 adults (>18years)	(Porta et al., 2012)
2007	β -HCH	17.8 (4.15-143)	Greece	61 adults (20-65 years)	(Kalantzi et al., 2011)*
2009-2010	β -HCH	All <LOD	Russia, 3 regions	209 samples (6-77 years)	(Rylander et al., 2011)*

2010-2011	β -HCH (pg/mL)	29.1 (4.1-368)	Sweden	246 adults (18-80 years)	(Bjeremo et al., 2013)
2003	γ -HCH	<1.7 (<1.7-110)	UK	154 adults (22-80 years)	(Thomas et al., 2006)
2009-2010	γ -HCH	All <LOD	Russia, 3 regions	209 samples (6-77 years)	(Rylander et al., 2011)*
BLOOD PLASMA					
2005-2010	β -HCH	27.0 (1.0-530) ^c	Greenland	1614 adults (18-88 years)	(Valera et al., 2013)
2006-2008	β -HCH	2.7 (ND-39.7) ^c	Nunavik, Canada	126 children (11-54 months)	(Turgeon O'Brien et al., 2012)*
2006-2008	γ -HCH	ND (ND-2.1)	Nunavik, Canada	126 children (11-54 months)	(Turgeon O'Brien et al., 2012)*

Table 9. Levels of mirex in mother's milk and blood in individual research studies.

MIREX (ng/g lipid)					
MOTHER'S MILK					
Year	Substance	Median (range)	Location	Population/No of samples	Reference
2009	Mirex	0.073 (ND-0.90) ^b	Turkey	47 women	(Cok et al., 2012)
2009-2010	Mirex	ND ^a	Belgium	84 women	(Croes et al., 2012)*
MATERNAL PLASMA					
2005-2007	Mirex	ND (ND-5,3)	Canada	123 pregnant women	(Foster et al., 2012)*
BLOOD SERUM					
2009-2010	Mirex	All <LOD	Russia, 3 regions	209 samples (6-77 years)	(Rylander et al., 2011)*
BLOOD PLASMA					
2005-2010	Mirex	31,1 (ND-760) ^c	Greenland	1614 adults (18-88 years)	(Valera et al., 2013)
2006-2008	Mirex	ND (ND-23,9)	Canada, Nunavik	126 children (11-54 months)	(Turgeon O'Brien et al., 2012)*

Table 10. Levels of PBB-153 in mother's milk and blood in individual research studies.

PBB-153 (ng/g lipid)					
MATERNAL PLASMA					
Year	Substance	Median (range)	Location	Population/No of samples	Reference
2007	BB153	0.18 (<0.014-0.85)	Denmark	51 pregnant women	(Frederiksen et al., 2010)
BLOOD SERUM					
2009-2010	PBB153	0.35 (ND-84.3)	USA	316 pregnant women	(Horton et al., 2013)*
BLOOD PLASMA					
2004	PBB 153	ND (ND-63.0)	Canada, Nunavik	883 adults (18-89 years)	(Dallaire et al., 2009)
2006-2008	PBB153	ND (ND-6.3)	Canada, Nunavik	109 children (11-54 months)	(Turgeon O'Brien et al., 2012)*

Table 11. Levels of PBDEs in mother's milk and blood in individual research studies.

PBDE (ng/g lipid - if nothing else is stated)					
MOTHER'S MILK					
Year	Substance	Median (range)	Location	Population/No of samples	Reference
2004-2006	BDE 47	1.15 (0.34-12.0)	France	77 women	(Antignac et al., 2009)
2009-10	BDE 47	0.67 ^a	Belgium	84 women	(Croes et al., 2012)*
2001-2003	Σ 15 PBDE	6.3 (0.3-69)	UK	54 women	(Kalantzi et al., 2004)
2002/2003	Σ 6 PBDE	10.2 ^a	Australia	157 women	(Toms et al., 2007)
2003-2005	Σ 7 PBDE	2.1 (0.48-82)	Norway	393 women	(Thomsen et al., 2010)
2003-2004	Σ 12 PBDE	2 (1.1-21)	Spain, Vallecas	22 women	(Gomara et al., 2007)*
2003-2004	Σ 12 PBDE	2.1 (0.55-8.1)	Spain, Getafe	30 women	(Gomara et al., 2007)*

2003-2004	Σ 4 PBDE	11 (2.7-108)	Canada, Kingston	39 women	(Siddique et al., 2012)
2004-2006	Σ 5 PBDE	51 (1.2-2010)	USA, North Carolina	303 women	(Daniels et al., 2010)*
2005	Σ 5 PBDE	1.62 (0.57-6.54)	Germany	42 women,	(Raab et al., 2008)
2006	Σ 7 PBDE	3.0 (2.0-6.4) ^a	Belgium	22 pools (a' 3-16 women)	(Roosens et al., 2010)*
2006	Σ 4 PBDE	1.50 (0.15-20.0) ^b	Germany	507 women	(Hoopmann et al., 2012)
2007	Σ 4 PBDE	1.31 (0.33-17.2) ^b	Germany	571 women	(Hoopmann et al., 2012)
2008	Σ 4 PBDE	1.31 (0.38-27.5) ^b	Germany	652 women	(Hoopmann et al., 2012)
2009	Σ 4 PBDE	1.12 (0.15-27.5) ^b	Germany	443 women	(Hoopmann et al., 2012)
2008-2009	Σ 4 PBDE	15 (2.9-119)	Canada, Sherbroke	48 women	(Siddique et al., 2012)
MATERNAL SERUM					
1999-2000	BDE 47	14.9 (12.9-17.2) ^e	USA	223 pregnant women	(Harley et al., 2010)
2001-2002	BDE 47	0.8 (0.04-6.1)	Netherlands	69 pregnant women	(Meijer et al., 2008)
2004-2006	BDE 47	2.83 (0.56-4.84)	France	91 pregnant women	(Antignac et al., 2009)
2005-2007	BDE 47	9.9 (ND-232) ^c	Canada	123 pregnant women	(Foster et al., 2012)*
2009-2010	BDE 47	7.90 (ND-1600)	USA	316 pregnant women	(Horton et al., 2013)*
2003-2004	Σ 12 PBDE	9.1 (4.3-26)	Spain, Vallecas	61 pregnant women	(Gomara et al., 2007)*
2003-2004	Σ 12 PBDE	7.8 (3.2-44)	Spain, Getafe	52 pregnant women	(Gomara et al., 2007)*
2003-2005	Σ 14 PBDE	9.6 (ND-120)	Spain, Valencia	174 pregnant women	(Vizcaino et al., 2011)*
2004-2005	Σ 9 PBDE	52.1 (21.4-1287)	Canada	97 pregnant women	(Foster et al., 2011)
2008-2010	Σ 4 PBDE	36.9 (3.59-694)	USA	140 pregnant women	(Buttke et al., 2013)
MATERNAL PLASMA					
2007	Σ 6 PBDE	1.76 (0.64-51.9)	Denmark	51 pregnant women	(Frederiksen et al., 2010)
BLOOD SERUM					
2003	BDE 47	2.9 (0.05-2800)	Finland	1988 elderly (57-70 years)	(Airaksinen et al., 2011)*
2001	Σ 6 PBDE	6.12 (2.72-20.1)	New Zealand	23 adults (20-69 years)	(Harrad and Porter 2007)
2002	Σ 7 PBDE	8.0 (0.99-121)	Spain, Catalonia	731 adults (18-74 years)	(Gari and Grimalt 2013)*
2003-2004	Σ 7 PBDE	3.83 (3.57-4.53)	Belgium	1286 children (14-15 years)	(Roosens et al., 2010)*
2004-2005	Σ 7 PBDE	4.55 (3.92-6.47)	Belgium	1515 adults (50-65 years)	(Roosens et al., 2010)*
2003	Σ 22 PBDE	5.6 (0.63-420)	UK	154 adults (22-80 years)	(Thomas et al., 2006)
2005-2007	Σ 6 PBDE	79.3 (31.4-1399)	US	618 girls (6-8 years)	(Windham et al., 2010)*
2007	Σ 5 PBDE	1.07 (0.68-13.3)	Greece	61 adults	(Kalantzi et al., 2011)*
BLOOD PLASMA					
2001-2004	BDE 47	1.9	Sweden	497 women (70-year olds)	(Salihovic et al., 2012)
2001-2004	BDE 47	2.2	Sweden	495 men (70-year olds)	(Salihovic et al., 2012)
2004	BDE 47	5.7 (ND-343.5) ^c	Canada, Nunavik	883 adults (18-89 years)	(Dallaire et al., 2009)
2006-2008	Σ 4 PBDE	59.8 (14.6-951) ^c	Canada, Nunavik	126 children (11-54 months)	(Turgeon O'Brien et al., 2012)*
2007-2008	Σ 3 PBDE	13.4 (3.4-2130) ^c	Canada, Nunavut	2172 adults (>18)	(Laird et al., 2013)*

Table 12. Levels of PCBs in mother's milk and blood in individual research studies.

PCB (ng/g lipid, if nothing else is stated)					
MOTHER'S MILK					
Year	Substance	Median (range)	Location	Population/No of samples	Reference
2007	PCB 153	76.6 (16.5-223)	France	44 women	(Focant et al., 2013)
2007-2008	PCB 153	41 (6-470)	Germany	516 women	(Raab et al., 2013)
2001-2003	Σ 15 PCB	180 (26-530)	United Kingdom	54 women	(Kalantzi et al., 2004)
2009	Σ 6 PCB	8.07 (±3.54) ^d	Turkey	47 women	(Cok et al., 2012)
2009-10	Σ 6 PCB	70.2*	Belgium	84 women	(Croes et al., 2012)*
MATERNAL SERUM					
2001-2002	PCB 153	63 (19-230)	Netherlands	90 pregnant women	(Meijer et al., 2008)
2004-2008	PCB 153	38.9 (37.5-40.4) ^e	Spain	1297 pregnant women	(Ibarluzea et al., 2011)
2004-2006	Σ 4 PCB	124	Spain	541 pregnant women	(Llop et al., 2010)*
2006	Σ 14 PCB	198	Italy (Polluted area)	70 pregnant women	(Bergonzi et al., 2009)*
MATERNAL PLASMA					
2005-2007	PCB 153	6.3 (1.3-49) ^c	Canada	123 pregnant women	(Foster et al., 2012)*
BLOOD SERUM					
2002	PCB 153	100 (0.7-1912) ^c	Spain, Catalonia	919 adults (18-74 years)	(Porta et al., 2010)
2003	PCB 153	290 (6.5-1600)	Finland	1988 elderly (57-70 years)	(Airaksinen et al., 2011)*
2006	PCB 153	68.6 (1.05-549)	Spain, Barcelona	231 adults (>18years)	(Porta et al., 2012)
2009-2010	PCB 153	78 (<LOD-534)	Russia, Nelmin-Nos	87 women (6-77 years)	(Rylander et al., 2011)*
2009-2010	PCB 153	92 (<LOD-222)	Russia, Nelmin-Nos	22 men (6-77 years)	(Rylander et al., 2011)*
2009-2010	PCB 153	59 (<LOD-156)	Russia, Izhma	25 women (15-55 years)	(Rylander et al., 2011)*
2009-2010	PCB 153	106 (<LOD-297)	Russia, Izhma	25 men (15-55 years)	(Rylander et al., 2011)*
2009-2010	PCB 153	67 (<LOD-137)	Russia, Usinsk	25 women (19-62 years)	(Rylander et al., 2011)*
2009-2010	PCB 153	97 (36-236)	Russia, Usinsk	25 men (19-62 years)	(Rylander et al., 2011)*
2010-2011	PCB 153 (pg/mL)	468.8 (42.1-2788.6)	Sweden	246 adults	(Bjermo et al., 2013)
2003	Σ 41 PCB	170 (14-670)	United Kingdom	154 adults (22-80 years)	(Thomas et al., 2006)
2005-2007	Σ 6 PCB	32.0 (15.7-708.9)	US	618 girls (6-8 years)	(Windham et al., 2010)*
2007	Σ 11 PCB	110 (36.03-402)	Greece	61 adults	(Kalantzi et al., 2011)*
BLOOD PLASMA					
2001-2004	PCB 153	219	Sweden	497 women (70-year olds)	(Salihovic et al., 2012).
2001-2004	PCB 153	248	Sweden	495 men (70 year olds)	(Salihovic et al., 2012)
2004	PCB 153	190 (6-5805) ^c	Canada, Nunavik	883 adults (18-89 years)	(Dallaire et al., 2009)
2004	PCB 153	82 (<LOD-211)	Norway	273 women (48-62 years)	(Rylander et al., 2012)*
2005-2010	PCB 153	504 (7.5-7700) ^c	Greenland	1614 adults (18-88 years)	(Valera et al., 2013)
2006-2008	Σ 10 PCB	72.1 (7.7-3060) ^c	Canada, Nunavik	126 children (11-54 months)	(Turgeon O'Brien et al., 2012)*
2007-2008	Σ 14 PCB	409 (35.1-16500) ^c	Canada, Nunavut	2172 adults (>18)	(Laird et al., 2013)*

Table 13. Levels of dioxins (PCDD/Fs) in mother's milk and blood in individual research studies.

PCDD/F					
MOTHERS MILK					
Year	Substance (pg/g lipid)	Median (range)	Location	Population/No of samples	Reference
2007	PCDD/Fs WHO ₂₀₀₅ -TEQ	9.2 (0.7-39.6)	France	44 women	(Focant et al., 2013)
2007-2008	PCDD/F WHO ₂₀₀₅ -TEQ	4.8	Germany	273 women	(Raab et al., 2013)
2009-10	PCDD/F WHO ₁₉₉₈ -TEQ	8.4 ^a	Belgium	84 women	(Croes et al., 2012)*
MATERNAL WHOLE BLOOD					
2000-2002	PCDD/Fs WHO ₂₀₀₅ -TEQ	13.1 (2.4-46.4)	Germany	226 pregnant women	(Wittsiepe et al., 2008)*
BLOOD SERUM					
2003-2005	PCDD WHO ₂₀₀₅ -TEQ	10 (0.6-88)	Russia	446 mothers (23-52 years)	(Humblet et al., 2010)*
2003-2005	PCDF WHO ₂₀₀₅ -TEQ	4.6 (0.3-147)	Russia	446 mothers (23-52 years)	(Humblet et al., 2010)*
WHOLE BLOOD					
2004-2005	PCDD/F WHO ₂₀₀₅ -TEQ	12.4 (2.78-39.0)	Norway	63 adults (31-88 years)	(Knutsen et al., 2011)*

Table 14. Levels of PeCB in mother's milk and blood in individual research studies.

PeCB (ng/g lipid)					
MOTHER'S MILK					
Year	Substance	Median (range)	Location	Population/No of samples	Reference
2008	PeCB	ND (ND-13.5)	New Zealand	39 women	(Mannetje et al., 2013)*
2009	PeCB	0.31 (0.063-2.56) ^b	Turkey	47 women	(Cok et al., 2012)
BLOOD SERUM					
2006	PeCB	ND (ND-57.68)	Spain	231 adults (>18 years)	(Porta et al., 2012)

Table 15. Levels of PFOS in mother's milk and blood in individual research studies.

PFOS (ng/mL – if nothing else is stated)					
MOTHER'S MILK					
Year	Substance	Median (range)	Location	Population/No of samples	Reference
2006	PFOS	2.9 (<0.4-28.2) ^a	Belgium	22 pools (a'3-16 women)	(Roosens et al., 2010)*
2007	PFOS	0.079 (ND-0.330)	France	48 women	(Antignac et al., 2013)
2007-2008	PFOS	0.05 (<0.02-0.26)	Germany	302 women	(Croes et al., 2012)
2008	PFOS	0.087 (0.040-0.25)	Norway	19 women	(Haug et al., 2011)
2009-2010	PFOS	0.10	Belgium	40 women	(Croes et al., 2012)
2010	PFOS	0.057 (0.015-0.29) ^b	Italy, Bologna	21 women	(Barbarossa et al., 2013)
MATERNAL SERUM					
2004-2005	PFOS	16.6 (10.8-22.9)	Canada	101 pregnant women	(Monroy et al., 2008)*
MATERNAL PLASMA					
1996-2002	PFOS	35.3 (6.4-107) ^b	Denmark	1399 pregnant women	(Fei et al., 2007)
BLOOD SERUM					
2001	PFOS	3.5 (NA-8)	Italy	8 adult women	(Kannan et al., 2004)
2001	PFOS	4.2 (NA-10.3)	Italy	42 adult men	(Kannan et al., 2004)
2002	PFOS	28.8 (3.7-65.1) ^b	Canada	56 adults (>20 years)	(Kubwabo et al., 2004)
2002-2003	PFOS	20.8 (12.7-29.5)	Australia	3802 samples (>16 years)	(Kärman et al., 2006)
2003-2004	PFOS	44.8 (34.9-64.4) ^a	Belgium	1286 children (14-15 years)	(Roosens et al., 2010)*

2004-2005	PFOS	62.5 (9.1-171) ^a	Belgium	1515 adults (50-65 years)	(Roosens et al., 2010)*
2006-2007	PFOS	14.8 (5-28.5) ^a	Australia	2420 children and adults	(Toms et al., 2009)*
2008	PFOS	6.3 (0.06-29.6)	Italy	230 adults (20-65 years)	(Ingelido et al., 2010)
2009	PFOS	13.7 (6.97-30.4)	Greece (Athens)	27 males (24-66 years)	(Vassiliadou et al., 2010)
2009	PFOS	7.03 (2.27-16.6)	Greece (Athens)	29 females (24-51 years)	(Vassiliadou et al., 2010)
2009	PFOS	10.5 (3.46-40.4)	Greece (Rural)	27 males (15-88 years)	(Vassiliadou et al., 2010)
2009	PFOS	8.47 (2.63-26.4)	Greece (Rural)	59 females (15-87 years)	(Vassiliadou et al., 2010)
BLOOD PLASMA					
1998 & 2000	PFOS	10.4 (4.9-19)	Belgium	4 adult females	(Kannan et al., 2004)
1998 & 2000	PFOS	17.6 (4.5-27)	Belgium	16 adult men	(Kannan et al., 2004)
2001	PFOS	35.8 (ND-1656)	USA	645 adults (20-69 years)	(Olsen et al., 2008)
2003-2004	PFOS	22.3 (6.2-131)	Germany	105 samples (5-84 years)	(Midasch et al., 2006)
2004	PFOS	18.7 (0.48-740) ^c	Canada, Nunavik	883 adults (18-89 years)	(Dallaire et al., 2009)
2004	PFOS	20 (5.4-84)	Norway	326 women (48-62 years)	(Rylander et al., 2010)*
2005	PFOS	12.2 (2.1-55.0)	Germany	356 adults (18-67 years)	(Fromme et al., 2007)07
2006	PFOS	14.2 (ND-77.9)	USA	600 adults (20-69 years)	(Olsen et al., 2008)
2006-2008	PFOS (ng/L)	3.37 (0.91-31.0) ^c	Canada, Nunavik	126 children (11-54 months)	(Turgeon O'Brien et al., 2012)*
2010	PFOS	8.6 (ND-102)	USA	600 adults (20-69 years)	(Olsen et al., 2008)

Table 16. Levels of toxaphene in mother's milk and blood in individual research studies.

TOXAPHENE (ng/g lipid)					
MOTHER'S MILK					
Year	Substance	Median (range)	Location	Population/No of samples	Reference
2009-2010	Parlar 26	0.5 ^a	Belgium	84 women	(Croes et al., 2012)*
2009-2010	Parlar 50	1.8 ^a	Belgium	84 women	(Croes et al., 2012)*
2009-2010	Parlar 62	ND ^a	Belgium	84 women	(Croes et al., 2012)*
BLOOD PLASMA					
2006-2008	Parlar 26	2.2 (0.3-81.0) ^c	Canada, Nunavik	126 children (11-54 months)	(Turgeon O'Brien et al., 2012)*
2006-2008	Parlar 50	3.5 (0.3-121) ^c	Canada, Nunavik	126 children (11-54 months)	(Turgeon O'Brien et al., 2012)*
2007-2008	Σ Parlar 26+50	28.7 (0.55-1510) ^c	Canada, Nunavik	2172 adults (>18)	(Laird et al., 2013)*

a) Pooled sample/s

b) Arithmetic mean (range)

c) Geometric mean (range)

d) Arithmetic mean (standard deviation)

e) Geometric mean (95% confidence interval)

*) External Quality control (e.g. AMAP ringtest and G-EQUAS) or pooled sample analyzed by the WHO reference laboratory.

ND) Not detected

<LOD) Lower than the Limit of Detection

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