

Table 12-A1. Guidelines for DDT/DDE/DDD.

Location	WHO	Canada	Greenland	Finland	Iceland	Norway	Russia	Sweden	United States
TDI <i>p,p'</i> -DDE - 20	ADI (µg/kg bw/d) ΣDDT + metabolites) <i>p,p'</i> -DDD - 20 <i>p,p'</i> -DDT - 20	20 µg/kg bw/d					ΣDDT **	20 µg/kg bw/d	
Drinking water	2 µg/L DDT 20 µg/L methoxychlor	0.03 mg/L (DDT and metabolites)* 0.9 mg/L (methoxychlor)*					10 µg/L	***	
Ambient air value							5 µg/m ³		
Human blood	200 µg/L total DDT								
Human urine									
Breast milk									
Hair									

* MAC. ** WHO/FAO (WHO 1984b). The use of DDT is banned in Sweden since 1970. *** are not allowed to be present in detectable amounts. Valid for all pesticides.

USA: EPA banned the use of DDT.
DDT: Animal carcinogen 8 h time-weighted average, 1 mg/m³.
OSHA 1 mg/m³ (skin) TWA.

Table 12-A2. Guidelines for HCH.

Location	WHO	Canada	Greenland	Finland	Iceland	Norway	Russia	Sweden	United States
TDI	8 µg/kg bw/d (γ-HCH, lindane)*	0.3 µg/kg bw/d **				8 µg/L ***		8 µg/kg; all usage forbidden 1988	
Drinking water		4 µg/L (MAC)				0.1 µg/L ****	α-HCH 10 µg/L β-HCH 10 µg/L γ-HCH 4 µg/L		0.2 µg/L
Ambient air value									
Human blood									
Human urine									
Breast milk									
Hair									

* no TDI established for α-HCH or β-HCH. ** Σ(α-HCH, β-HCH, γ-HCH, δ-HCH). *** JMPR 1989 (FAO/WHO). **** Maximum residue level for pesticides in drinking water:
0.1 µg/L: for each pesticide;
0.5 µg/L: sum of several pesticides in one sample;
Council Directive 80/778/EEC.

Table 12-A3. Guidelines for mirex.

Location	WHO	Canada	Greenland	Finland	Iceland	Norway	Russia	Sweden	United States
TDI		(PTDI) 0.07 µg/kg bw/d							
Drinking water		No guideline							
Ambient air value									
Human blood									
Human urine									
Breast milk									
Hair									

USA: Reasonably anticipated to be a carcinogen.
FDA action level, fish 0.1 ppm.
Pesticide registration cancelled.
EPA, IRIS: RFD (oral) 2.00 × 10⁻⁴ mg/kg/d.

Table 12-A4. Guidelines for dioxin (TCDD toxequivalents).

Location	WHO	Canada	Greenland	Finland	Iceland	Norway	Russia	Sweden	United States
TDI	10 pg/kg bw/d	10 pg/kg bw/d				0-35 pg/kg bw/week* 5 pg/kg bw/d	10 pg/kg bw/d 20 pg/L	35 pg/kg bw/week*	
Drinking water		15 pg/L (Ontario)					20 pg/L		30 pg/L
Ambient air value		30 ppt (Ontario)							
Human blood									
Human urine									
Breast milk									
Hair									

* Nordic expert group 1988.

USA: Reasonably anticipated to be a carcinogen.

NIOSH: Potential occupational carcinogen, limited exposure to the lowest feasible concentration.

Table 12-A5. Guidelines for furans (TCDD toxequivalents).

Location	WHO	Canada	Greenland	Finland	Iceland	Norway	Russia	Sweden	United States
TDI	10 pg/kg bw/d	10 pg/kg bw/d				5 pg/kg bw/d*	10 pg/kg bw/d	5 pg/kg bw/d*	
Drinking water		15 pg/L (Ontario)					20 pg/L		
Ambient air value		30 ppt (Ontario)							
Human blood									
Human urine									
Breast milk									
Hair									

* Nordic expert group 1988.

USA: Oral minimal risk level for 2,3,4,7,8-penta CDF = 0.001 µg/kg for 14 days or less.

Oral minimal risk level for 2,3,4,7,8-penta CDF = 0.00003 µg/kg for 15-364 days.

Table 12-A6. Guidelines for PCB.

Location	WHO	Canada	Greenland	Finland	Iceland	Norway	Russia	Sweden	United States
TDI		PTDI 1.0 µg/kg bw/d				5 pg/kg bw/d TCDD-eq***		All usage forbidden 1980. Restrictions for fish intake	
Drinking water		IMAC, 3 µg/L				0.1/0.5 µg/L	1 µg/L	0.2 µg/L (PAH)	0.5 µg/L
Ambient air value									
Human blood		**							
Human urine									
Breast milk		50 µg/L*							
Hair									

* Guidance value (for infants).

**	Women of reproductive age (µg/L)	Men and post-menopausal women (µg/L)
Tolerable	< 5	< 20
Concern	5-100	20-100
Action	100	100

*** Nordic expert group 1988.

USA: EPA considers PCBs to be probable cancer causing in humans.

ADI = 0.0035 mg/L calculated.

TLV TWA: 1 mg/m³ skin (42% chlor), 0.5 mg/m³ skin (54% chlor).

EPA, IRIS: MCL = 0.0005 mg/L.

OSHA TWA: 1 mg/m³ (skin) (42% chlor), 0.05 mg/m³ (skin) (54% chlor).

NIOSH TWA: 0.001 mg/m³ (42% or 54% chlor).

Table 12-A7. Guidelines for mercury.

Location	WHO	Canada	Greenland	Finland	Iceland	Norway	Russia	Sweden	United States
TDI	*	* PTDI						*****	
Drinking water	Total Hg, 1 µg/L	MAC, 1.0 µg/L		1 µg/L			5 µg/L	1 µg/L*****	2 µg/L
Ambient air value							3 µg/m ³ ****		
Human blood		**				1.7-9.9 µg/L***			
Human urine						0.1-6.9 µg/L			
Breast milk									
Hair		**							

* 0.47 µg/kg bw/d (methyl mercury). 0.71 µg/kg bw/d (total Hg).

**	Whole blood (ppb)	Hair (ppm)
Normal acceptable range	20	6
Increasing risk	20-100	6-30
At risk	> 100	> 30

*** Depending on diet. **** Work place 0.05 µg/m³. ***** Target value 0.1 µg/L. ***** Same as FAO/WHO limit values in fish. Recommendations for fish consumption.

USA: Drinking water, EPA & FDA 2 ppb mercury, water in rivers, lakes and streams 14.4 ppt.
 FDA, seafood products 1 ppm methylmercury.
 Occupational std. metallic mercury, inorganic forms 0.05 mg/m³.
 Wholeblood normal levels < 0.5-2 µg/100 mL (ASTDR), Urine, normal levels 0.43-11.4 µg/mL (ASTDR).
 Minimal Risk Level, MRL; proposed MRL for methylmercury = 14 ppm, MRL of 2 × 10⁻⁵ has been derived for normal inhalation to metallic mercury vapor.
 MRL of 1.4 × 10⁻⁵ mg/m³ was derived for chronic inhalation of metallic mercury vapor.
 MRL of 0.007 mg mercury/kg/d has been derived for acute oral exposure, inorganic mercury.
 MRL of 0.002 mg mercury/kg/d has been derived for intermediate oral exposure to inorganic mercury.
 MRL of 1.2 × 10⁻⁴ mg mercury/kg/d has been derived from acute/intermediate oral exposure to methyl mercury.

Table 12-A8. Guidelines for lead.

Location	WHO	Canada	Greenland	Finland	Iceland	Norway	Russia	Sweden	United States
TDI	*	**		50 µg/L				***	
Drinking water	1 µg/L	MAC, 1 µg/L					30 µg/L	10 µg/L	15 µg/L
Annual ambient air value		0.5-1 µg/m ³				0.2 µg/m ³	0.3 µg/m ³		1.5 µg/m ³
Human blood						40-278 µg/L		165-518 µg/L****	98 µg/L
Human urine						12-27 µg/L			
Breast milk									Excreted in milk, up to 12 µg/L
Hair									

* ADI: 3.5 µg/kg bw/d. PTDI: 3.57 µg/kg bw/d (children). ** PTDI 3.57 µg/kg bw/d (adult + children). *** Same as FAO/WHO. Recommendations for growing. Limit values in food. **** Workers, lower values for fertile women than for men and women above 50.

USA: TLV; Animal carcinogen. Threshold limit value; TWA 0.05 mg/m³ lead elements, Threshold limit value; TWA 0.15 mg/m³ lead arsenar, OSHA TWA; 0.2 mg(Pb)/m³.
 TLV; Biological exposure index; lead in blood 30 µg/100mL
 National primary and secondary ambient air quality standards for lead at its compounds are 1.5 µg/m³ over a calendar quarter.
 - Average blood levels in 1980 in US 98 µg/L.
 - Body burden - Average USA adult is reported to be not less than 100 mg and not more than 300 mg.

Table 12-A9. Guidelines for cadmium.

Location	WHO	Canada	Greenland	Finland	Iceland	Norway	Russia	Sweden	United States
TDI	1.0 µg/kg bw/d	PTDI, 1 µg/kg bw/d*				240 µg		*****	
Drinking water	400-500 µg/week/adult	5 µg/L		5 µg/L			1 µg/L	1 µg/L****	5 µg/L
Ambient air value	7.0 µg/kg bw/week						1 µg/m ³		
Human blood						< 2 µg/L** < 6 µg/L***		< 11 µg/L	
Human urine									
Breast milk									
Hair									

* Reported as PTWI = 7.0 µg/kg bw/week. ** Non-smokers. *** Smokers. **** Target value 0.1 µg/L. ***** TDI same as FAO/WHO. Advice for consumption of liver, kidney and mushrooms.

USA: TLV Suspected human carcinogen.

8 h, time weighted average: 0.01 mg/m³ (total dust).

8 h, time weighted average: 0.002 mg/m³ (respirable fraction).

EPA = Maximum contaminant level = 0.005 mg/L.

FDA set maximum concentration level of 0.01 mg Cd/L in bottled water and limits leaching from pottery and enamel to 0.5 µg/mL

OSHA TWA = dust 200 µg/m³ and fume 100 µg/m³.

NIOSH: Lowest feasible concentration.

Table 12-A10. Guidelines for nickel.

Location	WHO	Canada	Greenland	Finland	Iceland	Norway	Russia	Sweden	United States
TDI									
Drinking water				50 µg/L			100 µg/L	50 µg/L**	100 µg/L
Ambient air value							1 µg/m ³ *		
Human blood						0.24-2.8 µg/L			
Human urine						0.06-1.74 µg/L			
Breast milk									
Hair									

* Workplace 10 µg/m³. ** Target value 10 µg/L.

USA: EPA, IRIS: 100 µg Ni/L.

OSHA TWA: 1000 µg/m³ metal and soluble nickel compounds.

NIOSH: Potential occupational carcinogen 15 µg/m³. TLV: Confirmed human carcinogen.

Table 12-A11. Guidelines for arsenic.

Location	WHO	Canada	Greenland	Finland	Iceland	Norway	Russia	Sweden	United States
TDI	2.0 µg/kg bw/d*					190 µg/d			
Drinking water	10 µg/L	25 µg/L		50 µg/L		50 µg/L	50 µg/L	10 µg/L	50 µg/L
Ambient air value						10 µg/m ³	3 µg/m ³		
Human blood						0.5 µg/L**			
Human urine						0.5 µg/L**			
Breast milk									
Hair									

* As organic arsenic. ** Very unsecure – must be evaluated.

Table 12-A12. Plasma levels of persistent organic pollutants.

	Year(s) collected	n	Mean type A: arithmetic B: geometric	Mean \pm SD ($\mu\text{g/L}$ blood plasma)				
				ΣDDT^*	ΣPCB^{**}	$\Sigma\text{chlordanes}^{***}$	HCB	$\beta\text{-HCH}$
Maternal blood								
<i>Canada</i>								
Western Northwest Territories, Dene/Métis	1995	51	A G	1.3 0.9	2.2 \pm 2.2 1.6	0.2 0.1	0.3 \pm 0.3 0.2	0.1 \pm 0.3 0.1
North-central Northwest Territories, Inuit	1995	67	A G	1.9 1.4	6.1 \pm 5.1 4.3	1.0 0.7	0.8 \pm 0.8 0.5	0.1 \pm 0.1 0.1
Nunavik	1995	196	A G	6.0 4.6	13.4 \pm 10.8 10.0	2.0 1.4	0.9 \pm 0.7 0.7	0.1 \pm 0.1 0.1
<i>Russia</i>								
Norilsk	1995	26	A G	0.94 \pm 0.06 0.9	9.9 \pm 1.5 6.4	0.46 \pm 0.06 0.5	0.42 \pm 0.1 0.4	
Salekhard	1995	16	A G	0.71 \pm 0.07 0.7	10.3 \pm 3.8 4.8	0.48 \pm 0.94 0.5	0.40 \pm 1.7 0.4	
Nikel	1995	51	A G	3.9 3.4	4.6 \pm 1.9 4.2	0.2 0.1	0.5 \pm 0.3 0.5	1.9 \pm 1.2 1.7
<i>Greenland</i>	1995	117	A G	5.2 4.0	19.3 \pm 15.2 14.8	3.0 1.6	1.2 \pm 1.0 0.9	0.2 \pm 0.1 0.2
<i>Sweden</i>	1995	40	A G	1.1 0.9	6.6 \pm 2.8 6.1	0.1 0.1	0.2 \pm 0.1 0.2	0.1 \pm 0.1 0.1
<i>Norway</i>	1995	63	A G	0.9 0.7	4.0 \pm 1.7 3.6	0.1 0.1	0.4 \pm 1.0 0.2	0.1 \pm 0.2 0.1
<i>Iceland</i>	1995	40	A G	1.1 0.9	4.9 \pm 1.9 4.6	0.2 0.1	0.4 \pm 0.2 0.3	0.3 \pm 0.2 0.3
Cord blood								
<i>Canada</i>								
Nunavik, northern Quebec	1993-96	273	A G	1.33 1.01	2.47 1.94	0.31 0.24	0.18 0.14	0.03 0.02
Western Northwest Territories, Dene/Métis	1994-95	47	A G	0.34 0.27	0.46 \pm 0.43 0.24	0.07 0.05	0.08 \pm 0.08 0.06	0.02 \pm 0.01 0.02
North-central Northwest Territories, Inuit	1994-95	62	A G	1.34 1.01	1.32 \pm 1.08 0.96	0.18 0.12	0.18 \pm 0.15 0.14	0.03 \pm 0.02 0.03
<i>Russia</i>								
Norilsk	1995	26	A	0.57 \pm 0.08	2.1 \pm 0.10	0.14 \pm 0.04	0.12 \pm 0.02	
Salekhard	1995	16	A	0.62 \pm 0.12	1.6 \pm 0.22	0.11 \pm 0.04	0.18 \pm 0.02	

* Includes DDT + DDE. * As Aroclor 1260. * Includes α - + γ -chlordanes, *cis*-nonachlor, oxychlordanes and *trans*-nonachlor.

Table 12-A13. Blood levels of metals.

	Year(s) collected	n	Mean type A: arithmetic G: geometric	Mean \pm SD ($\mu\text{g/L}$ blood plasma)					
				Pb (whole blood)	Hg (whole blood)	Cd (whole blood)	Se (whole blood, except P: plasma, S: serum)	Cu (serum, except P: plasma)	Zn (serum, except P: plasma)
<i>Greenland</i>									
Disko	1994-95	43	G	51.4 \pm 62.7	19.8 \pm 16.3	1.29 \pm 1.2	64.3 \pm 13.4 (P)	2070 \pm 510 (P)	580 \pm 120 (P)
<i>Canada</i>									
North-central Northwest Territories, Inuit	1978-88	16	A	17.17615.48					
Western Northwest Territories, Dene/Metis	1994-95	51	G	28.3	1.7	0.7			
			A	32.5 \pm 17.0	2.0 \pm 1.1	1.3 \pm 1.4			
North-central Northwest Territories, Inuit	1994-95	67	G	36.1	3.5	1.8			
			A	42.2 \pm 26.2	4.3 \pm 26.2	2.6 \pm 1.7			
Nunavik	1994-95	198	G	82.9	13.7	3.9			
			A	83.5 \pm 52.5	17.2 \pm 13.0	5.0 \pm 3.2			
<i>Norway</i>									
Kirkenes	1994	40	G	12.4 \pm 6.2	3.4 \pm 1.2	0.54 \pm 0.75	124.0 \pm 15.0	2200 \pm 290	660 \pm 90
Hammerfest	1994	57	G	12.4 \pm 6.2	2.5 \pm 0.8	0.53 \pm 0.56	105.8 \pm 17.4	2090 \pm 370	510 \pm 100
Tromsø	1995	15	G	10.4 \pm 6.2		0.44 \pm 0.53	93.2 \pm 18.2	2090 \pm 300	460 \pm 70
Tromsø	1995	15	G				67.3 \pm 15.8 (S)		
Bergen	1994	50	G	14.5 \pm 6.2	3.4 \pm 1.1	0.46 \pm 0.54	106.6 \pm 18.2	2140 \pm 390	770 \pm 180
<i>Russia</i>									
Apatity	1993	37	G	31.1 \pm 16.6		0.37 \pm 0.41	139.0 \pm 15.0		
Arkhangelsk	1993	50	G	29.0 \pm 12.4	1.6 \pm 0.9	0.58 \pm 0.57	109.8 \pm 17.4	2310 \pm 430	520 \pm 80
Monchegorsk	1993	49	G	45.6 \pm 22.8		0.47 \pm 0.63	129.0 \pm 18.2		
Murmansk	1993	46	G	33.2 \pm 18.6		0.36 \pm 0.58	134.0 \pm 15.0		
Nikel (Group 2)	1993	50	G	22.8 \pm 10.3	2.3 \pm 1.0	0.12 \pm 0.05	107.0 \pm 18.2	2160 \pm 380	530 \pm 110
Salekhard	1995	9	G	24.9 \pm 8.3		0.40 \pm 0.24	81.4 \pm 11.1		
Norilsk	1995	29	G	18.6 \pm 8.3		0.29 \pm 0.20	80.6 \pm 11.9		
<i>Iceland</i>									
	1994-96	40	G	16.2 \pm 6.6	2.9 \pm 1.3	0.4 \pm 0.3			
<i>Sweden</i>									
Sweden smelter area			G	32 \pm 10 (n=241)		1.1 \pm 0.5 (n=64*)	52 \pm 10 (P) (n=232)		
Sweden control area			G	28 \pm 8 (n=144)		1.1 \pm 0.5 (n=43)	63 \pm 15 (P) (n=147)		
Sweden	1994-96	23	G	19.7 \pm 7.0	1.6 \pm 1.2	0.1 \pm 0.2			

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	Year(s) collected	n	Mean type A: arithmetic G: geometric	Mean ± SD (µg/L blood plasma)					
				Pb (whole blood)	Hg (whole blood)	Cd (whole blood)	Se (whole blood, except P: plasma, S: serum)	Cu (serum, except P: plasma)	Zn (serum, except P: plasma)
Cord blood									
<i>Greenland</i>									
Disko	1994-95	33	G	37.2±20.9	54.3±37.6		39.0±6.9 (P)	380±170 (P)	870±220 (P)
<i>Canada</i>									
Nunavik, northern Quebec	1996	299	G A	40.6 48.7	12.1 18.3		289.9 317.5 (n=228)		
Nunavik, Inuit	1978-82	125	A		33.8±2.01				
Nunavik, Cree	1971-82	600	A		22.69±23.82				
Northwest Territories, Inuit	1978-86	31	A		40.53±32.74				
Northwest Territories, Dene	1978-83	5	A		14.36±12.32				
North-central Northwest Territories, Inuit	1994-95	62	G A	29.0 34.0±22.9	5.7 7.9±6.4	0.1 0.2±0.1	72.5 73.3±11.3		
Western Northwest Territories, Dene/Metis	1994-95	47	G A	20.6 24.7±14.1	1.9 2.4±1.8	0.1 0.2±0.1	81.3 82.3±12.4 (n=44)		
Yukon	1977	31	A		4.12±1.87				
<i>Norway</i>									
Kirkenes	1994	20	G	12.4±6.2	5.2±2.2	<DL**	125±17.4		
Hammerfest	1994	50	G	12.4±6.2		<DL**	122±20.0		
Tromsø	1995	15	G	16.6±20.7		0.16±0.18	104±15.0		
Bergen	1994	50	G	12.4±6.2	5.2±2.2	0.12	112±22.9		
<i>Russia</i>									
Nikel	1994	24	G	22.8±10.4		0.12±0.02	105±10.5		
Arkhangelsk	1993	50	G	20.7±10.4		0.11±0.01	111±17.4		
Norilsk	1995	29	G	18.6±4.1		0.11±0.13	83.7±13.4		
Salekhard	1995	9	G	24.9±8.3		<DL**	93.2±15.8		
<i>Sweden</i>									
Sweden smelter area			G	28±8 (n=222)		0.7±0.4 (n=60)	45±11 (P) (n=196)		
Sweden control area			G	22±8 (n=131)		0.7±0.3 (n=40)	48±10 (P) (n=133)		

Pb, Hg, Cd, Se: whole blood concentration (unless indicated, P: plasma, S: serum)
Cu, Zn: serum concentration (unless indicated, P: plasma)

* Smokers; blood cadmium levels in non-smokers were about 50% lower.

** Detection limit (DL) for cadmium = 0.1 µg/L