

The Implementation Plan of Denmark (1997 - 2000) for AMAP Phase II



AMAP Phase II sampling stations in Greenland

Prepared Oct. 99 by the Arctic Environmental Secretariat for presentation to the AMAP ASG and the AMAP WG-13 Meetings.

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Implementation Plan 1997-2000

The core of the Danish implementation of AMAP Phase II in Greenland and the Faroe Islands is a number of AMAP projects funded by the Danish Environmental Protection Agency under the Dancea programme (Danish Cooperation for Environment in the Arctic).

Since 1997 one-year projects explicitly designed to implement AMAP Phase II have been initiated by Dancea each year. Dancea projects are funded one fiscal year at the time, thus only projects initiated in the period 1997-2000 are summarised in this plan. However, the Danish Implementation Plan for AMAP Phase II is expected to be expanded once a year from 2001 to include new projects funded by the Danish EPA.

In addition to the Dancea financed core projects summarised in this document a number of other AMAP-relevant projects are running in Greenland. As soon as the total AMAP-programme for Phase II has been finalised and the AMAP Project Directory is ready, it is our intention to include information on relevant supplementary projects in the Project Directory.

The Trend Monitoring Programme

The implementation plan of Denmark for the trend monitoring components of AMAP Phase II in Greenland and the Faroe Islands is the core work of Denmark for AMAP in 1997 - 2000.

Based on the results from AMAP's first assessment the implementation of AMAP Phase II in Greenland will in particular give priority to monitoring of POPs and Heavy Metals under the Marine Programme and the Human Health Programme, as well as traditional Greenlandic articles of food. Important parameters from the terrestrial, freshwater and atmospheric environment are included, too.

The following sections of this document contain

Annex 1: A number of tables which provide a total overview of species, pollutants etc., monitored in the trend programme in Greenland by Dancea financed projects.

Annex 2: A number of tables which provide a total overview of species, pollutants etc., monitored in the trend programme the Faroe Islands by the Dancea financed projects. The implementation of the Human Health Programme on the Faroe Islands has not been included in the tables yet, but will be later this year. The

Human Health Programme on the Faroe Islands is expected to be similar to that of the Human Health Programme in Greenland.

Annex 3: A number of tables which provide an overview of species, pollutants etc. monitored in the trend programme at the various sampling stations in Greenland by the Dancea financed projects.

Annex 4: A list of the POPs that are analysed for unless otherwise mentioned in the tables.

Annex 5: A list of the «Municipality Codes» used in the tables from Greenland.

Modelling, pathways and sources

Denmark will continue the development of a hemispherical transport model. The final outcome is a module system, capable of describing quantitatively the transport processes and pathways to the Arctic. The model will quantify the chemical transformations en route and the atmospheric deposition, wet or dry, of a number of environmentally important pollutants such as sulphur and nitrogen oxides, a number of toxic and bio-accumulating heavy metals, including Cu, Zn, Cd, Pb and Hg, as well as the radiatively important ozone. The model system will constitute a tool for understanding the atmospheric transport mechanisms and for identifying the source areas and atmospheric pathways.

The Effect Monitoring Programme

It is expected that the Human Health effect programme on biomarkers will be implemented in Greenland, when adopted by the AMAP WG.

Well defined birth cohorts in Greenland and the Faroe Islands are being established. These will form the basis for possible supplementary follow-up studies on the health situation of children, including studies on the relationship between neurological/ psychological effects and contaminant levels.

In East Greenland a project will look for effects on Polar Bear in relation to mercury and POP levels. Another project have been looking for effects on kidney and skeleton in Narwhal and Seal due to high cadmium levels.

The core of the Danish input to the Climate Effect Programme will be the «Zackenberg Basis Programme». The Programme will provide long term monitoring data on biotic and abiotic environmental- and climate parameters from a terrestrial ecosystem in Northeast Greenland. Another project provides data on effects of UV-B radiation on bacteria, phytoplankton and microzoo-plankton in a marine environment in West Greenland.

In addition to the above mentioned Dancea financed projects a number of already ongoing supplementary projects in Greenland will be included in AMAP's Project Directory.

AMAP Human Health Thematic Data Centre

Denmark intends to run the AMAP Human Health Thematic Data Centre in Phase II and cover the associated costs.

Assessment

Denmark will provide Lead Country expertise for the Human Health assessment work, and will - if requested by AMAP - consider to provide Key National Experts and Designated Experts to the drafting groups of other assessment reports.

As was the case in AMAP Phase I Denmark will probably prepare National Assessment Reports based on the monitoring data from Greenland and the Faroe Islands.

Data Reporting System

The Main contractors in the Danish Implementation Plan are:

- the National Environmental Research Institute
- University of Aarhus
- Risø National Laboratory
- National Institute of Public Health
- Food and Environmental Agency - Faroe Islands
- University of the Faroe Islands.

All data from projects in the Danish Implementation Plan will be reported to relevant AMAP Thematic Data Centres by the contractors. Contact between the scientists involved and AMAP, ASG and the TDCs can either be established directly between the parties or via Henrik Elling, the Arctic Environmental Secretariat, who will continue as «National Data Manager» in phase II.

Annex 1

Human Health, Greenland

POPs

	Plasma	Bloodcells	Wholeblood	Municipality
Pesticides				
Aldrin	X			1, 6, 12, 15, 17, 18
b-HCH	X			1, 6, 12, 15, 17, 18
a-chlordane	X			1, 6, 12, 15, 17, 18
c-chlordane	X			1, 6, 12, 15, 17, 18
Cisnonachlordane	X			1, 6, 12, 15, 17, 18
Oxychlordane	X			1, 6, 12, 15, 17, 18
Transnonachlordane	X			1, 6, 12, 15, 17, 18
DDE	X			1, 6, 12, 15, 17, 18
DDT	X			1, 6, 12, 15, 17, 18
Hexachlorobenzene	X			1, 6, 12, 15, 17, 18
Mirex	X			1, 6, 12, 15, 17, 18
PCB-congeners ¹	X			1, 6, 12, 15, 17, 18
PCB-arochlor 1260	X			1, 6, 12, 15, 17, 18
Toxaphenes ²	X			1, 6, 12, 15, 17, 18
Lipids				
Total lipids	X			1, 6, 12, 15, 17, 18
Total cholesterol	X			12
Phospholipids	X			12
Triglycerides	X			12
Saturated fatty acids	X	X		1, 6, 12, 15, 17, 18
Unsaturated fatty acids	X	X		1, 6, 12, 15, 17, 18
Poly unsaturated n-3	X	X		1, 6, 12, 15, 17, 18
Poly unsaturated n-6	X	X		1, 6, 12, 15, 17, 18

Notes:

¹ = PCB-congeners nos.: 28, 52, 99, 101, 105, 118, 128, 138, 153, 156, 170, 180, 183, 187

² = Toxaphenes nos.: 26, 32, 50, 62, 69

Heavy Metals

	Plasma	Bloodcells	Wholeblood	Municipality
Hg total			X	6, 17, 18
Me-Hg			X	6, 17, 18
Pb			X	6, 17, 18
Cd			X	6, 17, 18
Se	X		X	6, 12, 17, 18
Se	X			12

Heavy Metals, Greenland, Cd, page 1

Page 1		Muscle	Liver	Kidney	Blubber/tallow	Skin	Whole body	Egg	Hair	Municipality
Marine	Marin									
Mammals	Havpattedyr									
Ringed Seal	Ringsæl		X	X	X					13, 16, 18
Harp Seal	Grønlandssæl				X					8
Hooded Seal	Klapmyds				X					8
Walrus	Hvalros	X	X	X	X					16
Beluga	Hvidhval				X	X				15
Narwhal	Narhval				X	X				14
Minke Whale	Vågehval	X	X	X	X	X				6
Fin Whale	Finhval	X	X	X	X	X				6
Polar Bear	Isbjørn	X	X	X					X	18
Birds	Fugle									
Common Guillemot	Lomvie	X								6
Black guillemot	Tejst		X	X				X		13, 18
Fish	Fisk									
Atlantic Cod	Torsk		X							6
Capelin	Ammasset	X								6
Atlantic Salmon	Laks	X	X							6
Arctic Char	Fjeldørred	X								2, 6, 19
Sculpin	Ulk (alm.)		X							13, 18
Invertebrates	Invertebrater									
Snow crab	Stor grønlandsk krabbe	X	X							6
Blue Mussel	Blåmusling		X							13
Iceland Scallop	Kammusling	X								6

Heavy Metals, Greenland, Cd, page 2

Page 2		Muscle	Liver	Kidney	Blubber/tallow	Skin	Whole body	Egg	Hair	Municipality
Terrestrial	Terrestrisk									
Mammals	Pattedyr									
Caribou	Rensdyr		X	X	X					2, 6
Muskox	Moskusokse	X	X	X	X					8
Sheep	Får	X	X	X	X					2
Arctic Hare	Snehare	X	X	X						2
Birds	Fugle									
Rock Ptarmigan	Fjeldrype	X	X	X						6, 13
Flora	Planter									
Crowberry	Revling						X			6
Arctic Blueberry	Mosebølle						X			6
Lichen	Lav						X			2, 6

Heavy Metals, Greenland, Hg & Se, page 1

Page 1		Muscle	Liver	Kidney	Blubber/tallow	Skin	Whole body	Egg	Peat	Hair	Municipality
Marine	Marin										
Mammals	Pattedyr										
Ringed Seal	Ringsæl		X	X	X						13, 16, 18
Harp Seal	Grønlandssæl	X	X		X						8
Hooded Seal	Klapmyds				X						8
Walrus	Hvalros				X						16
Beluga	Hvidhval				X	X					15
Narwhal	Narhval				X	X					14
Minke Whale	Vågehval	X	X	X	X	X					6
Fin Whale	Finhval	X	X	X	X	X					6
Polar Bear	Isbjørn	X	X	X						X	18
Birds	Fugle										
Common Guillemot	Lomvie	X	X								6
Black guillemot	Tejst		X	X				X			13, 18
Fish	Fisk										
Atlantic Wolffish	Stribet havkat	X	X								6
Spotted Wolffish	Plettet havkat	X	X								6
Atlantic Cod	Torsk	X	X								6
Greenland Cod	Uvak	X									6
Capelin	Ammasset	X					X				6
Greenland Halibut	Hellefisk	X	X								6
Atlantic Redfish	Rødfisk										6
Atlantic Salmon	Laks	X	X								6
Arctic Char	Fjeldørred	X									2, 6, 19
Sculpin	Ulk (alm.)		X								13, 18

Heavy Metals, Greenland, Hg & Se, page 2

Page 2		Muscle	Liver	Kidney	Blubber/tallow	Skin	Whole body	Egg	Peat	Hair	Municipality
Invertebrates	Invertebrater										
Pink Shrimp	Dybvandsreje	X									6
Snow crab	Stor grønlandsk krabbe	X	X								6
Blue Mussel	Blåmusling						X				13
Iceland Scallop	Kammusling	X									6
Terrestrial	Terrestrisk										
Mammals	Pattedyr										
Caribou	Rensdyr		X	X	X						2, 6
Muskox	Moskusokse	X	X	X	X						8
Sheep	Får	X	X	X	X						2
Arctic Hare	Snehare	X	X	X							2
Birds	Fugle										
Rock Ptarmigan	Fjeldrype	X	X	X							6, 13
Plants	Planter										
Crowberry	Revling						X				6
Arctic Blueberry	Mosebølle						X				6
Lichen	Lav						X				2, 6
Peat	Tørv								X		3

POPs, Greenland, page 1

Page 1		Muscle	Liver	Kidney	Blubber/tallow	Skin	Whole organism	Egg	Blood	Milk	Municipality
Marine	Marin										
Mammals	Pattedyr										
Ringed Seal	Ringsæl	X	X	X	X						13, 16, 18
Harp Seal	Grønlandssæl	X	X	X	X						8
Hooded Seal	Klapmyds	X	X	X	X						8
Walrus	Hvalros	X	X	X	X						16
Beluga	Hvidhval	X	X	X	X	X					15
Narwhal	Narhval	X	X	X	X	X					14
Minke Whale	Vågehval	X	X	X	X	X					6
Fin Whale	Finhval	X	X	X							6
Polar Bear	Isbjørn				X				X	X	18
Birds	Fugle										
Common Guillemot	Lomvie	X	X								6
Common Eider	Ederfugl	X	X								6
King Eider	Kongeederfugl	X	X								6
Black-legged Kittiwake	Ride	X	X								6
Black guillemot	Tejst		X					X			6, 13
Fish	Fisk										
Atlantic Wolffish	Stribet havkat	X	X								6
Spotted Wolffish	Plettet havkat	X	X								6
Atlantic Cod	Torsk	X	X								6
Uvak	Uvaq	X	X								6
Capelin	Ammasset	X									6
Greenland Halibut	Hellefisk	X	X								6

POPs, Greenland, page 2

Page 2		Muscle	Liver	Kidney	Blubber/tallow	Skin	Whole organism	Egg	Blood	Milk	Municipality
Fish (cont.)	Fisk										
Atlantic Redfish	Rødfisk	X	X								6
Atlantic Salmon	Laks	X	X								6
Arctic Char	Fjeldørred	X	X								2, 6, 19
Sculpin	Alm. Ulk		X								13, 18
Invertebrates	Invertebrater										
Pink Shrimp	Dybhavsreje	X									6
Snow crab	Stor grønlandsk krabbe	X	X								6
Blue Mussel	Blåmusling						X				13
	Kammusling	X									6
Terrestrial	Terrestrisk										
Mammals	Pattedyr										
Caribou	Rensdyr	X	X	X	X	X					2, 6
Muskox	Moskusokse	X	X	X	X						8
Sheep	Får	X	X	X	X						2
Arctic Hare	Snehare	X	X	X	X						2
Birds	Fugle										
Rock Ptarmigan	Fjeldrype		X					X			6, 13

Coplanar PCBs, Greenland

		Muscle	Blubber/tallow	Municipality
Marine	Marin			
Mammals	Pattedyr			
Ringed Seal	Ringsæl	X	X	13
Harp Seal	Grønlandssæl	X	X	8
Hooded Seal	Klapmyds		X	8
Walrus	Hvalros		X	16
Beluga	Hvidhval	X	X	15
Narwhal	Narhval	X	X	14
Minke Whale	Vågehval	X	X	6
Fin Whale	Finhval	X		6
Fish	Fisk			
Greenland Halibut	Hellefisk	X		6
Atlantic Salmon	Laks	X		6
Terrestrial	Terrestrisk			
Mammals	Pattedyr			
Caribou	Rensdyr		X	2
Muskox	Moskusokse		X	8
Sheep	Får		X	2

PAHs, PAH metabolites, softeners and detergents, Greenland

		PAHs, PAH metabolites, softeners and detergents	Municipality
Precipitation	Nedbør	X	2
Peat / soil	Tørv / jord	X	2
Lichens	Lav	X	2
Sediment (lake)	Sediment, sø-	X	2, 19
Arctic Char (landlocked) (liver)	Fjeldørred (lever)	X	2, 19
Blue Mussel	Blåmusling	X	2, 13
Sculpin (liver)	Ulk (alm.) (lever)	X	2, 13, 18

Flame retardants, Greenland

CDPE and SCCP			
		Blubber	Municipality
Marine	Marin		
Mammals	Pattedyr		
Ringed Seal	Ringsæl	X	13
Harp Seal	Grønlandssæl	X	8
Hooded Seal	Klapmyds	X	8
Walrus	Hvalros	X	16
Beluga	Hvidhval	X	15
Narwhal	Narhval	X	14
Minke Whale	Vågehval	X	6
Fin Whale	Finhval	X	6

TBT, Greenland

		Liver	Sediment	Whole body	Municipality
Marine	Marin				
Ringed Seal	Ringsæl	X			13
Harp Seal	Grønlandssæl	X			8
Hooded Seal	Klapmyds	X			8
Walrus	Hvalros	X			16
Beluga	Hvidhval	X			15
Narwhal	Narhval	X			14
Minke Whale	Vågehval	X			6
Fin Whale	Finhval	X			6
Sediment	Sediment		X		6
Blue Mussel	Blåmuslinger			X	6

Radionuclides, Greenland

		Cs-137	Tc-99	Pu	Municipality
Atmosphere	Atmosfære				
Precipitation	Nedbør	X			1, 13, 16, 18
Marine	Marin				
Sea sediment	Havsediment			X	16
Seawater	Havvand	X	X		1, 13, 16, 18
Seawater	Havvand			X	16
Algae	Alger	X	X		1, 13, 16, 18
Algae	Alger			X	16
Benthic biota	Bunddyr			X	16
Scrimp	Reje	X	X		1, 13
Fish	Fisk	X			13, 18
Black guillemot	Tejst	X			13, 18
Black guillemot, egg	Tejst, æg	X			13, 18
Seal	Sæl	X			13, 16, 18
Whale	Hval	X			1, 13, 16
Terrestrial	Terrestrisk				
Soil	Jord	X			1, 13, 16, 18
Lichen / moss	Lav / mos	X			1, 13, 16, 18
Grass	Græs	X			1, 13
Caribou	Rensdyr	X			1, 13
Sheep	Får	X			1
Freshwater	Ferskvand				
Freshwater, lake	Søvand	X			1, 13, 16, 18
Arctic char	Fjeldørred	X			1, 13, 16, 18

Atmosphere, Greenland

Station Nord, Northeast Greenland		
	Air	Municipality
SO ₂	X	20
NH ₃	X	20
NH ₄	X	20
HNO ₃	X	20
NO ₃ -	X	20
Si	X	20
S	X	20
K	X	20
Ca	X	20
Cr	X	20
Fe	X	20
Ni	X	20
Cu	X	20
Zn	X	20
As	X	20
Cd	X	20
Pb	X	20
Hg	X	20
Ozone	X	20

Annex 2

Faeroe Islands, page 1

	PCB Note 1	CHL Note 2	DDT Note 3	Mirex	b-HCH, HCB	Total toxaphene Note 4	Hg	Se	Cd	Pb	Cu	PAH	TBT	PBDE	Polychlo. Note 5
Marine															
Blue Mussels (soft parts)	X		X		X		X		X	X	X	X			
Queen Scallop (soft parts)	X		X		X		X		X	X	X	X			
Fulmar (liver and sub.cut parts)	X		X		X		X		X	X	X	X			
Cod (liver and muscle)	X	X	X		X	X	X		X	X	X	X			
Brown Trout (muscle and liver)	X	X	X		X	X	X								
Grey Seal (Blubber, muscle and liver)	X	X	X		X	X	X		X	X	X	X			
Sediments (dated core segments)							X								
Dogwhelks													X		
Pilot Whale (blubber)	X	X	X	X	X	X						X			
Pilot Whale (muscle)							X	X	X						
Pilot Whale (kidney)									X						
Sculpin (liver)	X	X	X	X	X	X	X	X	X						
Black Guillemot (egg)	X	X	X	X	X	X	X								
Black Guillemot (liver)							X	X	X						

Faeroe Islands, page 2

	PCB Note 1	CHL Note 2	DDT Note 3	Mirex	b-HCH, HCB	Total toxaphene Note 4	Hg	Se	Cd	Pb	Cu	PAH	TBT	PBDE	Polychlo. Note 5
Terrestrial															
Moss and lichens, Note 6															
Hare	X	X	X	X	X	X	X	X	X						
Sheep							X	X	X						
Cow milk														X	X
Freshwater															
Arctic Char (landlocked)(muscle)	X	X	X	X	X	X	X	X	X						

Note 1: = PCB cong. nos: 28, 52, 99, 101, 105, 118, 128, 138, 153, 156, 170, 180, 183, 187

Note 2: = CHL (a-chlordan, g-chlordan, cis-nonachlor, oxy-chlordane, trans- nonachlor)

Note 3: = DDT (p,p'-DDT, p,p'-DDE, p,p'-DDD, o,p'-DDT, o,p'-DDE, o,p'-DDD)

Note 4: = Total toxaphene (parlars; 26, 32, 50, 62, 69)

Note 5: = Polychlo. = Polychlorodibenzo-p-dioxins Polychlorodibenzo-furans

Note 6: = Heavy Metals are not specified

Radionuclides, Faeroe Island

		Cs-137	Tc-99
Atmosphere	Atmosfære		
Precipitation	Nedbør	X	
Marine	Marin		
Seawater	Havvand	X	X
Algae	Alger	X	X
Shrimp	Reje	X	X
Fish	Fisk	X	
Black guillemot	Tejst	X	
Black guillemot, egg	Tejst, æg	X	
Whale	Hval	X	
Terrestrial	Terrestrisk		
Soil	Jord	X	
Lichen / moss	Lav / mos	X	
Grass	Græs	X	
Sheep	Får	X	
Potato	Kartoffel	X	
Cow milk	Komælk	X	
Freshwater	Ferskvand		
Freshwater, lake	Søvand	X	
Arctic char	Fjeldørred	X	

Annex 3

South Greenland

Nanortalik, Qaqortoq/Julianehåb & Narsaq

Mun. 1, 2 & 3



Human Health, Greenland, Nanortalik

POPs		
	Plasma	Bloodcells
Pesticides		
Aldrin	X	
b-HCH	X	
a-chlordane	X	
c-chlordane	X	
Cisnonachlordane	X	
Oxychlordane	X	
Transnonachlordane	X	
DDE	X	
DDT	X	
Hexachlorobenzene	X	
Mirex	X	
PCB-congeners ¹	X	
PCB-arochlor 1260	X	
Toxaphenes ²	X	
Lipids		
Total lipids	X	
Saturated fatty acids	X	X
Unsaturated fatty acids	X	X
Poly unsaturated n-3	X	X
Poly unsaturated n-6	X	X

Notes:

¹ = PCB-congeners nos.: 28, 52, 99, 101, 105, 118, 128, 138, 153, 156, 170, 180, 183, 187

² = Toxaphnes nos.: 26, 32, 50, 62, 69

Radionuclides, Greenland, Nanortalik

		Cs-137	Tc-99
Atmosphere	Atmosfære		
Precipitation	Nedbør	X	
Marine	Marin		
Seawater	Havvand	X	X
Algae	Alger	X	X
Scrimp	Reje	X	X
Whale	Hval	X	
Terrestrial	Terrestrisk		
Soil	Jord	X	
Lichen / moss	Lav / mos	X	
Grass	Græs	X	
Caribou	Rensdyr	X	
Sheep	Får	X	
Freshwater	Ferskvand		
Freshwater, lake	Søvand	X	
Arctic char	Fjeldørred	X	

Heavy Metals, Greenland, Qaqortoq

Cd

		Muscle	Liver	Kidney	Blubber/tallow	Whole organism
Terrestrial	Terrestrisk					
Caribou	Rensdyr		X	X	X	
Sheep	Får	X	X	X	X	
Arctic Hare	Snehare	X	X	X		
Lichen	Lav					X
Freshwater	Ferskvand					
Arctic Char	Fjeldørred	X				

Hg & Se

		Muscle	Liver	Kidney	Blubber/tallow	Whole organism
Terrestrial	Terrestrisk					
Caribou	Rensdyr		X	X	X	
Sheep	Får	X	X	X	X	
Arctic Hare	Snehare	X	X	X		
Lichen	Lav					X
Freshwater	Ferskvand					
Arctic Char	Fjeldørred	X				

POPs, Greenland, Qaqortoq

		Muscle	Liver	Kidney	Blubber/tallow	Skin
Marine	Marin					
Arctic Char	Fjeldørred	X	X			
Terrestrial	Terrestrisk					
Caribou	Rensdyr	X	X	X	X	X
Sheep	Får	X	X	X	X	
Arctic Hare	Snehare	X	X	X	X	

PAH, Greenland, Qaqortoq

PAHs, PAH metabolites, softeners and detergents		
		PAHs, PAH metabolites, softeners and detergents
Precipitation	Nedbør	X
Peat / soil	Tørv / jord	X
Lichens	Lav	X
Sediment (lake)	Sediment, sø-	X
Arctic Char (landlocked) (liver)	Fjeldørred (lever)	X
Blue Mussel	Blåmusling	X
Sculpin (liver)	Ulk (alm.) (lever)	X

Coplanar PCBs, Greenland, Qaqortoq

		Blubber/tallow
Terrestrial:	Terrestrisk	
Caribou	Rensdyr	X
Sheep	Får	X

Heavy metals, Greenland, Narsaq

		Hg
Peat	Tørv	X

Nuuk/Godthåb

Mun. 6



Human Health, GR. Nuuk

POPs			
	Plasma	Bloodcells	Wholeblood
Pesticides			
Aldrin	X		
b-HCH	X		
a-chlordane	X		
c-chlordane	X		
Cisnonachlordane	X		
OXychlordane	X		
Transnonachlordane	X		
DDE	X		
DDT	X		
Hexachlorobenzene	X		
Mirex	X		
PCB-congeners ¹	X		
PCB-arochlor 1260	X		
Toxaphenes ²	X		
Lipids			
Total lipids	X		
Saturated fatty acids	X	X	
Unsaturated fatty acids	X	X	
Poly unsaturated n-3	X	X	
Poly unsaturated n-6	X	X	

Notes:

¹ = PCB-congeners nos.: 28, 52, 99, 101, 105, 118, 128, 138, 153, 156, 170, 180, 183, 187

² = Toxaphenes nos.: 26, 32, 50, 62, 69

Heavy Metals			
	Plasma	Bloodcells	Wholeblood
Hg total			X
Me-Hg			X
Pb			X
Cd			X
Se	X		X

Heavy Metals, Greenland, Nuuk

Cd

Marine	Muscle	Liver	Kidney	Blubber/ tallow	Skin	Whole Organism
Mammals						
Minke Whale						
Fin Whale	X	X	X	X	X	
Birds	X	X	X	X	X	
Common Guillemot						
Fish	X					
Atlantic Cod						
Capelin		X				
Arctic Char	X					
Atlantic Salmon	X					
Invertebrates	X	X				
Snow crab						
Iceland Scallop	X	X				
	X					
Terrestrial						
Mammals						
Caribou						
Birds		X	X	X		
Rock Ptarmigan						
Plants	X	X	X			
Crowberry						
Arctic Blueberry						X
Lichen						X
						X

Heavy Metals, Greenland, Nuuk, p. 2

Hg & Se

Marine	Muscle	Liver	Kidney	Blubber/ tallow	Skin	Whole Organism
Mammals						
Minke Whale						
Fin Whale	X	X	X	X	X	
Birds	X	X	X	X	X	
Common Guillemot						
Fish	X	X				
Atlantic Wolffish						
Spotted Wolffish	X	X				
Atlantic Cod	X	X				
Greenland Cod	X	X				
Capelin	X					
Greenland Halibut	X					X
Atlantic Salmon	X	X				
Arctic Char	X	X				
Invertebrates	X					
Pink Shrimp						
Snow crab	X					
Iceland Scallop	X	X				
	X					
Terrestrial						
Mammals						
Caribou						
Birds		X	X	X		
Rock Ptarmigan						
Flora	X	X	X			
Crowberry						
Arctic Blueberry						X
Lichen						X
						X

POPs, Greenland, Nuuk

Marine	Muscle	Liver	Kidney	Blubber/ tallow	Skin	Egg
Mammals						
Minke Whale						
Fin Whale	X	X	X	X	X	
Birds	X	X	X			
Common Guillemot						
Common Eider	X	X				
King Eider	X	X				
Black-legged Kittiwake	X	X				
Black guillemot	X	X				
Fish		X				X
Atlantic Wolffish						
Spotted Wolffish	X	X				
Atlantic Cod	X	X				
Uvak	X	X				
Capelin	X	X				
Greenland Halibut	X					
Atlantic Redfish	X	X				
Atlantic Salmon	X	X				
Arctic Char	X	X				
Invertebrates	X	X				
Pink Shrimp						
Snow crab	X					
Iceland Scallop	X	X				
	X					
Terrestrial						
Mammals						
Caribou						
Birds	X	X	X	X	X	
Rock Ptarmigan						
		X				X

Coplanar PCBs, Greenland, Nuuk

		Muscle	Blubber/tallow
Marine	Marin		
Minke Whale	Vågehval	X	X
Fin Whale	Finhval	X	
Greenland Halibut	Hellefisk	X	
Atlantic Salmon	Laks	X	

Flame retardants, Greenland, Nuuk

CDPE and SCCP		
		Blubber
Marine	Marin	
Minke Whale	Vågehval	X
Fin Whale	Finhval	X

TBT, Greenland, Nuuk

		Liver	Sediment	Whole body
Marine	Marin			
Minke Whale	Vågehval	X		
Fin Whale	Finhval	X		
Sediment	Sediment		X	
Blue Mussel	Blåmusling			X

Sisimiut/Holsteinsborg

Mun. 8



Heavy Metals, Greenland, Sisimiut

Cd

		Muscle	Liver	Kidney	Blubber/tallow
Marine	Marin				
Harp Seal	Grønlandssæl				X
Hooded Seal	Klapmyds				X
Terrestrial	Terrestrisk				
Muskox	Moskusokse	X	X	X	X

Hg & Se

Marine	Marin				
Harp Seal	Grønlandssæl	X	X		X
Hooded Seal	Klapmyds				X
Terrestrial	Terrestrisk				
Muskox	Moskusokse	X	X	X	X

POPs, Greenland, Sisimiut

		Muscle	Liver	Kidney	Blubber/tallow
Marine	Marin				
Harp Seal	Grønlandssæl	X	X	X	X
Hooded Seal	Klapmyds	X	X	X	X
Terrestrial	Terrestrisk				
Muskox	Moskusokse	X	X	X	X

Coplanar PCBs, Greenland, Sisimiut

		Muscle	Blubber/tallow
Marine	Marin		
Harp Seal	Grønlandssæl	X	X
Hooded Seal	Klapmyds		X
Terrestrial	Terrestrisk		

Muskox	Moskusokse		X
--------	------------	--	---

Flame retardants, Greenland, Sisimiut

CDPE and SCCP

		Blubber
Marine	Marin	
Harp Seal	Grønlandssæl	X
Hooded Seal	Klapmyds	X

TBT, Greenland, Sisimiut

		Liver
Marine	Marin	
Harp Seal	Grønlandssæl	X
Hooded Seal	Klapmyds	X

Disko Bay

Ilulissat/Jakobshavn & Qeqertarsuaq/Godhavn

Mun. 12 & 13



Human Health, Greenland, Ilulissat

POPs

	Plasma	Bloodcells	Wholeblood
Pesticides			
Aldrin	X		
b-HCH	X		
a-chlordane	X		
c-chlordane	X		
Cisnonachlordane	X		
Oxychlordane	X		
Transnonachlordane	X		
DDE	X		
DDT	X		
Hexachlorobenzene	X		
Mirex	X		
PCB-congeners ¹	X		
PCB-arochlor 1260	X		
Toxaphenes ²	X		
Lipids			
Total lipids	X		
Total cholesterol	X		
Phospholipids	X		
Triglycerides	X		
Saturated fatty acids	X	X	
Unsaturated fatty acids	X	X	
Poly unsaturated n-3	X	X	
Poly unsaturated n-6	X	X	

Notes:

¹ = PCB-congeners nos.: 28, 52, 99, 101, 105, 118, 128, 138, 153, 156, 170, 180, 183, 187

² = Toxaphenes nos.: 26, 32, 50, 62, 69

Heavy Metals

	Plasma	Bloodcells	Wholeblood
Se	X		X

Heavy Metals, Greenland, Qeqertarsuaq

Cd

	Muscle	Liver	Kidney	Blubber/ tallow	Skin	Whole organism	Egg
Marine							
Mammals							
Ringed Seal		X	X	X			
Birds							
Black guillemot		X	X				X
Fish							
Sculpin		X					
Invertebrates							
Blue Mussel		X					
Terrestrial							
Birds							
Rock Ptarmigan	X	X	X				

Hg & Se

	Muscle	Liver	Kidney	Blubber/ tallow	Skin	Whole organism	Egg
Marine							
Mammals							
Ringed Seal		X	X	X			
Birds							
Black guillemot		X	X				X
Fish							
Sculpin		X					
Invertebrates							
Blue Mussel						X	
Terrestrial							
Birds							
Rock Ptarmigan	X	X	X				

POPs, Greenland, Qeqertarsuaq

		Muscle	Liver	Kidney	Blubber/ tallow	Whole organism	Egg
Marine	Marin						
Ringed Seal	Ringsæl	X	X	X	X		
Black guillemot	Tejst		X				X
Sculpin	Alm. Ulk		X				
Blue Mussel	Blåmusling					X	
Terrestrial	Terrestrisk						
Rock Ptarmigan	Fjeldrype		X				X

Coplanar PCBs, Greenland, Qeqertarsuaq

		Muscle	Blubber
Marine	Marin		
Ringed Seal	Ringsæl	X	X

PAHs, Greenland, Qeqertarsuaq

		PAHs, PAH metabolites, softeners and detergents
Blue Mussel	Blåmusling	X
Sculpin (liver)	Ulk (alm.) (lever)	X

Flame retardants, Greenland, Qeqertarsuaq

CDPE and SCCP		
		Blubber
Marine	Marin	
Ringed Seal	Ringsæl	X

TBT, Greenland, Qeqertarsuaq

		Liver
Marine	Marin	
Ringed Seal	Ringsæl	X

Radionuclides, Greenland, Qeqertarsuaq

		Cs-137	Tc-99
Atmosphere	Atmosfære		
Precipitation	Nedbør	X	
Marine	Marin		
Seawater	Havvand	X	X
Algae	Alger	X	X
Scrimp	Reje	X	X
Fish	Fisk	X	
Black guillemot	Tejst	X	
Black guillemot, egg	Tejst, æg	X	
Seal	Sæl	X	
Whale	Hval	X	
Terrestrial	Terrestrisk		
Soil	Jord	X	
Lichen / moss	Lav / mos	X	
Grass	Græs	X	
Caribou	Rensdyr	X	
Freshwater	Ferskvand		
Freshwater, lake	Søvand	X	
Arctic char	Fjeldørred	X	

Uummannaq/Umanaq

Mun. 14



Heavy Metals, Greenland, Uummannaq

Cd

Marine	Marin	Blubber	Skin
Narwhal	Narhval	X	X

Hg & Se

Marine	Marin		
Narwhal	Narhval	X	X

POPs, Greenland, Uummannaq

		Muscle	Liver	Kidney	Blubber	Skin
Marine	Marin					
Narwhal	Narhval	X	X	X	X	X

Coplanar PCBs, Greenland, Uummannaq

		Muscle	Blubber
Narwhal	Narhval	X	X

Flame retardants, Greenland, Uummannaq

CDPE and SCCP		
		Blubber
Narwhal	Narhval	X

TBT, Greenland, Uummannaq

		Liver
Narwhal	Narhval	X

Upernavik

Mun. 15



Human Health, Greenland, Upernavik

POPs

	Plasma	Bloodcells
Pesticides		
Aldrin	X	
b-HCH	X	
a-chlordane	X	
c-chlordane	X	
Cisnonachlordane	X	
Oxychlordane	X	
Transnonachlordane	X	
DDE	X	
DDT	X	
Hexachlorobenzene	X	
Mirex	X	
PCB-congeners ¹	X	
PCB-arochlor 1260	X	
Toxaphenes ²	X	
Lipids		
Total lipids	X	
Saturated fatty acids	X	X
Unsaturated fatty acids	X	X
Poly unsaturated n-3	X	X
Poly unsaturated n-6	X	X

Notes:

¹ = PCB-congeners nos.: 28, 52, 99, 101, 105, 118, 128, 138, 153, 156, 170, 180, 183, 187

² = Toxaphenes nos.: 26, 32, 50, 62, 69

Heavy Metals, Greenland, Upernavik

Cd

		Blubber	Skin
Beluga	Hvidhval	X	X

Hg & Se

		Blubber	Skin
Beluga	Hvidhval	X	X

POPs, Greenland, Upernavik

		Muscle	Liver	Kidney	Blubber	Skin
Beluga	Hvidhval	X	X	X	X	X

Coplanar PCBs, Greenland, Upernavik

		Muscle	Blubber
Beluga	Hvidhval	X	X

Flame retardants, Greenland, Upernavik

CDPE and SCCP		
		Blubber
Beluga	Hvidhval	X

TBT, Greenland, Upernavik

		Liver
Beluga	Hvidhval	X

Qaanaaq/Thule

Mun. 16



Heavy Metals, Greenland, Qaanaaq

Cd

		Muscle	Liver	Kidney	Blubber
Ringed Seal	Ringsæl		X	X	X
Walrus	Hvalros	X	X	X	X

Hg & Se

Ringed Seal	Ringsæl		X	X	X
Walrus	Hvalros				X

POPs, Greenland, Qaanaaq

		Muscle	Liver	Kidney	Blubber
Ringed Seal	Ringsæl	X	X	X	X
Walrus	Hvalros	X	X	X	X

Coplanar PCBs, Greenland, Qaanaaq

		Blubber
Walrus	Hvalros	X

Flame retardants, Greenland, Qaanaaq

CDPE and SCCP

		Blubber
Walrus	Hvalros	X

TBT, Greenland, Qaanaaq

		Liver
Walrus	Hvalros	X

Radionuclides, Greenland, Qaanaaq

		Cs-137	Tc-99	Pu
Atmosphere	Atmosfære			
Precipitation	Nedbør	X		
Marine	Marin			
Sea sediment	Havsediment			X
Seawater	Havvand	X	X	
Seawater	Havvand			X
Algae	Alger	X	X	
Algae	Alger			X
Benthic biota	Bunddyr			X
Seal	Sæl	X		
Whale	Hval	X		
Terrestrial	Terrestrisk			
Soil	Jord	X		
Lichen / moss	Lav / mos	X		
Freshwater	Ferskvand			
Freshwater, lake	Søvand	X		
Arctic char	Fjeldørred	X		

Ammassalik

Mun. 17



Human Health, Greenland, Ammassalik

POPs

	Plasma	Bloodcells	Wholeblood
Pesticides			
Aldrin	X		
b-HCH	X		
a-chlordane	X		
c-chlordane	X		
Cisnonachlordane	X		
Oxychlordane	X		
Transnonachlordane	X		
DDE	X		
DDT	X		
Hexachlorobenzene	X		
Mirex	X		
PCB-congeners ¹	X		
PCB-arochlor 1260	X		
toxaphenes ²	X		
Lipids			
Total lipids	X		
Saturated fatty acids	X	X	
Unsaturated fatty acids	X	X	
Poly unsaturated n-3	X	X	
Poly unsaturated n-6	X	X	

Notes:

¹ = PCB-congeners nos.: 28, 52, 99, 101, 105, 118, 128, 138, 153, 156, 170, 180, 183, 187

² = Toxaphnes nos.: 26, 32, 50, 62, 69

Heavy Metals

	Plasma	Bloodcells	Wholeblood
Hg total			X
Me-Hg			X
Pb			X
Cd			X
Se	X		X

Ittoqqortoormiit/Scoresbysund

Mun. 18



Human Health, Greenland, Ittoqqortoormiit

POPs

	Plasma	Bloodcells	Wholeblood
Pesticides			
Aldrin	X		
b-HCH	X		
a-chlordane	X		
c-chlordane	X		
Cisnonachlordane	X		
Oxychlordane	X		
Transnonachlordane	X		
DDE	X		
DDT	X		
Hexachlorobenzene	X		
Mirex	X		
PCB-congeners ¹	X		
PCB-arochlor 1260	X		
Toxaphenes ²	X		
Lipids			
Total lipids	X		
Saturated fatty acids	X	X	
Unsaturated fatty acids	X	X	
Poly unsaturated n-3	X	X	
Poly unsaturated n-6	X	X	

Notes:

¹ = PCB-congeners nos.: 28, 52, 99, 101, 105, 118, 128, 138, 153, 156, 170, 180, 183, 187

² = Toxaphenes nos.: 26, 32, 50, 62, 69

Heavy Metals

	Plasma	Bloodcells	Wholeblood
Hg total			X
Me-Hg			X
Pb			X
Cd			X
Se	X		X

Heavy Metals, Greenland, Ittoqqortoormiit

Cd

		Muscle	Liver	Kidney	Blubber	Egg	Hair
Marine	Marin						
Ringed Seal	Ringsæl		X	X	X		
Black guillemot	Tejst		X	X		X	
Sculpin	Ulk (alm.)		X				
Polar Bear	Isbjørn	X	X	X			X

Hg & Se

		Muscle	Liver	Kidney	Blubber	Egg	Hair
Marine	Marin						
Ringed Seal	Ringsæl		X	X	X		
Black guillemot	Tejst		X	X		X	
Sculpin	Ulk (alm.)		X				
Polar Bear	Isbjørn	X*	X*	X*			X*

Notes: * = Hg only

POPs, Greenland, Ittoqqortoormiit

		Muscle	Liver	Kidney	Blubber	Egg	Blood	Milk
Marine	Marin							
Ringed Seal	Ringsæl	X	X	X	X			
Sculpin	Alm. Ulk		X					
Black guillemot	Tejst		X			X		
Polar Bear	Isbjørn				X		X	X

PAHs, PAH metabolites, softeners and detergents, Greenland, Ittoqqortoormiit

		PAHs, PAH metabolites, softeners and detergents
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Sculpin (liver)	Ulk (alm.) (lever)	X
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Radionuclides, Greenland, Ittoqqortoormiit

		Cs-137	Tc-99
Atmosphere	Atmosfære		
Precipitation	Nedbør	X	
Marine	Marin		
Seawater	Havvand	X	X
Algae	Alger	X	X
Fish	Fisk	X	
Black guillemot	Tejst	X	
Black guillemot, egg	Tejst, æg	X	
Seal	Sæl	X	
Terrestrial	Terrestrisk		
Soil	Jord	X	
Lichen / moss	Lav / mos	X	
Freshwater	Ferskvand		
Freshwater, lake	Søvand	X	
Arctic char	Fjeldørred	X	

Northeast Greenland, Zackenberg

Mun. 19



Heavy Metals, Greenland, Northeast Greenland, Zackenberg

Cd

		Muscle
Freshwater	Ferskvand	
Arctic Char	Fjeldørred	X

Hg & Se

Freshwater	Ferskvand	
Arctic Char	Fjeldørred	X

POPs: Greenland, Northeast Greenland, Zackenberg

		Muscle	Liver
Marine	Marin		
Arctic Char	Fjeldørred	X	X

PAHs, PAH metabolites, softeners and detergents: Greenland, Northeast Greenland, Zackenberg

		PAHs, PAH metabolites, softeners and detergents
Sediment (lake)	Sediment, sø-	X
Arctic Char (landlocked) (liver)	Fjeldørred (lever)	X

Northeast Greenland, Station Nord

Mun. 20



Atmosphere, Greenland, Northeast Greenland, Station Nord

	Air
SO ²	X
NH ³	X
NH ⁴	X
HNO ³	X
NO ³ -	X
Si	X
S	X
K	X
Ca	X
Cr	X
Fe	X
Ni	X
Cu	X
Zn	X
As	X
Cd	X
Pb	X
Hg	X
Ozone	X

Annex 4

POPs

PCBs	Other OCs	Group
3	Toxaphene	
4 / 10	P26	Tox
7	P32	Tox
6	P50	Tox
8 / 5	P62	Tox
19	1,3,5-TCB	CBz
18	1,2,4-TCB	CBz
15 / 17	1,2,3-TCB	CBz
24 / 27	1245-Cl ₄ benzene	CBz
16 / 32	1234-Cl ₄ benzene	CBz
54 / 29	Cl ₅ -benzene	CBz
26	HCB	CBz
25	a-HCH	HCH
31 / 28	b-HCH	HCH
33 / 20 / 53	c-HCH	HCH
51	Cl ₈ -styrene	Styrene
22	heptachlor	Chlordane
45	oxychlordane	Chlordane
46	t-chlordane	Chlordane
52	c-chlordane	Chlordane
49	t-nonachlor	Chlordane
43	c-nonachlor	Chlordane
47 / 48	hept. epoxide	Chlordane
44	Aldrin	Cyclodiene
59 / 42	Dieldrin	Cyclodiene
41 / 71	endrin	Cyclodiene
64	p,p'-DDE	DDT
40	p,p'-DDD	DDT
100	p,p'-DDT	DDT
63	o,p'-DDE	DDT
74	o,p'-DDD	DDT
70 / 76 / 98	o,p'-DDT	DDT
66 / 95	mirex	
56 / 60	a-endosulfan	
91 / 55	β-endosulfan	
84 / 89	pentachloroanisole	
101		
99		

PCBs	Other OCs	Group
119		
83		
97		
87 / 81		
85		
136		
110		
82		
151		
144 / 135		
147		
107		
149		
118		
133		
114		
134 / 131		
146		
153		
105 / 132		
141 / 179		
130		
176		
141		
137		
138 / 163		
158		
178 / 129		
175		
187 / 182		
183		
128		
167		
185		
174		
177		
202 / 171 / 156		
201 / 157		
172 / 197		

PCBs	Other OCs	Group
197		
180		
193		
191		
200		
170 / 190		
198		
199		
196 / 203		
189		
208		
195		
207		
194		
205		
206		
208		
209		

Annex 5

Municipality Numbers used in the tables from Greenland

- 1 Nanortalik
- 2 Qaqortoq, (Julianehåb)
- 3 Narsaq
- 4 Ivittuut
- 5 Paamiut, (Frederikshåb)
- 6 Nuuk, (Godthåb)
- 7 Maniitsoq, (Sukkertoppen)
- 8 Sisimiut, (Holsteinsborg)
- 9 Kangaatsiaq
- 10 Aasiaat, (Egedesminde)
- 11 Qasigiannnguit, (Christianshåb)
- 12 Ilulissat, (Jakobshavn)
- 13 Qeqertarsuaq, (Godhavn)
- 14 Uummannaq
- 15 Upernavik
- 16 Qaanaaq, (Thule)
- 17 Ammassalik
- 18 Ittoqqortoormiit, (Scoresbysund)
- 19 North East Greenland National Park, south of Danmarkshavn
- 20 North East Greenland National Park, north of Danmarkshavn

