

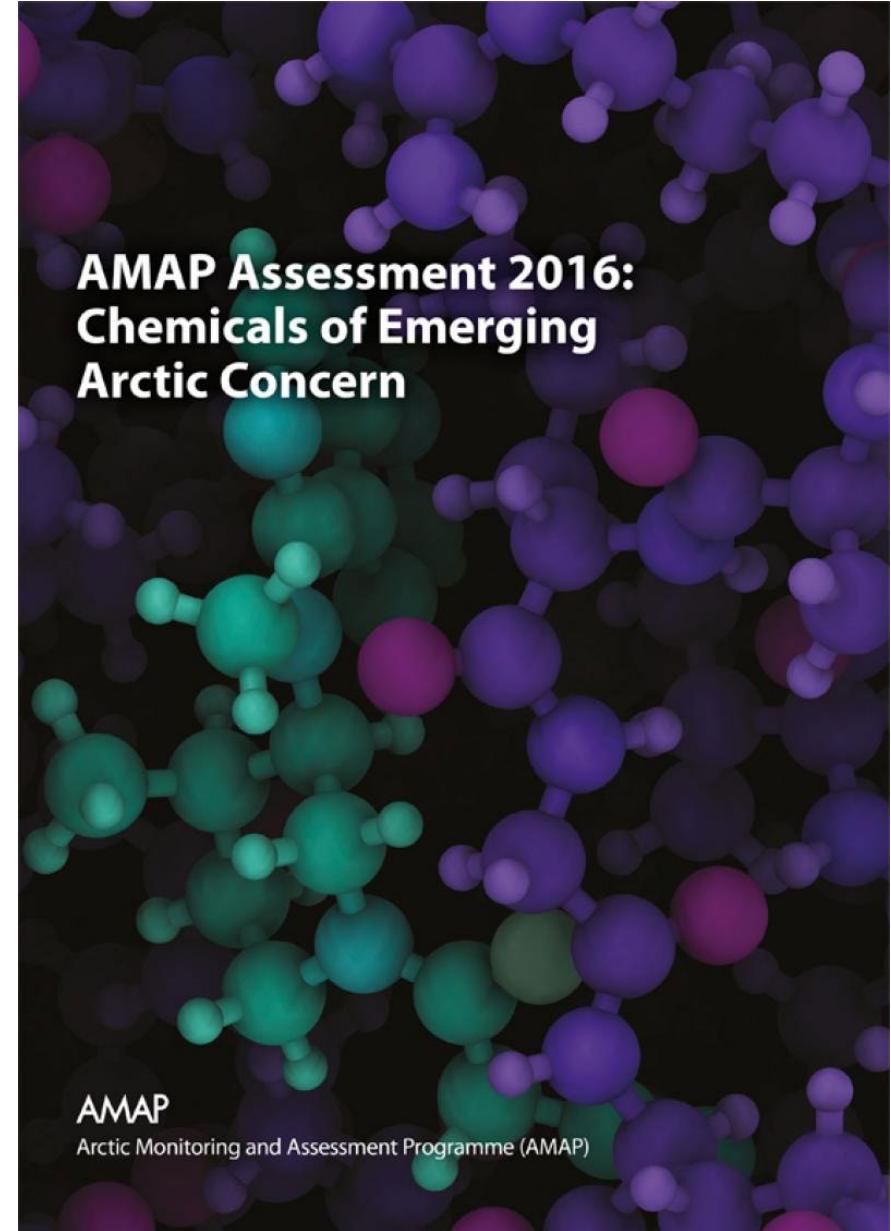
Screening of Chlorinated Paraffins, Dechloranes and UV filters in Nordic countries

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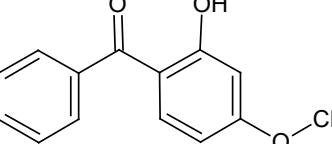
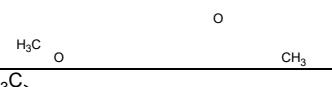
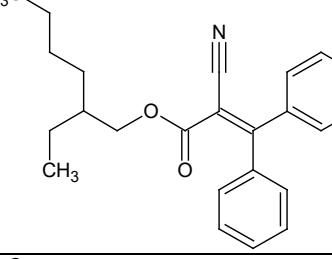
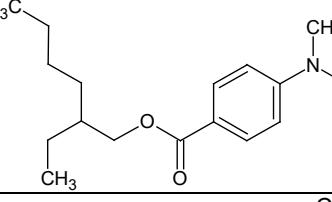
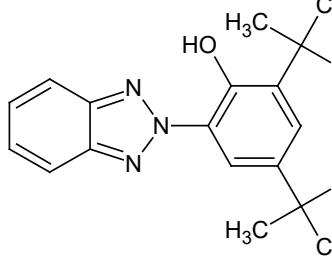
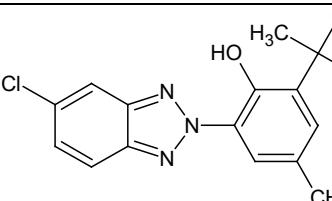
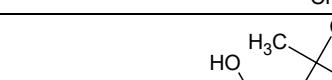
Background

- Chemicals of Emerging Arctic concern
- Three compound classes
- Significant concentrations in environmental samples
- PBT
- LRTP
- Regulation potential



UV-filters

- Additives in plastics and textiles
- Human skin protection

Name	Acronym	Structure	CAS	Log K _{ow}
Benzophenone-3	BP3		131-57-7	3,5
	EHMC-e		5466-77-3	
	EHMC-Z		5466-77-3	
Octocrylene	OC		6197-30-4	6,9
2-Ethylhexyl-4-dimethylaminobenzoate	ODPABA		21245-02-3	5,8
	UV-320		3846-71-7	6,3
Bumetizole	UV-326		3896-11-5	5,6
				

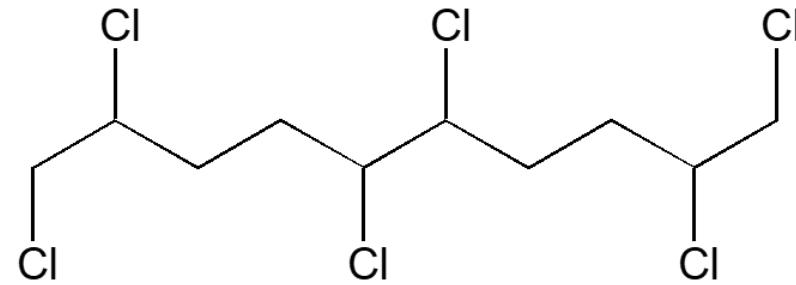
Dechloranes

- Flame retardant
- Possible impurities in pesticides
(Dieldrin, Aldrin)

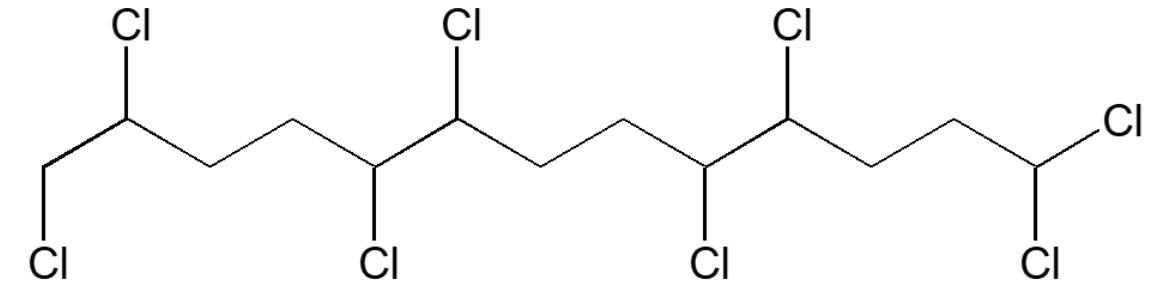
Name	Acronym	Structure	CAS	Log K _{ow}
Dechlorane plus syn	DPSyn		135821-03-3	8.85
Dechlorane plus anti	DPAnti		135821-74-8	8.85
Dechlorane 601	Dec601		13560-90-2	9.22
Dechlorane 602	Dec602		31107-44-5	7.37
Dechlorane 603	Dec603		13560-92-4	8.24
Dechlorane 604	Dec604		34571-16-9	8.84
Dibromoaldrin	DBALD		20389-65-5	5.77

Chlorinated paraffins

- Metal working fluids
- Plasticizer
- Flame retardants

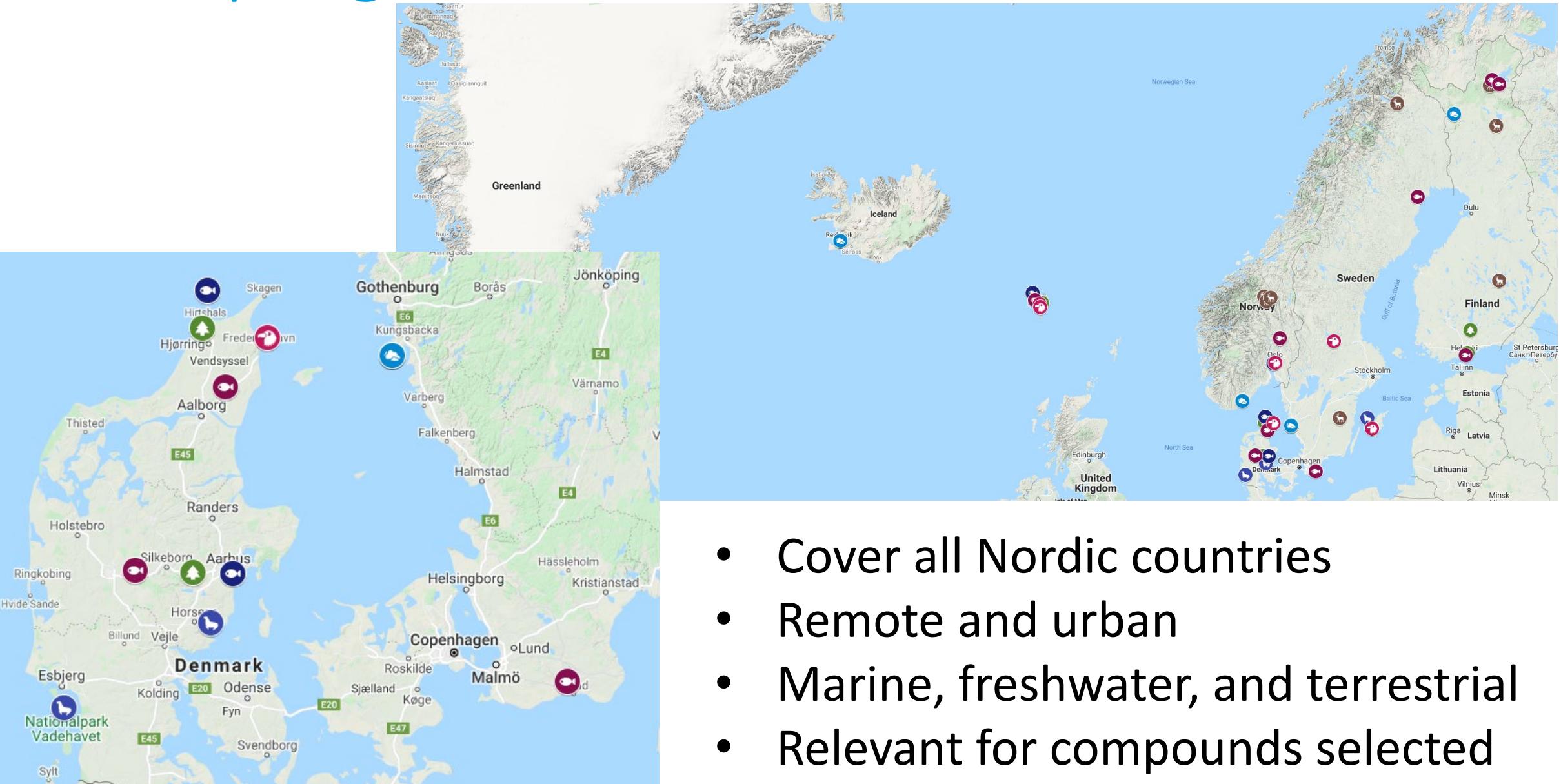


C₁₀H₁₆Cl₆



C₁₃H₂₀Cl₈

Sampling sites



Results - Detection frequency

Matrix	Bird Eggs REM+URB	Trout REM	Perch REM	Perch URB	Cod Live REM+URB	Grey seal REM	Terr. mammal REM	Air REM	Air URB	Pine needles REM	Pine needles URB
BP3	0	0	0	0	20	0	0	na	na	na	na
EHMC-E	14	0	0	0	0	0	0	na	na	na	na
EHMC-Z	0	0	0	0	0	0	0	na	na	na	na
OC	21	0	0	0	0	0	0	na	na	na	na
ODPABA	0	0	0	0	0	0	0	na	na	na	na
UV-320	21	0	0	17	60	100	0	na	na	na	na
UV-326	7	0	0	0	0	0	0	na	na	na	na
UV-327	50	0	0	17	60	50	0	na	na	na	na
UV-328	43	0	0	17	80	50	0	na	na	na	na
UV-329	0	0	0	0	60	0	0	na	na	na	na
DBA	0	0	0	0	0	0	0	0	0	0	0
Dec-602	100	100	0	67	100	100	78	0	0	0	0
Dec-603	71	0	0	0	60	50	0	0	0	0	0
Dec-604	0	0	0	0	0	0	0	0	0	0	0
Dec-601	0	0	0	0	0	0	0	0	0	0	0
DPsyn	7	0	0	0	0	50	0	25	67	0	0
DPanti	29	0	0	0	0	50	0	63	100	0	0
SCCP	100	67	100	83	100	50	100	100	100	50	100
MCCP	100	67	100	83	100	50	100	63	100	60	100
LCCP	21	67	22	83	60	50	56	63	100	30	80

UV mostly related to marine environment

Dec 602 & 603 mostly related to marine & freshwater biota

DP syn/anti mostly related to urban/marine biota and air

CPs:

- very frequent
- all type of environments

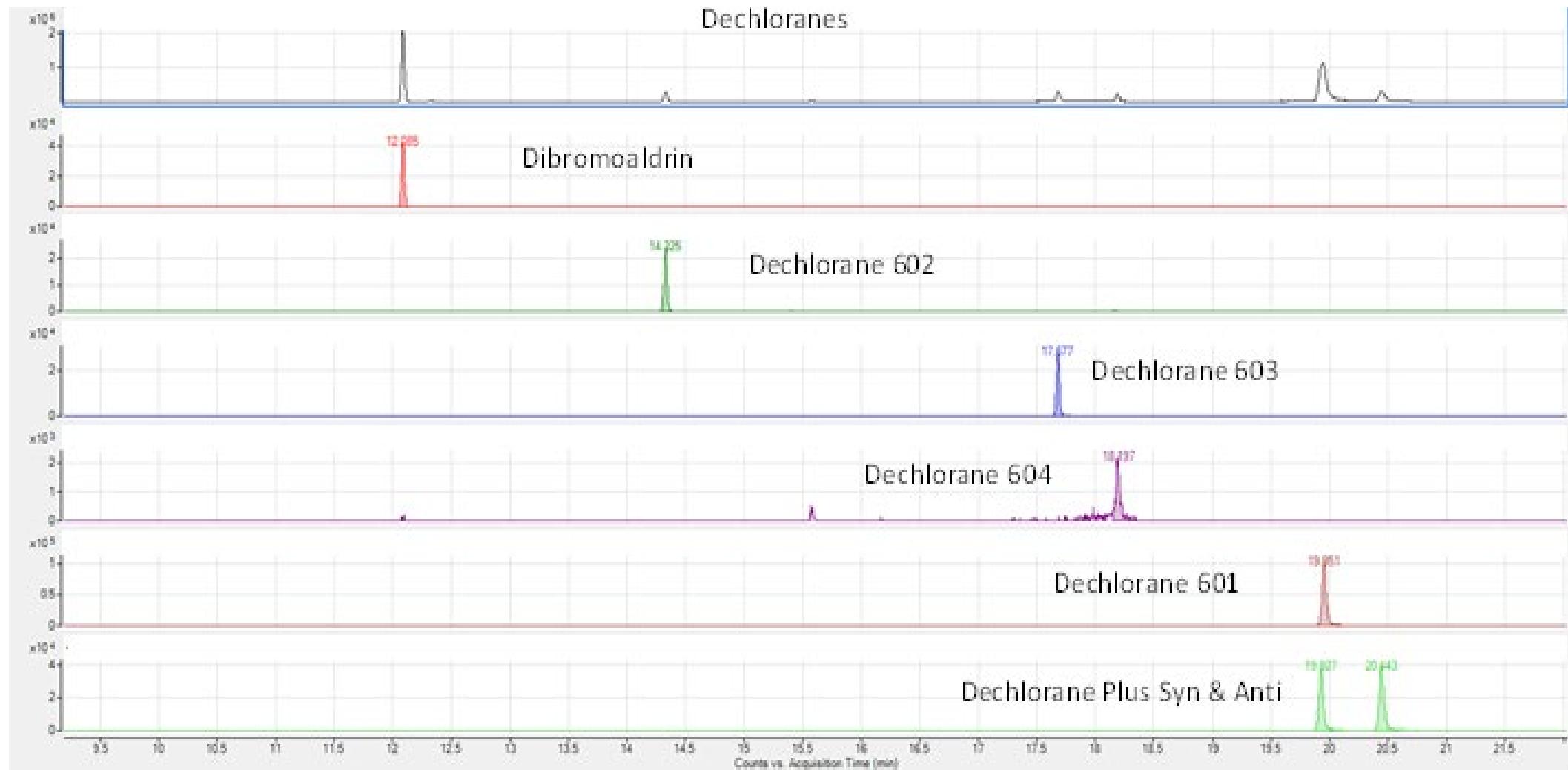
Focus: Chlorinated Paraffins

- Easy and inexpensive to produce
- Large production volume (600-1000 ktons/year in China)
- Random chlorination
- Several thousand different compounds

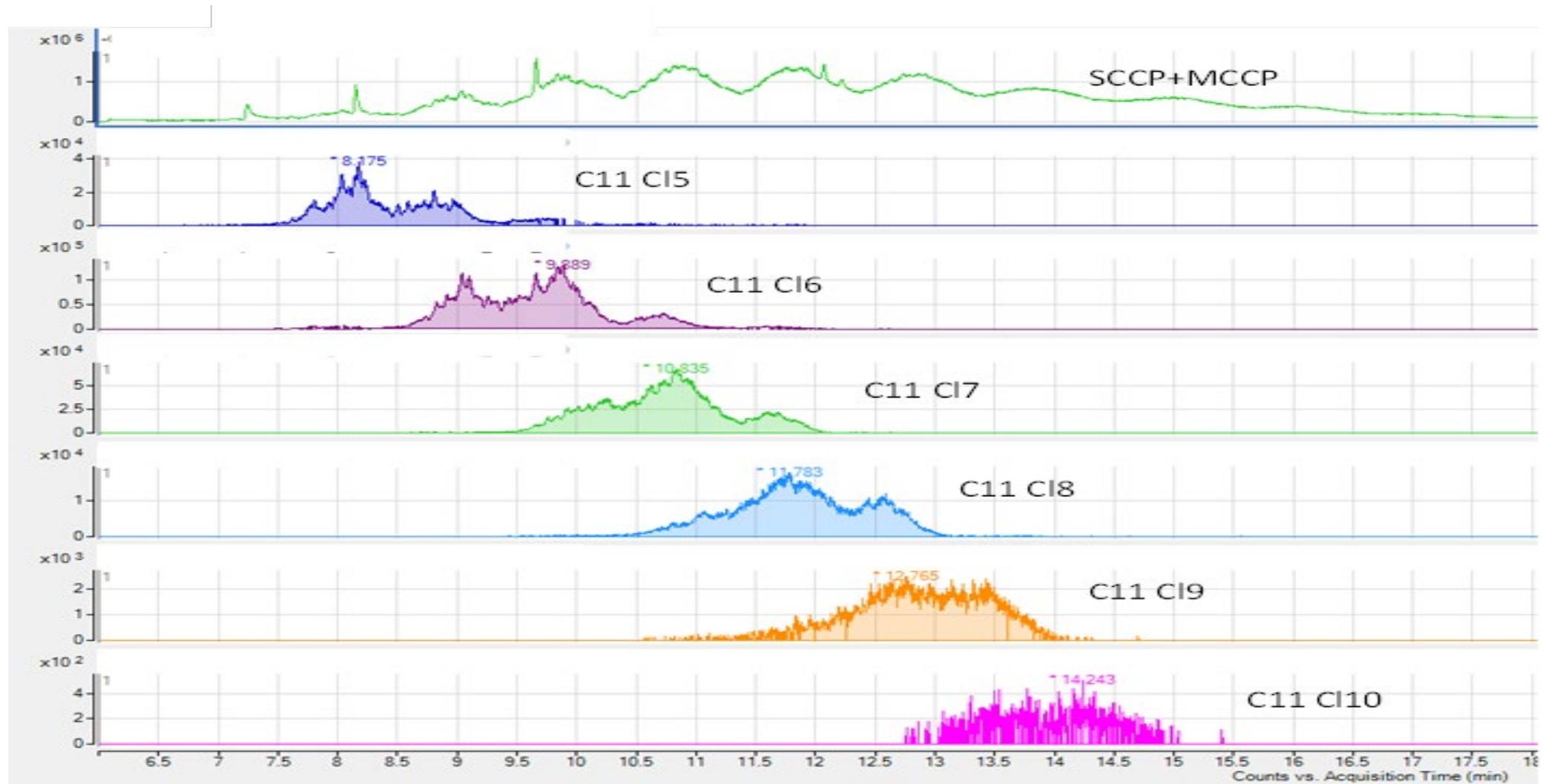
Focus: Chlorinated Paraffins

- Traditionally three compound groups
 - SCCPs (C10-C13)
 - MCCPs (C14-C17)
 - LCCPs (C18-)
- Increasing overlap between compound groups
- Chlorinated C7-C9 found in the environment

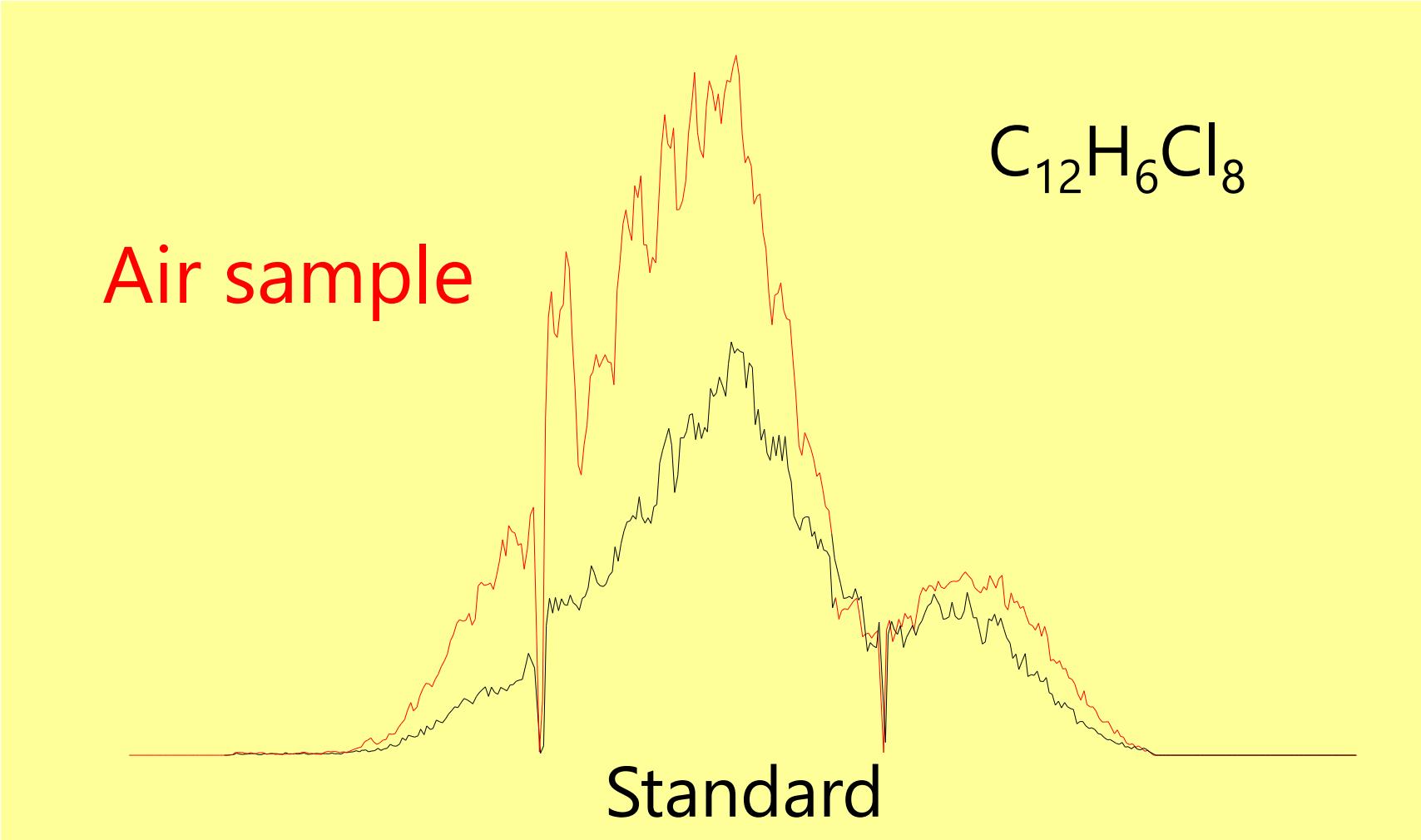
Separated signals – typical for many compounds



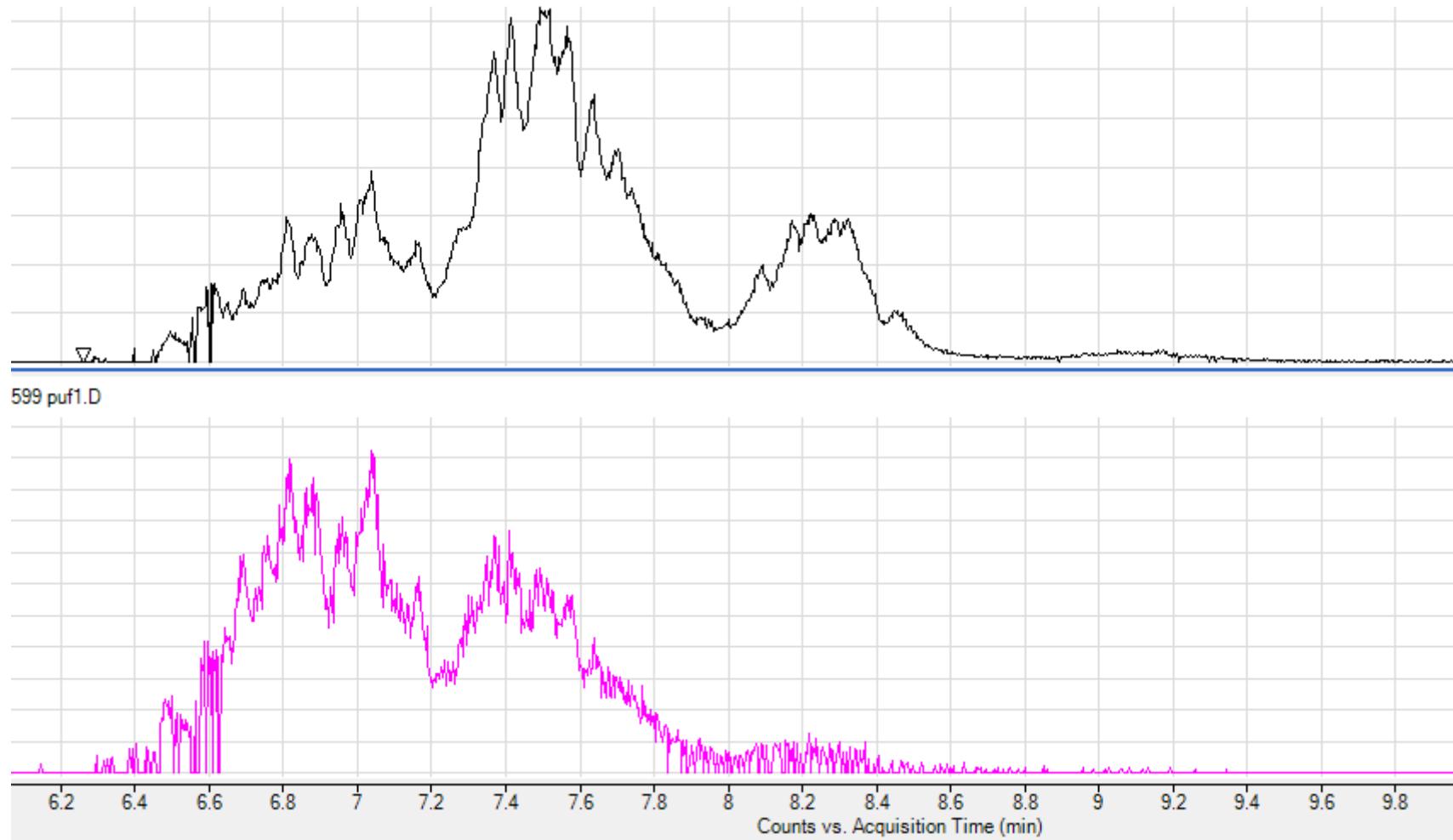
No separated signals – problem with CPs

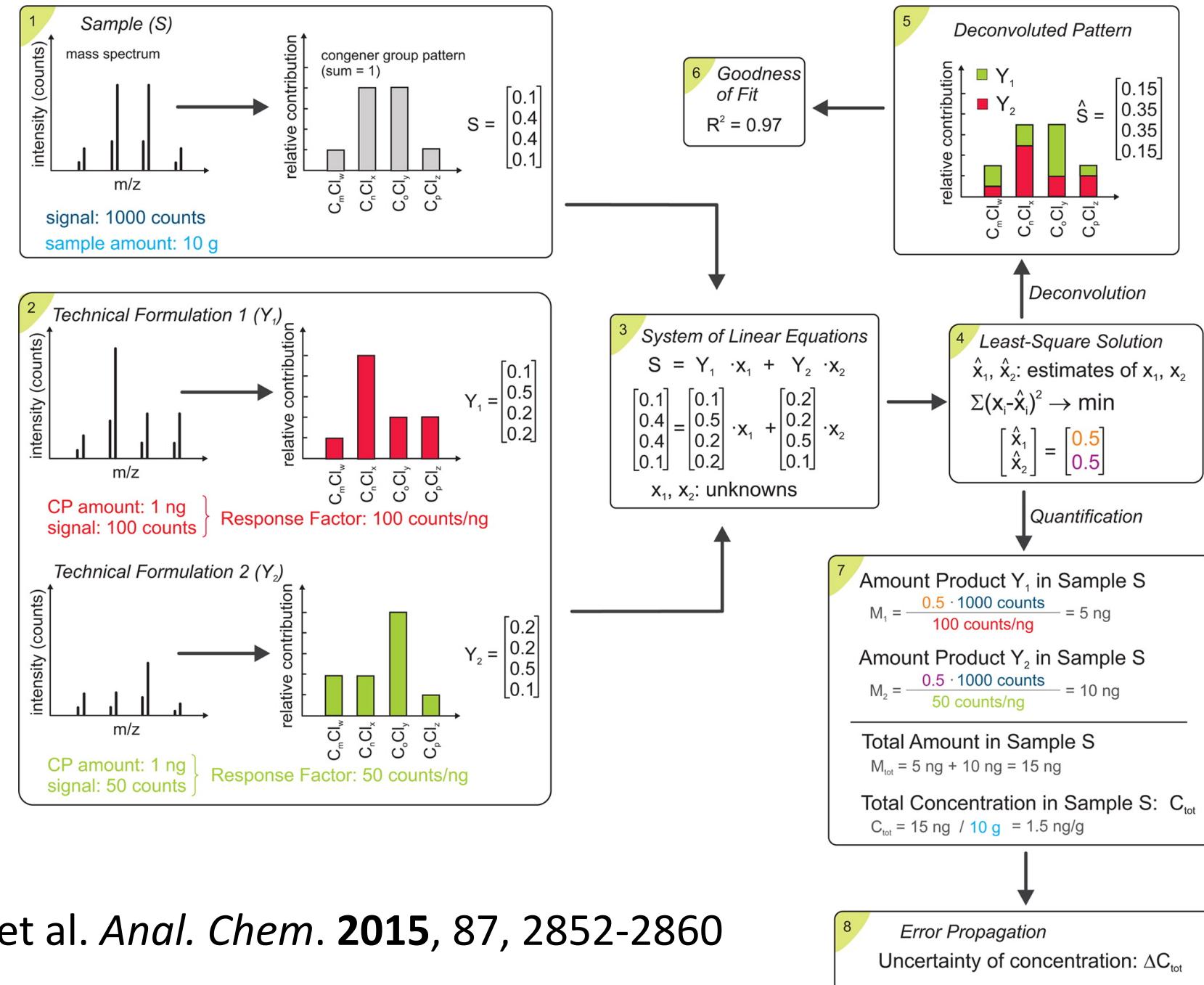


SCCP – Selected ion profile – Good match



SCCP – Selected ion profile – Bad match





CP uncertainty

- Very limited chromatographic separation
- Few relevant single standards, but technical mixtures
- Standard matching
- Batch to batch variations of standard mixtures

CP uncertainty

- Response factors depending on Cl number and chain length
- Response factors depending concentration (GC/MS)
- Lack of suitable internal standards
- Elevated concentrations in indoor air and dust
 - variable blank levels
- Large deviations for different quantification methods

LCCP - from GC to LC

GC:

- Broad peaks
- Poor sensitivity
- Unable to analyze less volatile LCCP

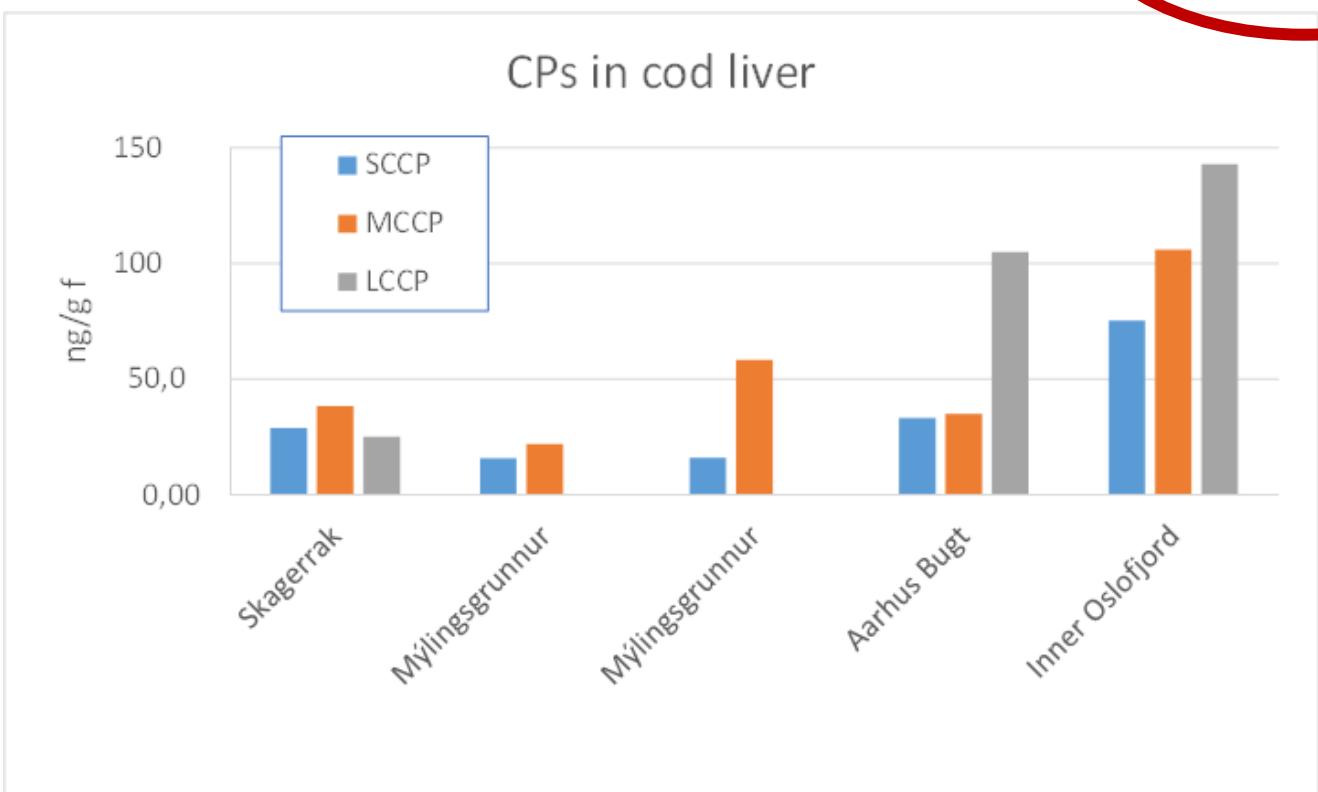
LC:

- Less/no problems with high boiling compounds
- Less variations in response factors
- Implementation of deconvolution quantification method
(but now also for SCCPs and MCCPs)

Results CPs

Matrix	Bird Eggs REM+URB	Trout REM	Perch REM	Perch URB	Cod Liver REM+URB	Grey seal REM	Terr. mammal REM	Air REM	Air URB	Pine needles REM	Pine needles URB
BP3	0	0	0	0	20	0	0	na	na	na	na
EHMC-E	14	0	0	0	0	0	0	na	na	na	na
EHMC-Z	0	0	0	0	0	0	0	na	na	na	na
OC	21	0	0	0	0	0	0	na	na	na	na
ODPABA	0	0	0	0	0	0	0	na	na	na	na
UV-320	21	0	0	17	60	100	0	na	na	na	na
UV-326	7	0	0	0	0	0	0	na	na	na	na
UV-327	50	0	0	17	60	50	0	na	na	na	na
UV-328	43	0	0	17	80	50	0	na	na	na	na
UV-329	0	0	0	0	60	0	0	na	na	na	na
DBA	0	0	0	0	0	0	0	0	0	0	0
Dec-602	100	100	0	67	100	100	78	0	0	0	0
Dec-603	71	0	0	0	60	50	0	0	0	0	0
Dec-604	0	0	0	0	0	0	0	0	0	0	0
Dec-601	0	0	0	0	0	0	0	0	0	0	0
DPSyn	7	0	0	0	0	50	0	25	67	0	0
DPanti	29	0	0	17	0	50	0	63	100	0	0
SCCP	100	67	100	83	100	50	100	100	100	50	100
MCCP	100	67	100	83	100	50	100	63	100	60	100
LCCP	21	67	22	83	60	50	56	63	100	30	80

Sample type	SCCPs	MCCPs	LCCPs
	(Min – max) Average Detection frequency	(Min – max) Average Detection frequency	(Min – max) Average Detection frequency
Perch REM	(<0,25 – 4,04) 2,40 100 %	(<0,65 – 31,9) 14,6 100 %	(<2 – 5,02) 3,86 22 %



ResultsCPs

- High concentration of all 3 groups in remote air
- Atmospheric long-range transport
- Very high concentration in urban air, especially LCCP
- Several CP sources in urban areas

SCCPs (Min – max) Average Detection frequency	MCCPs (Min – max) Average Detection frequency	LCCPs pg/m ³ (Min – max) Average Detection frequency
(43,6 - 547) 194 100 %	(<1160 - 2612) 570 63 %	(<100 - 190) 97,0 63 %

SCCPs (Min – max) Average Detection frequency	MCCPs (Min – max) Average Detection frequency	LCCPs pg/m ³ (Min – max) Average Detection frequency
(1 792 – 3 006) 2 473 100 %	(1 160 – 1 606) 1 325 100 %	(12 452 – 33 548) 21 202 100 %

Conclusions

UV:

- Marine > Freshwater >> Terrestrial environment

DEC:

- DEC 602 most frequent in biota,
- DPsyn/anti mainly in urban/marine biota and air

CPs:

- Very frequent in all sample types and environments
- Biota: roughly SCCP < M CCP < L CCP
- Also in terrestrial environment
- Many active sources, which needs attention and follow-up

Thank's for invitation and attention

