IVM Institute for Environmental Studies

VU UNIVERSITY AMSTERDAM

UNEP
United Nations Environment Programme

Capacity building for PCB analysis around the world

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Background

- Stockholm Convention on POPs requires a 'Global Monitoring Plan' (GMP) for **'Effectiveness evaluation**‘
- To be effective, monitoring data should “confirm a **50% decline** in the levels of POPs within a 10 year period”
- POPs laboratories must be capable – at any time – to analyse samples for POPs within a margin of ±25%;
- POPs: **PCBs**, dioxins, OCPs, BFRs, PFASs

Capacity Building

- Interlaboratory studies
- Training on-site and in reference labs
- Procurement
- Mirror analysis
- Protocols
- Professional instruction movies
- Technical advice

Activities: overview

On site training: 25 training missions in expert labs

Procurement

Air sampling

Workshops (Hong Kong, Beijing, Bamako, Suva (3), Barcelona, Amsterdam (2), Freiburg, Hanoi, Accra)

Training in expert labs

Activities

Guidelines

Presentations

Instruction Film PFOS

Special issue TrAC

Three interlab studies

Mirror exercise

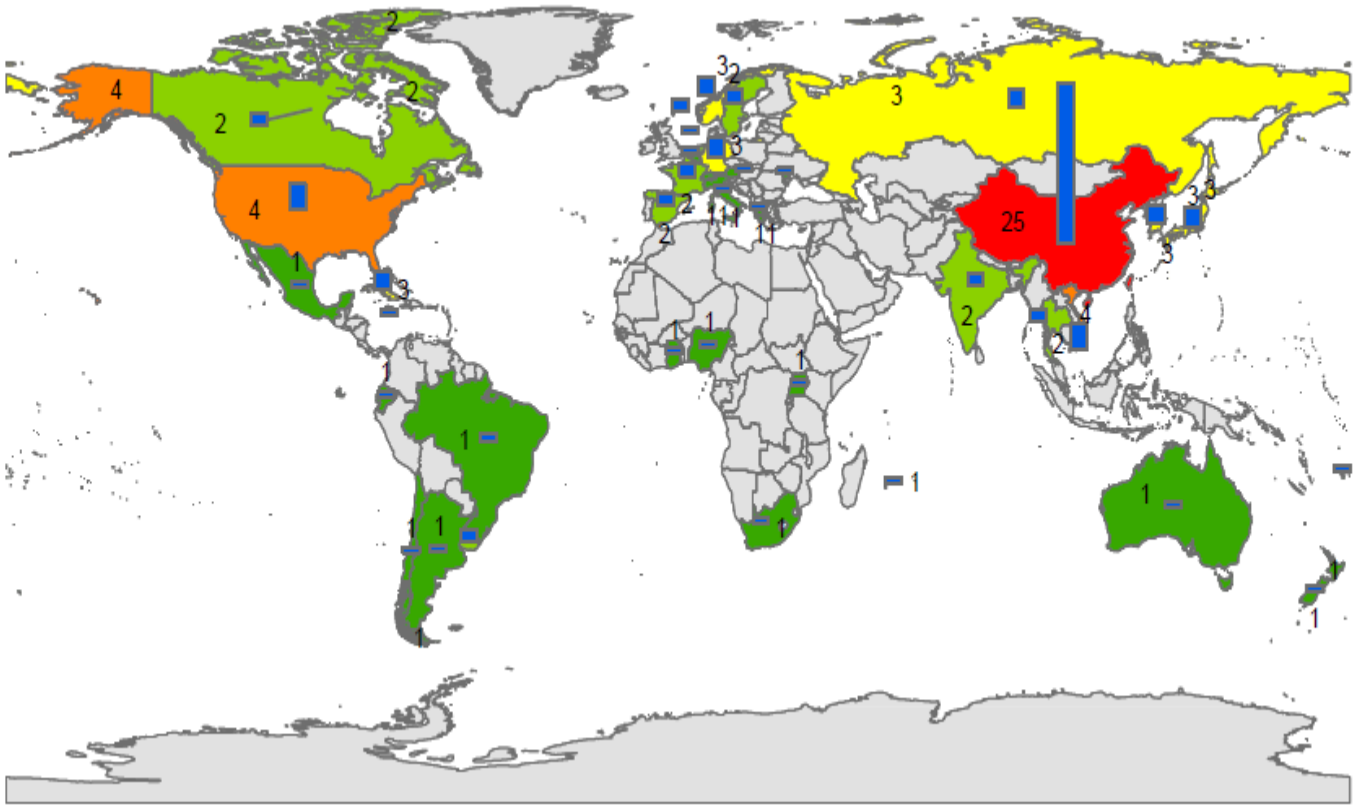
Training

- On-site training: needs-oriented
- Mirror analyses: your choice
- Advise on consumables
- Background information, literature

Interlab Participation

	1st Round	2nd Round	3rd Round
Subscription	103	106	175
Reported results	83	89	140
Results for PCBs	42	47	50
Countries	49	46	54

2nd ILS: Laboratories registered



CEE: Central and Eastern European

GRULAC: Group of Latin American and Caribbean Countries

WEOG: Western European and Other Groups

Region	Africa	Asia	CEE	GRULAC	WEOG	Total
No of Countries registered	9	9	2	10	16	46
No of Labs registered	12	45	4	14	31	106
No of Labs with results	5	42	4	11	27	89

Test Materials Interlab Studies

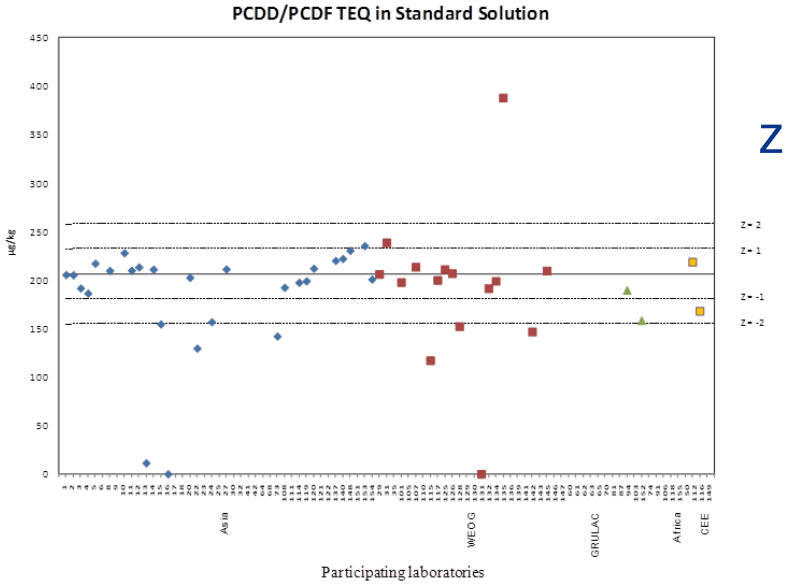
Testmaterial 1st Round	Test material 2nd Round	Test material 3rd Round
Standard Solution 6 indicator PCBs (28, 52, 101, 138, 153, 180), 1-10 µg/kg	Standard Solution 6 indicator PCBs (28, 52, 101, 138, 153, 180), 1-10 µg/kg	Standard Solution 6 indicator PCBs (28, 52, 101, 138, 153, 180), 1-10 µg/kg
Marine Sediment, North Sea (dry)	Marine Sediment, North Sea (dry)	Sediment, river Elb, Germany (dry)
Lake Trout (USA)	Pike perch fillet (NL)	Chinese mitten crab (NL)
Human Milk (S)	Human milk (S)	Human milk (S)
Fly ash (S)	Air, PUF extract waste incinerator, Sweden	Air, PUF extract, Barcelona (E)
	Transformer oil diluted Aroclor 1254 in toluene	

Participation Degree 2nd Round

Group	Standard solutions	Sedi-ment	Fish	Human milk	Air	Water	Human serum	Transfor-mer oil
OCP	50	27	36	21	23	-	-	-
PCB	47	38	43	28	25	-	-	19
dl-POPs	48	34	41	29	37	-	-	-
PBDE	42	30	34	19	21	-	-	-
PFAS	22	18	19	8	8	30	8	-

106 labs subscribed, 89 delivered data

Assessment



$$\text{z-score} = \frac{\text{Mean from Laboratory} - \text{Assigned Value}}{\text{Total Error}}$$

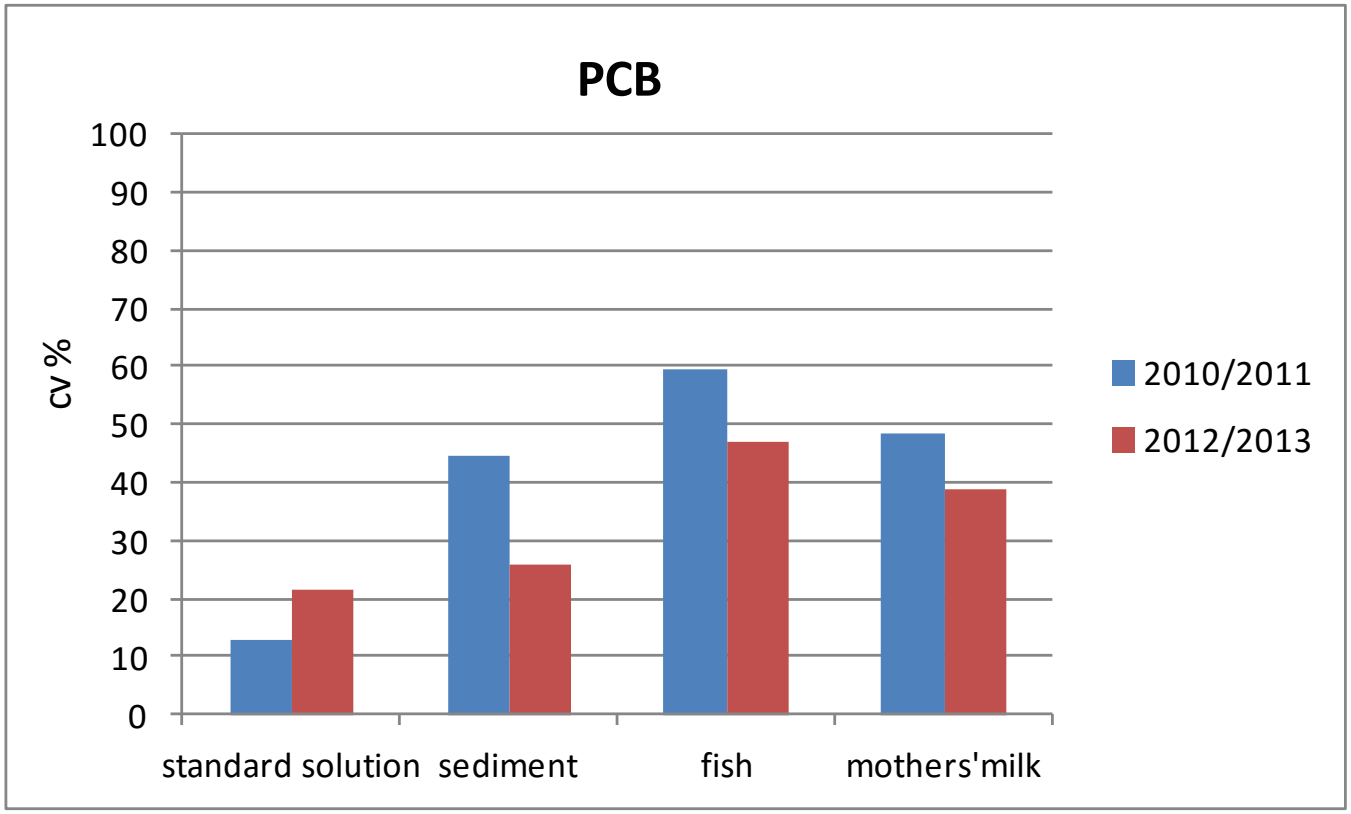
Target: z=12.5%

z-scores can be interpreted as follows:

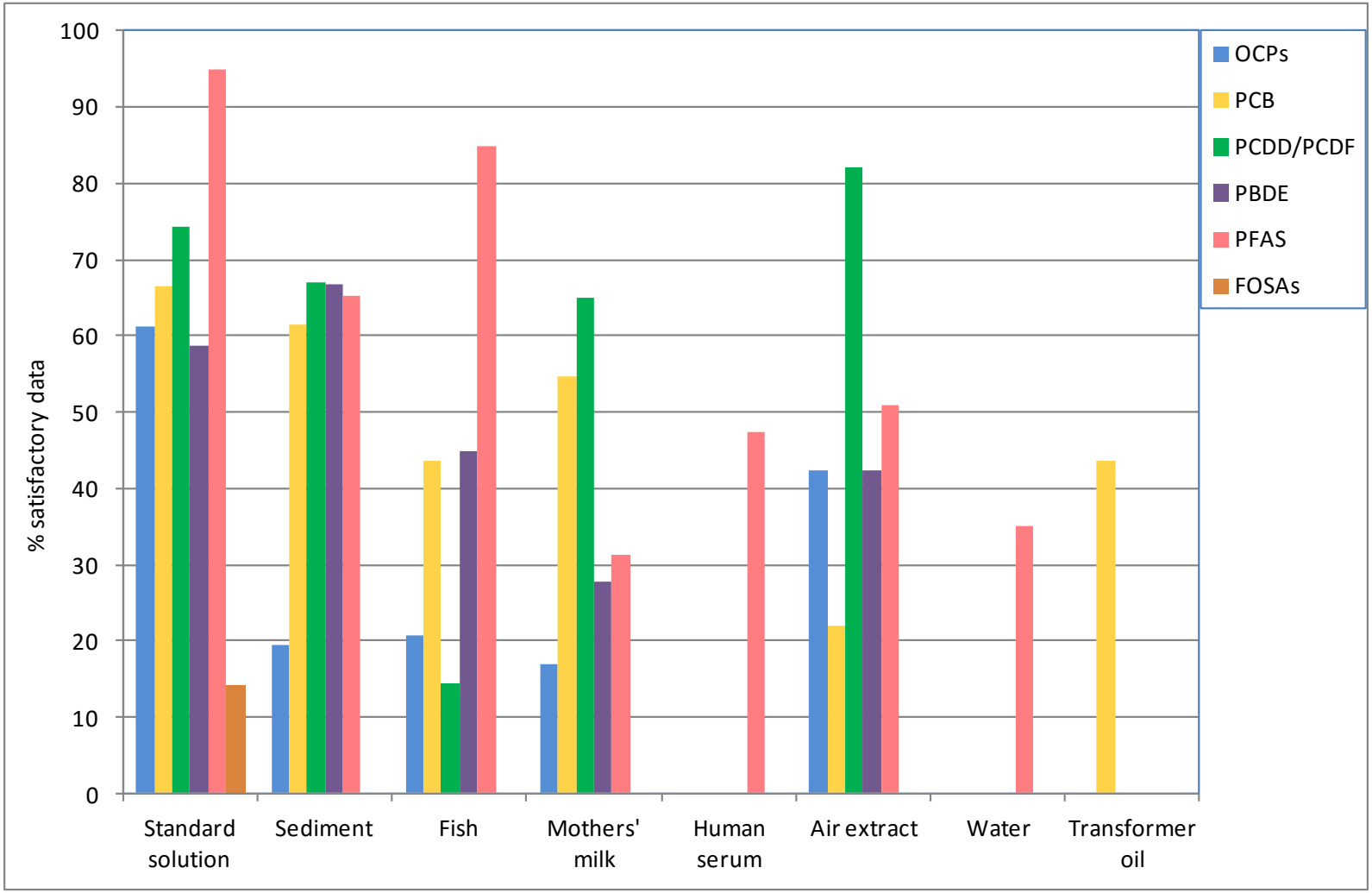
$\|z\| < 2$	Satisfactory	S
$2 < \|z\| < 3$	Questionable	Q
$\|z\| > 3$	Unsatisfactory	U

Test material	Compound Class	n	Between-Lab CV (%)
Standard solution	OCPs	22-51	8-25
	PCBs	40-41	12-19
	Dioxins, Furans, dl-PCBs	31-37	6-12
Lake trout	OCPs	10-34	40-240
	PCBs	30-34	48-113
	Dioxins, Furans, dl-PCBs	13-23	21-135
Sediment	OCPs	3-38	14-451
	PCBs	25-31	31-59
	Dioxins, Furans, dl-PCBs	19-28	11-98
Human milk	OCPs	4-20	31-332
	PCBs	18-24	26-117
	Dioxins, Furans, dl-PCBs	6-21	52-76
Fly ash	PCBs	10-12	25-191
	Dioxins, Furans, dl-PCBs	20-27	13-80

First vs. Second Interlab, PCBs



Percentage satisfactory z-scores, Round 2



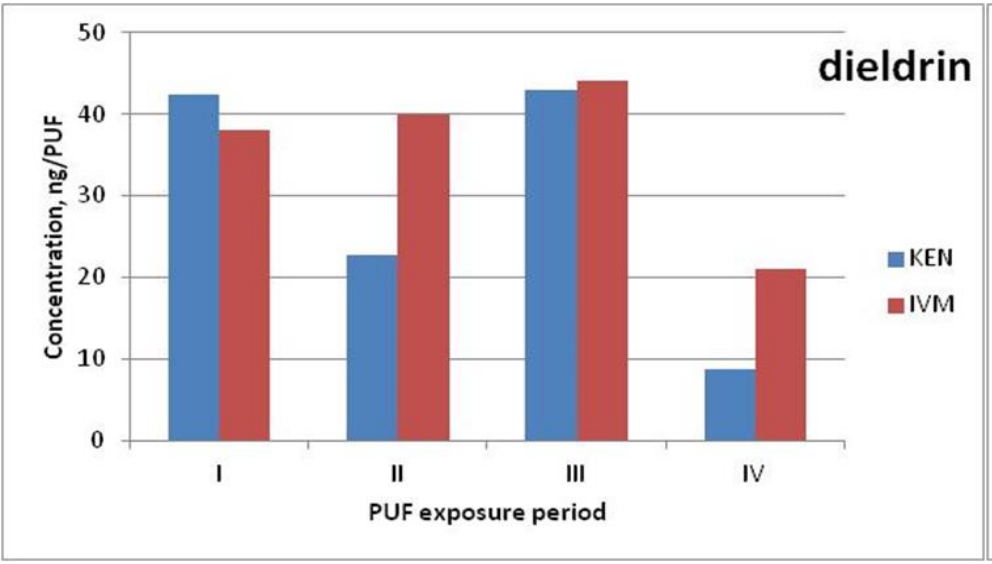
Performance of laboratories – z-scores

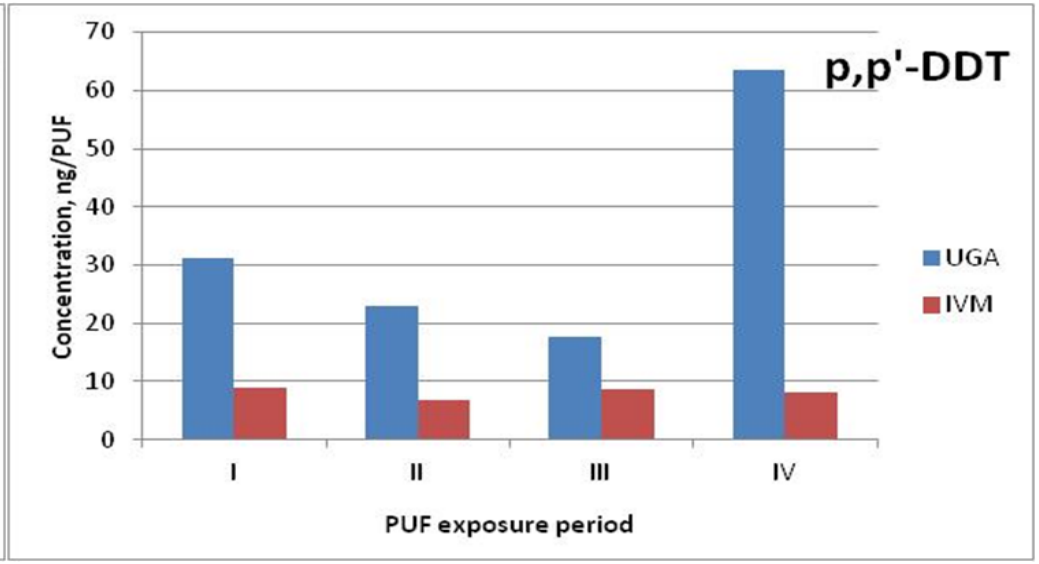
POP	OCPs			PCB(6)			dl-POPs			PBDE+PBB			PFAS		
# z-scores	2,603			1,427			5,018			1,170			435		
	10,653														
	S	Q	U	**S**	Q	U	**S**	Q	U	**S**	Q	U	**S**	Q	U
No	**1,495**	281	827	**787**	177	463	**3,804**	484	730	**646**	222	302	**377**	19	39
%	**57%**	11%	32%	**55%**	12%	32%	**76%**	10%	15%	**55%**	19%	26%	**87%**	4%	9%

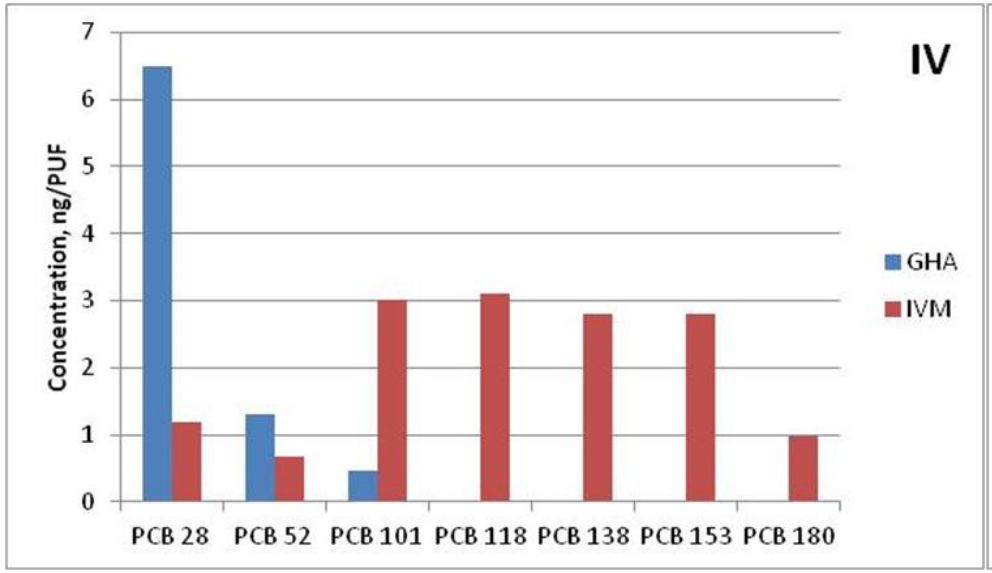
Semi-quantitative results:

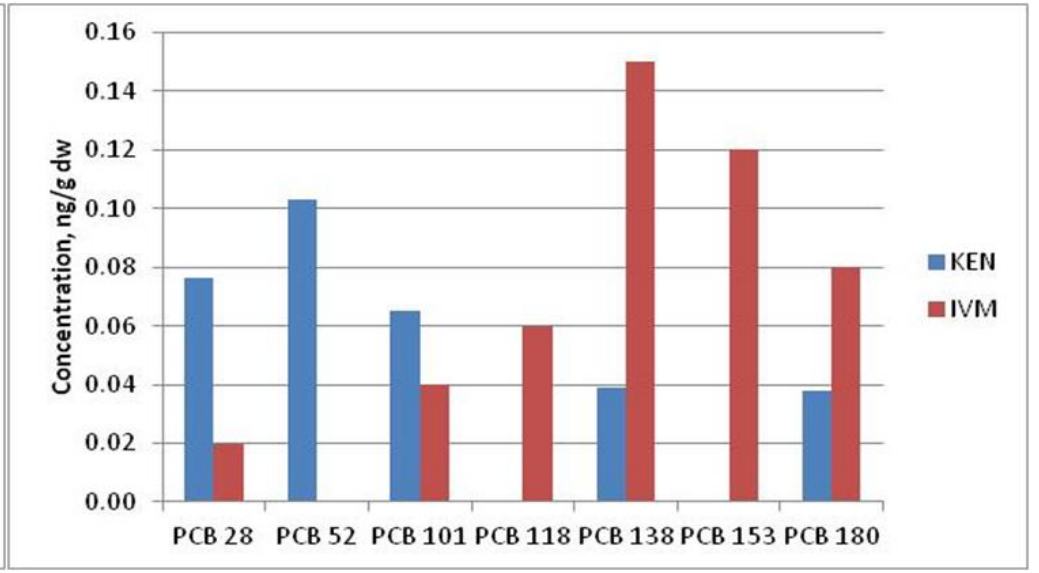
- Highest number of satisfactory results for dl-POPs (3,804); followed by OCPs (1,495)
- Highest number of unsatisfactory results for OCPs (827)
- Highest percentage of satisfactory results for PFAS (87%);followed by dl-POPs (76%)
- Highest percentage of unsatisfactory results for OCPs and PCB(6) (32%)

Mirror analyses in African countries









On-SiteTraining - Observations

- **Lack of consumables** (glassware, syringes, chemicals, etc.)
- **Bureaucracy** is hindering processes in laboratories
- Laboratories need to build up **routine**
- **Training** is needed for understanding basic principles

  of trace analysis (optimization, validation, clean lab, QA/QC)
- **Safety** issues need strong improvement
- Laboratories often have **a preference for food analysis**

Conclusions

- **Regular inter laboratory studies** are needed to monitor and improve the overall level of performance of POPs

- **More laboratories should receive training**, either in their own laboratory or, preferably, in an expert laboratory

- Labs are encouraged to train their own technicians by **repeatedly analysing certified and internal laboratory reference materials**

- **Interactive workshops** – through Webinars or on-site with the participating laboratories – may help to improve understanding and interpretation of the results and to dissimilate the lessons learned

Conclusions (II)

- **All** laboratories to pay more attention to **quality assurance (QA)** and method development

- Regular, **routine analyses** instead of one-off projects would help to build up the required level of experience for this type of analysis