



# Ambient air sampling and analysis

## national and cross-cutting activities in the UNEP/GEF GMP2 project in Africa

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Stockholm Convention  
Regional Centre for Capacity Building  
and the Transfer of Technology

*Final Results Workshop of the UNEP/GEF project on 'Establishing the Tools and Methods to Include the Nine New POPs into Global Monitoring Plan' and Inception Workshop for UNEP/GEF project on 'Continuing Regional Support for the POPs GMP under Stockholm Convention in the Africa Region', Ghana, Accra, 6-8 July 2016*

# Outline

- Background information - POPs monitoring in Africa - regional coverage and calibration study for tropical climate
- GEF GMP2 project issues:
  - arrangements
  - timeline
  - other practical issues
- How to maximize the benefits? - issues for consideration in support to the Global Monitoring Plan in Africa

# POPs Monitoring in Africa (1)

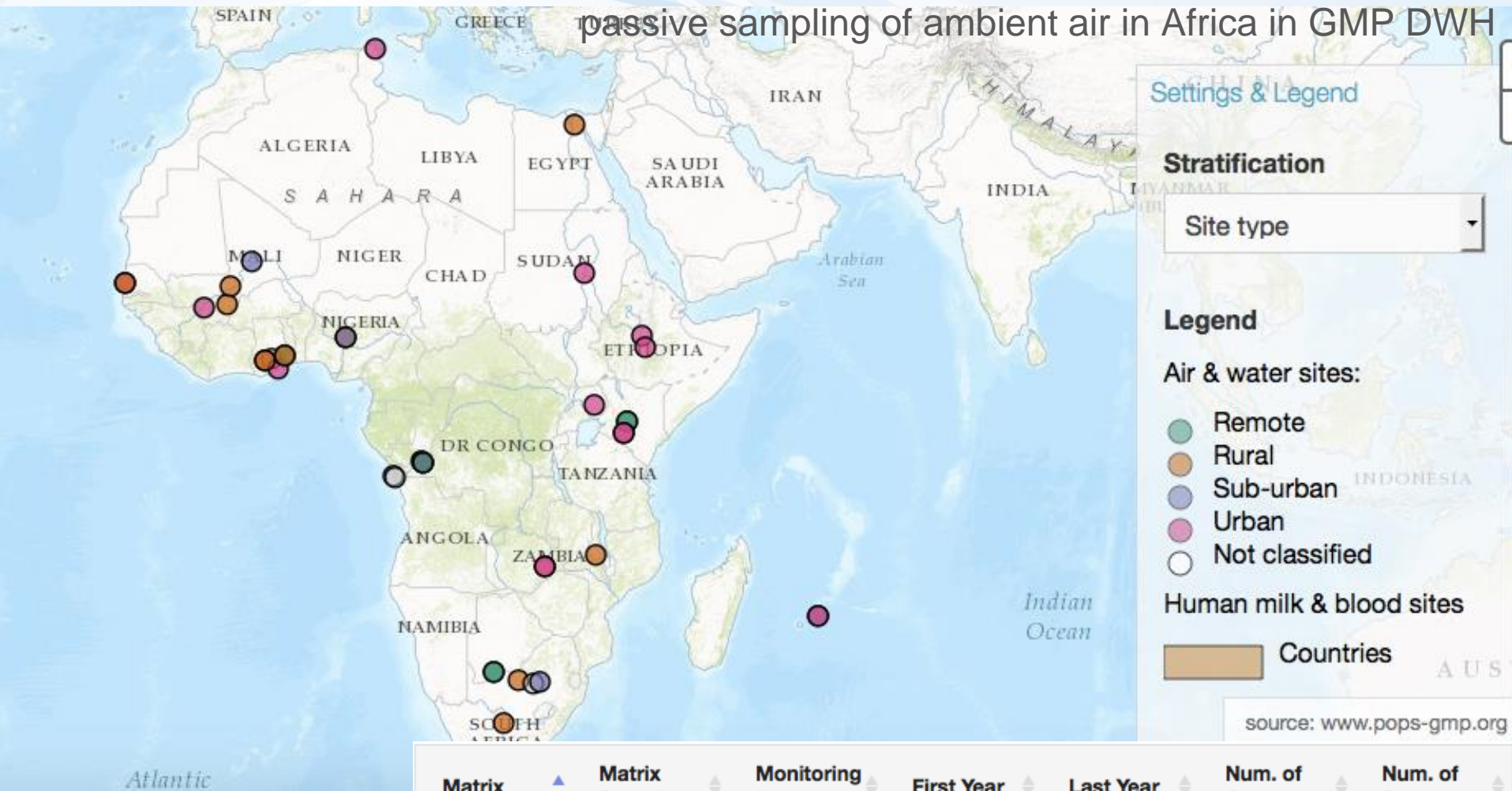


active sampling of ambient air by 2014



# POPs Monitoring in Africa (2)

passive sampling of ambient air in Africa in GMP DWH



Matrix	Matrix Specification	Monitoring Programme	First Year	Last Year	Num. of Compounds	Num. of Sites
Air	Passive	GAPS	2005	2009	12	7
Air	Passive	GMP UNEP	2010	2013	23	11
Air	Passive	MONET	2008	2012	17	23

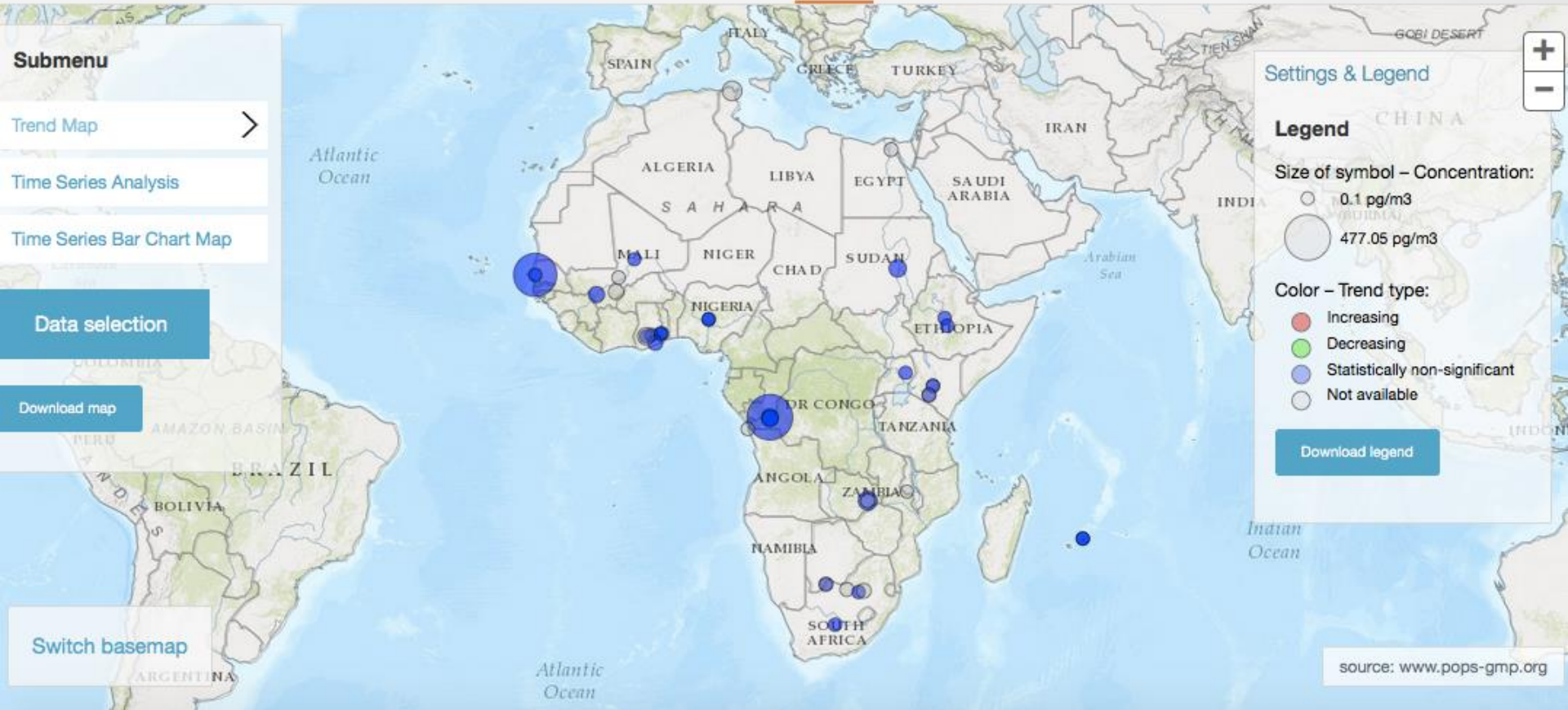


# POPs Monitoring in Africa (3)

GMP Data Warehouse – Data Visualization



SPATIAL DISTRIBUTION DATA AVAILABILITY SUMMARY STATISTICS TIME SERIES DATA EXPORTS



passive sampling, sum 6PCB in Africa in GMP DWH



# POPs Monitoring Activities since 2008

Air monitoring by three programmes (passive sampling):

GAPS 2005-2009 - data rather scattered, 7 sampling sites (changeable). As of 2014 sampling continues at 4 sites (3 countries - Kenya, Uganda and South Africa (2)) samples for 2010, 2012 and 2013 are archived, 2011 and 2014 data should be analyzed by now.

GEF projects (GMP1) - West Africa and Central and East Africa, limited amount of time (2 years max) - 2009-2012 (PAS), total of 11 sites/countries

MONET network (RECETOX) - 2008 pilot + 2010-onwards... in 15 countries (23 sites), now in 13 countries (13 sites), sampling at first 28 days, now 84 days/3 months (due to new POPs), all SC POPs + candidate chemicals analyzed

Data from all the above in the Global Monitoring Plan data warehouse until end 2013 + used in the preparation of regional monitoring reports and global monitoring report - see presentation by Vincent Madadi

2013 - two active samplers (low-vol) were provided to Ghana and Kenya (RECETOX donation) + training in 2013 and calibration study in 2014

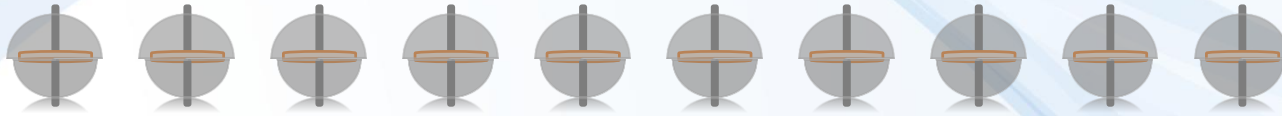




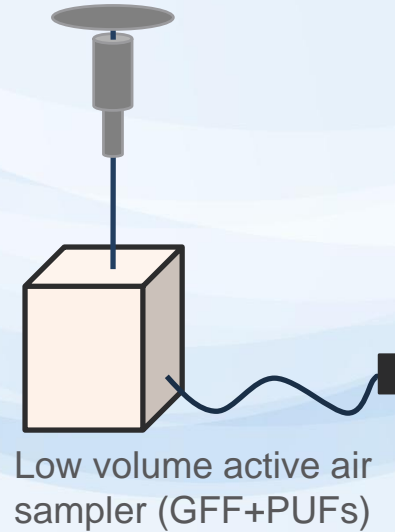
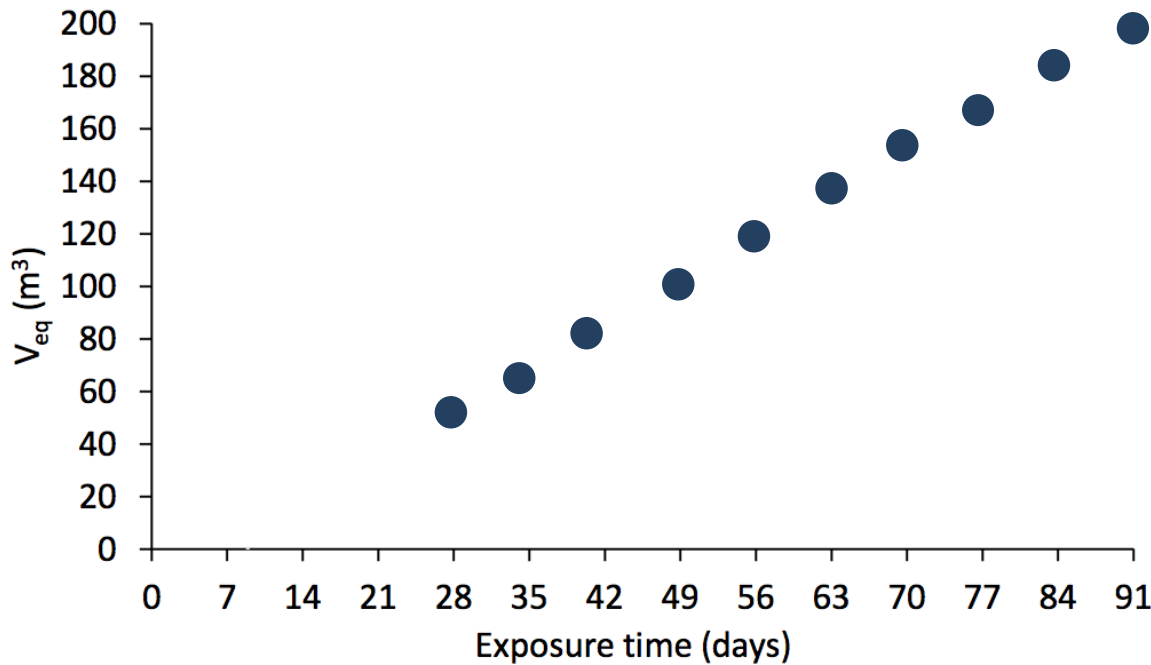
# Calibration study PAS/active - motivation

- Passive samplers are widely used globally, and particularly across Africa as part of MONET-Africa and GAPS
- Most calibration of passive samplers has been done in temperate regions
- Temperature is a known influence on passive sampler performance
- It is important to know whether the calibration data from temperate regions is also applicable to tropical/equatorial climate zones

# Calibration study structure



PUF disks deployed in passive samplers: double-dome chambers



Target compounds:  
indicator and dioxin-like PCBs, OCPs, PAHs, PCDD/Fs, PBDEs, novel FRs, drin pesticides\*

(\*not detected)



# Active sampling in Africa 2014

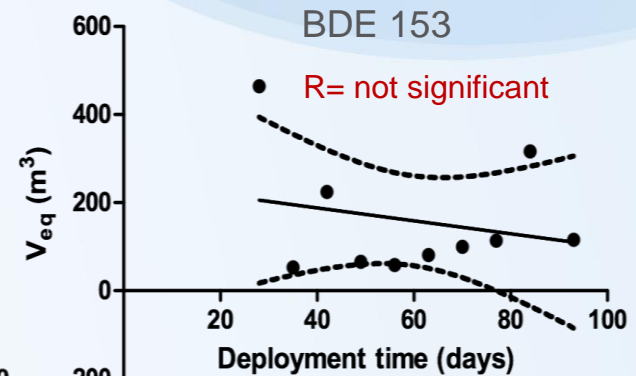
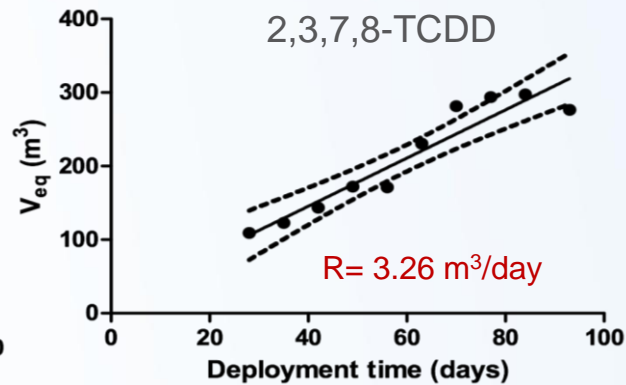
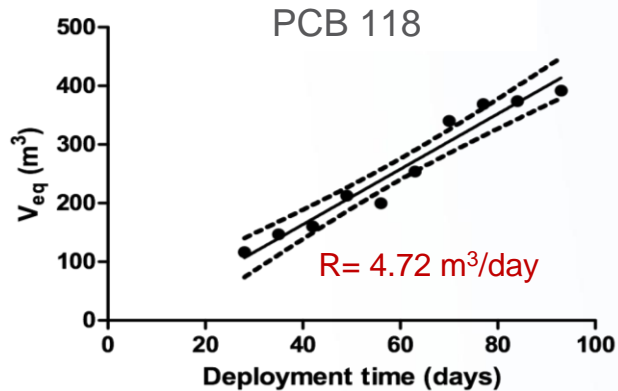
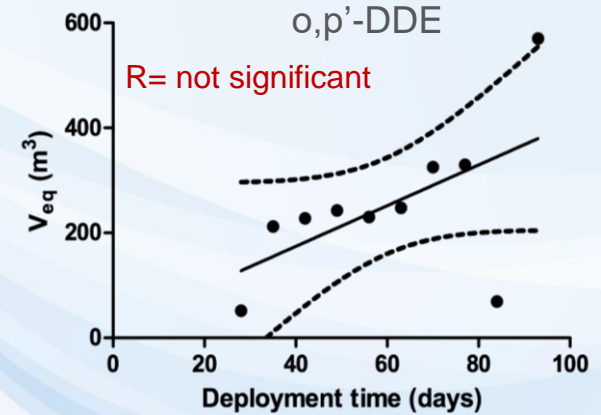
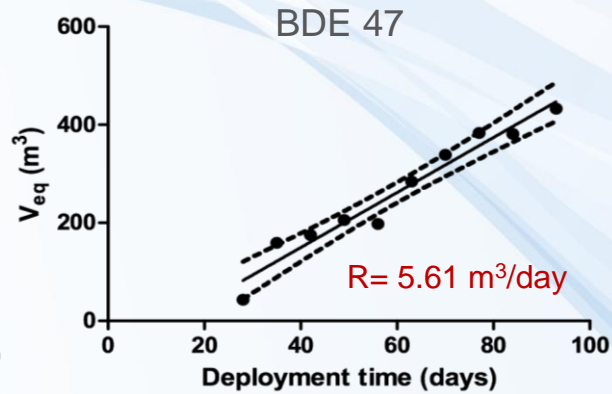
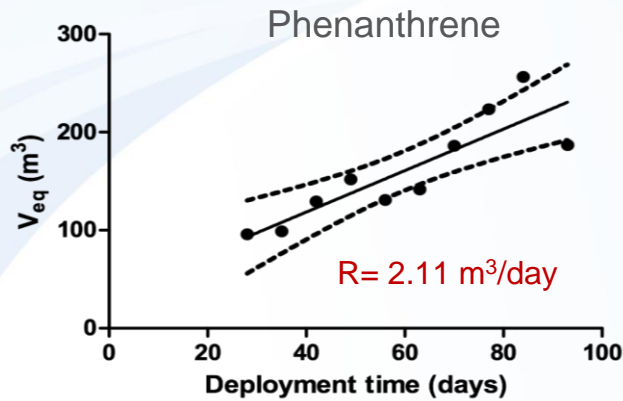
parallel study 2 sampling sites (Ghana and Kenya) with Leckel MVS-6 (Sven Leckel, Germany) - low volume active sampler parameters: polyurethane foam disks (4.4 cm diameter, 10 cm thick, density 0.030 g/cm<sup>3</sup>, type N 3038; Gumotex Breclav, Czech Republic) and sampling head devices for PM<sub>10</sub> equipped by Quartz Microfibre Filters (4.7 cm diameter, QM-A, Whatman, UK)

Continuous sampling cca 7 days (130-166 hrs), air volume collected: approx. 350 m<sup>3</sup> per run, amount of air carefully recorded in the protocol

sampling rates of individual chemicals were studied - see further

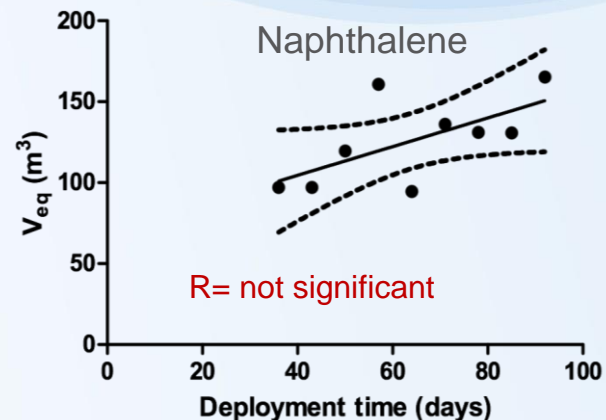
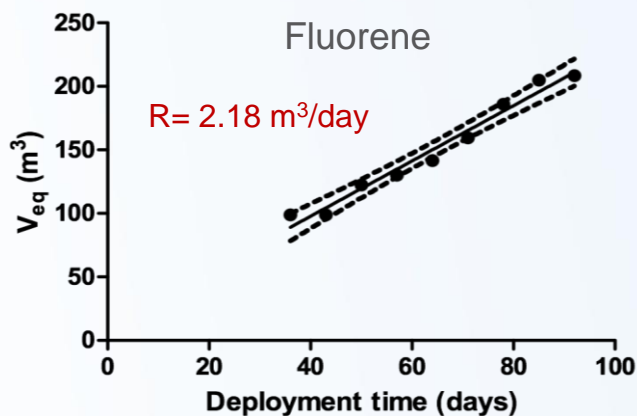
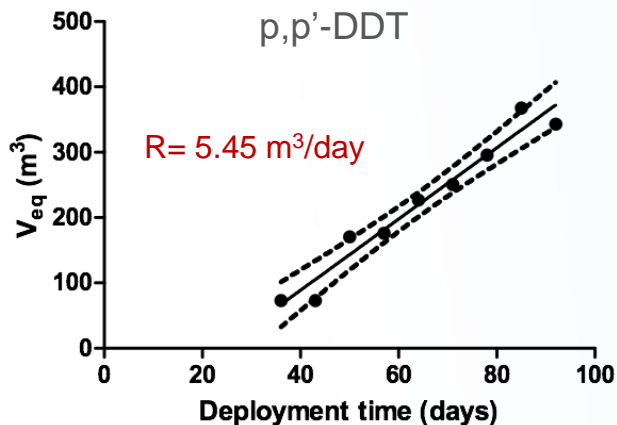
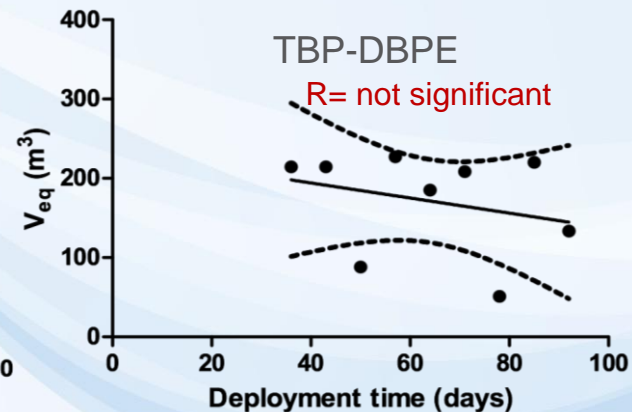
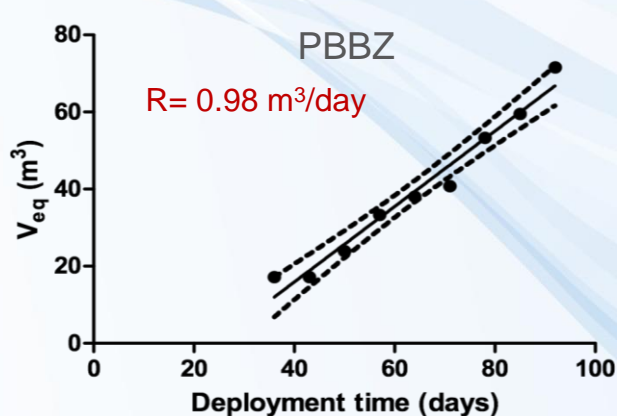
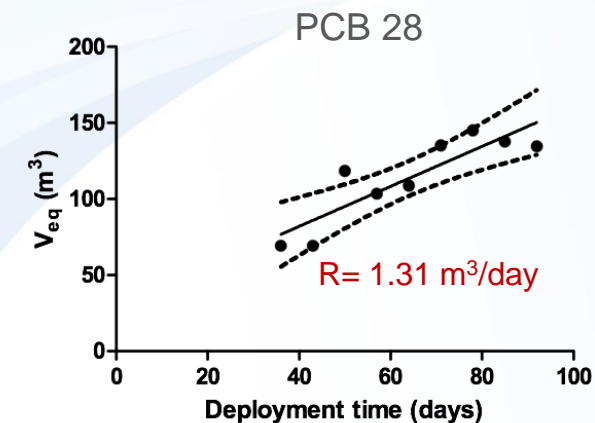


# Selected sampling rates - Kenya



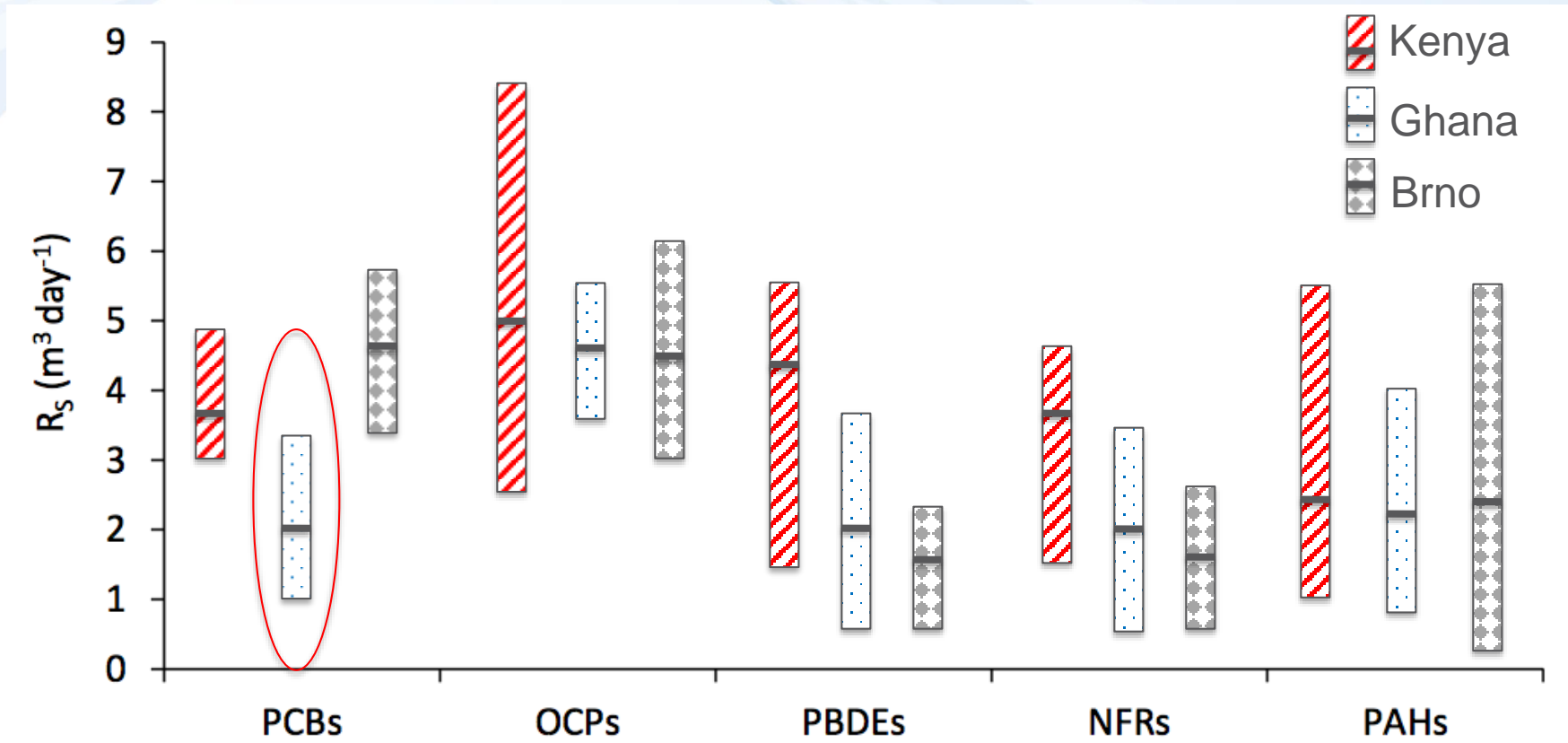
Good performance (linear uptake of PAS) for 58 of 73 SVOCs, average sampling rate of  $3.0 \pm 2.7 \text{ m}^3/\text{day}$

# Selected sampling rates - Ghana



Good performance (linear uptake of PAS) for 77 of 88 SVOCs, average sampling rate of  $2.6 \pm 2.3 m^3/day$

# Comparison of PAS sampling rates in warm vs. temperate regions





# Calibration study - conclusions

Good characterization of PAS in tropical climate

PAS sampling rates in tropical and temperate regions are comparable (factor of two)

Well characterized sites (and recalculation data) from the intercalibration study

= for trends, it is well adviseable that these well characterized sites continue sampling as spatial aggregation of air data is not allowed (GMP guidelines + GMP DWH data structure)



# Ambient air - passive sampling arrangements

- One PAS sampling site per country involved in the project, all samplers will be deployed on this same site
- Sampling material for PAS sampling dispatched by RECETOX to each project country in one go
- Sampling: 8 sampling periods over two years, 3 months each (90 days).
- Tracking information/sampling flow: excel sheet delivered with the sampling material (annexed to SOP) and labels
- Analyses of samples - national laboratories and expert laboratories IVM and MTM - (in line with XLS)
- Dispatching of exposed disks for analyses - every 6 months

# Ambient air - passive sampling - timetable

Delivery of the sampling material (by RECETOX) - tentative delivery date **end of August 2016**

NOTE: delivery date strongly depends on signature of individual country SSFAs (and availability of delivery addresses and names to be identified asap!)

Start of sampling: **October 2016**

Sampling timetable = 8 sampling periods: 2016-IV, 2017-I, 2017-II, 2017-III, 2017-IV, 2018-I, 2018-II, 2018-III, 3 months each (90 days)

Delivery of exposed PUF disks to relevant partner laboratory (MVM, IVM, national - see excel sheets according to sample label) - planned: **April 2017**, November 2017, April 2018, December 2018.



# Ambient air - passive sampling - practical issues

## Sampling site

Selection - avoid duplication (MONET/GAPS) but keep for GMP trends (GEF/GMP1 sites)

Each site is to be well documented - photos, GPS coordinates, narrative, average temperature and weather events/meteorology site (if possible)

## Sampling of air

Follow the SOPs for sampling

Record information into sampling into protocols+ XLS

Labelling of PUF in conformity with the excel sheet

Field blanks to be collected

Exposure times to be kept 3 months, 90 days

Record also temperature, ad hoc events (sandstorm, flood, fire...) to ease interpretation of results



# Ambient air - passive sampling - practical issues

## Storage of PUF disks

prior deployment - in their packaging, in the fridge/freezer  
after exposure - properly labeled, packed in aluminum foil and plastic bags, in dark, cool - ideally in the freezer, until sending to laboratories (timetable)

+ Keep protocol with the exposed disk at all times!

## Delivery of exposed disks for laboratory analyses

make sure sampling protocol, labels and any other complementary information are matching the relevant exposed PUFs,

include also field blanks

use use the reliable courier + also use supporting letters (customs, confirmation by laboratory etc...)

inform the partner laboratory of the delivery



# Passive sampling - checklist (1)

One sampling site per country identified (countries)

- positioning - please avoid duplication with MONET but maximize potential for trends = keep the same sites from GEF1 if applicable and consider also longer term stability)
- picture of the site + description (narrative - distance from buildings, industrial activities, type of site ....) + GPS coordinates + meteorological data (wind/temperature)
- contact person + contact details! - communicated to UNEP asap!

Sampling material delivery to countries (by RECETOX)

- PUFdisks and samplers labeled in conformity with EXCEL
- SOP for sampling + protocols included in the delivery
- delivered at once for all sampling periods, sent by courier to relevant contact person

Storage before exposure (countries)

store cleaned materials in conformity with SOP to avoid contamination prior to exposure



# Passive sampling - checklist (1)

## Sampling (countries)

Each country to follow the instructions in the sampling SOP, timeline: 3 months exposure/sample, record information to protocols

## Sample storage after exposure (countries)

Each country to follow instructions in the SOP, store samples in fridge prior transport to expert laboratories (avoid contaminations)

## Transport of samples for analyses (countries)

- for logistical reasons every 6 months (first time April 2017)
- countries send packages to laboratories defined in excel sheet (see sample label)
- provide all necessary complementary information with the PUF - protocols!
- avoid cross-contamination
- use couriers and customs letters/inform the target laboratory before sending the parcel

# GEF-GMP2 arrangements - active sampling

two sites in the region in this project

Sampling material dispatched by RECETOX (PUF cylinders and filters, precleaned) to countries in one go

Analyses performed by RECETOX and MTM

Dispatching of exposed sampling media - same timetable as PUFs

Expected sampling timetable: Oct2016, Dec 2016, Mar 2017, Jun2017, Aug2017, Oct2017, Jan2018, Apr 2018, Jul2018, Oct 2018 (taken in the same week at both sites) - specified in the excel sheet with the material delivered





# Active sampling - practical issues

## Sampling site

Selection - for trends in GMP it is well advisable that the two well characterized sites from the PAS-active study continue sampling

Each site is to be well documented - photos, GPS coordinates, narrative, Availability of temperature and meteorological data

Trained staff and equipment necessary

Continuous electricity supply and surveilled site is necessary

## Sampling of air

Follow the active sampling procedure for low-volume samplers

Continuous sampling of approx. 160 hours

10 samples to be collected in dedicated time intervals

Record information into sampling into protocols

Labelling of exposed material (PUFdisk/cylinder and quartz filter) in conformity with the excel sheet

Field blanks to be collected



# Active sampling - practical issues/checklist

## Storage of sampling material

prior deployment - in their packaging, in the fridge/freezer (PUF) or in clean/dry/cool place (quartz filters)

after exposure - properly labeled, packed in aluminum foil and plastic bags, in dark, cool - ideally in the freezer, until sending to partner laboratories (timetable)

+ Keep protocol with the exposed disk at all times!

## Delivery of exposed materials for laboratory analyses

prepare packaging according to the assigned partner laboratory (RECETOX or MTM) specified in the EXCEL

make sure sampling protocol, labels and any other complementary information are matching the relevant exposed media

include also field blanks

use use the reliable courier + also use supporting letters (customs, confirmation by laboratory etc...)

inform the partner laboratory of the delivery





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Thank you for your kind attention

