

# Environmental Biomarkers



Sampling, analysis and results

11th BioDetectors Conference 2018

**Aachen, Germany**

13-14 Sept 2018



Bridge between public concern, industrial and governmental pollution issues

**FRYSLAN** **1**  
NIEUWS VOOR IEDEREEN

WELKOM

WED. GEM. DE W. VAN DER W. 2018



# Cases CALUX

1. Estrogenic activity in **water**
2. PCDD/F/dl-PCBs in **hare**
3. POPs in **wool**
4. PAH in **dust** deposition
5. PCDD/F/dl-PCBs in **eggs** of backyard chicken

case

sampling

CALUX

Follow up



# Estrogenic activity in water



37.500 ton bottom ash

35 ng TEQ/kg dust  
PCDD/F/dl-PCBs

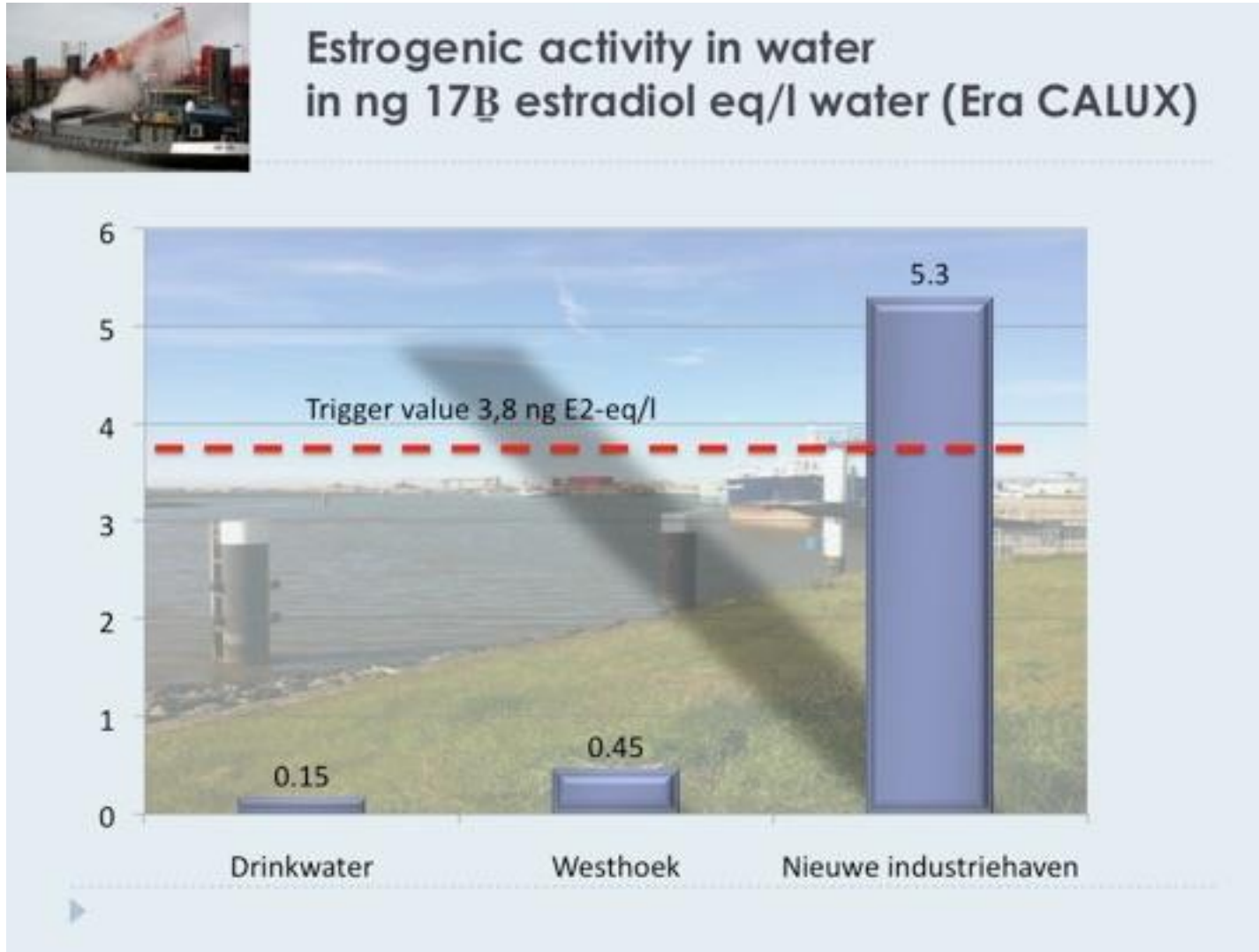
case

sampling

CALUX

Follow up

# ERA CALUX estrogenic activity



## Follow up

A (very expensive) counter study of the government (Rijkswaterstaat) two weeks **after loading** bottom ash in ships show **no** EDC activity.

Measures were taken to reduce dust deposition in the water, covering during transport and wetting the ash.





# Hare

Dioxins

Incinerator



Kings Garden

Dead animals near the  
incinerator

Reference?

case

sampling

CALUX

Follow up

?

# Reference hare from Kings garden



Hare age m/f	Distance incinerator	PCDD/F	dl-PCBs	PCDD/F/dl-PCBs	
2 years(m)	150	1,2	0,5	1,7	suspect
1 years (f)	200	0,17	0,17	0,34	suspect
3 months (f)	5400	1,8	0,6	2,4	suspect
<b>Kings Garden</b>	Reference	1,1	1,2	2,3	suspect
<b>Kings Garden</b>	Reference	1,1	1,6	2,7	suspect
<b>Kings Garden GC-MS (TEQ)</b>	Reference	1,44	1,75	3,19	suspect

case

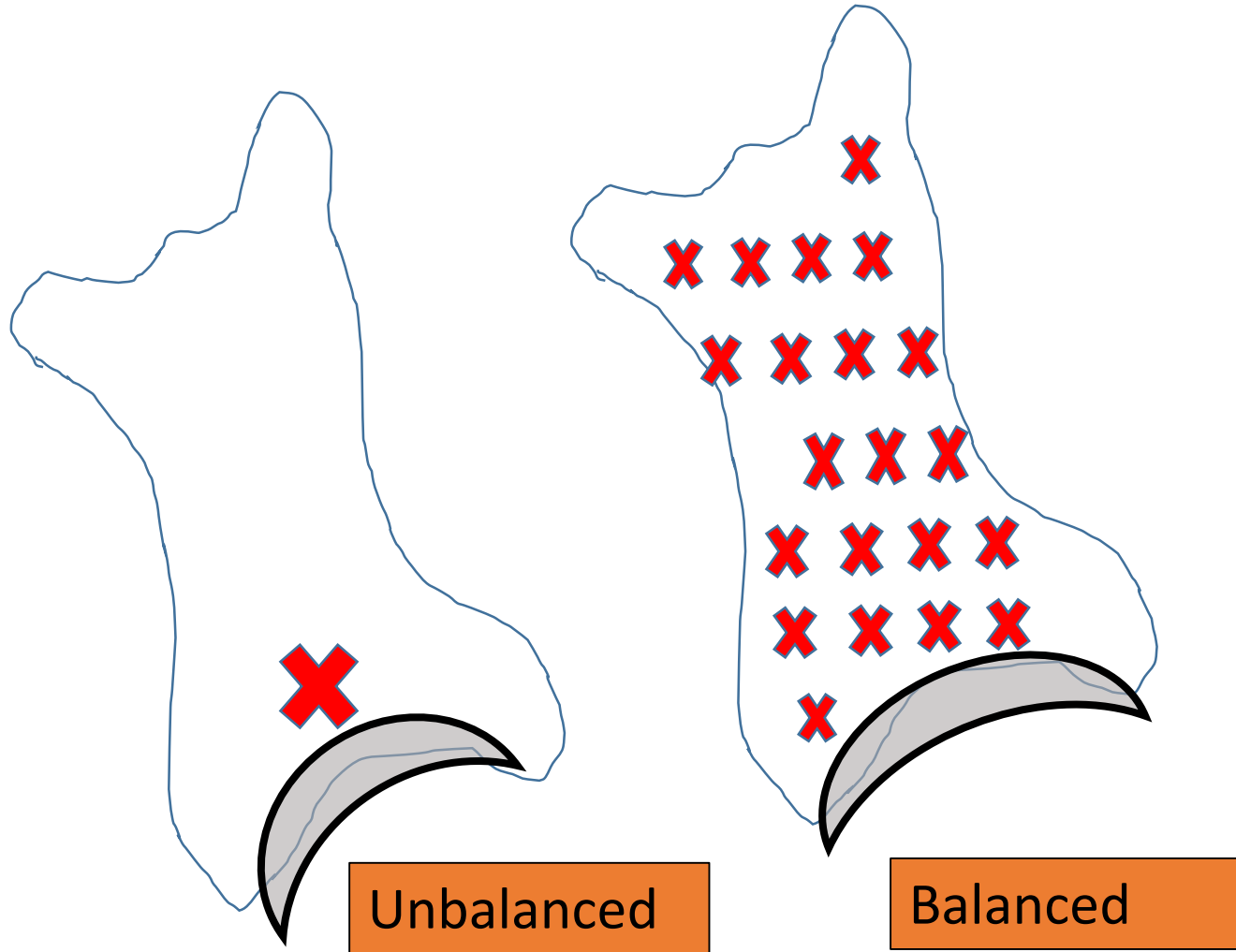
sampling

CALUX

Follow up

# Wool sampling design

Hypothesis to be tested, **can sheep's wool be used as a biomarker of POPs pollution in the environment of potential sources**



composite sampling

case

sampling

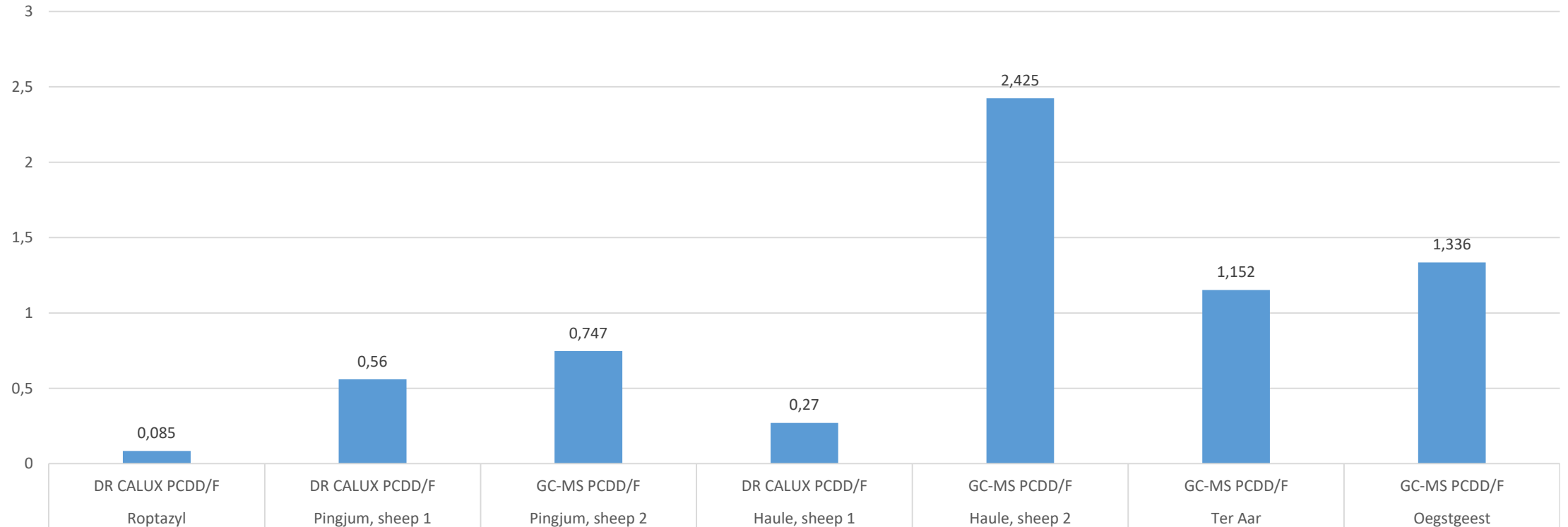
CALUX

Follow up



# DR CALUX and GC-MS wool

Results PCDD/F DR CALUX and GC-MS Wool  
(In pg BEQ/g and pg TEQ/g)

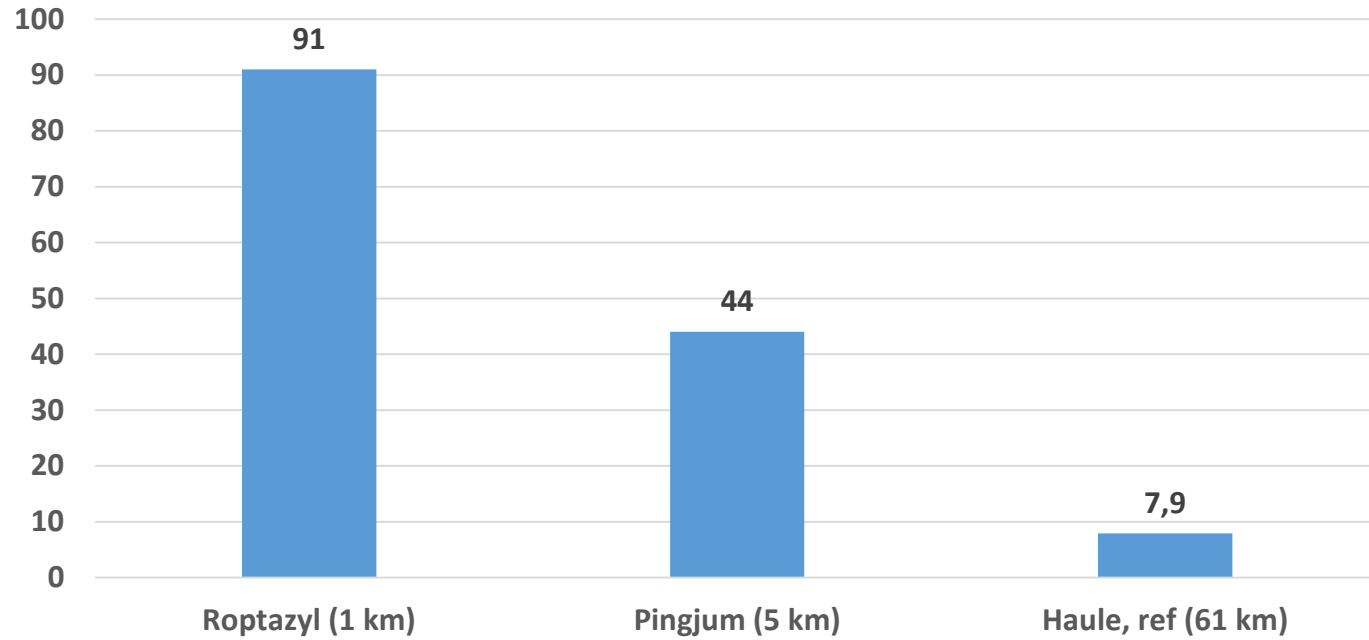


DR  
CALUX:  
pg BEQ/g

GC-MS:  
pg TEQ/g

Sampling procedures and analyte extractions are critical for valid comparison of analytical results.  
CALUX is very sensitive

PAH as a function of distance from Harlingen



ng Benzo[a]pyrene  
eq./g Wool





# Dust deposition IJst



case

sampling

CALUX

Follow up



100.000

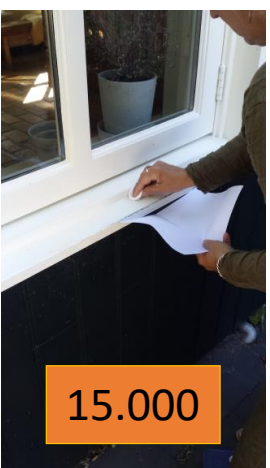
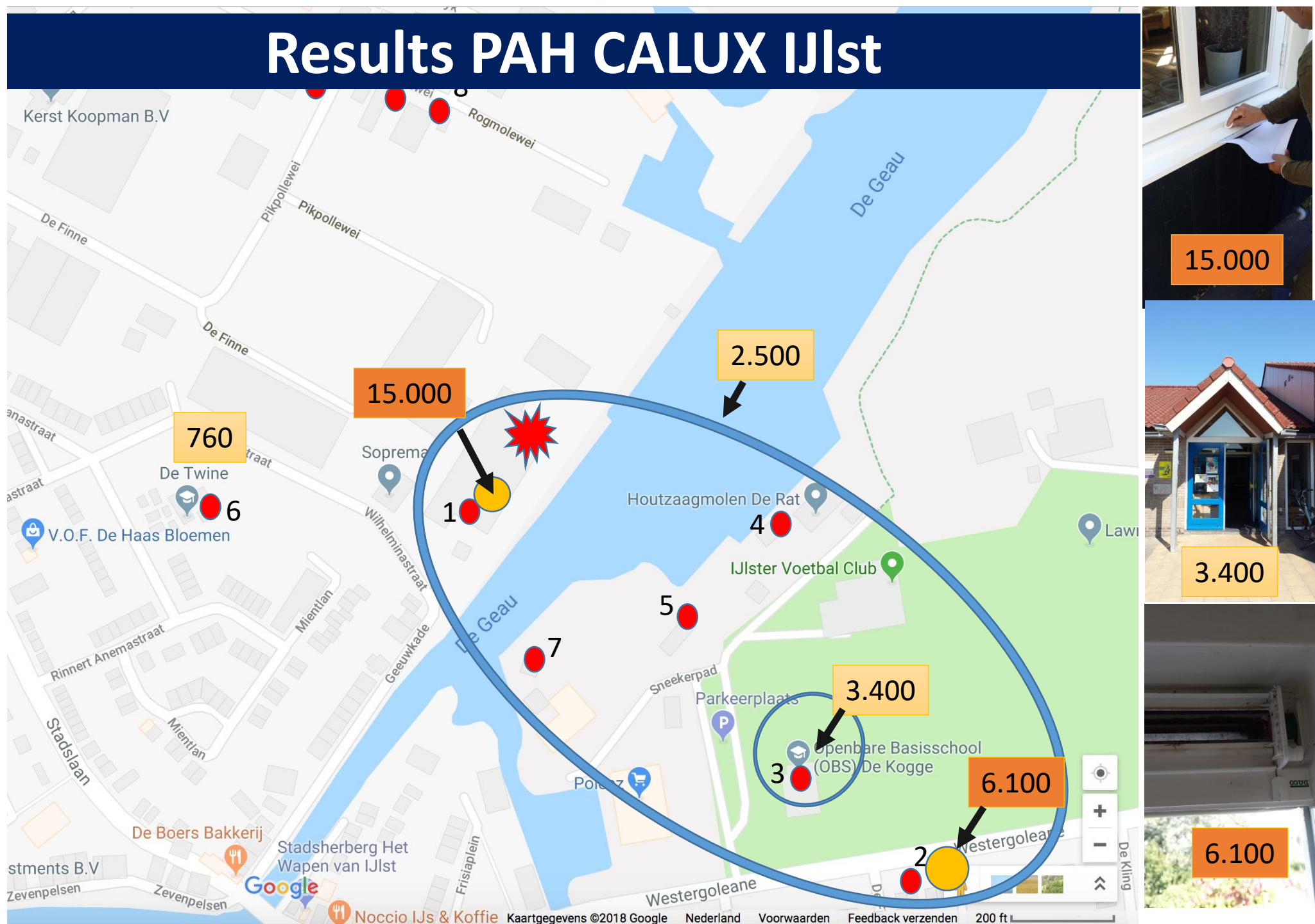


2.000



120

ng B(a)P eq/g d.s.



15.000



3.400

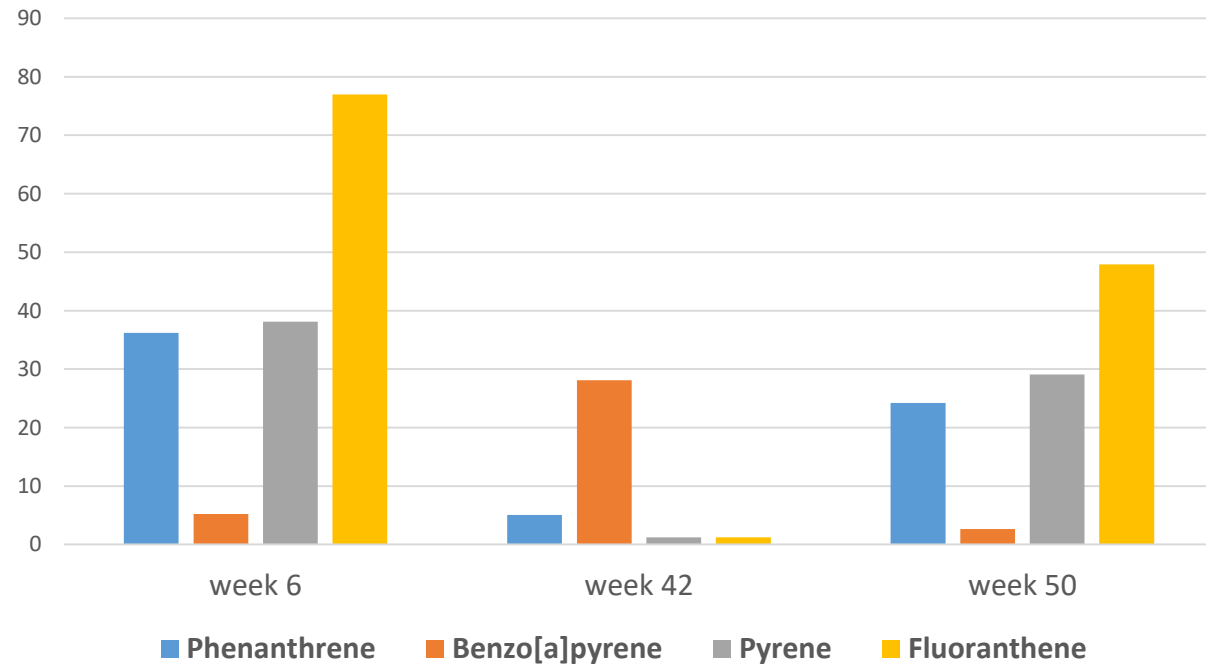


6.100

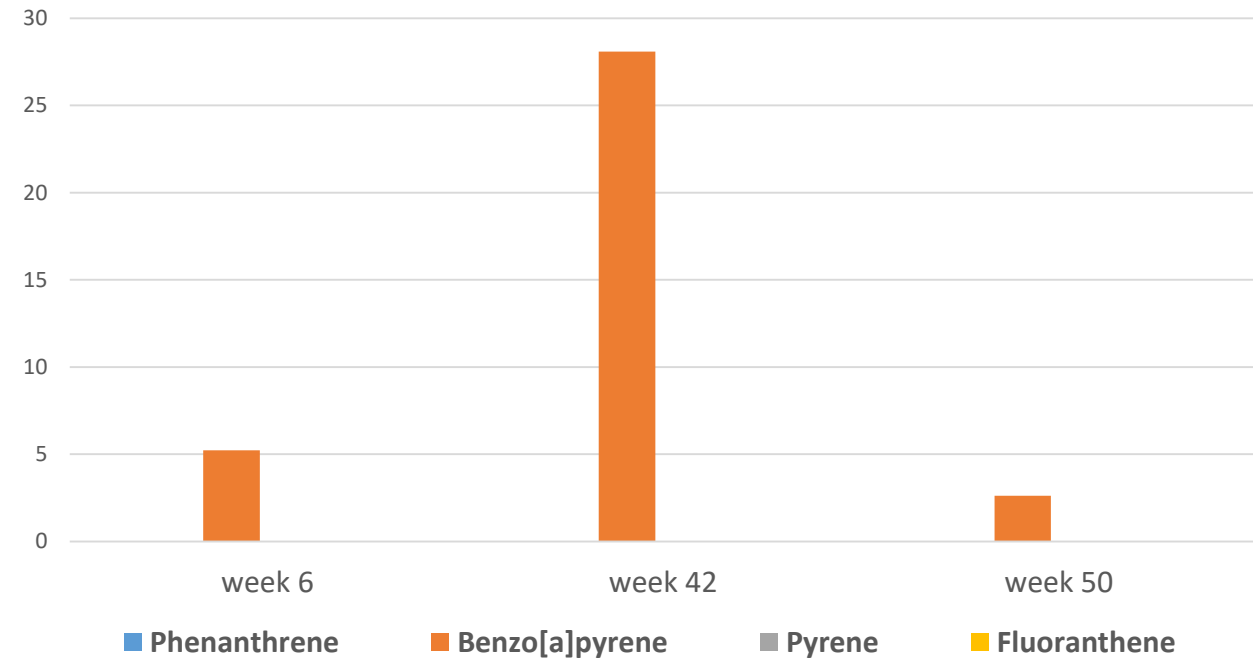


# Relative potencies vs concentrations

## Concentrations PAH



## Relative potencies REP PAH



Results biomonitoring incinerator REC Harlingen 2017, PAH deposition GC-MS

# Egg of backyard chicken

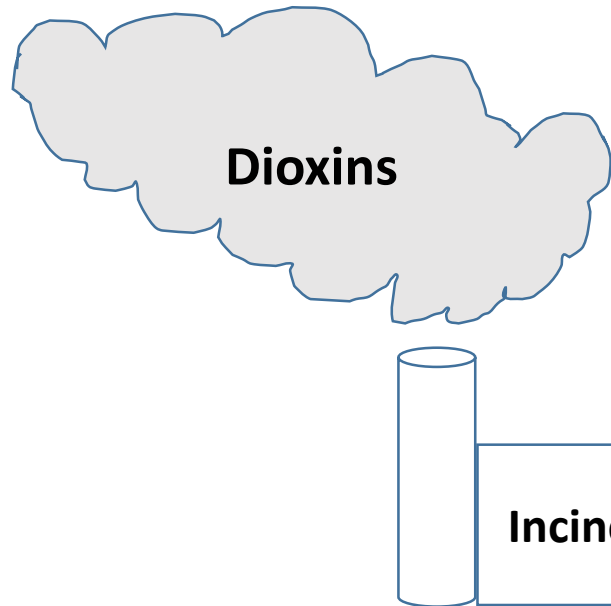


sampling

approach:

At more ( $n > 10$ ) locations (1 – 25 km), composite samples of 10 eggs of backyard chickens:

local and areal coverage = counteracting heterogeneity

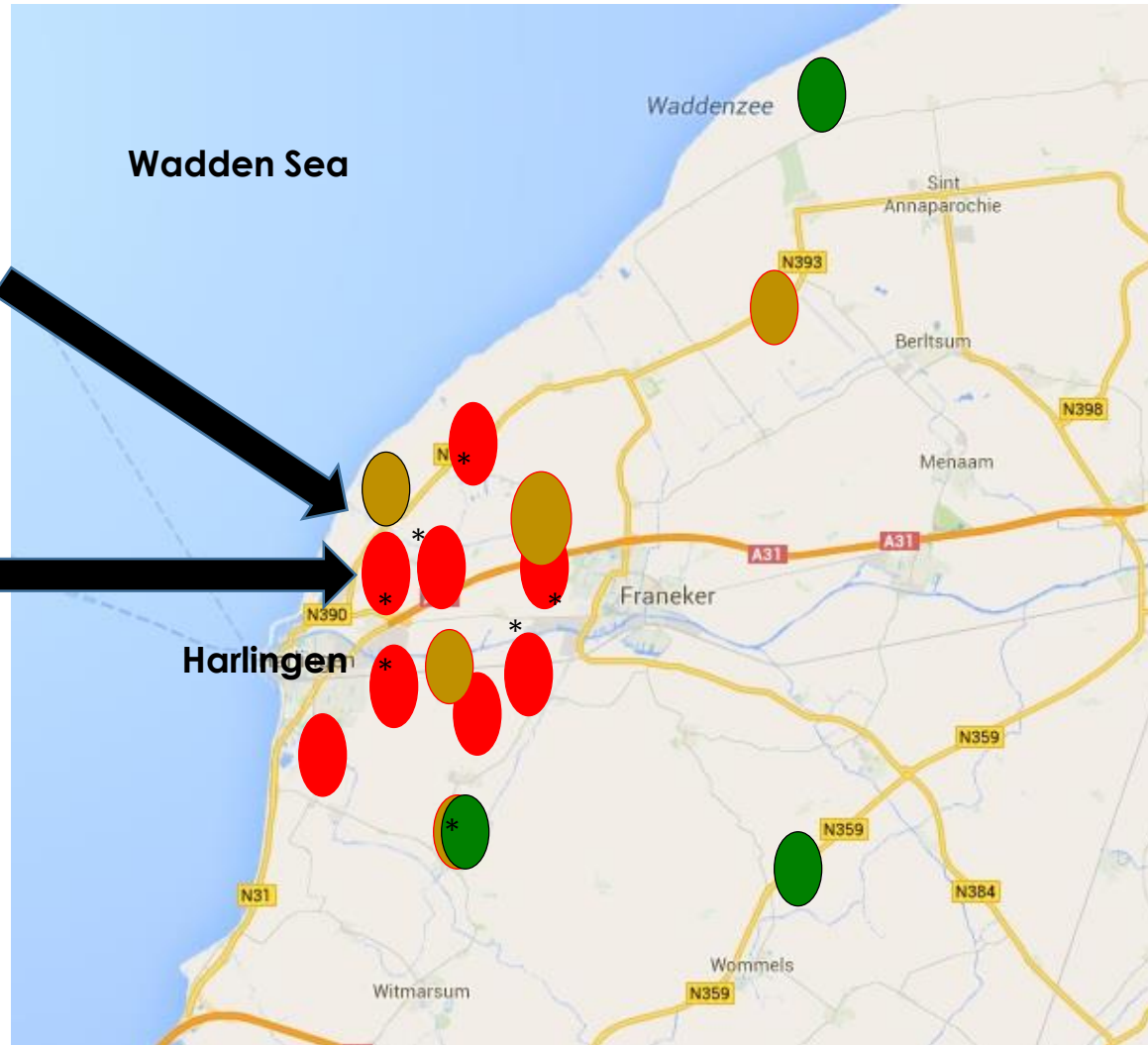


Composite-sampling

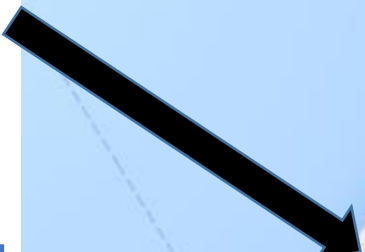




# DR CALUX results



Incinerator



13,8 pg BEQ/g  
17,4 pg TEQ/g



## DR CALUX®

- > 3,4 pg BEQ /g fat
- > 1,7 pg BEQ /g fat
- < 1,7 pg BEQ /g fat

T Verification by GC-MS

BEQ: Bioanalytical Equivalents

Distance

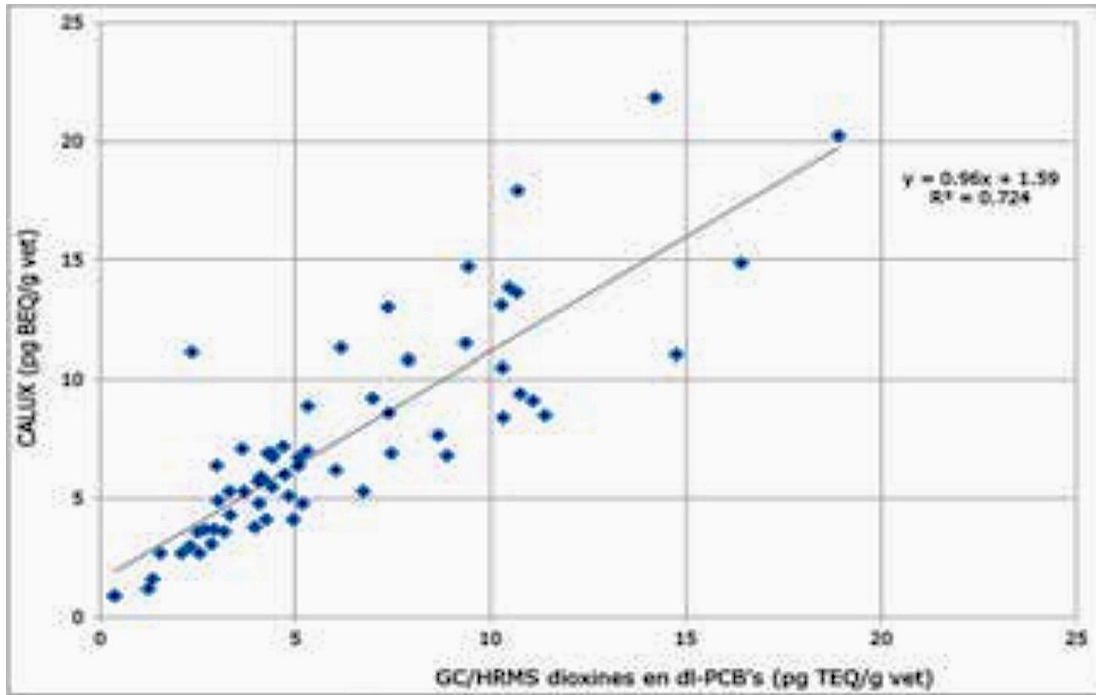
10 km



# Following up research CALUX

National (NL) research backyard chicken eggs

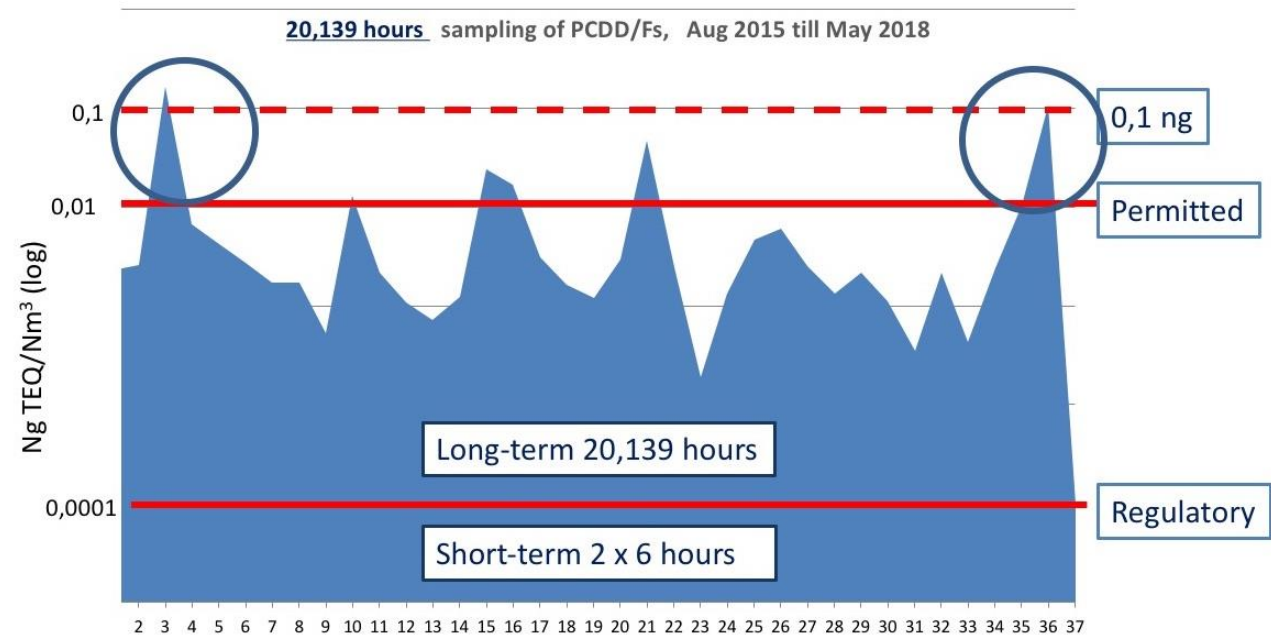
Verification CALUX-results; no false positive or negatives



Comparison CALUX BEQ and GC/HRMS TEQ

>20.000 hours long-term sampling AMESA

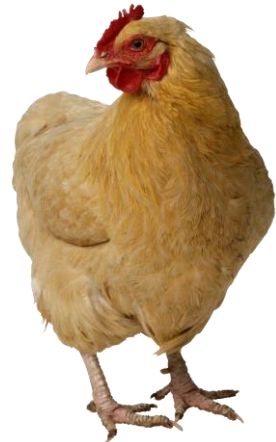
Verification structural high dioxin emissions (start-ups, bypass, temperature)



20.139 hours long-term sampling flue gas

# Conclusions CALUX bioassays

- Broad spectrum of applications
- Cost-efficient
- Rapid and sensitive technology
- Can be used as pilot screening research
- Reliable in results



Soil, feed, milk cow, milk goat, liver sheep, liver hare, eggs backyard chicken, birds, human blood serum



# CALUX bioassays

Helps a little bit on the way for a healthy world



Thank you kindly for your attention

