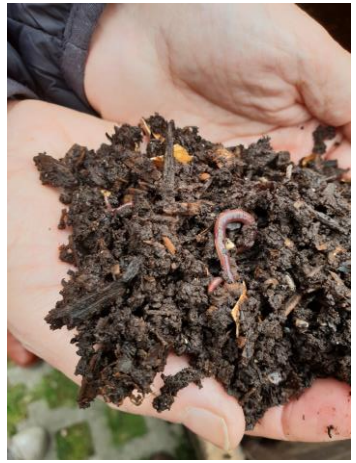
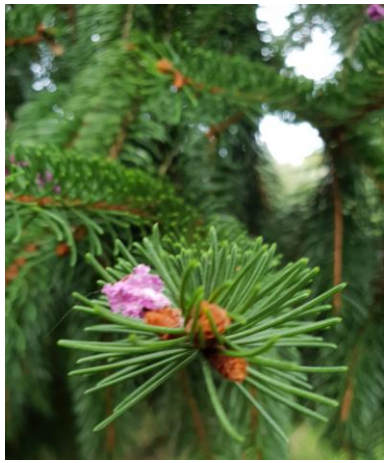
Biomonitoring

Persistent Organic Pollutants

Dioxins (PCDD/F/dl-PCBs), PBDD/F, PBB, PFAS, PAH

Kirsten Bouman

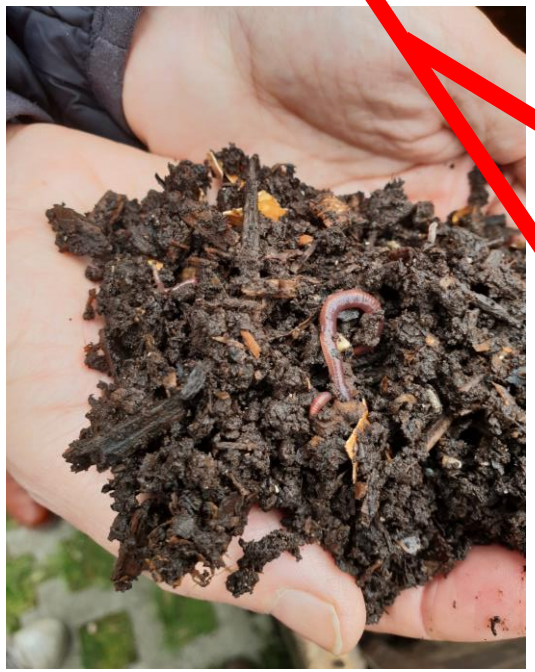




XR Zero Waste, June 15, 2021

Why use eggs of backyard chicken?

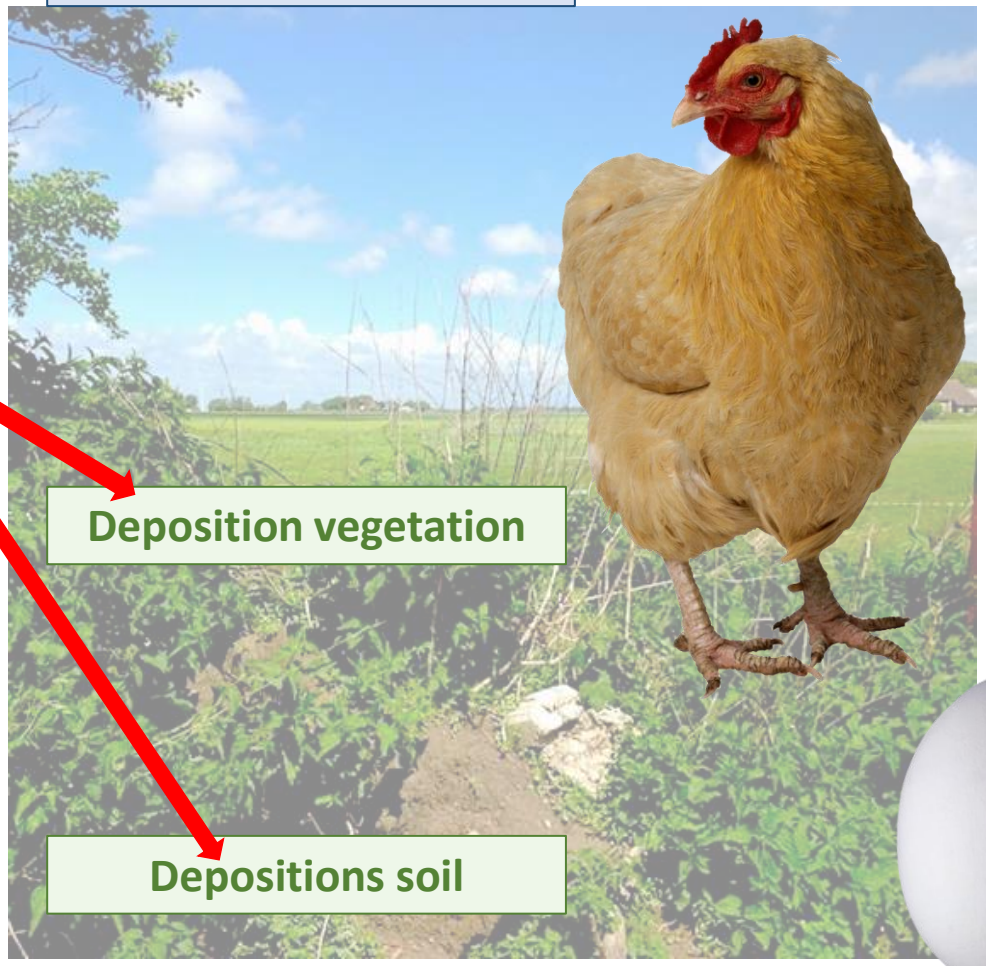
WtE incineration
Emissions SVHC

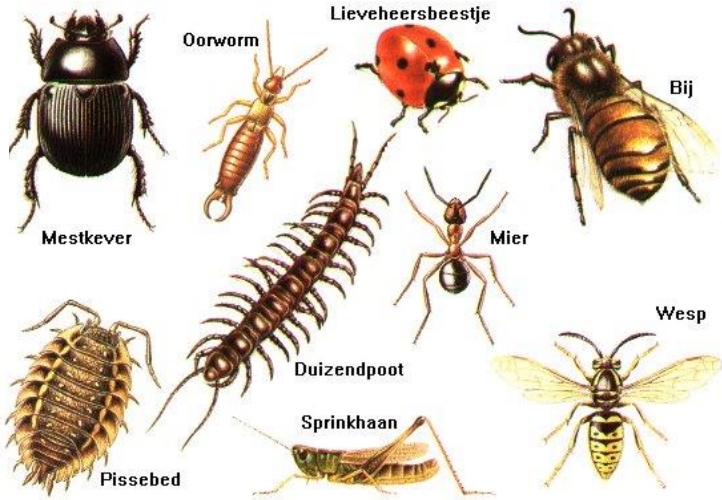


Air emissions

Deposition vegetation

Depositions soil





Bioaccumulation
Biomagnification
Biotransformation
Xenobiotical metabolism

Mass balance of a modern waste (WtE) incineration plant (100,000 t/annual)


Inside WtE REC Harlingen, Photo TW, 2011

All in compliance with EU emission standard

PFAS 25 mg

PXDD/F ?

HF 0,5 t

83 490 t/a

HCl 10 t

SOx 50 t

NOx 200 t

PCBs ?

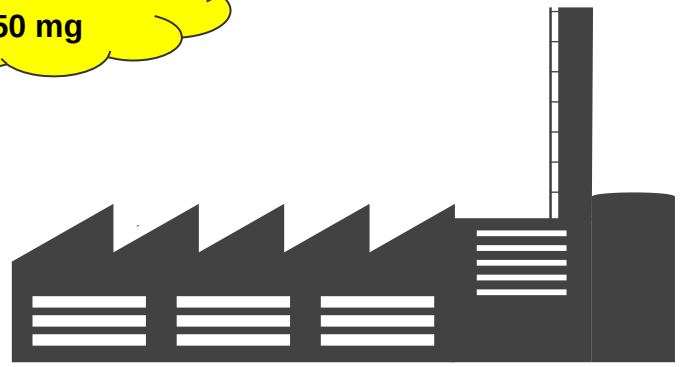
Heavy metals 600 kg

Exhaust gas emissions 480 000 000 m³

Dust 10 t

PCDD/F 50 mg

CO_2 41 500 t



Sludges 5 880 m³

Waste input 100 000 t

Bottom ash 30 240 t

Fly ash 5 594 t

Other hazardous 6 t

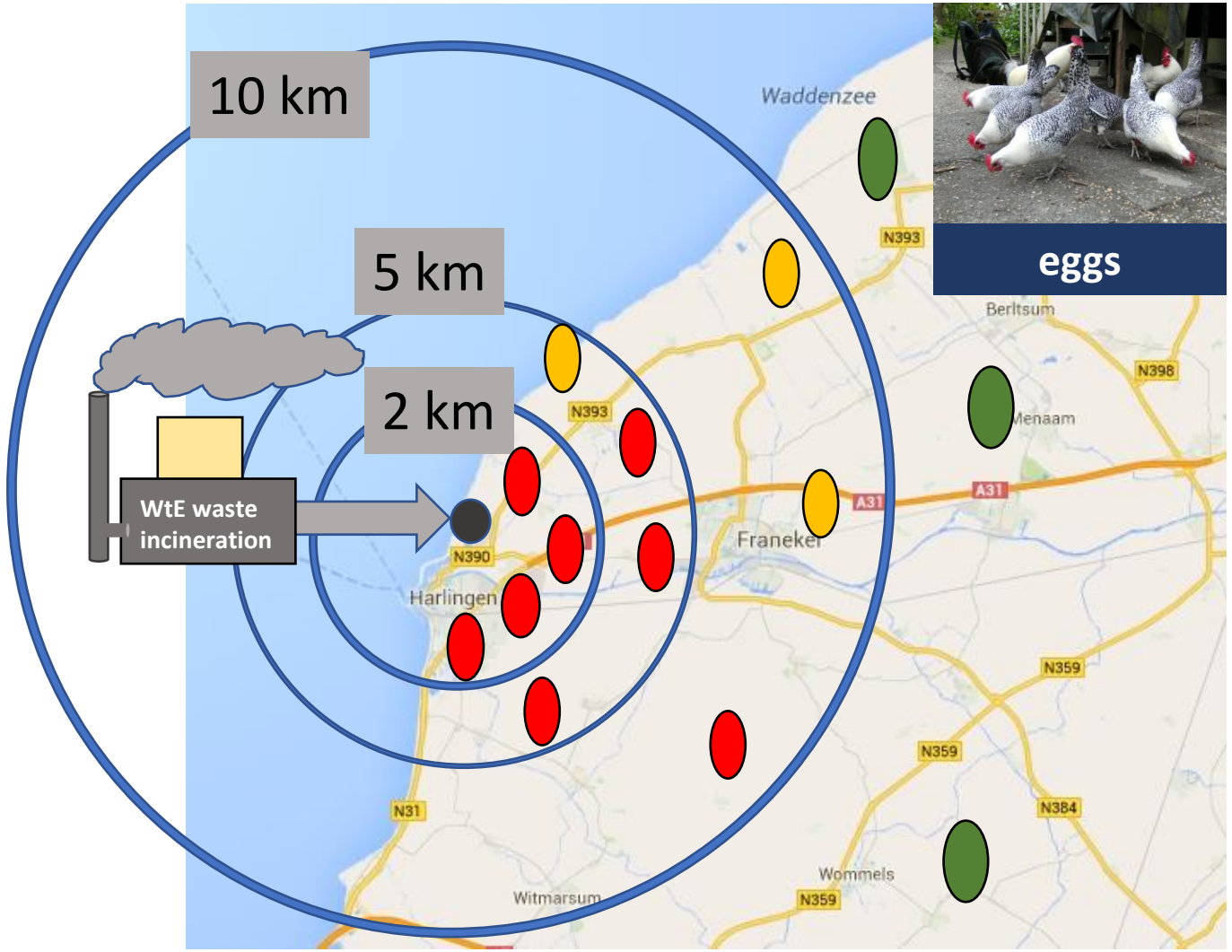
Natural gas 504 000 m³

water 21 000 m³

chemicals 2 910 t


WtE REC Harlingen, 2019

Results analyses backyard chicken eggs



eggs

Composite-sampling

per location

At more (n > 10) locations (1-10 km) composite samples of 10 eggs/location of backyard chickens:

2013-2014 Bioassay analyse DR CALUX®

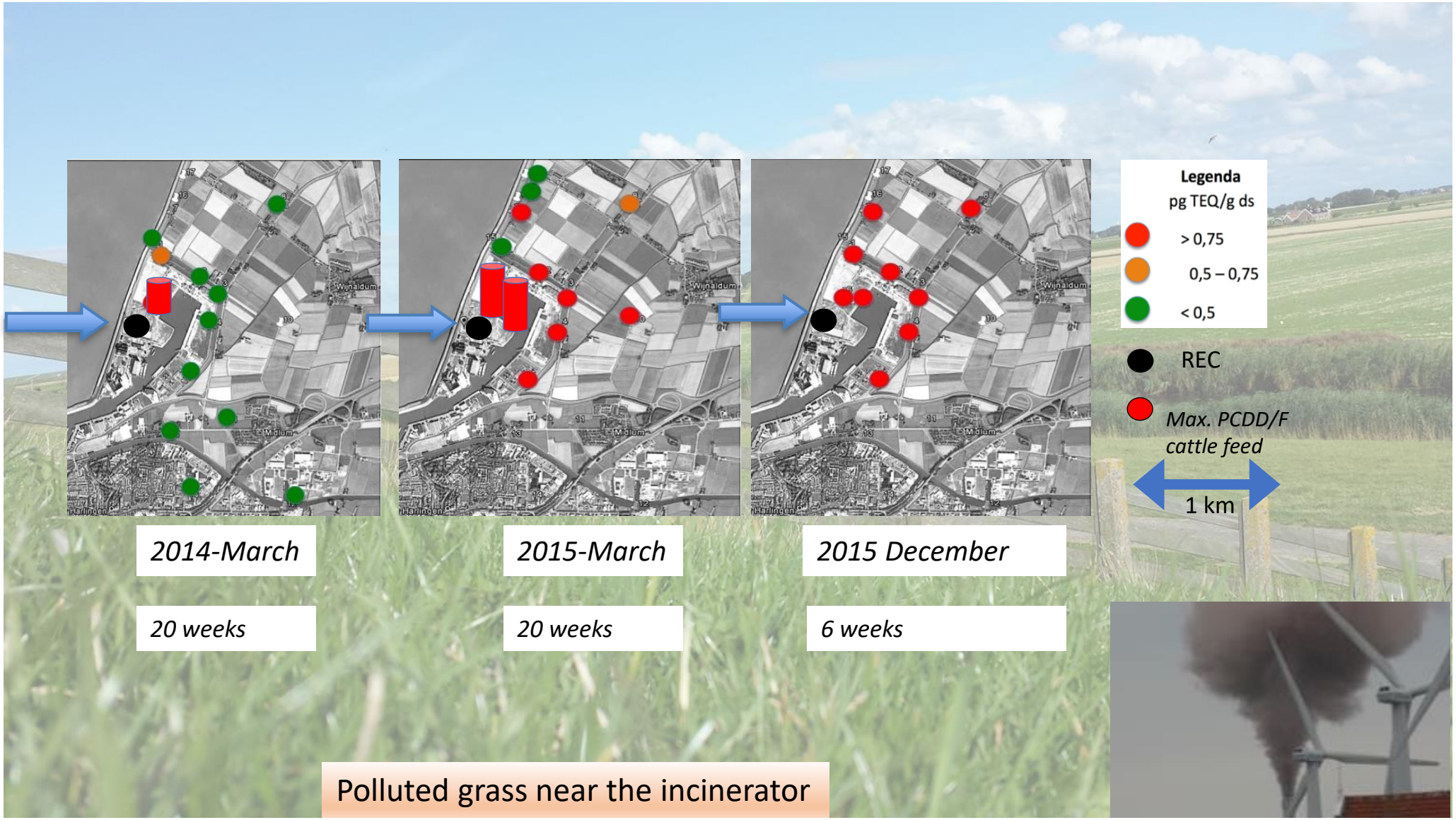
- > 3,4 pg BEQ /g fat
- ➢1,7 pg BEQ /g fat
- < 1,7 pg BEQ /g fat

BEQ: Bioanalytical EQuivalents

Distance

10 km

Results analyses dioxins (PCDD/F/dl-PCB) in grass



Sheep wool as biomarker for dioxin pollution? A pilot study

Arkenbout A[1], Li M[2], Olie K[3], Bouman KJAM[4], Esbensen, KH[5], Behnisch P[61,4] ToxicoWatch, Friesland, The Netherlands, [2]State Key Laboratory for Clean Energy Utilization, Institute for Thermal Power Engineering Zhejiang, Hangzhou, China, [3]IBED/ESPM, University of Amsterdam, Amsterdam, The Netherlands, 1018 WB, [5] Independent researcher, consultant; adjunct professor Aalborg University, Denmark, [6]BioDetection Systems BV (BDS), Amsterdam, The Netherlands, 1098 XH

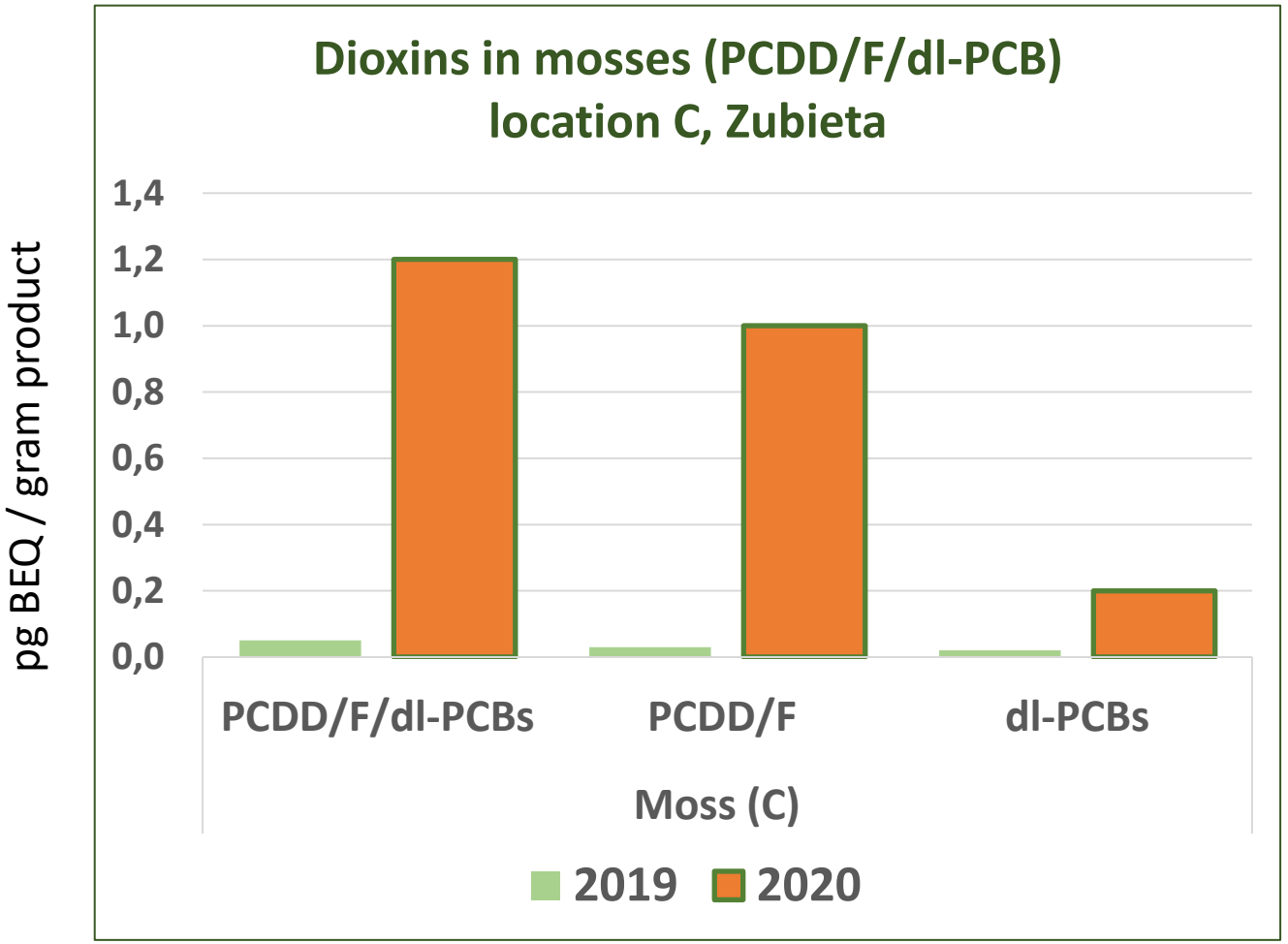
Analytical methods

- For this pilot study purpose, sheep wool samples are to be extracted from several geographical locations – near: incinerators, heavy traffic highways, urban agriculture – and from 'comparable regions' without any POP/PAH-industrial activity in the surroundings.
- Analyses GC-HRMS of all dioxin and furan congeners –10 gram wool Soxhlet extraction with toluene.
- Bioassays DR CALUX; 100 gram wool, 2-times cold shake extraction 180 ml hexane and clean-up with 2 big acid silica gel clean-up columns.
- Bioassay PAH-CALUX: 100 gram wool, 2-times cold shake extraction 180 ml hexane and clean-up with a basic alumina column (8%) water and 210 ml pentane solvent.

Dioxins (PCDD/F/dl-PCB) Mosses 2020

Results Mosses 2020 (***Goroldioa***)

Location C
20TWC-MOS-01



Elevation of dioxins (PCDD/F/dl-PCB) in mosses 2020 on location C

ZERO measurement dl-PCB in backyard chicken eggs, 2019

TOXICO WATCH

DR CALUX: (1-13)

GC-MS: (1)

1 → Location

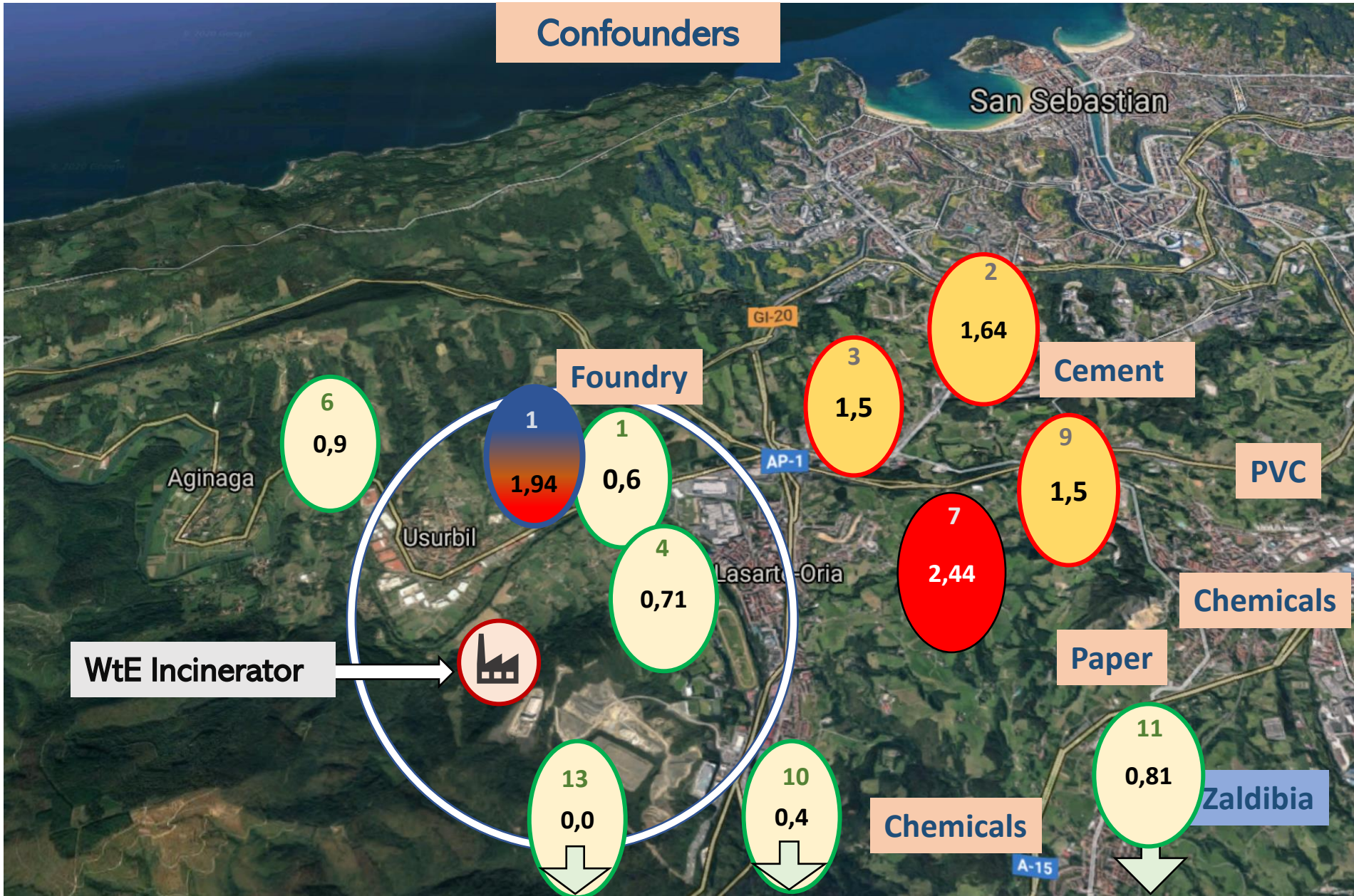
0,0 → pg BEQ/g fat

< 1,75 pg BEQ/g fat

> 1,75 pg BEQ/g fat

> 2,5 pg BEQ/g fat

> 1,75 pg TEQ/g fat action level



Results PFAS in water/sediment, Zubieta - 2020

TOXICO WATCH

Sediment 2
Results
ERaCALUX
PFAS

S2

20TW-SEDup-02
upstream WtE
EraCALUX: 0,018
PFAS: 0,014

Results 2020
ERaCALUX: 0,018 ng 17b Estradiol eq./g dw
PFAS: 0,014 ug PFOA eq./g dw

Short-term vs long-term measurements

Short-term

Sampling: 0,1 % of a year

- 12 hours measurement period (2 x 6 hours)
- Only under steady state conditions
- Pre-announced
- Only PCDD/F

Regulatory

Long-term

Sampling: 95 % of a year

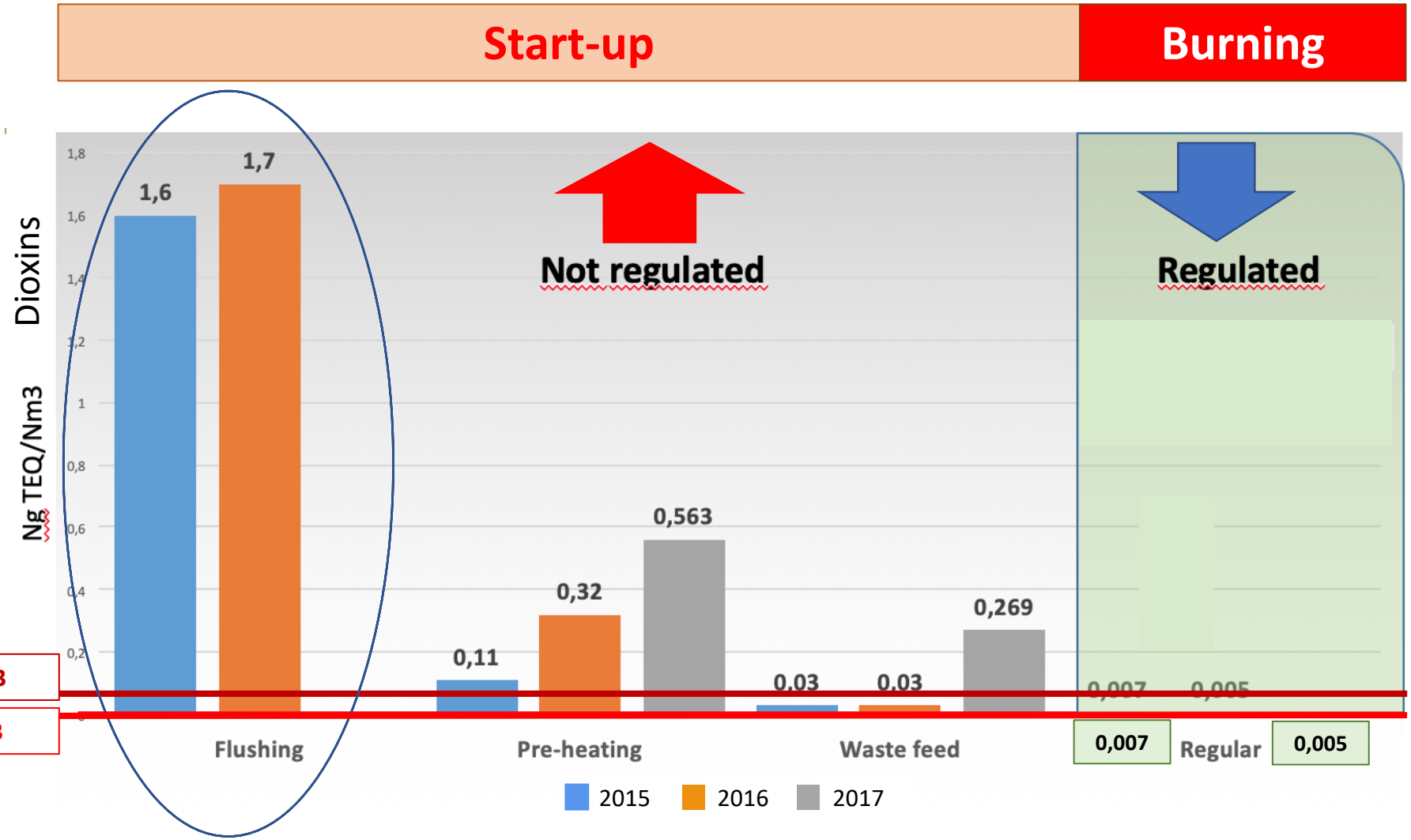
Semi-continuously

Other Than Normal Conditions (OTNOC)

Analyses of other UPOPs

Possibility of publication

Other Than Normal Operation Conditions (OTNOC)

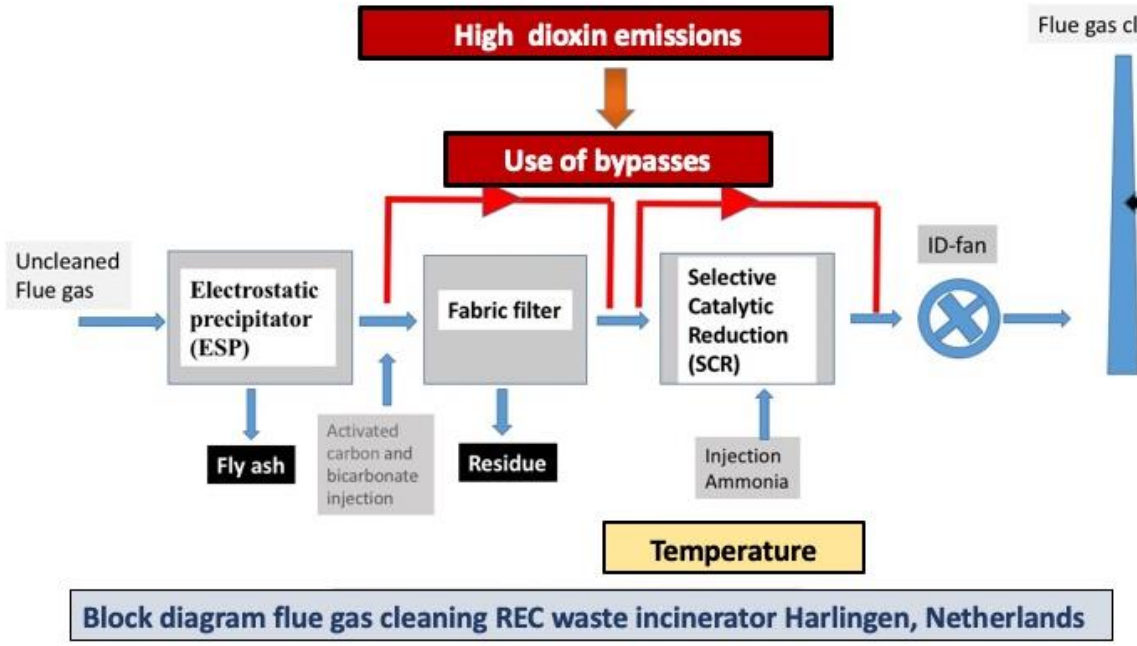


EU: 0,1 ng TEQ/Nm3

REC Permit: 0,01 ng TEQ/Nm3

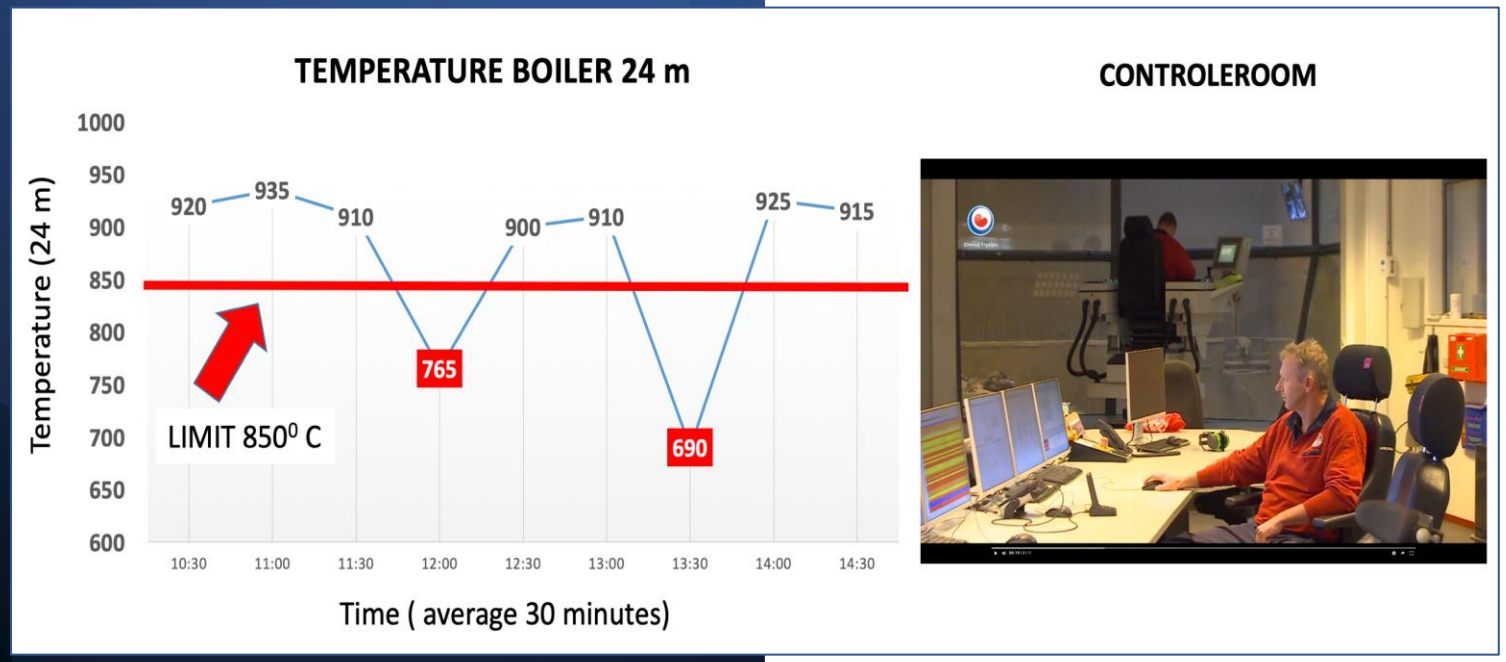
Start-up, shut down, failures, fall-out APCD

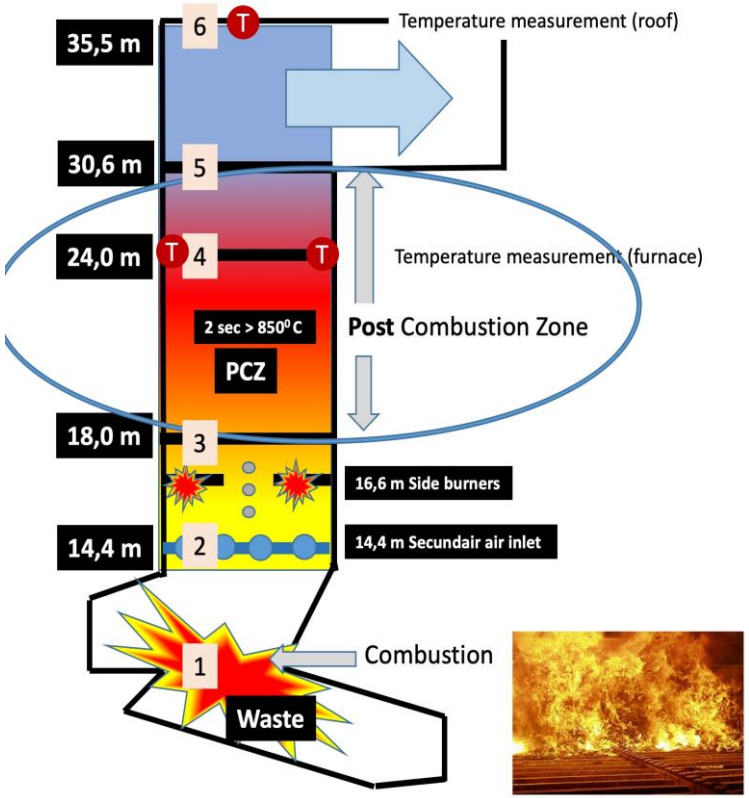
Bypassing Air Pollution Control Devices



Bypass -Particulier matter

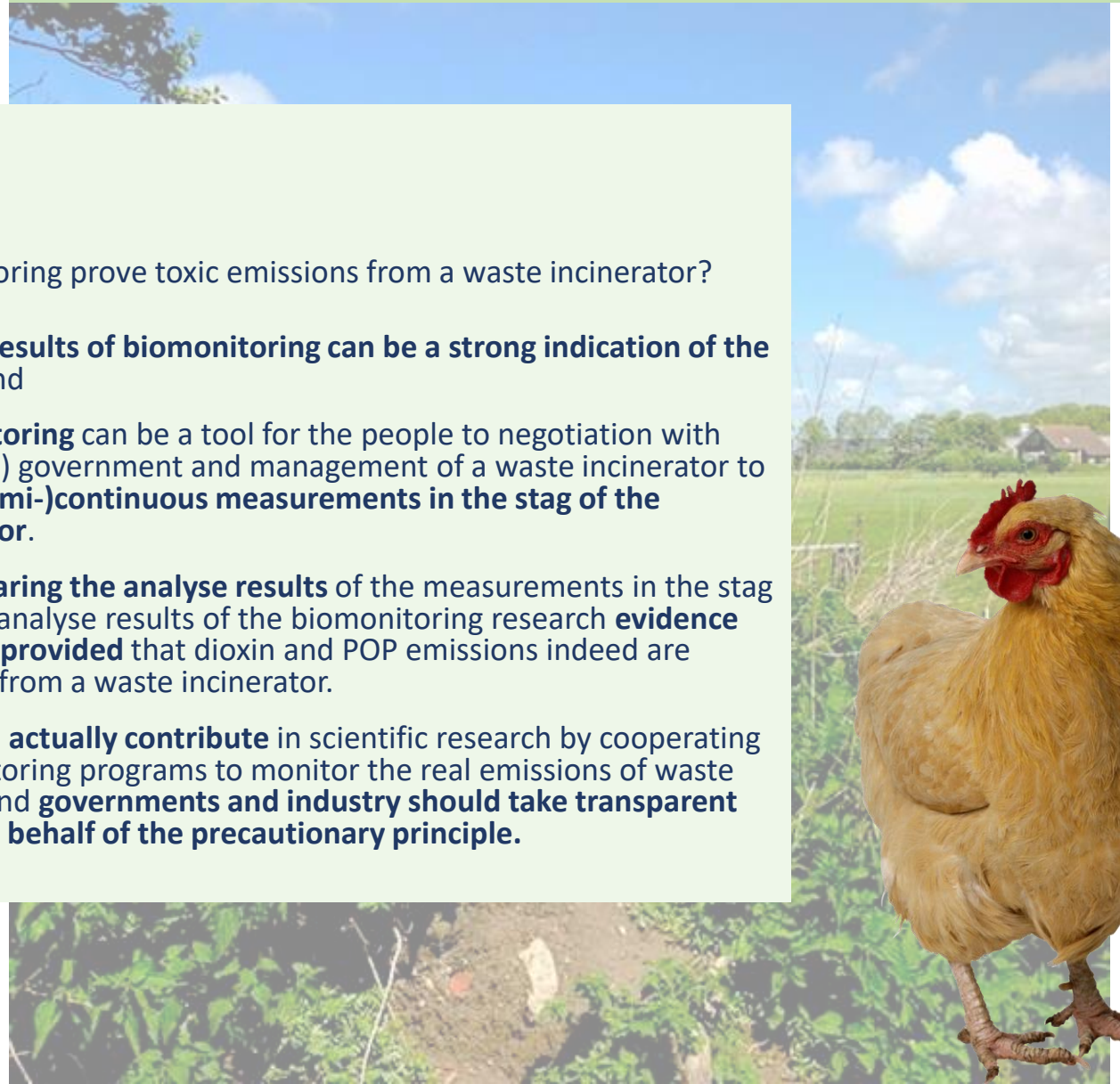
Hidden temperatures





Post Combustion zone

Why should we need biomonitoring?



To conclude:

Can biomonitoring prove toxic emissions from a waste incinerator?

- **analyse results of biomonitoring can be a strong indication of the source** and
- **Biomonitoring** can be a tool for the people to negotiation with the (local) government and management of a waste incinerator to **allow (semi-)continuous measurements in the stag of the incinerator**.
- By **comparing the analyse results** of the measurements in the stag with the analyse results of the biomonitoring research **evidence could be provided** that dioxin and POP emissions indeed are released from a waste incinerator.

So **people can actually contribute** in scientific research by cooperating with biomonitoring programs to monitor the real emissions of waste incineration and **governments and industry should take transparent discissions on behalf of the precautionary principle.**

Biomonitoring gives awareness to the people of the health risks

of toxic emissions of waste incineration

and

bringing people together for handling our waste problem

Thank you