

# Emission regimes of POPs of a Dutch incinerator: regulated, measured and hidden issues

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*100<sup>th</sup> Anniversary of Regaining Independence by Poland*



38<sup>th</sup> International Symposium on Halogenated Persistent Organic Pollutants

**Dioxin 2018**

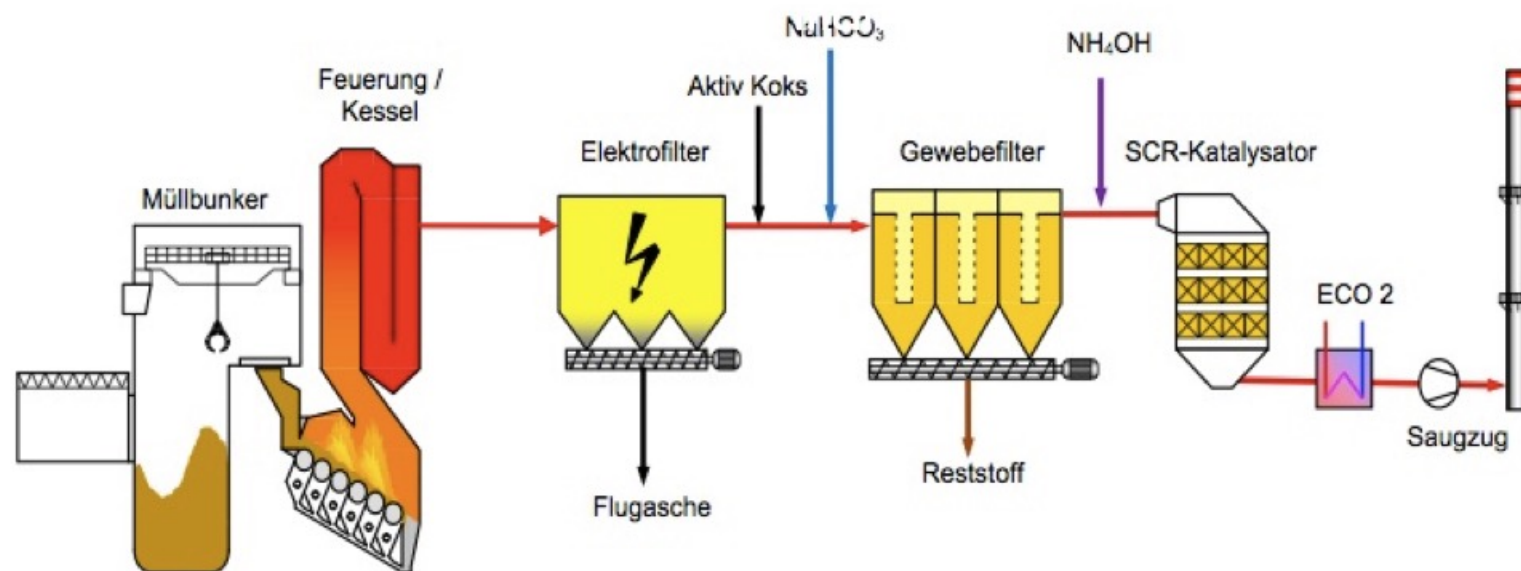
& 10<sup>th</sup> International PCB Workshop

26 - 31 August 2018, Kraków, Poland

# 'State of the art' incinerator, NL

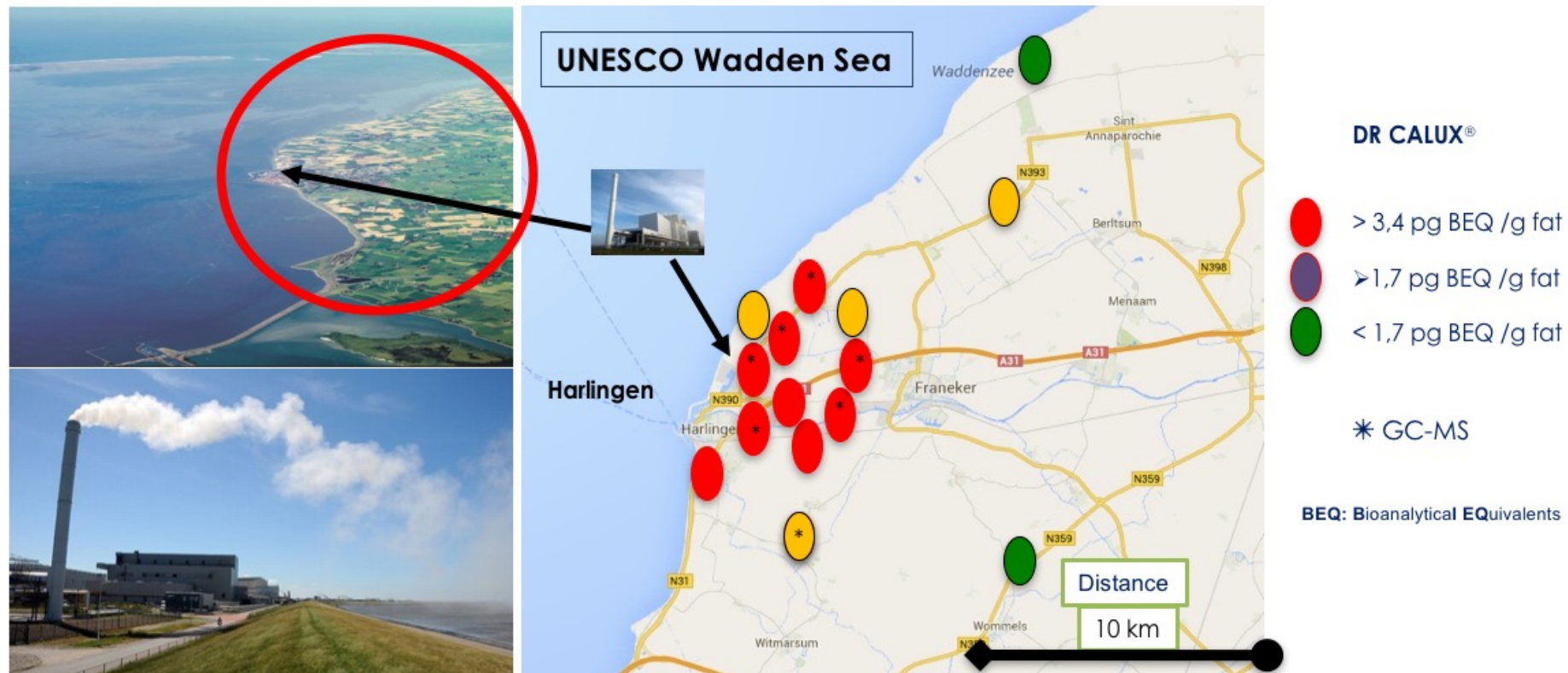


Best Available Techniques (BAT): Furnace, ESP, Fabric Filter, SCR katalysator



A more stringent permit of 0,01 ng TEQ/Nm<sup>3</sup> for dioxin emissions was given

# Pollution of dioxins



ToxicoWatch research on eggs of backyard chicken shows contamination of dioxins in the environment of the incinerator



# Dioxin emissions incinerator

## Short-term

### Regulated



- 12 hours measurement period ( 2 x 6 hours)
- Only under steady state conditions\*
- Pre-announced

**Sampling: 0,1 % of a year**

## Long-term

Optional, not in the Netherlands



- Continuous sampling
- All conditions\*

Adsorption **M**ethod for **S**ampling of dioxins  
**AMESA**

**uptime > 95 % a year**

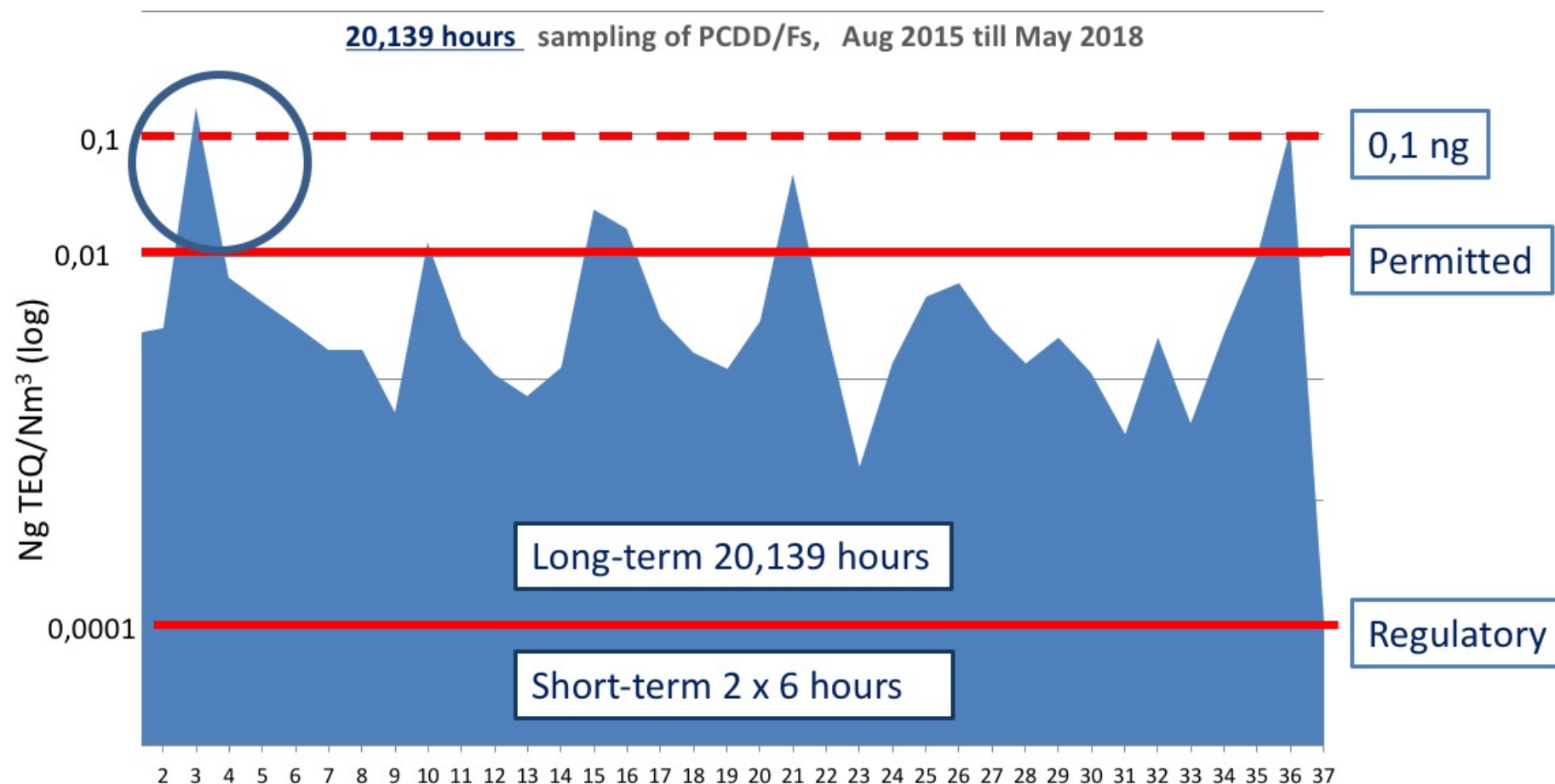
# Short- vs long-term measurements

Sampling	hours	ng TEQ/Nm <sup>3</sup>	Factor
Short-term, March 30, 2016	6	<0,00001	
Long-term March 26– April 26, 2016	256	0,01290	>1290
Short-term, 8 March 2017	6	0,00001	
Long-term March 7 – April 5, 2017	690	0,00460	460

Sampling for official monitoring purposes must be *representative*.  
Short-term sampling *underestimating* emission dioxin levels.



# Result longterm PCDD/F sampling



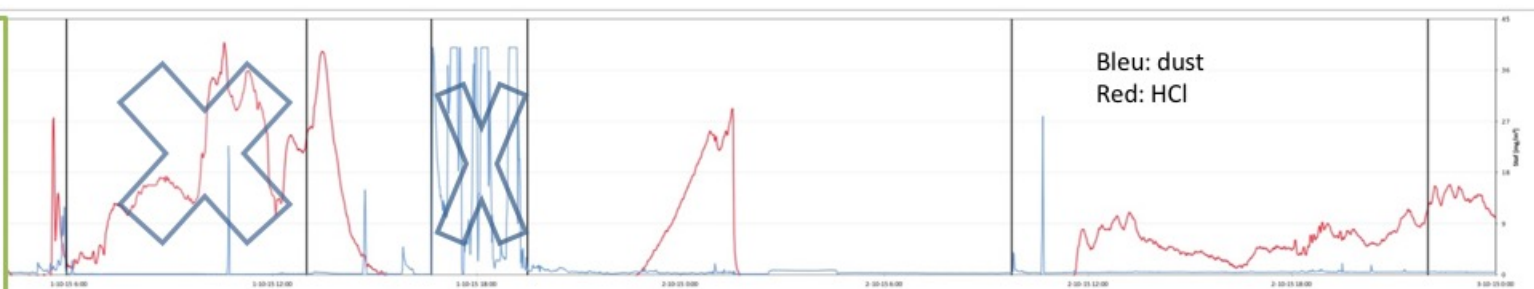
# AMESA during failure

## Interruption of sampling



### Parameters:

- Temperature
- Aux. Burners
- E-Filter
- Fabric Filter
- Active carbon
- AMESA



fase	normaal	A	B	C	D	E	normaal
proces-omstandigheden	korte trip ID fan om 05:21 uur; definitieve trip om 05:56 uur	afbranden afval op rooster	11:00 uur rooster laag; blussen afval doosertafel tot 15:30 uur	spoelen installatie	opstart met gasbranders (geen afval)	toeseter afval	
temperatuur (K) gem.	gemiddeld 962 °C	gemiddeld 411 °C	gemiddeld 442 °C	gem. 325 °C	gemiddeld 751 °C	gemiddeld 994 °C	1015 °C
afvalbranders							
E-filter							
doosertafel							
poederbed							
monsternamen	monster 2	afval 32 uur	monster 3	afval	monster 3	monster 3	mon. 3
tijd per fase	05:08 - 11:00	11:00 - 15:30	15:30 - 16:40	16:40 - 19:30	19:30 - 20:00	20:00 - 22:00	
uren per fase	7,0	3,6	3,0	3,0	14,5	12,0	



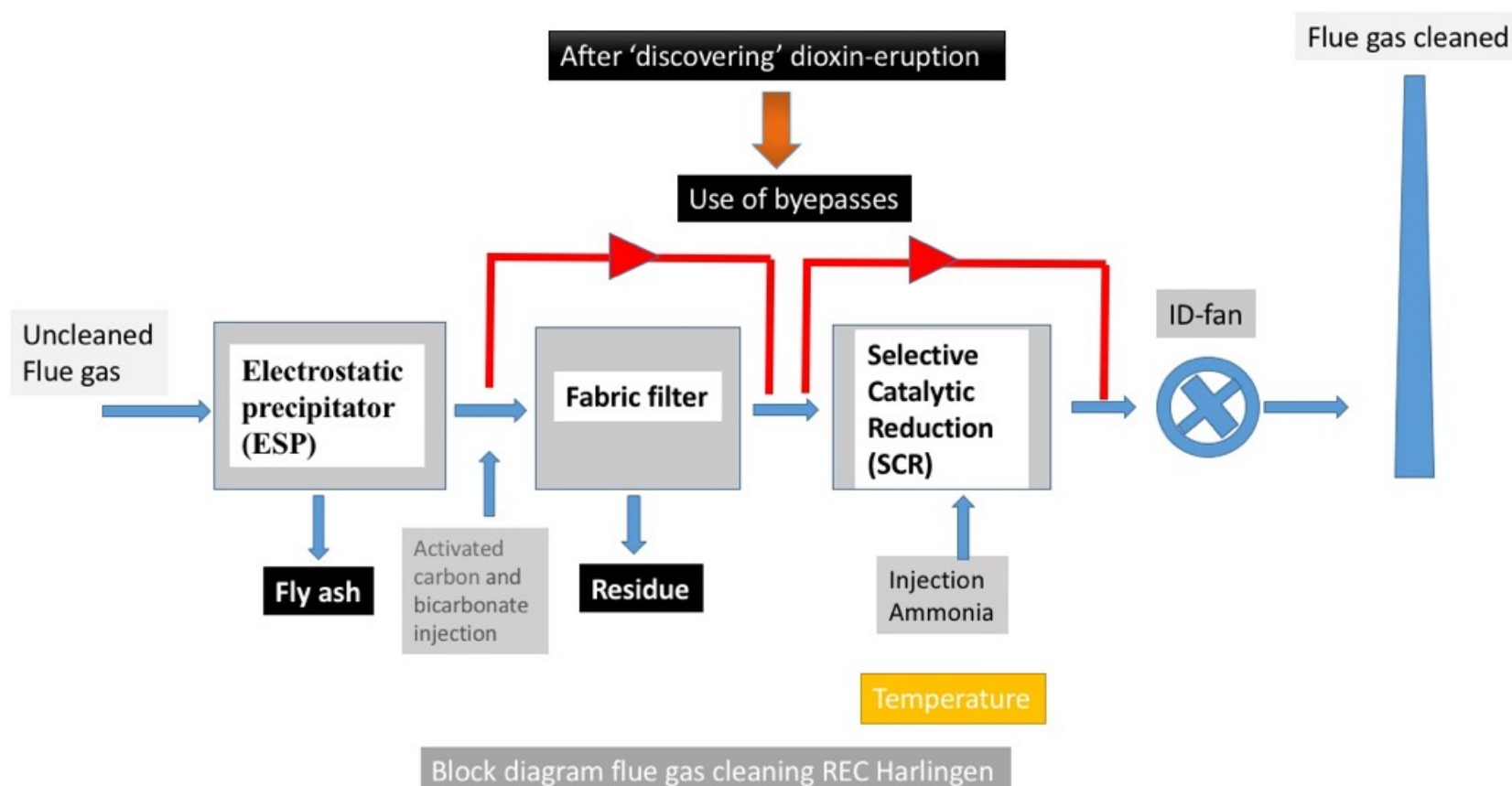
**5 hours** off: 'Fire-off' signal, uncontrolled burning of 19 ton undefined waste

**3,5 hours** off during flushing of dust (50-100 kg) with bypassing filters

- Measured 0,17 ng/Nm<sup>3</sup> when fire was off and the system was 'cleaned'.
- Emissions of dioxins was more the measured 27 mg PCDD/F (annual emission REC 5,3 mg)
- Factor 5



# Use of bypasses



Commitment: stop use bypasses



# Interruption of sampling

AMESA



Off-line

Codes interrupting AMESA	
FA	No fire, Auxilairy burners off
Alarm Power off	Failure by electricity or detonation
O2 > O2OGR or < O2UGR	Oxygen under a certain value
CO2 > CO2OGR or < CO2UGR	CO2 under a certain value
TRG < TRGMIN:	Temperature flue gas < 70 <sup>0</sup>
VH<VHUGR;	Velocity flue gas < 1,5 m/s

These codes causes a stop of sampling in the AMESA cartridge  
After a leakage test of 3 minutes, sampling starts again

Total time **off-line AMESA: 1496 hours (7,4%)**

# Shutdown/start-up data



	On-line	Off-line AMESA	Code AMESA	Event	pg TEQ /Nm <sup>3</sup>
REC 2	661:50	5:45	No fire	Shutdown <b>uncontrolled</b>	2,6
REC 3	666:54	4:33	No fire	<b>Start-up</b>	164,7
REC 10	256:17	6:26	VH < VHUGR, TRG < TRGMIN	Shutdown	12,9
ODRA	7:43	408:00	Power off	Maintenance, <b>Start-up</b>	1600
REC 15	640:55	5:49	VH < VHUGR	Shutdown, <b>Start-up</b>	1,2
REC 16	646:12	4:53	VH < VHUGR	Shutdown <b>Start-up</b>	23,9
REC 17	119:38	0:41	VH < VHUGR	Failure	16,7
REC 20	672:20	0:13	VH < VHUGR	Shutdown <b>Start-up</b>	1,2
REC 21	669:04	2:16	VH < VHUGR	Shutdown	2,9
REC 22	433:10	0:55	VH < VHUGR	<b>Start-up</b>	46,5
REC 26	578:03	0:10	VH < VHUGR	Shutdown	4,6
ODRA	2:00	571:00	Manual command	Maintenance, <b>Start-up</b>	1700
REC 28	408:50	0:17	VH < VHUGR	Shutdown, <b>Start-up</b>	2,5
REC 30	665:22	3:38	VH < VHUGR	Shutdown, <b>Start-up</b>	2,3
REC 32	666:49	2:26	VH < VHUGR	Shutdown,	0,3
REC 33	95:38	0:33	VH < VHUGR	<b>Start-up</b>	2,2
REC 35	572:12	2:46	VH < VHUGR	shutdown	2,4
REC 36	124:35	32:30	TRG < TRGMIN	shutdown	10,4
REC 37	265:03	181:15	VH < VHUGR 69% off-line	<b>Start-up</b>	11,3
ELM	1:38	-----	VH < VHUGR	Maintenance, <b>Start-up</b>	563
TOTAL		1233:35			

Maintenance-stop

Start up: "Electricity failure"

Maintenance-stop

Start up: "Miscommunication"

Maintenance-stop

Start up: "164 stops,  
69 % AMESA offline"

**Start-up:** cold start-up  
**Start-up:** hot start-up,

When velocity comes under the level of 1,5 m/s, sampling stops.  
When velocity comes above the level of 1,5 m/s, it takes 3 minutes to start sampling again  
Also when this happens within a minute

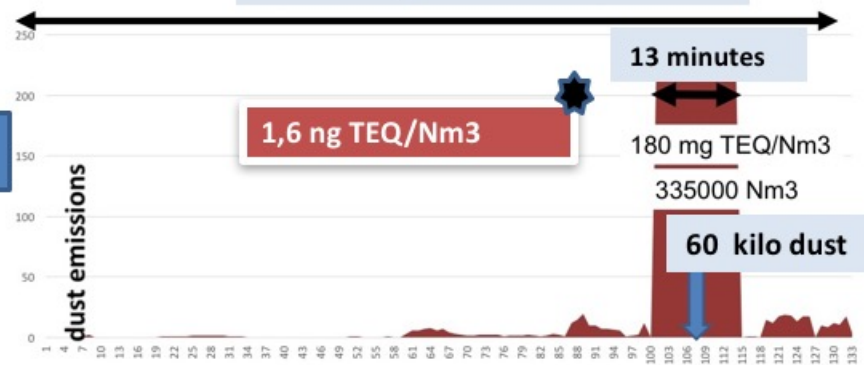
# Start-ups and dust emissions

Phase 1	Pre-flushing
Phase 2	Flushing (cold)
Phase 3	Heating up
Phase 3B	Flushing (hot)
Phase 4	Starting waste feed
Phase 5	Regular operation

Measure period 132 minutes

Start-up 2016

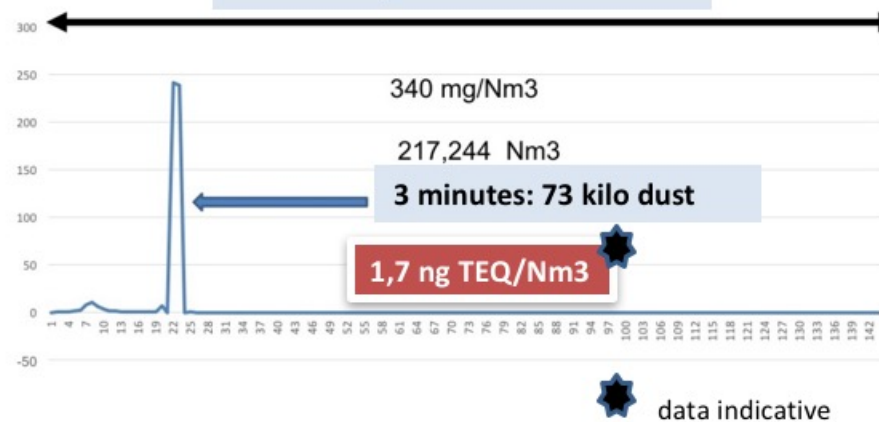
Phase 2



Measure period 83 minutes

Start-up 2017

Phase 2



Children's day-care

Total dust 2016: 759 kg (REC)



Limited

Total dust 2017: 222 kg (REC)

'Chasing dust emission',  
Only a few minutes

# Excess emissions during start-ups

Phase 1	Pre-flushing
Phase 2	Flushing (cold)
Phase 3	Heating up
Phase 3B	Flushing (hot)
Phase 4	Starting waste feed
Phase 5	Regular operation

## Phase 2

2016

1,6 ng TEQ/Nm<sup>3</sup>

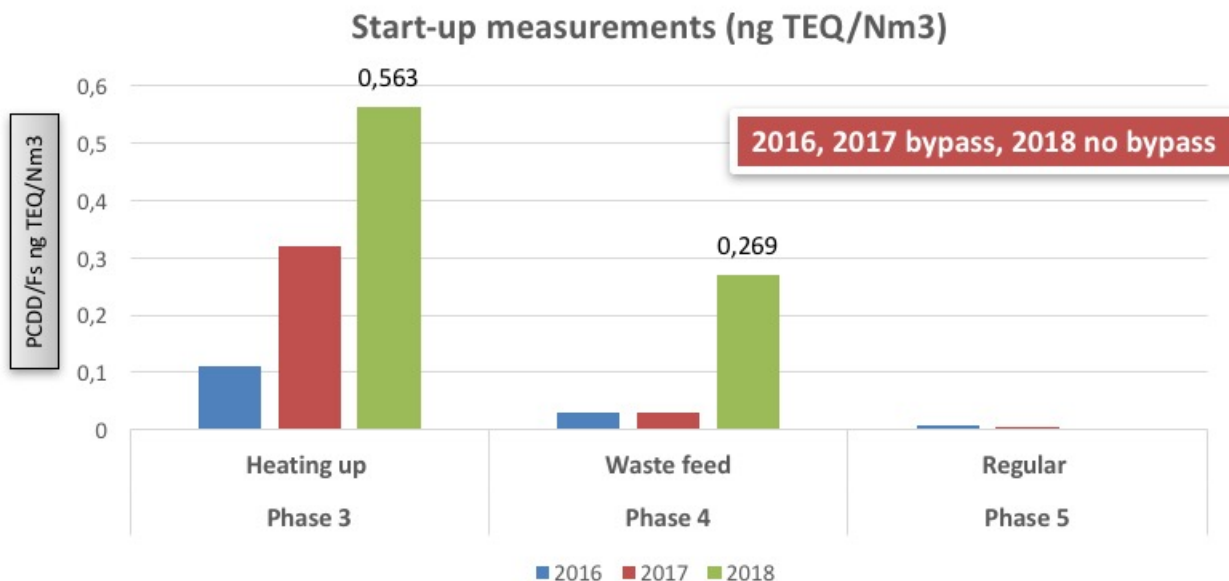
2017

1,7 ng TEQ/Nm<sup>3</sup>

2018

?

Parallel research by ODRA and EML (Not AMESA)

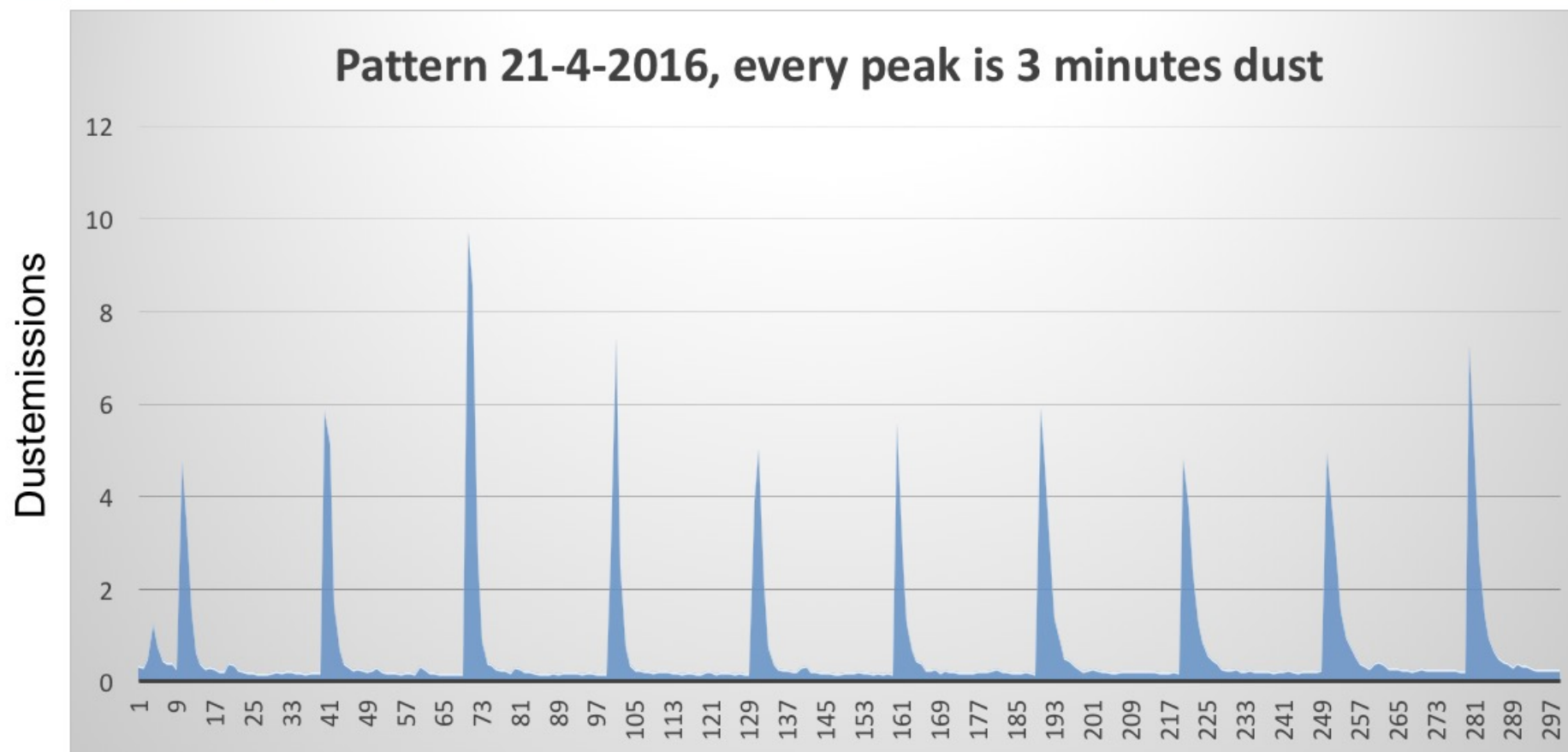


**2018: NO improvement in dioxin reduction**

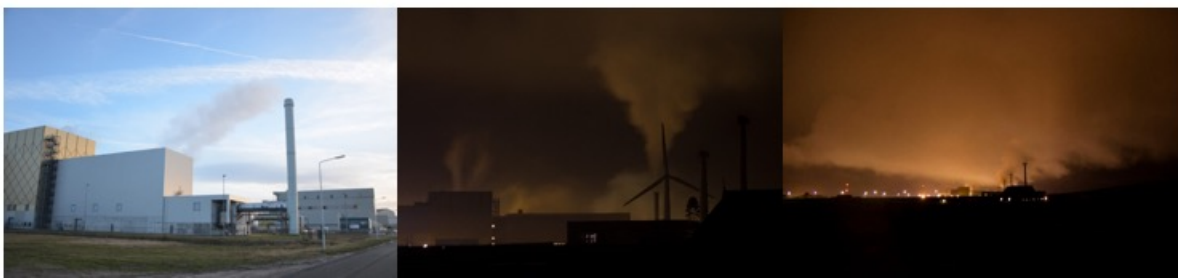
**Incinerator decides to stop** the AMESA, despite it was already paid, the amendments of the government and the call from **the population to continue** the AMESA measurements



# Start-up dust emissions



Most of the time, bypassing (dump stacks) takes only a few minutes

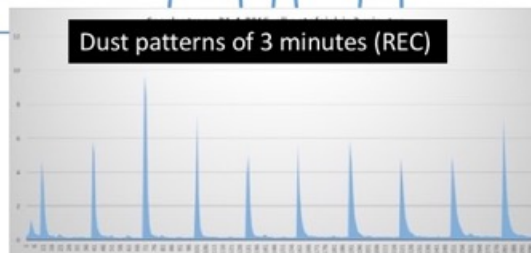
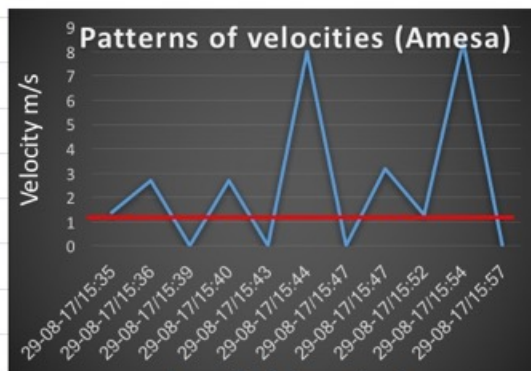
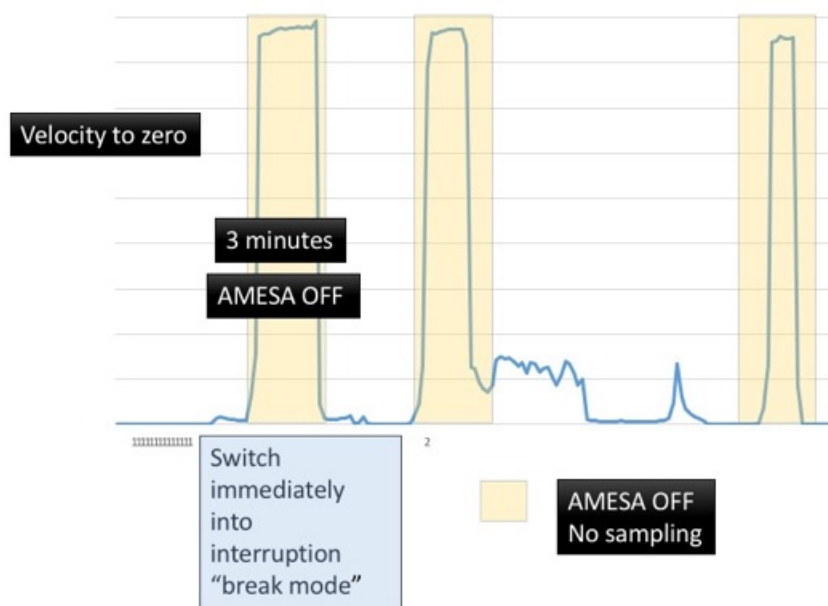


Night-shifts

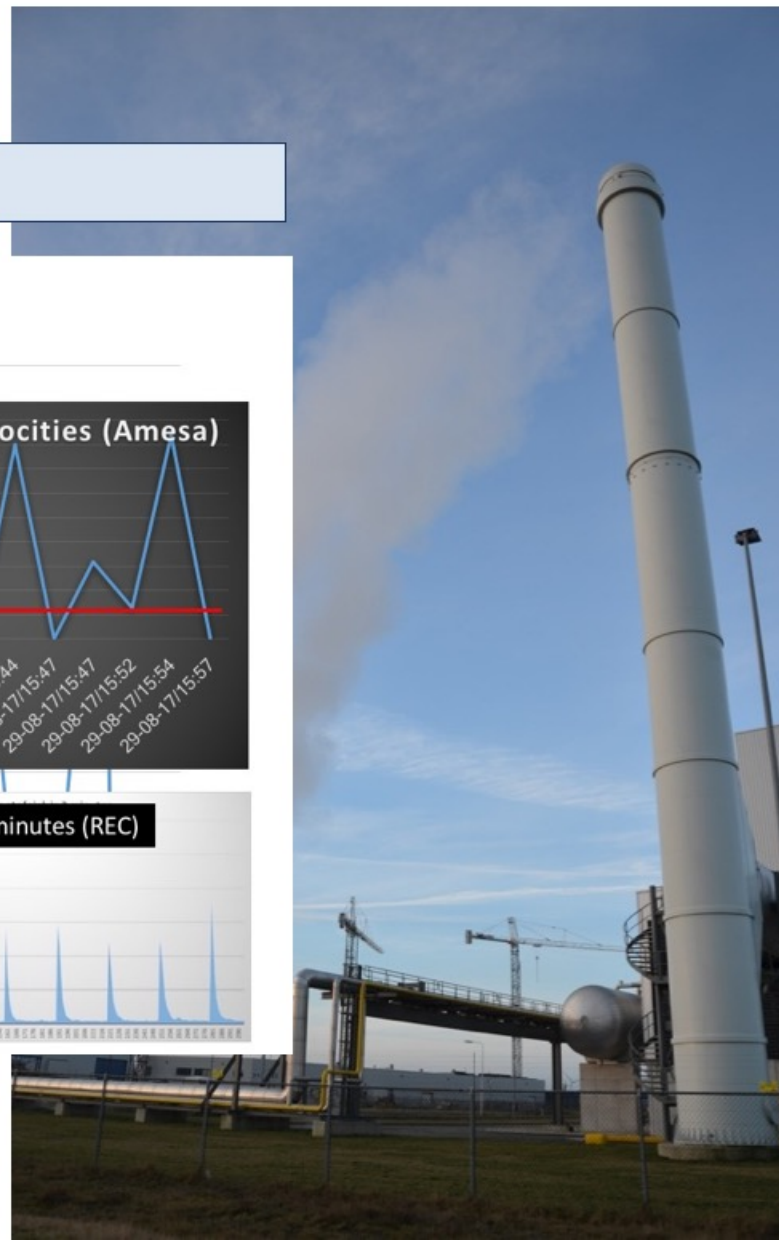
# Sample interruptions

Linking log files REC with Amesa

Patterns VH<VHUGR



Leakage test AMESA after VH<VHUGR)

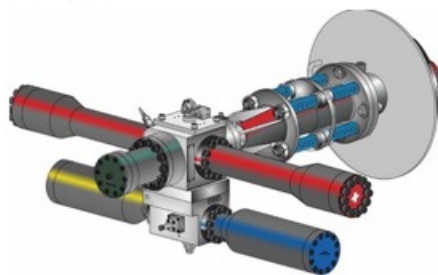


# Industrial cleaning

## Explosion

REC problems with HCl and HF,  
Corrosion and dustclotting

SMART Explosion



Shock Pulse Generator

Media: Explosion with gas cylinder

## Ontplofte gasfles oorzaak storing afvaloven

HE-25/3-2016

HARLINGEN – Een ontploffing in de afvaloven was de oorzaak van de ring van vorige week vrijdag. Omrin meldde dat het om een ventilator tussentijdens het afval zat die in de afvaloven enkele minuten



Door de bij de explosie optredende drukgolven worden de incrustaties en aanklevingen losgemaakt

What about interactions AMESA sampling?

Online Boiler Cleaning  
with Controlled and  
Dosed Gas Explosions



# Start-up after annual maintenance

## AMESA

2016: Not performed because a local “electricity failure”/’explosion’

2017: Not performed because of “miscommunication”

2018: Performed only 31% because of sample break ( $VH < VHUGR$ ).

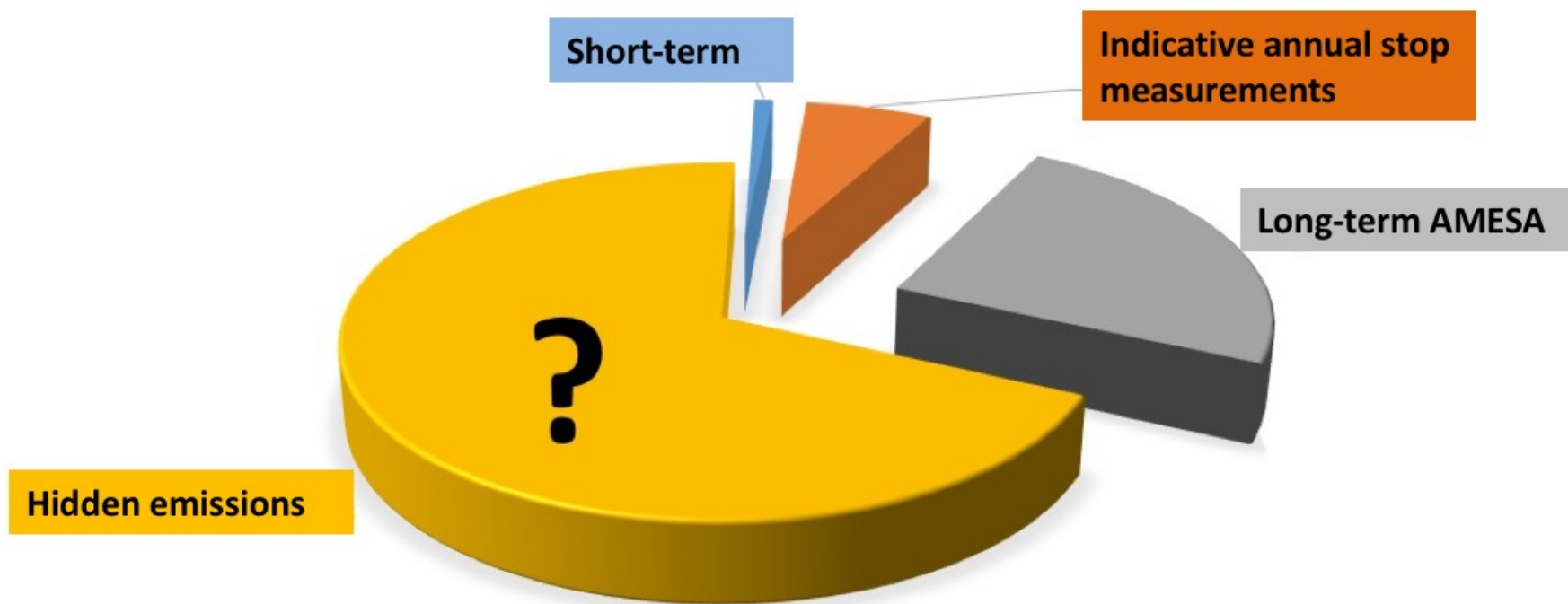
AMESA only sampling after the dump-stacks of dust.

**Data AMESA during start-ups are therefore incomplete, gravimetric measurements confirm this.**





# Hidden emissions



**Hidden dioxin emissions**

AMESA stops, but leaving many questions have arisen...

# Conclusions

- Sampling must be representative, continuous sampling must be continuous, without interruptions
- Under no circumstances bypassing of flue gas/dust, even when there's no waste to burn
- Shutdown and start-ups should be included in dioxin emissions calculation/regulation
- Start-ups cause exceeding dioxin emissions
- More research on industrial cleaning (detonation), maybe science is a step behind
- AMESA is a step ahead in sampling, but still there're a lot of shortcomings
- "Economy first" should not be No 1 on behalf of our health and our environment

*See also posters ToxicoWatch UPOP emissions and Postcombustion temperatures*

# Acknowledgement

## Contributions on our ToxicoWatch research

- S.A. Environnement; AMESA, Hamburg, Germany
- BDS, BioDetection System, Amsterdam, CALUX eggs
- GGD, Public Health Service,
- ODRA, Omgevingsdienst Regio Arnhem, *shortterm measurements*
- Arcadis, Consultancy
- Witteveen en Bosch, Consultancy
- MOBilisation for the Environment, Consultancy
- Sarolea lawyers
- KH Consultancy, University Aalborg, Denmark
- Local council township Harlingen,
- Gouvernement Province Fryslan,
- REC, Reststoffen Energie Centrale, *incinerator Harlingen*
- IBED/ESPM, University of Amsterdam

## Thank you for your attention