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CURRENT METHODICAL LIMIT OF LONG TERM EMISSION SAMPLING METHODS FOR MEASURING CONCENTRATIONS OF I-TEQ FROM PCDD/PCDFs

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Current situation

- Basic interest for continuous emission measurement results of PCDD/PCDFs increases
- but only in some sectors, mainly
  - waste incineration
  - cement industry
- and in some countries only
  - legal national regulations
    France (mid 2014)
    Belgium (~2000)
  - regional regulations
    e.g. Italy
  - national acceptance
    e.g. USA for replacing short time sampling obligations

Methods

- EN 1948-1
  Stationary source emissions — Determination of the mass concentration of PCDDs/PCDFs and dioxin-like PCBs
  Part 1: Sampling of PCDDs/PCDFs (2005)

- TS 1948-5: Stationary source emissions — Determination of the mass concentration of PCDDs/PCDFs and dioxin-like PCBs
  Part 5: Long-term sampling of PCDDs/PCDFs and PCBs (2015)

- GA X 43-139 (France, 2014)
  Guide for performance tests and periodic monitoring tests to be carried out on semi-continuous PCDDs and PCDFs measurement systems and for the management of cartridges

Municipal waste incinerator Vienna
designed by Friedensreich Hundertwasser

Methods: EN 1948-1

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- well established since >20 years, latest version >10 years
- validated
- provides 3 methods
  - cooled probe method
  - filter cooler method
  - dilution method
- where the dilution method is applicable for long term use also
  - with 2 limitations only:

    sampling time changed to >8 hours
    traversing missing

EN 1948-1 long term application

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- sampling time extension
  - component stability on filters
  - breakthrough
- traversing missing
  - representativeness influenced
- condensed (liquid) phase not included in analysis (cooled probe method and filter cooler method)
  - precipitation efficiency from liquid phase
  - wash out (after precipitation)
  - wash through (particulates)

Representativeness influence

EN 13248-1 defines number of sampling locations
Depending on diameter / square of the stack

Original representativeness of sampling 95%

Corresponding percentage of lower sampling locations number
results in the same statistical t-value

A replacing single sampling location can not be selected (component diameter different)

Diameter [mm]	Square [m²]	Sampling locations acc. EN 13284-1	1 sampling location	2 sampling locations	3 sampling locations
0 ... 1000	0,00 ... 0,80	**4**	64%	85%	92%
1001 ... 1600	0,80 ... 2,00	**8**	56%	78%	86%
1601 ... 2000	2,00 ... 3,10	**12**	52%	75%	83%
2001 ... 2256	3,10 ... **4,00**	**16**	51%	74%	82%
2257 ... 2520	**4,00** ... **5,00**	**20**	50%	73%	81%
> 2520	**> 5,00** 0,00	**24**	49%	73%	81%

Methods: TS 1948-5

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- currently: technical specification – good draft for EN
- unvalidated, start of validation in preparation
- complex validation expected
  e.g. 3 mm nozzles instead of min 6 mm
- contradictions to be banished
  e.g. inclusion/exclusion of precipitated dust inside the probes
- inappropriate references and cross references to be changed
  e.g.
  - some defined requirements not applicable for all methods
  - reference to EN 15267 inappropriate, is for AMS
    French GA X 43-139 created for exactly this issue

Materials

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DioxinMonitoringSystem®

- Automatic isokinetic sampling using EN 1948-1 dilution method
  prepared for EN 1948-5 conformity
- Industrial design - application in incineration plants' environment
- Sampling up to 6 weeks (tested up to 9 months!)
- MCerts and US-ETV certifies, produced in frame of ISO 9000 rules
- PM10, PM2.5 and PM1 application
- > 150 devices operating wordwide
- available since 1993


qualityaustria
Succeed with Quality

CERTIFICATE

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Sites:
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QUALITY MANAGEMENT SYSTEM
complying with the requirements of standard
ISO 9001:2008

Production of Measurement equipment

Registration No.: 10714/0
Date of initial issue: 20 June 2011
Valid until: 1 February 2015

Vienna, 2 February 2015

Signatures removed for security reasons


ETV

EPA

Baltic

ETV Joint Verification Statement


sira

MCERTS

Environment Agency

PRODUCT CONFORMITY CERTIFICATE

Continuous Isokinetic Dioxin Sampling System
Model 6.20

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Sira Certification Service

Long term sampling of stack emissions

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DioxinMonitoringSystem®

long term AND short term sampling applicable

Compounds:

dioxins (PCDD/F), PCB, other POPs

with ParTrace® add-on: PM10, PM2.5, PM1 additionally

Applications:

emission limitation, legal limits

DioxinMonitoringSystem® general features

- Control unit for computerized management of the individual processes
- Built for industrial environments
- Use of pure titanium for cartridges, nozzles and probes = NO GLASSWARE
- Sampling according to dilution method directly controlled accurate isokinetic sampling
- Reliable volume measurement
- Sophisticated temperature management
- Versatile sampling of many pollutants
- Dioxins (PCDD/PCDF), but also other POPs, heavy metals
- Sophisticated and experienced cartridge handling
- Best results in comparison measurements
- Automatic probe cleaning
- Automatic leak test
- Long time experience and development

DioxinMonitoringSystem® Standard version

- **Double probe** version available especially needed for improvement of the sampling representativity of stacks with diameter > 1.000 mm
- Fine dust sampling option **ParTrace®** for sampling and separating of PM10, PM2.5 and PM1 in parallel to the dioxins available
- Specification for dilution air provision
  - 6 bar
  - dew point < +5°C
  - 6 m³/h @ 1 bar nominal
  - 9 m³/h @ 1 bar max
- User interface in colour with keyboard

DioxinMonitoringSystem® Compact version

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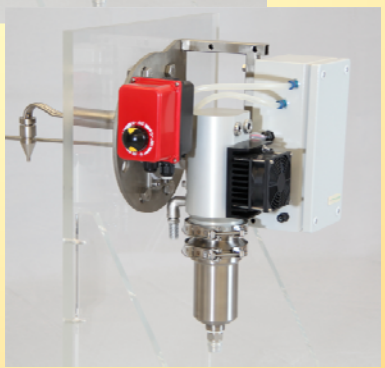
- **Single probe** version
- **Multiplex 1:2** option for alternating sampling from one of two chimneys available
- Fine dust sampling option **ParTrace®compact** for sampling and separating of PM10 in parallel to the dioxins available
- Specification for dilution air provision
  - 6 bar
  - dew point < -5°C
  - 4 m³/h @ 1 bar nominal
  - 7 m³/h @ 1 bar max
- User interface B/W with touch screen



Dilution method - Standard version

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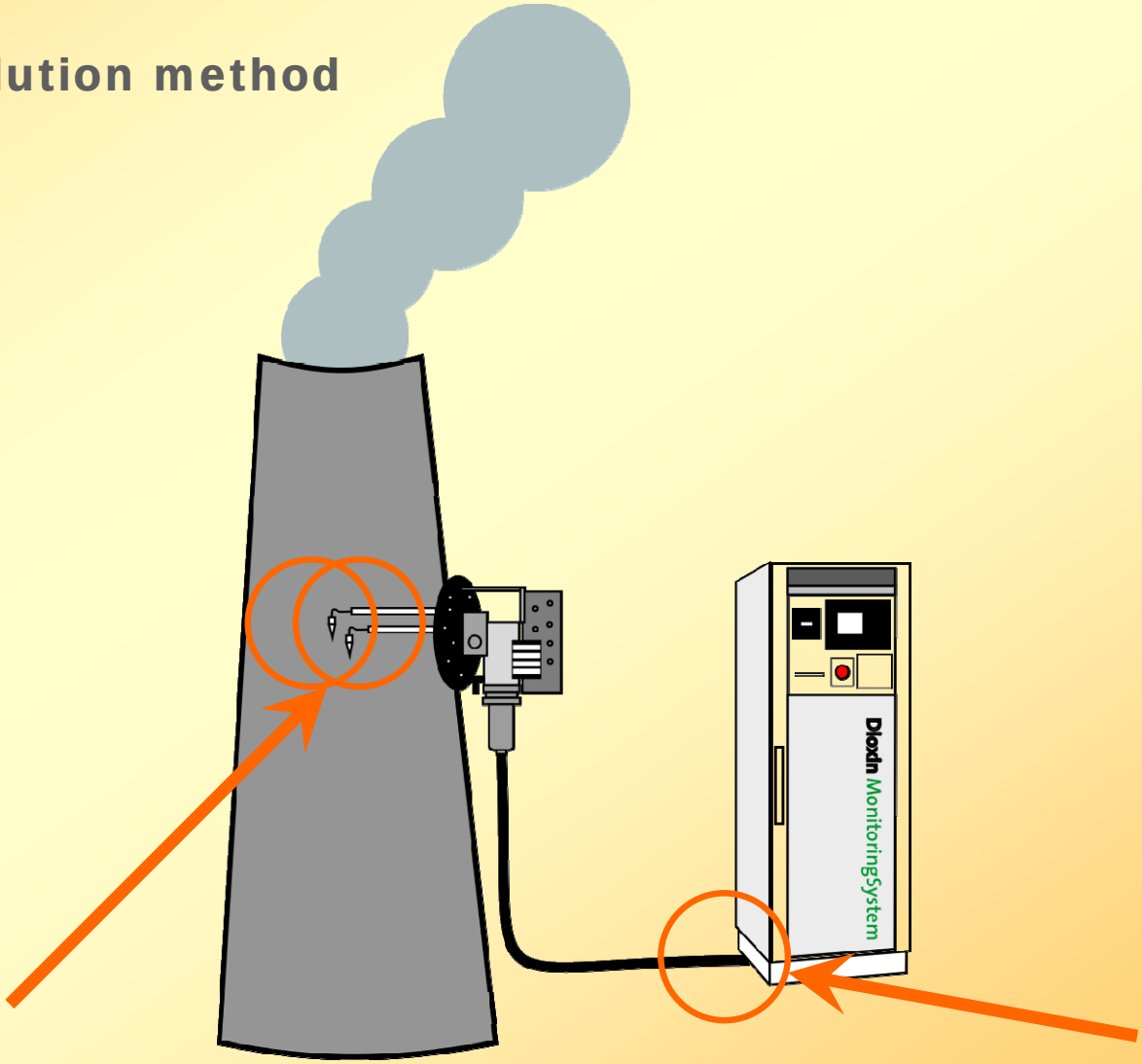
Method: EN1948-1/5 dilution method



Dilution method - Compact version

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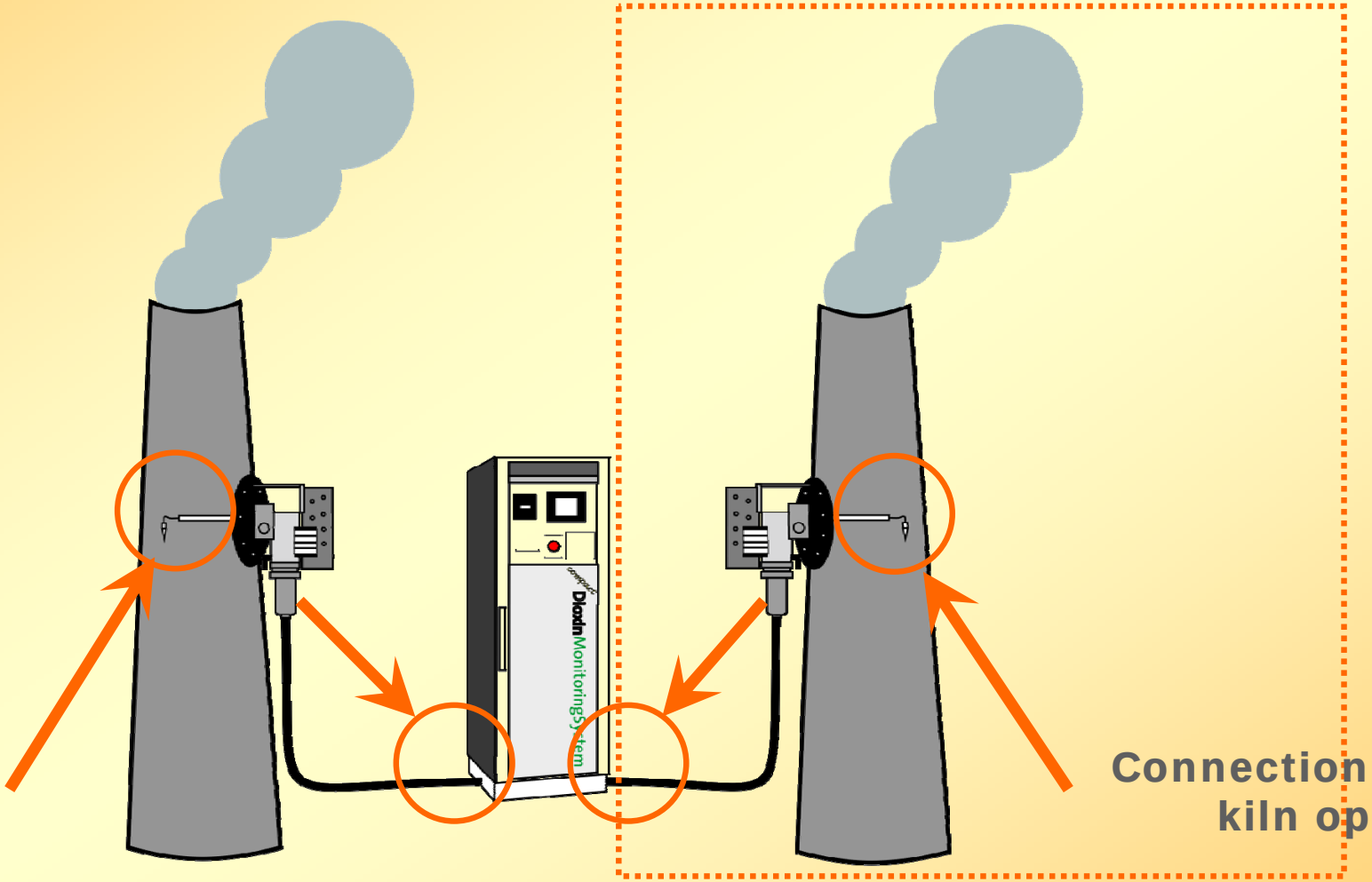
Method: EN1948-1/5 dilution method



Connection to a second kiln optionally

Multiplex 1:2 version

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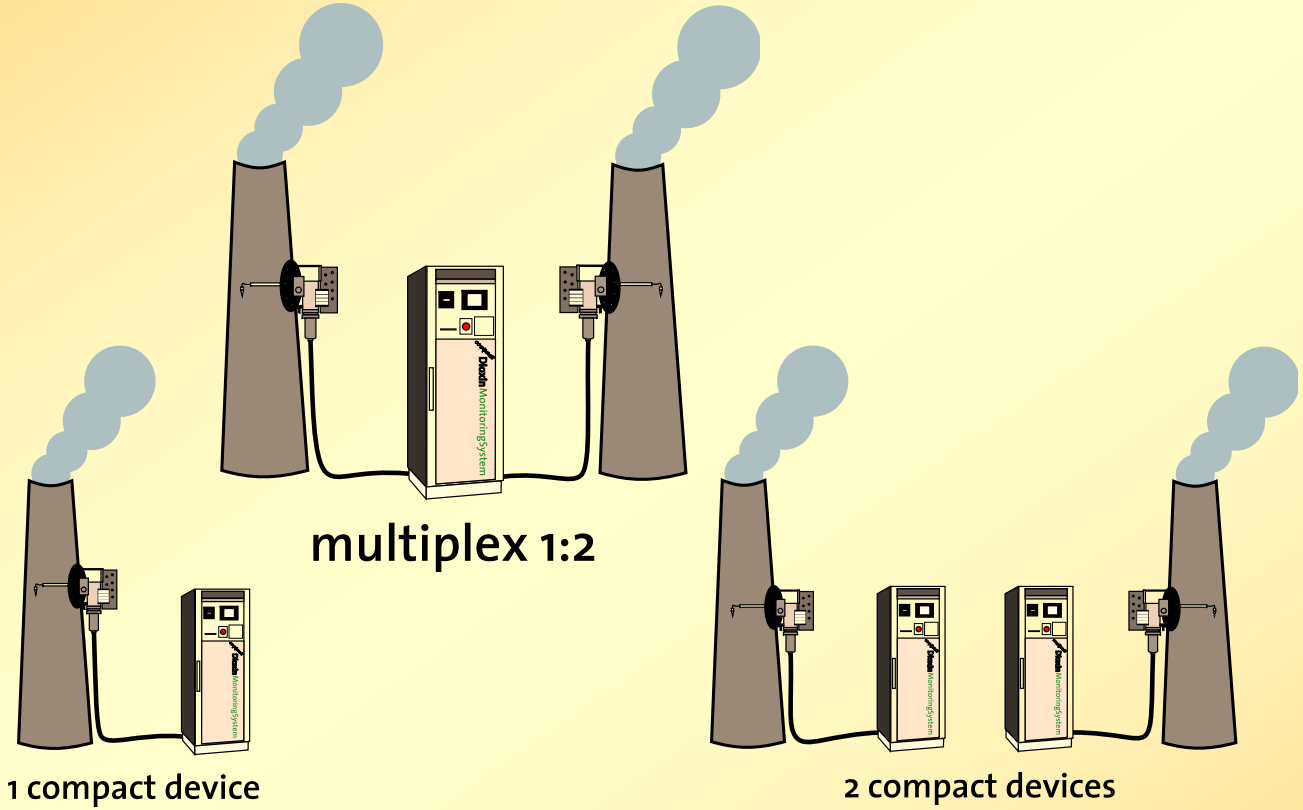
The multiplex 1:2 version is an extension for the **compact DioxinMonitoringSystem®** device to operate 1 of 2 sampling units alternating with one control unit only.
It represents a very cost efficient solution, designed for special applications and redundancy use.

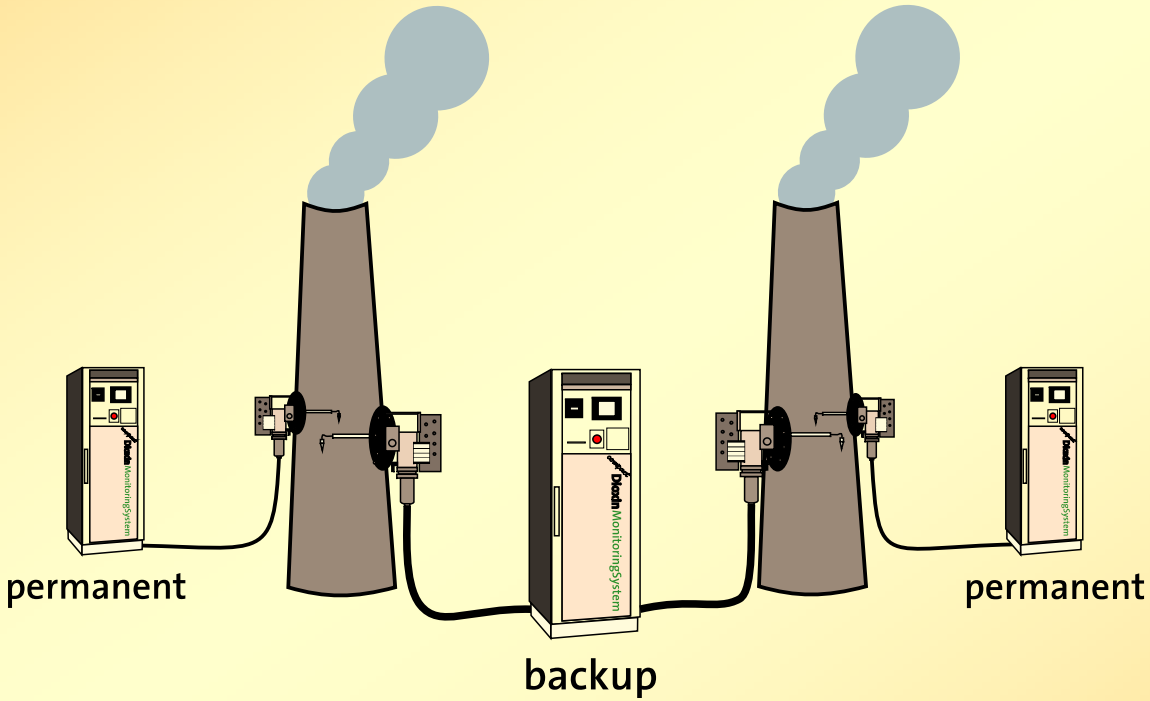


Features

- Independent , sequential operation of the sampling units
- Programmed manual or configured automatic switching
- Compact devices upgradeable to multiplex 1:2
- Multiplex devices upgradeable to 2 separate compact devices

Multiplex 1:2 - the redundancy solution

- one of two sampling lines alternating
- backup-device for two permanent monitored lines

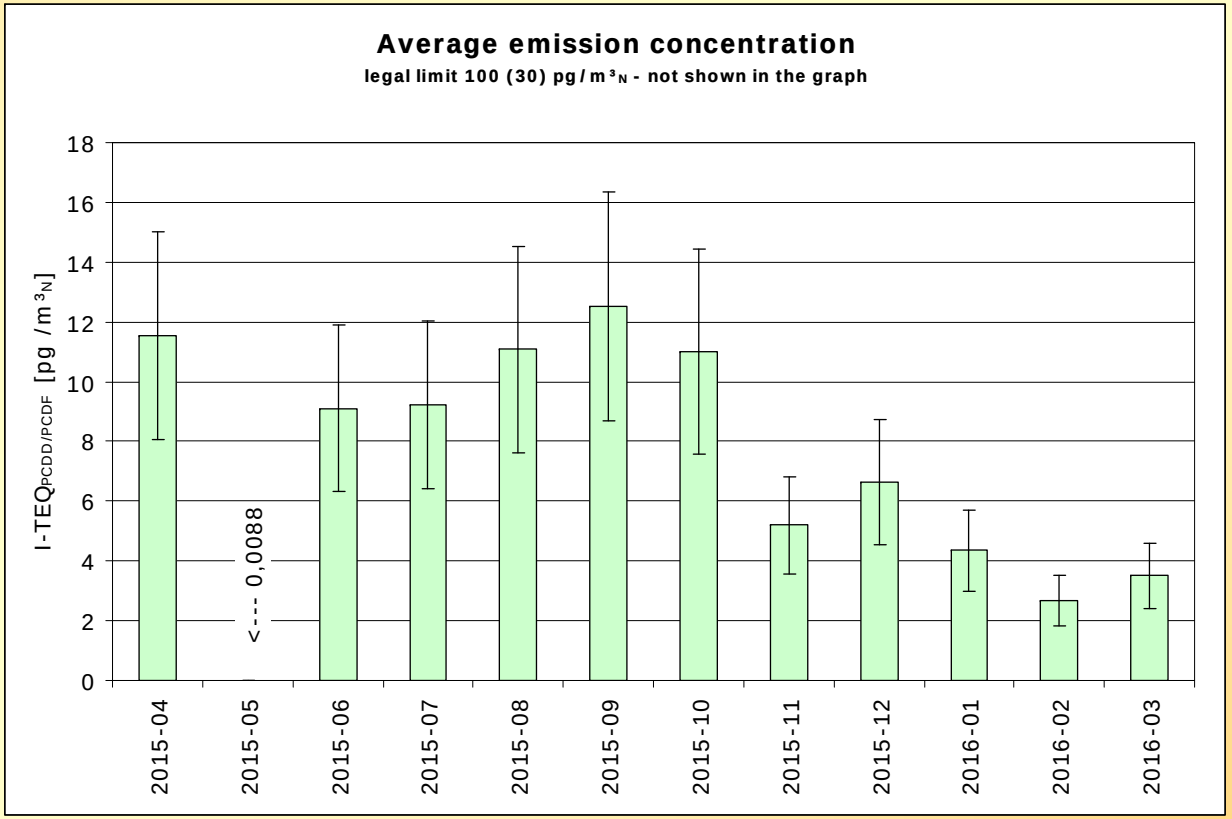


Location: Incineration plant Rüdersdorf

- operates since 2009
- incinerates municipal waste and biomass
- generates up to 35 MW electrical energy
- thermal power is up to 118 MW
- high operation experience

Emission samples

- sampling time one month
- processing and analysis by accredited laboratory in Bolzano
- according EN 1948-2 and -3

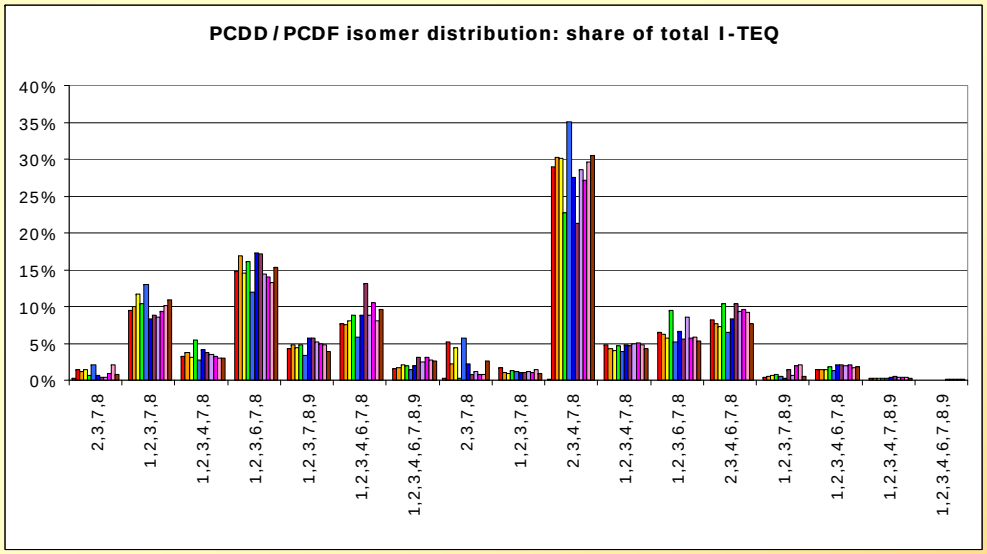


Sample 2015-05

- 16 of 17 I-TEQ isomers detected and quantified (1,2,3,7,8,9-HxCDF n.d.)
- Result = average emission of sampling period

$$0.0088 \pm 0{,}0027\ pg/m^3_N$$

- Typical 1,2,3,7,8,9-HxCDF share of I-TEQ < 1%



Estimated annual impact of this one plant

- average emission ~ 8 pg I-TEQ/m^3_N
- ~ 100.000 m^3_N/h
- operation time ~ 7.000 h/year
- mass flow

~ 5 mg $I\text{-}TEQ_{PCDD/PCDF}$/ year

Unregulated sectors

- Example of evidence from metallurgic industry
- No measurement obligations
- Emission evidence ~ 45 **n**g I-TEQ/m^3_N (1996, but process unchanged)
- ~ 1.000.000 m^3_N/h
- operation time ~ 4.000 h/year
- mass flow

>> 1 g $I\text{-}TEQ_{PCDD/PCDF}$/year

(calculated: 180 g)

Comparison of sectors

- Regulated sector

  ~ 5 mg I-TEQ$_{PCDD/PCDF}$/year/plant

- Unregulated sector

  >> 1.000 mg I-TEQ$_{PCDD/PCDF}$/year/plant

Conclusions

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- Plant operating skills and emission measurement skills are at very high level
- Regulating documents have to be reviewed for consistency and improved
- Regulation need to be harmonised for different sectors
  - for correct inventory calculation
  - for more effective investments

Acknowledgements

- Operators of the plant Rüdersdorf
  especially Mrs. Schröder, Mr. Lehmann and Mr. Zillmann
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