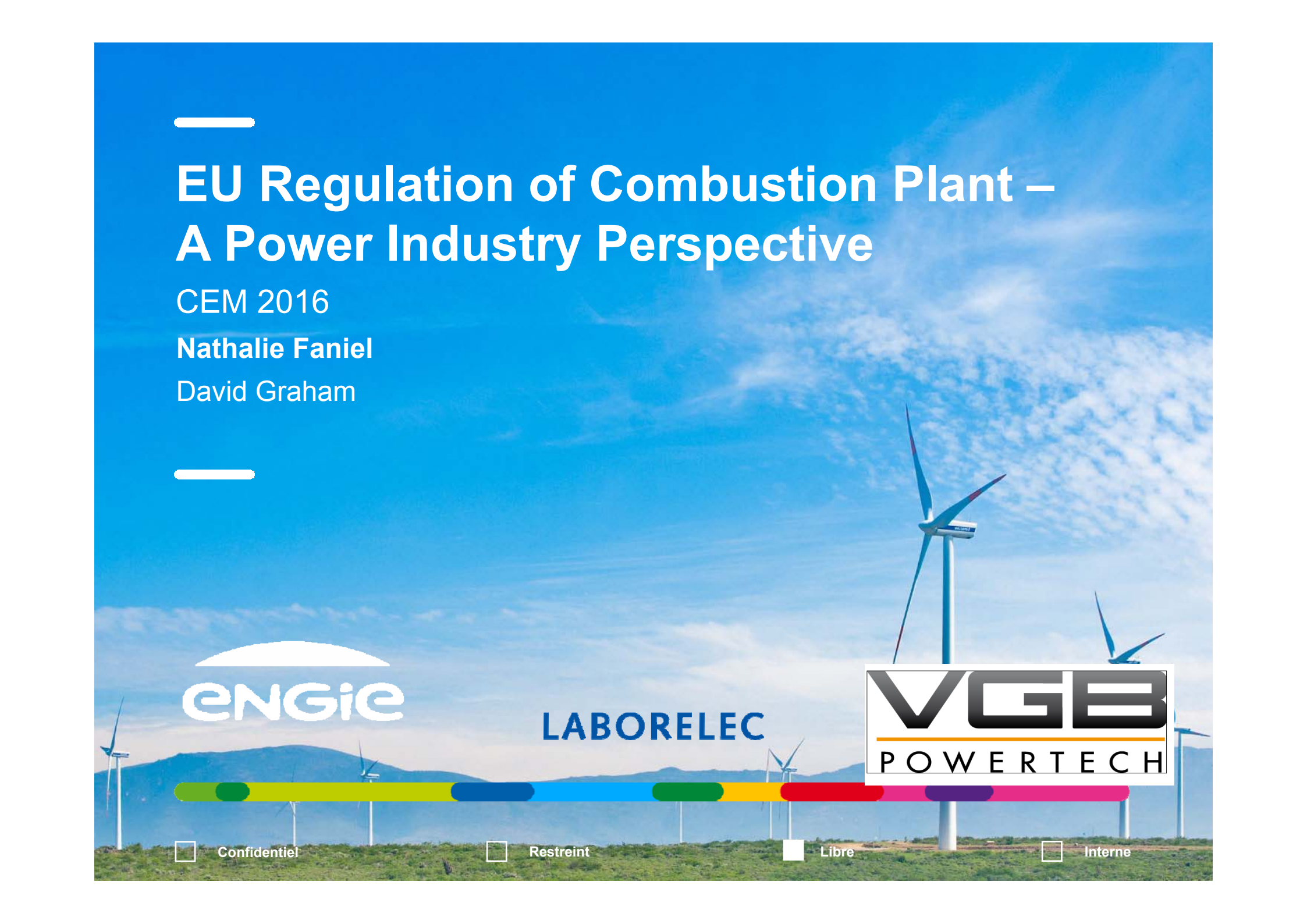
EU Regulation of Combustion Plant – A Power Industry Perspective

CEM 2016

Nathalie Faniel

David Graham



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Presentation on behalf of the VGB Emission Working Group

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Summary

Context

Air pollution within EU
Emission reduction needs to go further
European Directives

MCPD

Scope and principles
Outside the scope
Aggregation rule: lots of questions

IED

Scope
Low emission limit values- BREFs
Uncertainty requirements on emission measurements

Conclusion

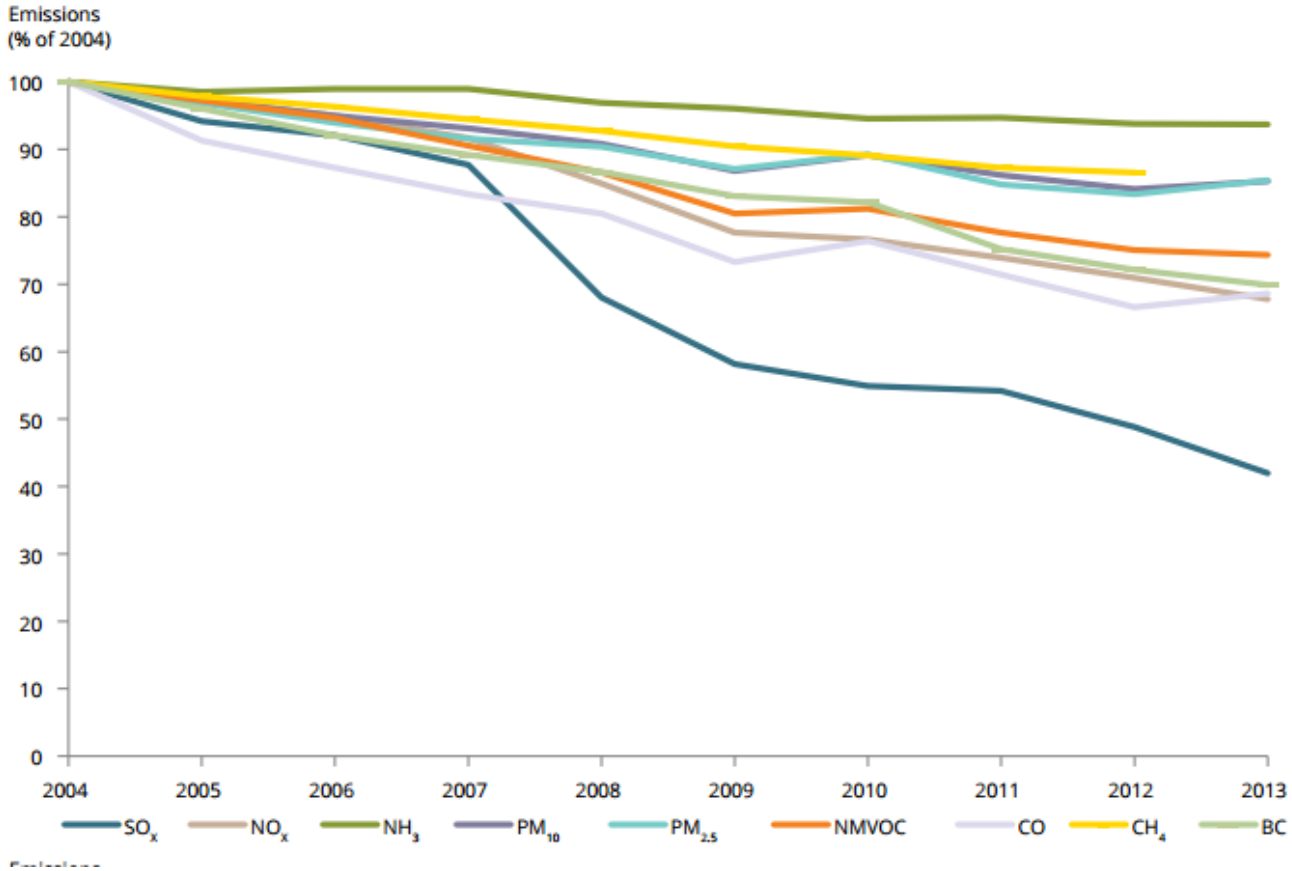
Context: air pollution within EU

From the introduction within the MCPD:

- ../..ecosystems continue to suffer from excess nitrogen and sulphur deposition associated with emissions from transport, unsustainable agricultural practices and power generation
- Scientific assessments show that the average lifetime loss for citizens of the Union due to air pollution is eight months
- Emissions of pollutants from the combustion of fuel in medium combustion plants are generally not regulated at Union level even though they contribute increasingly to air pollution, due in particular to an increase in the use of biomass as a fuel, driven by climate and energy policy

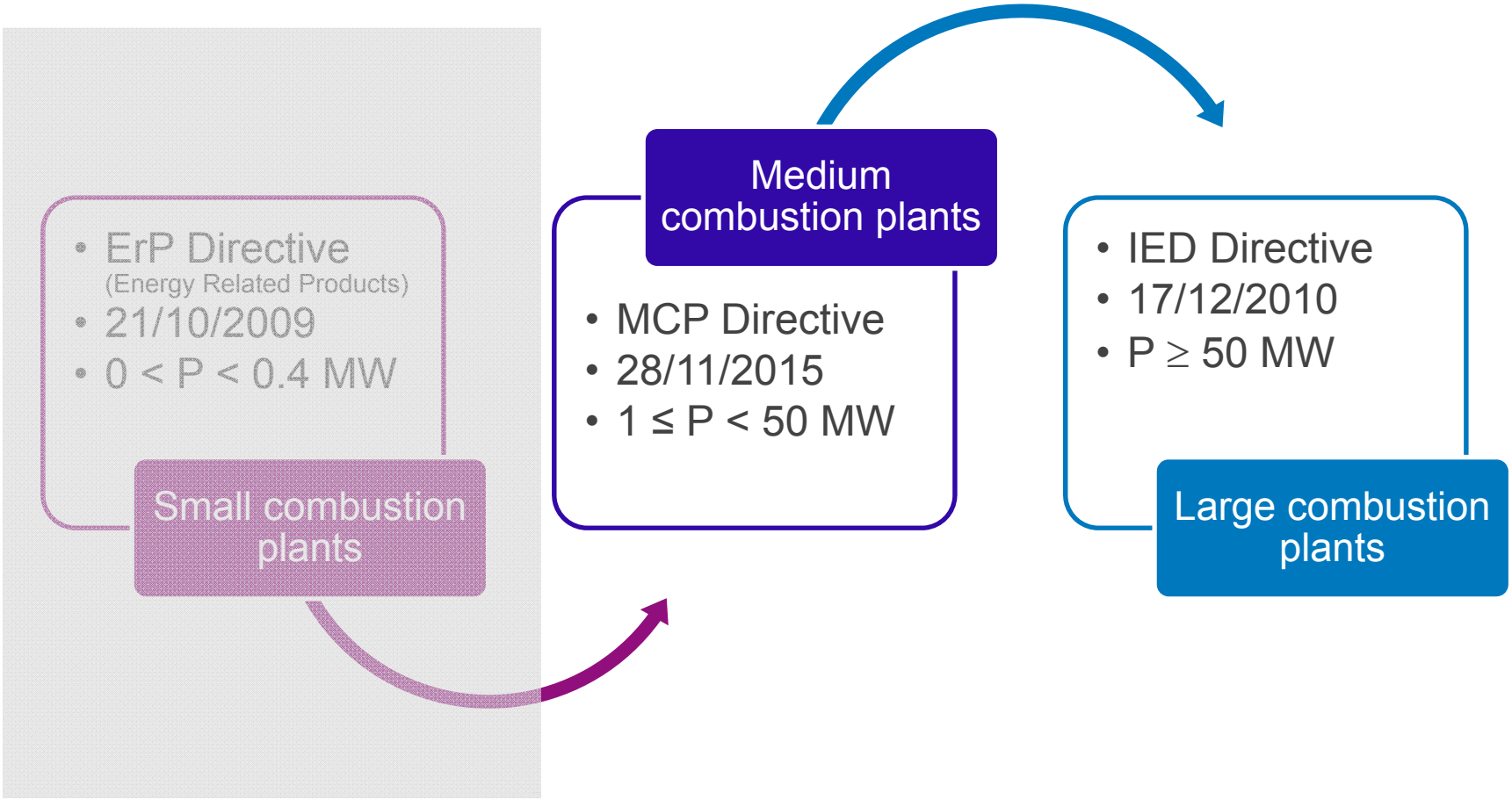
Context: emission reduction needs to go further

Figure 2.1 Development in EU-28 emissions of SO_x, NO_x, NH_3, PM_{10}, $PM_{2.5}$, NMVOCs, CO, CH_4 and BC (top) and of As, Cd, Ni, Pb, Hg, and BaP (bottom), 2004–2013 (% of 2004 levels)

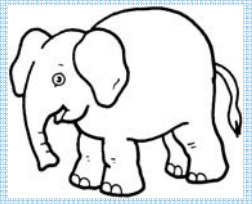
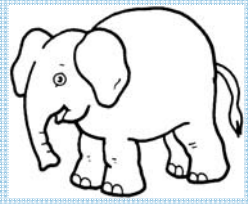


Source: EEA Report No 5/2015

Context: European Directives



Context: European Directives

	Total emissions	Control of the emissions
	Ton/year	**As it should be** Time and costs
MCP (Medium Combustion Plant)		
LCP (Large combustion Plant)		

Context: European Directives

	Total emissions	Control of the emissions	
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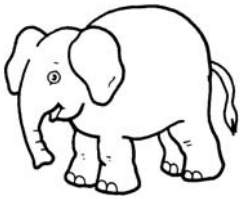
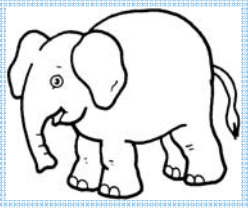
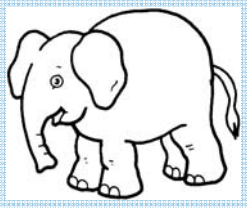
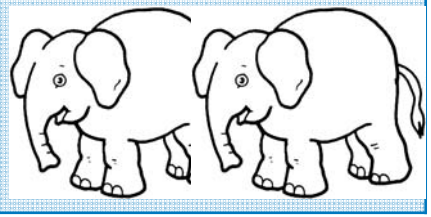
MCP (Medium Combustion Plant)			
LCP (Large Combustion Plant)			

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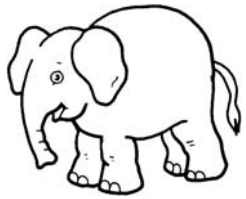
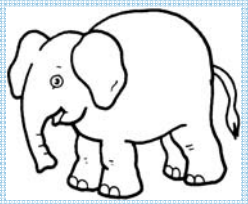
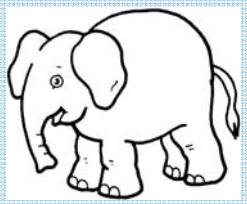
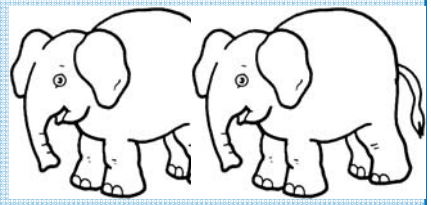
MCP (Medium Combustion Plant)			
LCP (Large combustion Plant)			
MCP---LCP aggregation			

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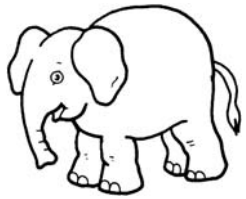
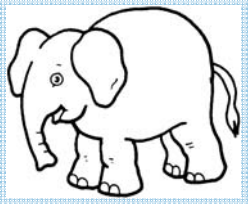
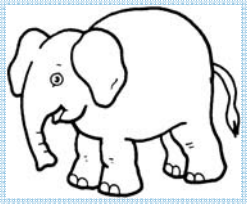
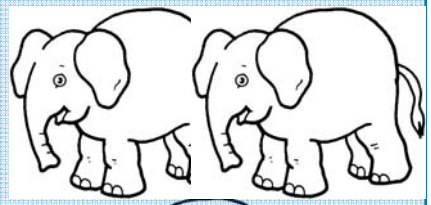
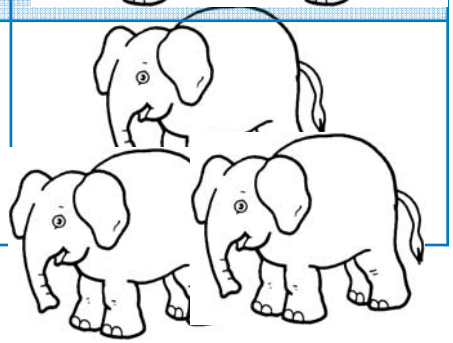
MCP (Medium Combustion Plant)			
LCP (Large combustion Plant)			
MCP→LCP aggregation			

MCPD: Scope and principles

- Applied to combustion plants for which the rated thermal input is:

  $1\ MW \leq I < 50\ MW$

- MCPD applies to MCP that are not part of an LCP on large sites (>50MWth)
- Pollutants: **NO_X, SO_2, dust (ELVs)** and **CO (monitoring only)**
- Covers all combustion plants including boilers, turbines and engines
  - **Existing plants**
  - **New plants**
  - **Exemptions**
  - **(Scope exclusions)**
- Obligation **to register**
- The Member States shall assess the need to apply **stricter ELV** in zones not complying with the ELV defined by the Ambient air directive (2008/50/EC)
- An **aggregation rule** only for the new plants

MCPD Exemptions

- **Plants operated less than 500 hours per year** (rolling average of 5 years): exemptions on ELV with a limit for dust at 200 mg/Nm^3.

- **District heating network**: additional period of 5 years for plants I > 5MW regarding the compliance with ELV, with a limit SO_2 at 1100 mg/Nm^3 and for dust at 150 mg/Nm^3.

- **Biomass**: combustion plants covered by the Directive 2008/50/CE (ambient air), possible exemption until 01/01/2030 with a limit for dust at 150 mg/Nm^3.

- **Gas compressors stations**: additional period of 5 years for plants I > 5 MW regarding the compliance with NO_X VLE (without limit).

- Possible derogation for 6 months on the **ELV for SO_2** because of an **interruption in the supply of low sulphur fuel** resulting from a serious shortage.

MCPD: Outside the scope

The MCP Directive shall not apply to medium combustion plants :

- covered by chapters III or IV of the IED Directive
- in which the gaseous products of combustion are used for the direct heating, drying or any other treatment of objects or materials
- post-combustion plants designed to purify the waste gases from industrial processes by combustion, and which are not operated as independent combustion plants
- firing refinery fuels alone or with other fuels for the production of energy within mineral oil and gas refineries
- any technical apparatus used in the propulsion of a vehicle, ship or aircraft
- gas turbines and gas and diesel engines, when used on offshore platforms
- used for research activities, development activities or testing activities relating to medium combustion plants

MCPD: Aggregation rule

As written in the Directive (article 4):

« *A combination formed by* ***two or more new medium combustion plants*** *shall be* ***considered to be a single medium combustion plant*** *for the purposes of this Directive and their rated thermal input shall be added together for the purpose of calculating the total rated thermal input of the plant, where:*

— the waste gases of such medium combustion plants are discharged through a common stack, or

— taking into account technical and economic factors, the waste gases of such medium combustion plants could, in the judgement of the competent authority, be discharged through a common stack. »

MCPD: Aggregation rule: lots of questions

- Room for interpretation
- What about the transposition into national legislation?
- Frequency of the controls

- How is the ELV set when there are different technical units attached to the same stack? How is compliance assessed in this situation?

- How to combine MCP operated continuously with MCP with intermittent operation? Result interpretation when there are several start up/ load changes within one hour?

IED scope

- Industrial Emission Directive 2010/75/EU
- Large Combustion Plants (LCP), with P> 50 MWth
- Waste incinerator (WI)
- Emission limit values
- Continuous emission monitoring (CEM with AMS) of pollutant emission into the air → quality requirement for the monitoring described in different standards
  - EN 15267-3 : Performance criteria and test procedures for AMS for monitoring emissions from stationary sources
  - EN 14181: Quality assurance of the CEM
  - EN 15259: Requirements for measurement sections and sites

IED: low emission limit values

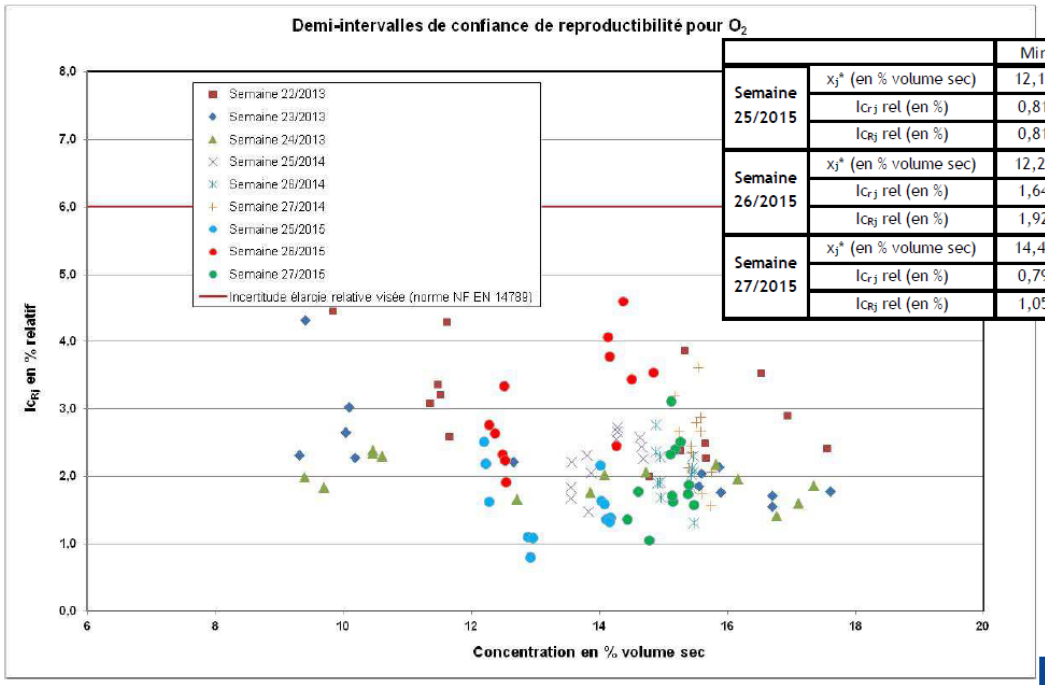
- IED defines Emission Limit Values for different fuels and different situations
- EU Implementing Decision defines the rules that govern start-up and shut-down.
- **Lower mandatory emission levels** are specified in Best Available Techniques Reference (BREF) documents for each industrial sector. The Large Combustion BREF is nearing completion and this specifies **emission levels** and monitoring requirements for **additional species → should be considered together with**
  - The process capability;
  - The overall environmental impact of achieving them (LCA);
  - **The available CEMs on the market and the existing standard reference method (SRM) to monitor/measure them.**

IED: uncertainty requirements on emission measurements

- From the QAL1 certification process, most CEMs (AMS) show very low S_{AMS}, letting us suppose that they are able to monitor very low ELV in compliance with the current required uncertainties (given as % of the daily ELV). **However, in practice this is not achievable.** QAL1 values, cannot be directly applied to industrial applications, despite the fact that site testing is included in the QAL1 process
- **Back calculation from QAL2 results** of the minimum ELVs that could be monitored, **shows very high uncertainty values**. Several possible reasons:
  - Harsh industrial environment
  - Heterogeneity of the measuring section
  - **Uncertainty of the SRM is significant and larger than zero as supposed in the standard (EN14181)**.

SRM : interlaboratory tests on O_2

Résultats O_2



		Min	Max	Moyenne
Semaine 25/2015	x_j* (en % volume sec)	12,19	14,16	
	Ic_{rj} rel (en %)	0,81	2,17	1,27
	Ic_{Rj} rel (en %)	0,81	2,52	1,57
Semaine 26/2015	x_j* (en % volume sec)	12,27	14,84	
	Ic_{rj} rel (en %)	1,64	4,37	2,70
	Ic_{Rj} rel (en %)	1,92	4,60	3,09
Semaine 27/2015	x_j* (en % volume sec)	14,43	15,47	
	Ic_{rj} rel (en %)	0,79	2,57	1,53
	Ic_{Rj} rel (en %)	1,05	3,11	1,92

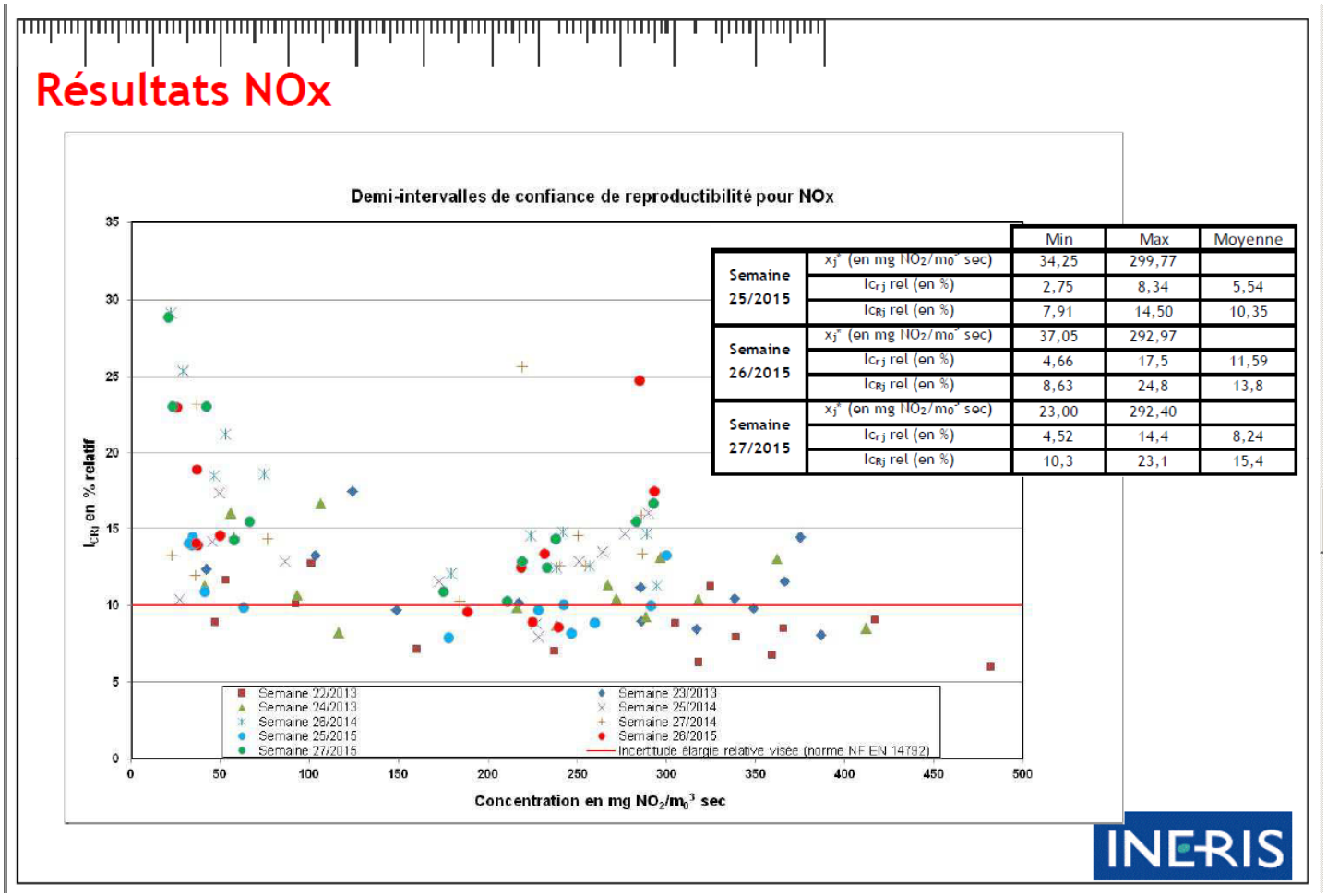
INERIS

Targeted uncertainty @ ref. value

EN 14789

6%

SRM: interlaboratory tests on NOx



		Min	Max	Moyenne
Semaine 25/2015	x_j^* (en mg NO_2/m_0^3 sec)	34,25	299,77	
	Ic_{rj} rel (en %)	2,75	8,34	5,54
	Ic_{Rj} rel (en %)	7,91	14,50	10,35
Semaine 26/2015	x_j^* (en mg NO_2/m_0^3 sec)	37,05	292,97	
	Ic_{rj} rel (en %)	4,66	17,5	11,59
	Ic_{Rj} rel (en %)	8,63	24,8	13,8
Semaine 27/2015	x_j^* (en mg NO_2/m_0^3 sec)	23,00	292,40	
	Ic_{rj} rel (en %)	4,52	14,4	8,24
	Ic_{Rj} rel (en %)	10,3	23,1	15,4

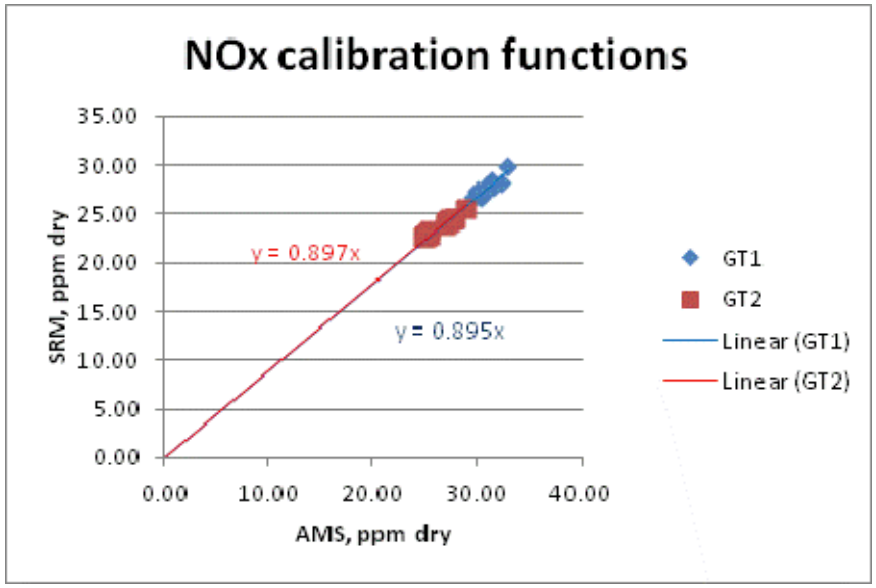
Targeted uncertainty @ ELV

EN14792

10%

QAL 2 result: example on NOx calibration

- Two similar GTs on the same site
- QAL2 : same date
- Two ABB Limas 11 UV → functional tests OK

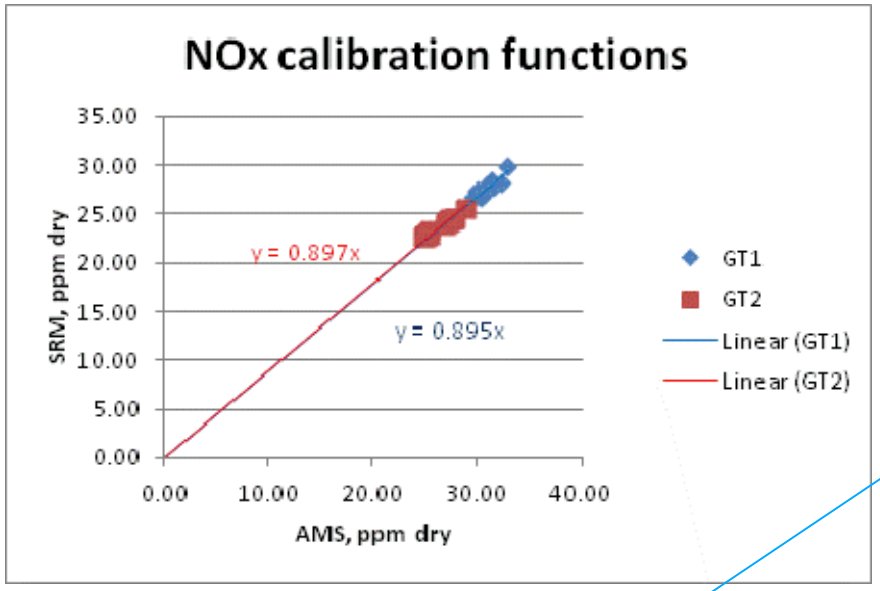


E	75.00 mg/Nm³ NO2 dry @ O_2 ref
P	20 %
σ_0	7.65 mg/Nm³ NO2 dry @ O_2 ref
k_v	0.98
S_D	2.71
$\sigma_0 * k_v$	7.47
$S_D \leq \sigma_0 * k_v$ ⇨	**the AMS passes the variability test**
Domaine validé	**64 mg/Nm³ NO2 dry @ O_2 ref**

E	75.00 mg/Nm³ NO2 dry @ O_2 ref
P	20 %
σ_0	7.65 mg/Nm³ NO2 dry @ O_2 ref
k_v	0.98
S_D	0.74
$\sigma_0 * k_v$	7.47
$S_D \leq \sigma_0 * k_v$ ⇨	**the AMS passes the variability test**
Domaine validé	**57 mg/Nm³ NO2 dry @ O_2 ref**

QAL 2 result: example on NOx calibration

- Two similar GTs on the same site
- QAL2 : same date
- Two ABB Limas 11 UV → functional tests OK



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P	20 %
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k_v	0.98
S_D	2.71
$\sigma_0 * k_v$	7.47
$S_D \leq \sigma_0 * k_v$ ⇨	**the AMS passes the variability test**
Domaine validé	**64 mg/Nm³ NO2 dry @ O_2 ref**

Min ELV: 27 mg/Nm³

E	75.00 mg/Nm³ NO2 dry @ O_2 ref
P	20 %
σ_0	7.65 mg/Nm³ NO2 dry @ O_2 ref
k_v	0.98
S_D	0.74
$\sigma_0 * k_v$	7.47
$S_D \leq \sigma_0 * k_v$ ⇨	**the AMS passes the variability test**
Domaine validé	**57 mg/Nm³ NO2 dry @ O_2 ref**

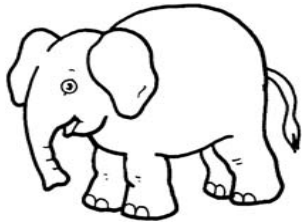
Min ELV: 7 mg/Nm³

Conclusions

- MCPD
  - Is complex to apply
  - Contains numerous exemptions and derogations
  - Aggregation rule could lead to nonsense situations
  - Interpretation by the national authorities can be variable
- IED – BREFs sets requirement on monitoring/measurements uncertainties that will not be achievable or enforceable for very low ELVs

As operators, we want to avoid that

→ →→



Thank you for your attention

Official text

- English version:

http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015L2193&from=EN

- French version:

http://eur-lex.europa.eu/legal-content/FR/TXT/PDF/?uri=CELEX:32015L2193&from=EN

Requirements – Emission limit values (ELV)

Existing plants 1 MW ≤ I ≤ 5 MW, other than gas turbines and engines

Pollutant (mg/Nm³)	Solid biomass	Other solid fuels	Gasoil	Liquid fuels other than gasoil	Natural gas	Gaseous fuels other than natural gas
SO_2	200	1 100	—	350	—	200
NO_x	650	650	200	650	250	250
Dust	50	50	—	50	—	—

Generic ELVs given.
For specific cases (footnotes); please look at the Directive.

Requirements – Emission limit values (ELV)

Existing plants 5 MW < I < 50 MW, other than gas turbines and engines

Pollutant (mg/Nm^3)	Solid biomass	Other solid fuels	Gasoil	Liquid fuels other than gasoil	Natural gas	Gaseous fuels other than natural gas
SO_2	200	400	—	350	—	35
NO_x	650	650	200	650	200	250
Dust	30	30	—	30	—	—

Generic ELVs given.
For specific cases (footnotes); please look at the Directive.

Requirements – Emission limit values (ELV)

Existing plants 1 MW ≤ I < 50 MW - Engines and gas turbines

Pollutant (mg/Nm^3)	Type	Gasoil	Liquid fuels other than gasoil	Natural gas	Gaseous fuels other than natural gas
SO_2	Engines and gas turbines	—	120	—	15
NO_X	Engines	190	190	190	190
	Gas turbines	200	200	150	200
Dust	Engines and gas turbines	—	10	—	—

Generic ELVs given.
For specific cases (footnotes); please look at the Directive.

Requirements – Emission limit values (ELV)

New plants 1 MW ≤ I < 50 MW, other than gas turbines and engines

Pollutant (mg/Nm³)	Solid biomass	Other solid fuels	Gasoil	Liquid fuels other than gasoil	Natural gas	Gaseous fuels other than natural gas
SO_2	200	400	—	350	—	35
NO_x	300	300	200	300	100	200
Dust	20	20	—	20	—	—

Generic ELVs given.
For specific cases (footnotes); please look at the Directive.

Requirements – Emission limit values (ELV)

New plants 1 MW ≤ I < 50 MW - engines and gas turbines

Pollutant (mg/Nm^3)	Type	Gasoil	Liquid fuels other than gasoil	Natural gas	Gaseous fuels other than natural gas
SO_2	Engines and gas turbines	—	120	—	15
NO_X	Engines	190	190	95	190
	Gas turbines	75	75	50	75
Dust	Engines and gas turbines	—	10	—	—

Generic ELVs given.
For specific cases (footnotes); please look at the Directive.

MCPD: Calendar

⇨Entry into force of the Directive: 20/12/2015
⇨Deadline for transposition in Member States: 19/12/2017

Existing plants =
- Plants put into operation before 20/12/2018 or
- Plants with a permit granted before19/12/2017 and put into operation no later than 20/12/2018

Application dates of the Emission limit values (ELV)	20/12/2018	01/01/2025*	01/01/2030*
Existing 1 MW ≤ I ≤ 5 MW			Annex II – part 1 tables 1 and 3
Existantes 5 MW < I < 50 MW		Annex II – part 1 tables 2 and 3	
New 1 MW ≤ I < 50 MW	Annex II part 2		

* permit or registration have to be done no later than one year before this date

Monitoring requirements and frequency measurements

- Measures required for pollutants with VLE imposed (NO_X , SO_2 , dust)
+ CO measurements for all installations
- Plants 1 MW ≤ I ≤ 20 MW: periodic measurements every three years
- Plants I > 20 MW: annual measurements

First steps to do in the four months following the granting of authorization or recording

Member States may require further, by replacing the periodic measurements by continuous measurements, regardless of the size of the installation