From BAT/BEP for Unintentional POP Reduction to Integrated Pollution Prevention and Control of Pollutants to Tackle the Triple Planetary Crisis

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Outline

- The Requirements of the Stockholm Convention
- The BAT/BEP guidelines
- General principles applied to BAT/BEP
- Relevant industrial sectors
  - Integrated steel works
  - Electric steelworks
  - Metal smelters
  - Cement plants
  - Electro plating installations
- IPPC permits in the EU
- The implementation of the Stockholm Convention in the EU

Unintentionally Produced POPs

Compounds included in Annex C:
PCDD, PCDF, PCB (incl. 12 dioxin-like PCB; WHO-TEFs), **HCB, PeCB and HCBD**

Article 5

Each Party shall at a minimum take the following measures to reduce the total releases … of each of the chemicals listed in Annex C, with the goal of their continuing minimization and, where feasible, ultimate elimination.

Article 5 & Annex C:
Measures to reduce or eliminate releases from unintentional production

- ***Develop*** **action plans within NIP (2 years after enter into force)**
- ***Promote***
  - **available, feasible and practical measures to achieve realistic and meaningful levels of release reduction or source elimination**
  - **substitute products and processes**
  - **the use of BAT/BEP**

Article 5 & Annex C: Measures to reduce or eliminate releases from unintentional production

- **in accordance with the implementation schedule of its action plan, *require* the use of best available techniques for new sources within source categories which a Party has identified as warranting such action in its action plan, with a particular initial focus on source categories identified in Part II of Annex C. (4 years after enter into force)**

Stockholm Convention BAT/BEP Guidance

The Stockholm Convention BAT/BEP Guideline stresses in the "guidance principles and cross-cutting considerations" (Section III.B):

- **Cleaner Production**
- **Integrated Pollution Prevention and Control**
- **Waste hierarchy**
- **Internalizing environmental costs and polluter pays.**
- **Sustainable Development Sustainable Consumption and Production**
- **Precautionary Approach.**

IED Directive on industrial emissions (integrated pollution prevention and control) – 2010 and 2024

- A framework directive aiming at a high level of protection for the environment from emissions of large scale industries (all environmental media)
- Not direct acting but a Framework Directive requiring Member States to introduce implementing law.
- Operating permits for industry with conditions to be based on “best available techniques” (BAT)
- Provides for an exchange of information on BAT

Emissions from integrated steelworks

Contaminated Sites – the legacy of not applying IPPC
PCDD/F/PCB contamination of cattle around EU steel plant

L'Ilva di Taranto ci avvelena e io perdo le pecore

http://city.corriere.it/interviste.shtml

Around a steel plant in Italy PCDD/F & PCB contamination of meat & milk (sheep/goat).

(Diletti et al, Giua et al; Org. Hal Compounds 71; 2009)

- **1600 sheep goats needed to be slaughtered**
- **2012: 20 km restriction zone for cattles.**
- **High cancer rates in area**

Emissions to air of an integrated steelworks (non-BAT; EU E-PRTR data) (10-12 Mio t steel/yr)

	Release to air/year)
PCDD/PCDF	99.6 g TEQ
PCB	0.13 tonnes
Benzene	237 tonnes
PAH	33.6 tonnes
Lead & compounds	79.2 tonnes
Chromium	3.87 tonnes
Mercury	1.5 tonnes
Cadmium & compounds	0.4 tonnes
Nickel	0.6 tonnes
PM10	5380 tonnes
HCN	3.94 tonnes
SOx	40,800 tonnes
NOx	28,100 tonnes
HF	568 tonnes
Carbon dioxide	11,300,000 tonnes
Carbon monoxide	569,000 tonnes
Ammonia	33.5 tonnes

This emissions of the plant were reduced in the last decade. However recent publications and documentary still reported on the increased death rates and cancer rates in this area also in children.

Article

Taranto's Long Shadow? Cancer Mortality Is Higher for People Living Closer to One of the Most Polluted City of Italy

Roberto Cazzolla Gatti [1,*] and Alena Velichevskaya [2]

https://doi.org/10.3390/su14052662

ELSEVIER

Environment International

Volume 132, November 2019, 105030

Industrial air pollution and mortality in the Taranto area, Southern Italy: A difference-in-differences approach

https://doi.org/10.1016/j.envint.2019.105030

Simona Leogrande [a] ✉, Ester Rita Alessandrini [b] ✉, Massimo Stafoggia [b]

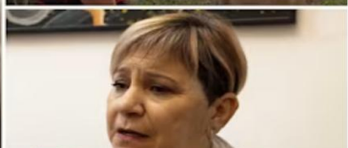
Inside Italy's 'toxic town', where children grow up fearing cancer

https://www.itv.com/news/2026-01-06/inside-italys-toxic-town-where-children-grow-up-fearing-cancer

WORLD | ITALY | CORBY | Tuesday 6 January 2026 at 10:25am

Amy Lewis

ITV News Reporter



Review Article http://dx.doi.org/10.1155/2013/753719

Environment and Health in Contaminated Sites: The Case of Taranto, Italy

Emissions to water of an integrated steelworks (non-BAT; EU E-PRTR data)

	Release to water (per year)
PAH	3.32 tons
Phenols	12.8 tons
Arsenic	0.88 tons
Copper	14.9 tons
Lead and compounds	0.91 tons
Chromium	10.9 tons
Mercury	0.46 tons
Cadmium and compounds	0.37 tons
Nickel	8,32 tons
Zinc	33.8 tons
Cyanides (as CN)	41.6 tons
Phosphourous	16.1 tons
TOC (as COD/3)	1250 tons
Total nitrogen	2140 tons

Capacity:
10-12 Mio tons

Lead Poisoning of Children Around Chinese Metal Smelters

- **Abnormal high levels of lead in 1,354 children in Hunan province, 851 children Shaanxi province, 200 in Yunnan province around metal smelters (affected up to 20 kilometers away from factories). (CNN 2009)**
- **Lead poisoning can cause severe developmental problems in children ranging from permanent brain damage, anemia and can cause lifelong consequences.**
- **Government offered free examinations for children & compensation for affected families.**
- **Eight factories were shut down (e.g. iron and manganese smelters) and only reopened after they meet standards.**

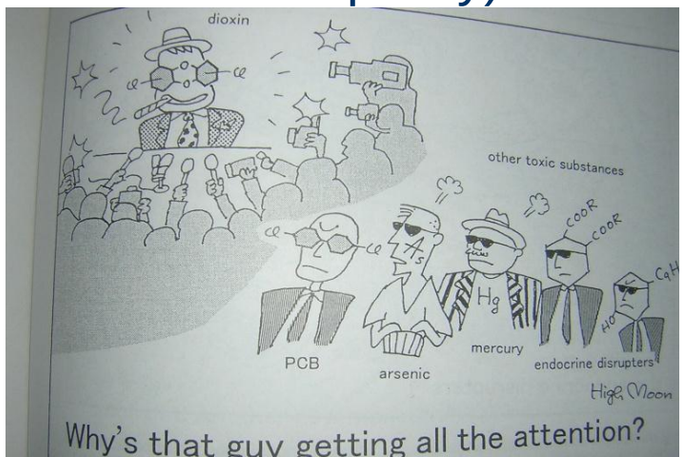
Source: CNN 02/09/2009:
http://edition.cnn.com/2009/WORLD/asiapcf/09/02/china.lead.poisoning.hunan/index.html

IPPC installations – electric steelworks (& other sec. metal)

Air Emissions of a BAT Electric Arc Furnace (1,8 mio t steel/a; 1,800,000 m3/h; 8,000 h/a)

Parameter	Concentration	unit	Emission Factor	unit	Annual Load	unit
Dust (PM)	**0,6**	**mg/Nm³**	4.8	g/t	8640	kg/a
Cadmium	0,0005	mg/Nm³	4.0	mg/t	7.2	kg/a
Mercury	0,044	mg/Nm³	352	mg/t	**633.6**	**kg/a**
Thallium	< 0.0005	mg/Nm³	< 4.0	mg/t	< 7.2	kg/a
Arsenic	0,0016	mg/Nm³	12.8	mg/t	23	kg/a
Cobalt	< 0.0005	mg/Nm³	< 4.0	mg/t	< 7.2	kg/a
Nickel	0,0005	mg/Nm³	4.0	mg/t	7.2	kg/a
Lead	0,0095	mg/Nm³	76	mg/t	**136.8**	**kg/a**
Chromium	0,0037	mg/Nm³	29.6	mg/t	53.3	kg/a
Copper	0,0016	mg/Nm³	12.8	mg/t	23.0	kg/a
Tin	0,0011	mg/Nm³	8.8	mg/t	15.8	kg/a
HCl	1,21	mg/Nm³	9.7	g/t	17.5	t/a
HF	0,115	mg/Nm³	0.9	g/t	1.6	t/a
NO_x	12	mg/Nm³	96	g/t	172.8	t/a
CO	284	mg/Nm³	2272	g/t	4089.6	t/a
Organic carbon	5,4	mg/Nm³	43.2	g/t	77.8	t/a
Benzene	0,58	mg/Nm³	4640	mg/t	**8352**	**kg/a**
Nickeltetracarbonyl	0,078	mg/Nm³	624	mg/t	**1123.2**	**kg/a**
Benzo(a)pyrene	< 0.00001	µg/Nm³	< 0.08	µg/t	< 0.14	g/a
Dibenz(a,h)anthracen	< 0.00001	µg/Nm³	< 0.08	µg/t	< 0.14	g/a
PCDD/F	0,068	ng TEQ/Nm³	0.54	µg/t	**1.0**	**g/a**
PCB (LAGA)	0,65	µg/Nm³	5.2	mg/t	**9360**	**g/a**
HCB	0,078	µg/Nm³	0.6	mg/t	**1100**	**g/a**

- UPOPs are only one pollutant class from large thermal emission sources.
- Other categories like heavy metals or PM can be more relevant from health impacts.
- They also can be reduced by measures reducing UPOPs emissions (e.g. dust filters, catalysts, improvement of combustion quality).



BAT for Waste gas dedusting (2000 and 2013):

Abatement techniques:

- ➔ **Efficient collection of primary and secondary dust emissions**
- ➔ **Well designed bag filter**

BAT for dust collection efficieny: 98%

BAT-AEL for Dust: 5 mg/Nm3 for new plants

15 mg/Nm^3 for existing plants

➔ **<5 mg/Nm^3**

BAT for the Reduction of PCDD/F (2000 and 2013)

Abatement techniques:

- ➔ **Post combustion with wet rapid quenching**
- ➔ **Injection of adsorbens (coal/lignite coke) and bag filter**

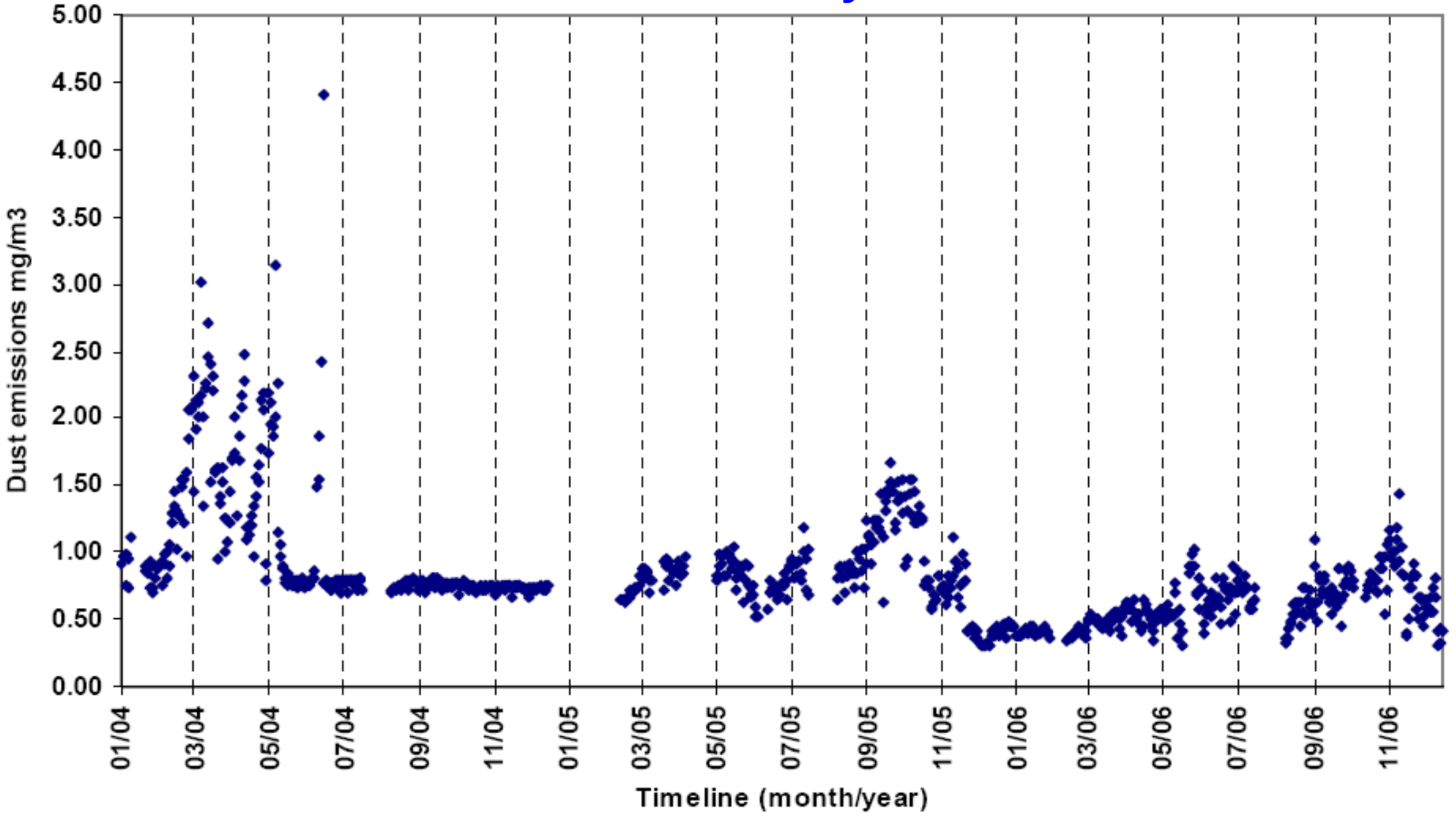
BAT-AEL for PCDD/F: < 0.1 – 0.5 ng I-TEQ/Nm^3

➔ **<0.1 ng I-TEQ/Nm^3**

Continuous self-monitoring of emissions to air from an EAF

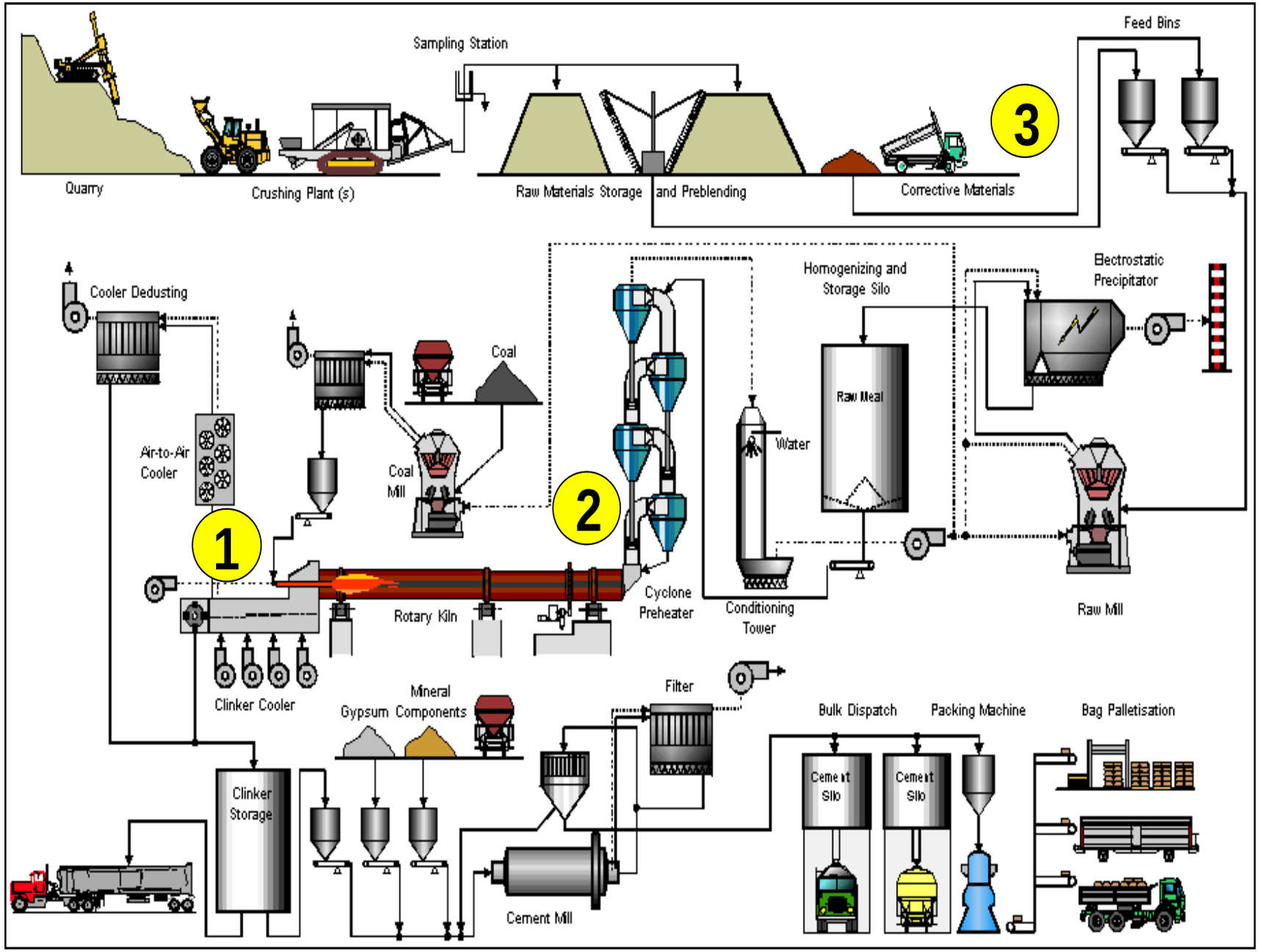
– dust, NOx, VOC, Hg

Online dust self-monitoring - daily mean values for dust from an EAF over three years

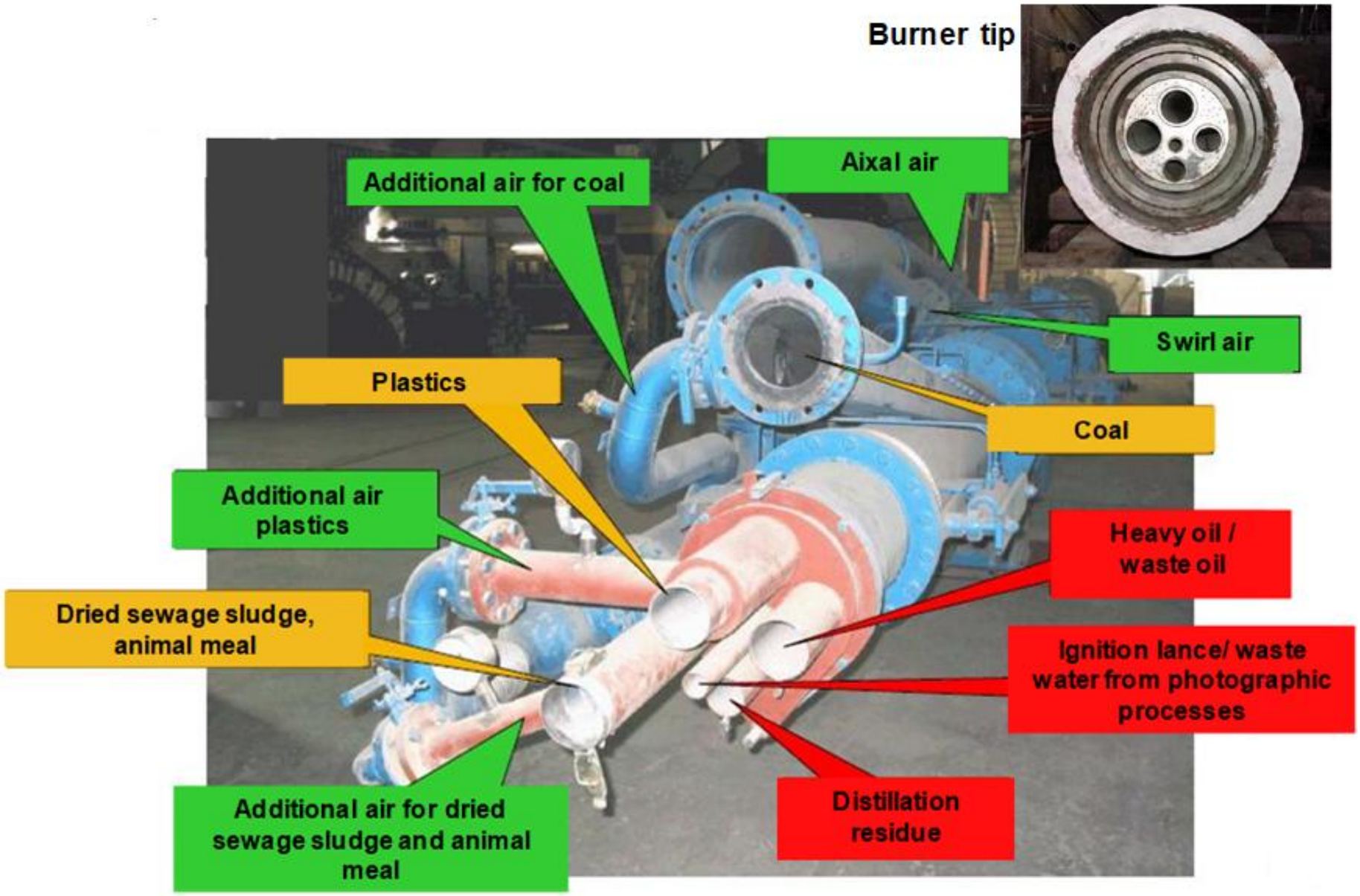


IPPC installations - cement plant

Overview of a cement works – with feeding points

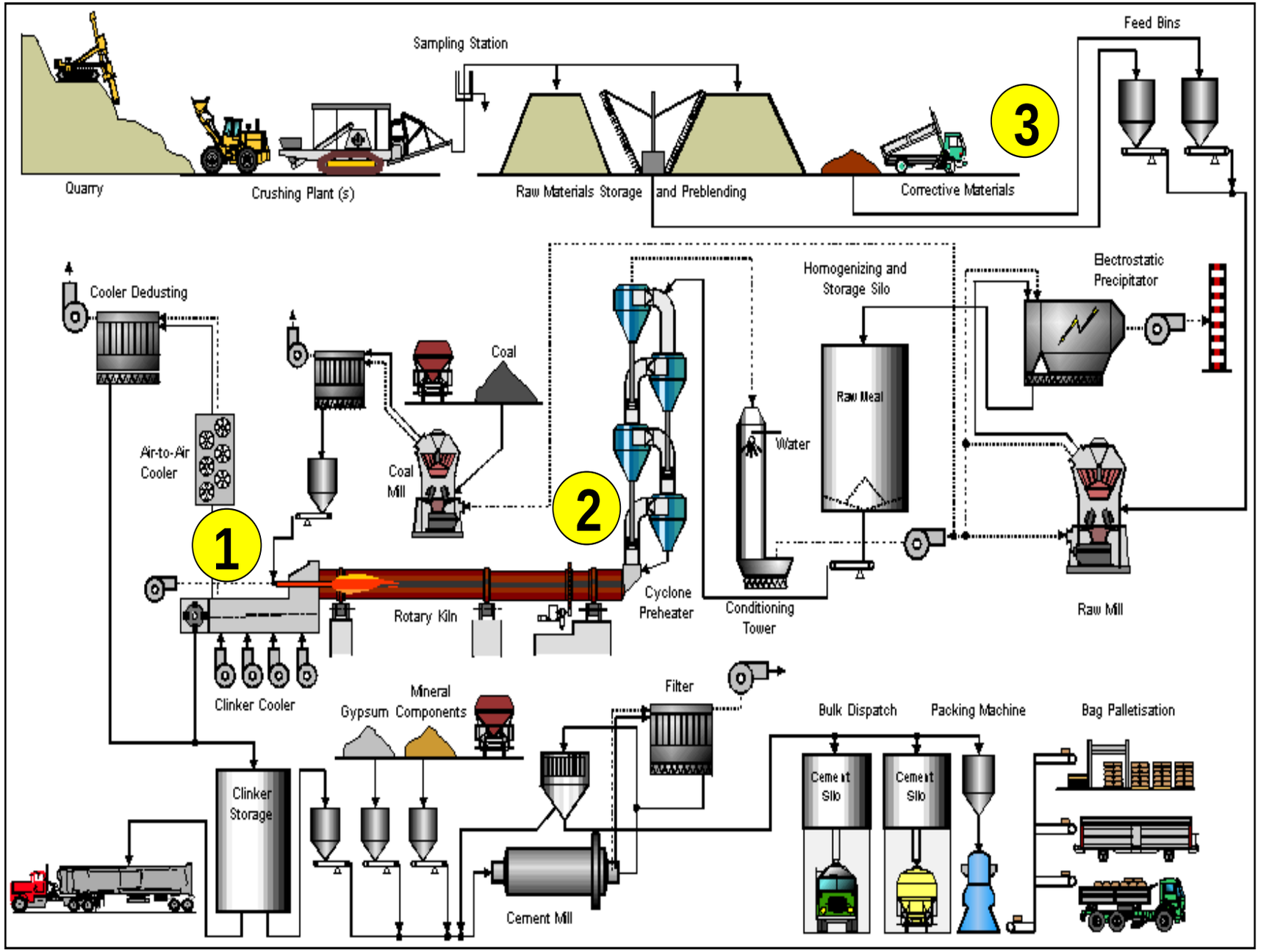


Burner and related input facilities for various waste-derived fuels to be fed to the main burner

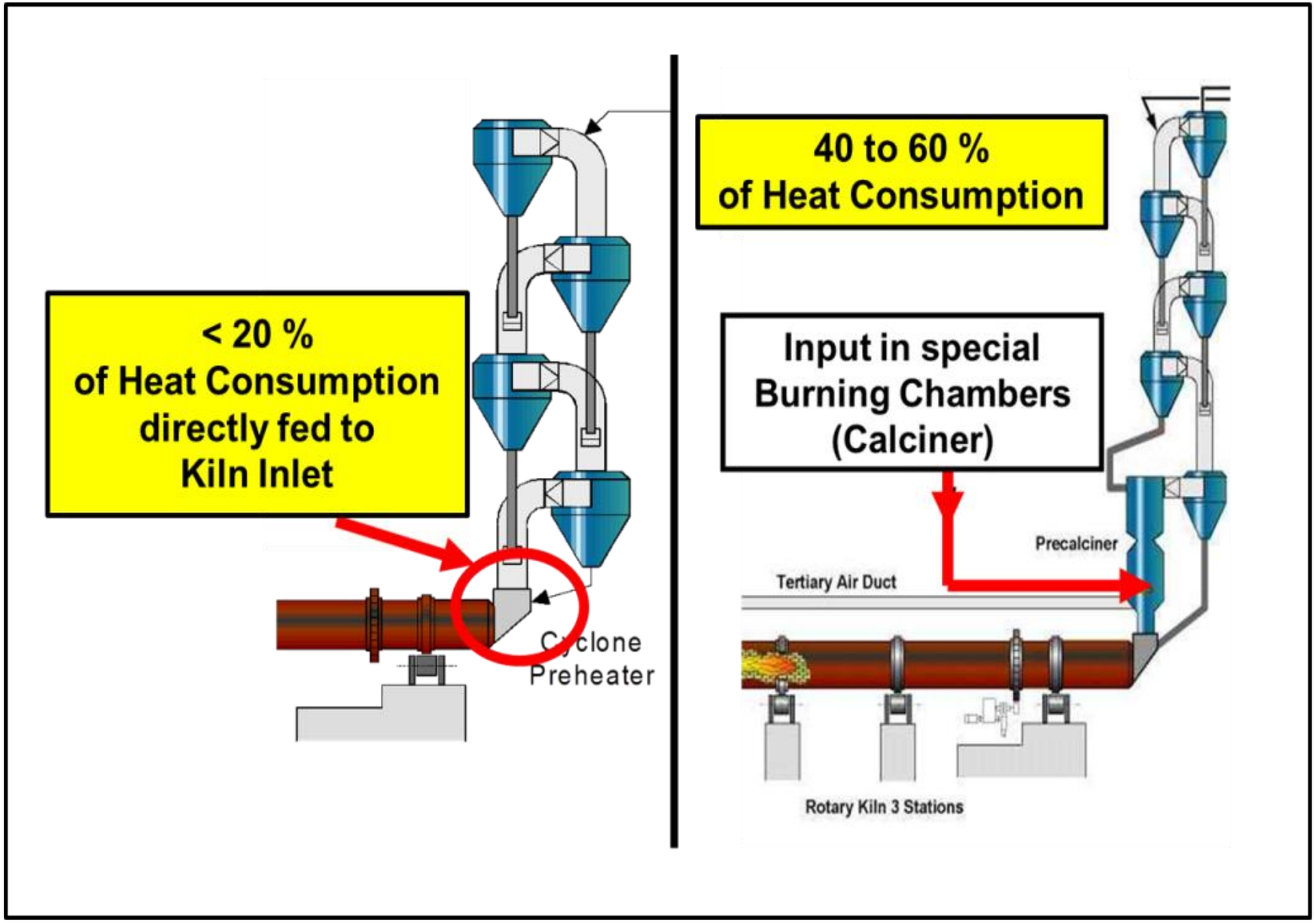


Feeding pipes for different waste-derived fuels to the main burner

Overview of a cement works – with feeding points



Fuel Input in Secondary Firings

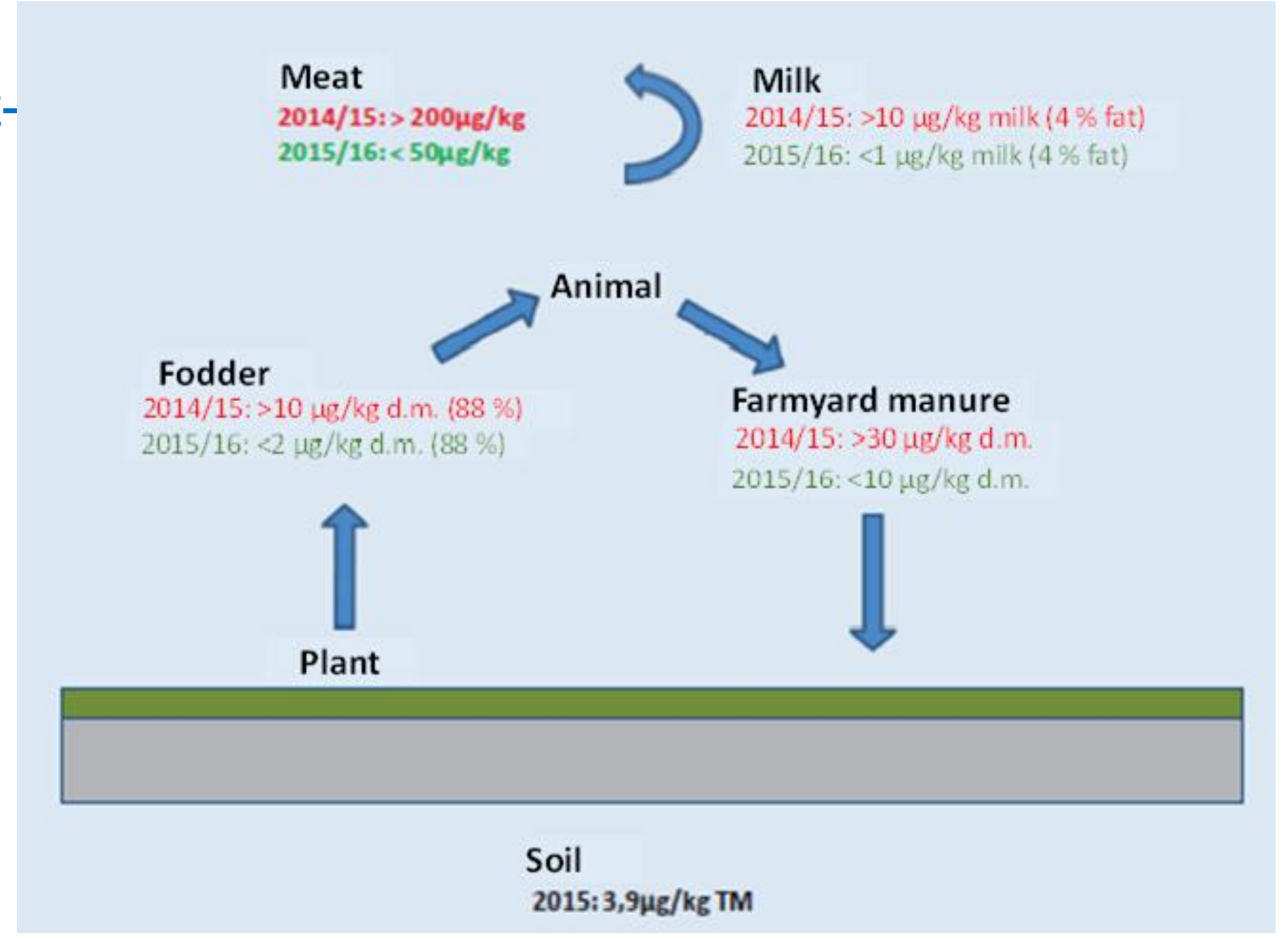


Cement works of w&p Zement GmbH in A-9373 Wietersdorf / Klein St. Paul in the valley Görtschitztal – HCB contamination in 2014

Two HCB spot monitoring actions at the clinker production plant of w&p Zement GmbH in 2014

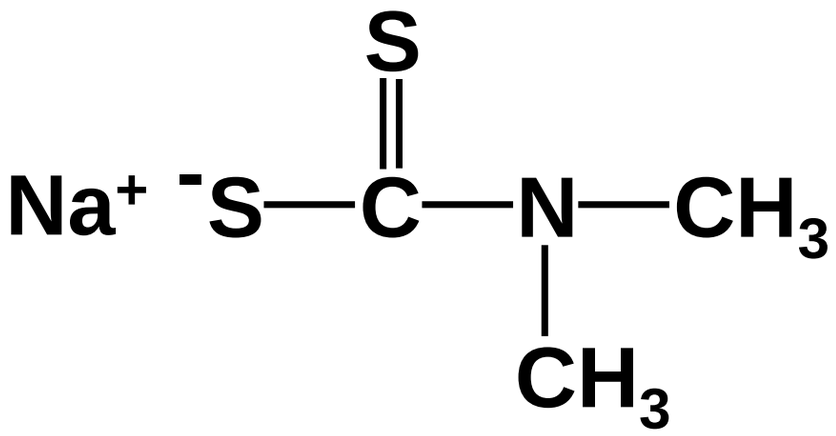
HCB measurements		**Date of monitoring**		**Comment**
	unit	18.10.2014	14.11.2014	
Value without feeding of carbide lime	[ng HCB/Nm^3] at 10 % O_2		2880	
Feeding of carbide lime to the kiln inlet	[ng HCB/Nm^3] at 10 % O_2		3550	
Feeding of carbide lime to the kiln inlet	[ng HCB/Nm^3] at 10 % O_2		82000	Value confirmed but not explainable
Feeding of carbide lime to the mixing chamber	[ng HCB/Nm^3] at 10 % O_2	3720	18300	
Feeding of carbide lime to the raw meal	[ng HCB/Nm^3] at 10 % O_2	8080	7070	
HCB content of carbide lime	**[µg HCB/kg]**	**321 - 779**	**18700 - 24600**	

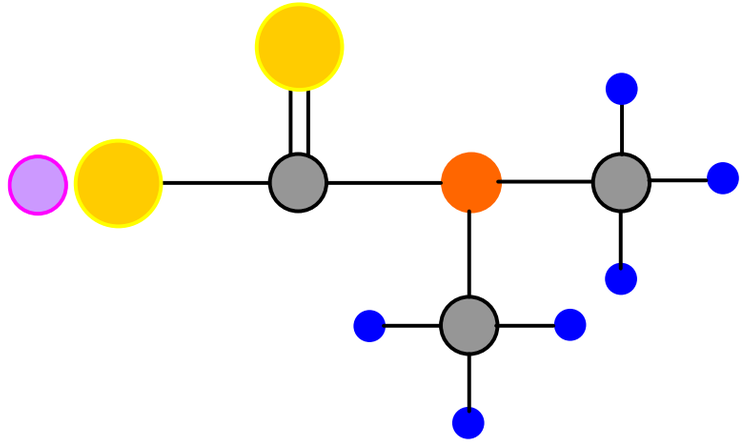
HCB in the cycle “soil-plant-fodder-animal-farmyard manure-product” in the valley Görtschitztal from 2014 to 2015



Precipitation of heavy metals with organic sulphides

➔ Organosulfide, esp. Dimethyldithiocarbamate (DMDTC)





Effect: heavy metal precipitation

but also cytotoxic ➔ broad band biocide

➔ toxic to bacteria, algae and fish

Toxicity of sodium dimethyldithiocarbamate (DMDTC)

- **Algae toxcicity = 0.25 mg/l (EC50)**
- **Fish toxicity = 0.76 mg/l (LC50)**
- **Bakteria toxicity = 3.65 mg/l (EC50, 3 h)**
- **Biodegradability: inconsistent information**

Commercial products: Plexon , Antiplex, Diplexin, Preventol Z, Simafloc usw.

Fish kill in River Neckar (Upper Neckar) in 2014

Complete inhibition of nitrification on a municipal wastewater treatment plant (AZV Oberer Neckar)

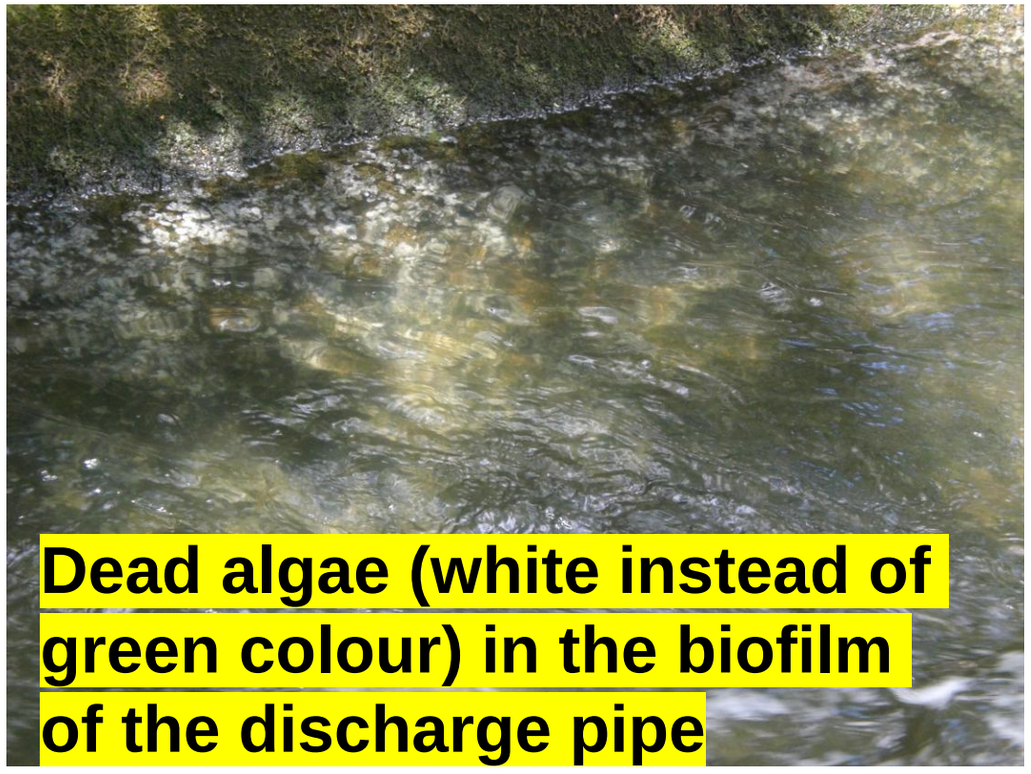
The identification of the reason required significant efforts

- **Analysis of DMDTC (only University of Stuttgart could do it – Dr. Kuch) – 12.5 kg/d – 31 L of a 40 % solution**
- **Sampling of sewer film**
- **Hint on an electroplating company**

Fish kill in River Neckar (Upper Neckar) in 2014

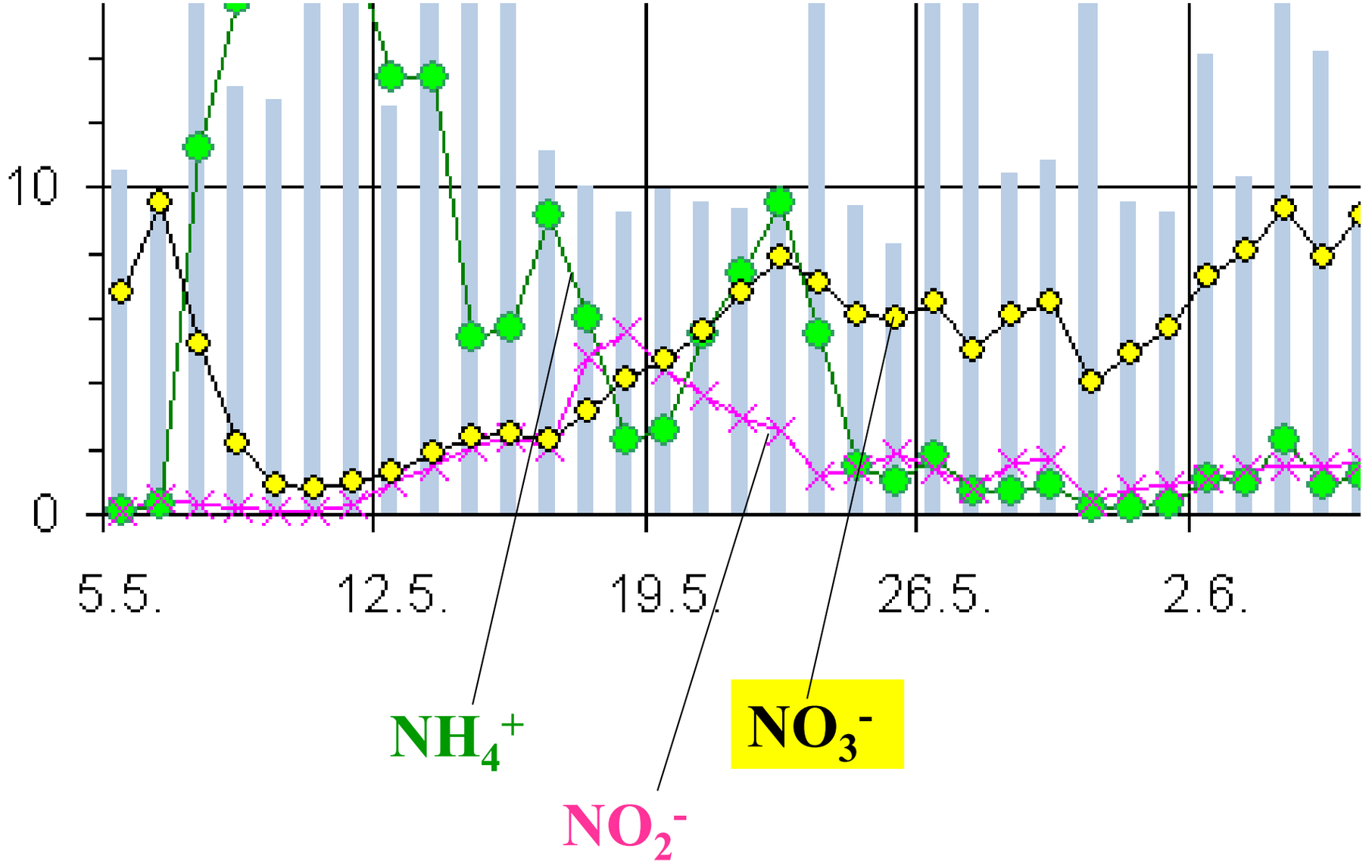
Discharge point of the municipal WWTP

- Foam and dead fish



Dead algae (white instead of green colour) in the biofilm of the discharge pipe

Nitrification inhibition – start of recovery after 22 May



DMDTC analysis of sewer biofilm in different sewer lines

N,N´-Dimethyldithiocarbamat - DMDTC			
Alle Angaben in mg/g	Values in [mg/g]		
ISWA_Nr.	Tagebuch-Nr.	Auftrags-Nr.	DMDTC
N_01	114-24633	114-87098	0,85
N_02	114-24634	114-87098	< 0,005
N_03	114-24635	114-87098	< 0,005
N_04	114-24636	114-87098	11,2
N_05	114-24637	114-87098	< 0,005
N_06	114-24638	114-87098	0,02

Permit taking into account:

- All aspects and pollutants
- IED Directive,
- Other EU-Direct.
  - Stockholm Conv.
- UNECE Protocol on long range transport (CLRTAP)

Owner or operator of an IPPC installation

Support of consultants

Application

1 IPPC-permit if dir ww disch.
2 permits

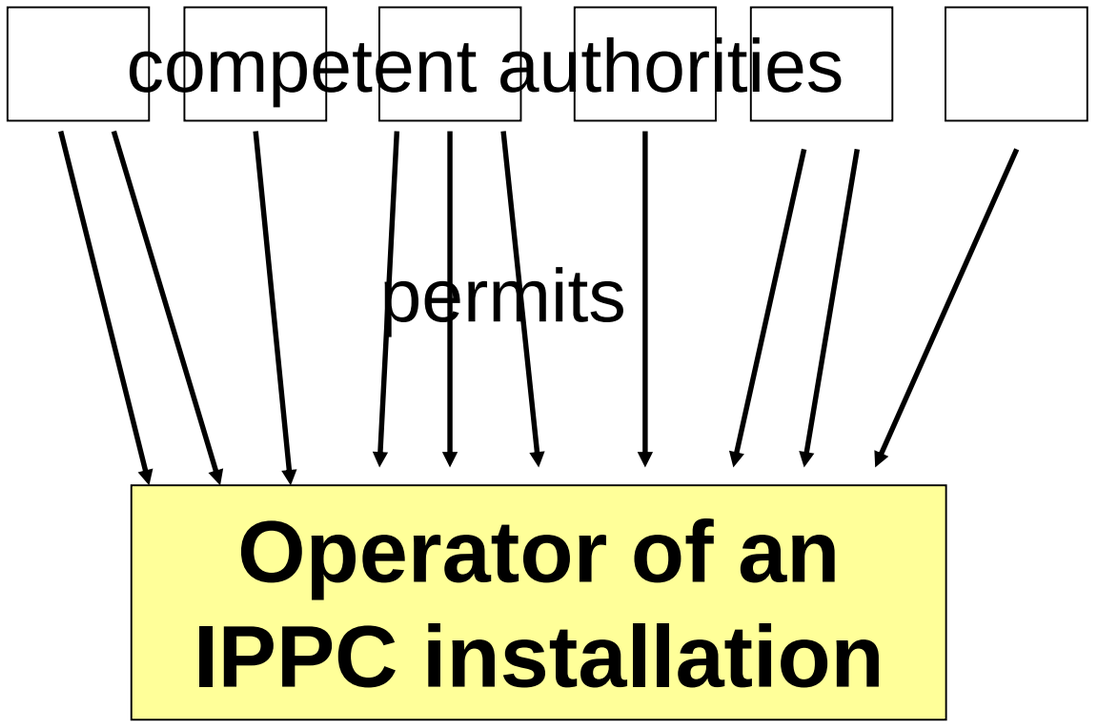
BREF(s)

IED Directive, other Directives and intern. Conv.

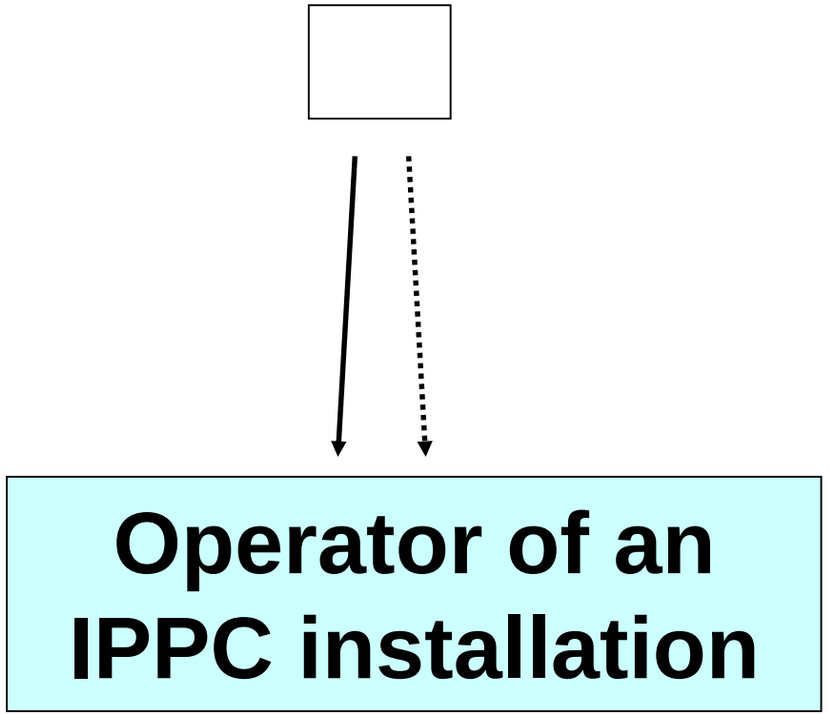
Competent authority
1 counter-part

Permitting of industrial installations: “yesterday” and today

Formerly: several competent authorities and many permits



Today: one competent authority issues 1 permit (or 2)



IPPC Directive – directly directs the competent authorities

- **The operation of an IPPC installation requires a permit**

  ➔ operator must apply for it

- **The permit shall include emission limit values (ELVs) and appropriate requirements and conditions based on BAT**

Article 15(2) of the IED Directive (2010/2024)

Without prejudice to Article 18 (Environmental Quality Standards), the emission limit values and the equivalent parameters and technical measures referred to in Article 14(1) and (2) shall be based on the best available techniques, without prescribing the use of any technique or specific technology.

BAT under Article 3(10) - definition

‘Best’ most effective in achieving a high general level of protection of the environment as a whole

‘Techniques’ includes both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned

‘Available’ developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, considering the costs and advantages …

Note: in determining BAT, special consideration should be given to the items listed in Annex III bearing in mind the likely costs and benefits

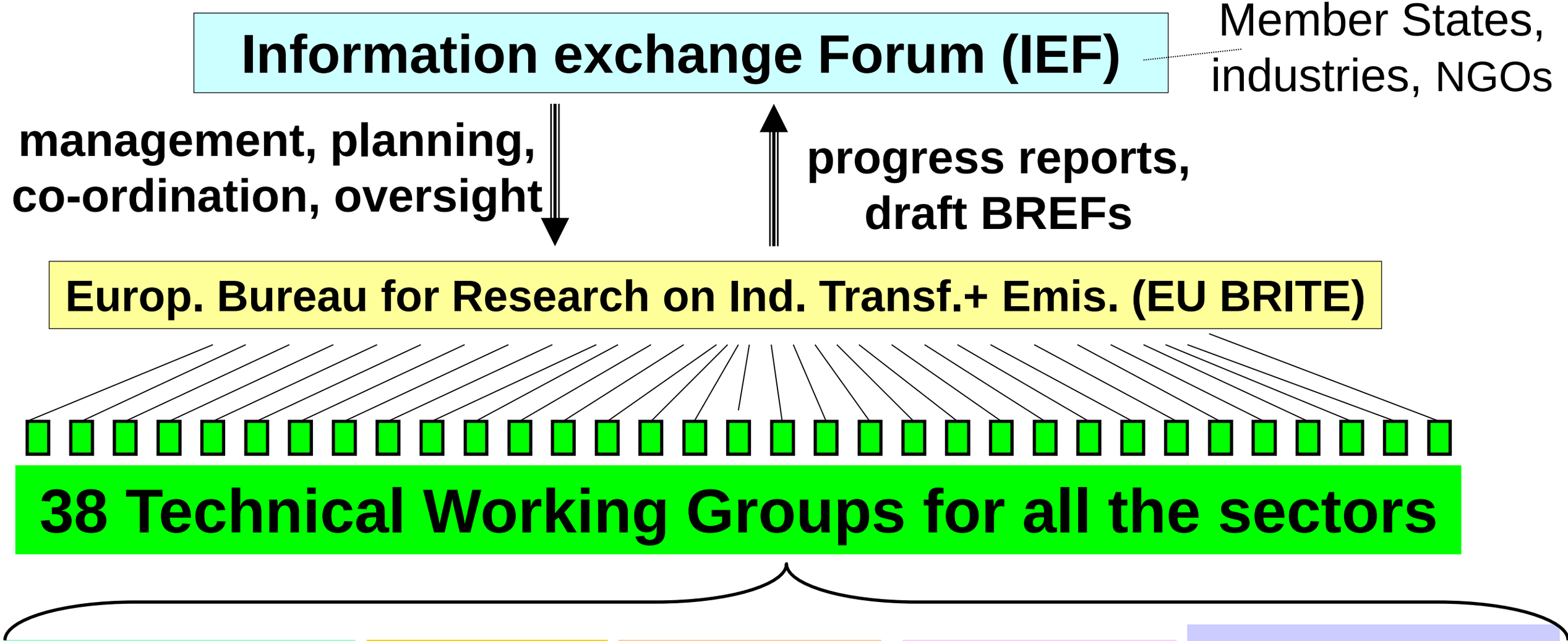
BAT under Article 2(11)

- **Article 13(1) of the IED Directive (IED 2010/2024) – Exchange of information:**

The European Commission shall organise an exchange of information between Member States, the industries concerned, non-governmental organisations promoting environmental protection and the Commission.

Result: Best Available Techniques REFerence Documents (BREFs)

Actors in the information exchange and for development of BREFs



5 Horizontal BREFs

ICS MON EFS ECM ENE

33 Vertical BREFS

Energy: 2 sectors

Metal: 5 sectors

Mineral: 4 sectors

Chemical: 9 sectors

Waste: 2 sectors

Others: 11 sectors

38 BREFs completed

➔ http://eippcb.jrc.es/reference/

Thank you for your attention

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Conclusions for industrial/IPPC permits

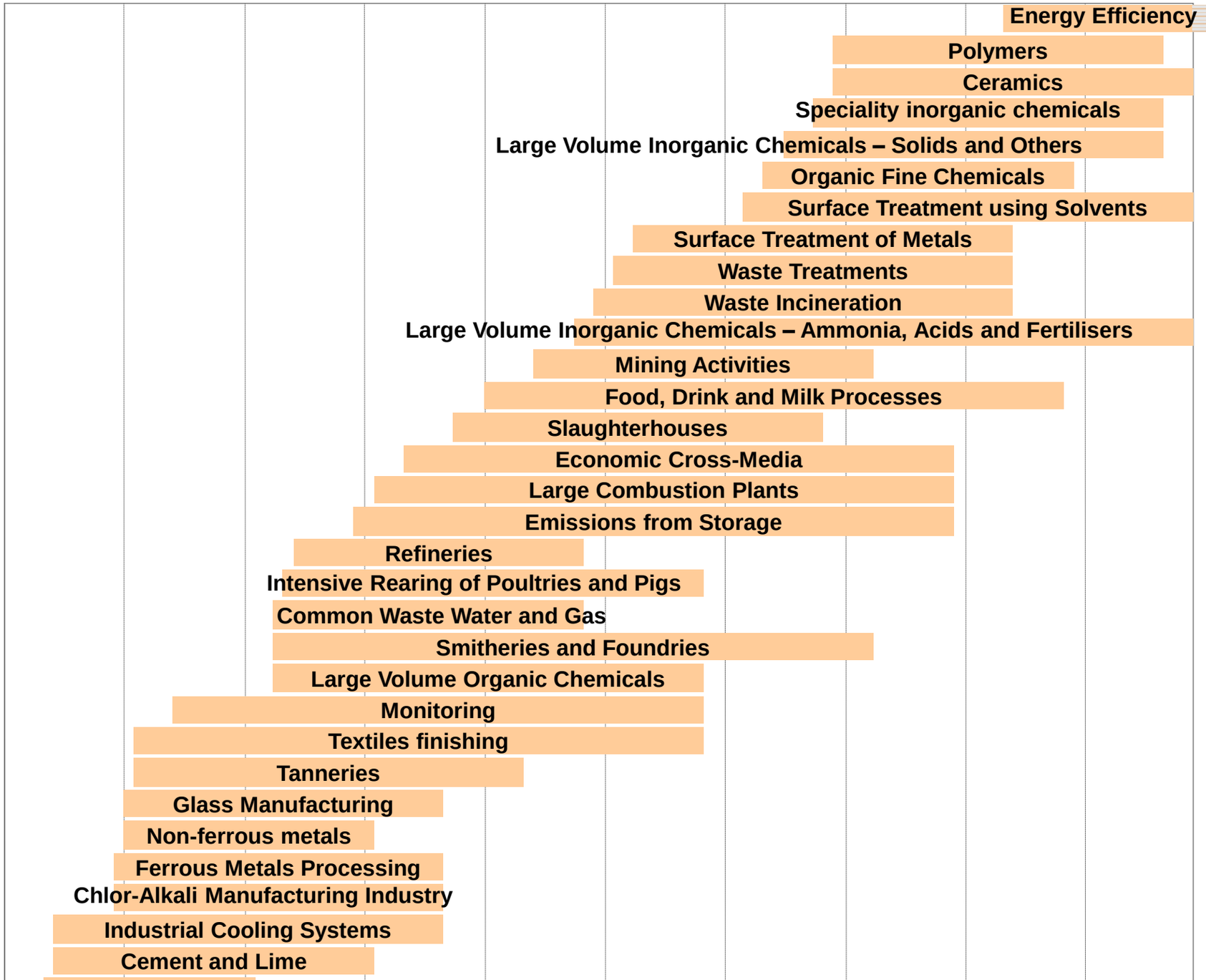
- **So far, there are no EU-unique emission limit values for PCDD/F emissions for industrial installations (with the exception of waste incineration and co-incineration plants)**
- **PCDD/F can not be used as the key monitoring parameter. EU has establishes EN standards for continuous monitoring/supervision for key emissions parameters (particles, TOC, acid gases etc.) and developed a Horizontal BAT Reference Document for monitoring.**

Conclusion on reduction of PCDD/F in industrial installations in the EU

- **Approach: IPPC Directive with the BAT concept and the development of Best Available Techniques Reference Documents (BREFs) ➔ the PCDD/F are regulated in the IPPC permits**
- **Permit conditions must be based on BAT which are sector-specific (described in the BREFs)**
- **All environmental aspects (and pollutants) are taken into account following the integrated approach (not only PCDD/F but all relevant poll.)**

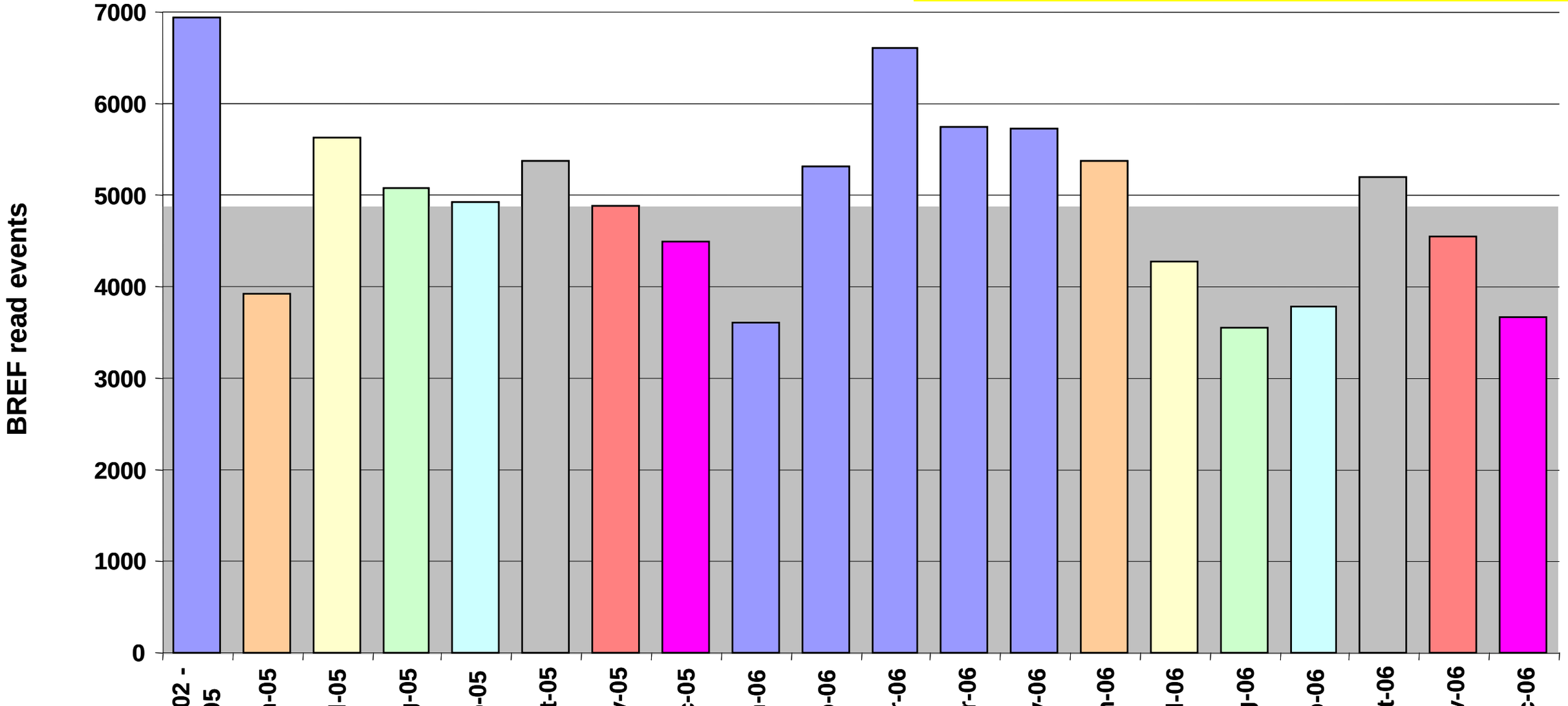
1997 – 2007

elaboration of 33 BREFs



BREF downloads in 2005 and 2006

2007: 72 000 downloads



Life-Cycle of uPOPs/POPs)