WASTE INCINERATION BREF BEST AVAILABLE TECHNIQUES BATAEL FOR DUST, TVOC, POP…
&
MARITIME FLUE GAS TREATMENT

TFTEI 2020- 23rd of October 2020, "Virtual WARSAW"

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ISWA Vice chair Working Group Energy Recovery

CNIM

CNIM RECOVERS MATERIAL AND ENERGY FROM MUNICIPAL SOLID WASTE OF **110** MILLION PEOPLE AROUND THE WORLD!

TORINO EfW, ITALY BY

CNIM

200 MILLION PEOPLE WASTE COMBUSTION FLUE GASES CLEANED BY Lab

MARINE SCRUBBERS
FOR MSC ORCHESTRA

Credit : BIG

https://www.youtube.com/watch?v=Zdw62f0pcbo

EfW AMAGERFORBRAENDING, COPENHAGEN, DENMARK

A NEW LANGUAGE TO LEARN IN EUROPE: THE "BREF" !

A NEW LANGUAGE TO LEARN IN EUROPE: THE "BREF" !

MAIN ABBREVIATIONS AND ACRONYMS 1/2

- ***IPPC:*** *Integrated Pollution Prevention and Control directive (1996; last rev. in 2008)*
- ***IED:*** *Industrial Emission Directive (24/11/2010)*

- ***EIPPCB / JRC****: European IPPC Bureau, part of the Joint Research Center in Seville office.(Technical Office of the European Commission coordinating BREF reviews)*
- ***TWG****: Technical Working Group set up by the European Commission to review BREFs*
- ***E.U.:*** *European Union*
- ***MSs****: Member States*
- ***NGOs****: Non Governmental Organizations*

- ***BAT:*** *Best Available Techniques*
- ***BREF:*** *BAT REFerence document*

- ***BATAEL:*** *Best Available Techniques Associated Emission Levels*
- ***BATAEPL:*** *Best Available Techniques Associated Environmental Performance Levels*
- ***BATAEEL:*** *Best Available Techniques Associated Energy Efficiency Levels*

- ***ELV****: Emission Limit Values*

- ***LCP:*** *Large Combustion Plants*
- ***ROM:*** *Reference on Monitoring*
- ***WI:*** *Waste Incineration*
- ***WT****: Waste Treatment*

A NEW LANGUAGE TO LEARN IN EUROPE: THE "BREF" !

MAIN ABBREVIATIONS AND ACRONYMS 2/2

- ***KEI***: *Key Environmental Issue*

- ***MSW:*** *Municipal Solid Waste*
- ***ONHW***: *Other Non Hazardous Waste*
- ***HW***: *Hazardous waste*
- ***SS***: *Sewage sludge*

- ***NOC:*** *Normal Operation Conditions*
- ***OTNOC:*** *Other Than Normal Operation Conditions*
- ***EOT:*** *Effective Operating Time*
- ***R-EOT:*** *Relevant EOT (EOT when waste is burning)*

- ***AMS***: *Automated Monitoring System (= Online instrument)*
- ***SRM:*** *Standard Reference Method (= Methods for calibration)*
- ***QAL1***: *Quality Assurance Level 1 (Initial certification of instruments)*
- ***QAL2***: *Quality Assurance Level 2 (Online instruments on site calibration by SRM/3y)*
- ***AST:*** *Annual Surveillance Test (Intermediary test between QAL2)*

- ***GUM:*** *Guidance on Uncertainty Measurements*
- ***ILC:*** *Inter Laboratory Comparison*
- ***DAHS***: *Data Acquisition and Handling System*

- ***PCDD, PCDF, DL-PCB:*** *Polychlorodibenzo-dioxins & -furans, Dioxin Like-PCB*
- ***PM 10 & PM 2.5:*** *Particulate Matters < 10 µm & < 2.5 µm*

WASTE INCINERATION BREF REVISION 1 (DECEMBER 2019)

Same structure as the 1st WI BREF (of 2006)

764 pages, 7 chapters + Introduction & Annexes

- PREFACE
- SCOPE
- 1 GENERAL INFORMATION ON WASTE INCINERATION
- 2 APPLIED PROCESSES AND TECHNIQUES
- 3 CURRENT EMISSION AND CONSUMPTION LEVELS
- 4 TECHNIQUES TO CONSIDER IN THE DETERMINATION OF BAT
- 5 BEST AVAILABLE TECHNIQUES (BAT) CONCLUSIONS
- 6 EMERGING TECHNIQUES
- 7 CONCLUDING REMARKS AND RECOMMENDATIONS FOR FUTURE WORK
- 8 ANNEXES
- 9 GLOSSARY
- 10 REFERENCES

REVISION OF THE WASTE INCINERATION BREF – MILESTONES

- 1/2015: Kick-off Meeting in Seville
- **1/2016: EIPPCB's questionnaire to operators for data collection 2014**
- 24/5/2017: First draft of the revised WI BREF
- 2/2019: Draft BAT conclusions presented to IED Article 13 Forum
- 6/2019: IED Article 75 Committee vote (Member States)
- **3/12/2019**: **Publication of only the BAT-conclusions** in Official Journal of EU in 23 EU languages

  ⇒ Implementation **before 12/2023** (4 years)
- End December 2019: Complete **WI BREF** (only in English) published on EIPPCB website as a JRC Science for Policy Report

- ***WI BREF***: *Waste Incineration BAT Reference document*
- ***EIPPCB - JRC***: *European IPPC Bureau, part of the Joint Research Centre in Seville office. (Technical Office of the European Commission coordinating BREF reviews)*
- ***TWG***: *Technical Working Group set up by the European Commission to review BREFs*
- ***MSs***: *Member States*

WI BREF 2019
BAT CONCLUSIONS (CHAPTER 5)

Written as a stand-alone doc.

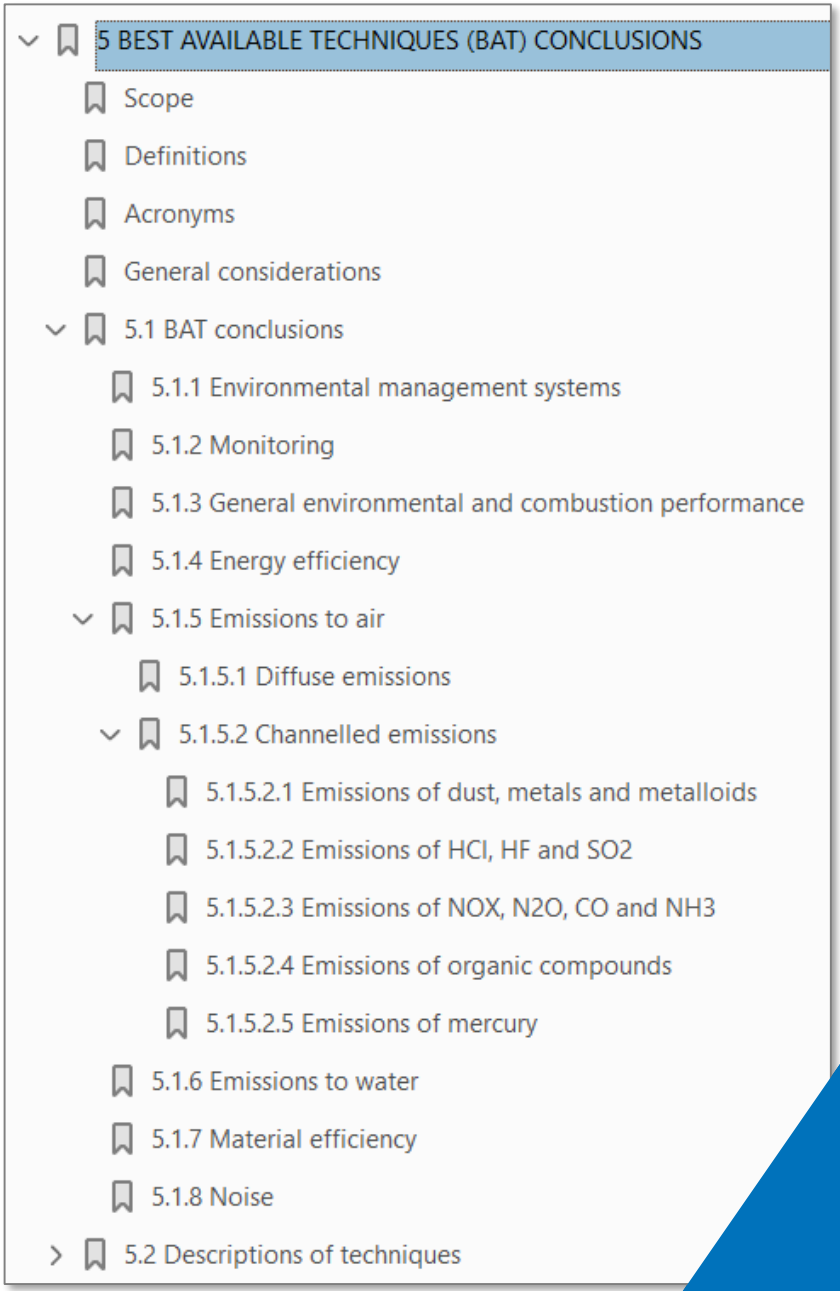
Implementing decision of the Commission

Mandatory in reference to the list of BAT conclusions given in the BREF (see IED Art. 14.3)

37 BAT conclusions (BAT-c)

- BAT-c 1 on Environmental management system
- BAT-c 2-8 on monitoring
  - Energy efficiency, key parameters, channelled emissions to air and water, emissions during OTNOC, content of unburnt substances and POP content in output stream
- BAT-c 9-18 on General environmental and combustion performances
- BAT-c 19-20 on energy efficiency → Including BATAEEL
- BAT-c 21-31 on emissions to air → Including BATAEL
- BAT-c 32-34 on emissions to water
- BAT-c 35-36 on material efficiency
- BAT-c 37 on noise

- ***BAT-c**: BAT conclusion*
- ***BATAEPL:** BAT Associated Environmental Performances Levels (include BATAEL)*
- ***BATAEL**: BAT Associated Emission Levels*
- ***BATAEEL**: BAT Associated Energy Efficiency Level*



WI BREF 2019
SOME EUROPEAN WTE PLANTS THAT PARTICIPATED IN THE 2016 DATA

Reference line	Name of the installation	City	Country	Main activity	Capacity	Prevalent type of waste burnt	Flue-gas cleaning techniques installed
FR071.2R	Carrières Sur Seine	Carrières Sur Seine	FR	5.2. (a)	20 t/h	M	SCR BF DSI
FR072.1R	Lagny	Saint Thibault des Vignes	FR	5.2. (a)	20 t/h	M	SNCR ESPd BF DSI
FR072.2R	Lagny	Saint Thibault des Vignes	FR	5.2. (a)	20 t/h	M	SNCR ESPd BF DSI
FR073.1R	ESIANE	Villers St Paul	FR	5.2. (a)	20 t/h	M	SNCR ESPd BF DSI
FR073.2R	ESIANE	Villers St Paul	FR	5.2. (a)	20 t/h	M	SNCR ESPd BF DSI
FR075R	Cergy	Saint Ouen l'Aumone	FR	5.2. (a)	21 t/h	M	SCR BF WS1s WS2s
FR076.1R	MULHOUSE	Sausheim	FR	5.2. (a)	21 t/h	M	SCR ESPd ESPw Cyc WS2s
FR076.2R	MULHOUSE	Sausheim	FR	5.2. (a)	21 t/h	M	SCR ESPd ESPw Cyc WS2s
FR077R	SARCELLES	Sarcelles	FR	5.2. (a)	20 t/h	M	SCR BF DSI
FR078R	Bourgoin-Jallieu	Bourgoin-Jallieu	FR	5.2. (a)	22 t/h	M	SCR BF sWS
FR080.1R	W-T-E Plant Thiverval-Grignon	Thiverval Grignon	FR	5.2. (a)	27.8 t/h	M	SNCR ESPd WS2s DSI Qch
FR080.2R	W-T-E Plant Thiverval-Grignon	Thiverval Grignon	FR	5.2. (a)	27.8 t/h	M	SNCR ESPd WS2s DSI Qch
FR080.3	W-T-E Plant Thiverval-Grignon	Thiverval Grignon	FR	5.2. (a)	243000 t/yr	M	SNCR BF WS1s WS2s DSI Qch
FR082.1R	NOVALIE	Vedene	FR	5.2. (a)	26.8 t/h	M	SNCR BF sWS DSI
FR082.2R	NOVALIE	Vedene	FR	5.2. (a)	26.8 t/h	M	SNCR BF sWS DSI
FR082.3R	NOVALIE	Vedene	FR	5.2. (a)	26.8 t/h	M	SNCR BF sWS DSI
FR082.4R	NOVALIE	Vedene	FR	5.2. (a)	26.8 t/h	M	SNCR BF sWS DSI

WI BREF 2019
EUROPEAN WTE PLANTS THAT PARTICIPATED IN THE 2016 DATA COLLECTION

Reference line	Name of the installation	City	Country	Main activity	Capacity	Prevalent type of waste burnt	Flue-gas cleaning techniques installed
UK11.1R	Dudley EfW	Dudley	UK	5.2. (a)	6 t/h	M	SNCR BF WS1s DSI Other
UK11.2R	Dudley EfW	Dudley	UK	5.2. (a)	6 t/h	M	SNCR BF WS1s DSI Other
UK12R	NA	Lincoln	UK	5.2. (a)	19.2 t/h	M	SNCR BF DS_rea PC
UK13.1R	NA	Nottingham	UK	5.2. (a)	11.3 t/h	M	SNCR BF DSI
UK13.2R	NA	Nottingham	UK	5.2. (a)	11.3 t/h	M	SNCR BF DSI
UK14.1R	Knostrop Clinical Waste Incinerator	Leeds	UK	5.2. (b)	2 t/h	C	BF DS_rea DSI
UK14.2R	Knostrop Clinical Waste Incinerator	Leeds	UK	5.2. (b)	2 t/h	C	BF DS_rea DSI
UK15R	Thames Water Utilities Ltd	Barking, Essex	UK	5.2. (a)	13.5 t/h	S	Prim ESPd BF WS2s Other
UK17R	Blackburn Meadows Renewable Energy Plant	Sheffield	UK	5.2. (a)	25 t/h	O	SNCR BF DSI
UK18	Kemsley CHP Plant K2 Incinerator	Kemsley, Sittingbourne, Kent	UK	5.2. (a)	29 MW thermal input	O	SNCR BF DSI

NB:
Main activity: 1.1 Energy – Combustion // 4 Chemical industry // 4.1(f) Chemical – Production of organic chemicals – Halogenic hydrocarbons // 4.3 Chemical – Production of phosphorus-, nitrogen- or potassium-based fertilisers // 5.1 (a) Waste – Disposal or recovery of hazardous waste – Biological treatment // 5.1 (b) Waste – Disposal or recovery of hazardous waste – Physico-chemical treatment // 5.2 (a) Waste – Disposal or recovery of waste in waste (co-)incineration plants – Non-hazardous waste // 5.2 (b) Waste – Disposal or recovery of waste in waste (co-)incineration plants – Hazardous waste // 5.3 (a) Waste – Disposal of non-hazardous waste // 5.3 (b) Waste – Recovery, or a mix of recovery and disposal, of non-hazardous waste // 6.11 Other – Independently operated treatment of waste water
Prevalent waste burnt: M = municipal solid waste; S = sewage sludge; O = other non-hazardous waste; C = clinical waste; H = hazardous waste.
Capacity: capacity as reported in the questionnaire for the main activity of the plant. The capacity may be reported for the reference line or for the entire plant. Inconsistent or missing information has been supplemented with the amount of waste burnt in 2014
Techniques to reduce emissions to air: Bed = Adsorption bed // BF = Bag filter // Cyc = (Multi-)cyclone // DS_rcy = Dry scrubber recirculation system // DS_rea = Dry scrubber mixing unit reactor // DSI = Dry sorbent injection // ESPd = Dry electrostatic precipitator // ESPw = Wet electrostatic precipitator // FSI = In-furnace desulphurisation // PC = Post-combustion // Prim = Primary techniques // Qch = Quench system // SCR = Selective catalytic reduction // SNCR = Selective non-catalytic reduction // sWS = Semi-wet scrubber // WS1s = Wet scrubber (1-stage) // WS2s = Wet scrubber (2-stage) // WS3s = Wet scrubber (3-stage).
NI = No information provided.
Source: [81, TWG 2016]

MAIN NEW REQUIREMENTS ON AIR EMISSIONS

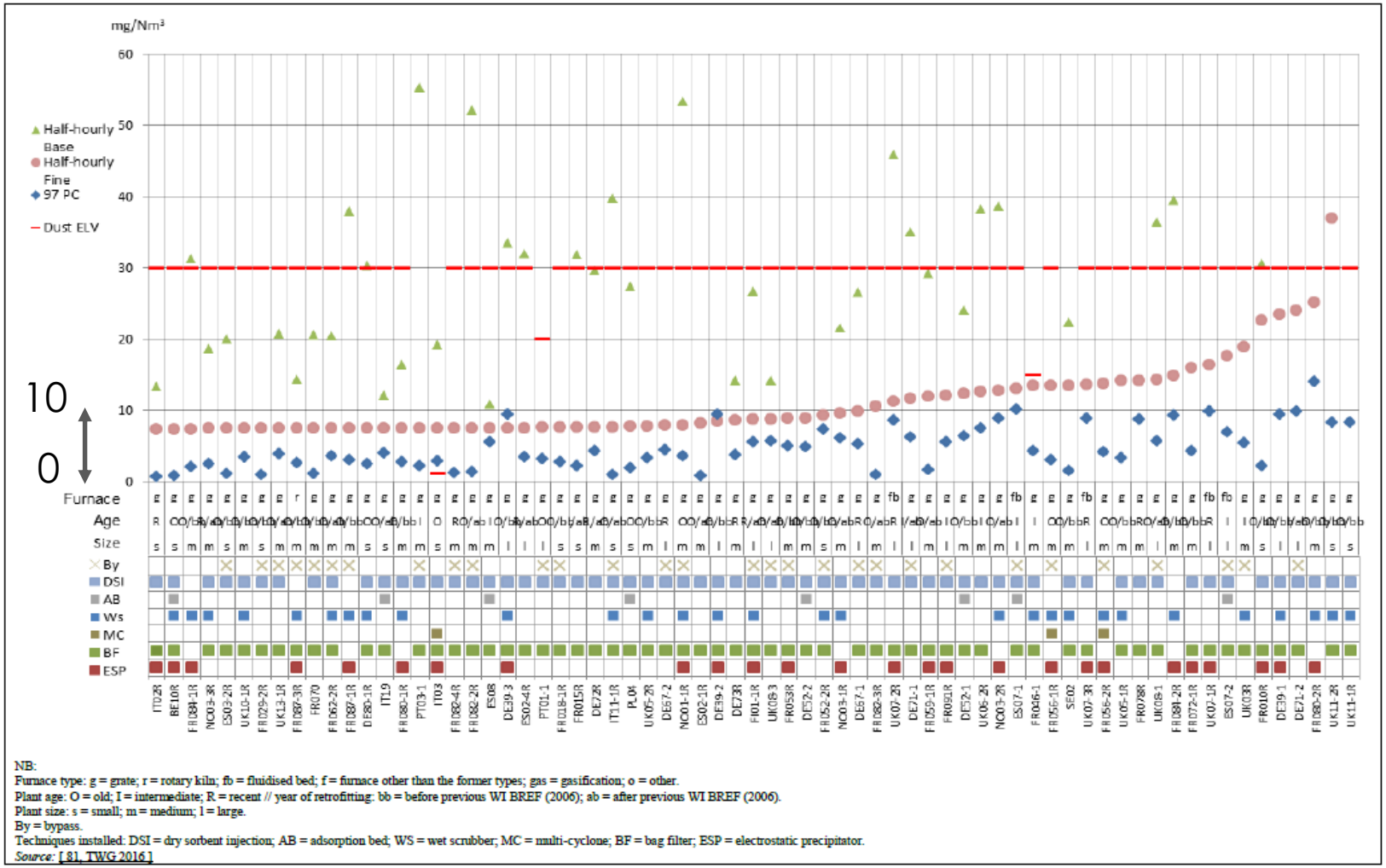
- ELV must be set to ensure that emissions do not exceed BATAEL under NOC (Normal Operating Conditions) (IED Art. 15.3)

- Continuous sampling of PCDD/F or PCDD/F + PCB-DL once every month + BATAEL (BAT 30)
  - With exemptions
- Continuous Hg monitoring + BATAEL (BAT 31)
  - Exemption if "*waste with a proven low and stable mercury content*"
- Continuous monitoring of NH_3 + BATAEL (BAT 29)
- NOx BATAEL: 50-120 (new plants) 50-150 (existing) or 180 if SCR not applicable

- ***PCDD/F:*** *dioxins & furanes (polychlorobenzodioxins and polychlorodibenzofurans). 17 toxic out of 210*
- ***PCB-DL*** *: dioxin-like PCB (Polychlorinated biphenyls) . 12 PCB-DL among 209 PCBs*

BATAEL ARE DIRECTLY DERIVED FROM OPERATING VALUES …

HALF-HOURLY AVERAGE EMISSSION LEVELS FOR CONTINUOUS *DUST* FOR MSW WTE (3/3)

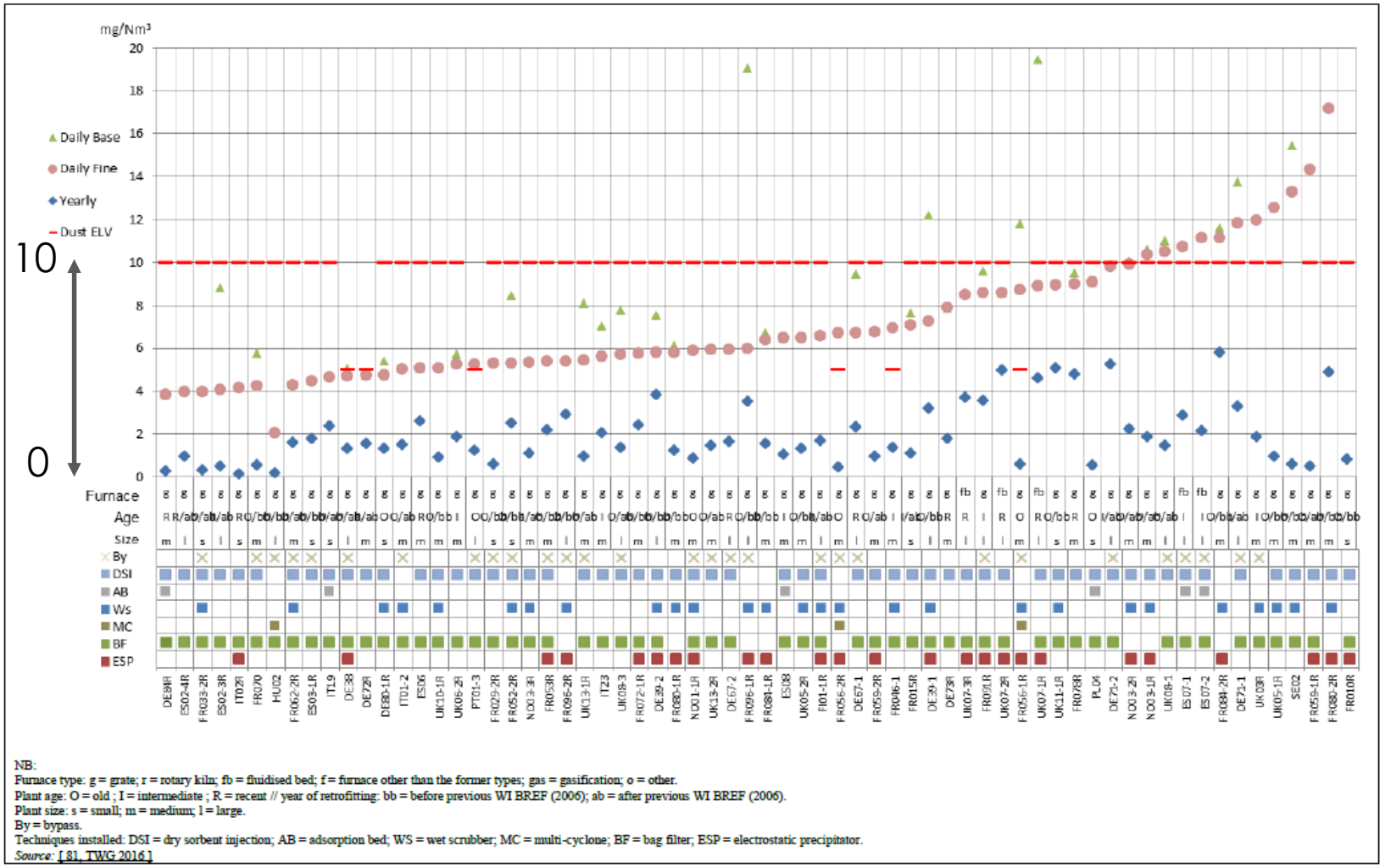


NB:
Furnace type: g = grate; r = rotary kiln; fb = fluidised bed; f = furnace other than the former types; gas = gasification; o = other.
Plant age: O = old; I = intermediate; R = recent // year of retrofitting: bb = before previous WI BREF (2006); ab = after previous WI BREF (2006).
Plant size: s = small; m = medium; l = large.
By = bypass.
Techniques installed: DSI = dry sorbent injection; AB = adsorption bed; WS = wet scrubber; MC = multi-cyclone; BF = bag filter; ESP = electrostatic precipitator.
Source: [81, TWG 2016]

Figure 8.64: Half-hourly average emission levels for continuously monitored dust emissions to air from reference lines incinerating predominantly MSW (3/3)

BATAEL ARE DIRECTLY DERIVED FROM OPERATING VALUES …

DAILY & YEARLY AVERAGE EMISSSION LEVELS FOR CONTINUOUS *DUST* FOR MSW WTE (3/3)

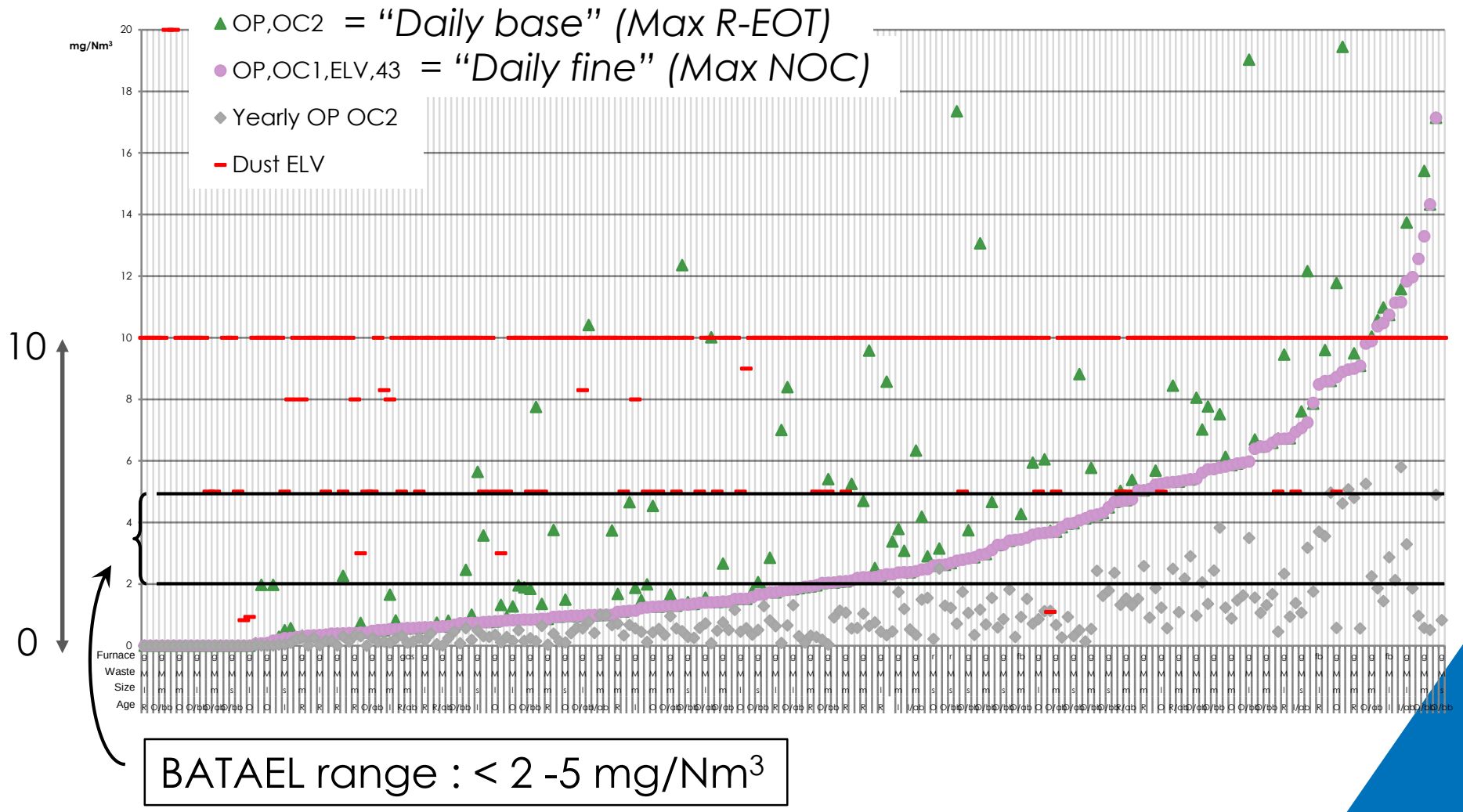


NB:
Furnace type: g = grate; r = rotary kiln; fb = fluidised bed; f = furnace other than the former types; gas = gasification; o = other.
Plant age: O = old ; I = intermediate ; R = recent // year of retrofitting: bb = before previous WI BREF (2006); ab = after previous WI BREF (2006).
Plant size: s = small; m = medium; l = large.
By = bypass.
Techniques installed: DSI = dry sorbent injection; AB = adsorption bed; WS = wet scrubber; MC = multi-cyclone; BF = bag filter; ESP = electrostatic precipitator.
Source: [81, TWG 2016]

Figure 8.14: Daily and yearly average emission levels for continuously monitored dust emissions to air from reference lines incinerating predominantly MSW (3/3)

BATAEL ARE DIRECTLY DERIVED FROM OPERATING VALUES …

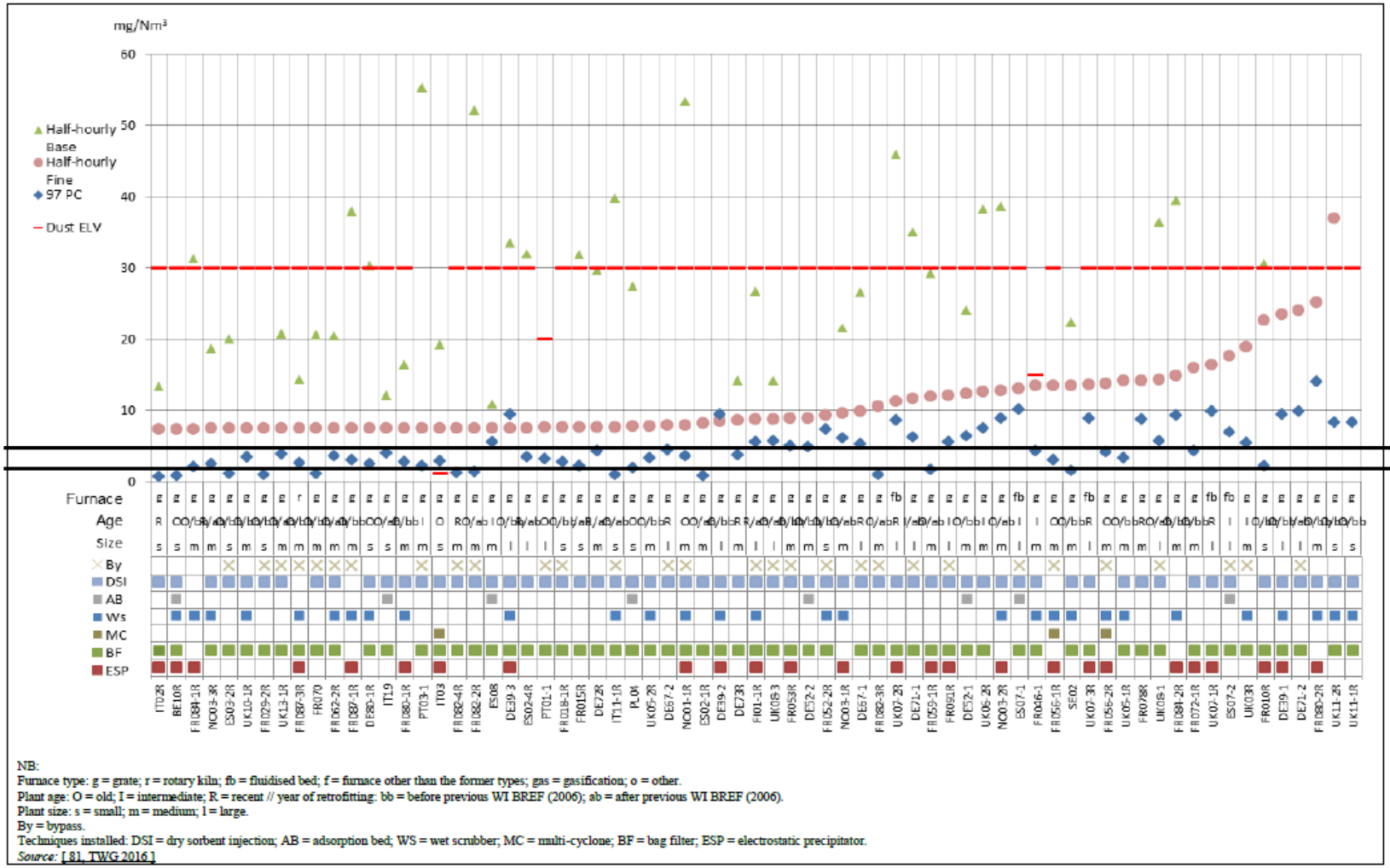
Maximum daily means and yearly average for ***DUST*** for MSW
(source: EIPPCB to TWG (BREF Annex))



BATAEL range : < 2 -5 mg/Nm^3

BATAEL ARE DIRECTLY DERIVED FROM OPERATING VALUES …

HALF-HOURLY AVERAGE EMISSSION LEVELS FOR CONTINUOUS *DUST* FOR MSW WTE (3/3)



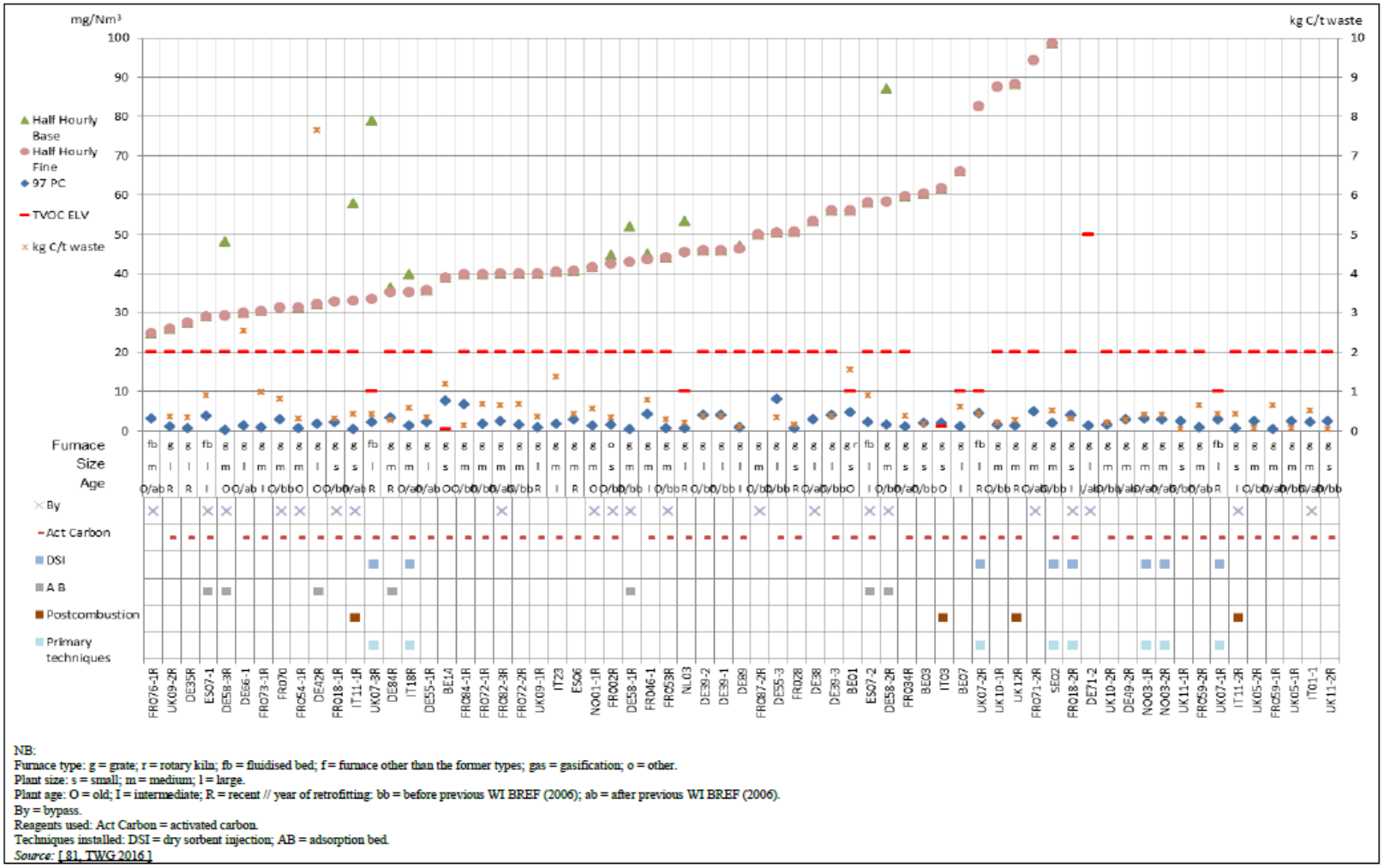
NB:
Furnace type: g = grate; r = rotary kiln; fb = fluidised bed; f = furnace other than the former types; gas = gasification; o = other.
Plant age: O = old; I = intermediate; R = recent // year of retrofitting: bb = before previous WI BREF (2006); ab = after previous WI BREF (2006).
Plant size: s = small; m = medium; l = large.
By = bypass.
Techniques installed: DSI = dry sorbent injection; AB = adsorption bed; WS = wet scrubber; MC = multi-cyclone; BF = bag filter; ESP = electrostatic precipitator.
Source: [81, TWG 2016]

Figure 8.64: Half-hourly average emission levels for continuously monitored dust emissions to air from reference lines incinerating predominantly MSW (3/3)

BATAEL range : < 2 -5 mg/Nm³

BATAEL ARE DIRECTLY DERIVED FROM OPERATING VALUES …

HALF-HOURLY AVERAGE EMISSSION LEVELS FOR CONTINUOUS *TVOC* FOR MSW WTE (3/3)



NB:
Furnace type: g = grate; r = rotary kiln; fb = fluidised bed; f = furnace other than the former types; gas = gasification; o = other.
Plant size: s = small; m = medium; l = large.
Plant age: O = old; I = intermediate; R = recent // year of retrofitting: bb = before previous WI BREF (2006); ab = after previous WI BREF (2006).
By = bypass.
Reagents used: Act Carbon = activated carbon.
Techniques installed: DSI = dry sorbent injection; AB = adsorption bed.
Source: [81, TWG 2016]

Figure 8.76: Half-hourly average emission levels for continuously monitored TVOC emissions to air from reference lines incinerating predominantly MSW (3/3)

BATAEL ARE DIRECTLY DERIVED FROM OPERATING VALUES …

DAILY & YEARLY AVERAGE EMISSSION LEVELS FOR CONTINUOUS *TVOC* FOR MSW WTE (3/3)

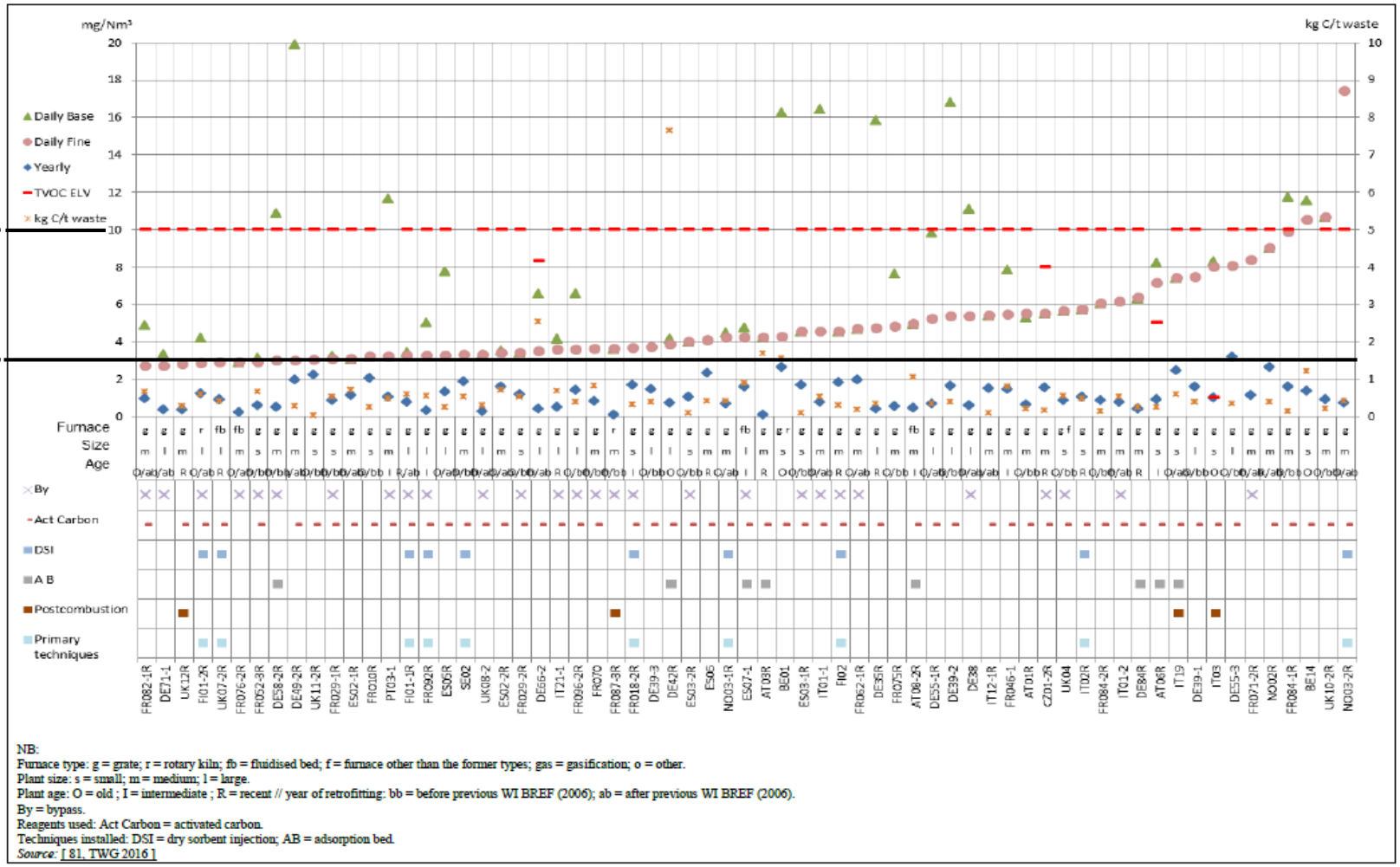


Figure 8.26: Daily and yearly average emission levels for continuously monitored TVOC emissions to air from reference lines incinerating predominantly MSW (3/3)

BATAEL range TVOC : <3 -10 mg/Nm³

WI BREF 2019 BATAEL VS. IED ANNEX VI DAILY CONTINUOUS ELV

Air emission at stack		IED Annex VI daily and periodic ELVs			BATAELs (WI BREF 12/2019)		
Substance	Unit (11% O_2, dry)	IED ELV	Max. Conf. interval [1]	Sampling period	NEW plants	EXISTING plants	Sampling period
Dust	mg/Nm^3	10	3	Daily	**<2-5**		Daily
TVOC	mg/Nm^3	10	3	Daily	**<3-10**		Daily
CO	mg/Nm^3	50			**10-50**		Daily
HCl	mg/Nm^3	10	4	Daily	**<2-6**	**<2-8**	Daily
HF	mg/Nm^3	1	0,4	Daily	**<1**		Daily [2]
SO_2	mg/Nm^3	50	10	Daily	**5-30**	**5-40**	Daily
NO_x (SCR, SNCR…)	mg/Nm^3	200	40	Daily	**50-120**	**50-150**	Daily
SNCR, if SCR not possible						**up to 180**	
NH_3 (SCR or SNCR) (Exist. SNCR not wet)	mg/Nm^3				**2-10**	**2-10 (15)**	Daily
Hg	$\mu g/Nm^3$	50		Periodic, short term	**<5-20**		Daily [3, 4]
					1-10		Long term sampling [3]
					<5-20		Periodic, short term [3]

(1): According to IED Annex VI, Part 8, Section 1.2, the value of the confidence interval should be subtracted from the measured values to determine the half-hourly average values and then the daily average values.
(2): HF continuous measurement may be replaced by periodic measurements if HCl emission are proven to be sufficiently stable.
(3): Hg continuous measurement may be replaced by long-term sampling or periodic measurements if incinerated waste Hg content proven low and stable (e.g. mono-streams of waste of a controlled composition).
(4): Hg ½_hr average indicative value (not BATAELs) for new plants 15-35 $\mu g/Nm^3$, for existing 15-40 $\mu g/Nm^3$.

WI BREF 2019 BATAEL VS. IED ANNEX VI DAILY CONTINUOUS ELV

Air emission at stack		IED Annex VI daily and periodic ELVs			BATAELs (WI BREF 12/2019)		
Substance	**Unit (11% O_2, dry)**	**IED ELV**	**Max Conf. interval [1]**	**Sampling period**	**NEW plants**	**EXISTING plants**	**Sampling period**
PCDD/F [5]	ng $_{I\text{-}TEQ}/Nm^3$				**<0.01-0.06**	**<0.01-0.08**	Long term sampling [6]
PCDD/F + PCB-DL [5]	ng $_{I \& WHO\text{-}TEQ}/Nm^3$				**<0.01-0.08**	**<0.01-0.1**	
PCDD/F [5]	ng $_{I\text{-}TEQ}/Nm^3$	0.1		Periodic, short term	**<0.01-0.04**	**<0.01-0.06**	Periodic, short term
PCDD/F + PCB-DL [5]	ng $_{I \& WHO\text{-}TEQ}/Nm^3$			Periodic, short term	**<0.01-0.06**	**<0.01-0.08**	
Cd+Tl	mg/Nm^3	0.05		Periodic, short term	**0.005 - 0.02**		Periodic, short term
Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V	mg/Nm^3	0.5		Periodic, short term	**0.01-0.3**		Periodic, short term

(5): Either the BATAELs for PCDD/F or the BATAELs for PCDD/F + PCBs-DL apply. PCB-DL monitoring does not apply if PCB-DL are proven to be less than 0.01 ng $_{WHO\text{-}TEQ}/Nm^3$.
(6): The long term sampling BATAELs do not apply if the emission levels are proven to be sufficiently stable.

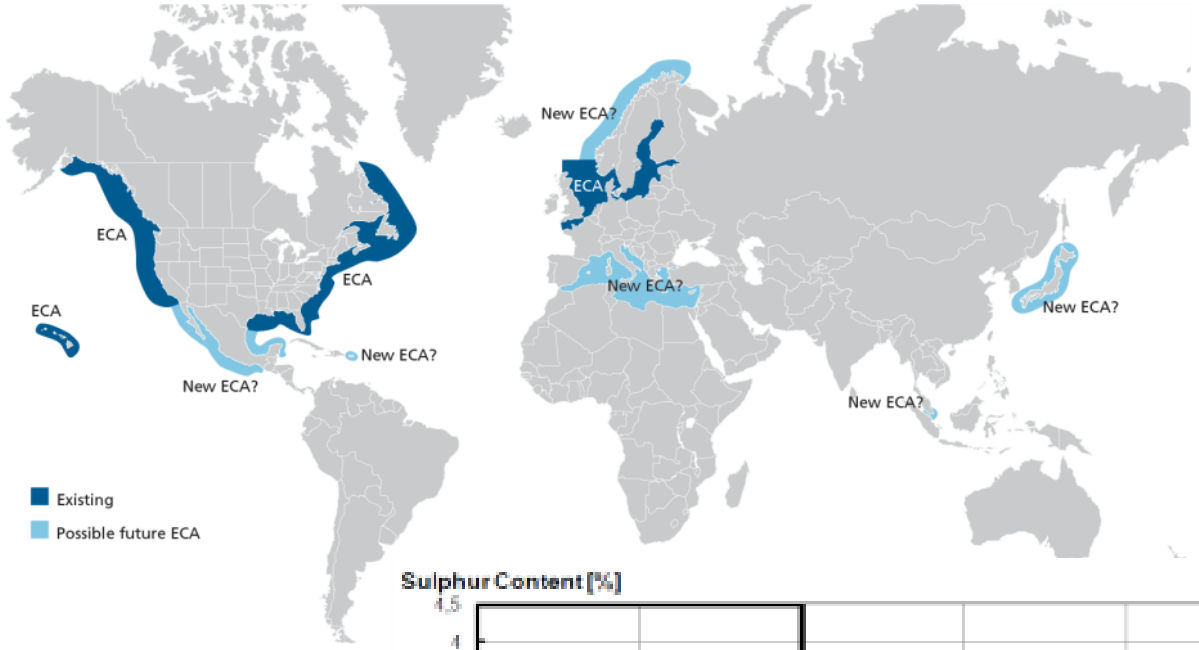
MARITIME ACTIVITIES



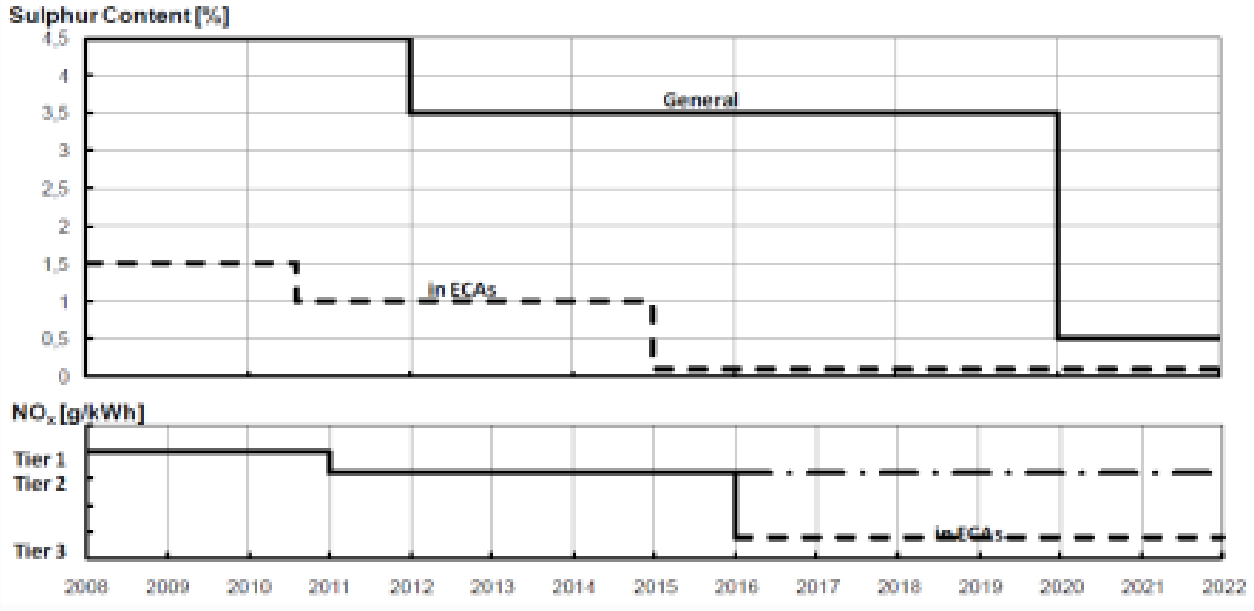


DeepBlueLAB™
Exhaust Gas Cleaning

WHY MARINE SCRUBBERS…OR FUEL CHANGES?



IMO WORLDWIDE & ECA ZONES



DeepBlueLAB™
Exhaust Gas Cleaning

MARITIME DIESEL EXHAUST GAS CLEANING SYSTEM

DeepBlueLAB
LAB Marine Business line for Exhaust Gas Cleaning Solution

SOx Removal With WET Solution

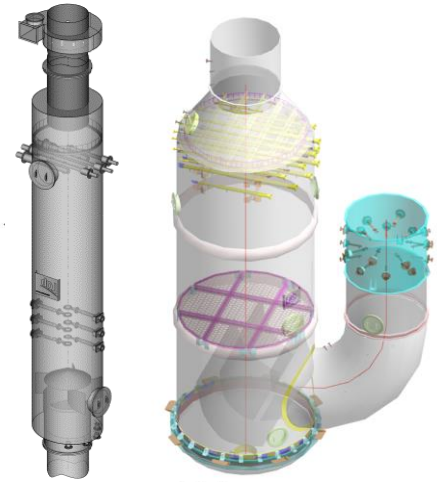
DeepBlueLAB SOx

NOx Removal With SCR Solution

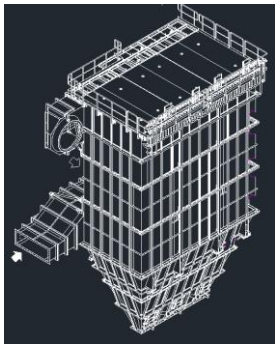
DeepBlueLAB NOx

SOx + Dust Removal With Particles Filter

DeepBlueLAB PM



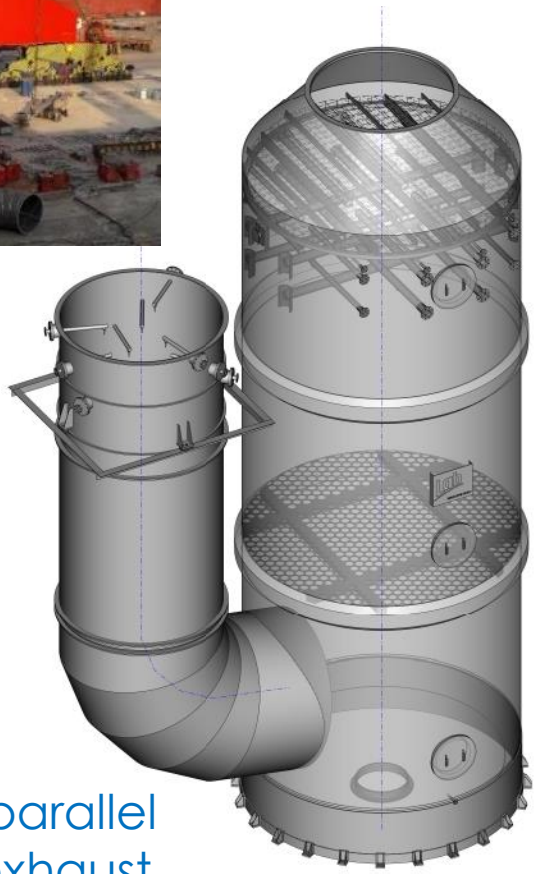
In-line Off-line

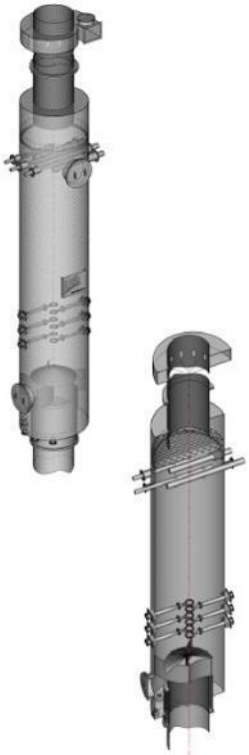


CNIM

OFF-LINE OR IN-LINE DESOX SCRUBBERS CONFIGURATIONS

DeepBlueLAB™
Exhaust Gas Cleaning



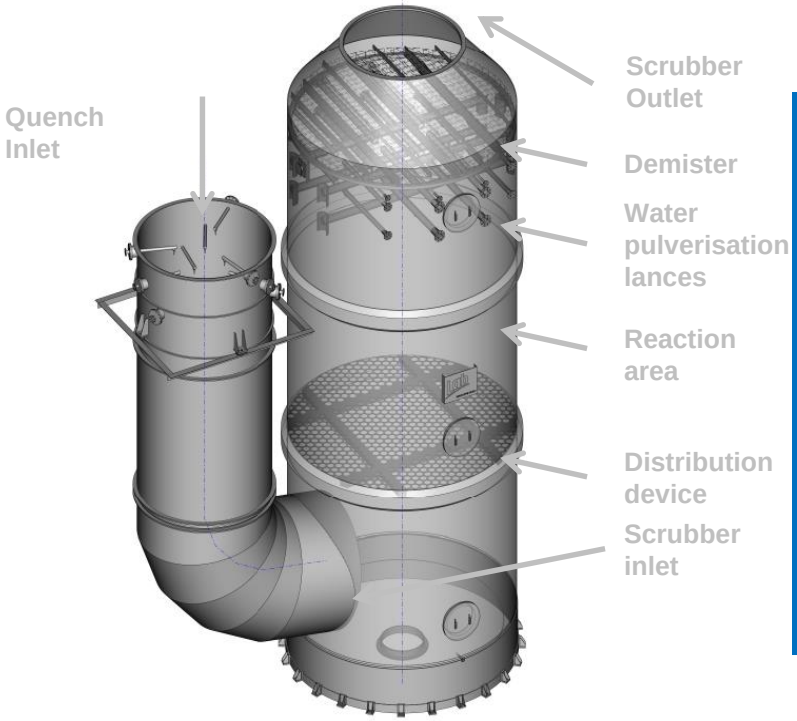


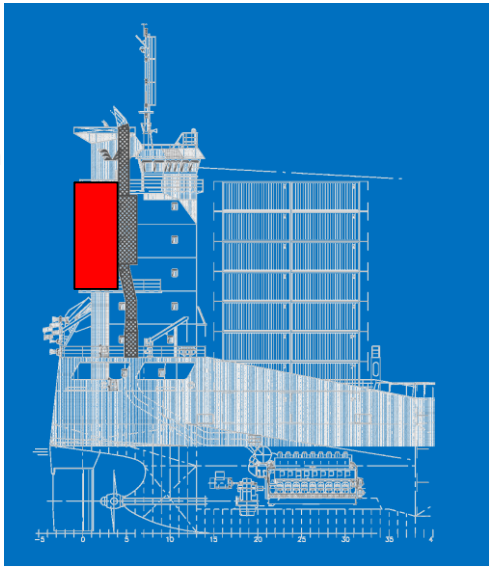
- OFF-LINE : in parallel with existing exhaust
- IN-LINE : replacing silencers, compact

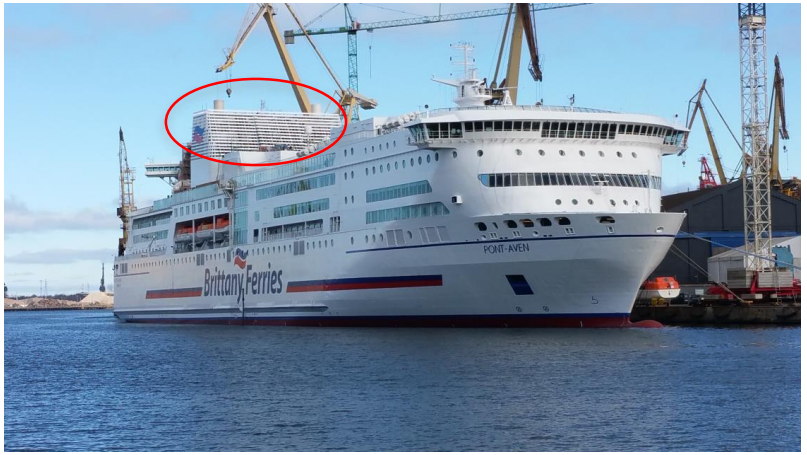
OFF-LINE SCRUBBER ARRANGEMENT

DeepBlueLAB™ Exhaust Gas Cleaning

- GRP scrubber with by-pass & dampers
- Corrosion free with easy maintenance & repair
- Low pressure drop





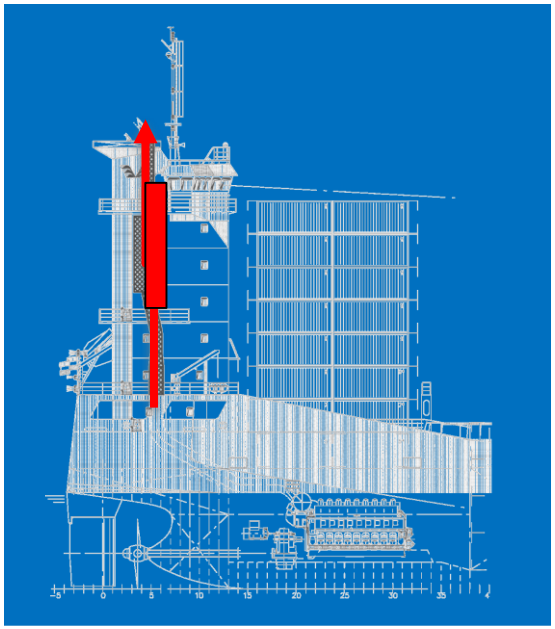


CNIM

IN-LINE SCRUBBER ARRANGEMENT

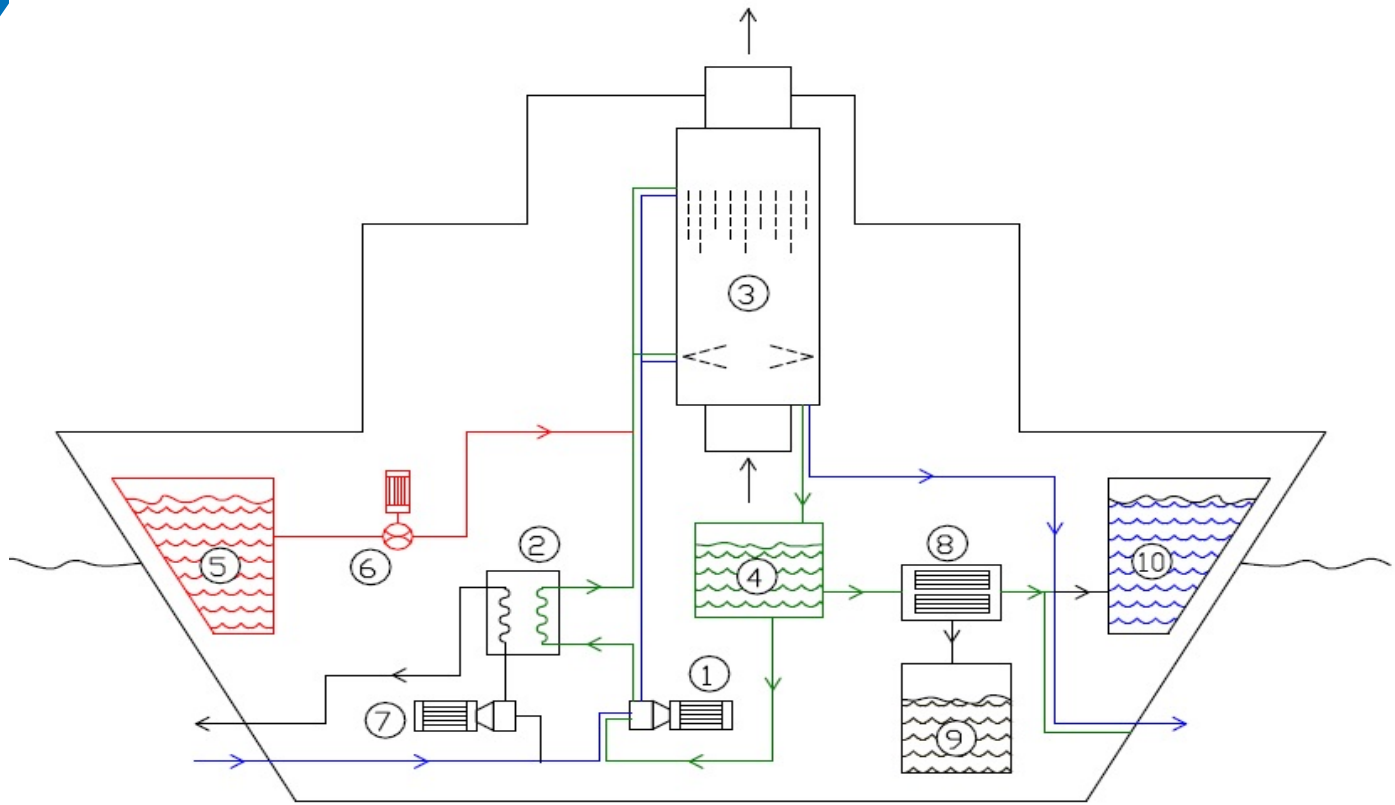
DeepBlueLAB™ Exhaust Gas Cleaning

- Super austenic steel tower (254 SMO)
- Compact & easy arrangement : no by-pass, direct installation in the funnel
- Multi engine configuration
- Temperature resistant
- Dry operation possible
- Sound reducer (option)



CNIM

OPEN LOOP / CLOSED LOOP DESIGN



OPEN LOOP CONFIGURATION :

1 - Scrubbing pumps
3 - Scrubber

CLOSE LOOP CONFIGURATION :

1 - Scrubbing pumps
3 - Scrubber
4 - Process tank

5 - Reagent tank
6 - Reagent dosing pumps

7 - Cooling pumps
2 - Heat exchanger

8 - Water treatment
9 - Concentrate tank
10 - Holding tank (Zero Discharge)

Hybrid ready configuration

- Open Loop (sea water reagent – unlimited autonomy)
- Ready for Closed Loop (protected areas/harbours)

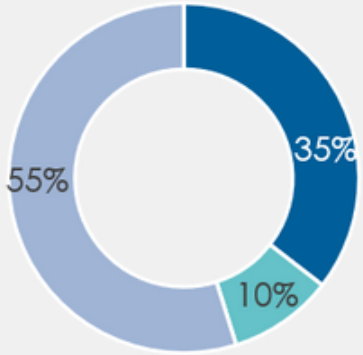
Hybrid Configuration

- Open Loop
- Closed Loop ($Mg(OH)_2$ reagent & sludge tanks)
- Full Closed Loop (0 discharge) (wash water tank)

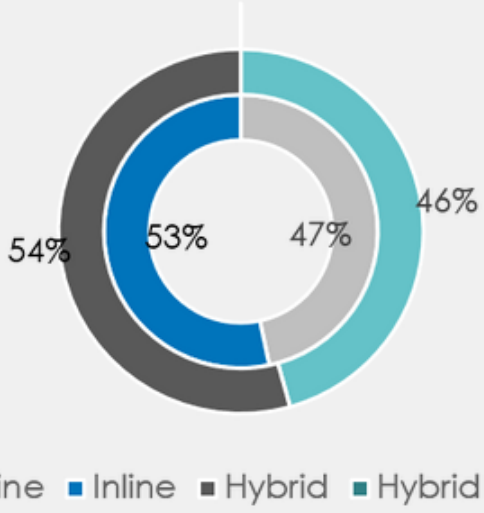
EXHAUST GAS CLEANING SYSTEM – LAB SOLUTION

Key figures of the Marine activity

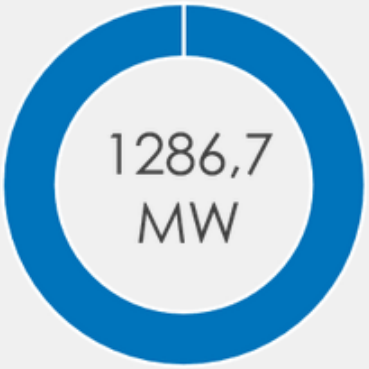
Maritim Sector



EGCS configuration



Treated power



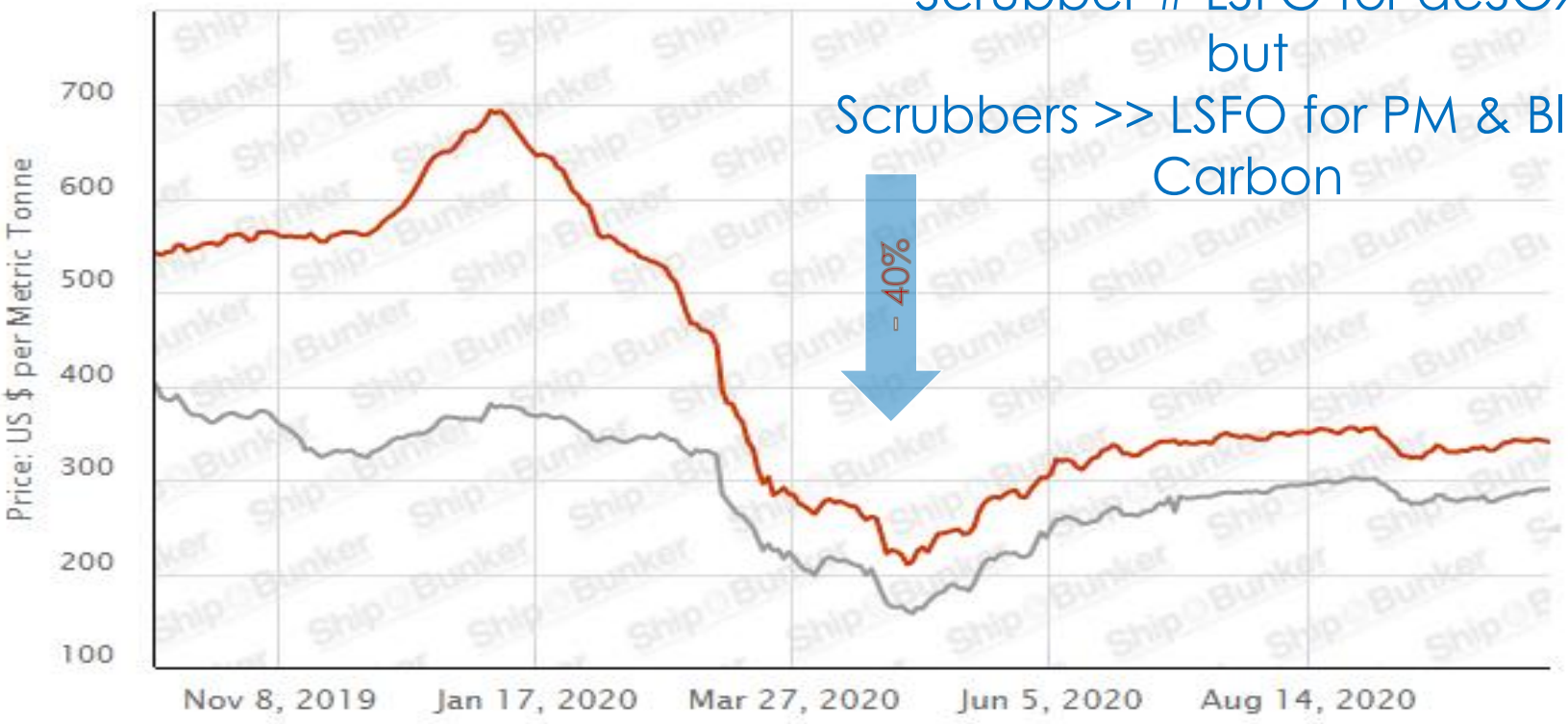
EXHAUST GAS CLEANING SYSTEM – LAB SOLUTION

DeepBlueLAB SOx - Wet Solution (SOx Removal) Applicable to all engine power

		Inline scrubber (Metallic)	Offline scrubber (GRP or Metallic)
Gas side		**DeSOx performances** > 97,1% (MARPOL) **DeDust performances** 60 to 80% (fct of scrubber internal arrangement)	
Water side configuration	Open Loop	No Treatment on water side Compliant with MARPOL regulation (PAH, Turbidity, pH)	
	Hybrid	Suspended solid and part of heavy metal reduction, Compliant with MARPOL regulation (PAH, Turbidity, pH)	

MARINE SCRUBBER MARKET VS FUEL PRICE

Scrubber # LSFO for deSOx
but
Scrubbers >> LSFO for PM & Black Carbon



Spread LSFO vs HFO : 350$/t - 2019/12 =>> 50$/t - 2020/10
=> Marine scrubber market from "<2 y pay-back" to "stand-by"

COPENHAGEN (DK) BY 2025: 1ST CO_2-NEUTRAL CAPITAL & 100% RENEWABLE AND RECOVERY HEAT IN DISTRICT HEATING (98% OF CITY'S DEMAND)

by BIG Architects

MARINE SCRUBBERS
FOR MSC ORCHESTRA

by Gottlieb Paludan Architects

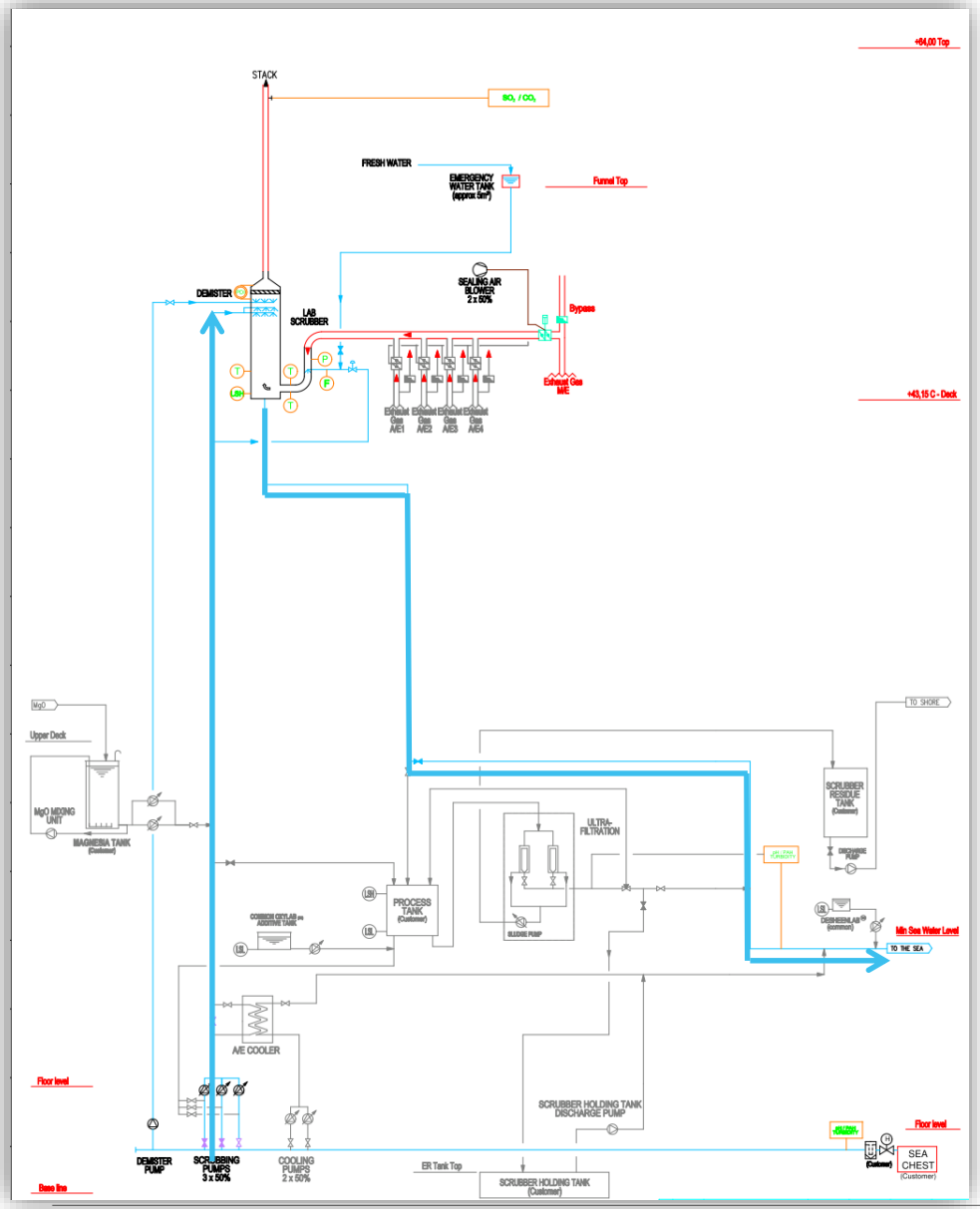
Copenhill

250MWth Waste to Energy
with LAB flue gas condensation
& absorption heat pumps

BIO4 "Plant power"

500 MWth Wood Boiler
with LAB flue gas condensation

OPEN LOOP DESIGN



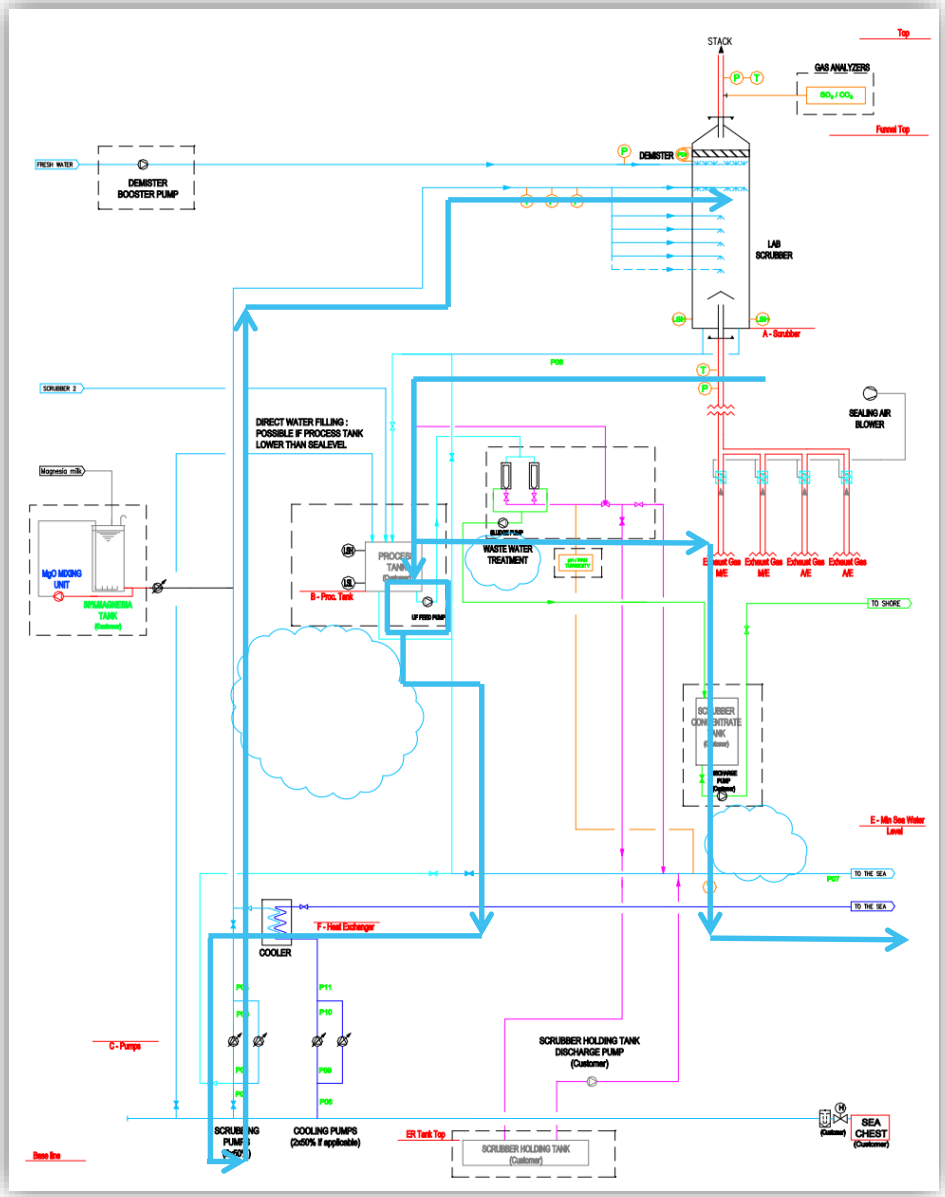
Operation in SECA zones or worldwide (according local reglementation)

Autonomy unlimited

SOx Treatment by using only seawater

Evolutive design (Hybrid ready)

CLOSED LOOP DESIGN



-ZERO Discharge Mode

-No Effluent!

-Operation in protected areas and harbors

-Controlled Discharge Mode (according IMO requirement)

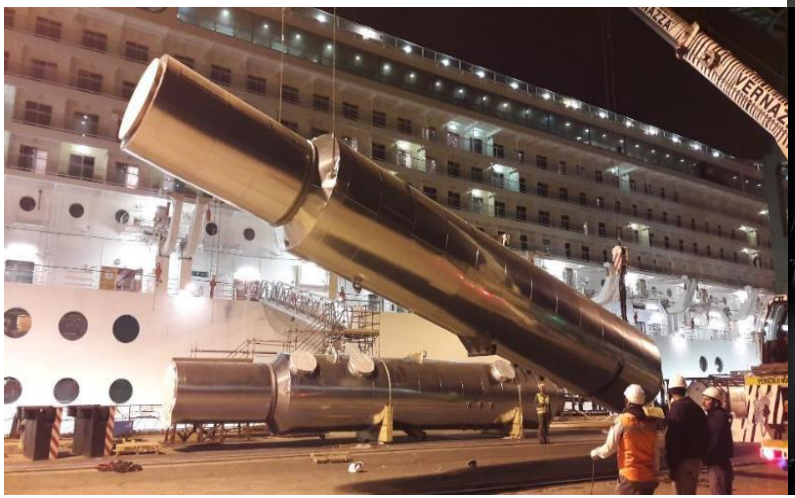
-Waste Water treatment

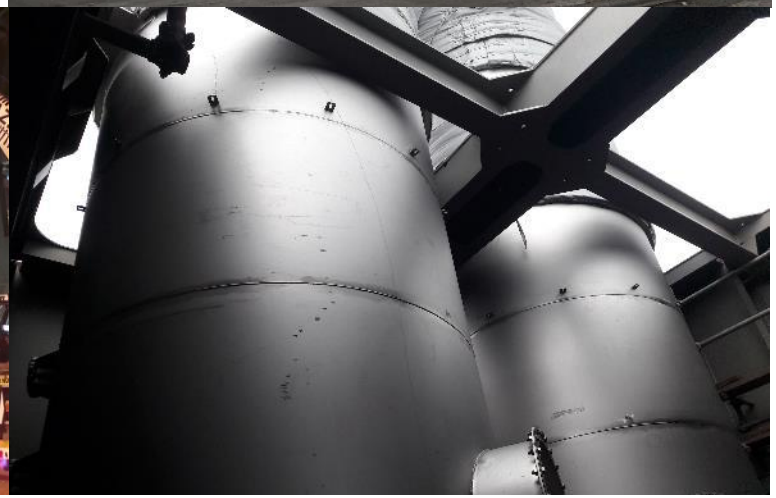
-Autonomy depending on sludge tank capacity

-SOx Treatment by Magnesia Milk

WET SOLUTION – IN-LINE INSTALLATION

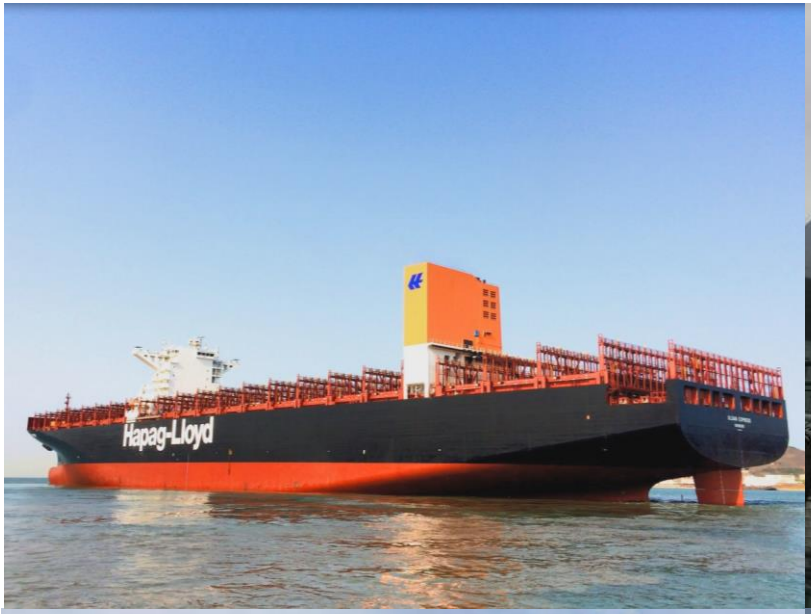
DeepBlueLAB™ high-alloy austenitic stainless steel Marine Scrubber





OFF-LINE GRP SCRUBBER INSTALLATION

LAB SCRUBBER OFF-LINE IN PLACE



EXHAUST GAS CLEANING SYSTEM – LAB SOLUTION

DeepBlueLAB NOx - NOx Removal With our SCR Solution

SCR
On all type of engine and any kind of fuel up to 4,5% Sulphur

DeNOx performances in % of reduction of the NOx Emission

- TIER I to TIER III equivalent to 80% of reduction
- TIER II to TIER III equivalent to 74 to 76% of reduction (depend in Engine speed)