Final Meeting of the Technical Working Group (TWG) for the review of the BAT reference document for Large Combustion Plants (LCP BREF)

Preliminary draft conclusions – Day 3

Coal and/or lignite

BAT 19 in Revised Draft 1

Techniques to reduce NO_X and CO emissions (1/6) – BP 1.3.3.1

- The decision on the SNCR technique is not supported by EL.
- The decision on the SCR technique is not supported by EL.
- Specify in the BREF chapter on 'Concluding remarks and recommendations for future work' that further information on the applicability of the SCR technique should be collected during the next BREF review , in particular with respect to the combustion of indigenous fuels.

Coal and/or lignite

BAT 19 in Revised Draft 1

Techniques to reduce NO_X and CO emissions (2/6) – BP 1.3.3.1

BAT 19. In order to prevent and/or reduce NO_X emissions to air while limiting CO and N_2O emissions to air from the combustion of coal and/or lignite, BAT is to use one or a combination of the techniques given below.

Technique		Description	Applicability
a	Combustion optimisation	See description in Section 10.8. Generally used in combination with other techniques included in this table	Generally applicable

Coal and/or lignite

BAT 19 in Revised Draft 1

Techniques to reduce NO_X and CO emissions (3/6) – BP 1.3.3.1

	Technique	Description	Applicability
b	Combination of other primary techniques for NO_X reduction (e.g. air staging including overfire air, fuel staging, flue-gas recirculation, LNB)	See description in Section 10.8 for each single technique. The choice and performance of appropriate (combination of) primary techniques may be influenced by the boiler design	Generally applicable

Coal and/or lignite

BAT 19 in Revised Draft 1

Techniques to reduce NO_X and CO emissions (4/6) – BP 1.3.3.1

	Technique	Description	Applicability
c	Selective non-catalytic reduction (SNCR)	See description in Section 10.8. Can be applied with a 'slip' SCR system	The applicability may be limited in the case of boilers with a high cross-sectional area preventing a homogeneous mixing of NH_3 and NO_X. The applicability may be limited in the case of combustion plants operated in emergency- or peak-load modes with highly variable boiler loads

Coal and/or lignite

BAT 19 in Revised Draft 1

Techniques to reduce NO_X and CO emissions (5/6) – BP 1.3.3.1

	Technique	Description	Applicability
d	Selective catalytic reduction (SCR)	See description in Section 10.8.	Not applicable to combustion plants of < 300 MW_{th} operated in emergency-load mode. Not generally applicable to combustion plants of < 100 MW_{th}. There may be technical and economic restrictions for retrofitting existing plants operated in peak-load mode and existing plants of ≥ 300 MW_{th} operated in emergency-load mode

Coal and/or lignite

BAT 19 in Revised Draft 1

Techniques to reduce NO_X and CO emissions (6/6) – BP 1.3.3.1

Technique		Description	Applicability
e	Combined techniques for NO_X and SO_X reduction	See description in Section 10.8. They can be applied either alone or in combination with other primary techniques in coal-fired PC boilers	Applicable on a case-by-case basis, depending on the fuel characteristics and combustion process

Coal and/or lignite

Table 10.3 in Revised Draft 1

BAT-AELs for NO_X and CO (1/6) – BP 1.3.3.2

- The decision on the BAT-AEL for NO_X for ≥ 300 FBC boiler combusting coal and/or lignite and lignite-fired PC boiler is not supported by CZ, DE, EE, EL, PL, RO, SK, EEB, CAN Europe, Euracoal, Eurelectric.
- The decision on the BAT-AEL for NO_X for ≥ 300 coal-fired PC boiler is not supported by PL, BE, IE, UK, EEB, CAN Europe, Euracoal, Eurelectric.

Coal and/or lignite

Table 10.3 in Revised Draft 1

BAT-AELs for NO_X and CO (2/6) – BP 1.3.3.2

Table 10.3: BAT-associated emission levels (BAT-AELs) for NO_X and CO emissions to air from the combustion of coal and/or lignite

Combustion plant total rated thermal input (MW_{th})	BAT-AELs (mg/Nm^3)				
	NO_X				CO
	Yearly average		Daily average or average over the sampling period		Yearly average
	New plant	Existing plant (4)	New plant	Existing plant	New or existing plant (4)
(4) These BAT-AELs do not apply ~~when~~ to existing plants operated in peak- or emergency-load modes.					

Coal and/or lignite

Table 10.3 in Revised Draft 1

BAT-AELs for NO_X and CO (3/6) – BP 1.3.3.2

Combustion plant total rated thermal input (MW_{th})	BAT-AELs (mg/Nm^3)				
	NO_X				CO (4)
	Yearly average		Daily average or average over the sampling period		Yearly average
	New plant	Existing plant (4)	New plant	Existing plant	New or existing plant
<100	100–150	100–270	155–200	165–330	< 30–140
100–300	50–100	100–180	80–130	155–210	< 30–140

Coal and/or lignite

Table 10.3 in Revised Draft 1

BAT-AELs for NO_X and CO (4/6) – BP 1.3.3.2

Combustion plant total rated thermal input (MW_{th})	BAT-AELs (mg/Nm^3)				
	NO_X				CO (4)
	Yearly average		Daily average …		Yearly average
	New plant	Existing plant (4)	New plant	Existing plant	New or existing plant
≥ 300 FBC boiler combusting coal and/or lignite and lignite-fired PC boiler	50–85	< 85–175 (8)	80–125	140–220	< 30–100 (7)

(7) The higher end of the BAT-AEL range can be as high as 140 mg/Nm^3 in the case of limitations due to boiler design, and/or in the case of fluidised bed boilers not fitted with secondary abatement techniques for NO_X emissions reduction.

(8) The lower end of the range is considered achievable when using SCR.

Coal and/or lignite

Table 10.3 in Revised Draft 1

BAT-AELs for NO_X and CO (5/6) – BP 1.3.3.2

Combustion plant total rated thermal input (MW_{th})	BAT-AELs (mg/Nm^3)				
	NO_X				CO (4)
	Yearly average		Daily average …		Yearly average
	New plant	Existing plant (4)	New plant	Existing plant	New or existing plant
≥ 300 coal-fired PC boiler	65–85	65–150	80–125	< 85–200 (6)	< 5–100 (7)

(6) In the case of plants operated in peak- or emergency-load modes, the higher end of the range is 220 mg/Nm^3.

(7) The higher end of the BAT-AEL range can be as high as 140 mg/Nm^3 in the case of limitations due to boiler design, and/or in the case of fluidised bed boilers not fitted with secondary abatement techniques for NO_X emissions reduction.

Coal and/or lignite

BAT 3 ter in Revised Draft 1

BAT-AELs for NO_X and CO (6/6) – BP 1.3.3.2

Substance/ Parameter	Fuel/Process	… thermal input	Standard(s) (1)	Minimum monitoring frequency	Monitoring associated with
NO_X	Coal and/or lignite including waste co-incineration plants	All sizes	Generic EN standards	Continuous (2)	BAT 19
CO					

(2) In the case of plants with a rated thermal input of < 100 MW_{th} operated in emergency-load mode, the monitoring frequency may be reduced to at least once every year. In the case of plants with a rated thermal input of < 100 MW_{th} operated in peak-load mode, the monitoring frequency may be reduced to at least once every six months. (to be revisited)

Coal and/or lignite

BAT 21 in Revised Draft 1

Techniques to reduce SO_X, HCl, HF emissions (1/6) – BP 1.3.5

BAT 21. In order to prevent and/or reduce SO_X, HCl and HF emissions to air from the combustion of coal and/or lignite, BAT is to use one or a combination of the techniques given below.

Technique		Description	Applicability
a	Fuel choice	Use of fuel with low sulphur (e.g. down to 0.1 weight % - dry basis), chlorine or fluorine content. ~~Often used in combination with other end-of-pipe techniques for combustion plants of > 50 MW_{th}~~	Applicable within the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State. The applicability may be limited due to design constraints in the case of plants combusting highly specific indigenous fuels

Coal and/or lignite

BAT 21 in Revised Draft 1

Techniques to reduce SO_x, HCl, HF emissions (2/6) – BP 1.3.5

	Technique	Description	Applicability
b	Boiler sorbent injection (in-furnace or in-bed)	See description in Section 10.8. Applied in combination with a downstream dedusting system	Generally applicable
c	Duct sorbent injection (DSI)	See description in Section 10.8. Mostly used in combustion plants of < 300 MW_{th}, in combination with a dedusting system (ESP, bag filter). Can be used for HCl/HF removal when no specific FGD end-of-pipe technique is implemented	Generally applicable

Coal and/or lignite

BAT 21 in Revised Draft 1

Techniques to reduce SO_X, HCl, HF emissions (3/6) – BP 1.3.5

Technique		Description	Applicability
d	Circulating fluidised bed (CFB) dry scrubber	See description in Section 10.8	Generally applicable
e	Spray-dry absorber (SDA)	See description in Section 10.8. Mostly used in combustion plants of < 1500 MW_{th} for the combustion of fuels with low and moderate sulphur content	Generally applicable

Coal and/or lignite

BAT 21 in Revised Draft 1

Techniques to reduce SO_x, HCl, HF emissions (4/6) – BP 1.3.5

Technique		Description	Applicability
f	Wet flue-gas desulphurisation (Wet FGD)	See description in Section 10.8	Not applicable to combustion plants operated in emergency-load mode. There may be technical and economic restrictions for applying the technique to combustion plants of < 300 MW_{th}, and for retrofitting existing plants operated in peak-load mode.
g	Seawater FGD	See description in Section 10.8	

Coal and/or lignite

BAT 21 in Revised Draft 1

Techniques to reduce SO_X, HCl, HF emissions (5/6) – BP 1.3.5

	Technique	Description	Applicability
h	Combined techniques for NO_X and SO_X reduction	See description in Section 10.8. Not very common, they can be applied either alone or in combination with other primary techniques in coal-fired PC boilers	Applicable on a case-by-case basis, depending on the fuel characteristics and combustion process
i	Wet scrubbing	See description in Section 10.8. The techniques can be used for HCl/HF removal when no specific FGD end-of-pipe technique is implemented	Generally applicable

Coal and/or lignite

BAT 21 in Revised Draft 1

Techniques to reduce SO_x, HCl, HF emissions (6/6) – BP 1.3.5

	Technique	Description	Applicability
j	Replacement of the gas-gas heater located downstream of the wet FGD	Replacement of the gas-gas heater downstream of the wet FGD by a multi-pipe heat extractor, or removal and discharge of the flue-gas via a cooling tower or a wet stack	Only applicable to combustion plants fitted with a wet FGD system and a downstream gas-gas heater when the heat exchanger needs to be changed or replaced

Coal and/or lignite

Table 10.5 in Revised Draft 1

BAT-AELs for SO_2 (1/7) – BP 1.3.6

- The decision on the BAT-AELs for plants of < 100 MW_{th} and of 100-300 MW_{th} is not supported by CEFIC.
- The decision on the BAT-AELs for plants of ≥ 300 MW_{th} is not supported by EL, EEB, CAN Europe.
- The decision on the BAT-AELs for plants of ≥ 300 MW_{th} which are specifically designed to fire indigenous lignite fuels is not supported by CZ, EE, SK, CAN Europe, Euracoal, Euroheat & Power.
- For plant designed to combust indigenous lignite fuels, reflect on how to consider techniques that reduce the SO_2 concentration in the raw gas.

Coal and/or lignite

Table 10.5 in Revised Draft 1

BAT-AELs for SO_2 (2/7) – BP 1.3.6

- Specify in the BREF chapter on 'Concluding remarks and recommendations for future work' that more information should be collected during the next BREF review in order to assess if there is a need to differentiate between coal and lignite concerning SO_2 emission levels.
- Specify in the BREF that the UK is of the opinion that the upper end of the daily average BAT-AEL of 205 mg/Nm^3 for existing PC-fired plants of ≥ 300 MW_{th} and put into operation before 7 January 2014 are not achievable with coal originating from the UK.
- Consider adding a definition for new/Existing FGD systems.

Coal and/or lignite

Table 10.5 in Revised Draft 1

BAT-AELs for SO_2 (3/7) – BP 1.3.6

Table 10.5: BAT-associated emission levels (BAT-AELs) for SO_2 emissions to air from the combustion of coal and/or lignite

Combustion plant total rated thermal input (MW_{th})	BAT-AELs (mg/Nm^3)			
	Yearly average		Daily average	Daily average or average over the sampling period
	New plant	Existing plant ([3])	New plant	Existing plant
<100	150–200	150–360	170–220	170–400
100–300	80–150	95–200	135–200	135–250

([3]) These BAT-AELs do not apply when plants operate in peak- or emergency-load modes. (to be revisited)

NB: NA = no BAT-AEL.

Coal and/or lignite

Table 10.5 in Revised Draft 1

BAT-AELs for SO_2 (4/7) – BP 1.3.6

Combustion plant total rated thermal input (MW_{th})	BAT-AELs (mg/Nm^3)			
	Yearly average		Daily average	Daily average …
	New plant	Existing plant ([3])	New plant	Existing plant
≥ 300 PC boiler	10–75	10–130 ([5])	25–110	25–165 ([4])
≥ 300 Fluidised bed boiler([1])	20–75	20–180	25–110	50–220

([1]) For circulating fluidised bed boilers, the lower end of the range can be achieved by using a high efficiency wet FGD system. The higher end of the range can be achieved by using boiler in-bed sorbent injection.

([4]) The higher end of the BAT-AEL range is 220 mg/Nm^3 in the case of plants operated in peak- or emergency-load modes. For existing plants put into operation no later than 7 January 2014, the upper end of the BAT-AEL range is 205 mg/Nm^3.

([5]) The lower end of the range can be achieved when using low-sulphur fuel in combination with a wet abatement system.

Coal and/or lignite

Table 10.5 in Revised Draft 1

BAT-AELs for SO_2 (5/7) – BP 1.3.6

For a plant with a total rated thermal input of more than 300 MW_{th}, which is specifically designed to fire indigenous lignite fuels and which can demonstrate that it cannot achieve the BAT-AELs mentioned in Table 10.5 for techno-economic reasons, the upper end of the yearly average BAT-AEL range is as follows:

(i) for a new FGD system: RCG × 0.01 with a maximum of 200 mg/Nm^3;

(ii) for an existing FGD system: RCG × 0.03 with a maximum of 320 mg/Nm^3;

…

Coal and/or lignite

Table 10.5 in Revised Draft 1

BAT-AELs for SO_2 (6/7) – BP 1.3.6

… in which RCG represents the concentration of SO_2 in the raw flue-gas as a yearly average (under the standard conditions given under General considerations) at the inlet of the SO_X abatement system, expressed in mg/Nm^3 at a reference oxygen content of 6 % O_2.

In these cases the daily average BAT-AELs set out in Table 10.5 do not apply

Coal and/or lignite

BAT 3 ter in Revised Draft 1

BAT-AELs for SO_2 (7/7) – BP 1.3.6

Substance/ Parameter	Fuel/Process	… thermal input	Standard(s) (1)	Minimum monitoring frequency	Monitoring associated with
SO_2	Coal and/or lignite including waste co-incineration	All sizes	Generic EN standards	Continuous (2)	BAT 21

(2) In the case of plants with a rated thermal input of < 100 MW_{th} operated in emergency-load mode, the monitoring frequency may be reduced to at least once every year. In the case of plants with a rated thermal input of < 100 MW_{th} operated in peak-load mode, the monitoring frequency may be reduced to at least once every six months. (to be revisited)

Coal and/or lignite

Table 10.6 in Revised Draft 1

BAT-AELs for HCl and HF (1/5) – BP 1.3.7

- Exemption for CFB? (to be revisited)
- Continuous measurements of HCl less accurate (to be revisited)

Coal and/or lignite

Table 10.6 in Revised Draft 1

BAT-AELs for HCl and HF (2/5) – BP 1.3.7

Table 10.6: BAT-associated emission levels (BAT-AELs) for HCl and HF emissions to air from the combustion of coal and/or lignite

Pollutant	Combustion plant total rated thermal input (MW_{th})	BAT-AELs (mg/Nm^3)	
		Average of samples obtained during one year	
		New plant	Existing plant (1)

(1) The lower end of these BAT-AEL ranges may be difficult to achieve in the case of plants fitted with a wet FGD system and a downstream gas-gas heater.

Coal and/or lignite

Table 10.6 in Revised Draft 1

BAT-AELs for HCl and HF (3/5) – BP 1.3.7

Pollutant	Combustion plant total rated thermal input (MW_{th})	BAT-AELs (mg/Nm^3) Average of samples obtained during one year	
		New plant	Existing plant (1)
HCl	≥ 100	1–3	1–5 (2)(3)
	< 100	1–6	2–10 (2)
HF	≥ 100	< 1–2	< 1–3 (3)
	< 100	< 1–3	< 1–6

(2) In the case of CFB boilers, in the case of plants combusting fuels with a chlorine content of > 1000 mg/kg (dry), or in the case of plants operated in peak- or emergency-load mode, the higher end of the range is 20 mg/Nm^3.

(3) In the case of plants operated in peak- or emergency-load modes and in the case of plants fitted with a wet FGD system with a downstream gas-gas heater, the higher end of the BAT-AEL range is 7 mg/Nm^3

Coal and/or lignite

BAT 3 ter in Revised Draft 1

BAT-AELs for HCl and HF (4/5) – BP 1.3.7

Substance/ Parameter	Fuel/ Process	… thermal input	Standard(s) (1)	Minimum monitoring frequency	Monitoring associated with
HCl	Coal and/or lignite	All sizes	EN 1911	At least once every three months (2) (8)	BAT 21
HF			No EN standard available		

(2) In the case of plants with a rated thermal input of < 100 MW_{th} operated in emergency-load mode, the monitoring frequency may be reduced to at least once every year. In the case of plants with a rated thermal input of < 100 MW_{th} operated in peak-load mode, the monitoring frequency may be reduced to at least once every six months.

Coal and/or lignite

BAT 3 ter in Revised Draft 1

BAT-AELs for HCl and HF (5/5) – BP 1.3.7

Substance/ Parameter	Fuel/ Process	… thermal input	Standard(s) (1)	Minimum monitoring frequency	Monitoring associated with
HCl	Coal and/or lignite	All sizes	EN 1911	At least once every three months (2) (8)	BAT 21
HF			No EN standard available		

(8) The monitoring frequency may be reduced if it is demonstrated that the emission levels are consistently within the BAT-AELs set. In these specific cases, periodic measurements could be carried out each time that a change of the fuel and/or waste characteristics may have an impact on the emissions, but in any case at least once every year.

Coal and/or lignite

BAT 23 in Revised Draft 1

Techniques to reduce mercury emissions (1/8) – BP 1.3.10

- The decision on the technique carbon sorbent injection is not supported by CZ, Eurelectric, Euracoal.
- The decision on the technique halogenated additives is not supported by Euracoal.

Coal and/or lignite

BAT 23 in Revised Draft 1

Techniques to reduce mercury emissions (2/8) – BP 1.3.10

BAT 23. In order to reduce mercury emissions to air from the combustion of coal and/or lignite, BAT is to use an appropriate combination of the techniques given below.

	Technique	Description	Applicability
Co-benefit from techniques primarily used to reduce emissions of other pollutants			
a	Bag filter	See description in Section 10.8.	Generally applicable
b	Electrostatic precipitator (ESP)	See description in Section 10.8. Better mercury removal efficiency is achieved at flue-gas temperatures below 130°C	Generally applicable

Coal and/or lignite

BAT 23 in Revised Draft 1

Techniques to reduce mercury emissions (3/8) – BP 1.3.10

	Technique	Description	Applicability
Co-benefit from techniques primarily used to reduce emissions of other pollutants			
c	Selective catalytic reduction (SCR)	See description in Section 10.8. Only used in combination with other techniques to enhance or reduce the mercury oxidation before capture in a subsequent FGD or dedusting system, depending on the selected strategy	Not applicable to combustion plants of < 300 MW_{th} operated in emergency-load mode. Not generally applicable to combustion plants of < 100 MW_{th}. There may be technical and economic restrictions for retrofitting existing plants operated in peak-load mode and existing plants of ≥ 300 MW_{th} operated in emergency-load mode

Coal and/or lignite

BAT 23 in Revised Draft 1

Techniques to reduce mercury emissions (4/8) – BP 1.3.10

	Technique	Description	Applicability
Co-benefit from techniques primarily used to reduce emissions of other pollutants			
d	Flue-gas desulphurisation (FGD) technique (e.g. wet FGD, spray- dry absorber or duct sorbent injection)	See descriptions in Section 10.8	Applicable when the technique is mainly used for SO_X, HCl and/or HF abatement. Wet FGD is not applicable to combustion plants operated in emergency-load mode. There may be technical and economic restrictions for applying wet FGD to combustion plants of < 300 MW_{th}, and for retrofitting existing combustion plants operated in peak-load mode

Coal and/or lignite

BAT 23 in Revised Draft 1

Techniques to reduce mercury emissions (5/8) – BP 1.3.10

Technique		Description	Applicability
Specific techniques to reduce mercury emissions			
e	Fuel choice	Use coal and/or lignite fuels with low mercury content	Applicable within the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State

Coal and/or lignite

BAT 23 in Revised Draft 1

Techniques to reduce mercury emissions (6/8) – BP 1.3.10

	Technique	Description	Applicability
Specific techniques to reduce mercury emissions			
f	Carbon sorbent (e.g. activated carbon or halogenated activated carbon) injection in the flue-gas	See description in Section 10.8. Generally used in combination with an ESP/bag filter. The use of this technique may require additional treatment steps to further segregate the mercury-containing carbon fraction prior to further reuse of the fly ash	Generally applicable

Coal and/or lignite

BAT 23 in Revised Draft 1

Techniques to reduce mercury emissions (7/8) – BP 1.3.10

Technique		Description	Applicability
Specific techniques to reduce mercury emissions			
g	Use of halogenated additives in the fuel or injected in the furnace	Addition of halogens (e.g. brominated additives) into the furnace to oxidise elemental mercury into soluble or particulate species, thereby enhancing mercury removal in downstream abatement systems	Generally applicable in the case of a low halogen content in the fuel~~, within the constraints associated with the control of halogen emissions to air and within the constraints associated with the corrosion potential of equipment~~

Coal and/or lignite

BAT 23 in Revised Draft 1

Techniques to reduce mercury emissions (8/8) – BP 1.3.10

Technique		Description	Applicability
Specific techniques to reduce mercury emissions			
h	Fuel pretreatment	Fuel washing, blending and mixing in order to limit/reduce the mercury content or improve mercury capture by pollution control equipment	Applicability is subject to a previous survey for characterising the fuel and for estimating the potential effectiveness of the technique

Coal and/or lignite

Tables 10.8/10.9 in Revised Draft 1

BAT-AELs for mercury (1/3) – BP 1.3.11

- The decision on the BAT-AELs for coal-fired plants is not supported by NL, EEB, CAN EUROPE, Euracoal, Eurelectric, ESWET.
- The decision on the BAT-AELs for lignite-fired plants is not supported by CZ, EE, EL, PL, EEB, CAN Europe, ESWET, Euracoal, Eurelectric, EPPSA, Euroheat & Power.

Coal and/or lignite

Table 10.8 in Revised Draft 1

BAT-AELs for mercury (2/3) – BP 1.3.11

Table 10.8: BAT-associated emission levels (BAT-AELs) for mercury emissions to air from the combustion of coal

Combustion plant total rated thermal input (MW_{th})	BAT-AELs ($\mu g/Nm^3$) ~~(1)~~		Averaging period
	New plant	Existing plant	
< 300	< 1–3 (1)	< 1–9 (1)(2)	Average of samples obtained during one year
≥ 300	< 1–2	< 1–4 (2)	Yearly average

(1) These BAT-AELs do not apply in the case of plants ~~of < 300 MW_{th}~~ operated in peak- or emergency-load modes.

(2) The lower end of the range can be achieved with specific mercury abatement techniques.

Coal and/or lignite

Table 10.9 in Revised Draft 1

BAT-AELs for mercury (3/3) – BP 1.3.11

Table 10.9: BAT-associated emission levels (BAT-AELs) for mercury emissions to air from the combustion of lignite

Combustion plant total rated thermal input (MW_{th})	BAT-AELs ($\mu g/Nm^3$) ~~(1)~~		Averaging period
	New plant	Existing plant	
< 300	< 1–5 (1)	< 1–10 (1)(2)	Average of samples obtained during one year
≥ 300	< 1–4	< 1–7 (2)	Yearly average

(1) These BAT-AELs do not apply in the case of plants operated in peak- or emergency-load modes.

(2) The lower end of the range can be achieved with specific mercury abatement techniques.