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 6

Iron & steel process gases in boilers

BAT 52 in Revised Draft 1

Techniques to reduce NO_X emissions (1/6) – BP 1.7.1

- The decision on the techniques to reduce NO_X emissions is not supported by Eurofer, Euracoal.
- Indicate in the BREF that the SNCR technique is currently not used in Europe.

Iron & steel process gases in boilers

BAT 52 in Revised Draft 1

Techniques to reduce NO_X emissions (2/6) – BP 1.7.1

BAT 52 In order to prevent and/or reduce NO_X emissions to air from the combustion of iron and steel process gases in boilers, BAT is to use one or a combination of the techniques given below.

Technique		Description	Applicability
a	Low-NO_X burners (LNB)	See description in Section 10.8. Specially designed low-NO_X burners in multiple rows per type of fuel or including specific features for multi-fuel firing (e.g. multiple dedicated nozzles for burning different fuels, or including fuels premixing)	Generally applicable

Iron & steel process gases in boilers

BAT 52 in Revised Draft 1

Techniques to reduce NO_X emissions (3/6) – BP 1.7.1

Technique		Description	Applicability
b	Air staging	See description in Section 10.8	Generally applicable
c	Fuel staging	See description in Section 10.8	Generally applicable
d	Flue-gas recirculation	See description in Section 10.8	Generally applicable

Iron & steel process gases in boilers

BAT 52 in Revised Draft 1

Techniques to reduce NO_X emissions (4/6) – BP 1.7.1

	Technique	Description	Applicability
e	Selective catalytic reduction (SCR)	See description in Section 10.8	Not applicable to combustion plants operated in emergency-load mode. Not generally applicable to plants of < 100 MW_{th}. Retrofitting existing plants may be constrained by the availability of sufficient space and by the combustion plant configuration. ~~There may be technical and economic restrictions for retrofitting existing plants operated in peak-load mode.~~

Iron & steel process gases in boilers

BAT 52 in Revised Draft 1

Techniques to reduce NO_X emissions (5/6) – BP 1.7.1

Technique		Description	Applicability
f	Selective non-catalytic reduction (SNCR)	See description in Section 10.8	Not applicable to combustion plants operated in emergency-load mode. ~~The applicability may be limited in the case of combustion plants operated in peak-load mode with frequent fuel changes and frequent load variations~~

Iron & steel process gases in boilers

BAT 52 in Revised Draft 1

Techniques to reduce NO_X emissions (6/6) – BP 1.7.1

	Technique	Description	Applicability
g	Advanced control system	See description in Section 10.8. This technique is used in combination with other techniques	Generally applicable to new plants. The applicability to old combustion plants may be constrained by the need to retrofit the combustion and/or control command system(s)
h	Process gas management system	See BAT 56 b	See BAT 56 b

Iron & steel process gases in CCGTs

BAT 53 in Revised Draft 1

Techniques to reduce NO_X emissions (1/6) – BP 1.7.2

- The decision on the techniques to reduce NO_X emissions is not supported by Eurofer.

Iron & steel process gases in CCGTs

BAT 53 in Revised Draft 1

Techniques to reduce NO_X emissions (2/6) – BP 1.7.2

BAT 53 In order to prevent and/or reduce NO_X emissions to air from the combustion of iron and steel process gases in CCGTs, BAT is to use one or a combination of the techniques given below.

Iron & steel process gases in CCGTs

BAT 53 in Revised Draft 1

Techniques to reduce NO_X emissions (3/6) – BP 1.7.2

	Technique	Description	Applicability
a	Dry low-NO_X burners (DLN)	See description in Section 10.8. DLN that combust iron and steel process gases differ from the ones that combust natural gas only	Applicable within the constraints associated with the reactiveness of iron and steel process gases such as coke oven gas. The applicability may be limited in the case of ~~a very old~~ turbines where a retrofitting package is not available or when steam/water addition ~~injection~~ systems are installed

Iron & steel process gases in CCGTs

BAT 53 in Revised Draft 1

Techniques to reduce NO_X emissions (4/6) – BP 1.7.2

Technique		Description	Applicability
b	Low-NO_X burners (LNB)	See description in Section 10.8	Only applicable to supplementary firing for heat recovery steam generators (HRSG) of combined cycle gas turbine (CCGT) combustion plants
c	Selective catalytic reduction (SCR)	See description in Section 10.8	~~Not applicable to combustion plants operated in emergency-load mode.~~ Retrofitting existing plants may be constrained by the availability of sufficient space. ~~There may be technical and economic restrictions for retrofitting existing plants operated in peak-load mode~~

Iron & steel process gases in CCGTs

BAT 53 in Revised Draft 1

Techniques to reduce NO_X emissions (5/6) – BP 1.7.2

	Technique	Description	Applicability
d	Water/steam addition	See description in Section 10.8. In dual fuel gas turbines using DLN for iron and steel process gases combustion, water/steam addition is generally used when combusting natural gas	The applicability may be limited due to water availability
e	Advanced control system	See description in Section 10.8. This technique is used in combination with other techniques	Generally applicable to new plants. The applicability to old combustion plants may be constrained by the need to retrofit the combustion and/or control command system(s)

Iron & steel process gases in CCGTs

BAT 53 in Revised Draft 1

Techniques to reduce NO_X emissions (6/6) – BP 1.7.2

	Technique	Description	Applicability
f	Process gas management system	See BAT 56 b	See BAT 56 b

Iron & steel process gases

BAT 54 in Revised Draft 1

Techniques to reduce CO emissions (1/2) – BP 1.7.3

- The decision on the technique oxidation catalysts is not supported by Eurofer.
- Add in the BREF that the technique oxidation catalysts is currently not used in Europe.

Iron & steel process gases

BAT 54 in Revised Draft 1

Techniques to reduce CO emissions (2/2) – BP 1.7.3

BAT 54 In order to prevent and/or reduce CO emissions to air from the combustion of iron and steel process gases, 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 applicable
e	Oxidation catalysts	See description in Section 10.8	Only applicable to CCGTs. The applicability may be limited by lack of space, the load requirements and the sulphur content of the fuel

Iron & steel process gases

Table 10.32 in Revised Draft 1

BAT-AELs for NO_X and CO (1/6) – BP 1.7.4

- Consider adding a reference to the mixing rule of the IED in the BAT conclusions.
- The decision on the BAT-AELs for NO_X is not supported by Eurelectric, EU Turbines, Eurofer.

Iron & steel process gases

Table 10.32 in Revised Draft 1

BAT-AELs for NO_X and CO (2/6) – BP 1.7.4

Table 10.32: BAT-associated emission levels (BAT-AELs) for NO_X and CO emissions to air from the combustion of 100 % iron and steel process gases

Combustion plant type	O_2 reference level (%)	BAT-AELs (mg/Nm^3) (1)		
		NO_X		CO
		Daily average or average over the sampling period	Yearly average (4)	Yearly average (4)

(1) Plants combusting a mixture of gases with an equivalent LHV of > 20 MJ/Nm^3 are expected to emit at the higher end of the BAT-AEL ranges.

(4) These BAT-AELs do not apply to plants operated in peak- or emergency-load modes.

Iron & steel process gases

Table 10.32 in Revised Draft 1

BAT-AELs for NO_X and CO (3/6) – BP 1.7.4

Combustion plant type	O_2 reference level (%)	BAT-AELs (mg/Nm^3) (1)		
		NO_X		CO
		Daily average …	Yearly average (4)	Yearly average (4)
New boiler	3	22–100 ~~(5)(9)~~	15–65	< 5–35

~~(5) The higher end of the BAT-AEL range may be different on days when auxiliary liquid fuels are used. In this case, the higher end of the BAT-AEL range may correspond to the higher end of the BAT-AEL range reported in the BAT conclusions that apply to the combustion of the corresponding (auxiliary) fuel and to the case of plants operated in peak- or emergency-load modes.~~

Iron & steel process gases

Table 10.32 in Revised Draft 1

BAT-AELs for NO_X and CO (4/6) – BP 1.7.4

Combustion plant type	O_2 reference level (%)	BAT-AELs (mg/Nm³) (1)		
		NO_X		CO
		Daily average …	Yearly average (4)	Yearly average (4)
Existing boiler	3	22–160 ~~(5)~~ (6) (7)	20–100 (7)	< 5–100

~~(5) The higher end of the BAT-AEL range may be different on days when auxiliary liquid fuels are used. In this case, the higher end of the BAT-AEL range may correspond to the higher end of the BAT-AEL range reported in the BAT conclusions that apply to the combustion of the corresponding (auxiliary) fuel and to the case of plants operated in peak- or emergency-load modes.~~

(6) The higher end of the BAT-AEL range may be exceeded ~~a few days every year in the case of plants not fitted with~~ when SCR cannot be used and when using a high share of COG (e.g. > 50 %) and/or combusting COG with a relatively high level of H_2. In this case the higher end of the BAT-AEL range is 220 mg/Nm³.

(7) The lower end of the BAT-AEL range can be achieved when using SCR.

Iron & steel process gases

Table 10.32 in Revised Draft 1

BAT-AELs for NO_X and CO (5/6) – BP 1.7.4

Combustion plant type	O_2 reference level (%)	BAT-AELs (mg/Nm³) (1)		
		NO_X		CO
		Daily average or average over the sampling period	Yearly average (4)	Yearly average (4)
New CCGT	15	30–50	20–35	< 5–20
Existing CCGT	15	30–70 ~~(8)~~	20–50 (7)	< 5–20

(7) The lower end of the BAT-AEL range can be achieved when using SCR.

~~(8) In the case of plants operated in emergency- or peak-load modes, the higher end of the BAT-AEL range is 80 mg/Nm³.~~

Iron & steel process gases

BAT 3 ter in Revised Draft 1

BAT-AELs for NO_X and CO (6/6) – BP 1.7.4

Substance/ Parameter	Fuel/ Process	Combustion plant rated thermal input	Standard(s) (1)	Minimum monitoring frequency	Monitoring associated with
NO_X	Iron and steel process gases	All sizes	Generic EN standards	Continuous (2)	BAT 52, 53
CO					BAT 54

(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)

Iron & steel process gases

BAT 56 in Revised Draft 1

Techniques to reduce SO_X emissions (1/4) – BP 1.7.5

- The decision on the techniques to reduce SO_2 emissions is not supported by Eurofer.

Iron & steel process gases

BAT 56 in Revised Draft 1

Techniques to reduce SO_X emissions (2/4) – BP 1.7.5

BAT 56 In order to prevent and/or reduce SO_X emissions to air from the combustion of iron and steel process gases, BAT is to use a combination of the techniques given below.

	Technique	Description	Applicability
a	Coke oven gas pretreatment at the iron- and steel-works	Use of one of the following techniques: • desulphurisation by absorption systems; • wet oxidative desulphurisation	Only applicable to coke-oven ~~integrated~~ plants

Iron & steel process gases

BAT 56 in Revised Draft 1

Techniques to reduce SO_X emissions (3/4) – BP 1.7.5

Technique		Description	Applicability
b	Process gas management system and auxiliary fuel choice	See description in Section 10.8. Use, as much as the iron- and steel-works allow it, of: • a majority of blast furnace gas with low sulphur content in the fuel diet; • a combination of fuels with averaged low sulphur content, e.g. individual process fuels with very low S content such as: …	Generally applicable, within the constraints associated with the availability of different types of fuel

Iron & steel process gases

BAT 56 in Revised Draft 1

Techniques to reduce SO_X emissions (4/4) – BP 1.7.5

Technique		Description	Applicability
b	Process gas management system and auxiliary fuel choice	… • BFG with sulphur content < 10 mg/Nm^3; • coke oven gas with sulphur content < 300 mg/Nm^3; and auxiliary fuels such as: • natural gas; • liquid fuels with sulphur content of ≤ 0.4 % (in boilers). Use of a limited amount of fuels with higher sulphur content	…

Iron & steel process gases

Table 10.34 in Revised Draft 1

BAT-AELs for SO_2 (1/4) – BP 1.7.6

- The decision on the BAT-AELs for SO_2 is not supported by UK, EU turbines, Eurofer, Eurelectric.

Iron & steel process gases

Table 10.34 in Revised Draft 1

BAT-AELs for SO_2 (2/4) – BP 1.7.6

Table 10.34: BAT-associated emission levels (BAT-AELs) for SO_2 emissions from the combustion of iron and steel process gases

Iron & steel process gases

Table 10.34 in Revised Draft 1

BAT-AELs for SO_2 (3/4) – BP 1.7.6

Type of combustion plant	O_2 reference level (%)	BAT-AELs for SO_2 (mg/Nm^3)	
		Daily average or average over the sampling period	Yearly average (4)
New or existing Boiler	3	50–200 (2) ~~(3)~~	25–150
New or existing CCGT	15	20–70	10–45

(2) The higher end of the BAT-AEL range may be exceeded when using a high share of COG (e.g. > 50 %). In this case the higher end of the BAT-AEL range is 300 mg/Nm^3.

~~(3) The higher end of the BAT-AEL range may be different on days when auxiliary liquid fuels are used. In this case, the higher end of the BAT-AEL range may correspond to the higher end of the BAT-AEL range reported in the BAT conclusions that apply to the combustion of the corresponding (auxiliary) fuel and to the case of plants operated in peak- or emergency-load modes.~~

~~(4) These BAT-AELs do not apply when plants operate in peak-load or emergency-load modes.~~

Iron & steel process gases

BAT 3 ter in Revised Draft 1

BAT-AELs for SO_2 (4/4) – BP 1.7.6

Substance/ Parameter	Fuel/ Process	… thermal input	Standard(s) (1)	Minimum monitoring frequency	Monitoring associated with
SO_2	Iron and steel process gases	All sizes	Generic EN standards	Continuous (2)	BAT 56

(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)

Iron & steel process gases

BAT 58 in Revised Draft 1

Techniques to reduce dust emissions (1/3) – BP 1.7.7

BAT 58 In order to reduce dust emissions to air from the combustion of iron and steel process gases, BAT is to use one or a combination of the techniques given below.

Technique		Description	Applicability
a	Fuel choice / management	Use of a combination of process gases and auxiliary fuels with low averaged dust or ash content ~~as much as the iron- and steel-works allow it~~	Generally applicable, within the constraints associated with the availability of different types of fuel

Iron & steel process gases

BAT 58 in Revised Draft 1

Techniques to reduce dust emissions (2/3) – BP 1.7.7

Technique		Description	Applicability
b	Blast furnace gas pretreatment at the iron- and steel-works	Use of one or a combination of dry dedusting devices (e.g. deflectors, dust catchers, cyclones, electrostatic precipitators) and/or subsequent dust abatement (venturi scrubbers, hurdle-type scrubbers, annular gap scrubbers, wet electrostatic precipitators, disintegrators)	Only applicable if blast furnace gas is combusted

Iron & steel process gases

BAT 58 in Revised Draft 1

Techniques to reduce dust emissions (3/3) – BP 1.7.7

	Technique	Description	Applicability
c	Basic oxygen furnace gas pretreatment at the iron- and steel-works	Use of dry (e.g. ESP or bag filter) or wet (e.g. wet ESP or scrubber) dedusting. Further description is given in the Iron and Steel BREF	Only applicable if basic oxygen furnace gas is combusted
d	Electrostatic precipitator (ESP)	See descriptions in Section 10.8.	Only applicable to plants combusting auxiliary fuels with high ash content in a significant proportion
e	Bag filter		

Iron & steel process gases

Table 10.36 in Revised Draft 1

BAT-AELs for dust (1/4) – BP 1.7.8

- The decision on the BAT-AELs for dust is not supported by Eurelectric, EU Turbines, Eurofer.

Iron & steel process gases

Table 10.36 in Revised Draft 1

BAT-AELs for dust (2/4) – BP 1.7.8

Table 10.36: BAT-associated emission levels (BAT-AELs) for dust emissions to air from the combustion of iron and steel process gases

Iron & steel process gases

Table 10.36 in Revised Draft 1

BAT-AELs for dust (3/4) – BP 1.7.8

Combustion plant type	BAT-AELs for dust (mg/Nm^3)		O_2 reference level (%)
	Daily average or average over the sampling period	Yearly average	
Boiler	2–10 ~~(3)~~	2–7	3
CCGT	2–5	2–5	15

~~(3) The upper end of the BAT-AEL range may be higher on days when auxiliary liquid fuels are used. In this case, the higher end of the BAT-AEL range may correspond to the higher end of the BAT-AEL range reported in the BAT conclusions that apply to the combustion of the corresponding (auxiliary) fuel and to the case of plants operated in peak- or emergency-load modes.~~

~~NB: NA = No BAT-AELs~~

Iron & steel process gases

BAT 3 ter in Revised Draft 1

BAT-AELs for dust (4/4) – BP 1.7.8

Substance/ Parameter	Fuel/ Process	Combustion plant total rated thermal input	Standard(s) (1)	Minimum monitoring frequency	Monitoring associated with
Dust	Iron and steel process gases	All sizes	Generic EN standards	Continuous (2)(3)	BAT 58

(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)

(3) In the case of boilers with a rated thermal input of < 100 MW_{th} or of CCGTs the monitoring frequency may be at least once every six months if the emissions are proven to be sufficiently stable.

Chemical industry process fuels

BAT 65 in Revised Draft 1

Techniques to reduce NO_X and CO emissions (1/5) – BP 1.9.3.1

BAT 65 In order to prevent and/or reduce NO_X emissions to air while limiting CO emissions to air from combustion plants using process fuels from the chemical industry, BAT is to use one or a combination of the techniques given below.

	Technique	Description	Applicability
a	Low-NO_X burners (LNB)	See description in Section 10.8	Generally applicable
b	Air staging	See description in Section 10.8	Generally applicable

Chemical industry process fuels

BAT 65 in Revised Draft 1

Techniques to reduce NO_X and CO emissions (2/5) – BP 1.9.3.1

	Technique	Description	Applicability
c	Fuel staging	See description in Section 10.8. Applying fuel staging when using liquid fuel mixtures may require a specific burner design	Generally applicable
d	Flue-gas recirculation	See description in Section 10.8	Generally applicable to new plants. Applicable to existing plants within the constraints associated with chemical installation safety

Chemical industry process fuels

BAT 65 in Revised Draft 1

Techniques to reduce NO_X and CO emissions (3/5) – BP 1.9.3.1

	Technique	Description	Applicability
e	Selective non-catalytic reduction (SNCR)	See description in Section 10.8.	Generally applicable to new plants. Applicable to existing plants within the constraints associated with chemical installation safety. Not applicable to combustion plants operated in emergency-load mode. The applicability may be limited in the case of plants operated in peak-load mode with frequent fuel changes and frequent load variations

Chemical industry process fuels

BAT 65 in Revised Draft 1

Techniques to reduce NO_x and CO emissions (4/5) – BP 1.9.3.1

	Technique	Description	Applicability
f	Selective catalytic reduction (SCR)	See description in Section 10.8.	Generally applicable for new plants. Applicable to existing plants within the constraints associated with duct configuration, space availability, as well as chemical installation safety. Not applicable to combustion plants operated in emergency-load mode. There may be technical and economic restrictions for retrofitting existing plants operated in peak-load mode. Not generally applicable to combustion plants of < 100 MW_{th}

Chemical industry process fuels

BAT 65 in Revised Draft 1

Techniques to reduce NO_X and CO emissions (5/5) – BP 1.9.3.1

	Technique	Description	Applicability
g	Fuel choice	See description in Section 10.8	Applicable within the constraints associated with the availability of different types of fuel
h	Water/steam addition	See description in Section 10.8	The applicability may be limited due to water availability
i	Advanced control system	See description in Section 10.8	Generally applicable

Chemical industry process fuels

Table 10.39 in Revised Draft 1

BAT-AELs for NO_X and CO (1/4) – BP 1.9.3.2

- The decision on the BAT-AELs for NO_X emissions is not supported by CEFIC.
- Add in the chapter on 'Concluding remarks and recommendations for future work' that further information should be gathered during the next BREF review on the impact of high nitrogen and hydrogen contents on NO_X emissions.

Chemical industry process fuels

Table 10.39 in Revised Draft 1

BAT-AELs for NO_X and CO (2/4) – BP 1.9.3.2

Table 10.39: BAT-associated emission levels (BAT-AELs) for NO_X and CO emissions to air from combustion plants using process fuels from the chemical industry

Chemical industry process fuels

Table 10.39 in Revised Draft 1

BAT-AELs for NO_X and CO (3/4) – BP 1.9.3.2

Fuel phase	BAT-AELs (mg/Nm³)				
	NO_X				CO
	Yearly average		Daily average or average over the sampling period		Yearly average
	New plant	Existing plant ~~(2)~~	New plant	Existing plant	New or existing plant ~~(2)~~
Mixture of gases and liquids	30–85	80–290 (1)	50–110	100–330 (1)	< 5–30
Gases only	20–80	70–180	30–100	85–210	< 5–30

(1) For existing plants ~~of < 100 MW_{th}~~ using liquid fuels with a nitrogen content higher than 0.6 % (w/w), the higher end of the BAT-AEL range is 380 mg/Nm³.

~~(2) The yearly BAT-AELs do not apply to existing plants operated in peak- or emergency-load modes.~~

Chemical industry process fuels

BAT 3 ter in Revised Draft 1

BAT-AELs for NO_X and CO (4/4) – BP 1.9.3.2

Substance/ Parameter	Fuel/Process	… thermal input	Standard(s) (1)	Minimum monitoring frequency	Monitoring associated with
NO_X	Process fuels from the chemical industry in boilers	All sizes	Generic EN standards	Continuous (2)	BAT 65
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.

Chemical industry process fuels

BAT 66 in Revised Draft 1

Techniques to reduce SO_X, HCl & HF emissions (1/6) – BP 1.9.4.1

BAT 66 In order to reduce SO_X, HCl and HF emissions to air from the combustion of 100 % process fuels from the chemical industry in boilers, BAT is to use one or a combination of the techniques given below.

Chemical industry process fuels

BAT 66 in Revised Draft 1

Techniques to reduce SO_X, HCl & HF emissions (2/6) – BP 1.9.4.1

	Technique	Description	Applicability
a	Wet flue-gas desulphurisation (Wet FGD)	See description in Section 10.8	Generally applicable to new plants. Applicable to existing plants within the constraints associated with duct configuration, space availability, and chemical installation safety. FGD and seawater FGD are not applicable to combustion plants operated in emergency-load mode. There may be technical and economic restrictions for applying wet FGD or seawater FGD to combustion plants of < 300 MW_{th}, and for retrofitting combustion plants operated in peak-load mode with wet FGD or seawater FGD

Chemical industry process fuels

BAT 66 in Revised Draft 1

Techniques to reduce SO_X, HCl & HF emissions (3/6) – BP 1.9.4.1

Technique		Description	Applicability
b	Wet scrubber	See description in Section 10.8. Wet scrubbing is used to remove HCl and HF when no Wet FGD is used to reduce SO_X emissions	Generally applicable to new plants. Applicable to existing plants within the constraints associated with duct configuration, space availability, and chemical installation safety.
c	Boiler sorbent injection (in-furnace or in-bed)	See description in Section 10.8	

Chemical industry process fuels

BAT 66 in Revised Draft 1

Techniques to reduce SO_X, HCl & HF emissions (4/6) – BP 1.9.4.1

Technique		Description	Applicability
d	Duct sorbent injection (DSI)	See description in Section 10.8. The technique is used in combination with a dust abatement technique	Generally applicable to new plants. Applicable to existing plants within the constraints associated with duct configuration, space availability, and chemical installation safety.
e	Spray-dry absorber (SDA)	See description in Section 10.8	

Chemical industry process fuels

BAT 66 in Revised Draft 1

Techniques to reduce SO_x, HCl & HF emissions (5/6) – BP 1.9.4.1

Technique		Description	Applicability
f	Seawater FGD	See description in Section 10.8	Generally applicable to new plants. Applicable to existing plants within the constraints associated with duct configuration, space availability, and chemical installation safety. FGD and seawater FGD are not applicable to combustion plants operated in emergency-load mode. There may be technical and economic restrictions for applying wet FGD or seawater FGD to combustion plants of < 300 MW_{th}, and for retrofitting combustion plants operated in peak-load mode with wet FGD or seawater FGD

Chemical industry process fuels

BAT 66 in Revised Draft 1

Techniques to reduce SO_X, HCl & HF emissions (6/6) – BP 1.9.4.1

Technique		Description	Applicability
g	Fuel choice	See description in Section 10.8	Applicable within the constraints associated with the availability of different types of fuel and/or an alternate use of the process fuel

Chemical industry process fuels

Table 10.40 in Revised Draft 1

BAT-AELs for SO_2, HCl & HF (1/8) – BP 1.9.4.2–1.9.4.3

- The decision on the BAT-AEL for SO_2 is not supported by CEFIC.
- The decision on the BAT-AEL for HCl is not supported by ESWET.

Chemical industry process fuels

Table 10.40 in Revised Draft 1

BAT-AELs for SO_2, HCl & HF (2/8) – BP 1.9.4.2–1.9.4.3

Table 10.40: BAT-associated emission levels (BAT-AELs) for SO_2 emissions to air from the combustion of 100 % process fuels from the chemical industry in a boiler

Chemical industry process fuels

Table 10.40 in Revised Draft 1

BAT-AELs for SO_2, HCl & HF (3/8) – BP 1.9.4.2–1.9.4.3

Pollutant	BAT-AELs (mg/Nm^3)	
	Yearly average ~~(1)~~	Daily average or average over the sampling period ~~(2)~~
SO_2	10–110	90–200

~~(1) The yearly BAT-AELs do not apply to existing plants operated in peak- or emergency-load modes.~~

~~(2) The higher end of the BAT-AEL range may be different on days when auxiliary liquid fuels are used. In this case, the higher end of the BAT-AEL range may correspond to the higher end of the BAT-AEL range reported in the BAT conclusions that apply to the combustion of the corresponding auxiliary fuel and to the case of plants operated in peak- or emergency-load modes.~~

Chemical industry process fuels

BAT 3 ter in Revised Draft 1

BAT-AELs for SO_2, HCl & HF (4/8) – BP 1.9.4.2–1.9.4.3

Substance/ Parameter	Fuel/Process	… thermal input	Standard(s) (1)	Minimum monitoring frequency	Monitoring associated with
SO_2	Process fuels from the chemical industry in boilers	All sizes	Generic EN standards	Continuous (2) (14)	BAT 66

(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)

(14) For plants of < 100 MW_{th}, the monitoring frequency may be adjusted after an initial characterisation of the fuel (see BAT 5) based on a risk assessment of the load of pollutants in the emissions to air …

Chemical industry process fuels

Table 10.41 in Revised Draft 1

BAT-AELs for SO_2, HCl & HF (5/8) – BP 1.9.4.2–1.9.4.3

Table 10.41: BAT-associated emission levels (BAT-AELs) for HCl and HF emissions to air from the combustion of process fuels from the chemical industry in a boiler

Chemical industry process fuels

Table 10.41 in Revised Draft 1

BAT-AELs for SO_2, HCl & HF (6/8) – BP 1.9.4.2–1.9.4.3

Combustion plant total rated thermal input (MW_{th})	BAT-AELs (mg/Nm^3)			
	HCl		HF	
	~~Average over the sampling period~~ Average of samples obtained during one year			
	New plant	Existing plant	New plant	Existing plant
< 100	1–7	2–15	< 1–3	< 1–6
≥ 100	1–5	1–9 (1)	< 1–2	< 1–3

(1) In the case of plants operated in peak- or emergency-load modes, the BAT-AEL range is 1–10 ~~2–15~~ mg/Nm^3. (to be revisited)

(2) In the case of plants operated in peak- or emergency-load modes, the BAT-AEL range is < 1–6 ~~0.2–10~~ mg/Nm^3. (to be revisited)

Chemical industry process fuels

BAT 3 ter in Revised Draft 1

BAT-AELs for SO_2, HCl & HF (7/8) – BP 1.9.4.2–1.9.4.3

Substance/ Parameter	Fuel/Process	… thermal input	Standard(s) (1)	Minimum monitoring frequency	Monitoring associated with
HCl	Process fuels from the chemical industry in boilers	All sizes	EN 1911	At least once every three months (2)(8)(15)	BAT 66
HF			No EN standard available		

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

(15) The monitoring frequency may be adjusted after an initial characterisation of the fuel (see BAT 5) based on a risk assessment of the load of pollutants in the emissions to air

…

Chemical industry process fuels

BAT 3 ter in Revised Draft 1

BAT-AELs for SO_2, HCl & HF (8/8) – BP 1.9.4.2–1.9.4.3

Substance/ Parameter	Fuel/Process	… thermal input	Standard(s) (1)	Minimum monitoring frequency	Monitoring associated with
HCl	Process fuels from the chemical industry in boilers	All sizes	EN 1911	At least once every three months (2) (8)	BAT 66
HF			No EN standard available		

(8) The 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.

Chemical industry process fuels

BAT 67 in Revised Draft 1

Techniques/BAT-AELs for dust and metals (1/5) – BP 1.9.5

- The decision on the BAT-AEL for dust is not supported by ESWET, EEB, CAN Europe.
- The decision on the dust monitoring is not supported by CEFIC.

Chemical industry process fuels

BAT 67 in Revised Draft 1

Techniques/BAT-AELs for dust and metals (2/5) – BP 1.9.5

BAT 67 In order to reduce emissions to air of dust, particulate-bound metals, and trace species from the combustion of process fuels from the chemical industry in boilers, BAT is to use one or a combination of the techniques given below.

Technique		Description	Applicability
a	Fuel choice	See description in Section 10.8. Use of a combination of process fuels from the chemical industry and auxiliary fuels with low averaged dust or ash content	Applicable within the constraints associated with the availability of different types of fuel.

Chemical industry process fuels

BAT 67 in Revised Draft 1

Techniques/BAT-AELs for dust and metals (3/5) – BP 1.9.5

	Technique	Description	Applicability
b	Bag filter	See description in Section 10.8	Generally applicable
c	~~High-performance~~ Electrostatic precipitator (ESP)	See description in Section 10.8	
d	Dry, semi-dry or wet FGD system	See description in Section 10.8	See BAT 66 ~~Generally applicable when the technique is mainly used for SO_x, HCl and/or HF abatement~~

Chemical industry process fuels

Table 10.42 in Revised Draft 1

Techniques/BAT-AELs for dust and metals (4/5) – BP 1.9.5

Table 10.42: BAT-associated emission levels (BAT-AELs) for dust emission to air from the combustion of 100 % process fuels from the chemical industry in a boiler

Combustion plant total rated thermal input (MW_{th})	BAT-AELs for dust (mg/Nm^3)			
	Yearly average		Daily average or average over the sampling period	
	New plant	Existing plant	New plant	Existing plant
≥ 50 MW_{th} ~~All sizes~~	2–5	2–15	2–10 ~~(1)~~	2–25 ~~(1)~~

~~(1) The upper end of the BAT-AEL range may be higher on days when auxiliary liquid fuels are used. In this case, the higher end of the BAT-AEL range may correspond to the higher end of the BAT-AEL range reported in the BAT conclusions that apply to the combustion of the corresponding (auxiliary) fuel and to the case of plants operated in peak- or emergency-load modes.~~

Chemical industry process fuels

BAT 3 ter in Revised Draft 1

Techniques/BAT-AELs for dust and metals (5/5) – BP 1.9.5

Substance/ Parameter	Fuel/Process	… thermal input	Standard(s) (1)	Minimum monitoring frequency	Monitoring associated with
Dust	Process fuels from the chemical industry in boilers	All sizes	Generic EN standards and EN 13284-2	Continuous (2)	BAT 67

(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)

Techniques/BAT-AELs for TVOC and PCDD/F (1/7) – BP 1.9.7

- The decision on the monitoring of PCDD/F is not supported by EEB, CAN Europe, ESWET.

Chemical industry process fuels

Table 10.45 in Revised Draft 1

Techniques/BAT-AELs for TVOC and PCDD/F (2/7) – BP 1.9.7

BAT-AELs

PCCD/F

- Align the BAT-AEL with the one for waste co-incineration in biomass-, peat-, coal- and/or lignite-fired combustion plants, taking into account the differences in the reference oxygen level, and express it as an average over the sampling period.

TVOC

- Align the BAT-AEL with the one for waste co-incineration in biomass-, peat-, coal- and/or lignite-fired combustion plants, taking into account the differences in the reference oxygen level, and express it as an average over the sampling period.

Techniques/BAT-AELs for TVOC and PCDD/F (3/7) – BP 1.9.7

BAT 69 In order to reduce emissions to air of volatile organic compounds and polychlorinated dibenzo-dioxins and -furans from the combustion of process fuels from the chemical industry in boilers , BAT is to use one or a combination of the techniques in BAT 4 and below.

Techniques/BAT-AELs for TVOC and PCDD/F (4/7) – BP 1.9.7

	Technique	Description	Applicability
a	Activated carbon injection	See description in Section 10.8	Only applicable to combustion plants using fuels derived from chemical processes involving chlorinated substances. Generally applicable to new plants. Applicable to existing plants within the constraints associated with duct configuration, space availability, as well as chemical installation safety
b	Selective catalytic reduction (SCR)	See description in Section 10.8. The SCR system is adapted and larger in comparison with an SCR system only used for NO_X reduction	
c	Rapid quenching through wet scrubbing / flue-gas condenser	See description of wet scrubbing / flue-gas condenser in Section 10.8	

Chemical industry process fuels

Table 10.45 in Revised Draft 1

Techniques/BAT-AELs for TVOC and PCDD/F (5/7) – BP 1.9.7

Table 10.45: BAT-associated emission levels (BAT-AELs) for PCDD/F and TVOC emissions to air from the combustion of 100 % process fuels from the chemical industry in a boiler

Pollutant	Unit	BAT-AELs (to be revisited)
		Average over the sampling period
PCDD/F (1)	~~pg~~ ng I-TEQ/Nm^3	~~1–100~~ < 0.0024–0.036
TVOC	mg/Nm^3	~~1–24~~ 0.6–18

(1) These BAT-AELs only apply to combustion plants using fuels derived from chemical processes involving chlorinated substances.

Chemical industry process fuels

BAT 3 ter in Revised Draft 1

Techniques/BAT-AELs for TVOC and PCDD/F (6/7) – BP 1.9.7

Substance/ Parameter	Fuel/ Process	… thermal input	Standard(s) (1)	Minimum monitoring frequency	Monitoring associated with
PCDD/F	Process fuels from chemical industry in boilers	All sizes	EN 1948-1, EN 1948-2, EN 1948-3	At least once every six months (8) (12)	BAT 69

(8) The frequency may be reduced if it is demonstrated that the emission levels are proven to be sufficiently stable ~~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.

(12) In the case of process fuels from the chemical industry, monitoring is only applicable when the fuels contain chlorinated substances ~~chlorine compounds~~.

Chemical industry process fuels

BAT 3 ter in Revised Draft 1

Techniques/BAT-AELs for TVOC and PCDD/F (7/7) – BP 1.9.7

Substance/ Parameter	Fuel/ Process	… thermal input	Standard(s) (1)	Minimum monitoring frequency	Monitoring associated with
TVOC	Process fuels from chemical industry in boilers	All sizes	EN 12619	At least once every six months (8)	BAT 69

(8) The frequency may be reduced if it is demonstrated that the emission levels are proven to be sufficiently stable ~~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.

Offshore platforms

BAT 60 in Revised Draft 1

Techniques to reduce NO_X and CO emissions (1/3) – BP 1.8.2

BAT 60 In order to prevent and/or reduce NO_X emissions to air from the combustion of gaseous and/or liquid fuels on offshore platforms, BAT is to use one or a combination of the techniques given below.

	Technique	Description	Applicability
a	Dry low-NO_X burners (DLN)	See description in Section 10.8	Applicable to new gas turbines (standard equipment) within the constraints associated with the fuel quality variations. The applicability may be limited for existing gas turbines by: availability of retrofitting package (for low load operation), complexity of the platform organisation and space availability

Offshore platforms

BAT 60 in Revised Draft 1

Techniques to reduce NO_X and CO emissions (2/3) – BP 1.8.2

	Technique	Description	Applicability
b	Lean-burn concept	See description in Section 10.8	Only applicable to new gas-fired engines
c	Low-NO_X burners	See description in Section 10.8	Only applicable to boilers
d	Advanced control system	See description in Section 10.8	Generally applicable to new plants. The applicability to old combustion plants may be constrained by the need to retrofit the combustion and/or control command system(s)

Offshore platforms

BAT 60 in Revised Draft 1

Techniques to reduce NO_X and CO emissions (3/3) – BP 1.8.2

BAT 61. In order to prevent and/or reduce CO emissions to air from the combustion of gaseous and/or liquid fuels in gas turbines on offshore platforms, BAT is to use one or a combination of the techniques given below ~~in BAT 42 and BAT 49~~.

Technique		Description	Applicability
d	Oxidation catalysts	See description in Section 10.8	Not applicable to combustion plants operated in emergency-load mode Retrofitting existing plants may be constrained by the availability of sufficient space and the requirement not to overload the platform
e	Combustion optimisation	See description in Section 10.8	Generally applicable

Offshore platforms

Table 10.37 in Revised Draft 1

BAT-AELs for NO_X and CO (1/4) – BP 1.8.3

- Add in the chapter on 'Concluding remarks and recommendations for future work' that more information on offshore platforms should be collected during the next BREF review, in particular on the use of dual fuel gas turbines combusting liquid fuels.
- The decision on the BAT-AELs for NO_X is not supported by EEB, CAN Europe.

Offshore platforms

Table 10.37 in Revised Draft 1

BAT-AELs for NO_X and CO (2/4) – BP 1.8.3

Table 10.37: BAT-associated emission levels (BAT-AELs) for NO_X and CO emissions to air from the combustion of gaseous and/or liquid fuels in open-cycle gas turbines on offshore platforms

Plant type	BAT-AELs (mg/Nm^3) (2)	
	NO_X	CO
	Average over the sampling period	

(2) These BAT-AELs are based on ≥ 70 % of baseload power available on the day ~~expressed for a turbine load of > 70 % when using DLN burners and about 70 % when not using DLN burners when the monitoring is performed periodically~~.

Offshore platforms

Table 10.37 in Revised Draft 1

BAT-AELs for NO_X and CO (3/4) – BP 1.8.3

Plant type	BAT-AELs (mg/Nm³) (2)	
	NO_X	CO
	Average over the sampling period	
New gas turbines combusting gaseous fuels (3)	~~7~~ 15–50 (4)	< 75
Existing gas turbines combusting gaseous fuels (3)	< 50–350 (1)	< 100
~~Existing/New dual fuel gas turbine combusting liquid fuels~~	~~145–250~~	~~< 100~~

(1) The lower end of the BAT-AEL range can be achieved with DLN burners.

(3) This includes single fuel and dual fuel gas turbines.

(4) The higher end of the BAT-AEL range is 250 mg/Nm³ if DLN burners are not applicable. ~~cannot be used, e.g. due to poor quality fuels.~~

Offshore platforms

BAT 3 ter in Revised Draft 1

BAT-AELs for NO_X and CO (4/4) – BP 1.8.3

Substance/ Parameter	Fuel/ Process	Combustion plant total rated thermal input	Standard(s) (1)	Minimum monitoring frequency	Monitoring associated with
NO_X	OCGT on offshore platforms	All sizes	EN 14792	At least once every year (5)	BAT 60
CO	OCGT on offshore platforms	All sizes	EN 15058	At least once every year (5)	BAT 61
(5) PEMS may be used alternatively.					