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FINAL MEETING
OF THE TECHNICAL WORKING GROUP (TWG)
FOR THE REVIEW OF

THE BAT REFERENCE DOCUMENT
FOR LARGE COMBUSTION PLANTS (LCP BREF)

SEVILLE,

in the period 1 June to 19 June 2015 (indicative dates)

BACKGROUND PAPER (BP)

Purpose of this background paper and of the final technical working group (TWG) meeting

The objective of this background paper is to outline the main issues proposed to be discussed at the final meeting of the Technical Working Group (TWG) for the review of the BAT reference document for 'Large Combustion Plants' (LCP BREF).

The meeting is intended to be held in Seville in the period 1 June to 19 June 2015 with the objective of agreeing upon the remaining work needed to finalise the review of the LCP BREF. In particular, it is proposed that the TWG meeting focuses on:

- agreeing on the BAT conclusions and therefore on the actual text in Chapter 10 (and related items) of the LCP BREF;
- agreeing on the main corresponding modifications proposed for the sections on 'Techniques to consider in the determination of BAT';
- agreeing on the remaining work needed for finalising the BREF.

This background paper includes:

- background information for the TWG meeting;
- the issues proposed for discussion at the final TWG meeting, including a summary of the main TWG comments received on the first draft of the revised LCP BREF (June 2013) and the EIPPCB assessments of those comments;
- the proposed modifications to the draft LCP BREF resulting from the TWG members' comments;
- the proposals to include, when appropriate, in the *Concluding remarks and recommendations for future work* Chapter of the BREF.

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Background information

The kick-off meeting for the review of the LCP BREF was held from 25 to 28 October 2011 in Seville. The first draft (D1) of the revised LCP BREF was issued in June 2013, with the consultation period for TWG members ending in September 2013. More than 8 500 comments were submitted by the TWG and all of these have been made available in the BATIS workspace.

The distribution of the comments received on D1 of the LCP BREF is summarised in Table 1.

Table 1 Distribution of the total number of comments submitted on the first draft of the revised LCP BREF (D1, June 2013)

BREF Chapter/Section	Comments received on the first draft of the revised LCP BREF (D1)	
	Number	Percentage
Whole document	144	1.7 %
Scope	30	0.4 %
Chapter 1 (Sector description)	234	2.7 %
Chapter 2 (General Processes)	380	4.5 %
Chapter 3 (General Techniques)	1124	13.2 %
Chapter 4 (Gasification)	95	1.1 %
Chapter 5 (Solid fuels)	1001	11.8 %
Chapter 6 (Liquid fuels)	302	3.5 %
Chapter 7 (Gaseous fuels)	645	7.6 %
Chapter 8 (Multi-fuels)	110	1.3 %
Chapter 9 (Co-incineration)	134	1.6 %
Chapter 10 (BAT conclusions)	4132	48.6 %
Chapter 11 (Emerging techniques)	112	1.3 %
Other Sections	67	0.8 %
Total	**8510**	**100 %**

All the comments qualified as 'major' in their submission have been assessed by the EIPPCB, and those concerning the sections on 'Techniques to consider in the determination of BAT' and Chapter 10 (i.e. on BAT conclusions for large combustion plants) have been carefully considered in the preparation of this background paper and the new draft of these sections will be made available prior to the final TWG meeting.

An updated version of the LCP D1 will be made available before the final TWG meeting, in which the new text will appear in **blue**, compared to the **green** text of the first draft and the **black** text from the original BREF.

We strongly advise you to obtain a copy that shows the coloured text, as it is designed to help you to take part in discussions at the meeting.

Before coming to the meeting

As a TWG member you should read this background paper (BP) as well as the new version of the sections on 'Techniques to consider in the determination of BAT' and Chapter 10 before coming to the meeting, in order to establish your position on the identified issues. Final TWG meetings are characterised by deep technical discussions and represent the last opportunity for the TWG to discuss the contents of the BREF and reach conclusions. Whether or not your position differs from any proposal in this background paper, you should come to the meeting prepared to justify your position and **if you have a different view, you will be required to present an alternative proposal and the basis for that proposal from the BREF.**

IMPORTANT: Please bring the following documents with you to the meeting (all of these will be made available on the BATIS members' workspace) as the *EIPPCB will not be able to provide you with hard copies at the meeting*:

- this background paper (coloured version);
- the first draft of the revised LCP BREF dated June 2013 (coloured version);
- the updated version of the sections on 'Techniques to consider in the determination of BAT' and Chapter 10 of the LCP BREF (coloured version).
- the updated graphs/figures including the emission levels (and emission prevention/reduction techniques used) reported for all the plants that submitted a questionnaire in 2012

Aim and structure of this background paper

The aim of this background paper is to structure and enable efficient discussions at the final TWG meeting. Some items relevant to the BAT conclusions are proposed for discussion at the final TWG meeting (i.e. items under Section 1 of this BP) while other items are proposed to be discussed only if requested in advance of the meeting (i.e. items listed in Section 2 of this BP). This is because, from an assessment of the TWG comments, some of the BAT conclusions are not considered to be controversial, and therefore do not appear to require further discussion. Please note that the order of the discussion items in this background paper will not necessarily be the order of the discussion at the meeting.

TWG members are requested to contact the EIPPCB at least 10 working days before the TWG meeting **(i.e. by 20 May 2015)** if they wish **to request any other items from Chapter 10 (i.e. BAT conclusions) for discussion at the meeting or to propose additional agenda items** for the meeting. Please note that the possibility of including additional items in the meeting agenda is extremely limited due to time restrictions.

Each item in this background paper is presented according to the following structure:

- the location in the first draft (D1) of the LCP BREF (June 2013) where issues are presented;
- the current text in the first draft (D1) of the LCP BREF (June 2013) that the issues relate to;
- a summary of the most relevant comments related to the issues, made on the first draft (D1) of the LCP BREF (June 2013);
- the EIPPCB assessment of the comments;
- the EIPPCB proposal to resolve the issues.

Note that the following numbering convention is used throughout this background paper (BP):

D1, Section x.x.x.x.x, page...	relates to the numbering in the first draft (D1) of the LCP BREF (June 2013)
BP Section y.y.y, page...	relates to the numbering in this background paper

The acronym 'D1' is only used for the purpose of this background paper and will not appear in the final LCP BREF.

Different colours and text styles are used in the following sections to facilitate the use of this BP. **It is therefore recommended that the TWG members print a coloured copy of this background paper (BP)**. The following colour and text style code is used:

Location in D1	*Pink italic text accompanied by the page number and the BREF Section number*
Current text in D1	**Green text:** Text of the sections from D1
Summary of comments:	*Italic text:* *Individual comments or a summary of the main comments related to the item*
EIPPCB Assessment	**Black bold text:** **EIPPCB assessment related to the item to be discussed**
EIPPCB proposal	**Green text:** **EIPPCB proposal that will be included in the latest version of the drafted BAT conclusions for discussion at the final TWG meeting**

Working plan after the meeting

After this final TWG meeting, the revised draft of the LCP BREF will be completed by the EIPPCB, including the addition of Chapter 12 (Concluding remarks and recommendations for future work). Afterwards, the TWG will be given another short commenting period that should focus on the changes made as a result of the conclusions reached at the final TWG meeting. The EIPPCB will then take these comments into account, together with the 'minor' comments submitted on D1, to produce the final draft (FD) that will be submitted for opinion to the IED Article 13 Forum. In the final step, the BAT conclusions will be submitted for formal approval to the IED Article 75 Committee.

Abbreviations used in this background paper

Abbreviation	Meaning
BAT	Best Available Techniques (as defined in Article 3(10) the IED)
BAT-AEL	Emission level associated with the BAT (as defined in Article 13(3) of the IED)
BAT-AEPL	BAT-associated environmental performance level (as described in Section 3.3 of Commission Implementing Decision 2012/119/EU)
BAT-AEEL	Energy efficiency levels associated with BAT as one type of BAT-AEPL
BATIS	BAT Information System
BFB(C)	Bubbling fluidised bed (combustion)
BP	Background paper
BREF	BAT reference document (as defined in Article 3(11) of the IED)
CAK BREF	BAT reference document for the Production of Chlor-alkali
CCGT	Combined cycle gas turbine, with or without supplementary firing
CEMS	Continuous emission monitoring system
CFB(C)	Circulating fluidised bed (combustion)
CHP	Combined heat and power
COD	Chemical oxygen demand
CWW BREF	BAT reference document for Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector
D1	First draft of the revised LCP BREF from June 2013
DF-(type)	Pilot fuel ignited (type)
DH	District heating
DSI	Duct dry sorbent injection
EIPPCB	European IPPC Bureau
EFL	Equivalent full load
ELV	Emission limit value
EMS	Environmental Management System
EN	European Standard adopted by CEN (European Committee for Standardisation, from its French name Comité Européen de Normalisation)
FBC	Fluidised bed combustion
FID	Flame ionisation detector
GD-(type)	Gas diesel (type)
GLS BREF	BAT reference document for the Manufacture of Glass
HFO	Heavy fuel oil
HRSG	Heat recovery steam generator
ICS BREF	BAT reference document for Industrial Cooling Systems
IED	Industrial Emissions Directive (2010/75/EU)
IGCC	Integrated gasification combined cycle plant
IS BREF	BAT reference document for Iron and Steel Production
ISO	International Organisation for Standardisation. Also international standard adopted by this organisation
KOM	Kick-off meeting of the TWG for the review of the LCP BREF
LCP BREF	BAT reference document on Large Combustion Plants
LFO	Light fuel oil
LHV	Lower heating value
MAC-EQS	Maximum allowable concentration – environmental quality standard
ROM REF	JRC Reference Report on Monitoring of emissions to air and water from IED installations
MS	EU Member State
ND	Not determined
NFM BREF	BAT reference document for the Non-Ferrous Metals Industries
NMHC	Non-methane hydrocarbons
NMVOC	Non-methane volatile organic compounds
OCGT	Open-cycle gas turbine
OTNOC	Other than normal operating conditions
PC	Pulverised combustion
PEMS	Predictive emissions monitoring system

PP BREF	BAT reference document on the production of Pulp, Paper and Board
RAI	Request for additional information
REF BREF	BAT reference document on the Refining of Mineral Oil and Gas
SCR	Selective catalytic reduction
SDS	Flue-gas desulphurisation by using a spray dryer
SG-(type)	Spark ignited (type)
SIS	Small isolated system
SNCR	Selective non-catalytic reduction
SW	Solid waste
TAN BREF	BAT reference document for the Tanning of Hides and Skins
TOC	Total organic carbon
TSS	Total suspended solids
TWG	Technical Working Group
US EPA	United States Environment Protection Agency
VOC	Volatile organic compounds
WBB	Wet bottom boiler
WBP BREF	BAT reference document for the Production of Wood-based Panels
WFD	Water Framework Directive
WFGD	Wet flue-gas desulphurisation

Categorisation of combustion plants according to their total rated thermal input

For the purpose of this background paper, when a range of values for the total rated thermal input is indicated, this is to be read as 'equal to or greater than the lower end of the range and lower than the upper end of the range'. For example, the plant category 100-300 MW_{th} is to be read as: combustion plants with a total rated thermal input equal to or greater than 100 MW_{th} and lower than 300 MW_{th}.

1 ITEMS PROPOSED FOR DISCUSSION AT THE FINAL TWG MEETING ON THE REVIEW OF THE LCP BREF

1.1 General issues

1.1.1 Averaging periods in the case of continuous monitoring

<table>
<tr><td>Location in D1:</td><td>P. 735 – Chapter 10</td></tr>
<tr><td>Current text in D1:</td><td>Where emission levels associated with the best available techniques (BAT-AELs) are given for different averaging periods, all of those BAT-AELs apply.

[…]

For averaging periods, the following definitions apply:

<table>
<tr><td>Daily average</td><td>Emissions to air: maximum over one year of the averages over a period of 24 hours of hourly averages given by a continuous measurement</td></tr>
<tr><td>Yearly average</td><td>Emissions to air: average over a period of one year of hourly averages given by a continuous measurement</td></tr>
<tr><td rowspan="2">Average of samples obtained during one year (for periodic measurements)</td><td>Emissions to air: average of the values obtained during one year of the periodic measurements taken with the Monitoring frequency set for each parameters</td></tr>
<tr><td>Emissions to water: average (weighted according to the daily flows) over one year of the periodic measurements taken with the monitoring frequency set for the relevant parameter</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>Application of both short-term (ST) and long-term (LT) BAT-AELs
• Only one of the two averaging periods should be applicable (SE_18).
• Clarify the relationship and binding character of mutually applied BAT-AEL ranges based on either daily or yearly averages (Eurelectric_565_657_841).
• Delete the requirement of both applying BAT-AELs (SE_96).
• Support having both LT and ST BAT-AELs (AT_1, EEB_129).

Short-term average:
1. Define BAT-AELs as a percentage of daily averages (Euroheat&Power_ 4, CEFIC_3).
2. <u>Support systematic short term (ST) BAT-AELs</u>
• Include systematically ST averages pursuant Article 13(2) of the IED (AT_1_109, BE_59).
3. <u>Support daily BAT-AELs</u>
• Favour the setting of (only) daily average for continuously monitored pollutants (DE_10_38, SK_11, Marcogaz_122).
• Support the setting of daily average for consistency with the IED Annexes V and VI (BE_30, IE_19_20_21_22_23_24, ES_53, COGEN_33, EPPSA_419, Eurelectric_629, Eurits_6).
4. <u>Support consistency with the IED Annex V (hourly, daily)</u>
• (Euroheat&Power_ 13_34_78, IE_9_16_21_29, ETN_12, Marcogaz_97, UK_10, PT_11_16_19_20_22_24_32_36_38_40_102).
5. <u>Oppose daily or ST BAT-AELs:</u>
• Not enough plants submitted short-term values (FI_1).
• Delete BAT-AEL given as daily average for process boilers (CEPI_12_or_ 70).
• Keep only yearly averages (Euroheat&Power_ 63, CZ_63).
• Support only monthly averages. EUTurbines_85, ETN_33
6. <u>Derivation of daily BAT-AELs from 95th Percentile of ST data</u>
• Derive daily from 110 % of monthly BAT-AELs to be consistent with the IED Annex V (ES_22_24, Eurelectric_629).
• It is not clear how daily BAT-AELs are derived from 95th Percentile of ST averages (FR_75, EEB_18).
• This derivation cannot reflect the variability in emissions resulting from the inconsistencies in the volumes and properties of I&S process gases that have to be consumed at the sector plants (Eurofer_164).
• The method for deriving daily averages (95th percentile of various short-term averages) is</td></tr>
</table>

	not adequate (FI_1). • *It is not possible to derive daily average from hourly averages due to their high variability; due to the extremely low number of operating hours during each day of the year, even the 95th percentile of the hourly values is likely to be lower than the "daily average" (Eurelectric_651).* ***Long-term average*** *7. <u>Oppose yearly average BAT-AELs</u>* • *It is not appropriate to set long term (LT) (month-year) BAT-AELs for continuously monitored pollutants (DE_10_38).* • *It is not relevant to set BAT-AEL for the sector as yearly average in concentration (IT_59).* • *Yearly averages are not used for setting guarantees in the case of new plants (EPPSA_4_419).* *8. <u>Support yearly average BAT-AELs:</u>* • *Keep only yearly averages (FI_1, Euroheat&Power_ 63, CZ_63).* • *Support yearly average (CEFIC_3).* *9. <u>Support monthly instead of yearly average BAT-AELs</u> (Consistency with the IED Annex V)* • *AT_1, BE_30, IE_9_21_29, PT_11_16__19_20_24_36_38_40_102, ES_24_53_72, UK_10, IE_8_20_21_22_23_24, EEB_129, COGEN_33, EPPSA_4_419, ETN_12_32_34, Eurelectric_629, Euroheat&Power_13_34_78, EUTurbines_3_85, Marcogaz_40_97,* *10. <u>Derivation of monthly average BAT-AELs from yearly averages:</u>* • *Available data are not sufficient to derive monthly average (FI_1).* • *Emissions over one year cannot equate directly to a monthly average and should be adjusted to set LT BAT- AELs as monthly average values in excess of the stated yearly average values (Euroheat&Power_ 13, UK_10).* • *It is not possible to derive monthly averages from yearly averages due to current operation mode driven by market requirements and to variation of meteorological conditions (Eurelectric_650).*
EIPPCB assessment:	**<u>General and 'double' BAT-AELs</u>** **In the period 2011-2012, the TWG gathered and submitted the detailed plant-specific data it had agreed to collect, including emission data expressed as short-term (including the 95th percentile of mainly hourly averages) and yearly averages. The information collected did not include monthly average data.** **The issue of which averaging period(s) should be used to express BAT-AELs in the revised LCP BREF was discussed at the intermediate informal TWG meeting that took place in Seville on 17-18 June 2014. The first outcomes of the additional data collection carried out in spring 2014, for the purpose of comparing different averaging periods, were also discussed at this meeting. Participants of this meeting were reminded that the IED foresees (in Article 15(3)) the possibility to use for the emission limit values set in the permit different averaging periods than the one(s) stipulated for the BAT-AEL. It was also reminded that implementation and compliance issues are not in the remit of the BREFs/TWGs. The way forward agreed at the informal TWG meeting was to set BAT-AELs expressed both as long-term (LT) and short-term (ST) averages using, to the greatest possible extent, the available data/information already provided in 2011-2012 by the TWG.** **In December 2014, NL, with the support of Eurelectric, kindly provided the TWG with a statistical tool that could be used for deriving daily and monthly averages from the 95th percentile of the hourly averages and the yearly averages, based on the plant-specific data collected in 2011-2012 and on the additional data collection of spring 2014, as well as on further data collected through Eurelectric in autumn 2014.** **The NL tool is founded on a statistical method based on the Student's T distribution. The tool provides two formulas for estimating a maximum of daily averages and a maximum of monthly averages over the year, using as input data: 1) reported 95th percentile of hourly averages and yearly averages, and 2) parameters reflecting a typical number of independent hourly averages per day (Nivd), a number of acceptable daily average exceedances in five years (i.e. one exceedance) and a number of minimum valid daily averages per month (i.e. five). Taking the yearly average as reference parameter, a standard deviation is calculated based on known hourly averages, and then a standard deviation is estimated for daily averages by using the parameter Nivd. NL compared real and estimated 95th percentiles of daily averages to derive an empirical level of Nivd that represents the best possible matching of these real and estimated averages. The determined Nivd is included in the formulas that would apply to all the plants for dust, SO_X and NO_X emissions, regardless of e.g. the fuel**

	combusted, the plant size and/or the techniques implemented. **We consider that maximum daily and maximum monthly averages are parameters difficult to assess in the absence of other contextual information about the operation of the plant or the rules defining when they are considered valid. This contextual information is not available, which would highly limit their use for directly or indirectly setting BAT-AELs.** **The number of independent hourly averages in a day strongly depends on the type of technique implemented and how this is operated, and these aspects are not reflected in the statistical method.** **The comparison between real and estimated values uses a ratio of 10 % difference between these two values as acceptability criterion, which is often not far from the ratio between the derived and the original values.** **Furthermore, only a maximum global level of 87 % of estimated averages for NO_X, SO_X, CO and dust emissions (in the case of monthly averages derivation) would meet this acceptability criterion.** **Therefore, we are of the view that, although the method can provide a general estimation of daily and monthly averages derived from 95th percentiles of hourly averages and yearly averages, the reference data it relies on are too weak and it introduces too many uncertainties in order for it to be used with sufficient confidence in the conversion and definition of robust BAT-AELs.** **The EIPPCB assessment for proposing short-term (ST) and long-term (LT) BAT-AELs has been performed taking into account the information available, the comments submitted to D1, the way forward decided upon at the June 2014 intermediate TWG meeting (referred to above) and the subsequent exchanges of views within the TWG. The statistical tool proposed by NL has therefore not been used for deriving the BAT-AEL ranges.** **<u>ST average</u>** **The short-term (ST) BAT-AELs proposed in this BP are based on expert judgements made 1) after a careful analysis of the available short-term emission data from the submitted questionnaires (be they in the form of 95th percentiles of hourly (or half-hourly) averages or in the form of maximum half-hourly, hourly, daily or 48-hour averages); 2) after considering the comments submitted on D1 referring to daily BAT-AEL ranges; 3) after considering other available data/information exchanged by the TWG, including on applied techniques; 4) taking into account the requirements set by the IED (especially in Chapter III/Annex V); 5) and with a view to ensuring consistency with the BAT-AELs proposed for different plant size categories and those proposed in LT average.** **<u>LT average</u>** **The long-term average proposed in the BAT conclusions is the yearly average, as decided at an early stage in the review process when designing the questionnaire. Use of the yearly average allows the techniques' performance to be assessed and compared, minimising special conditions that may affect them for some months of the year, and thus enables a better comparison of plants and techniques. The long-term (LT) BAT-AELs proposed in this BP are based on expert judgements made 1) after a careful analysis of the available LT emission data from the submitted questionnaires (mainly in the form of yearly averages of short-term values (half-hourly, hourly, daily or 48-hour data over a year of reference); 2) after considering the comments submitted in response to D1 referring to yearly BAT-AEL ranges; 3) after considering other available data/information exchanged by the TWG, including on applied techniques; 4) taking into account the requirements set by the IED (especially in Chapter III/Annex V); 5) and with a view to ensuring consistency with the BAT-AELs proposed for different plant size categories and those proposed in ST average. In the case of plants operated in peak- or emergency-load modes, it is proposed to set only daily BAT-AELs (see Section 1.1.6 of this BP).**
EIPPCB proposal:	• **Generally, set both daily and yearly BAT-AELs.** • **Include in an annex to the BREF the tool proposed by NL in order to facilitate the work of those Member States that choose to use different averaging periods in permitting to those used in the BREF.**

1.1.2 Scope

Location in D1:	*P. 733 – Chapter 10*
Current text in D1:	**Scope** These BAT conclusions concern the following activities specified in Annex I to Directive 2010/75/EU, namely: 1.1: Combustion of fuels in installations with a total rated thermal input of 50 MW_{th} or more, including plants composed of aggregated units of 15 MW_{th} or more including plants composed of aggregated units of 15 MW_{th} or more. 1.4: Gasification of coal or other fuels in installations with total rated thermal input of 20 MW_{th} or more, only when this activity is directly associated to a combustion process. 5.2: Disposal or recovery of waste in waste co-incineration plants – only when taking place in combustion plants with a total rated thermal input of 50 MW_{th} or more. In particular, these BAT conclusions cover the following processes and activities: ❖ combustion; ❖ gasification associated to a combustion process; ❖ upstream and downstream activities directly associated with the abovementioned activities as well as the emission prevention and control techniques applied. The fuels considered in these BAT conclusions are any solid, liquid or gaseous combustible material including: ❖ primary solid fuels (hard coal, brown coal, lignite, peat); ❖ biomass (e.g. wood, sawdust, bark, straw) and wood waste not contaminated by halogenated organic compounds or metals; ❖ primary liquid fuels (heavy and light fuel oil); ❖ gaseous fuels (natural gas, hydrogen-containing gas and syngas); ❖ other industry-specific fuels (production residues and by-products from chemical and iron and steel industries); ❖ waste excluding un-sorted municipal waste. These BAT conclusions do not address the following activities: ❖ combustion of fuels in units with a rated thermal input of less than 15 MW_{th}; ❖ gasification of fuels, when not associated with the combustion of the resulting gas; ❖ the upstream and downstream processes not directly associated with combustion or gasification processes; ❖ combustion in process furnaces or heaters; ❖ combustion in post-combustion plants; ❖ flaring; ❖ combustion in coke battery ovens; ❖ combustion in cowpers; ❖ disposal or recovery of waste in waste incineration plants (as defined in IED article 3 (40)), and in waste co-incineration plants other than combustion plants.
Summary of comments:	***1. Plants of < 50 MW_{th}*** *1.1. Clarify if aggregation rules of the IED article 29 apply (BE_2, Marcogaz_91, Eurelectric_567_641_843, DK_176, PO_58, Euracoal_90, CEFIC_183, CONCAWE_3, PT_4) and how to understand the scope when a combustion unit <15 MW_{th} releases through a common stack with an aggregated thermal input of > 15 MW_{th} (BE_2, Eurofer_6).* *1.2. Recall explicitly in the scope the approach followed in the questionnaire for defining a combustion plant (combustion plant is defined as having only one flue-gas release point where air emissions are monitored) (CEFIC_6).* *1.3. Clarify how plants are aggregated to reach the 50 MW_{th} threshold (CEFIC_74).* *1.4. Delete in BAT-conclusions and BAT-AELs reference to units <50 MW_{th} (Concawe_32); clearly define BAT-AELs for plants 50 - 100 MW_{th} instead of*

	< 100 MW_{th} (PL_131). *1.5. Plants of 15–50 MW_{th} within installations > 50 MW_{th} should be covered by BAT-conclusions but not by BAT-AELs and associated monitoring (DK_149).* *1.6. Set custom-BAT-AELs for plants of 15–50 MW_{th} (ETN_8).* *1.7. Plants of 15–50 MW_{th} within installations > 50 MW_{th} should be excluded from BAT-conclusions (by applicability restriction) and have separate BAT-AELs and associated monitoring (Eurelectric_636).* *1.8. Exclude plants < 50 MW_{th} from the LCP BREF scope and include them in the MCP Directive scope (Eurelectric_637).* ***2. Processes / fuels covered*** ***2.1. Processes*** • *Replace 'combustion plants' by 'installation' in the third bullet of the covered activities, regarding waste co-incineration' (PT_6).* • *Include more clearly CHP plants (CEFIC_17_40).* • *Exclude explicitly recovery boilers (SE_20_21_50) and TRS burners (SE_20_21).* • *Clearly exclude the steam crackers as being part within the furnaces category (CEFIC_113).* • *BAT-AELs associated with diesel engines should be eliminated. Not in the IED (ES_18).* • *Be more explicit about the waste-co-incineration plants not covered (SE_15), e.g.: 'waste co-incineration plants other than waste co-incineration plants whose main purpose is the generation of energy or production of material products and which uses waste as a regular or additional fuel or in which waste is thermally treated for the purpose of disposal through the incineration by oxidation of waste as well as other thermal treatment processes, such as pyrolysis, gasification or plasma process, if the substances resulting from the treatment are subsequently incinerated' instead of "waste co-incineration plants other than combustion plants' (Euracoal_91).* • *State more clearly that the list of excluded activities may be 'included within installations with a total rated thermal input of 50 MWt_h or more' (Eurelectric_640).* • *Qualify as 'large' the combustion plants mentioned in the last bullet point of the list of excluded activities (Euracoal_95).* • *Exclude storage activities (CEFIC_185).* ***2.2. Fuels - wastes*** • *Exclude biogas, landfill gas and mine gas combustion (Eurelectric_570_661_846_849, Euracoal_93).* • *The list of fuels is not consistent with the one agreed at the KOM (CEFIC_12).* • *Exclude clearly refinery fuels (CONCAWE_1, CEFIC_113_184, PT_5, EL_6_7, PL_183_186, SK_23).* • *Add 'commercial' before 'primary liquid fuels' (CONCAWE_31, EL_5).* • *Exclude clearly black liquor (PT_5).* • *The biomass included in the scope does not match with the IED definition (Article3 (31)) (PL_60, DE_16_150).* • *Include liquid biomass as a fuel covered by the scope (E&P_1, SE_12_77).* • *The inclusion of all the possible gases that can be combusted is incomplete (PL_63).* • *Add 'non-waste' before industry-process fuels, making reference to the Waste Framework Directive, and open the scope to other industry process-fuels than only the ones listed (DE_17_151).* • *Production residues can be considered as waste according to the Directive 98/2008/EC and it would be better to refer to the list of waste of the Annex II to D1 (DE_18_152).* • *Clearly indicate whether industry-process-fuels from petrochemical plants are included or not (PT_8).* • *Include the co-incineration of un-sorted wastes in the scope to avoid plants co-incinerating unsorted-waste without BAT-conclusions (PL_64).* • *Exclude co-incineration of wastes that have high levels of metals or halogens (SE_30).* • *Brown coal and lignite quoted as two different fuels are the same fuel (Euracoal_92).*
EIPPCB assessment:	**1. <u>Plants of < 50 MW_{th}</u>** **1.1. (to 1.3.) Data were collected at plant level with a plant being defined in the questionnaire as 'having only one flue-gas release point where air emissions are monitored.' This allowed the comparison of techniques and levels of emission without the need for considering the complex cases in terms of layout**

	of aggregated plants. However, the conclusions derived for a given flue-gas stream, categorised by plant size, would also generally apply in these cases of aggregated plants with several flue-gas streams released through a same stack with a total equivalent flue-gas stream. The assessment performed regarding the applicability of techniques is completely valid for both standalone and aggregated plants. The IED already defines an aggregation rule under Chapter III (Articles 28/29) that could be useful to use in the case of the LCP BREF for consistency. **1.4. (to 1.7.) Plants covered by the BAT conclusions are defined through the Scope and the definition of 'combustion plant' in the BAT conclusions. As assessed in 1.1. above, the aggregation rule of the IED could apply in the case of the LCP BREF. At the KOM, the TWG agreed to cover plants of 15 MW_{th} within installations of 50 MW_{th} or more. Data/information were collected on more than 100 such 15–50 MW_{th} plants. However, there is a parallel ongoing co-decision process on the Commission's proposal for a Directive on medium combustion plants (MCPD, covering plants 1–50 MW_{th}), which may interfere with the review of the LCP BREF for combustion plants < 50 MW_{th}.** **2. <u>Processes and fuels covered/excluded</u>** **2.1. <u>Processes</u>** • **Waste co-incineration is covered as long as it takes place in combustion plants that are covered by the scope even if they do not co-incinerate waste. Thus the third bullet of the scope needs to be revised as it implies that only waste co-incineration in combustion plants of > 50 MW_{th} would be covered.** • **CHP Plants are covered in D1 and its conclusions. They are implicitly covered in the scope which does not distinguish/exclude any of the products of the combustion plants (electricity, heat, mechanical power).** • **Recovery boilers and TRS burners are covered by the PP BREF and may thus be excluded from the LCP BREF.** • **The scope already clearly excludes process furnaces and heaters. The corresponding definition could be more explicit on steam crackers, which are covered by the LVOC BREF.** • **It was agreed to cover diesel engines in the review at the KOM. The proposal of BAT-AELs depends on the information available.** • **The definition proposed by Euracoal for the excluded waste co-incineration activities does not match the combustion plant one as e.g. 'production of material products' is not a purpose of a combustion plant. A definition of 'combustion plant' is already given in the BAT conclusions including the purpose, which is 'to use the heat thus generated', based on the IED.** • **The proposed specification regarding the excluded activities does not add clarity.** • **The redundancy of the last bullet of excluded activities and of the last bullet of covered activities regarding waste co-incineration leads to confusion. Removing the part on waste co-incineration of the last bullet of excluded activities would clarify the statement.** • **Storage activities are part of upstream activities directly associated with the combustion activity. There are proposals in the BP and BAT conclusions for implementing management plans e.g. in the case of diffuse emissions (see BAT 1).** • **There is no need to list coke battery furnaces and cowpers in the processes excluded as they are mentioned as example in the definition of process furnaces or heaters.** • **The thresholds corresponding to disposal or recovery of waste in waste co-incineration plants (activity 5.2 in the Annex I to the IED) are not mentioned in the scope.** • **The statement regarding the coverage of 'combustion' and 'gasification associated to a combustion process' are redundant with the three first bullets of the scope.** **2.2. <u>Fuels/wastes</u>** • **Combustion of these gases (biogas, landfill gas and mine gas) is not covered by the specific BAT conclusions due to a lack of information available during the review process; however the general conclusions apply to any kind of fuels, as it is stated in the general statement 'The fuels considered in these BAT conclusions are any solid, liquid and/or gaseous combustible material including:'.**

	• **The list of fuels specifically mentioned in Chapter 10 may differ from the list agreed at the KOM as there are no specific conclusions for some fuels (e.g. oil shale, liquid biomass), as a result of the exchange of information exercise. However, the general statement covers these fuels (see point just above) and thus the general conclusions apply to these fuels.** • **It was agreed at the KOM to exclude refinery fuels from the scope.** • **'Commercial' fuels and 'non-commercial' fuels with the same characteristics cannot be treated differently.** • **Black liquor is excluded through the exclusion of recovery boilers.** • **Biomass is defined in the IED; there is no need to repeat the definition in the scope.** • **The addition of 'non-waste' before 'industry process fuels' is not needed as they are by default 'non-waste': if they were waste they would be considered in the following point of the list (waste, except for unsorted municipal waste). However, BAT conclusions are only proposed for the sectors that have submitted data (iron and steel and chemical sectors) and there is no need to refer to the WFD. The scope is not limited to process fuels from the chemical or the iron and steel industries).** • **'Production residues' are not defined in the WFD, but could be removed to avoid any legal misinterpretation. Annex II to D1 is not linked to the BAT conclusions section but is only an annex to the BREF to illustrate the chapter on co-incineration. The BAT conclusions is a standalone document that cannot refer to an annex to the BREF.** • **Industry process fuels from the petrochemical sector are included in the scope and are covered under the definition of 'process fuels from the chemical industry'.** • **No plants co-incinerating unsorted municipal waste took part in the data collection exercise.** • **Apart from the unsorted municipal wastes, all other waste streams are covered by the BREF/BAT conclusions. The content level of metals and halogens in the fuel would be limited as a consequence of the BAT-AELs set for corresponding metal/halogen emissions to air and water. In order to be consistent with the scope of the recently started Waste Incineration BREF review, it is also proposed to slightly adjust the scope of the LCP BAT conclusions to not cover waste co-incineration if > 40 % of the heat comes from hazardous waste and to also exclude waste co-incineration plants burning only waste with the exception of those burning biomass-type waste such as demolition wood.** • **Lignite and brown coal are indeed the same fuel.** • **The qualification of 'primary' before solid and liquid fuels is not of added value.**
EIPPCB proposal:	**1. <u>Plants of < 50 MW_{th}</u>** • **Change the first bullet point of the scope to: 'Combustion of fuels in installations with a total rated thermal input of 50 MW_{th} or more, only when this activity takes place in combustion plants of 50 MW_{th} or more'.** • **See further assessment of the 'combustion plant' definition (Section 2.11 of this BP).** • **Provisionally remove, in consultation with DG ENV, combustion plants of < 50 MW_{th} from the scope of the LCP BREF, pending the outcome of the MCPD co-decision process.** **1. <u>Processes / activities covered</u>** **2.1. <u>Processes</u>** • **Change the third bullet point regarding activities covered for waste co-incineration to: 'Disposal or recovery of waste in waste co-incineration plants – only when taking place in combustion plants covered under 1.1 above'.** • **Add a bullet point explicitly excluding recovery boilers and TRS burners used in the PP sector.** • **Modify the definition of 'process furnaces or heaters' to explicitly exclude steam crackers from the scope.** • **The scope covers diesel engines. See further details of the proposed BAT-AELs in the appropriate section of this BP (1.5.2).** • **Remove the general mention of waste co-incineration from the last bullet of excluded activities, while keeping the explicit exclusion of waste**

	incineration. • **Do not exclude storage activities.** • **Remove coke battery furnaces and cowpers from the list of excluded processes.** • **Include the thresholds corresponding to disposal or recovery of waste in waste co-incineration plants (activity 5.2 in the Annex I to the IED) are not mentioned in the scope.** • **Remove 'combustion' and 'gasification associated to a combustion process' after the three introductory bullet points.** **2.2. Fuels/wastes** • **Do not exclude the combustion of biogas, landfill gas, or mine gas. Explicitly exclude the combustion of refinery fuels.** • **Add a bullet point clearly excluding distillation and conversion residues from the refining of crude oil.** • **Do not add the adjective 'commercial' in the definition of gas oil-HFO.** • **Replace the partial list of biomass sources with a reference to the legal definition of IED Article 3(31).** • **Do not add 'non-waste' before 'industrial process fuels'. Add 'e.g.' in the brackets before mentioning the process fuels from the chemical and iron and steel industries.** • **Remove 'production residues' from the brackets after 'industry-specific fuels' and add 'e.g.' before natural, in brackets.** • **Exclude waste co-incineration where more than 40 % of the resulting heat release comes from hazardous waste and waste co-incineration plants burning only waste with the exception of those burning biomass-type waste such as demolition wood.** • **Delete 'brown coal' from the list of solid fuels covered.** • **Remove 'primary' before solid and liquid fuels.**

1.1.3 Consideration of load modes, load factors and limited lifetime for setting BAT conclusions and BAT-AEPLs

Location in D1:	*Whole Chapter 10*
Current text in D1:	No text
Summary of comments:	*<u>Equivalent full load factor (EFL)</u>* *1. Limit the applicability of BAT-AELs for turbines when the EFL is >70 % (EUTurbines_5).* *2. Set separate BAT conclusions and BAT-AELs for base load plants operated with an EFL <70 % (EL_5, Eurelectric_629).* *3. Include BAT-AELs for each load factor (IE_20, ES_33_35_53).* *<u>Load modes</u>* *4. Provide BAT-AELs for each load mode (CZ_99, EL_5, ES_20_33_35_53, IE_3_16_20_23_29, IT_143, PT_101, SE_54_55, UK_1_62, E&P_2_3_67_79, Eurelectric_84_629_647_696, Euromot_93).* *5. BAT-AEELs and BAT-AELs are only applicable to base load plants (UK_49_65, E&P_54_102)* *6. Exclude plants <500 h/yr (CZ_118, DK_153, PL_13, CEPI_8, ETN_3_42, Eurelectric_634, E&P_13_117), or <1000 h/yr (CEFIC_19_42), or < 1500 h/yr (ETN_6) from the scope of the BAT conclusions.* *7. Exclude boilers and engines operated < 500 h/yr from BAT-AELs and BAT-AEELs and request only the record of operating hours (Eurelectric_586_866).* *8. Clarify the applicability of BAT conclusions in the case of emergency and peak load plants (FR_60_76, PT_48)* *9. Increase BAT-AELs for peak- and mid-merit-load plants (ETN_3_6, PL_55, CEPI_8, E&P_33), e.g. + 20 % systematically (CZ_102_118_161, E&P_102_117_159); only set daily averages for such plants (DK_154).* *10. Reduce the number of BAT-conclusions for peak load plants (DK_154).* *11. Submitted data are also representatives for sub-base load plants (no flaw in the data collection exercise) (EEB_105).* *12. Energy efficiency BAT-AEELs should not be defined for emergency plants and should be distinguished between the different load modes (Euracoal_106, EUTurbines_82).* *13. Clarify the BAT-AELs applicability in cases where a plant could move from one load regime one year to another load regime another year (ETN_10).* *14. Reduce lower limit of net electrical efficiency range to account for wider load mode operation and load ranges (IT_89, E&P_114, Eurelectric_161).* *<u>Limited lifetime</u>* *15. Increase BAT-AELs for plants with limited lifetime (ETN_3, UK_1).*
EIPPCB assessment:	**<u>Equivalent full load factor (EFL)</u>** **1. (to 3.) The consideration of load factors (operation of the plant at a load different from the nominal capacity expressed as a percentage of the full capacity) to assess the environmental performance of combustion plants was agreed at the KOM. Data and information on emission levels and implemented techniques were submitted along with information that allowed the calculation of the so-called 'equivalent full load factor' through bulk information and questionnaires at plant level. This information has been assessed including in the case of turbines and proposals are made in this BP. Generally, the influence of EFL on emissions is already included in the proposed BAT-AEPL ranges in this BP. In the case of energy efficiency BAT-AEELs, the assessment focussed on those plants operated with an EFL of > 70 % for completing the review and proposing design-based BAT-AEELs.** **<u>Load modes</u>** **4. (to 14.) The consideration of load modes (number of operating hours per year) to assess the environmental performance of combustion plants was agreed at the KOM. Data and information on emission levels and techniques implemented were submitted along with the number of operating hours per year through bulk information and questionnaires at plant level. The influence load modes may have on achievable pollutant emission levels and energy efficiency levels is fuel-, combustion process-, size- and technique-dependent. There is thus no possible general formula that could apply to all the cases. The possible impact of the load mode was assessed for each BAT conclusion and BAT-AEPL individually, based on available techno-economic information and looking at implemented techniques and**

	achieved performances. This is reflected in new proposals for BAT conclusions, often in the form of footnotes for peak- and emergency-load modes. No split between mid-merit and baseload plants could be made based on available data. **Limited lifetime** **15. The assessment of lifetime is plant-specific and is included in cost-benefit assessments performed at plant level and assessed by the competent authorities.**
EIPPCB proposal:	**Equivalent full load factor** **Assess case by case the need to address the influence of load factors in the fuel-specific BAT conclusions, e.g. via footnotes to the BAT-AEPLs or by adding information under the applicability of techniques.** **Load modes** **Assess case-by-case, for each plant category, the need to address the influence of load modes in the fuel-specific BAT conclusions e.g. Assess case by case, for each plant category, the need to address the influence of load modes in the fuel-specific BAT conclusions, e.g. via footnotes to the BAT-AEPLs or by adding information under the applicability of techniques.** **Limit the applicability of the BAT-conclusions on energy efficiency and the BAT-AEELs only to plants operated in mid-merit or baseload modes.** **Limited lifetime** **Do not set general BAT conclusions and BAT-AEPLs depending on the expected plant lifetime.**

1.1.4 Subtraction of the measurement uncertainty

Location in D1:	*P. 738 – General considerations*
Current text in D1:	[…] emission levels associated with the best available techniques (BAT-AELs) for emissions to air given in these BAT conclusions are expressed […] without subtraction of uncertainty
Summary of comments:	1. *Specify that the measurement uncertainty should be subtracted from the measurement results before comparing them with ELVs based on BAT-AELs in order to be consistent with Annex V, Part 3, No. 9 and 10 of the IED (CZ_64, PL_16, UK_7, E&P_14_16, Euracoal_104, Eurelectric_581_587_644_861, ETN_14, Marcogaz_41).* 2. *Clarify in the general considerations that the format of the values used in the BAT-AELs differs from the one of the values set in the IED ELVs regarding their validation (uncertainty subtraction) (SE_13).* 3. *Remove the information that the 'uncertainty is not subtracted' from the general considerations as the validation is a matter specific to each country (CEPI_23).*
EIPPCB assessment:	**1. (to 3.) How uncertainties are used for demonstrating compliance with the IED is an implementation issue and is therefore not in the BREF/TWG remit. Compliance rules are defined by Member State competent authorities. Rules on how to handle the measurement uncertainty during implementation were not defined in previously adopted BAT conclusions. Raw data without uncertainty subtraction have been used for deriving BAT-AEPLs as different approaches for validating data are used throughout Europe. Levels of uncertainty associated with the reported data were also reported as contextual information, giving a better insight on the real quality of monitoring.**
EIPPCB proposal:	**1. Delete the sentence in the BAT conclusions on the subtraction of the measurement uncertainty.** **2. Clarify in Chapter 3 of the BREF that raw data without subtraction of the measurement uncertainty were used for the analysis and the setting of BAT.** **3. Add in the BREF information about the averaged uncertainty assigned to measured results from European combustion plants, derived from data collected at plant level.**

1.1.5 Type of BAT conclusions on energy efficiency

Location in D1:	*Whole Chapter 10*
Current text in D1:	No text
Summary of comments:	1. *Keep Energy efficiency BAT-AEELs in the BREF (CZ_69, EEB_19, E&P_69).* 2. *The BAT-AEELs should not be binding (CZ_69, E&P_69).* 3. *Set BAT-AEELs only for new plants (CZ_81, EL_4, Eurelectric_218_628_686, E&P_35_68_81_210).* 4. *Provide clear indication to what specific operating conditions (e.g. load) the provided values of 'energy efficiency' refer to (AT_3_4, PL_70, ES_75_24); take account of the load factor whether by mentioning that the set BAT-AEELs correspond to a load factor > 70 %, or by lowering the lower-end of the range in the case of lower load factors (EL_65, ES_44_45, Eurelectric_681_684).* 5. *Use design or base-load efficiency for the BAT conclusions and not yearly average (CZ_69, DE_36, DK_90_94_120_171_176_181, EL_147, IT_97_103_114_148_160_161, CEFIC_50, E&P_69, Euracoal_106_177, ETN_59_62, Eurelectric_473_474_521_522_681_918_984), especially for CHP plants where the total fuel utilisation should be determined at full heating load (ETN_4_58).* 6. *Clarify if the performance is name plate, or performance test or daily running efficiency (UK_20 63, E&P_210).* 7. *Energy efficiency should be measured as spot test at MCR and the conclusions expressed as nominal values (UK_24_30_63, DK_118, IT_79, ES_76, E&P_214, ETN_18, Eurelectric_472_959). This can be backed up by fuel input vs electrical output measurements but these measurements will depend on load and will therefore not be as accurate (UK_30).* 8. *The practical performance level may be controlled by way of a Heat Rate Test. (Eurelectric_162, DK_104_121_123)* 9. *Split the levels depending on the size and on whether the plants are existing or new (Eurelectric_473_474_521_522).* 10. *Provide a clear definition of 'energy efficiency' used throughout the BREF (AT_2).* 11. *Annual thermal efficiency of a CHP plant depends on the concrete demand for the heat and electricity, on the number of SU/SD (Euracoal_106).* 12. *Clarify when, for a plant, recoverable heat generation exceeds the heat demand (PL_164_165, FI_55, Eurofer_16). A steam extraction unit will at times operate in a condensing mode and at times in a combined mode (Eurelectric_683).* 13. *The proposed BAT-AEELs should be at least at the same levels as the ones of the 2006 LCP BREF (NL_61). Remove the word 'above' in all cases (E&P_101_119_63).*
EIPPCB assessment:	**1. (to 9.) This topic was discussed at the intermediate informal TWG meeting that took place in Seville on 17-18.06.2014. The general way forward agreed at this meeting was to create a TWG task force on energy efficiency (TFEE) to deliver additional data/information on energy efficiency according to plant 'design' values in parallel to the EIPPCB proceeding with the assessment of the comments received on the proposals to set yearly BAT-AEELs.** **Setting BAT-AEELs for energy efficiency based on yearly averages would allow the real operation of the plants to be taken into consideration as in the case of pollutant emission levels. However, the impact different parameters may have on the real energy efficiency are very wide-ranging and could make it difficult to propose a sound BAT-AEEL range without entering into detailed exceptions corresponding to the effect of each and every parameter. Using levels corresponding to design conditions is easier to make comparison between plants without the impact of operational parameters which will affect these plants equally anyway. The TFEE submitted such 'design' energy efficiency levels after a data collection exercise performed at plant level in summer 2014. These design levels can further be compared with yearly energy efficiency levels from the questionnaires submitted in the general data collection in 2012, once filtered, e.g. by load conditions.** **According to the TFEE, there are several methods/approaches used to assess energy efficiency at the 'design' stage; these include in-house assessments, reference to equipment supply contracts, or other accepted standards, and the design energy efficiency value is not significantly impacted by the different methods/approaches/standards used. 'Design' efficiency data submitted refer to levels achieved when the plant operates at maximum continuous rating (MCR) and,**

	in the case of CHP plants, when the plant is operated at full load simultaneously for both heat and power. It is deemed appropriate to carry out a performance test according to EN or equivalent standards after the combustion plant commissioning, and after every change that may have a significant impact on the energy efficiency. **10. The meaning of energy efficiency may be different in the BREF depending on the context it is used.** **11. (+12.) Values proposed in D1 were based on yearly averages from the collected data. As per the assessment made in Paragraph 1. above, it is now proposed to define design-based BAT-AEELs. This simplifies the presentation of BAT-AEELs as net electrical efficiency applies to plants generating only power and CHP plants, and net total fuel utilisation applies to CHP plants and plants generating only heat. See also the proposal made in Section 2.12 (General considerations) about the way in which BAT-AEELs for energy efficiency are expressed.** **13. The 'above' in the upper ends of BAT-AELs aims at expressing the possibility that current higher levels of energy efficiency could be improved in the case of new plants. However, this way of expressing the range is not consistent with the way the lower ends of the ranges are expressed in the BAT-AELs for emissions to air.**
EIPPCB proposal:	**1. (to 10.) Set energy efficiency levels in the form of design values based on the design data submitted by the TFEE in 2014 and on the yearly data from the data collection exercise from 2012 after filtering (e.g. by load). Set a monitoring frequency for a performance test corresponding to 'after the commissioning of the plant and after every modification that could significantly affect the energy efficiency of the plant'.** **10. (and 12.) Delete 'whose recoverable heat generation does/does not exceed the heat demand' in the BAT-AEEL tables on energy efficiency.** **13. Remove the word 'above' from the higher ends of the BAT-AELs.**

1.1.6 Type of conclusions on CO emissions

Location in D1:	*Whole Chapter 10*
Current text in D1:	No text
Summary of comments:	*1. General* *1.1. Remove conclusions related to CO emissions as they are not of high relevance for the environment (Marcogaz_31).* *2. Averaging periods* *2.1. A number of comments have been submitted requested short term-average (i.e. daily averages) for CO.*
EIPPCB assessment:	**1. General** **1.1. CO was identified as a key pollutant at the KOM. Due to trade-offs between NO_X and CO, priority is given to NO_X reduction in this review. Subsequently, CO levels and corresponding techniques are derived based on the set of well performing plants for NO_X emissions. CO is also one of the pollutants covered by the European Commission regulation (Directive 2000/69/EC of 16.11.2000 setting an air quality target.** **2. Averaging periods** **2.1. Only BAT-AELs expressed as a yearly average are proposed for CO emissions. This is to give more flexibility for achieving a good short-term and long-term performance for NO_X emissions, considering the possible variations of the combustion (e.g. fuel moisture, quick changes of load).**
EIPPCB proposal:	**1. General** **1.1. Keep BAT conclusion on CO.** **2. Averaging periods** **2.1. Do not propose daily averages for CO.**

1.2 General BAT conclusions

1.2.1 Monitoring

1.2.1.1 General issues on monitoring of emissions

Location in D1:	*Whole document*
Current text in D1:	No text
Summary of comments:	1. *The monitoring regime should be described in the **JRC Reference Report on monitoring** and not in this BREF (ETN_7).* 2. *Include provisions on the **monitoring associated to BAT-AELs** in the relevant BAT-AEL tables instead of a separate BAT conclusion on monitoring (NL_38).* 3. *Clarify the **status of 'monitoring frequency'** when used in BAT conclusions (SE_17).* 4. *Include specific monitoring requirements for **plants operated in peak-load mode with frequent start-ups** (more than 3 starts per week) (EU_Turbines_6).* 5. *Add flexibility provisions to deviate from continuous measurements in specific cases (e.g. plants operating in emergency- or peak-load modes, plants smaller than 100 MW_{th}, plants with very low emissions etc.) (Eurelectric_566_658_842, CEFIC_236_262_267_287_294, Euracoal_89).* 6. ***Frequency of measurements** should be based on expected variations of the measured parameter (FI_6).* 7. *Change the **monitoring frequency for plants < 50 MW_{th}** from continuous to periodic (UK_16) (4 times/yr) (Eurofer_224).* 8. *Add applicability restrictions to the monitoring specifications for emissions from the combustion of process fuels from the chemical industry so that only relevant parameters, i.e. expected to be present in the fuel, are monitored (CEFIC_5_77)* 9. *Include BAT conclusions on the necessity and frequency of the **calibration** of the monitoring system (PT_13).*
EIPPCB assessment:	**1. The JRC Reference Report on Monitoring of emissions to air and water from IED installations (ROM) provides guidance for the drawing up of BREFs and BAT conclusions, but it is not a BREF and it does not contain BAT conclusions. Article 3(12) of the IED specifies that BAT conclusions contain BAT-AELs and the associated monitoring. Moreover, Section 3.1 of the Guidance (Commission implementing decision 2012/119/EU on the drawing up of BREFs) stipulates that *'BAT conclusions should also address monitoring associated with BAT (frequency and methods of monitoring). This can be done either by including separate conclusions on monitoring or as part of other conclusions such as where an environmental performance range is provided'*.** **2. In recent BAT conclusions, monitoring requirements are separated from BAT-AEL tables, as this provides a better overview.** **3. Recent BAT conclusions on monitoring define the minimum monitoring frequency (e.g. WBP, NFM and CWW BREF).** **4. (+5. +6. +7. +8.) Based on the submitted comments and the available information, mainly from the submitted questionnaires, applicability restrictions and/or provisions for less frequent monitoring may be justified, depending on the pollutant, the fuel, the plant size, and the operation mode.** **9. Requirements on calibration are often included in the relevant EN standards. Further guidance is given in the ROM.**
EIPPCB proposal:	**1. Keep BAT conclusions on monitoring.** **2. Summarise the monitoring requirements for emissions to air and water in separate BAT conclusions.** **3. Specify that monitoring frequencies are given as minimum frequencies.** **4. (+5. +6. +7. +8.) Include applicability restrictions and/or provisions for less frequent monitoring regimes, where deemed appropriate (see the detailed assessment for each parameter in the following sections on emissions to air and water).** **9. Do not add a BAT conclusion on the calibration of monitoring instruments.**

1.2.1.2 BAT 2 – Monitoring of emissions to air and water

Location in D1:	*P. 740 – Section 10.1.2*
Current text in D1:	**2. BAT is to monitor emissions to:** **a. air, after all the flue-gas treatment steps, and before mixing with other flue-gases and releasing;** **b. water, at the point of discharge,** **for the pollutants given in each BAT-AEL table of these conclusions, with at least the frequency indicated in the same table and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.**
Summary of comments:	*1. General* *1.1. Include a systematic monitoring approach depending on the plant size with continuous direct measurement for plants > 100 MW_{th}, continuous direct or indirect measurement for plants 50–100 MW_{th}, and periodic measurement for plants < 50 MW_{th} (CEFIC_191_192, CONCAWE_39).* *1.2. The standards to be followed should be 'EN or ISO', as sometimes ISO standards are better than EN ones (ETN_57, Eurelectric_196).* *1.3. Replace the statement related to the frequency by 'on a regular basis' (FI_93, CEPI_32) or remove 'at least' from this statement (SE_59).* *2. Emissions to air (a)* *2.1. Remove the text 'before mixing with other flue-gases' or rephrase, as monitoring should take place where emissions occur (CONCAWE_41, EL_13, PL_92, Eurelectric_193_194, E&P_20, UK_15).* *2.2. Rephrase as it could be understood that measurement is performed after each flue-gas treatment step (PL_92, Eurelectric_194_205).* *2.3. It may not always be possible to monitor emissions before their mixing (Eurelectric_592_873, PT_13_76_78).* *3. Emissions to water (b)* *3.1. The monitoring takes place at the exit point of the plant which may differ from the discharge point (to the water body, collector channel etc.,) (Eurofer_208).* *3.2. This conclusion is too prescriptive (UK_17, E&P_22).* *3.3. Flexibility should be allowed to monitor before the point of discharge (PL_100).* *3.4. Further mention that measurements should take place before mixing with other wastewater streams (DK_9).*
EIPPCB assessment:	**1. General** **1.1. The monitoring depends on the emissions from the combustion of each fuel type by different types of plant split by size, and is based on the information exchanged on monitoring practices and implemented techniques.** **1.2. Both the IED (Annex V, Part 3) and recent BAT conclusions give preference to EN standards. This is also recognised in the JRC Reference Report on the monitoring of emissions from IED installations. This favours a more consistent approach in Europe with respect to monitoring.** **1.3. Different wordings have been used in the recent approved BAT conclusions like '… on a regular basis with the frequency indicated…' in the PP BREF or '… with at least the frequency indicated…' in the REF BREF. The latest proposals by TWGs (e.g. WBP, NFM, IRPP) correspond to the second expression.** **2. (+3.) Emissions to air (a) and to water (b)** **BAT-AELs refer to the point where the emissions leave the installation, consistently with the provisions of Article 15(1) of the IED. Deciding on the exact monitoring point(s) in permitting is an implementation issue carried out under the responsibility of the competent authorities and is influenced by local/regional/national practice/policies as well as by the installation configuration. Thus there is no need to further elaborate on this in a BAT conclusion.** **Recent BAT conclusions (e.g. WBP and CWW) contain a BAT conclusion on the monitor of key process parameters relevant for emissions to air and water.** **In recent BAT conclusions, monitoring requirements are separated from BAT-AEL tables, as this provides a better overview.**

EIPPCB proposal:	**1. General** **1.1. Keep the prevalence for EN standards in the BAT statement.** **1.2. Keep the proposed statement on the minimum monitoring frequency.** **2. (+3.) Emissions to air (a) and to water (b)** **Remove indications on the exact location where to perform the monitoring.** **Add a BAT conclusion on the monitoring of key process parameters relevant for emissions to air and water.** **Summarise the monitoring requirements for emissions to air and water in separate BAT conclusions.**

1.2.1.3 BAT 3 – Process parameters and other environmental parameters

Location in D1:	*P. 740 – Section 10.1.2*
Current text in D1:	**3. In order to ensure general good environmental and combustion performance, BAT is to monitor the process parameters and the additional environmental parameters given below.**

Parameter	Applicability	Point of measurement	Monitoring frequency
Energy output (power, heat, mechanical output)	All combustion plants	At plant/installation boundaries	Continuous
Waste generation	All combustion plants	At plant/installation boundaries	
Waste water flow	All combustion plants	Before discharge to receiving water	
Noise level	All combustion plants	At plant/installation boundaries	3 times/yr
Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V, Cd, and Tl emissions to air	Combustion plants using coal, lignite, biomass, peat, HFO	After all the flue-gas treatment, steps, and before mixing with other flue-gases and releasing	3 times/yr
Zn emissions to air	Combustion plants co-incinerating sewage sludges	After all the flue-gas treatment steps, and before mixing with other flue-gases and releasing	3 times/yr
N_2O emissions to air	Biomass- and peat-fired CFB boilers	After all the flue-gas treatment steps, and before mixing with other flue-gases and releasing	Twice/yr

{This BAT conclusion is based on information given in Sections 5.1.4.4, 5.2.3.6, 6.1.3.2 and 6.1.3.3}

Summary of comments:	*1. General* *1.1. Delete BAT 3 (SE_47, E&P_9).* *1.2. Remove this general conclusion and split and locate the appropriate parts in each appropriate fuel-specific section (Euracoal_108, Eurelectric_590, 871).* *1.3. This conclusion is too onerous and unfocussed. Some parameters should be removed and the frequency of others should be reduced (ES_25, ETN_16, UK_19, E&P_24, Eurelectric_197).* *1.4. Make the monitoring dependant on its relevance (CEFIC_84, DK_70).* *1.5. Introduce a risk-based approach for determining the appropriate pollutants and the way of monitoring them depending on each specific case (IE_12, UK_14, E&P_19).* *1.6. There is lack of data in the BREF supporting the proposed conclusions (Eurofer_7).* *1.7. Adjust the frequencies in the case of plants operated in peak- or emergency-load modes (FI_15).*

	1.8. Definition of the point of measurement for air emissions is not clear (Euracoal_109, Eurelectric_591_872). *2. <u>Energy output</u>* *2.1. Exempt plants < 100 MW_{th} from continuous monitoring (ES_26); adapt a risk based approach for setting the monitoring frequency for smaller plants (E&P_21).* *2.2. Replace the monitoring frequency from continuous to periodic for the heat output (Eurelectric_203_593_875).* *2.3. Exclude gas turbines and gas engines for mechanical drive from the applicability of this technique (Eurelectric_874).* *3. <u>Waste generation</u>* *3.1. Provide a minimum monitoring frequency (BE_33, PT_12).* *3.2. Exclude open-cycle gas turbines from the application of this parameter (Eurelectric_201_202).* *3.3. Exclude turbines for mechanical drive from the application of this parameter (IT_70, Marcogaz_101).* *4. <u>Waste water flow</u>* *4.1. Provide a minimum monitoring frequency (BE_33, PT_12).* *4.2. Exclude open-cycle gas turbines from the application of this parameter (Eurelectric_201_202).* *4.3. Limit the applicability to contaminated waste water, excluding e.g. cooling waste waters or run-off waters (FI_16).* *4.4. The point of measurement should be before mixing with other not contaminated waste water flows (DE_18, DK_10).* *4.5. Add 'continuous' as monitoring frequency (AT_108).* *4.6. In case of release of waste waters in subsequent treatment plants, the measurement takes place somewhere else (e.g. according to CWW BAT conclusions) (CEFIC_75).* *4.7. Exclude turbines for mechanical drive from the application of this parameter (IT_70,Marcogaz_101).* *5. <u>Noise level</u>* *5.1. Remove this parameter (DE_31, Marcogaz_99, CEFIC_75, ETN_55, Euracoal_111, Eurelectric_594_876, Eurofer_210, SK_1_3); treat this issue transversally for all the BREFs (DE_33_174).* *5.2. Except the plants belonging to a bigger installation (CEPI_18_33) and small plants (IT_68).* *5.3. Indicate the point of measurement: On a local basis depending on the plant surroundings (industrial area, rural area, urban area, etc.,…) (DK_69).* *5.4. Change the frequency to:* • *1/yr (ES_27, IT_68, PT_49, CEFIC_2_25, CEPI_18, ETN_17).* • *Once after initial start-up and after each substantial modification with relevant influence on sound radiation (CZ_71, DE_119, Eurelectric_594_876, E&P_71, ETN_54), and periodically upon specific demand (AT_11).* • *Once every 3 (or 1 to 5) years and after significant change to the plant (EL_14, FR_64, CEFIC_193, CEPI_33),* • *Once after initial start-up and then use of a noise model at site level (CEFIC_85, Eurelectric_594_876, ETN_56).* • *Two times in period of two consecutive years (winter/summer) (PL_93).* • *One campaign at the appropriate time after commissioning (Marcogaz_31_42).* • *Every second year, and document 3times/yr whether any new source of noise has been added (SE_19).* • *Frequency and location dependent on environmental impact (ETN_15) and national regulations (PT_77).* *6. <u>Metals</u> (<u>Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V, Cd, and Tl emissions to air)</u>* *6.1. Remove this parameter (DE_32).* *6.2. Exclude biomass-fired plants (SE_18, E&P_5, EPPSA_1_418).* *6.3. Exclude coal- and lignite-fired plants (EL_15, Euracoal_114, Eurelectric_204).* *6.4. Exclude HFO-fired plants (SE_18, E&P_5).* *6.5. Allow to perform mass balance assessments (CONCAWE_40) or to use calculation models (DK_70).* *6.6. Change the frequency to:* • *1/yr (CEFIC_2).* • *1/yr for solid fuels firing (FI_18).* • *1/yr and in case of fuel type change (CZ_72, CY_3, PL_95, CEFIC_24, E&P_72).*

	• *1/yr and less in case or low and stable emission levels (CEPI_35).* • *1/yr via the chemical analysis of the fuels completed with the dust monitoring (Eurofer_211).* • *Less than 1/yr (UK_20, E&P_25).* • *1/6 months (IT_71, PT_50).* • *Direct measurements or analysis based on metals content in the fuel (CEFIC_195).* • *Case specific for other than solid fuels firing (FI).* *6.7. Change the applicability:* • *Applicable only when metals are present in the fuel (CEFIC_194).* • *Applicable only for non-conventional fuels and waste (DE_120, E&P_23, Eurelectric_595_877, UK_18).* *7. <u>Zn emissions to air</u>* *7.1. Merge this pollutant with the other metals (DK_70, FI_18, FR_63).* *7.2. Remove this pollutant (DE_121, Euracoal_112_115, Eurelectric_198_199_878_596).* *8. <u>N_2O emissions to air</u>* *8.1. Remove the pollutant (DE_122, Euracoal_113, Eurelectric_597_879, EPPSA_2_355).* *8.2. Include the combustion of coal and lignite (PL_97).* *8.3. Change the frequency to:* • *1/yr (CZ_E&P_70) at minimum and maximum load of the plant (PL_96).* • *Once/2 yrs (FI_19, CEPI_34).* • *1/yr and in case of fuel type change (DK_71).* *9. <u>Additional parameters</u>* *9.1. Include Selenium in vapour form to the list of metals (DK_70).* *9.2. Include methane and NMVOC (NO_24).* *9.3. Include Hg (once/yr) (PL_98).* *9.4. Include NH_3 for plants fitted with SNCR and/or SCR (continuous or 1/yr).*
EIPPCB assessment:	**1. <u>General</u>** **1.1. (to 1.7) The comments submitted reflect concerns over the cost and justification for performing such monitoring with the frequencies proposed. This monitoring does not duplicate the proposals for monitoring made in each fuel-specific BAT conclusion. It is transversal to several plant categories and is thus deemed appropriate to set it as a general BAT conclusion. This represents a BAT in that it allows the building of knowledge on key parameters and in further controlling the plant and its environmental impact. The appropriateness of setting each parameter and the associated frequency are discussed in detail below.** **1.8. The point of measurement of emissions to air is the same as the one defined for BAT-AELs for emissions to air.** **2. <u>Energy output</u>** **As per assessments made in Sections 1.1.5 and of this BP, it is proposed to set BAT-AEELs as 'design' values and to set a monitoring frequency for performance tests corresponding to 'after the commissioning of the plant and after every modification that could significantly affect the energy efficiency of the plant'. The proposal in D1 to monitor continuously would then not be needed.** **3. <u>Waste generation</u>** **Waste generation is important to monitor in order to get an overall view of the environmental performance of the installation. Such an overview can be gained by making a balance of the waste generated periodically. There is a proposal to include in BAT 1 and 12 (EMS and waste management) the carrying out of a waste management plan. That plan should contain much more information on waste quantities than a monitoring once every year.** **4. <u>Waste water flow</u>** **Waste water flows are important to monitor in order to get an overall view of the environmental performance of the installation. The continuous monitoring of flows enables the yearly loads of pollutants emitted by the plant to be determined. The monitoring refers to direct discharges to a receiving water body at the point where the emission leaves the installation and is limited to those streams arising from the use of wet abatement techniques for reducing emissions of pollutants to air.** **5. <u>Noise level</u>** **Noise is not (yet) covered in a horizontal BREF and is thus, when relevant, covered in each and every BREF. Noise is a relevant issue for combustion plants, which**

	include rotating or vibrating devices. The fact that this topic is not specifically covered by IED Chapter 3 does not prevent it from being covered in the BREF. The assessment of submitted comments shows that the frequency of monitoring is the main issue of concern. The noise levels are quite stable after the plant has started up. Modifications or equipment malfunctioning could lead to an increase in the initial noise levels. It is however deemed necessary to periodically monitor noise levels to check any abnormal malfunctioning, except in the case of plants included in a bigger integrated industrial installation where there may be more activities generating noise. However it is proposed the addition of a new BAT (BAT 13 bis) on 'noise management plan' which will include noise monitoring provisions. **6. Metals (Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V, Cd, and Tl emissions to air)** **No rationale supports the request for removing the BAT conclusion. BAT conclusions are proposed concerning the reduction of dust and particulate-bound metals emissions to air for the combustion of coal, biomass, HFO (e.g. BAT 22, BAT 29, BAT 34, BAT 39), even if no BAT-AELs are set for particulate-bound metals emissions. The list of pollutants reflects the pollutants monitored in the case of waste co-incineration. The reduction of such pollutants is controlled through an appropriate monitoring, at least once per year. Depending on the type of fuels used and on the knowledge of levels of pollutants emitted, this frequency may be adjusted.** **7. Zn emissions to air** **This pollutant is of interest not only when co-incinerating sludge due the potentially high level of Zn contained in this waste, but also when combusting other fuels in the same conditions as described in the previous point (Combustion plants is the second polluting industrial sector regarding Zn in the EPRTR 2012 with 15 % of emissions).** **8. N_2O emissions to air** **A BAT conclusion is proposed concerning the limitation of N_2O emissions to air for the combustion of biomass (BAT 26), even if no BAT-AELs are set for N_2O emissions. In the case of coal combustion, a BAT is proposed as well as BAT-AELs and associated monitoring directly with the BAT-AELs. The limitation of this pollutant is controlled through an appropriate monitoring, at least once per year. As the measurement may vary depending on the load, it is recommended to perform it at a standardised boiler load of > 70 %.** **9. Additional parameters** **9.1. According to the BREF (Section 1.3.2), Selenium (Se) has the same propensity as As or Hg to be poorly retained within solid particles and thus to be released via emissions to air.** **9.2. The comment is not supported by any rationale or information. According to the assessment made in Section 1.6.7 of this BP, NMVOC and CH_4 levels from turbines and boilers seem low. See Section 1.6.7 of this BP regarding the monitoring of NMVOC and CH_4 in the case of engines.** **9.3. (+9.4) Hg and NH_3 emissions monitoring are already dealt with in the tables where conclusions and BAT-AELs are proposed.**
EIPPCB proposal:	**1. General** **1.1. (to 1.7) Define separate BAT conclusions on the monitoring of key process parameters relevant for emissions to air and water in BAT 3 bis, on the monitoring of emissions to air in BAT 3 ter and on the monitoring of emissions to water from flue-gas treatment in BAT 3 quater. Discuss in detail the appropriateness and the associated monitoring frequencies for each parameter below.** **1.8. Change the point of measurement to 'emissions to air'.** **2. Energy output** **Remove the continuous monitoring of the energy output. Keep the periodic monitoring of energy efficiency through performance tests to be carried out after the commissioning of the plant and after every modification that could significantly affect the energy efficiency of the plant (BAT 3).** **3. Waste generation: Remove the parameter.** **4. Waste water flow: Move to a new BAT on monitoring of key process parameters relevant for emissions to air and water (BAT 3 bis); focus on waste water from flue-gas treatment; change the monitoring frequency to: 'continuously'.** **5. Noise level: Add a noise management plan to the Environmental Management Plan (BAT 1) including noise monitoring provisions.** **6. Metals (Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V, Cd, and Tl emissions to air):** **Move to a new BAT on monitoring of emissions to air (BAT 3 ter).**

	Decrease the frequency to at least once every year for coal and/or lignite, biomass and/or peat, and HFO- and/or gas oil-fired boilers and engines. Add a footnote allowing the adjustment of the appropriate list of pollutants to monitor and the adjustment of the monitoring frequency based on a risk assessment. **7. Zn emissions to air: Move to a new BAT on monitoring of emissions to air (BAT 3 ter). Merge this pollutant with the other metals.** **8. N_2O emissions to air: Keep the periodic monitoring of this pollutant (BAT 3 ter); change the monitoring frequency to at least once every year; add a footnote: 'the measurement is performed with a boiler load of > 70 %'.** **9. Additional parameters** **9.1. Add Se in the list of metals to be monitored based on a risk assessment (BAT 3 ter).** **9.2. (to 9.4) Do not set additional general monitoring for NMVOC, CH_4 or NH_3 emissions.**

1.2.2 General environmental and combustion performance

1.2.2.1 BAT 5 – Fuel characterisation

Location in D1:	*P. 741 – Section 10.1.3*
Current text in D1:	**BAT5 - In order to improve the general environmental performance of combustion plants and to reduce emissions to air, BAT is to perform fuel characterisation for all the fuels used, in accordance with EN standards, with at least the frequency given below. BAT is also to integrate the outcome of the characterisation with the advanced computerised process control system.**

Fuel(s)	Sampling frequency	Analysis and characterisation parameters
Biomass	Representative daily biomass fuel samples	• LHV • moisture
	A monthly composite sample which is created using the daily composite samples	• Ash, metals • N, C, S content
Coal/lignite	Once / week	• LHV, moisture, volatiles, ash, fixed carbon, C, H, N, S, O,
	Once / month and at each change of coal/lignite origin	• Cl, F, Br,
	3 times / year, of the coal/lignite that is combusted when the periodic measurements of metal emissions to air take place and at each change of coal/lignite place of origin	• metals and trace species (Cd, Tl, Hg, Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V, Zn).
HFO	At each fuel delivery	• Ash, metals • N, C, S content
LFO	At each fuel delivery	• Ash, metals • N, C, S content
Natural gas	Monthly (provided by the fuel supplier)	• LHV, CH_4, C_2H_8, C_3, C_4, CO_2, N_2
Non-commercial fuels in Chemical plants	At each change of production mode that leads to a change in the by-product residues used as fuel	• C, H, N, S, O, Cl, F, Br, • metals and trace species (Cd, Tl, Hg, Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V, Zn).
Wastes	To be defined in the (pre)-acceptance procedure	• LHV, moisture, volatiles, ash, C, H, N, S, O, Cl, F, Br, metals and trace species

	(Cd, Tl, Hg, Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V, Zn) *{This BAT conclusion is based on information given in Sections 5.2.1.2 and 5.2.3.2}*
Summary of comments:	1. *General* 1.1. *Remove the BAT conclusion as it will be binding and requires being included in permits. This fuel characterisation is performed normally by the operators (DE_33).* 1.2. *Change the wording to make the BAT conclusion less prescriptive (FI_10, SE_60, CEPI_39).* 1.3. *Replace the requirements on monitoring by a general requirement 'through a product(fuel) supplier specification and/or guarantee according to international or national standards' (DK_73, Eurofer_214).* 1.4. *Remove the lines for coal/lignite, HFO, LFO and natural gas as the analysis of fuels is mainly done for the optimisation of the technical process (Eurelectric_602_610); remove the BAT conclusions (Euracoal_119).* 1.5. *This conclusion applies only when no monitoring is performed at stack level (DE_5_35); this conclusion is useful only when no end-of pipe technique is used (e.g. for dust or SO_2 (SE_23).* 1.6. *Allow the possibility to supplement or replace the measurements by computer based calculation and balance estimations (DK_155).* 1.7. *Add in the statement the compliance with ISO standards at the same level as EN standards (DK_77, Eurelectric_611); allow the use of other equivalent standards (SE_29, E&P_13).* 1.8. *Add at the end of the statement: 'in cases where the fuel quality variability benefits this integration' (EL_25, Eurelectric_618).* 1.9. *Incorporate the possibility to derive maximum SO_X emissions at stack based on S fuel content analysis to avoid performing a direct monitoring in case of low sulphur fuels (DK_157).* 1.10. *The BAT conclusion is not supported by information in sections 5.2.1.2 and 5.2.3.2 (Eurofer_8).* 1.11. *Monitoring* 1.11.1. *Change to 'Monitoring to be performed by the operator so as to fully understand the composition variability and ensure compliance with emissions to air and water' (UK_21, E&P_26).* 1.11.2. *Change to 'at each fuel delivery' when it is the main fuel and to 'once/month' when it is an auxiliary fuel (ES_29).* 1.11.3. *Change to 'based on experience' (CEFIC_76).* 1.11.4. *Include the possibility to replace the proposed frequencies by the ones that may be already included in some standards on fuel monitoring (FI_21) or in line with the EU ETS Monitoring and reporting guidelines which also require the fuel monitoring (UK_22, E&P_27).* 2. *Biomass* 2.1. *Add peat (FI_20).* 2.2. *Change the frequency to 'on each delivery' and limit the parameters to moisture, LHV and, for deliveries > 2000 t/month, to ash, N and S (SE_61, E&P_10).* 2.3. *Change the frequency to: 'A monthly combined sample which is created using daily samples and yearly combined samples which is created using the monthly samples' (FI_20, Eurelectric_656).* 2.4. *Weekly or monthly composite sampling is a common practice only for plants > 300 MW_{th}. For smaller plants, this would induce high costs (DK_74).* 2.5. *Change the parameters to: 'Analysis and characterisation parameters as required by the standards' (FI_20).* 2.6. *LHV can be calculated from moisture for some biomasses (AT_13).* 2.7. *Change the frequency for the analysis of moisture and LHV to once/month (DK_75, CEPI_37, Eurelectric_885).* 2.8. *Apply the same analysis frequency for metals as for coal (UK_25, Eurelectric_885, E&P_30).* 2.9. *Change the frequency for metals to once/yr and at each supplier change (SE_20).* 2.10. *Change the frequency for the analysis of ash, metals, N, C and S to once/yr (CEPI_37) or to 'when a new quality of fuel is introduced at the plant' (DK_72)..* 2.11. *Keep the frequency for ash, and include a monthly analysis for metals, volatiles, Na, K, Ca, P, Cl (PL_101).* 2.12. *Include a monthly analysis of Cl (DK_76).*

	3. Coal/lignite *3.1. Include that the sampling and the analysis has to be performed by the supplier (CZ_75).* *3.2. Change the frequency to 'on each delivery' and do not include the metals but Hg (SE_61, E&P_10).* *3.3. There is already a regulation regarding the monitoring of fuel input for CO_2 emissions covering the monitoring of LHV, moisture, volatiles, ash, fixed carbon, C, H, N, S, O (EL_18_26, DE_123, Euracoal_121).* *3.4. The weekly monitoring of fixed carbon, C, H, N, S, O is not justified (DK_77, Eurelectric_604); the weekly monitoring of C, H, N, O is not justified as it takes too much time and this would be costly (PL_102).* *3.5. Change the monitoring frequency for LHV, moisture, ash, S to 'once/day' (PL_102).* *3.6. Change the frequency to once/yr and in case of change of fuel type for analysis of LHV, moisture, volatiles, ash, fixed carbon, C, H, N, S, O (PT_52, E&P_73), or to once/month for plants < 100 MW_{th} (CEFIC_22), or 'every 20 000 tonnes and at least six times a year' 9CEPI_38).* *3.7. Limit the monitoring of Br, Cl and F to 'at each change of fuel type' (DK_77, CEFIC_21), or to 'once/month' (UK_26, E&P_31), or to '3 times/year for plants > 100 MW_{th} and once/yr for plants < 100 MW_{th} and for peak-load plants' (PL_104), or delete these pollutants (DE_123, EL_18, Eurelectric_604).* *3.8. Monitoring of metals at each change of fuel simultaneously with monitoring at stack is too ambitious (EL_18, UK_27, E&P_32); limit the monitoring of metals when the periodic monitoring at stack takes place (PT_79).* *3.9. Change the monitoring frequency for metals to once/yr (DK_77) and at every change of fuel (CEFIC_23), or to 'once/yr for plants < 100 MW_{th} and for peak-load plants'(PL_104), or delete them (DE_123, EL_18, Eurelectric_604).* *4. HFO* *4.1. Remove as this is a standard fuel (E&P_12).* *4.2. Add that it is the supplier who delivers the analysis at each fuel delivery (FI_22, CEPI_43, Euromot_55_83), at least when the fuel is used as back-up (PL_107); add the possibility to use delivery information from the supplier instead of sampling the fuel (DK_158).* *4.3. Change the monitoring frequency to 1/month (Eurelectric_616), or to 'at most monthly or at each delivery if the frequency of the delivery is less than a monthly one' (Concawe_60), or to 'at each fuel delivery unless a fuel specification (based on national or international standards) is provided by the fuel supplier or sufficient stability regarding composition is proven' (SE_25), or to 'once a year and at each change in the production process of a given fuel type' (CZ_74, E&P_74).* *4.4. Be more precise about the meaning of 'delivery' mentioning that this corresponds to delivery by boat (SE_26).* *4.5. Replace 'ash' by 'solid part' (PL_105, Eurelectric_614).* *4.6. Limit the parameters to be monitored to ash and S (SE_61, E&P_10).* *4.7. Change the monitoring frequency for metals to 2 times/yr (SK_4), or delete metals as not part of the commercial specification of the product (Concawe_62).* *4.8. Keep only the monitoring at each delivery for LHV and S, change to 'once/year' for the other parameters (UK_28, E&P_33).* *4.9. Add H, PCI, PCS, viscosity and density (ES_28).* *5. LFO* *5.1. Remove as this is a standard fuel (DE_124, SE_61 E&P_10_12, Eurelectric_605).* *5.2. Add that it is the supplier who delivers the analysis at each fuel delivery (FI_23, Euromot_55_83), at least when the fuel is used as back-up (PL_107); add the possibility to use delivery information from the supplier instead of sampling the fuel (DK_158).* *5.3. Be more precise about the meaning of 'delivery' mentioning that this corresponds to delivery by boat (SE_24).* *5.4. Change the monitoring frequency to 1/month (Eurelectric_616), or to 'at most monthly or at each delivery if the frequency of the delivery is less than a monthly one' (Concawe_61); replace the frequency by 'At each fuel delivery unless a fuel specification (based on national or international standards) is provided by the fuel supplier or sufficient stability regarding composition is proven' (AT_12, SE_25), or to 'once a year and at each change in the production process of a given fuel type' (CZ_74, E&P_74).* *5.5. Replace 'ash' by 'solid part' (PL_106, Eurelectric_615).* *5.6. Delete metals as not being part of the commercial specification of the product (Concawe_63).*

	5.7. Keep only the monitoring at each delivery for LHV and S, change to 'once/year' for the other parameters (UK_28, E&P_33). *5.8. Add H, PCI, PCS, viscosity and density (ES_28).* *6. Natural gas* *6.1. Delete as no environmental improvement is expected from such a conclusion (CEFIC_200).* *6.2. Remove as this is a standard fuel (DE_125, EL_20, Eurelectric_606).* *6.3. Include also that the analysis has to be performed by the supplier (CZ_75, E&P_75).* *6.4. Change the frequency to: 'weekly or lower frequency if gas composition varies' (DK_25).* *6.5. Add the following parameters to be monitored: Wobbe index, H_2, H_2S, C_2H_6, C_2+ (EUTurbines_72).* *7. Process fuels from the chemical industry* *7.1. Allow the possibility to have group of fuel characterised instead of one by one fuel to avoid re-characterising the fuels too often (CEFIC_26_3).* *7.2. Limit the monitoring frequency to the 'case of significant change of fuel mixture' (CEFIC_87).* *7.3. The frequency linked to 'each process change' is not enough precise and could lead to a lot of unnecessary analysis (CEFIC_72).* *7.4. Change the monitoring frequency to 'once every 6 months with footnotes: (a) monitoring frequencies may be adapted if, after a period of one year, the data series clearly demonstrate a sufficient stability and (b) N and S monitoring in fuel is not applicable when continuous measurements of NO_X and SO_X are carried out at the stack' (CEFIC_201).* *7.5. Limit the applicability to only the relevant compounds (CEFIC_19_88).* *7.6. Add an applicability restriction: 'Based on information on raw materials and production process, only those parameters that can reasonably be expected to be present in the respective non-commercial fuel have to be determined' (CEFIC_19).* *7.7. Remove the monitoring of samples and trace species (CEFIC_44).* *8. Wastes* *8.1. Make a reference to the EN 15359 standard for setting the frequency (FI_24).*
EIPPCB assessment:	**1. General** **1.1. (to 1.11.) Characterisation (detailed analysis) of fuels to be combusted in an LCP is important as it allows optimising the operation of combustion-related processes, controlling polluting emissions and the operation of emission control processes, and optimising waste management and resources. Depending on the type of fuel combusted, some parameters may or may not need to be characterised. Then, testing the fuel periodically to ensure it is within the characterisation parameters depends on the fuel quality variability and the on level of each compound in the fuel to be combusted, which are very plant-specific. Thus the testing according to similar frequencies for all the plants may not be appropriate. This testing can be performed by the operator itself or by the supplier; the statement allows this; however it could be more explicit. Using EN standards as standards of reference is the common approach in all the BREFs.** **2. Biomass** **2.1. Peat is considered under the same section as Biomass and has been forgotten in D1 in this table.** **2.2. (to 2.12.) Regarding the pollutants to characterise, Cl and F are also important as there are BAT-AELs proposed for HCl and HF. 'Metals' is not enough precise.** **3. Coal/lignite** **3.1. (to 3.9.) The new wording proposed for the statement does not contradict or add additional burden to the regulation on fuel monitoring for CO_2 emissions,** **4. (+5.) HFO/LFO** **4.1. (to 5.7.) Even being a standard fuel, there may be important variations in the content of some compounds from one fuel origin to another, thus justifying to perform periodic testing for optimising the plant functioning. Ash content is a parameter commonly used when performing proximate analysis. Levels of C in the fuel is important for the efficiency of the combustion, the other parameters are important for the impact on air emissions, mainly with N, S and ash contents that may have an impact on the techniques to be applied for reducing air pollutants. In the case of liquid fuels, not all the metals are relevant; the two more relevant are Ni and V.**

	4.2. LFO could be renamed to gas oil for consistency throughout the BAT conclusions. **6. Natural gas** **6.1. (to 6.5.) The natural gas characteristics are not supposed to vary a lot in the grid, and the operator has not many possibilities to change the quality of supply. However, the interconnection of natural gas grids together with the reinforcement of the grid with LNG terminals for security reasons of supply in Europe may lead in the future to variable natural gas quality that may affect the gas-fired plants. It is thus relevant to characterise at least once the quality of the natural gas and then to have it tested from time to time. In this respect, the list of parameters to be characterised can be completed with the Wobbe index and the hydrogen content (H_2 and H_2s).** **7. Process fuels from the chemical industry** **7.1. (to 7.7.) The possible spectrum of fuels composition is very wide for this type of fuels. A first assessment of the compounds that could be expected to be found in the fuels can be performed prior to starting the characterisation.** **8. Wastes: The standards are generically mentioned in the statement (see point 1.1 of this section).** **9. Other fuels: Iron and steel process gases were missing in the table. Information about relevant substances/parameter used for the characterisation of such fuels are described in the BREF Section 7.3.1.1.**
EIPPCB proposal:	**1. General** **1.1. (to 1.11.) Reformulate the BAT statement to clearly distinguish between characterisation and testing. Remove the column on sampling frequency and add in the statement the possibility to define this frequency according to the fuel variability and to a risk assessment. Keep a list of parameters to be characterised. Keep the reference to EN standards as reference. Add the possibility to use other standards in case EN standards do not exist.** **2. Biomass** **2.1. Add peat to biomass.** **2.2. (to 2.12.) Include Cl and F in the list of compounds to characterise. Detail the list of metals consistently with the list proposed for coal/lignite.** **3. Coal/lignite** **3.1. (to 3.9.) Keep the proposed list of parameter to monitor.** **4. (+5.) HFO/LFO** **4.1. (to 5.7.) Keep the periodic testing of some pollutants. Replace 'metals' by 'Ni and V'. Change 'LFO' to 'gas oil'.** **6. Natural gas** **6.1. (to 6.5.) Keep the list of parameters to characterise; add the Wobbe index and the hydrogen content.** **7. Process fuels from the chemical industry** **7.1. (to 7.7.) Add a footnote stating that the list of parameters to be characterised can be reduced based on an assessment of the compounds that could be reasonably expected to be found from the products and processes applied at the chemical installation supplying the fuels.** **8. Wastes: Do not mention specifically the EN 15359 standard.** **9. Other fuels: include iron and steel process gases in the table.**

1.2.2.2 BAT 6 – Emissions during start-up and shutdown periods

Location in D1:	*P. 741 – Section 10.1.3*
Current text in D1:	**BAT 6 - In order to minimise the emissions during start-up and shutdown (SU/SD) periods, BAT is to shorten those periods to the minimum time necessary to meet the consumer (e.g. the grid) requirements.**
Summary of comments:	1. <u>General</u> 1.1. *Remove this BAT conclusion as SU/SD periods should not be specified in the permits as a requirement (UK_36, E&P_41CEFIC_20), or as it may damage the combustion plant and is difficult to check (E&P_11), or it is not well enough defined (SE_27).* 1.2. *Amend the statement by adding: '... according to the implementing decision 2012/249' (AT_115, DK_156, IE_13, IT_73, PT_81).* 1.3. *The duration of SU/SD periods may be limited by, or should take into account, the type of techniques implemented for reducing the pollutant emissions (Malta_9_11, EUTurbines_73).* 1.4. *Plants combusting iron and steel process gases cannot meet this BAT conclusion (Eurofer_215).* 1.5. *Add also the need 'to warm up the equipment, prevent mechanical damage'(CEFIC_202, SE_28), or 'to comply with ELVs' (EL_21) within the SU/SD period.* 1.6. *SU/SD periods need to be decided on a site by site basis (UK_29, E&P_34).* 1.7. *Improve the requirements attached to this BAT conclusion based on a more detailed assessment in the BREF (BE_34, EEB_143).*
EIPPCB assessment:	• **Shorten the SU/SD periods is not exactly a technique. To be able to reduce the occurrence and the duration of SU/SD periods and therefore to minimise the emissions during those periods, some techniques can be proposed.** • **Reduction of the number and duration of SU/SD can be achieved by carrying out improvements in the auxiliary devices (e.g. Plant 449, 'dynamic classifiers on the mills'), combustion optimisation and/or use of emissions abatement systems. In the last case, it may be referred not only to SU/SD periods but also during normal operating conditions.** • **To reduce the number and duration of SU/SD periods, reduction of the load threshold of the start-up and shutdown periods can be considered (e.g. Plant 195 combined cycle turbine using low load operation point).** • **To reduce the emissions during the SU/SD, an appropriate combination of techniques listed in BAT 4 may be used (e.g. Plant 25-2, 'Fuel choice').** • **Emissions monitoring during SU/SD periods would provide valuable input for the operator to reduce emissions during this periods, and for the elaboration of more specific techniques during SU/SD for the next review of the LCP BREF.** • **The reflection on how to reduce emissions during SU/SD may need to be assessed plant by plant, using a risk based approach included in a management plan. This management plan could cover more widely any kind of OTNOC that may have an impact on emissions.** • **In parallel of this management plan for OTNOC, it would be appropriate to include a BAT conclusion on the appropriate design and maintenance of abatement techniques, as it is also considered important to prevent and/or reduce the occurrence and duration of OTNOC. This kind of BAT conclusion is already included in other approved BREFs.**
EIPPCB proposal:	• **Propose a modification of BAT 6 to include techniques that are focussed on limitation of the number, the duration and the emissions during start-up and shutdown periods** • **Propose a new BAT (6 bis) related to a management plan for minimising the occurrence and duration of other than normal operating conditions (OTNOC).** • **Propose a new BAT (6 ter) for the monitoring of emissions during OTNOC.** • **Propose a new BAT (6 quater) that in order to reduce emissions to air, BAT is to ensure by appropriate design, maintenance and/or operation that the emission abatement systems are used at optimal capacity and availability during normal operating conditions (NOC).**

1.2.3 BAT 11 – Reduction of emissions to water

<table>
<tr><td>Location in D1:</td><td>page 745</td></tr>
<tr><td>Current text in D1 part I:</td><td>
BAT 11. In order to reduce the emission of pollutants contained waste water discharged into receiving waters, combustion plants fitted with wet abatement techniques for controlling their emissions to air, BAT is to use a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Mechanical treatment</td><td>Sedimentation, filtration, oil separation.</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Physico-chemical treatment</td><td>Removal of fluoride, sulphide, COD, particulates by adding chemicals to cause the solids to settle, and removal of metals by increasing the pH (precipitation, flocculation, coagulation, sedimentation, neutralisation)</td><td>Generally applicable</td></tr>
<tr><td>c.</td><td>Zero liquid discharge (ZLD)</td><td>Precipitation, softening, crystallisation, evaporation</td><td>Applicable only to plants discharging to very sensitive receiving waters, where techniques (a) and (b) do not enable meeting the environmental quality standards</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments part I:</td><td>
1. <u>General</u>
• In the BAT statement, replace 'a combination' by 'one or a combination', as not all techniques can be applied (CEFIC_216).
• Add a BAT conclusion with performance levels for indirect discharges to ensure that metal emissions are controlled at the source (DK_16_22).
2. <u>Techniques</u>
2.1. <u>Zero liquid discharge (ZLD)</u>
• ZLD is only applicable in small plants due to the high energy consumption (DE_19, Eurelectric_595_621_907).
• Delete technique. If it is applicable to very sensitive receiving waters, this technique is beyond BAT (FI_42).
• ZLD is not applicable to chemical plants, as organic compounds may impede crystallisation (CEFIC_217).
• ZLD is not applicable to pulp and paper plants, as there is often a common waste water treatment (CEPI_50).
2.2. <u>Other techniques</u>
• Add a technique on the mixing of waste water from WFGD with coal/lignite ash (Eurelectric_596, E&P_21, PL_21)
</td></tr>
<tr><td>EIPPCB assessment-part I:</td><td>
1. <u>General</u>
It seems better to refer to 'waste water from flue-gas treatment' instead of 'waste water from wet abatement systems', as the former is more generic and also covers waste water from condensers.
The treatment of waste water from flue-gas treatment is generally most efficient when applied as close as possible to the source, thereby avoiding dilution with other waste water streams. The techniques described in BAT 11 apply to both, direct and indirect discharges.
Waste water from flue-gas treatment is usually treated by using a combination of techniques.
2. <u>Techniques</u>
2.1. <u>Zero liquid discharge (ZLD)</u>
ZLD is a combination of techniques that results in no waste water discharges. Depending on plant-specific conditions, ZLD may be achieved for different waste water streams and by using different combinations of techniques. Therefore, it seems more appropriate to list individual treatment techniques in the table, such as those given in Chapter 3 of the BREF.
Evaporation allows plants to recover clean water for reuse, thereby reducing water usage. A few plants worldwide use evaporation, including larger plants (e.g. reference plants 211/212 (418+433 MW_{th}) and 253 (1420 MW_{th})). However, evaporation implies high energy consumption which may offset the environmental benefits.
</td></tr>
</table>

<table>
<tr><td></td><td>

2.2. Other techniques

The addition of coal/lignite ash to waste water from WFGD results in a residue that is typically disposed of as waste. This prevents the recycling/reuse of the ash (proposed as BAT 13 d) and requires extra landfill volume.

A number of end-of-pipe waste water treatment techniques that were reported in the questionnaires and in a recent publication of the US EPA are not listed in the table. Moreover, optimised combustion and operation of abatement devices (e.g. SCR/SNCR, dust abatement) reduce the transfer of some pollutants (i.e. COD, total nitrogen) to waste water.

</td></tr>
<tr><td>EIPPCB proposal - part I:</td><td>

1. General

Harmonise the BAT statement with recent BAT conclusions, refer to waste water from flue gas treatment, and refer to an appropriate combination of techniques. Specify that the treatment should be carried out as close as possible to the source (see CAK and CWW BREF).

2. Techniques

2.1. Zero liquid discharge (ZLD)

Delete this technique and the other categories of techniques and replace them by the individual treatment techniques.

2.2. Other techniques

Move the technique 'evaporation' to the BAT conclusion on water usage and reformulate the applicability restriction.

Do not add the technique 'addition of coal/lignite ash to WFGD waste water'.

Add the following end-of-pipe techniques to the table: adsorption on activated carbon, aerobic biological treatment, anoxic/anaerobic biological treatment, ion exchange, flotation, oxidation, and stripping. Add a primary technique on optimised combustion and operation of waste gas abatement techniques.

Add a column specifying typical pollutants abated as in the CWW BREF. Specify that the techniques are generally applicable, except in the case of aerobic biological treatment, where nitrification may be impeded by high chloride concentrations. Add the description of the techniques at the end of the BAT conclusions.

</td></tr>
<tr><td>Current text in D1 part II:</td><td>

BAT-associated emission levels

BAT-associated emission levels to receiving waters are given in Table 10.1.

Table 10.1: BAT-AELs for emissions to water from combustion plants fitted with wet abatement techniques

Parameters	Unit	BAT-AEL Average of samples obtained during one year	Monitoring frequency
COD([2])	mg/l	30 – 150	Periodic measurement: once/month
Suspended solids		5 – 30	
Fluoride as F [(3)]		1 – 15	
Chloride as Cl [(3)]		500 – 1000	
Sulphate as SO_4 [(3)]		300 – 1500 ([1])	
Sulphide as S		0.01 – 0.1	
Sulphite as SO_3		1 – 5	
Total N		1 – 50	
THC		1 – 10	
Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V		0.01 – 1	
Cd+Tl		0.01 – 0.25	
Hg		0.001 – 0.015	
Zn		0.01 – 0.5	

([1]) The lower end of the ranges is achieved by plants where other streams than just the stream from the wet abatement techniques, are mixed before discharging into receiving waters.
([2]) Due to difficulties in monitoring COD emissions in the case of high levels of chlorides in waters, TOC is directly measured instead of COD when chloride concentration exceeds 1000 mg/l, and COD concentration is then estimated through a plant-specific correlation pattern.
([3]) BAT-AELs not applicable when using salty water e.g. for seawater WFGD

</td></tr>
</table>

Summary of comments part II:	***Table 10.1 BAT-AELs:*** *1. <u>General</u>* • *Specify that the BAT-AELs for emission to water should be considered as a reference taking into account the plant characteristics and the pollutant load (ES_33).* • *Specify that the setting of ELVs for waste water streams other than from flue-gas treatment is the prerogative of the competent authorities in the MS (Eurelectric_605, PL_122, EL_50).* • *Add BAT-AELs for water from neutralisation and sedimentation tanks/basins (DK_18).* • *Add BAT-AELs for acidic wash water from boilers and condensers (DK_19).* • *Add BAT-AELs for direct discharges to the sea and for waste water from sources other than FGD (PT_61).* • *Limit the BAT-AELs exclusively to FGD waste water, as this is the most problematic stream in LCPs and as this is in line with the 2006 LCP BREF (see Section 4.5.13 of the BAT chapter) (Eurelectric_608, PL_18_19, E&P_18_19).* • *Specify that the BAT-AELs are not applicable to industrial sites with common waste water treatment (e.g. chemical industry, pulp and paper production) (CEFIC_4_17_27_92, CEPI_52, FI_96).* • *The proposed BAT-AEL do not differentiate between direct and indirect discharges (e.g. to an off-site waste water treatment plant) (IT_76).* • *The proposed BAT-AELs do not take into account the dilution caused by cooling water at the final discharge point. Consider setting performance levels at the outlet of the FGD waste water treatment (UK_103).* • *Specify that the BAT-AELs apply after FGD waste water treatment before mixing with other waste water streams (DE_ 26).* • *The proposed BAT-AELs do not seem to be consistent with typical performances of plants reported in chapter 3 (IT_76).* • *The BAT-AELs are very difficult to achieve (Eurelectric_598, Euromot_170, MT_16).* • *The upper end of the BAT-AEL ranges must not exceed the MAC-EQS for the relevant priority hazardous substances according to Directive 2013/39/EU (EEB_149).* • *The BAT-AEL ranges should take into account the quality of the raw water (e.g. TSS levels may be up to 30 mg/l) (UK_58, E&P_62)* *2. <u>Averaging period</u>* • *Express BAT-AELs on a short-term basis to better control the proper functioning of the waste water treatment (e.g. as 24-hour composite sample or qualified random sample) (DE_28, BE_43).* • *Express BAT-AELs on a short-term basis for substances with acute toxic effects (DK_8).* *3. <u>Monitoring frequency</u>* • *Decrease the frequency to once every three months if the emission levels are stable (FI_41).* • *Decrease the frequency and require a one-off measurement upon fuel change (E&P_79, CZ_79).* • *Decrease the frequency as emission levels are generally stable (MT_14_16).* • *When waste water is collected in basins, monitoring should take place immediately before discharge (DK_21).*

	4. <u>TOC/COD</u> • *Delete the BAT-AEL for COD for biomass. Values ought to be very low unless COD originates from other sources (e.g. bottom ash) (SE_35).* • *COD can only be marginally reduced with precipitation (DK_22).* • *Set a BAT-AEL range for TOC as an alternative to COD instead of giving a general footnote (Eurelectric_604, FR_72, PL_121).* *5. <u>Total suspended solids (TSS)</u>* • *Increase the upper end of the BAT-AEL range to 100 mg/l (FI_40).* *6. <u>Fluoride (F^-)</u>* • *Increase the upper end of the BAT-AEL range to 30 mg/l due to the solubility of fluoride and the performance of several reference plants (e.g. 121 (stream 1), 122, 124/134, 131, 138/139, 141) (Eurelectric_601_623_909, Euracoal_127, EL_47).* *7. <u>Chloride (Cl^-)</u>* • *Delete the BAT-AEL, as:* *- the environmental impact depends on the receiving water body (E&P_14);* *- chloride is not removed when using typical abatement techniques (e.g. precipitation with hydroxide/sulphide) (DE_20, EL_45, PL_19_20, Euracoal_126, E&P_19_20, Eurelectric_599_622);* *- water recycling increases the chloride concentration (DE_20, PL_19_20, E&P_19_20);* *- the proposed levels cannot be met by the reference plants (EL_45, Euracoal_126, Eurelectric_599_622_908).* • *Delete the BAT-AEL for biomass since chloride is not removed when using typical abatement techniques (SE_34).* • *Chloride is not removed with usual precipitation techniques (DK_22).* • *Increase the upper end of the BAT-AEL range to 10 000 mg/l for discharges to marine waters due to water recycling and because typical abatement techniques do not remove chloride (PT_84).* • *The BAT-AEL range should take into account the quality of the fuel and the water (PL_19, E&P_19, Euromot_170).* • *Define BAT-AELs depending on the sensitivity of the receiving water body, as in many cases there is no major impact (e.g. for discharges to marine water)(DK_17, SE_34).* *8. <u>Sulphate (SO_4^{2-})</u>* • *Delete the BAT-AEL, as:* *- the environmental impact depends on the receiving water body (E&P_15);* *- the solubility of sulphate limits its abatement (EL_46, Eurelectric_600);* *- water recycling increases the sulphate concentration (PL_19_20, E&P_19_20);* *- the proposed levels cannot be met by the reference plants (e.g. 123, 124/134, 131) (EL_46, Eurelectric_600);* *- some plants do not precipitate gypsum (E&P_15).* • *Increase the upper end of the BAT-AEL range to 2000 mg/l due to:* *- the solubility of sulphate (Euracoal_127, Eurelectric_623_909);* *- water recycling which increases the sulphate concentration (DE_21);* *- the performance of several reference plants (DE_21) (e.g. 123, 124/134, 131) (Euracoal_127, Eurelectric_623_909);* *- the low toxicity of sulphate (DE_21).* • *The abatement of sulphate by precipitation is limited by its solubility: 1000–2000 mg/l are typically achieved for waste water with a low salinity (low chloride), and 2000–4000 mg/l for waste water with a high salinity (DK_22).* • *Meeting the proposed BAT-AEL range would require increasing the temperature of the waste water (PT_85), using toxic chemicals such as barium chloride for precipitation (DK_22), or zero liquid discharge techniques (e.g. evaporation and crystallisation) (PL_20, E&P_20).* • *Delete the BAT-AEL for biomass since levels of sulphur in biomass are low (SE_100).* • *Define BAT-AELs depending on the sensitivity of the receiving water body, as in many cases there is no major impact (e.g. for discharges to marine water) (DK_17, SE_100).* • *The BAT-AEL range should take into account the quality of the fuel, the water and the limestone (Mg content) (PL_19, E&P_19, Euromot_170).* • *The lower end of the range is based on mixed waste water from various sources. This sounds as if waste water could be diluted instead of being treated (DK_17).* • *Clarify what is meant with 'the lower end of the ranges' (BE_44).* *9. <u>Sulphide (S^{2-})</u>* • *Increase the upper end of the BAT-AEL range to 0.2 mg/l (Eurelectric_601_623_909, Euracoal_127, EL_47).*

	10. Sulphite (SO_3^{2-}) • *Increase the upper end of the BAT-AEL range to 20 mg/l (Eurelectric_601_623_909, Euracoal_127, EL_47).* • *Decrease the upper end of the BAT-AEL range to 1 mg/l in line with Portuguese legislation (PT_14).* *11. Total nitrogen* • *Delete the BAT-AEL, as:* *- nitrogen is not removed when using typical abatement techniques (e.g. precipitation with hydroxide/sulphide) (PL_19_20, E&P_19_20);* *- water recycling increases the nitrogen concentration (PL_19_20, E&P_19).* • *Delete or modify the BAT-AEL, as the proposed levels cannot be met by the reference plants (e.g. 123 (stream 1)) (Euracoal_176; Eurrelectric_603_625_911).* • *Decrease the upper end of the BAT-AEL range to 15 mg/l in line with Portuguese legislation (PT_14).* • *Nitrogen cannot be removed with precipitation (DK_22).* • *No techniques for the reduction of nitrogen emissions in highly saline waters are described (PL_22, E&P_22).* • *The BAT-AEL range should take into account the quality of the fuel (PL_19, E&P_19).* *12. THC* • *Delete the BAT-AEL as very few data were provided (Eurelectric_602_624_910_ Euracoal_128, EL_48_49).* • *Delete the BAT-AEL for biomass. Values ought to be very low unless THC originates from other sources (e.g. bottom ash) (SE_37).* *13. Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V* • *Delete the BAT-AEL for Co, Mn, Sb, and V as very few data were provided (Eurelectric_602_624_910, Euracoal_128, EL_48_49).* • *Define BAT-AELs for individual metals as they show different properties and toxicities (AT_113, DE_22).* • *Set BAT-AELs to < 25 µg/l for Pb and to < 50 µg/l for Cr, Cu, and Ni (DE_22).* • *As and Sb cannot be removed with precipitation. Only co-precipitation may take place (DK_22).* *14. Cd+Tl* • *Cd and Tl have different properties and toxicities. Set the BAT-AEL for Cd individually at < 5 µg/l (DE_23).* • *Set the BAT-AEL for Cd at < 3 µg/l, as this is achievable with precipitation (DK_20).* *15. Hg* • *Decrease the upper end of the BAT-AEL range to 5 µg/l, as a large number of coal-fired plants with FGD show levels < 5 µg/l (EEB_39).* • *Decrease the lower end of the BAT-AEL range to 0.2 µg/l. Several coal-fired plants with FGD show levels < 1 µg/l, while some biomass/peat-fired plant with FGD show levels < 0.8 µg/l (EEB_40).* • *Decrease the BAT-AEL to < 5 µg/l, in order to meet environmental quality standards (DE_24).* *16. Dioxins and furans* • *Add a BAT-AEL for dioxins and furans of < 0.3 ng/l for waste incineration plants (DE_25).*
EIPPCB assessment:	**1. General** **BAT-AELs and their legal implications are defined/described in the IED. BREFs are technical documents that do not interpret legislation or give guidance to permitting authorities on how to set permit conditions.** **Waste water from flue-gas treatment carries the largest share of the pollutant load emitted to water. The original BREF only defined BAT-AELs for waste water from wet FGD.** **There seems to be some ambiguity if the BAT-AELs also apply to sites with common waste water treatment.** **The IED requires ELVs to be set at the point where the emission leaves the installation. It is difficult to set BAT-AELs for indirect discharges due to the unknown effect of downstream waste water treatment plants. Therefore, recent BAT conclusions defined BAT-AELs for emissions to water only for direct discharges to a receiving water body at the point where the emission leaves the installation.** **Performance levels at the outlet of the FGD waste water treatment do not constitute BAT-AELs unless the outlet corresponds to the installation boundary.** **Since it is proposed to express BAT-AELs as short-term averages (see below), the levels should be revised, based on the reported data (in particular the graphs and tables**

	provided to the TWG in April 2014), the comments and any additional information provided. The performance of an installation does not only depend on the technologies used, but also on the way they are designed, maintained, and operated. **Emission data used to derive BAT-AELs have been reported without reference to any intake loads. The issue is of a generic nature and seems more related to implementation. It was already discussed at the IED Article 13 forum in the context of the CWW BREF review. It was agreed not to include specifications on how to deal with intake loads.** **BAT-AELs are based on BAT and not on environmental quality standards.** **2. <u>Averaging period</u>** **BAT-AELs expressed as short-term averages are easier to implement by permitting authorities. In the EU, emission limit values for emissions to water are usually expressed as short-term averages, often based on 24-h composite samples.** **The 2006 LCP BREF contained BAT-AEL values expressed as short-term values (24-h composite samples). Recent BAT conclusions usually contained short-term BAT-AELs in those sectors, where only physico-chemical treatment techniques are used (i.e. CAK, GLS, NFM, and IS BREFs), but long-term BAT-AELs in those sectors where biological treatment techniques are used (i.e. CWW, PP, REF, TAN). IED Annex VI for waste (co-)incineration plants set ELVs as daily average values.** **Both short-term values (minimum/maximum) and yearly average values were provided during the data collection. The fluctuation of the maximum values around the average depends on the pollutant, but is generally lower than in other industry sectors where biological waste water treatment is used (e.g. chemical industry).** **3. <u>Monitoring frequency</u>** **EPRTR data suggest that combustion plants are major contributors to emissions of fluoride, chloride, and metals/metalloids to water within the activities covered by that regulation. Compared to waste incineration, the contribution of combustion plants to overall emissions to water in EPRTR is much higher.** **For waste incineration plants, IED Annex VI, Part 6 requires a daily measurement for TSS and at least a monthly measurement for metals and metalloids in waste water from flue gas treatment. Similarly, a monthly measurement of relevant metal emissions to water was recently agreed during the review of the NFM BREF.** **In the questionnaires, the reported measurement frequency was often around once every month, sometimes less frequent, but sometimes also more frequent.** **Specifying the appropriate measurement time (e.g. immediately before release from batch treatment) seems more related to implementation.** **4. <u>TOC/COD</u>** **In the 2006 LCP BREF, the BAT-AEL for COD from FGD waste water was set to < 150 mg/l in 24-h composite samples. No BAT-AEL for TOC was given.** **TOC/COD loads in waste water can be reduced by optimised design and operation of combustion and waste gas abatement techniques, independent of the fuel. TOC/COD is also partially co-precipitated during the precipitation of metals.** **The parameter COD is widely used for the monitoring of emissions of organic compounds. However, it is increasingly replaced by the parameter TOC which does not rely on the use of very toxic compounds (i.e. mercury and Cr(VI)). Moreover, high chloride concentrations may impede the measurement of COD.** **The COD/TOC ratio is site-specific. Theoretically, it ranges from 0.67–5.3 for organic compounds. At the end of the 1990s, a study carried out in Germany examined the COD/TOC ratio in a number of industry sectors. For waste water from the scrubbing of flue gases from firing systems, the median accounted for 2.7.** **For TOC, a number of plants achieve maximum emission levels below 50 mg/l, while a few achieve maximum emission levels below 20 mg/l. For COD, a number of plants achieve maximum emission levels below 150 mg/l, while a few achieve maximum emission levels below 60 mg/l.** **5. <u>Total suspended solids (TSS)</u>** **In the 2006 LCP BREF, the BAT-AEL for TSS from FGD waste water was set to 5–30 mg/l in 24-h composite samples.** **A number of plants achieve maximum TSS emission levels below 30 mg/l while a few achieve maximum emission levels below 10 mg/l.**
	6. <u>Fluoride (F^-)</u> **In the 2006 LCP BREF adopted in 2006, the BAT-AEL for fluoride from FGD waste water was set to 1–30 mg/l in 24-h composite samples.** **Fluoride levels are usually reduced by precipitation with calcium. In pure water, calcium fluoride has a solubility of 16 mg/l at 20 °C corresponding to a fluoride concentration of 7.8 mg/l. Using the solubility product constant and assuming a calcium concentration of 300 mg/l (corresponding to a calcium sulphate concentration of 1000 mg/l), a theoretical**

fluoride concentration of 1.3 mg/l could be calculated. In practice, however, treated waste water frequently has much higher fluoride concentrations because of slow nucleation and/or high ionic strength.

A number of plants (including the reference plants 121, 122, 124/134, and 138/139) using precipitation with calcium achieve maximum emission levels below 25 mg/l, while a few achieve maximum emission levels below 10 mg/l.

7. **Chloride (Cl^-)**

Techniques to remove chloride such as reverse osmosis and evaporation-crystallisation are rarely applied and imply significant cross-media effects (i.e. energy consumption) and costs. Without knowing the local conditions, it is difficult to assess if the environmental benefits outweigh the cross-media effects and increased costs. BAT-AELs for chloride have not yet been set in any adopted BAT conclusions.

Nevertheless, the high concentration values reported by some plants seem to justify setting a monitoring requirement for chloride and further assessing the issue during the next BREF review.

8. **Sulphate (SO_4^{2-})**

In the 2006 LCP BREF, the BAT-AEL for sulphate from FGD waste water was set to 1000–2000 mg/l in 24-h composite samples.

Although sulphate is not considered very toxic, the loads discharged with waste water from flue-gas treatment are high. For each parameter/pollutant, the impact of the emission depends on the quality and quantity of the waste water as well as on the sensitivity of the receiving environment. The issue is of a generic nature and seems more related to implementation.

Sulphate levels in untreated waste water from flue-gas treatment depend on the raw water quality, the fuel quality and the water recycling rate. Sulphate levels are usually reduced by precipitation with calcium salts (limestone/lime). Other techniques such as evaporation-crystallisation and precipitation with barium are rarely used and imply cross-media effects. Residual sulphate levels thus depend on the solubility of calcium sulphate, which increases with increasing temperatures and salinity (e.g. chloride concentration). The chloride concentration is determined by the raw water quality (e.g. sea water), the fuel quality and the water recycling rate in the flue-gas treatment system.

A number of plants (including the reference plants 123, 124/134, and 131) using precipitation with calcium achieve maximum emission levels below 2 g/l, while a few achieve maximum emission levels below 1.3 g/l. The reported chloride concentrations are in all cases below 5 g/l. The concentration range of 1.3–2 g/l corresponds to the solubility of calcium sulphate in low-salinity water.

Sulphate levels in waste water with chloride levels higher than 5 g/l were not reported, but literature indicates that the solubility of sulphate could increase up to 4 g/l and higher at chloride levels of about 20 g/l, depending on the temperature.

The sulphur content of biomass may not always be low (e.g. in peat). Moreover, the sulphate levels in waste water also depend on the water recycling rate. For example, plant 464 uses biomass (i.e. wood) as fuel and shows high sulphate levels, because no calcium compounds are used in the flue-gas treatment.

The techniques and associated emission levels of this BAT apply to waste water from flue-gas treatment without mixing with other waste water streams (see above). Footnote 1 on the lower end of the range could thus be misleading.

9. **Sulphide (S^{2-})**

In the 2006 LCP BREF, the BAT-AEL for sulphide from FGD waste water was set to < 0.2 mg/l in 24-h composite samples.

The few reported emission data suggest that the BAT-AEL from the 2006 LCP BREF could be considered appropriate, as maximum emission levels are below 0.1–0.2 mg/l.

No EN standard for the measurement of sulphide is available. ISO 13358 allows the measurement of easily released sulphide and ISO 10530 the measurement of dissolved sulphide, both in the concentration range of 0.04–1.5 mg/l. Emission levels were reported on the basis of easily released sulphide, which covers the sum of dissolved sulphides and of those undissolved sulphides that are easily released upon acidification.

10. **Sulphite (SO_3^{2-})**

In the 2006 LCP BREF, the BAT-AEL for sulphite from FGD waste water was set to 0.5–20 mg/l in 24-h composite samples.

BAT-AELs are derived from emission data and not from legislation.

The few reported emission data suggest that the BAT-AEL from the 2006 LCP BREF could be considered appropriate, as maximum emission levels are generally below 20 mg/l, but may even be below 1 mg/l.

11. **Total nitrogen**

In the 2006 LCP BREF, the BAT-AEL for total nitrogen from FGD waste water was set

	to < 50 mg/l in 24-h composite samples. **BAT-AELs are derived from emission data and not from legislation.** **Nitrogen compounds in waste water from flue gas treatment mainly originate from the dissolution of NO_X and NH_3. Total nitrogen levels thus depend on the combustion and the performance of SCR/SNCR, but also on the fuel, the combustion process, the raw water quality and the water recycling rate. Some reference plants use stripping to remove ammonia (e.g. 464, 470, 473, 662). End-of pipe techniques to reduce nitrate levels were not reported in the questionnaires.** **In the United States, some plants use aerobic biological treatment to reduce COD/TOC levels and, depending on the conditions, also to reduce ammonium levels. Furthermore, some plants use anoxic/anaerobic biological treatment to reduce levels of nitrate, mercury, and selenium. However, plant-specific information (e.g. on performance and costs) was not provided.** **During the review of the CWW BREF, it was concluded that the BAT-AEL for total (inorganic) nitrogen would not apply to inorganic chemical sites without biological waste water treatment.** **Overall, few data referring exclusively to waste water from flue gas treatment were reported. Data reported for mixed waste water streams are difficult to use due to the dilution effect.** **Nevertheless, the high concentration values reported by some plants seem to justify setting a monitoring requirement for total nitrogen and further assessing the issue during the next BREF review.**

	12. <u>THC</u> **Very few data were reported.** **13. <u>(+14. +15.) Metals and metalloids</u>** **In the 2006 LCP BREF, the BAT-AELs for metals from FGD waste water were set to: 0.01–0.02 mg/l for Hg, < 0.050 mg/l for Cd, < 0.1 mg/l for Pb, < 0.5 mg/l for Cr, Cu, Ni, and < 1 mg/l for Zn (all in 24-hour composite samples). No BAT-AEL was set for As.** **Few plants reported emission levels for Co, Mn, Sb, Tl, V, and the sum of metals and metalloids.** **As the metals show different properties and toxicities, it seems more appropriate to define individual BAT-AELs for relevant metals and metalloids (i.e. As, Cd, Cr, Cu, Hg, Ni, Pb, Zn).** **Dissolved metals are usually removed by precipitation with hydroxide and (organo)sulphides. As and Hg cannot be precipitated with hydroxide, but with (organo)sulphides. The residual levels of metals after precipitation depend on the raw waste water composition and the dosage of the reagent.** **A number of plants achieve the following maximum emission levels:** **As 50 µg/l, Cd 5 µg/l, Cr 50 µg/l, Cu 50 µg/l, Hg 5 µg/l, Ni 50 µg/l, Pb 20 µg/l, and Zn 200 µg/l.** **A few plants achieve the following maximum emission levels:** **As 10 µg/l, Cd 2 µg/l, Cr 10 µg/l, Cu 10 µg/l, Hg 0.5 µg/l, Ni 10 µg/l, Pb 10 µg/l, and Zn 50 µg/l.** **16. <u>Dioxins and furans</u>** **No data were reported.**
EIPPCB proposal - part II:	**1. <u>General</u>** • **Do not include further guidance on how to understand or use the BAT-AELs.** • **Only set BAT-AELs for waste water from flue gas treatment and clarify the wording of the table caption.** • **Specify that the BAT-AELs refer to direct discharges to a receiving water body at the point where the emission leaves the installation.** • **Do not specify how to take into account potential intake loads.** **2. <u>Averaging period</u>** • **Express the BAT-AEL as short-term averages (24-hour composite samples) and revise the numerical values accordingly.** **3. <u>Monitoring frequency</u>** • **Keep a minimum monitoring frequency of at least once every month without further specifications.** **4. <u>TOC/COD</u>** • **Add a primary technique on optimised combustion and operation of waste gas abatement techniques (see above).** • **Express the BAT-AEL for organic contaminants both with the parameter TOC and COD. Clarify that either the BAT-AEL for TOC or COD applies.**

- **Set the BAT-AEL for TOC at 20–50 mg/l and for COD at 60–150 mg/l, both as daily averages.**

5. **Total suspended solids (TSS)**
   - **Set the BAT-AEL at 10–30 mg/l as daily average.**
6. **Fluoride (F^-)**
   - **Set the BAT-AEL at 10–25 mg/l as daily average.**
7. **Chloride (Cl^-)**
   - **Delete the BAT-AEL for chloride.**
   - **Keep a monthly monitoring requirement.**
   - **Specify in the BREF chapter on concluding remarks and recommendations for future work that further information on techniques to reduce chloride emissions should be collected during the next BREF review.**
8. **Sulphate (SO_4^{2-})**
   - **Keep the BAT-AEL and base it on the solubility of calcium sulphate.**
   - **Set the BAT-AEL at 1.3–2.0 g/l as daily average.**
   - **Include a footnote that the upper end of the range may not apply in the case of high salinity (e.g. chloride concentrations ≥ 5 g/l) due to the increased solubility of calcium sulphate.**
   - **Include a footnote that the BAT-AEL only applies to plants using calcium compounds in flue gas treatment.**
   - **Delete the footnote on the lower end of the range.**
9. **Sulphide (S^{2-})**
   - **Set the BAT-AEL for easily released sulphide at 0.1–0.2 mg/l as daily average.**
10. **Sulphite (SO_3^{2-})**
    - **Set the BAT-AEL at 1–20 mg/l as daily average.**
11. **Total nitrogen**
    - **Delete the BAT-AEL for total nitrogen.**
    - **Keep a monthly monitoring requirement.**
    - **Specify in the BREF chapter on concluding remarks and recommendations for future work that further information on techniques to reduce total nitrogen emissions should be collected during the next BREF review.**
12. **THC**
    - **Delete the BAT-AEL for THC.**
13. **(+14. + 15.) Metals an metalloids**
    - **Delete the BAT-AEL for Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V.**
    - **Do not set BAT-AELs for Co, Mn, Sb, Tl, and V.**
    - **Set the following BAT-AELs for individual metals as daily averages: As 10–50 µg/l, Cd 2–5 µg/l, Cr 10–50 µg/l, Cu 10–50 µg/l, Hg 0.5–5 µg/l, Ni 10–50 µg/l, Pb 10–20 µg/l, Zn 50–200 µg/l.**
16. **Dioxins and furans**
    - **Do not set a BAT-AEL for dioxins and furans.**

1.3 Coal and/or lignite combustion

1.3.1 BAT 17 – General environmental performance

<table>
<tr><td>Location in D1:</td><td>p. 750 – Section 10.2.1.1</td></tr>
<tr><td>Current text in D1:</td><td>17. In order to improve the general environmental performance of the combustion of coal and lignite, and in addition to BAT 4, BAT is to use the technique given below.

<table>
<tr><th colspan="2">Techniques</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Integrated combustion process assuring a high boiler efficiency and including primary measures to reduce the generation of NO_X emissions, such as air and fuel staging, advanced low-NO_X burners and/or reburning, etc.</td><td>Combustion processes such as pulverised combustion, fluidised bed boilers or moving grate firing allow this integration</td><td>Generally applicable</td></tr>
</table>
{This BAT conclusion is based on information given in Section 5.1.4.2}</td></tr>
<tr><td>Summary of comments:</td><td>1. Remove this BAT conclusion as it is redundant and partially inconsistent with BAT 19 on NO_X, CO and NH_3 emissions (DK_116).
2. The energy efficiency that is mentioned in the name of the technique should not only refer to the boiler as but also to the possibility to recover heat from the flue-gas (PL_124).
3. Change the applicability to 'fuel and plant specific', as the reduction/abatement techniques quoted in the name of the technique are not suited for all combustion processes such as fluidised bed and grate firing boilers (Eurelectric_679_640_240, Euracoal_130).
4. Delete 'air and fuel staging' from the technique name (EPPSA_374).
5. Add applicability restrictions linked to the boiler geometry and to space availability for existing plants (EL_61).</td></tr>
<tr><td>EIPPCB assessment:</td><td>1. This BAT focuses on the combustion process as such, when it allows the inclusion of primary techniques in its design. BAT 19 is related to NO_X emissions reduction, including primary and/or secondary techniques. These are complementary.
2. This BAT focuses on the combustion process as such, and thus refers to the highest efficiency of the boiler. Energy recovery from the flue-gas is discussed in other BAT (see BAT 7 and fuel-specific BATs setting associated BAT-AEELs).
3. (+4.) The list of integrated reduction/abatement techniques does not claim to be exhaustive or inclusive of all types of combustion processes, as it is preceded by 'such as'.
5. The integration of primary techniques to combustion processes will be generally applicable based on the high number of example plants which operate with primary techniques. Any specificity linked to the retrofit of primary techniques to certain kinds of existing plants is mentioned in the corresponding applicability of the reduction/abatement techniques in the fuel-specific conclusions.</td></tr>
<tr><td>EIPPCB proposal:</td><td>1. (to 5.) Do not change BAT 17.</td></tr>
</table>

1.3.2 BAT 18 – Energy efficiency

1.3.2.1 BAT 18 – Energy efficiency

<table>
<tr><td>Location in D1:</td><td>Section 10.2.1.2 - p. 750</td></tr>
<tr><td>Current text in D1:</td><td>18. In order to increase the energy efficiency of coal and lignite combustion, BAT is to use a combination of the techniques described in BAT7 and of the technique given below.

<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Lignite pre-drying</td><td>Reduction of lignite moisture content before combustion to improve combustion conditions</td><td>Applicable to new and existing lignite-combustion plants</td></tr>
</table>
{This BAT conclusion is based on information given in Section 5.1.4.3}</td></tr>
<tr><td>Summary of comments:</td><td><u>Missing technique</u>
1. Add the dry bottom ash system as another BAT (IT_67).

<u>Technique a (lignite pre-drying)</u>
2. This technique is emerging (DE_9, Euracoal_131_137, Eurelectric_241_641_680).
3. This technique should not be compulsory (PL_23, E&P_23).
4. Restrict the applicability depending on the boiler configuration for effective combustion and heat transfer (EL_62).</td></tr>
<tr><td>EIPPCB assessment:</td><td><u>Missing technique</u>
1. Dry bottom ash handling is a technique described in Chapter 3 of the BREF (Optimisation of bottom ash quality) and proposed as new source performance standard by the US EPA. This technique enables an increase in the boiler energy efficiency of 0.1–0.5 percentage points.
<u>Lignite pre-drying (a)</u>
2. (to 4) Lignite pre-drying systems will soon be commercially available but have so far only been under development as an in-house technique. Thus the technique does not meet the requirements for being considered as BAT.</td></tr>
<tr><td>EIPPCB proposal:</td><td>Missing technique
1. Add a new technique: 'dry bottom ash system'
<u>Lignite pre-drying (a)</u>
2. Keep this technique as emerging.</td></tr>
</table>

1.3.2.2 Table 10.2 – BAT-AEELs for energy efficiency – coal and/or lignite

Location in D1: *Section 10.2.1.2 - p. 751*

Current text in D1:

BAT-associated environmental performance levels

The BAT-associated energy efficiency levels are given in Table 10.2.

Table 10.2 BAT-associated environmental performance levels for energy efficiency of coal and lignite combustion

Combustion plant rated thermal input	BAT-AEPL (yearly average – LHV basis)		
	Net electrical efficiency (%)(1)		Net total fuel utilisation (%) – New and existing plants - CHP mode (1)
	New plants	Existing plants	
> 1000 MW_{th} whose main purpose is electricity production	39 to above 42(2)	33.5 – 42 (2) (3)	-
< 1000 MW_{th} whose main purpose is electricity production	36.5 to above 40(2)	32.5 – 40 (2) (3)	-
< 1000 MW_{th} whose main purpose is heat production	-	-	75 – 97

(1) Within the given ranges, the achieved energy efficiency can be negatively affected (up to 4 percentage points) by the type of cooling system used, the geographical location of the combustion plant and the load variations.
(2) The lower end of the ranges is achieved in case of unfavourable local conditions, low-grade lignite-fired plants, plants operated in peak or mid-merit modes and older plants (first commissioned before 1985).
(3) The achievable improvement of thermal efficiency depends on the specific plant, but an incremental improvement of more than 3 percentage points is seen as associated with the use of BAT for existing plants.

Summary of comments:

<u>*General*</u>

1. *Clearly define the concept of 'main purpose' of the plant used for splitting in different categories (CZ_82, PL_27_163, E&P_27_82).*
2. *Stress the relevance of steam parameters in case of new plants for high energy efficiency levels (Eurelectric_642_919).*

<u>*Plants of ≥ 1000 MW_{th}*</u> *– Net electrical efficiency*

<u>*Existing plants*</u>

3. *Decrease the range to 31.5–42 % (EL_63, PL_163, Eurelectric_682) considering ref plants 169 and 170).*
4. *Increase the range to 36–42 % (NL_56) as proposed values could not be lower than the ones of the 2006 BREF.*
5. *Increase the upper end of the range based on information from the BREF up to 45 % (EEB_24) and the lower end of the range to 38 % for recently commissioned plants (EEB_26).*

<u>*New plants*</u>

6. *Increase the range to 41–47 % as proposed values could not be lower than the ones of the 2006 BREF (NL_56).*
7. *Increase the upper end of the range (e.g. Boxberg Block R, with Net Electrical Efficiency up to 43.7 %) (DE_129).*

<u>*Plants of < 1000 MW_{th}*</u> *– Net electrical efficiency*

<u>*Existing plants*</u>

8. *Decrease the range to 27.5–40 % for existing plants (PL_163).*
9. *Decrease the range to 28–40 % for existing plants (EL_63, Eurelectric_682).*
10. *Increase the range to 36–40 % as proposed values could not be lower than the ones of the 2006 BREF (NL_56).*
11. *Set the lower end of the range at 35 % for recently commissioned plants (EEB_26)*
12. *Change the range for net total fuel utilisation to 75–94 % as the higher value cannot be higher than the boiler efficiency which is described in Section 5.1.1.4 (DE_10; remove BAT-AEELs corresponding to total fuel utilisation for CHP plants, as they may be flexible in terms of production of heat and electricity, or modify the range to 50–97 % instead of 75–97 % (PL_27, E&P_27).*

	Footnote ([1]) *13. Clarify if the -4 % apply within the given range or could lead to levels lower than the range (CZ_83, E&P_83).* *14. Modify the statement by indicating that the energy efficiency can be negatively impacted on both lower and upper end (up to 4 % points) (Eurelectric_684).* *Footnote ([2])* *15. Remove the indication of 'unfavourable conditions' or set specific corresponding BAT-AEELs (EEB_23).* *16. The footnote is not applicable to new plants (EEB_27).* *Footnote ([3])* *17. 3 % incremental improvement could be difficult to achieve as this will be very plant dependent, depending on the original design of the plant and the retrofits already performed (IT_78, ES_28_42_43, UK_66).* *18. Remove this footnote as it is not credible without knowing the techniques already used (E&P_70, UK_66, Eurelectric_685).* *19. 3 % increase implies the complete rebuilt of a plant (Euracoal_138, Eurelectric_642_919).*
EIPPCB assessment:	**General** **1. See further explanation in Section 2.11 (definitions) of this background paper and Section 1.1.5 (type of BAT conclusions on energy efficiency).** **2. Steam parameters are already mentioned in techniques (a) to (c) of the general conclusion (BAT 7). As the higher levels of energy efficiency correspond to the use of these techniques, this could be emphasised in the conclusions with a footnote.** **Plants of ≥ 1000 MW_{th}** **Existing plants** **3. (to 5.) Values proposed in D1 were based on yearly averages from the collected data. As per the assessment made in Section 1.1.5 of this BP, it is now proposed to define design-based BAT-AEELs. Information has been submitted via the TFEE with design net electrical efficiencies between 33.7 % and 42.3 % for lignite-fired plants and between 33.8 % and 43.7 % for coal-fired plants. A parallel assessment based on yearly efficiencies from the 2012 questionnaires, considering only plants with a LHV of > 6 MJ/kg and commissioned after 1985, confirms a lower level of energy efficiency around 34 %, taking Plant 129 as a reference, and an upper level of 43.3 %.** **New plants** **6. (+7.) Design energy efficiency levels are already mentioned in the BREF with net electrical efficiencies as high as 45 % in the case of new plants (e.g. in Section 0 2.7, p.73, and Tables 5.9 and 5.10, p. 377 in D1). Information has been submitted via the TFEE with design net electrical efficiencies between 45.9 % and 46 % for coal-fired plants and 42–43.7 % for lignite-fired plants that were commissioned after 2010. EL has provided additional input on the achievable efficiency at lignite-fired plants that could be as low as 41.5 % in the case of low-quality fuel (LHV < 6 MJ/kg). There is no rationale supporting the NL comment to replace the upper end of the range with 47 %.** **Plants of < 1000 MW_{th}** **Existing plants** **8. (to 11.) Values proposed in D1 were based on yearly averages from the collected data. As per the assessment made in Section 1.1.5 of this BP, it is now proposed to define design-based BAT-AEELs. Information has been submitted via the TFEE with design net electrical efficiencies between 31.4 % and 39 % for lignite-fired plants and between 32.65 % and 41.2 % for coal-fired plants (40 % is given as the higher end of the range in the summary table, but Plant 26 which achieves 41.2 % has been omitted). A parallel assessment based on yearly efficiencies from the 2012 questionnaires, considering only plants commissioned after 1985, gives a lower level of net electrical energy efficiency of 31.7 % in the case of coal-firing (Plant 26 used as a reference) or 30.9 % in the case of (low-quality) lignite-firing (Plant 170 used as a reference), and an upper level of 39.7 % in the case of coal-firing (Plant 34 used as a reference) or 39.3 % in the case of lignite-firing (Plant 25-1 used as a reference.** **12. Information given in Section 5.1.1.4 aims at illustrating the difference in efficiency depending on the type of fuel combusted, acknowledging that there are heat losses. Additional information has been submitted via the TFEE with design net total fuel utilisation between 80 % and 90.5 %. Higher levels up to 96.4 % were collected at plant level in 2012 as yearly averages from plants that did not take part in the TFEE data collection (i.e. Plants 1000, 1001, 19) where there may be varyingly efficient heat recovery systems implemented (e.g. flue-gas condensation). Furthermore, the net total fuel utilisation is dependent from the heat demand, be it in design or operating conditions. Thus, if the proposed BAT-AEELs correspond to targets to achieve using BAT, it may be that they cannot be achieved due to an excessively low potential heat demand. A footnote could be added to mention this limitation.**

	New plants **No comments were submitted regarding the proposed BAT-AEL range for new plants; no further additional information was provided by the TFEE.** **Footnotes** **13. (+14.) Footnote ([1]) clearly states that level variations are 'within the given ranges'. The load variation is no longer to be considered an impacting factor in this footnote as the levels are defined at full load.** **15. In footnote ([2]), 'unfavourable local conditions' does indeed mean 'unfavourable climatic conditions', which is more specific. There is no need to set specific BAT-AEELs corresponding to these conditions as they are already included in the proposed BAT-AEL. The reference to different load modes is not needed anymore.** **16. Footnote ([2]) remains applicable to new plants as the conditions mentioned could occur and the footnote does not imply being outside of the scope of the BAT-AEEL but at 'the lower end'.** **17. (to 19.) Footnote ([3]) needs to be refined as it could be understood that an increase of 3 percentage points can be achieved in any case. Indeed the possible improvement depends on the techniques already implemented in each specific case.**
EIPPCB proposal:	**General** **1. Delete: 'whose main purpose is heat/electricity'.** **2. Add a footnote for new plants mentioning that the higher end of the BAT-AEEL range can be achieved with high steam parameters (pressure, temperature).** **Plants of ≥ 1000 MW_{th}** **3. (to 5.) Change the proposed net electrical efficiency BAT-AEEL for existing plants to design values of 33.5–44 % for coal-fired plants and to 33.5–42.5 % for lignite-fired plants.** **6. (+7.) Change the proposed BAT-AEEL for new plants to design values of 45–46 % for coal-fired plants and to 42–44 % for lignite-fired plants. Add a footnote mentioning that in the case of plants burning lignite with a LHV < 6 MJ/kg, the lower end of the range is 41.5 %.** **Plants of < 1000 MW_{th}** **Existing plants** **12. (to 11.) Change the proposed net electrical efficiency BAT-AEEL for existing plants to design values of 32.5–41.5 % for coal-fired plants and to 31.5–39.5 % for lignite-fired plants. Change the proposed net total fuel utilisation BAT-AEEL for existing plants to design values of 75–97 %. Add a footnote that these levels may not be achievable in the case of an excessively low potential heat demand.** **New plants** **Keep the BAT-AEEL range proposed in D1 for both coal and lignite firing; change it to as design.** **Footnotes** **13. (+14.) Remove the reference to the load variations in footnote ([1]).** **15. (+16.) Replace 'local conditions' with 'climatic conditions' and remove the reference to different load modes in footnote ([2]); keep it applicable to new plants.** **17. (to 19.) Add to footnote ([3]): '…depending on the original design of the plant and on the retrofits already performed'.** **20. Reorganise and simplify the BAT-AEELs table to have the net electrical efficiency and net total fuel utilisation BAT-AEELs reported on the same line with footnotes in the heading of the columns mentioning that 1) net electrical efficiency BAT-AEELs apply to power generation only plants and to CHP plants, and 2) net total fuel utilisation BAT-AEELs apply to CHP plants and to heat generation only plants.**

1.3.3 BAT 19 – NO_X, CO and NH_3 emissions to air

1.3.3.1 BAT conclusion

Location in D1:	*Section 10.2.1.3 - p. 751*
Current text in D1:	**19. In order to prevent or reduce NO_X emissions while limiting CO and NH_3 (if SNCR or SCR techniques are used) emissions to air from the combustion of coal and lignite, BAT is to use one or a combination of the techniques given below.**

Plants < 100 MW_{th}

Technique		Description	Applicability
a.	Complete combustion	See description in Section 10.8. CFB boilers allow achieving a good combustion performance while limiting NO_X emissions to air, sometimes without the need for an additional technique(s).	Generally applicable
b.	Combination of primary techniques (air staging including boosted overfire air, fuel staging, flue gas recirculation, LNB) for NO_X reduction	See descriptions in Section 10.8 for each single technique. Primary techniques are used in combination, alone for lignite-fired PC boilers, sometimes in combination with SNCR in fluidised-bed boilers and grate-firing, and possibly in combination with SNCR or SCR in coal-fired PC boilers.	Generally applicable
c.	SNCR	See description in Section 10.8. Sometimes applied in addition to primary measures at coal PC or grate-firing plants	Applicable to coal PC plants
d.	SCR	See description in Section 10.8 Sometimes applied in addition to primary measures at coal PC plants	Applicable to coal PC plants.

{This BAT conclusion is based on information given in Section 5.1.4.6}

Plants 100 MW_{th} – 300 MW_{th}

Technique		Description	Applicability
a	Complete combustion	See descriptions in Section 10.8. Generally used in combination with other techniques included in this table	Generally applicable
b	Combination of primary techniques (air staging including boosted overfire air, fuel staging, flue gas recirculation, LNB) for NO_X reduction	See description in Section 10.8. for each single technique. Primary techniques are used in combination, alone for lignite-fired PC boilers, sometimes in combination with SNCR in fluidised-bed boilers, and in combination with SNCR or sometimes SCR in coal-fired PC boilers.	Generally applicable
c	SNCR	See description in Section 10.8. Applied alone or in combination with primary measures, in coal-fired PC boilers, and sometimes in fluidised-bed boilers together with primary measures	Generally applicable
d	SCR	See description in Section 10.8. Sometimes applied in addition to primary measures in coal PC plants	Generally applicable

e	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

{This BAT conclusion is based on information given in Section 5.1.4.6}

Plants > 300 MW_{th}			
Technique		**Description**	**Applicability**
a	Complete combustion	See description in Section 10.8. Generally used in combination with other techniques included in this table	Generally applicable
b	Combination of primary techniques (air staging including boosted overfire air, fuel staging, flue gas recirculation, LNB) for NO_X reduction	See description in Section 10.8 for each single technique. Primary techniques are used in combination, alone for lignite-fired PC boilers, sometimes in combination with SNCR in fluidised-bed boilers, and almost always with an additional SCR in coal-fired PC boilers.	Generally applicable
c	SNCR	See description in Section 10.8. SNCR is applied either alone or in combination with other primary techniques in fluidised-bed boilers	Generally applicable
d	SCR	See description in Section 10.8. SCR is applied either alone or in combination with other primary techniques. in coal-fired PC boilers	Generally applicable
e	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

{This BAT conclusion is based on information given in Section 5.1.4.6}

Summary of comments:

1. *General*
   - 1.1. *Create additional size categories for large coal- and lignite-fired plants > 300 MW_{th} (Euracoal_140, Eurelectric_248).*
   - 1.2. *Limit the applicability of the BAT conclusions to baseload modes (Eurelectric_79_89, E&P_73_84, PL_29).*
2. *Techniques*
   - 2.1. *(a) Complete combustion*
     - *Do not limit the description to CFB boilers (EPPSA_375_378, PO_127).*
     - *The technique is redundant with BAT4 on general environmental performance (DK_123).*
     - *Change the name to 'high degree of combustion conversion' (EL_67, Eurelectric_689).*
   - 2.2. *(b) Combination of primary techniques*
     - *Add an applicability restriction: '…within the constraints given by boiler geometry and space availability' (Eurelectric_691).*
   - 2.3. *(c) SNCR*
     - *SNCR is also applicable to lignite-fired plants and to coal PC boilers (E&P_77_96, CZ_87, PO_129_130).*
     - *SNCR is always used in combination with primary techniques and not alone (DK_122).*
     - *The applicability is limited in the case of large boilers (DK_124).*
     - *The applicability is limited in the case of plants operated in peak-load mode (due to frequent start-ups, variable loads, economic viability) (FI_45).*

	• *The applicability is boiler process specific (Euracoal_141, Eurelectric_78_645_692_1035, Euroheat&Power_72).* • *Add an applicability restriction: '...within the constraints given by boiler geometry and space availability' (EL_69, Eurelectric_691).* *2.4. (d) SCR* • *SCR is also applicable to lignite-fired plants if economically viable (E&P_90, CZ_90).* • *SCR is only applicable to plants >1000 MW_{th} (Eurelectric_693).* • *SCR is always used in combination with primary measures, and not alone (DK_122).* • *The applicability is limited in the case of peak-load plant (due to frequent start-ups, variable loads, economic viability) (FI_45).* • *Add an applicability restriction: '...within the constraints given by boiler geometry and space availability' (EL_69).*
EIPPCB assessment:	**1. General** **1.1. In terms of the techniques used by plants of ≥ 300 MW_{th}, no further categories are deemed necessary.** **1.2. Several reference plants located in SE, IT, FR operated in peak- or mid-merit-load modes use the proposed BATs The applicability to these load modes and to emergency-load mode is further assessed technique by technique.** **1.3. There seems to be confusion through the comments between the description where information has been reported on the main combination of techniques that may be applied from example plants in Europe or outside, and the applicability, which should only include the restrictions to the general applicability of a technique. The information reported in the description may not be needed in the BAT conclusions and would fit better in the Sections on 'techniques to consider in the determination of BAT' of the BREF.** **2. Techniques** **2.1. Complete combustion (a)** **'Complete combustion' is an 'unreachable' target. 'Combustion optimisation' seems to be a better wording. This technique is applicable in all load modes. The wording needs to be improved to avoid misunderstandings: CFB boilers can achieve the proposed BAT-AELs without additional techniques (e.g. Plant 19V), depending on their design. This is not described in the general BAT 4, being specific to coal-/lignite-fired plants of < 100 MW_{th} based on collected data.** **2.2. Combination of primary techniques (b)** **A lot of examples have been provided regarding the retrofit of existing boilers with primary techniques. Primary techniques are deemed applicable in all load modes. The influence the boiler design may have on primary techniques implementation could be mentioned in the description.** **2.3. SNCR (c)** **Example plants firing lignite and fitted with SNCR have been provided (Additional information - CZ-01) showing the applicability of this technique to such plants.** **BAT 17, on the general use of integrated primary techniques, applies, along with this BAT that refers to the use of 'one or a combination of the following techniques'.** **Non-homogeneous mixing of NH_3/NO_X may happen in boilers with a high cross-sectional area (e.g. > 600 MW_{th}) that could limit the applicability of this technique in such cases. However, suppliers are continuously working on improving the technique for larger boilers.** **The negative impact of load variations and boiler design can be offset by acting on the reagent type or droplet size, and /or the number of levels of reagent injection. These parameters may however influence the achievable NO_X removal efficiency. If necessary, this technique may also be combined with a slip catalyst; however, this combination may not be cost-effective in the case of plants operated in emergency- and peak-load modes.** **The capital cost is much lower than for the SCR technique and the operational cost is directly linked to the amount of chemical used, which makes it suitable for plants operated in peak-load or emergency-load modes except in case of variable loads.** **2.4. SCR (d)** **SCR has not been applied so far to lignite-fired plants in Europe but has recently been applied to such plants in the US where technical challenges have been overcome.**

	Regarding the applicability of SCR to plants of < 1000 MW_{th}, it should be noted that 57 questionnaires were submitted for combustion plants of < 1000 MW_{th} equipped with SCR, of which 18 are from the coal sector; the technique has been fitted to combustion plants of < 100 MW_{th} combusting other fuels (e.g. biomass), even if this is not very common for boilers. Slip SCR can also be fitted in combination with SNCR, representing a solution with a lower capital cost than a full SCR. **Regarding the applicability to mid-merit plants, the submitted document UKTWG6 tends to conclude that retrofitting SCR at an existing PC boiler operated in mid-merit mode may be too costly. The conclusions of this study are based on the use of parameters that are very specific to each case and that may give different conclusions depending on their choice. Furthermore, example plants operated in mid-merit mode and fitted with SCR were proposed in the data collection (e.g. Plants 267, 213). With this document providing context, it could be expected that the retrofit applicability for plants operated in peak-load modes may need to be assessed on a case by case basis and that the technique may not be applicable to smaller plants (< 300 MW_{th}) operated in emergency-load mode.**
EIPPCB proposal:	**1. General** **Further assess the applicability to emergency-, peak-load and mid-merit-load modes technique by technique depending on available information. Remove the information on typical combination of techniques from the description.** **2. Techniques** **2.1. Complete combustion (a)** **Change the technique name to: 'Combustion optimisation'. Remove the information about CFB boilers from the description.** **2.2. Combination of primary techniques (b)** **Do not change the statement. Add in description that the choice and performance of appropriate (combination of) primary techniques may be influenced by the boiler design.** **2.3. SNCR (c)** **Change the wording of the description in order to also include lignite-fired plants in the applicability.** **Remove the mention of 'SNCR/SCR alone' from the description.** **Add an applicability restriction for larger boilers with a high-cross sectional area but without mentioning any plant size threshold as this may vary in the future.** **Add an applicability restriction in the case of plants operated in emergency- or peak-load modes with high boiler load variations.** **2.4. SCR (d)** **Keep the technique generally applicable to plants of < 1000 MW_{th}, down to 100 MW_{th}.** **Add in applicability that SCR is not generally applicable to plants of < 100 MW_{th} and is not applicable to plants of < 300 MW_{th} operated in emergency-load mode, and more generally that there may be technical and economic restrictions for retrofitting existing plants operated in peak-load modes or existing plants of ≥ 300 MW_{th} operated in emergency-load mode.**

1.3.3.2 Table 10.3 – BAT-AELs for NO_X, CO and NH_3 – coal and/or lignite

1.3.3.2.1 Table 10.3 – General

Location in D1: *Section 10.2.1.3 – p. 753*

Current text in D1:

BAT-associated emission levels
The BAT-associated emission levels for NO_X, NH_3 and CO are given in Table 10.3.

Table 10.3: BAT-associated emission levels for NO_X, NH_3 and CO emissions to air from the combustion of coal and lignite

Combustion plant rated thermal input (MW_{th})	BAT-AEL for NO_X (yearly average - mg/Nm^3)		BAT-AEL for NO_X (daily average - mg/Nm^3)		BAT-AEL for CO (yearly average - mg/Nm^3)	BAT-AEL for NH_3 ([1]) (yearly average - mg/Nm^3)	Monitoring frequency
	New plants	Existing plants	New plants	Existing plants			
≤ 100	100 – 200	100 – 270	ND		10 –100	< 5	Continuous measurement
100 - 300	100 – 150	100 – 180	ND		10 – 100	< 5	
> 300 FBC (coal-lignite) and PC lignite firing	50 – 150	50 – 180	140 – 220		12 – 80	< 1 – 3.5	
> 300 PC coal firing	65 – 100	65 – 180	80 – 125	80 – 220	1 – 55	< 1 – 3.5	

([1]) Ammonia emissions are associated with the use of SCR and SNCR

Summary of comments:

1. *<u>NO_X emissions</u>*
   - *Do not set BAT-AELs for peak-load plants (costs are three times higher than for base-load plants) and/or mid-merit plants (E&P_29_73_81_84, Eurelectric_86).*
   - *Set a BAT-AEL of < 450 mg/Nm^3 or < 495 mg/Nm^3 as yearly average for all the plants operated in peak-load mode (FI_46) (FR_90).*
   - *Set daily BAT-AELs for NO_X for plants < 300 MW_{th} based on the ELVs of the IED (FR_87).*
2. *<u>CO emissions</u>*
   - *Do not set BAT-AELs for existing plants (EL_71, E&P_28_74_93_94_99, CZ_93_94_99, Eurelectric_80_646_920, PL_133, Euracoal_143).*
   - *Set general BAT-AELs for all plant sizes: 30-250 mg/Nm^3 for existing plants and 30-150 mg/Nm^3 for new plants (FI_46).*
   - *Set general BAT-AELs for grate firing due to inhomogeneous combustion in such plants: < 200 mg/Nm^3 (Eurelectric_704, E&P_101, CZ_101).*
   - *Set only BAT-AELs for baseload modes (Eurelectric_79_89, E&P_73_84, PL_29).*
3. *<u>NH_3 emissions</u>*
   - *Increase the lower end to < 5 mg/Nm^3 as there is no further particular environmental effect below this level (DK_128).*
   - *Keep the lower end of the range unchanged (when using SCR), and change the upper end to 10 mg/Nm^3 (when using SNCR) (DK_126, E&P_23, SE_62, E&P_16).*
   - *Change the range to < 10 mg/Nm^3 as mentioned in table 3.33 of the BREF (Eurofer_225).*
   - *Delete or change the range to < 15 mg/Nm^3 (Eurelectric_649_923, Euracoal_145).*
   - *Review to < 5 mg/Nm^3 for plants equipped with SCR and WFGD, and to 10-15 mg/Nm^3 otherwise (Eurelectric_699).*
   - *Review to 5-15 mg/Nm^3 (FI_114).*
   - *Change the range to < 20 mg/Nm^3 for encompassing the cases of smaller plants for which not enough data are available (CEFIC_18).*
   - *Change the range to < 20 mg/Nm^3 as daily average when using SNCR (SE_62, E&P_16).*
   - *Define NH_3 level before de-dusting as a performance parameter for controlling the fly ash quality (PL_133).*

   <u>Plants of ≥ 300 MW_{th}</u>
   - *Increase the higher end of the range to < 25 mg/Nm^3 to reflect tests performed at a lignite-fired boiler implementing SNCR (submitted information refers to emissions from 3 to 15 mg/Nm^3 without more contextual info) (E&P_100, CZ_100).*

	• *Use ELVs from reference plants fitted with SCR for setting the BAT-AELs because of the lack of available data (Eurelectric_701_702).* 4. *Monitoring* • *Modify NO_X measurement frequency for plants < 100 MW_{th} to 2/yr (consistency with IED) (E&P_95, CZ_95).* • *Do not monitor continuously NH_3 in the case of using SCR (non- measurable values in case of WFGD) or change to periodic measurement (1/yr). (DK_125, E&P_75_76, Euracoal_146, Eurelectric_81_82_650_700_924).* • *Remove the need to continuously monitor CO and NH_3 in plants fitted with particulate collection and WFGD (SP_47).* • *Continuous monitoring of CO and NH_3 is only applicable to new plants (economic issue for existing plants < 100 MW_{th}) (PL_132).*
EIPPCB assessment:	**1. NO_X emissions** • **A three times higher cost for a technique compared to another one does not mean that the technique is not economically viable.** • **The assessment regarding peak- and emergency-load modes is technique-dependent and is thus assessed on a plant size category basis, depending on the available information.** • **Daily BAT-AELs are proposed based on the available submitted data/information.** **2. CO emissions** **CO is an environmental parameter the TWG at the KOM decided to cover.** **In relation to trade-offs between NO_X and CO emissions, priority is given to NO_X reduction in this review. Subsequently, CO levels and corresponding techniques are derived using the set of well performing plants for NO_X emissions as a basis. Data on CO emissions are available at plant level including for existing plants and different load modes, thus CO BAT-AELs can be proposed based on this information.** **The reassessment included the cases of grate firing plants with information submitted by plants of up to 166 MW_{th} which reported CO emissions (Plants 92, 93, 109, 406, 462, 683, 685, 687, 688, 1014, 1015). More details are given for each size category in Sections 1.3.3.2.2 and 1.3.3.2.3. of this BP.** **3. NH_3 emissions** **All reported data show levels of NH_3 emissions below 10 mg/Nm^3:** • **for plants of < 100 MW_{th}, 1 reported data just below 10 mg/Nm^3;** • **for plants of 100–300 MW_{th}, 1 reported data at 0.5 mg/Nm^3;** • **for plants of ≥ 300 mg/Nm^3, all reported data (18 plants) including 3 plants fitted with SNCR are below 3.5 mg/Nm^3.** **Information reported in Table 3.33 is relevant for all kinds of applications.** **There is little additional information to support the submitted comments requesting the increase of the NH_3 emission levels higher than 10 mg/Nm^3.** **NH_3 as a pollutant is considered to deserve less focus in this LCP BREF review than NO_X but is however important when using SNCR/SCR. It is therefore proposed to set BAT-AELs, but only in the form of a yearly average, to reflect the issue of optimisation of the secondary deNO_X technique in the long term.** **NH_3 slip will be lower in the case of SCR use where the mixing is better than in the case of SNCR use where the mixing is expected to be less homogenous.** **NH_3 slip could be higher at the outlet of the boiler in case of SNCR application at lignite-fired plants with a high cross sectional area, but these plants are usually fitted with de-dusting systems and WFGD, and the information provided regarding these plants shows that levels < 10 mg/Nm^3 are achievable [Additional information CZ-01/02].** **Footnote ([1]) could be improved to inform of the applicability of the BAT-AEL on NH_3 only when SCR and/or SNCR is used.** **The level of ammonia in ash is an important parameter for ash reuse. It is however up to the end users to set an appropriate level depending on the type of use targeted.** **4. Monitoring** **NH_3 emissions are linked to NO_X emissions, when SNCR and/or SCR are used, and to the good mixing of both compounds. Therefore it is appropriate to monitor NH_3 and NO_X emissions in the same way. Plants fitted with de-dusting devices along with WFGD may have a very low level of NH_3 slip at stack, thus the requirement for NH_3 monitoring could be lower in such cases.** **Questionnaires report available CEMS devices with NH_3 LoD < 0.2 mg/Nm^3 (see e.g. Plants 123 or 253).** **CO emissions are linked to NO_X emissions. Therefore it is appropriate to monitor CO**

	and NO_X emissions in the same way. De-dusting and WFGD techniques have no relevant effects on CO emissions. **According to the available contextual information submitted with the questionnaires at plant level, the continuous monitoring of NO_X and CO emissions is a common practice, at least for plants of > 50 MW_{th}, as already recognised in the 2006 LCP BREF. Plants of < 100 MW_{th} operated in peak- or emergency-load modes could have less stringent requirements in terms of monitoring, e.g. periodic monitoring, given their limited levels of emissions.**
EIPPCB proposal:	**1. <u>NO_X emissions</u>** **2. Assess on a plant size category basis the merit of setting separate BAT-AELs for peak-load or emergency-load plants, and of setting daily averages where not proposed in D1, based on the available information (see Section 1.1.1).<u>CO emissions</u>** **• Keep BAT-AELs for CO, as yearly averages only.** **• See further details on proposed BAT-AELs for plant size categories.** **3. <u>NH_3</u>** **• Change the proposed BAT-AELs to < 5–10 mg/Nm^3 as a general BAT-AEL for all the sizes, with a footnote mentioning that the lower end of the range may correspond to the use of SCR in combination with wet abatement techniques, and the upper end may correspond to the use of SNCR without wet abatement techniques.** **• The proposed BAT-AEL for NH_3 emissions to air is shown in BAT 4 bis** **• Change footnote ([1]) to: `The proposed BAT-AEL for NH_3, and NH_3 monitoring are only applicable when SNCR and/or SCR techniques are used'.** **4. <u>Monitoring</u>** **• NO_X/CO/NH_3: keep continuous monitoring. Add a footnote for plants of 50–100 MW_{th} operated in peak-load or in emergency-load modes mentioning the possibility of a minimum monitoring frequency defined as periodic with respectively at least 2 samples/year (peak-load) and at least 1 sample /year (emergency-load).** **• NH_3 slip: Add a footnote mentioning the possibility to apply periodic monitoring (at least once every year) when using de-dusting and wet abatement techniques and when the levels of NH_3 are well within the proposed BAT-AELs.** **• Add in the heading of the BAT-AEL for NO_X/CO/NH_3, in brackets: '…or average over the sampling period'.**

1.3.3.2.2 Table 10.3 – BAT-AELs for NO_X, CO and NH_3 – plants ≤ 100 MW_{th}

<table>
<tr><td>Location in D1:</td><td>Section 10.2.1.3 – p. 753</td></tr>
<tr><td>Current text in D1:</td><td>
BAT-associated emission levels
The BAT-associated emission levels for NO_X, NH_3 and CO are given in Table 10.3.

Table 10.3: BAT-associated emission levels for NO_X, NH_3 and CO emissions to air from the combustion of coal and lignite
<table>
<tr><th rowspan="2">Combustion plant rated thermal input (MW_{th})</th><th colspan="2">BAT-AEL for NO_X (yearly average - mg/Nm^3)</th><th colspan="2">BAT-AEL for NO_X (daily average - mg/Nm^3)</th><th rowspan="2">BAT-AEL for CO (yearly average - mg/Nm^3)</th><th rowspan="2">BAT-AEL for NH_3 ([1]) (yearly average - mg/Nm^3)</th><th rowspan="2">Monitoring frequency</th></tr>
<tr><th>New plants</th><th>Existing plants</th><th>New plants</th><th>Existing plants</th></tr>
<tr><td>≤ 100</td><td>100 – 200</td><td>100 – 270</td><td colspan="2">ND</td><td>10 –100</td><td>< 5</td><td>Continuous measurement</td></tr>
<tr><td colspan="8">([1]) Ammonia emissions are associated with the use of SCR and SNCR</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td>
1. <u>NO_X emissions:</u>
1.1. <u>Yearly averages</u>
• Increase the upper end of the range for existing plants: 300 mg/Nm^3 (E&P_28, CEFIC_16).
• Increase the upper end of the range for existing pulverised lignite-fired plants: 350 mg/Nm^3 (DE_126, Eurelectric_648_922, Euracoal_144_147).
1.2. <u>Daily averages</u>
• Provide daily average 80-220 mg/Nm^3 for new plants and 80-300 mg/Nm^3 for existing plants (AT_64).
2. <u>CO emissions:</u> Change for existing plants to: < 150 mg/Nm^3 (Euracoal_143, Eurelectric_646_698). Remind also about the general comment to change the range to < 200 mg/Nm^3 for grate firing plants.
</td></tr>
<tr><td>EIPPCB assessment:</td><td>
1. <u>NO_X emissions</u>
Regarding peak- and emergency-load modes, the same primary techniques can apply as in the case of other load modes, and no evidence demonstrates a different environmental performance when these techniques are applied in plants operated in these modes. However, a yearly average may not be needed for these modes as their operation throughout the year is limited to 1500 hours.
The yearly BAT-AELs proposed in D1 can be kept for this category, based mainly on the use of primary techniques. No rationale supports the comment for higher BAT-AELs in the case of lignite-fired plants and the same techniques can apply both for coal and lignite firing.
Based on data from provided questionnaires (e.g. 81, 407, 462, 1015), daily BAT-AELs could be proposed for existing plants at 165–330 mg/Nm^3.
Despite the lack of available data, lower daily BAT-AELs could be proposed for new plants using as background information the reported data and BAT-AELs proposed for existing plants and for plants of 100–300 MW_{th}.

2. <u>CO emissions</u>
The reassessment of available data shows that, for 50–100 MW_{th} plants, the levels of CO emissions associated with plants proposed as BAT for NO_X are in the range of 9–131 mg/Nm^3. Regarding plants operated in peak- and in emergency-load modes, it may not be appropriate to set yearly averages, as for NO_X emissions, due to their being operated less than 1500 hours per year. It could therefore be proposed to exclude them from the BAT-AELs.
</td></tr>
<tr><td>EIPPCB proposal:</td><td>
1. <u>NO_X emissions</u>
• <u>Plants of <100 MW_{th}</u>
○ Keep the proposed yearly BAT-AELs for new and existing plants at 100–200 mg/Nm^3 and 100–270 mg/Nm^3. respectively
○ Propose daily BAT-AELs for existing plants: 165 – 330 mg/Nm^3.
○ Propose daily BAT-AELs for new plants: 155–240 mg/Nm^3.
○ Add a footnote mentioning that yearly BAT-AELs do not apply when plants operate in peak- or emergency-load modes.
2. <u>CO emissions</u>
• Change the proposed yearly BAT-AELs to 10–140 mg/Nm^3.
• Add a footnote mentioning that these BAT-AELs do not apply when plants operate in peak- or emergency-load modes.
</td></tr>
</table>

1.3.3.2.3 Table 10.3 – BAT-AELs for NO_X, CO and NH_3 – plants of 100–300 MW_{th}

<table>
<tr><td>Location in D1:</td><td>Section 10.2.1.3 – p. 753</td></tr>
<tr><td>Current text in D1:</td><td>
BAT-associated emission levels
The BAT-associated emission levels for NO_X, NH_3 and CO are given in Table 10.3.

Table 10.3: BAT-associated emission levels for NO_X, NH_3 and CO emissions to air from the combustion of coal and lignite
<table>
<tr><th rowspan="2">Combustion plant rated thermal input (MW_{th})</th><th colspan="2">BAT-AEL for NO_X (yearly average - mg/Nm^3)</th><th colspan="2">BAT-AEL for NO_X (daily average - mg/Nm^3)</th><th rowspan="2">BAT-AEL for CO (yearly average - mg/Nm^3)</th><th rowspan="2">BAT-AEL for NH_3 ([1]) (yearly average - mg/Nm^3)</th><th rowspan="2">Monitoring frequency</th></tr>
<tr><th>New plants</th><th>Existing plants</th><th>New plants</th><th>Existing plants</th></tr>
<tr><td>100 - 300</td><td>100 – 150</td><td>100 – 180</td><td colspan="2">ND</td><td>10 – 100</td><td>< 5</td><td>Continuous measurement</td></tr>
<tr><td colspan="8">([1]) Ammonia emissions are associated with the use of SCR and SNCR</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td>
1. <u>NO_X emissions</u>
1.1. <u>Yearly averages</u>
• Increase the upper end of the range for existing plants to 200 mg/Nm^3 (E&P_28).
1.2. <u>Daily averages</u>
• Provide daily BAT-AELs (EEB_152); set daily BAT-AELs at 80-170 mg/Nm^3 for new plants and at 80-200 mg/Nm^3 for existing plants (AT_64).
2. <u>CO emissions</u>
• Provide daily BAT-AELs (EEB_152).
• Increase the upper end of the range to 200 mg/Nm^3 for existing lignite-fired and coal FBC plants (Euracoal_143, Eurelectric_646_698).
• Increase the upper end of the range to 140 mg/Nm^3 for existing coal PC plants (Euracoal_143, Eurelectric_646_698).
• For grate-firing, change to 100-240 mg/Nm^3 the yearly BAT-AELs (CEFIC). Reminder also of the general comment to change the range to < 200 mg/Nm^3 for grate firing plants of any size.
</td></tr>
<tr><td>EIPPCB assessment:</td><td>
1. <u>NO_X emissions</u>
The data submitted for this category of plants show yearly emissions below 180 mg/Nm^3 (e.g. Plants 25-1, 109, and 213), when using primary techniques, and/or SNCR, and/or SCR depending on the type of combusted fuel and combustion process. No further rationale/evidence supports the comment for higher BAT-AELs.
Data on short-term emissions for existing plants are available from submitted questionnaires (e.g. Plants 156, 25-1, 109, 462 (smaller plant)), within a range of 155-210 mg/Nm^3 that could be used for proposing BAT-AELs for existing plants. Despite lack of data for existing plants, available information for existing plants can be used as background for proposing BAT-AELs for new plants.
Regarding peak- and emergency-load modes, the same techniques (mainly primary techniques or SNCR) can apply as in the case of other load modes, and no evidence demonstrates a different environmental performance when these techniques operate in these modes. However, a yearly average may not be needed for these modes as their operation throughout the year is limited to 1500 hours.
2. <u>CO emissions</u>
Levels of CO emissions associated with the plants proposed as BAT for NO_X are in the range 27–97 mg/Nm^3, including plants burning lignite (e.g. Plants 25-1 and 109), and fluidised bed boilers (e.g. Plant 25-1). Regarding emissions from grate firing plants in this size range, data were reported for 5 plants (Plants 109, 406, 683, 685, 1014) plus for Plant 688 which also burns herbaceous biomass (46 %). Plant 109 applies BAT for NO_X and has yearly average CO emissions of 97 mg/Nm^3. The other plants are not proposed as they do not apply BAT for NO_X.
Thus it could be proposed, as for smaller plants, to increase the higher end of the range for CO emissions to take into consideration the levels for grate firing.
Regarding plants operated in peak- and in emergency-load modes, it may not be appropriate to set yearly averages, as for NO_X emissions, due to their being operated less than 1500 hours per year. It could therefore be proposed to exclude them from the BAT-AELs.
</td></tr>
<tr><td>EIPPCB proposal:</td><td>
1. <u>NO_X emissions</u>
• Keep the yearly BAT-AELs proposed in D1.
• Propose daily BAT-AELs for existing plants at 155 – 210 mg/Nm^3 and for new plants at 130–175 mg/Nm^3.
</td></tr>
</table>

	• **Add a footnote mentioning that yearly BAT-AELs do not apply when plants operate in peak- or emergency-load modes.** **2. CO emissions** • **Change the proposed yearly BAT-AELs to 10 – 140 mg/Nm^3.** • **Add a footnote mentioning that these BAT-AELs do not apply when plants operate in peak- or emergency-load modes.**

1.3.3.2.4 Table 10.3 – BAT-AELs for NO_X, CO and NH_3 – plants of > 300 MW_{th}

Location in D1:	*Section 10.2.1.3 – p. 753*
Current text in D1:	**BAT-associated emission levels** **The BAT-associated emission levels for NO_X, NH_3 and CO are given in Table 10.3.** **Table 10.3: BAT-associated emission levels for NO_X, NH_3 and CO emissions to air from the combustion of coal and lignite**

Combustion plant rated thermal input (MW_{th})	BAT-AEL for NO_X (yearly average - mg/Nm^3)		BAT-AEL for NO_X (daily average - mg/Nm^3)		BAT-AEL for CO (yearly average - mg/Nm^3)	BAT-AEL for NH_3 ([1]) (yearly average - mg/Nm^3)	Monitoring frequency
	New plants	Existing plants	New plants	Existing plants			
> 300 FBC (coal-lignite) and PC lignite firing	50 – 150	50 – 180	140 – 220		12 – 80	< 1 – 3.5	Continuous measurement
> 300 PC coal firing	65 – 100	65 – 180	80 – 125	80 – 220	1 – 55	< 1 – 3.5	
([1]) Ammonia emissions are associated with the use of SCR and SNCR							

Summary of comments:	1. *NO_X emissions* 1.1. *FBC (coal-lignite) and PC lignite firing of >300 MW_{th}* 1.1.1. *Yearly average* ○ *Decrease the upper end of the range for existing plants to 170 mg/Nm^3 (EEB_31_33_37).* ○ *Increase the lower end of the range for existing plants to 120 mg/Nm^3 (EL_70).* ○ *Increase the upper end of the range for existing plants to 200 mg/Nm^3 (DE_126, EL_70, E&P_28_81_99, Euracoal_144, Eurelectric_86_648_697).* ○ *Decrease the upper end of the range for new coal-FBC plants to 100 mg/Nm^3 (EEB_31_33_37).* ○ *Increase the upper end of the range for new plants to 200 mg/Nm^3 (EL_70, Eurelectric_697).* 1.2. *PC coal-fired plants of >300 MW_{th}* 1.2.1. *Yearly average* ○ *Increase the upper end of the range for existing plants to 200 mg/Nm^3 (CZ_99, E&P_28_67_79_81_99, Eurelectric_84_86_696, UK_62).* ○ *Decrease the upper end of the range for existing plants to 135 mg/Nm^3 (EEB_36).* ○ *Decrease the upper end of the range for new plants to 85 mg/Nm^3 (EEB_31_33_37).* ○ *Increase the upper end of the range for new plants to 150 mg/Nm^3 (Eurelectric_697).* 1.2.2. *Daily average* ○ *Decrease the upper end of the range for existing plants to 190 mg/Nm^3 (EEB_134).* ○ *Increase the upper end of the range for new plants to 165 mg/Nm^3 (FR_88).* 2. *CO emissions* • *Increase the upper end of the range to 140 mg/Nm^3 (Euracoal_143, Eurelectric_646_698) or to 150 mg/Nm^3 (E&P_93_99, CZ_93_99) for existing coal PC plants.* • *Increase the upper end of the range to 200 mg/Nm^3 for existing lignite-fired and coal FBC plants (EL_71, Euracoal_143, Eurelectric_646_698).* • *Change the range to 50-100 mg/Nm^3 for PC coal firing (PL_2).*

EIPPCB assessment:	**1. NO_X emissions** **1.1. FBC (coal-lignite) and PC lignite firing of ≥ 300 MW_{th}** **Existing FBC coal- and/or lignite-fired plants and PC lignite-fired plants are considered in a separate category as less NO_X emissions are generated from the boiler due to a lower temperature of combustion, and thus these plants do not necessarily need to use end-of pipe abatement techniques for NO_X reduction.** **1.1.1. Yearly averages** **Based on the available data collected at plant level, several existing plants operated in different countries achieve NO_X emission levels within the proposed range in D1 by using primary techniques, sometimes along with SNCR, and keeping the CO emissions below 100 mg/Nm^3. There are further data submitted as bulk information showing NO_X emission levels down to 85 mg/Nm^3 that can be achieved after retrofitting with SCR at lignite-fired plants, in the US [Additional information – EEB-06].** **Regarding peak- and emergency-load modes, the same primary techniques, sometimes with SNCR, can apply as in the case of other load modes, and no evidence demonstrates a different environmental performance when these techniques operate in these modes. However, a yearly average may not be needed for these modes as their operation throughout the year is limited to 1500 hours.** **For new lignite-fired plants, it is proposed to review the higher end of the yearly BAT-AELs in light of NO_X emission levels achieved at example US plants.** **New FBC boilers can achieve the same level of performance that are expected for new PC boilers (< 85 mg/Nm^3) using the same type of end-of-pipe techniques.** **1.1.2. Daily averages** **Daily BAT-AELs for new plants could be revised based on updated information regarding the use of SCR on lignite-fired plants. BAT-AELs could further be based on the ones defined for coal combustion in PC plants.** **1.2. PC coal-fired plants of ≥ 300 MW_{th}** **1.2.1. Yearly averages** **There is no evidence-based rationale supporting the comment for increasing the higher end of the yearly BAT-AEL range up to 200 mg/Nm^3 for existing plants. The rationale supporting the comment to decrease the higher end of the range is based on the application of a reduction efficiency of 74–78 % compared with the emission limit values set in the LCP Directive of 2001.** **Re-assessment of the contextual information provided with the questionnaires shows reduction efficiencies associated to SCR retrofits from 69 % (Plant 268) to 89 % (Plant 121). These levels may depend on different parameters, including the year of retrofit and the plant configuration. The provided emission data include cases with plants fitted with SCR and plants fitted only with SNCR and/or with primary techniques. As plants using only primary techniques achieve levels of emission below 500 mg/Nm^3, it is expected that plants retrofitted with SCR and properly operated would achieve levels below 150 mg/Nm^3. The higher end of the range proposed in D1 could thus be reviewed accordingly.** **Based on reported data (up to Plant 141) and on the expected performance of new SCR (> 85 % of reduction efficiency), levels lower than 85 mg/Nm^3 can be achieved for new plants on a yearly basis.** **Regarding peak- and emergency-load modes for PC-coal plants, primary techniques with SNCR or small SCR would allow reaching yearly emission levels as low as 200 mg/Nm^3. Thus a different higher end of the BAT-AEL range could be set in this case. Furthermore, a yearly average may not be needed for these modes as their operation throughout the year is limited to 1500 hours, so daily levels of up to 220 mg/Nm^3 could be then derived as a reference value.** **1.1.1. Daily average** **Based on a reassessment of available data for existing plants achieving yearly level of emissions below 150 mg/Nm^3, a slightly revised BAT-AEL range could be proposed, taking as reference for the higher end of the range Plants 267 or 415-1 with emissions lower than 195 mg/Nm^3.** **Several plants commissioned between 1987 and 2008 and performing very well (e.g. Plants 367, 34, 253) can be taken as reference for setting daily BAT-AELs as proposed in D1 for new plants.** **2. CO emissions** **Levels of CO emissions associated with the plants proposed as BAT for NO_X are in the range, for coal firing, of 2–61 mg/Nm^3, with the exceptions of two fairly old plants (1990) reporting 120 mg/Nm^3 (Plant 26) and 138 mg/Nm^3 (Plant 99, which is a CFB boiler), and for lignite firing, of 5–60 mg/Nm^3.**

	Considering the full set of data available for coal- and lignite-fired plants of ≥ 300 MW_{th} (about 100 plants) more generally, it can be seen that almost all of them operate with yearly CO emission levels < 100 mg/Nm^3, with very few exceptions (about six) in the form of plants older than 1990 with CO levels up to 140 mg/Nm^3, and five more cases where the levels can reach up to 200 mg/Nm^3 for lignite-fired plants struggling to comply with their ELV. **Regarding plants operated in peak- and in emergency-load modes, it may not be appropriate to set yearly averages, as for NO_X emissions, due to their being operated less than 1500 hours per year. It could therefore be then proposed to exclude them from the BAT-AELs.**

EIPPCB proposal:	**1. NO_X emissions**
	• **Add a footnote mentioning that yearly BAT-AELs do not apply when plants operate in peak- or emergency-load modes.**
	• **Lignite-fired plants and coal-fired fluidised bed boilers: Keep proposed yearly and daily BAT-AELs for existing plants; change BAT-AELs for new plants aligning them with the ones proposed for coal firing.**
	• **Coal-fired pulverised combustion boilers:**
	  ○ **Change the proposed yearly BAT-AELs for existing plants to 65-150 mg/Nm^3 and change the proposed yearly BAT-AELs for new plants to 65-85 mg/Nm^3.**
	  ○ **Change the proposed daily BAT-AELs for existing plants to 80-200 mg/Nm^3 and keep the proposed daily BAT-AELs proposed in D1 for new plants.**
	  ○ **Add a footnote mentioning that the higher end of the daily BAT-AELs is 220 mg/Nm^3 in the case of plants operated in peak- or emergency-load modes.**
	2. CO emissions
	• **Change the proposed yearly BAT-AELs to < 5–100 mg/Nm^3; add a footnote mentioning that CO emission levels can reach levels up to 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 techniques for NO_X emissions reduction.**
	• **Add a footnote mentioning that these BAT-AELs do not apply when plants operate in peak- or emergency-load modes.**

1.3.4 BAT 20 – N_2O emissions to air

Location in D1:	*Section 10.2.1.3 – p. 754*
Current text in D1:	**20. In order to prevent or reduce N_2O emissions to air from the combustion of coal and lignite in circulating fluidised-bed boilers, BAT is to apply BAT 4 and the technique given below.**

	Technique	Description	Applicability
a.	Combustion temperature control	Control of the combustion temperature enables achieving balanced emissions to air of N_2O and NO_X	Generally applicable

{This BAT conclusion is based on information given in Section 5.1.4.6}

BAT-associated emission levels

The BAT-associated emission levels for NO_X, NH_3 and CO are given in Table 10.4.

Table 10.4: BAT-associated emission levels for N_2O emissions to air from the combustion of coal and lignite in circulating fluidised bed boilers

Combustion plant	Pollutant	BAT-AEL (average of samples obtained during one year - mg/Nm^3)	Monitoring frequency
CFBC	N_2O	20 – 150	twice/yr

Summary of comments:	*BAT conclusion* *1. Remove the BAT conclusion as N_2O emissions are plant specific and the technique may have high negative cross-media effects on SO_2 emissions and on the operational behaviour of the combustion (Euracoal_148, Eurelectric_149_651_705_706_925_926).* *2. Detail more the measures that could be taken for controlling the temperature (BE_46).* *BAT-AELs* *3. Delete the table or set BAT-AELs only for new plants (PL_134).* *4. Set different BAT-AELs for coal and lignite combustion (Euracoal_150).* *5. Take into account the effect of load and coal participation for setting the BAT-AELs (FI_48).* *6. Change the monitoring to once/yr (CZ_106, DK_130, FI_47, E&P_85_106, Eurelectric_90_652_926).* *7. Set a continuous monitoring for new plants ≥ 100 MW_{th} and periodic monitoring (2/yr) for new plants < 100 MW_{th} (PL_135).* *8. Change the BAT-AELs to 20–80 mg/Nm^3 (DK_131).*
EIPPCB assessment:	**BAT conclusion** **1. (+2.) The temperature of combustion has an impact on the level of N_2O emitted, as do other parameters e.g. the amount of excess air, the carbon content, the O/N ratio of the fuel or the use of SNCR or SCR (Additional information – EIPPCB-10/11). Thus the level of N_2O emitted depends on the techniques used for controlling the NO_X emissions and is controlled as a trade-off of the use of these techniques. These techniques are already listed for the control of NO_X emissions. The level of N_2O emissions also depends on the equivalent full load factor (see BREF Section 5.1.3).** **BAT-AELs** **3. (to 8.) There is limited added value to monitor twice a year instead of once a year as the measurement needs to be carried out in load-similar conditions. However, a measurement needs to be taken in the event of a fuel change as the N_2O levels may be affected. As the level of emissions may be impacted, it is important to mention the minimum load (e.g. above 70 %) along with the measurement frequency. Levels of N_2O emitted may depend on different parameters such as the techniques implemented for controlling NO_X emissions or operational parameters and not only the type of fuel combusted. There is no further evidence-based rationale in the comments to support the request to change the proposed BAT-AEL.**
EIPPCB proposal:	**BAT conclusion** **1. (+2.) Remove BAT 20. Change the statement of BAT 19 to: '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.'** **BAT-AELs** **3. (to 8.) Keep the proposed BAT-AELs. Change the proposed monitoring frequency to at least once every year. Add a footnote mentioning that the measurement takes place with a combustion plant load of > 70 %.**

1.3.5 BAT 21 – SO_X, HCl, HF emissions to air

<table>
<tr><td>Location in D1:</td><td>Section 10.2.1.4 - P. 754</td></tr>
<tr><td>Current text in D1:</td><td>
BAT 21 - In order to prevent and reduce SO_X, HCl and HF emissions to air from the combustion of coal and lignite, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a</td><td>Fuel choice</td><td>Use of fuel with low S (down to 0.1 %), Cl-, F-coal/lignite content. Used often in combination with other end-of-pipe techniques for plants above 50 MW_{th}</td><td>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.</td></tr>
<tr><td>b</td><td>Boiler sorbent injection (in-furnace or in-bed)</td><td>See description in Section 10.8.
Applied in combination with a downstream de-dusting device</td><td>Generally applicable</td></tr>
<tr><td>c</td><td>DSI (Dry sorbent injection)</td><td>See description in Section 10.8.
Generally used in plants < 300 MW_{th}, in combination with a de-dusting device (ESP, Fabric filter)</td><td>Generally applicable</td></tr>
<tr><td>d</td><td>Spray-dry absorber (SDA)</td><td>See description in Section 10.8.
Generally used in plants < 1500 MW_{th} for the combustion of fuels with low and moderate sulphur content</td><td>Generally applicable</td></tr>
<tr><td>e</td><td>Wet FGD</td><td>See description in Section 10.8</td><td>Applicable to plants > 300 MW_{th}</td></tr>
<tr><td>f</td><td>Seawater FGD</td><td>See description in Section 10.8</td><td>Applicable to plants > 300 MW_{th}</td></tr>
<tr><td>g</td><td>Combined techniques for NO_X and SO_X reduction</td><td>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</td><td>Applicable on a case-by-case basis, depending on the fuel characteristics and combustion process</td></tr>
<tr><td>h</td><td>Wet scrubbing</td><td>See description in Section 10.8.
Can be used for HCl / HF removal when no specific FGD end-of-pipe technique is implemented</td><td>Generally applicable</td></tr>
<tr><td>i</td><td>Retrofit of the gas-gas heater located downstream of the wet FGD or SDA</td><td></td><td>Applicable when the plant is fitted with a wet FGD or SDA</td></tr>
</table>
{This BAT conclusion is based on information given in Section 5.1.4.5}
</td></tr>
<tr><td>Summary of comments:</td><td>
<u>General</u>
1. Mention HCl and HF reductions only as side effects of SO_2 reduction (EL_74, Eurelectric_707).
2. Add a new technique: CFBC (Eurelectric_708).
<u>Technique a (Fuel choice)</u>
3. Modify the description by mentioning only S-fuel content <1 % (raw conditions) as European lignite deposits have higher S-fuel values than 0.1 % (PL_137).
4. Constrain the applicability of this technique to the boiler design and limit the applicability in the case of combustion of indigenous fuels (EL_72_75, Eurelectric_709).
<u>Technique c (DSI)</u>
5. Remove the information from the column description; keep only 'generally applicable' (CZ_107, E&P_107, Eurelectric_710), or modify the description mentioning that the technique is mostly applied in plants < 300 MW_{th} (EL_73), as the DSI technique can be a second step abatement of HCl and HF, including downstream a CFBC > 300 MW_{th}.(Eurelectric_710).
<u>Techniques e and f (wet and seawater FGD)</u>
</td></tr>
</table>

	6. The applicability of these techniques should be limited to plants >1000 MW_{th} (Eurelectric_711). *Technique i (gas-gas heater retrofit)* *7. The description given is too general. 'Replacement' would be better in the name than 'retrofit' (FI_49).* *8. Applicability of the technique should be decided on a site by site basis depending on CO_2 burden (E&P_86) and on the duct configuration (Eurelectric_91).* *9. Limit the applicability of the technique to the cases where the heat exchanger has to be replaced anyway (DK_139).*
EIPPCB assessment:	**General** **1. Although some techniques were initially designed mainly for SO_2 reduction, they may act differently in terms of HCl/HF reduction, and/or may be used for preferentially abating HCl/HF over SO_2, like a (pre-)wet scrubber or a (polishing) DSI after a CFB boiler.** **2. The CFB dry scrubber has been applied to several new or retrofitted plants in recent years with high levels of removal efficiency and could be included in the list of BAT.** **Technique a (fuel choice)** **3. 0.1 % is given as an indication in the description of what can be considered 'low'. Techniques are neither prescriptive nor exhaustive. The BAT statement indicates 'one or a combination of the given techniques', allowing the most suitable technique to be chosen on a case-by-case basis. Applicability restrictions for fuel choice include the energy policy of the Member States.** **4. Combustion plants are usually designed with the potential for burning a variety of fuels with given characteristics or they may need to be retrofitted, to a greater or lesser extent, depending on the new type of fuel to be used, except in the case of combustion of indigenous fuels where the original design may be more constrained due to highly specific fuel characteristics. The possibilities to combust different fuels are very plant-dependent; however there are a lot of examples of combustion plants frequently changing fuel suppliers, and even plants that have previously burnt indigenous fuels that are now able to burn imported fuels.** **Technique c (DSI)** **5. The description is based on the information exchange during the LCP BREF review process. The term 'mostly used…' seems more appropriate.** **Techniques e and f (wet and seawater FGD)** **6. More than twenty coal-fired plants of < 1000 MW_{th} that submitted questionnaires are fitted with a WFGD. However, the application of the technique at existing plants operated < 1500 h/yr may need to be assessed on a case-by-case basis, or even be considered too costly for plants operated in emergency mode.** **Technique i (gas-gas heater retrofit)** **7. Apart from the name of the technique, there is no description in D1. The description from Section 5.1.4.5.2 could be used. The technique consists of the replacement of the heat exchanger with a new one.** **8. The BAT statement is 'one or a combination of techniques', meaning that the proper technique(s) will be implemented on a site-by-site basis. The technique description includes the replacement or removal of the pre-existing gas-gas heater. Therefore the situation after this replacement should be better in terms of CO_2 emissions.** **9. In Section 5.1.4.5.2 it is mentioned that, due to economic reasons, the replacement should take place when the heat exchanger needs to be replaced.**
EIPPCB proposal:	**General** **1. Do not change the BAT statement.** **2. Include the CFB scrubber in the list of techniques.** **Technique a (fuel choice)** **3. In the description, add 'e.g.' before the example 'down to 0.1 %'.** **4. Add an applicability restriction in the case of plants burning highly specific indigenous fuels (see proposal below).** **Technique c (DSI)** **5. Replace 'generally' with 'mostly' in the description of the technique. The same also applies to the SDA technique description.** **Techniques e and f (wet and seawater FGD)** **6. Do not modify the size level threshold for the applicability of WFGD. Include that there may be techno-economic restrictions for applying this technique to plants of < 300 MW_{th} and to plants operated in peak-load mode, and that the technique is not applicable to plants operated in emergency-load mode.**

	Technique i (gas-gas heater retrofit) **7. Include the description from Section 5.1.4.5.2 in the table, replacing the word 'retrofit' with 'replacement' in the technique title, delete 'or SDA' in the technique title.** **8. (+9) Change the applicability to 'Only applicable to plants fitted with a WFGD and a downstream gas-gas heater when the heat exchanger needs to be changed or replaced'.**

1.3.6 Table 10.5 – BAT-AELs for SO_X – coal and/or lignite

<table>
<tr><td>Location in D1:</td><td>Section 10.2.1.4 - P. 755</td></tr>
<tr><td>Current text in D1:</td><td>Table 10.5: BAT-associated emission levels for SO_X emissions to air from the combustion of coal and lignite with S content < 3 %
<table>
<tr><th rowspan="2">Combustion plant rated thermal input (MW_{th})</th><th colspan="4">BAT-AEL (mg/Nm^3)</th><th rowspan="2">Monitoring frequency</th></tr>
<tr><th>New plants (yearly average)</th><th>Existing plants (yearly average)</th><th>New plants (daily average)</th><th>Existing plants (daily average)</th></tr>
<tr><td>50 – 100</td><td>150 – 200</td><td>150 – 400</td><td rowspan="2">ND</td><td rowspan="2">ND</td><td rowspan="3">Continuous measurement (2)</td></tr>
<tr><td>100 – 300</td><td>80 – 150</td><td>80 – 200</td></tr>
<tr><td>> 300 (Pulverised combustion)</td><td>10 – 75</td><td>10 – 130</td><td>25 – 110</td><td>25 – 220</td></tr>
<tr><td>> 300 (Fluidised bed boilers) (1)</td><td>20 – 150</td><td>20 – 180</td><td colspan="2">ND</td><td></td></tr>
<tr><td colspan="6">(1) The lower end of the range is achieved by high efficiency wet FGD system. The higher end can be achieved by boiler / in-bed sorbent injection.
(2) Only SO_2 is continuously measured, SO_3 is periodically measured (e.g. during calibration).</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td><u>General</u>
1. Exclude from the BAT conclusions plants firing indigenous fuels that apply the provisions of article 31 of the IED (use of desulphurisation rate instead of SO_2 emission concentrations) (CZ_117, EL_79, Euracoal_152, Eurelectric_655_714_929, E&P_116).
2. Do not set BAT-AELs for peak-load plants due to an implementation cost 3 times higher than in the case of base load plants (E&P_31, PL_31), and the same for mid-merit plants (E&P_89, Eurelectric_94).
3. Change the S-content reference value to < 2.5 % (fuel as received) (EL_78).
4. Apply systematic rules for BAT-AELs depending on the load mode: exclusion for emergency mode, +20 % for peak-load and mid-merit modes (E&P_121).
5. Create separate categories for plants combusting:
5.1. Fuels with S-content < 2 % and fuels with S-content in the range of 2–3 % (CZ_114, E&P_113).
5.2. Indigenous fuels for which the SO_2 content in the raw flue-gas is >5000 mg/Nm^3 in one hand (with desulphurisation rates instead of BAT-AELs), and coal and lignite excluding the previous category in the other hand (DE_6_21_131).
6. Replace lower end of the ranges by < higher end of the ranges (DK_134).

<u>Heading</u>
7. Remove the S-Fuel content to avoid having consequences on the fuel supply market (Eurelectric_97, E&P_93_95).
8. Specify reference conditions corresponding to the S-fuel content (CZ_109_112, E&P_109_112, Euracoal_151, Eurelectric_654_713_928).

<u>Plants of 50–100 MW_{th}</u>
<u>Yearly average</u>
9. Increase the higher end of the range to 500 mg/Nm^3 for peak-load plants with pre-existing deSOX system, and to 800 mg/Nm^3 for the other peak-load plants (FI_50).
<u>Daily average</u>
10. Add BAT-AELs based on the IED ELVs, instead of 'ND' (FR_94), or based on submitted data (e.g. Plant 19) (EEB_122).
11. Modify the monitoring requirement to 2/yr (E&P_108, CZ_108).

<u>Plants of 100–300 MW_{th}</u>
<u>Yearly average</u></td></tr>
</table>

	12. Increase the higher end of the range to 500 mg/Nm^3 for peak-load plants with pre-existing deSOX system, and to 800 mg/Nm^3 for the other peak-load plants (FI_50). *13. Increase the higher end of the range to 250 mg/Nm^3 for existing plants (PL_30, CEFIC_14, E&P_30).* *<u>Daily average</u>* *14. Add BAT-AELs based on the IED ELVs, instead of 'ND' (FR_94), or based on submitted data (e.g. Plant 19) (EEB_122).* *<u>PC boilers of > 300 MW$_{th}$</u>* *15. Assess the possibility to set different BAT-AELs for different sizes > 300 MW$_{th}$ (Euracoal_154, Eurelectric_657).* *<u>Yearly average existing plants</u>* *16. Increase the higher end of the range to 800 mg/Nm^3 for peak-load plants without pre-existing deSOX system (FI_50).* *17. Increase the higher end of the range and align it with the IED ELVs [200 mg/Nm^3 monthly average] (CZ_110, PL_30, E&P_30_100_110_114, Eurelectric_93_715).* *18. Change the BAT-AELs to 20–180 mg/Nm^3 (CZ_113).* *19. Change the BAT-AELs to 50–200 mg/Nm^3 (EL_77).* *20. Include an applicability exception for those plants that were recently retrofitted to comply with the IED ELVs (SP_49, FR_92, Eurelectric_716_719_931).* *<u>Yearly average new plants</u>* *21. Increase the higher end of the range to 150 mg/Nm^3 (EL_77).* *<u>Daily average existing plants</u>* *22. Keep the proposed BAT-AELs (CZ_113).* *23. Change the BAT-AELs to 50–220 mg/Nm^3 (EL_77).* *24. Decrease the higher end of the range (EEB_136).* *<u>Daily average new plants</u>* *25. Increase the higher end of the range to 165 mg/Nm^3 (EL_77).* *<u>FBC boilers of > 300 MW$_{th}$</u>* *<u>Yearly average</u>* *26. Increase the higher end of the range to 800 mg/Nm^3 for peak-load plants without pre-existing deSOX system (FI_50).* *27. Increase the higher end of the range to 200 mg/Nm^3 for plants > 1500 h/yr (FI_50).* *<u>Daily average</u>* *28. Add BAT-AELs based on the IED ELVs, instead of 'ND' (FR_95).* *29. Delete footnote ([1]) as it does not identify explicitly the lower and upper ends of the range (BE_47) or does not reflect the situation of plants that have implemented techniques to meet the IED ELVs (Eurelectric_721).*

EIPPCB assessment:	**General** **1. Information and data were collected via the questionnaires on the sulphur (S) and ash content of the fuel(s) used, and on whether or not the plants were combusting 'indigenous' fuels. Thus, the proposed BAT conclusions also cover plants burning 'indigenous' fuels. How the BAT conclusions and the provisions of the IED are actually used to set permit conditions is an implementation issue and is not under the remit of the TWG (see also Section 2.2 of this document).** **2. (+4.) See general assessment in Section 1.1.3.** **3. (+5.) The level of reference for S content in the fuel was proposed based on the data collected through the questionnaires. The reassessment of the available data takes into consideration the qualification of indigenous fuels. For non-indigenous fuels, the maximum reported S content in the fuel is about 2 % with the ash content generally between 10 % and 20 %, and in some cases up to 25 %. Plants combusting indigenous fuels are either combusting fuels with roughly the same S and ash characteristics than non-indigenous fuels (slightly wider range for ash content from 5 % to 25 %) or combusting fuels with a higher sulphur content (> 3 %). Since the LHV of lignite is lower than for coal, this could lead to a higher SO_2 content in the raw flue-gas There can therefore be some limitations in reaching proposed BAT-AELs for the bigger (≥ 300 MW_{th}) plants burning indigenous lignite, despite applying BAT with state-of-the-art SO_X reduction efficiencies. These plants have less or no flexibility in using the fuel choice as a technique to reduce the SO_X emissions. Therefore the creation of two categories could be proposed as regards the applicable BAT-AELs: one for plants combusting indigenous fuels with a high level of sulphur dioxide in the raw flue-gas, based on levels of SO_2 reduction efficiency, and another one for all the other plants with a corresponding BAT-AEL in SO_2 concentration (see also the assessment of comment 8 below).** **6. The BAT-AELs are proposed as ranges pursuant to the Commission implementing decision of 10.02.2012 laying down the rules on drawing up BREFs (see Section 3.3.1).** **7. The fuel S content is no longer proposed to be included in the BAT conclusions (see proposal 17).** **8. Reference conditions for data reporting in the questionnaires are 'weight % - dry basis'. 'Dry basis' excludes all moisture. 'As received' would include total moisture and 'dry ash free' would also exclude ash apart from moisture. However, the fuel S content is no longer proposed to be included in the BAT conclusions (see proposal 17).** **Plants of 50–100 MW_{th}** **Yearly average** **9. The review of available data shows emission levels below 360 mg/Nm^3 (Plant 462). The BAT-AELs proposed are based on the implementation of low capital cost techniques such as low-sulphur fuel combustion or boiler sorbent injection that are available for peak-load plants. However a yearly average may not be needed for these load modes as their operation throughout the year is limited to 1500 hours.** **Daily average** **10. Very little data/information is available for revising the short-term BAT-AELs. The current daily BAT-AEL in the 2006 LCP BREF is 150–400 mg/Nm^3.** **11. All but one plant which submitted questionnaires perform continuous monitoring. The 2006 LCP BREF already sets continuous monitoring as BAT. It could be justified that plants of < 100 MW_{th} operated in peak- or emergency-load modes benefit from less frequent monitoring requirement due to their reduced operating time, e.g. periodic monitoring.** **Plants of 100–300 MW_{th}** **Yearly average** **12. No further information that would support new proposals for this operating mode was submitted with the comments on D1 regarding peak-load plants. The use of low-sulphur fuel alone, or in combination with low CAPEX techniques like duct sorbent injection, can be taken as a BAT reference for proposing BAT-AELs for plants operated in peak- or emergency-load modes. (See also the assessment for plants of ≥ 300 MW_{th}). However, BAT-AELs expressed as yearly averages may not be needed for these load modes as the operation throughout the year is limited to 1500 hours.** **13. Plants 109, 153-2 and 213 were taken as the reference for proposing BAT-AELs in**

D1 in the range of 80–200 mg/Nm^3, using SDA or dry sorbent techniques. In particular, Plant 213 which reported emissions of 329 mg/Nm^3 as a yearly average was about to be retrofitted to achieve levels below 200 mg/Nm^3 thanks to an upgrade of the SDA technique already in place, when the questionnaire was submitted.

Daily average

14. Based on the available information (Plant 109 with max of daily average and the planned retrofit of Plant 213 that is expected to lead to a decrease in emissions of 40 %, additional information EEB-07/08), short-term levels of SO_2 emission are reported between 135–250 mg/Nm^3.

PC boilers of ≥ 300 MW_{th}

15. There are no clear correlations from the data/information submitted between the techniques implemented, the emission levels of SO_2 and the size of the plants above 300 MW_{th} that would justify different categories based on the size.

Yearly average existing plants

16. In the data set, no plant is operated in emergency-load mode, one plant (435-1 – Low-S fuel (0.42 %) as only technique – Plant included in TNP) is operated in peak-load mode, eight old plants were submitted that operate in mid-merit mode (267, 268, 435-2, 496, 101, 69, 99, 18-1). Plant 435-2 was retrofitted with a WFGD IN 2008 in order to meet the ELV of 400 mg/Nm^3 set in the permit; it achieves levels of SO_2 emissions of 233 mg/Nm^3. Levels for Plants 267-268 are about 200 mg/Nm^3, the lowest SO_2 emissions being achieved by using low-sulphur fuels (0.13 % S). Regarding the applicability to mid-merit plants, the submitted UKTWG7 document tends to conclude that retrofitting a wet FGD at an existing PC boiler operated in mid-merit mode may not be cost-effective. The conclusions of this study are based on the use of parameters that are very specific to each case and that may give different conclusions depending on their choice. Furthermore, example plants operated in mid-merit load mode and fitted with WFGD were proposed in the data collection (e.g. Plants 496, 101). With this document providing context, it could be expected that the retrofit applicability for plants operated in peak-load mode may need to be assessed on a case-by-case basis, and that the technique may not be applicable to plants operated in emergency mode.

For plants operated in peak- or emergency-load modes, the use of very low-sulphur fuel through the example of Plants 267-268 can be seen as BAT, as this is a primary technique not requiring CAPEX, and thus BAT levels could be set. However, yearly averages may not be needed for these load modes as the operation throughout the year is limited to 1500 hours.

17. (+18. +19.) Based on the assessment of point 3, two categories could be proposed for setting BAT-AELs as yearly averages for existing plants:

17.1. The first category refers to those plants combusting indigenous fuels with SO_2 levels in the raw flue-gas above a certain concentration, which could not, for techno-economic reasons, achieve the general BAT-AELs set. For these plants, it is proposed to derive BAT-AELs based on reference levels of SO_2 reduction efficiency of the abatement technique, as it could be difficult to get higher SO_2 reduction efficiencies because the FGD system is already at state-of-the-art level. The available information (Additional information – EPPSA-04, eippcb-12) shows that SO_2 reduction efficiency levels of between 97 % (upgrades) and more than 98.5 % (new systems) or even 99 % could be achieved. The SO_2 reference content in the raw flue-gas for this category can be derived taking as a basis the upper level of the BAT-AEL range (130 mg/Nm^3 – see below Section 17.2 of this BP), and a reduction efficiency of 97 % of the FGD system; this gives as a result 4350 mg/Nm^3. A higher end of the range can be set taking as a reference the worst sulphur content in the fuel (5.4 %) in Europe, based on the information provided to the TWG by the 'low quality fuel initiative', and a reduction efficiency of 98.5 % for existing plants and 99 % for new plants.

17.2. The second category refers to the general case, i.e. those coal- and lignite-fired plants not covered by the first category: in this category, the appropriate combination of fuel choice with a secondary abatement technique (wet scrubber as the main reference from the questionnaires provided) allows yearly average emission levels between 10 and 130 mg/Nm^3 to be achieved. In this range plants burn coal or lignite from the international market with a sulphur content that can vary from 0.1 % to 3 % and use abatement

	techniques with reduction efficiencies that can vary from 86 % to 99 %. There is no need to specify the fuel S content here as another category is created for plants burning indigenous fuels where the S content may be an issue. 20. A general footnote could not cover all possible cases. The proposed range is defined on the basis of the possible upgrade of existing systems with no need to rebuild entirely new ones. Yearly average new plants 21. Several existing plants operate at levels lower than 75 mg/Nm^3, corresponding to levels achieved with recent FGD installations (abatement efficiency above 98 % or even 99 % as yearly averages with S content in fuels up to 2 %). However, as proposed for existing plants, a footnote could be added for plants combusting indigenous fuels with SO_2 levels in the raw flue-gas above 5000 mg/Nm^3. For these plants, it is proposed to derive BAT-AELs from a reference SO_2 reduction efficiency of more than 98.5 %. Daily average existing plants 22. (+23. +24.) Regarding plants combusting 'conventional' fuels, the lower end has been defined using the data from Plant 34, the reported data being maximum values of a short-term average. For the higher end, according to the reported data, levels of up to 205 mg/Nm^3 could be considered as representing BAT levels, taking Plant 388 as a reference. For the 'new category' of plants combusting indigenous fuels, the variation on a short-term basis is very high depending on the content of S and free calcium oxide in the fuel, as shown by the reported data (variations up to three times), and it could be difficult to derive a meaningful short-term average. Daily average new plants 25. For new plants, the comment proposes to align the daily higher end of the range with the minimum requirement set by the IED without any other rationale. Several existing plants achieve levels below the proposed 110 mg/Nm^3. FBC boilers of ≥ 300 MW_{th} Yearly average 26. See the assessment of comment at point 16 for coal PC boilers. There are no specificities linked to the use of fluidised bed techniques regarding this assessment. 27. Most of the fluidised-bed plants that submitted data are deemed not well performing - in emissions terms - being only fitted with boiler sorbent injection, except for one plant (Plant 387), which has been used for setting the BAT-AEL. No additional information is provided with the comment. The plant's performance is affected when indigenous fuels are used, like for PC boilers. Thus, the same reasoning can apply, with special provision for plants with raw flue-gases containing more than 6000 mg/Nm^3 SO_2. Daily average 28. After reviewing the available data (Plant 387) and considering the possibility to retrofit these plants with wet techniques like for PC boilers, it is considered that these plants could perform with SO_2 daily averages between 50 and 220 mg/Nm^3 for existing plants and 25 and 185 mg/Nm^3 for new plants, by applying a correction ratio derived from the proposed yearly BAT-AELs. Footnote ([1]) 29. The level of performance in the case of CFB boilers depends on the technique used and it may be worth specifying this in a footnote. This is not the case for BFB boilers. This way of expressing achievable emission levels within a BAT-AEL is consistent with other recently approved BREFs.
EIPPCB proposal:	General 1. Do not change the scope of the BAT conclusions regarding plants covered by IED Article 31. 2. (+4.) See detailed assessment of the load modes according to the plant sizes. 3. (+5. +7.) Propose differentiated BAT-AELs for pulverised combustion (PC) plants of ≧ 300 MW_{th} combusting indigenous fuels with higher SO_2 content in the raw flue-gas (see proposal below – point 17). 6. Keep proposing BAT-AELs in ranges. 8. Remove the reference to the sulphur content of the fuel from the BAT statement. Specify that the SO_2 concentration levels in the raw flue-gas are expressed 'under standard conditions' as per the general conditions. Plants of 50–100 MW_{th} Yearly average 9. Change the proposed yearly BAT-AELs for existing plants of 50–100 MW_{th} to 150–

	360 mg/Nm^3. Add a footnote mentioning that yearly BAT-AELs do not apply when plants operate in peak- or emergency-load modes. **Daily average** **10. Propose a daily BAT-AEL of 170–400 mg/Nm^3 for existing plants. Do not propose a daily BAT-AEL for new plants.** **11. Keep the proposed continuous monitoring for plants of 50–100 MW_{th} Add a footnote for plants of < 100 MW_{th} operated in peak- or in emergency-load modes, setting a minimum monitoring frequency of at least 2 samples/yr (peak-load mode) and at least 1 sample/yr (emergency-load mode).** **Plants of 100–300 MW_{th}** **Yearly average** **12. (+13.) Keep the proposed yearly BAT-AELs for existing plants. Add a footnote mentioning that yearly BAT-AELs do not apply when plants operate in peak- or emergency-load modes.** **Daily average** **14. Propose a daily BAT-AEL for existing plants of 135–250 mg/Nm^3. Do not set a daily BAT-AEL for new plants.** **PC boilers of ≥ 300 MW_{th}** **15. Do not create different categories based on size for plants of ≥ 300 MW_{th}.** **Yearly average for existing plants** **16. Do not propose specific BAT-AELs for plants operated in mid-merit load mode. For plants operated in peak-load modes, change the higher end of the BAT-AEL range to 220 mg/Nm^3 through a footnote. Add in the applicability the need to assess the applicability for plants operated in peak-load mode on a case-by-case basis, and that the technique is not applicable for plants operated in emergency-load mode.** **17. (+18. +19.)** **17.1. Add separate conclusions for plants combusting indigenous fuels with a SO_2 content in the raw flue-gas of more than 4350 mg/Nm^3 (standard conditions) as a yearly average and that could not achieve the BAT-AEL proposed in 17.2 for techno-economic reasons. Set corresponding yearly BAT-AELs for SO_2 based on a SO_2 reduction efficiency of 97–98.5 % with a higher end of the range that should not exceed 400 mg/Nm^3.** **17.2. Keep the proposed yearly BAT-AEL expressed in concentration for the general case.** **20. Do not introduce a footnote for recently retrofitted plants.** **Yearly average for new plants** **21. Keep the proposed yearly BAT-AEL expressed in concentration for the general case. Add separate conclusions for plants combusting indigenous fuels with a SO_2 content in the raw flue-gas of more than 5000 mg/Nm^3 (standard conditions) as a yearly average, allowing an alternative BAT-AEL to be derived based on a SO_2 reduction efficiency of 98.5–99 % with a higher end of the range that should not exceed 270 mg/Nm^3 (idem for FBC plants).** **Daily average for existing plants** **22. (+23. +24.) Change the proposed daily BAT-AEL to 25–205 mg/Nm^3 for existing plants combusting non-indigenous fuels. Add in separate conclusions that daily BAT-AELs may not apply to plants combusting indigenous fuels with SO_2 concentrations of > 4350 mg/Nm^3 (standard conditions) in the raw flue-gas (idem for FBC plants).** **Daily average for new plants** **25. Keep the proposed BAT-AEL for daily averages for new plants combusting 'conventional' fuels. Add in separate conclusions that daily BAT-AELs may not apply to plants combusting indigenous fuels with SO_2 concentrations of > 5000 mg/Nm^3 (standard conditions) in the raw flue-gas (idem for FBC plants).** **FBC boilers of ≥ 300 MW_{th}** **Yearly average** **26. (+27.) Keep the proposed yearly BAT-AELs. Add separate conclusions for plants combusting indigenous fuels with a SO_2 content in the raw flue-gas of more than 6000 mg/Nm^3 (standard conditions) as a yearly average and that could not achieve the general BAT-AEL for techno-economic reasons. Set corresponding yearly BAT-AELs for SO_2 based on a SO_2 reduction efficiency of 97–98.5 %. For plants operated in peak- or emergency-load modes, change the higher end of the daily BAT-AEL range to 220 mg/Nm^3.**

	Daily average **28. Propose daily average BAT-AEL range to 50–220 mg/Nm^3 for existing plants combusting 'conventional' fuels and to 25–185 mg/Nm^3 for new plants.** **Footnote ([1])** **29. Keep the footnote and specify that it applies only to circulating fluidised bed boilers.**

1.3.7 Table 10.6 – BAT-AELs for HCl and HF – coal and/or lignite

Location in D1:	*Section 10.2.1.4 - p. 755*
Current text in D1:	**Table 10.6: BAT-associated emission levels for HCl and HF emissions to air from the combustion of coal and lignite**

Pollutant	BAT-AEL (average of samples obtained during one year - mg/Nm^3)	Monitoring frequency
HCl	< 1 – 5	4 times/yr
HF	< 0.1 – 2	

Summary of comments:	*General* *1. Derive different BAT-AELs depending on the technique used (FGD with contact transfer by regenerative heat transfer, FGD with no such transfer, dry sorbent techniques), taking into consideration the data of table 5.20 (FR_97, Euracoal_155, E&P_99, Eurelectric_95_658_722_932).* *2. Change the lower end of the ranges to values statistically significant (IT_85).* *3. Split BAT-AELs depending on load mode/factor (ES_50).* *4. Define BAT-AELs only for plants where the fuel characteristics cannot be proven to demonstrate that the AELs can be achieved (ES_50, E&P_91).* *5. Delete table 10.6 (UK_101, ES_50, E&P_32) or set BAT-AEPLs for HCL/HF as the techniques used for HCl/HF reduction are the ones used for SO_X reduction (FI_51) or set a transition period up to 2030 for FBC boilers not equipped with end-of pipe techniques (E&P_32, PL_32), or follow the organisation of table 10.5 on SO_X conclusions to set the conclusions for HCl/HF (DK_140, Euracoal_157).* *6. Differentiate between new and existing plants (PT_91, Euracoal_157).* *7. Set higher levels for FBC using dry FGD systems (FR_97).* *8. Lower end of the ranges may be difficult to achieve for plants equipped with gas-gas heaters (GGH) due to condensation and re-evaporation from the GGH (DK_136).* *Alternative proposed levels* *9. HCl BAT-AELs* • *< 10 mg/Nm^3 (CZ_120, FR_97, E&P_119).* • *< 5 mg/Nm^3 (DK_140).* • *< 25 mg/Nm^3 for existing 50–100 MW_{th} plants (FI_51).* • *< 10 mg/Nm^3 for existing >100 MW_{th} plants (FI_51).* • *< 10 mg/Nm^3 for new plants (FI_51).* *10. HF BAT-AELs* • *<5 mg/Nm^3 (CZ_120, FR_97, E&P_119).* • *<3 mg/Nm^3 (DK_140).* • *< 2 mg/Nm^3 for existing and new plants (FI_51).* *Monitoring* *11. Change the minimum frequency to once/yr (EL_80, DK_135, ES_50, Eurelectric_100), for alignment with metals monitoring (DK_140).* *12. Change the minimum frequency to once/yr when demonstration is made of low emissions on the long term by using the same fuel, and in case of fuel diet change (CZ_121_123, E&P_120_122, Euracoal_156, Eurelectric_659_723_933, Eurofer_226).* *13. Change the minimum monitoring frequency to twice/yr (Euracoal), according to PT regulation (PT_58).* *14. Only set monitoring frequency for new plants, with continuous monitoring for plants ≥ 100 MW_{th} and periodic monitoring 4 times/yr for plants< 100 MW_{th} (PL_142)*

EIPPCB assessment:	**General** **1. Data reported at plant level and used for deriving BAT conclusions and BAT-AELs are given in the figures 5.33 and 5.34 in the Section 5.1.4 'Techniques to consider for the determination of BAT' of the BREF. Contextual information supports differentiating achieved performance between wet and dry applied techniques, but not between FGD with contact transfer by regenerative heat transfer and FGD with no such transfer (see points 9 and 10 below for the outcome of the assessment).** **2. The ranges are based on collected data. The limit of detection of HCl is about 0.06 mg/Nm^3 and for HF about 0.1 µg/Nm^3.** **3. The level of HCl/HF emitted is more linked to the Cl/F fuel content and to the applied technique's reduction efficiency than to the load mode/factor.** **4. The definition of BAT-AELs for plants with an expected stable, low level of emissions is more a question of monitoring requirements than a question of having applicable BAT-AELs or not.** **5. (+6. +7.) As far as emission levels are concerned, BAT-AELs apply and not other types of BAT-AEPLs. Levels of HCl/HF were already set in the 2006 LCP BREF. Depending on the Cl- or F- content in the fuel, an operator may need to choose one or a combination of techniques, according to their effectiveness in HCl/HF emissions reduction, even if these techniques may have been designed to firstly target, in general, SO_X emissions. The use of dry techniques is also assessed for proposing BAT-AELs. The BAT-AELs structure applied for SO_X emissions could be used as a basis for expressing BAT-AELs for HCl/HF emissions, including distinction of new and existing plants.** **8. Plants still equipped with a GGH may have a leakage and condensation phenomenon that could make it difficult for them to achieve the values corresponding to the lower end of the BAT-AELs. However, it should be noted that there is no such evidence in the data collected, because it is not indicated which plants are equipped with a GGH.** **Alternative BAT-AELs** **9. HCl emissions** **Much more data are available for plants of ≥ 300 MW_{th} than for plants of < 300 MW_{th}. Reassessment of these data confirm that plants of ≥ 300 MW_{th} fitted with BAT and well operated achieve emission levels on a yearly basis below 5 mg/Nm^3. CFB boilers can be fitted, if needed, with end-of-pipe techniques (e.g. a polishing DSI) to get the HCl emissions reduced to about < 5–10 mg/Nm^3 (See EPPSA-01 paper – Additional information).** **HCl emission levels submitted from plants of 100–300 MW_{th} are comparable to those of plants of ≥ 300 MW_{th}, thus for HCl and HF the category can group all of the plants of ≥ 100 MW_{th}.** **For plants of ≥ 100 MW_{th} operated in peak- or emergency-load modes, the levels of HCl emissions may be higher as they may implement only the low-sulphur fuel technique, possibly in combination with dry sorbent injection. The achievable levels of emissions corresponds thus to the ones of plants of < 100 MW_{th}.** **As HCl reduction efficiencies for plants of < 100 MW_{th} are expected to be half that of the one of plants of ≥ 300 MW_{th}, based on the comparison of SO_X emission levels by applying dry techniques, the HCl emission levels are expected to be double those of bigger plants, that is within 2–10 mg/Nm^3. These levels would also apply to plants operated in peak- or emergency-load modes.** **The reported data show that new plants of ≥ 100 MW_{th} fitted with wet or dry techniques could achieve less than 3 mg/Nm^3 as yearly HCl emissions. Following the same reasoning as above for existing plants, new plants of < 100 MW_{th} are expected to achieve yearly HCl emissions lower than 6 mg/Nm^3.** **10. HF emissions: the same reasoning as in point 9 above can be used for HF emissions, taking Plant 132 with HF emissions slightly above 3 mg/Nm^3 as the reference for plants of ≥ 300 MW_{th} for setting the higher end of the range.** **Monitoring** **11. (to 14.) From the information collected in the questionnaires, the monitoring is performed in many different ways from a periodic measurement with one sample per year to continuous measurement, without one predominant type of monitoring. Given the fact that HCl/HF are key pollutants but that there have been no requirements on halogen emissions in the LCP regulations so far, a flexible approach with periodic monitoring at least every three months could be sufficient, with a possibility to reduce the frequency if the reported levels are low enough within the BAT-AEL ranges.** **Plants of < 100 MW_{th} operated in peak-load or emergency-load modes could have**

	less stringent requirements in terms of monitoring, e.g. less frequent monitoring, given their limited time of operation and emission levels.
EIPPCB proposal:	**<u>General</u>** **1. Do not set the BAT-AELs based on values from Section 5.1.4 of the BREF.** **2. Do not change the lower end of the proposed range.** **3. See the detailed proposal below for further information on load mode consideration.** **4. Keep the proposed BAT-AELs for plants even with a stable, low level of HCl/HF emissions.** **5. (+6. +7.) Revise the proposed BAT-AELs based on the information available on the levels of emission and on the techniques performance for reducing HCl/HF emissions, and taking as contextual information the categories and techniques proposed for SO_X emissions.** **8. Add a footnote mentioning that the lower end of the range is difficult to achieve for wet FGD with a gas-gas heater.** **<u>Alternative BAT-AELs</u>** **9. <u>HCl emissions</u>:** • **Plants ≥ 100 MW_{th}: keep < 1–5 mg/Nm^3 for existing plants and change to < 1–3 mg/Nm^3 for new plants; add a footnote for a higher end of the range at 10 mg/Nm^3 in the case of existing CFB boilers and of plants operated in peak- or emergency-load modes.** • **Plants of < 100 MW_{th}: propose 2–10 mg/Nm^3 for existing plants and < 1–6 mg/Nm^3 for new plants.** **10. <u>HF emissions</u>:** • **Plants ≥ 100 MW_{th}: change to < 0.1–3 mg/Nm^3 for existing plants and keep < 0.1–2 mg/Nm^3 for new plants; add a footnote for plants operated in peak- or emergency-load modes for which the higher end of the range is 6 mg/Nm^3.** • **Plants of < 100 MW_{th}: Change to 0.2–5 mg/Nm^3 for existing plants and < 0.1–3 mg/Nm^3 for new plants.** **<u>Monitoring</u>** **11. (to 14.) Keep the minimum measurement frequency of at least 4 times/yr with a footnote allowing its reduction when emissions are proven to be low over the long term, the frequency in that case being at each change of fuel characteristics that may impact the emissions, and at least once/yr. Set a different monitoring frequency for plants of 50–100 MW_{th} operated in peak-load or in emergency-load modes, respectively at least twice and once every year.**

1.3.8 BAT 22 – Dust and particulate-bound emissions to air

<table>
<tr><td>Location in D1:</td><td>Section 10.2.1.5 – p. 755</td></tr>
<tr><td>Current text in D1:</td><td>BAT22 - In order to reduce dust and metal emissions to air from the combustion of coal and lignite, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Cyclones</td><td>See description in Section 10.8. Only used as a pre-cleaning stage in the flue-gas path, in combination with other technique(s) listed in this table</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Electrostatic precipitator (ESP)</td><td>See description in Section 10.8. At least a two-fields ESP is used for smaller plants</td><td>Generally applicable</td></tr>
<tr><td>c.</td><td>Bag filter</td><td>See description in Section 10.8.</td><td>Generally applicable</td></tr>
<tr><td>d.</td><td>Boiler sorbent injection</td><td>See description in Section 10.8. Generally used in fluidised-bed boilers sized 50 – 100 MW_{th} in combination with ESP / bag filter</td><td>Generally applicable</td></tr>
<tr><td>e.</td><td>Dry or semi-dry FGD system (e.g. SDA, DSI)</td><td>See description in Section 10.8. Generally used in fluidised-bed boilers sized 100 – 300 MW_{th} in combination with ESP / bag filter</td><td>Applicable to plants >100 MW_{th}</td></tr>
<tr><td>f.</td><td>WFGD</td><td>See description in Section 10.8. Generally used in plants >300 MW_{th} in combination with ESP / bag filter</td><td>Applicable to plants >300 MW_{th}</td></tr>
</table>
{</td></tr>
<tr><td>Summary of comments:</td><td>1. <u>General</u>
1.1. Include BAT conclusions for diffuse dust emissions (FR_99).
1.2. Limit the applicability of the BAT conclusions to base-load plants (E&P_102, Eurelectric_103).
2. <u>Technique a (Cyclones):</u> This technique is not applicable if ESP or bag filter are also used (EL_81, Eurelectric_724).
3. <u>Technique b (ESP)</u>: Remove, in the technique description, the qualification of a minimum 'two-field' ESP (CEFIC_12, PL_145).
4. <u>Technique c (Bag filter)</u>: Limit the applicability only to plants < 300 MW_{th} as there is only limited experience of application to large boilers (EL_84, Eurelectric_725).
5. <u>Technique d (Boiler sorbent injection)</u>: There is no size limitation for the applicability of this technique to be reported in the description (EPPSA_383).
6. <u>Technique e (dry or semi-dry FGD)</u>: The range of applicability of this technique is broader than the one given in the description (EPPSA_383).
7. <u>Technique f (WFGD)</u>: This technique is not applicable to plants < 1000 MW_{th} (Eurelectric_726).</td></tr>
<tr><td>EIPPCB assessment:</td><td>1. <u>General</u>
1.1. Diffuse dust emissions are considered as a general topic covered by the proposed BAT 9bis and BAT 9ter (See Section 2.15 of this BP).
1.2. Example plants of all sizes with load regimes including mid-merit or even peak-load modes are fitted with one or a combination of the proposed techniques. The applicability is assessed technique by technique.
<u>Cyclones (a)</u>
2. BAT conclusions are mainly derived from the implementation of ESP or bag filters, alone or in combination with desulphurisation techniques. The cyclones alone are not considered BAT but can be part of a pretreatment. Techniques are neither exhaustive nor prescriptive. Thus this technique can be removed from the list of BAT.
<u>ESP (b)</u>
3. The ESP's number of fields is not the only parameter influencing its performance and the final level of dust emissions.
<u>Bag filter (c)</u>
4. Several examples of plants of ≥ 300 MW_{th}, even bigger than 1000 MW_{th}, using a bag filter have been submitted as reference plants.</td></tr>
</table>

	Boiler sorbent injection (d) and dry/semi-dry FGD (e) **5. (+6.) The ranges given in the description can be improved based on updated supplier information and on available plant data (Plant 387 for BSI, Plants 189, 443-1, 69 for SDA or Dry FGD).** **WFGD (f)** **7. Numerous plants of 300–1000 MW_{th} use WFGD systems (see collected data at plant level). The applicability is the same as the one mentioned for SO_2 emissions to air (See section 1.3.5 of this BP).**
EIPPCB proposal:	**General** **1. See proposed BAT 1 on EMS for diffuse emissions, and assess the different load regimes based on the techniques applied.** **Cyclones (a)** **2. Remove the technique from the list.** **ESP (b)** **3. Remove the 'two-field' minimum indication in the ESP description.** **Bag filter (c)** **4. Do not limit the applicability of bag filters to only plants of < 300 MW_{th}.** **Boiler sorbent injection (d) and dry/semi-dry FGD (e)** **5. (+6.) Keep the description of the Boiler sorbent injection technique, and change the range to 'up to 800 MW_{th}' for DSI/SDA techniques. Change the applicability to 'generally applicable' to match the applicability of these techniques for SO_X reduction.** **WFGD (f)** **7. Keep the applicability of WFGD to plants of ≥ 300 MW_{th}. Include that there may be techno-economic restrictions for applying this technique to plants of < 300 MW_{th} and to plants operated in peak-load mode, and that the technique is not applicable to plants operated in emergency-load mode.**

1.3.9 Table 10.7 – BAT-AELs for dust – coal and/or lignite

1.3.9.1 Table 10.7 – General

<table>
<tr><td>Location in D1:</td><td>Section 10.2.1.5 – p. 756</td></tr>
<tr><td>Current text in D1:</td><td>
BAT-associated emission levels
The BAT-associated emission levels for dust emissions to air are given in Table 10.7.

Table 10.7: BAT-associated emission levels for dust emissions to air from the combustion of coal and lignite

<table>
<tr><th rowspan="3">Combustion plant rated thermal input (MW_{th})</th><th rowspan="3">Unit</th><th colspan="4">BAT-AEL</th><th rowspan="3">Monitoring frequency</th></tr>
<tr><th>New plants</th><th>Existing plants</th><th>New plants</th><th>Existing plants</th></tr>
<tr><th colspan="2">Yearly average</th><th colspan="2">Daily average</th></tr>
<tr><td>50 – 100</td><td rowspan="4">mg/Nm^3</td><td>2 – 15</td><td>2 – 20</td><td>ND</td><td>4 – 28</td><td rowspan="4">Continuous measurement</td></tr>
<tr><td>100 – 300</td><td>2 – 10</td><td>2 – 20</td><td>ND</td><td>4 – 25</td></tr>
<tr><td>300 – 1000</td><td>< 5</td><td>1 – 15</td><td>ND</td><td>4 – 20</td></tr>
<tr><td>> 1000</td><td>< 3</td><td>< 1 – 10</td><td>4 – 10</td><td>4 – 20</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td>
1. <u>General</u>
1.1. Set BAT-AELs for plants operated only in baseload mode (E&P_102, Eurelectric_103).
1.2. Differentiate BAT-AELs between plants firing coal and plants firing lignite (Eurelectric_660_728).
1.3. Merge the plant categories 300–1000 MW_{th} and ≥ 1000 MW_{th} due to the use of similar techniques (CZ_126, E&P_125, Euracoal_159, Eurelectric_661_730_934).
</td></tr>
<tr><td>EIPPCB assessment:</td><td>
1. <u>General</u>
1.1. Data from the questionnaires submitted show that several plants operated in mid-merit mode achieve the proposed levels based on the implementation of proposed techniques. Further assessment is performed for each size category of plants for peak-load or emergency-load modes.
1.2. There is no clear correlation between the dust emissions achieved and the type of fuel combusted. No further evidence supports the comment.
1.3. The techniques used are typically ESP+WFGD for plants of ≥ 1000 MW_{th}, whereas plants in the size range 300–1000 MW_{th} may use more diverse combinations of dry or wet FGD with an ESP or bag filter. Collected data show that levels achieved for plants of ≥ 1000 MW_{th} are generally lower than the ones achieved by plants of 300–1000 MW_{th}.
</td></tr>
<tr><td>EIPPCB proposal:</td><td>
1. <u>General</u>
1.1. Do not propose differentiated BAT-AEL levels for mid-merit plants. See further details on the load issue for each category of plant in the following tables.
1.2. Do not split coal and lignite combustion.
1.3. Keep the 300–1000 MW_{th} and <u>≥</u> 1000 MW_{th} size separation.
</td></tr>
</table>

1.3.9.2 Table 10.7 – BAT-AELs for dust – plants of < 300 MW_{th}

<table>
<tr><td>Location in D1:</td><td>Section 10.2.1.5 – p. 756</td></tr>
<tr><td>Current text in D1:</td><td>
BAT-associated emission levels
The BAT-associated emission levels for dust emissions to air are given in Table 10.7.

Table 10.7: BAT-associated emission levels for dust emissions to air from the combustion of coal and lignite

<table>
<tr><th rowspan="4">Combustion plant rated thermal input (MW_{th})</th><th rowspan="4">Unit</th><th colspan="4">BAT-AEL</th><th rowspan="4">Monitoring frequency</th></tr>
<tr><th>New plants</th><th>Existing plants</th><th>New plants</th><th>Existing plants</th></tr>
<tr><td colspan="2"></td><td></td><td></td><td></td></tr>
<tr><th colspan="2">Yearly average</th><th colspan="2">Daily average</th></tr>
<tr><td>50 – 100</td><td rowspan="2">mg/Nm^3</td><td>2 – 15</td><td>2 – 20</td><td>ND</td><td>4 – 28</td><td>Continuous measurement</td></tr>
<tr><td>100 – 300</td><td>2 – 10</td><td>2 – 20</td><td>ND</td><td>4 – 25</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td>
1. <u>Plants of 50–100 MW_{th}</u>
Change the BAT-AEL ranges to:
1.1. Existing plants – yearly average
• 15–30 mg/Nm^3 (FI_52)
• 2–30 mg/Nm^3(PL_33, E&P_33) based on the IED.
1.2. New plants – daily average
• 2–20 mg/Nm^3 (AT_65)
1.3. New plants – yearly average
• 5–15 mg/Nm^3 (FI_52)
1.4. Reduce monitoring frequency to 2/yr (CZ_124, E&P_123)

2. <u>Plants of 100–300 MW_{th}</u>
Change the BAT-AEL ranges to:
2.1. Existing plants – yearly average
• 5–20 mg/Nm^3 (FI_52)
• 2–25 mg/Nm^3(PL_33, E&P_33) based on IED
• 2–30 mg/Nm^3 or 2–50 mg/Nm^3 if boiler sorbent injection (CEFIC_11)
2.2. New Plants – yearly average
• 5–15 mg/Nm^3 (FI_52)
• < 10 mg/Nm^3 with WFGD (Eurelectric_728)
• < 15 mg/Nm^3 without WFGD (Eurelectric_728)
2.3. New Plants – daily average
• 2–20 mg/Nm^3 (AT_65)
</td></tr>
<tr><td>EIPPCB assessment:</td><td>
1. <u>Plants of 50–100 MW_{th}</u>
<u>Existing plants yearly average</u>
1.1. The set of reference plants (range 50–100 MW_{th}) achieve dust emission levels within the range proposed in D1. Regarding plants operated in peak- or emergency-load modes, the same techniques can apply as in the case of other load modes; no evidence supports the economic non-viability or the different environmental performance when these techniques operate in these modes. However, yearly averages may not be needed for these load modes, due to their limited operation time throughout the year.
<u>New plants daily average</u>
1.2. After reassessment of the available data, a daily average range could be proposed for new 50–100 MW_{th} plants at 6–20 mg/Nm^3.
<u>New plants yearly average</u>
1.3. The lower end of the range should take into consideration the fact that reported values in the questionnaires are around or very close to the limit of detection (LoD) for dust of about 0.3 mg/Nm^3. The limit of quantification (LoQ) for dust of about 2 mg/Nm^3 seems a more appropriate value for setting the lower end of the range.
</td></tr>
</table>

	Monitoring frequency **1.4. According to the available contextual information at plant level submitted with the questionnaires, the continuous monitoring of dust emissions is a common practice, at least for plants of ≥ 50 MW_{th}, as it was already recognised in the 2006 LCP BREF. Plants of < 100 MW_{th} operated in peak-load or emergency-load modes could have less stringent requirements in terms of monitoring, e.g. periodic monitoring, given their limited operating time and levels of emissions.** **2. Plants of 100–300 MW_{th}** **Existing plants yearly average** **2.1. There is no evidence supporting the comments. Several plants that submitted a questionnaire perform within the proposed range. The best performing plants are those fitted with ESPs or bag filters along with dry injection or semi-dry absorber desulphurisation techniques, achieving dust emission levels between 2 mg/Nm^3 and 17 mg/Nm^3.** **Regarding the peak-load and emergency-load modes, the same primary techniques can apply as in the case of other load modes, and no evidence supports different environmental performance when these techniques operate in these modes. However, yearly averages may not be needed for these modes due to their limited operation time throughout the year.** **New plants yearly average** **2.2. Modern dedusting techniques combined with dry or semi-dry techniques are able to achieve levels of emissions of < 10 mg/Nm^3.** **New plants daily average** **2.3. Based on a reassessment of the available data, and taking into consideration the proposed levels for plants of 50–100 MW_{th}, a daily BAT-AEL could be proposed with the following range: 2–20 mg/Nm^3.**
EIPPCB proposal:	**1. Plants of 50–100 MW_{th}** **Existing plants yearly average** **1.1. Keep the proposed yearly BAT-AELs of 2–20 mg/Nm^3 for plants of 50–100 MW_{th} - Add a footnote mentioning that yearly BAT-AELs do not apply to peak- and emergency-load modes for plants of 50–100 MW_{th}.** **New plants daily average** **1.2. Propose a daily BAT-AEL of 4–20 mg/Nm^3 for new 50–100 MW_{th} plants,** **New plants yearly average** **1.3. Keep the proposed lower end of the ranges at 2 mg/Nm^3.** **Monitoring frequency** **1.4. Keep continuous monitoring for plants of ≥ 50 MW_{th}. Add a footnote for plants of 50–100 MW_{th} operated in peak-load or in emergency-load modes mentioning the possibility of a minimum monitoring frequency defined as periodic with at least two samples/yr (peak-load) and at least one sample/yr (emergency-load) respectively.** **2. Plants of 100–300 MW_{th}** **Existing plants - yearly and daily averages** **2.1. Keep the proposed yearly and daily BAT-AELs for existing plants. Add a footnote mentioning that yearly BAT-AELs do not apply to peak- or emergency-load modes.** **New plants - yearly average** **2.2. Keep the proposed yearly BAT-AELs for new plants.** **New plants - daily average** **2.3. Propose a new daily BAT-AEL of 2–20 mg/Nm^3 for new plants.**

1.3.9.3 Table 10.7 – BAT-AELs for dust – plants of > 300 MWth

Location in D1: *Section 10.2.1.5 – p. 756*

Current text in D1:

BAT-associated emission levels

The BAT-associated emission levels for dust emissions to air are given in Table 10.7.

Table 10.7: BAT-associated emission levels for dust emissions to air from the combustion of coal and lignite

Combustion plant rated thermal input (MW_{th})	Unit	BAT-AEL				Monitoring frequency
		New plants	Existing plants	New plants	Existing plants	
		Yearly average		Daily average		Continuous measurement
300–1000	mg/Nm^3	< 5	1 – 15	ND	4 – 20	
> 1000		< 3	< 1 – 10	4 – 10	4 – 20	

Summary of comments:

1. *Plants of 300–1000 MW_{th}*

Change the BAT-AEL ranges to:

1.1. *Existing plants – yearly average*
- *1–10 mg/Nm^3 (EEB_45).*
- *5–15 mg/Nm^3 (FI_52).*
- *1–20 mg/Nm^3 (CZ_125, EL_82_83, PL_33, E&P_3_124, Eurelectric_7293) based on IED.*
- *< 20 mg/Nm^3 for plants without WFGD (Eurelectric_728).*
- *< 20 mg/Nm^3 for peak-load plants (FI_52).*

1.2. *Existing plants – daily average*
- *4–22 mg/Nm^3 (CZ_125, EL_82, E&P_124) based on IED.*
- *2–20 mg/Nm^3 (EEB_137) based on additional data from Plant 141.*

1.3. *New plants – yearly average*
- *5–15 mg/Nm^3 (FI_52).*
- *< 10 mg/Nm^3 (Euracoal_158, Eurelectric_255_660).*
- *< 10 mg/Nm^3 with WFGD (Eurelectric_728).*
- *< 15 mg/Nm^3 without WFGD (Eurelectric_728).*

1.4. *New plants – daily average*
- *1–10 mg/Nm^3 (AT_65).*

2. *Plants of ≥ 1000 MW_{th}*

Change the BAT-AEL ranges to:

2.1. *Existing plants – yearly average*
- *< 1–8 mg/Nm^3 (EEB_46).*
- *5–15 mg/Nm^3 (FI_52).*
- *1–20 mg/Nm^3 (CZ_125, EL_82, PL_33, E&P_33_124) based on IED.*
- *< 20 mg/Nm^3 for peak-load plants (FI_52).*
- *< 15 mg/Nm^3 (PL_4).*
- *< 15 mg/Nm^3 with WFGD (Eurelectric_728).*
- *< 20 mg/Nm^3 without WFGD (Eurelectric_728).*

2.2. *Existing plants – daily average*
- *4–22 mg/Nm^3 (CZ_125, EL_82, E&P_124) based on IED.*
- *< 15 mg/Nm^3 (AT_66).*
- *< 25 mg/Nm^3 (PL_6).*

2.3. *New plants – yearly average*
- *5–15 mg/Nm^3 (FI_52).*
- *< 10 mg/Nm^3 (PL_3, Euracoal_158, Eurelectric_255_660).*

2.4. *New plants – daily average*
- *< 15 mg/Nm^3 (PL_5).*

3. *Monitoring*
- *Change the lower end of the ranges to 5 mg/Nm^3 as values < 5 mg/Nm^3 are not guaranteed by manufacturers or may be too low to allow calibration of the CEMs (FI_113, E&P_103, Eurelectric_104_255_660_728).*

EIPPCB assessment:	**1. Plants of 300–1000 MW_{th}** **Existing plants yearly average** **1.1. Typically, the combination of a bag filter with WFGD would allow the best performance to be achieved (< 12.1 mg/Nm^3 in the available examples). A well performing combination of an ESP with WFGD or other combinations of dry/semi-dry desulphurisation systems with a bag filter achieve similar (22 plants < 15 mg/Nm^3) or even better performances (< 2 mg/Nm^3 in some cases). Yearly averages may not be needed for plants operated in peak- or emergency-load modes as their operation throughout the year is limited to 1500 hours.** **Existing plants daily average** **1.2. Two plants show short-term levels of < 3 mg/Nm^3 (141 + additional information EEB-09, 415-1), thus this level could be proposed as the lower end of the range. No evidence supports the comment in favour of changing the higher end of the range that was already set at 20 mg/Nm^3 in the 2006 LCP BREF.** **New plants yearly average** **1.3. Reported data show that existing plants are able to achieve levels well below 5 mg/Nm^3. The corresponding implemented abatement (e.g. ESP or bag filter with WFGD) and monitoring techniques are available.** **New plants daily average** **1.4. The reassessment of available data for plants achieving yearly dust emissions of < 5 mg/Nm^3 enables the proposal of values for a daily average, as all these plants have short-term values (95th percentile of hourly averages) between 2 mg/Nm^3 and 10 mg/Nm^3.** **2. Plants of ≥ 1000 MW_{th}** **Existing plants yearly average** **2.1. Reported data show that most of the existing plants that submitted a questionnaire have emission levels below 10 mg/Nm^3, using mainly a combination of an ESP and WFGD or even when using dry FGD (e.g. Plant 387). Yearly averages may not be needed for plants operated in peak- or emergency-load modes as their operation throughout the year is limited to 1500 hours.** **Existing plants daily average** **2.2. Reassessment of the available short-term data from submitted questionnaires show that all the plants achieving a yearly average below 10 mg/Nm^3 achieve a short-term average below 16 mg/Nm^3.** **New plants yearly average** **2.3. Reported data show that several existing plants are able to achieve levels below 3 mg/Nm^3. The corresponding techniques are available and do not necessarily imply the use of bag filters, as shown by some example plants. The levels are however close to the limit of quantification of dust; it could thus be proposed to set the higher end slightly higher than proposed in D1 at 5 mg/Nm^3.** **New plants daily average** **2.4. Available data for plants achieving < 3 mg/Nm^3 show short-term values (95th percentile of hourly averages) well within the proposed range in D1.** **2.5. Monitoring: see the assessment done at point 1.3 of plants of 50–100 MW_{th}.**
EIPPCB proposal:	**1. Plants of 300–1000 MW_{th}** **Existing plants yearly average** **1.1. Change the proposed yearly BAT-AELs for existing plants to 2–15 mg/Nm^3. Add a footnote mentioning that yearly BAT-AELs do not apply to peak- and emergency-load modes.** **Existing plants daily average** **1.2. Change the proposed daily BAT-AELs for existing plants to 3–20 mg/Nm^3.** **New plants yearly average** **1.3. Change the proposed yearly BAT-AELs for new plants to 2–5 mg/Nm^3.** **New plants daily average** **1.4. Propose a daily BAT-AELs for new plants: 3–10 mg/Nm^3.** **2. Plants of ≥ 1000 MW_{th}** **Existing plants yearly average** **2.1. Change the proposed yearly BAT-AELs for existing plants to 2–10 mg/Nm^3. Add a footnote mentioning that yearly BAT-AELs do not apply to peak- and emergency-load modes.** **Existing plants daily average** **2.2. Change the proposed daily BAT-AEL for existing plants to 3–16 mg/Nm^3.** **New plants yearly average**

	2.3. Change the proposed yearly BAT-AEL for new plants to < 2–5 mg/Nm^3. **New plants daily average** **2.4. Change the proposed daily BAT-AEL for new plants to 3–10 mg/Nm^3.** **Monitoring** **3. Change the lower ends of the ranges to '(<) 2 mg/Nm^3' when the lower end of the ranges are equal to or below 2 mg/Nm^3.**

1.3.10 BAT 23 – Mercury emissions to air

Location in D1:	*p. 757 – Section 10.2.1.6*
Current text in D1:	**23. In order to reduce mercury emissions to air from the combustion of coal and lignite, BAT is to use an appropriate combination of the techniques given below.**

Technique		Description	Applicability
Co-benefit from measures taken for other pollutants			
1.	Bag Filter	See description in Section 10.8. See BAT 22	Generally applicable
2.	ESP	See description in Section 10.8. See BAT 22. Better removal efficiency at flue-gas temperatures below 130°C	Generally applicable
3.	SCR	See description in Section 10.8. See BAT 19. Only used in combination with other techniques to enhance the mercury oxidation before capture in a subsequent FGD unit	Generally applicable to plants > 300 MW_{th} Applicable to coal-fired PC boilers for plants < 300 MW_{th}
4.	FGD technique (e.g. wet limestone scrubbers, spray dryer scrubbers or dry sorbent injection)	See descriptions in Section 10.8. See BAT 21	Generally applicable when there is a need to reduce SO_X content in emissions to air
Specific measures for mercury reduction			
5.	Fuel choice	Select coal and lignite with Hg content < 25 µg/kg	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
6.	Carbon sorbent (e.g. activated carbon) injection in the flue-gas	See description in Section 10.8. Generally used in combination with ESP/bag filter	Generally applicable
7.	Use of halogenated additive to the fuel or injected in the furnace	Addition of halogens into the furnace to oxidise the flue-gas mercury into a soluble species, thereby enhancing mercury removal in downstream control devices	Applicable in the case of a low halogen content in the fuel, within the constraints associated with the control of halogen emissions to air
8.	Fuel pretreatment	Fuel washing, blending and mixing in order to limit / reduce the Hg content	Applicability is subject to a previous survey for characterising the fuel and for estimating the potential effectiveness of the technique

{This BAT conclusion is based on information given in Section 5.1.4.4}

Summary of comments:	*1. <u>General</u>* *1.1. There is no cost effective technique for mercury reduction (E&P_108, Eurelectric_110).* *1.2. The techniques are not applicable to plants < 100 MW_{th} (CEFIC_10).* *2. <u>Technique a (bag filter)</u>: The technique is applicable only to plants < 300 MW_{th} as there is limited experience for bigger plants (Eurelectric_662_731_931).* *3. <u>Technique c (SCR)</u>* *3.1. The technique is not applicable to lignite-fired plants (EL_85, PL_147, Eurelectric_663_732_937) and to FBC boilers (PL_147).* *3.2. Add to the description that the level of Hg oxidation depends on the SCR material and on the flue-gas composition, and that halogenated additives may enhance the Hg oxidation (Eurelectric_664_733_938).* *4. <u>Technique e (fuel choice)</u>* *4.1. Delete the technique or review its description by increasing the maximum level of mercury contained in the fuel from 25 µg/kg to 200 µg/kg (EL_86, Eurelectric_260_666_734).* *4.2. This technique is not applicable to lignite-fired plants (PL_146_149).* *5. <u>Technique f (carbon sorbent injection)</u>* *5.1. The technique is applicable only to those plants that do not reuse the generated fly ashes in the cement industry (PL_34, E&P_34).* *5.2. Change the applicability to 'Applicable if the by-product quality remains within the requirements set for its reuse' (Eurelectric_358_667_735) or to 'Applicable depending on fly ash requirements' (DK_143) or to 'Applicable within the constraints associated with off-site reuse of ashes and gypsum' (PT_92).* *5.3. This technique is not compatible with the use of an ESP for plants < 100 MW_{th} and cannot allow achieving the proposed BAT-AELs (CEFIC_9).* *6. <u>Technique g (halogenated additive)</u>* *6.1. This technique in combination with a two-field-ESP might not allow achieving the proposed BAT-AELs for plants < 100 MW_{th} (CEFIC_9).* *6.2. Add the following applicability restriction: 'Applicable within the constraints associated with the corrosion potential and the by-products reuse' (Eurelectric_109_261_668_736).* *6.3. Do mention that this technique with Br is the best performer compared to the others or create a separate line for it (SE_39).* *7. <u>Technique h (fuel pre-treatment)</u>: remove the technique as there is a lack of operational experience regarding its implementation, and mercury compounds in fuels are hardly soluble in water (Eurelectric_263_669_737).*
EIPPCB assessment:	**1. <u>General</u>** **1.1. All the techniques described to reduce emissions of mercury are commercially available and have been implemented in existing plants. There is no rationale supporting the comment.** **1.2. Few data are available for plants of < 100 MW_{th}. [Plants 407, 20-2, 19] For 50–100 MW_{th} plants, the combination of fuel choice with dedusting techniques, together with the use of a Hg-specific abatement technique if needed should enable the proposed BAT-AELs to be achieved.** **2. <u>Bag filter (a)</u>: Example plants of ≥ 300 MW_{th}, even bigger than 1000 MW_{th}, have been submitted as reference plants.** **3. <u>SCR (c)</u>** **3.1. See the detailed assessment in Section 1.3.3.1, point 2.4 on the applicability of SCR, in particular to lignite-fired plants.** **3.2. A detailed technique description is presented in Sections 5.1.4.4.2 and 3.3.3.5.3 of the BREF. The description of the technique in the BAT conclusions includes information on the combination of techniques, and only applicability restrictions are reported (in line with the BREF Guidance). The suggested modification would therefore fit better in the descriptive sections of the BREF.** **4. <u>Fuel choice (e)</u>** **4.1. The proposed level of Hg content in the fuel seems arbitrary. Using a fuel containing a higher content of Hg could be compensated by using an efficient end-of-pipe abatement technique.** **4.2. There is already an applicability restriction linked to the energy policy of the Member State which covers the case of lignite use.** **5. <u>Carbon sorbent injection (f)</u>** **5.1. (+5.2.) The use of this technique leads to higher levels of Hg being captured and collected as fly ash in the dedusting system compared to situations where technique (f) is not used. The levels in the fly ash would however correspond**

	generally to the current levels in the case of the use of other techniques as co-benefit of reducing NO_X, SO_X or dust emissions. In the case of excessively high Hg concentrations in the fly ash, there is still a way of using a process which separates the carbon-rich particles that would then need to be disposed of, or there is a possibility to change the sorbent type (EEB-2, Additional information – Eurelectric-02). **When fly ashes are thermally reprocessed, there may also be a need to use an additional technique to further segregate the mercury-containing carbon fraction prior to the thermal treatment, in order to avoid the re-release of the captured Hg in the fly ash as elemental mercury (Additional information - Eurelectric-02).** **The quality of gypsum generated from the WFGD slurry is not significantly impacted by the use of this technique as most of the Hg is adsorbed onto the carbon sorbent and captured into the dedusting device before reaching the WFGD system.** **5.3. There is no size constraint for the implementation of the carbon sorbent injection technique. There is no longer a description of the number of fields an ESP should contain. The BAT is the combination of appropriate techniques including fuel choice, dedusting technique and/or Hg-specific techniques.** **6. <u>Fuel halogenated additives (g)</u>** **6.1. There is no size constraint for the implementation of the carbon sorbent injection technique. There is no longer a description of the number of fields an ESP should contain. The BAT is the combination of appropriate techniques including fuel choice, dedusting technique and/or Hg-specific techniques.** **6.2. From the documents (VGB 2012, Kema 2013, Additional information – EEB-11) made available in the exchange of information, the level of Br injected is generally much lower than the level of Cl contained in the fuel, and thus equipment corrosion should not be significantly impacted by this technique. There is still a residual risk at long term that needs to be monitored. Experience so far indicates that there is not a clear link between the use of these halogenated additives and discernible corrosion problems. The use of halogenated additives may have cross-media effects with regard to the transfer of halogens and Hg in the fly ashes and FGD waste waters/gypsum that are generally kept at reasonable levels with the proposed BAT-AELs for Hg.** **6.3. The improved performance obtained by using brominated additives compared to other halogenated additives is described in Section 5.1.4.4.3.3 of the BREF. However, operators are free to choose other types of halogens. Since the BREF focuses mostly on the use of brominated additives, this would be better identified in the technique description.** **7. <u>Fuel pretreatment (h)</u>: This is one of the techniques to reduce Hg emissions, and there is experience showing that reduction levels could be higher than 70 % (Additional information EEB-12/13/14). However, the technique may not be suitable for fuels of all coal types and cross-media effects need to be assessed, hence the applicability restriction related to performing a study/survey prior to its possible implementation.**
EIPPCB proposal:	**1. <u>General</u>** **1.1. Keep the proposed list of techniques.** **1.2. Keep the techniques generally applicable for plants of < 100 MW_{th}.** **1.3. Align the applicability of the techniques proposed as co-benefit with the applicability in the sections where they are proposed as main technique.** **2. Do not limit the applicability of <u>bag filters</u> (technique a) only to plants of < 300 MW_{th}.** **3. <u>SCR (c)</u>** **3.1. Keep the technique generally applicable to plants of < 1000 MW_{th}, down to 100 MW_{th}. Add in applicability that the technique is not generally applicable to plants of < 100 MW_{th}, that there may be technical and economic restrictions for retrofitting existing plants operated in peak-load mode and plants of ≥ 300 MW_{th} operated in emergency-load mode.** **3.2. Do not add further description.** **4. <u>Fuel choice (e)</u>** **4.1. Change the description to 'Select a fuel with low Hg content'.** **4.2. Do not add a special applicability restriction for lignite combustion.** **5. <u>Carbon sorbent injection (f)</u>** **5.1. (+5.2.) Keep the applicability unchanged and add to the description: 'the use of this technique may require additional treatment steps to further segregate the**

	mercury-containing carbon fraction prior to further reuse'. **5.3. Do not limit the applicability only to plants of ≥ 100 MW_{th}.** **6. Halogenated techniques (g)** **6.1. Do not set an applicability restriction for plants of < 100 MW_{th}.** **6.2. Add the following applicability constraint: 'Applicable within the constraints associated with the corrosion potential of equipment.** **6.3. Name 'brominated additives' in the description of the technique.** **7. Fuel pretreatment (h): do not remove the technique.**

1.3.11 Tables 10.8 and 10.9 – BAT-AELs for mercury – coal and/or lignite

1.3.11.1 Tables 10.8 and 10.9 – General

Location in D1:	*p. 757 – Section 10.2.1.6*
Current text in D1:	**BAT-associated emission levels** The BAT-associated emission levels for mercury are given in Table 10.8 and Table 10.9. **Table 10.8: BAT-associated emission levels for mercury emissions to air from the combustion of coal (anthracite and bituminous)** **Combustion plant rated thermal input (MW_{th}) / BAT-AEL (µg/Nm^3) New plants / BAT-AEL (µg/Nm^3) Existing plants / Averaging period / Monitoring frequency** <300 | 0.5 – 5 | 1 – 10 | Average of samples obtained during one year | Periodic measurement: 4 times/yr >300 | 0.2 – 2 | 0.2 – 6 | Yearly average | Continuous measurement **Table 10.9: BAT-associated emission levels for mercury emissions to air from the combustion of sub-bituminous coal and lignite** **Combustion plant rated thermal input (MW_{th}) / BAT-AEL (µg/Nm^3) New plants / BAT-AEL (µg/Nm^3) Existing plants / Averaging period / Monitoring frequency** <300 | 1 – 10 | 2 – 20 | Average of samples obtained during one year | Periodic measurement: 4 times/yr > 300 | 0.5 – 5 | 0.5 – 10 | Yearly average | Continuous measurement
Summary of comments:	*1. Monitoring* *1.1. Continuous monitoring should be replaced by periodic monitoring as:* • *it is the case for incineration plants;* • *it is difficult to measure simultaneously Hg gas compounds and Hg bound to solid particles (CZ_132);* • *Hg is not associated with short-term air quality effects (E&P_110);* • *continuous monitoring is costly (EL_87).* *1.2. Change the continuous monitoring to a periodic monitoring with a frequency of 1/yr and in case of fuel change (CZ_131_134_135_138, FR_105, E&P_130_132_133), or depending on the fuel Hg-content (Eurelectric_674_744).* *1.3. Replace the continuous monitoring by a pollution inventory approach as continuous monitoring is expensive and cost-benefit is not clear (EL_88, IT_88, UK_104, Eurelectric_111, E&P_109_110).* *1.4. Change the periodic monitoring (*Plants *< 300 MW_{th}) (4 times/yr) to:* • *1/yr and in case of fuel change (FR_105, Eurofer_227, CEFIC_8);* • *1/yr in combination with PEMS based on historical data and fuel input (ES_54, Eurelectric_359_673_742);* • *flexible monitoring depending on the fuel Hg-content (Eurelectric_394).*

	2. Use the definition of the ASTM system for differentiating between bituminous and sub-bituminous coals (DE_23_136) and clarify / explain why such a differentiation is proposed (E&P_106, Eurelectric_108). *3. Do not split the coal into different sub-categories for table 10.8 (Eurelectric_670_738_939).* *4. Remove the BAT-AELs for Hg as it is the first time ever such levels would be defined, and just require the continuous monitoring instead of periodic monitoring (Euracoal_160).* *5. Remove the BAT-AELs as they would affect the Polish social welfare (PL_35_36, E&P_35_36).* *6. Raise the lower end of the ranges to 1µg/Nm^3 as there is no recognised method for lower levels or it's below the detection limit (FI_53, Eurelectric_671_677_940), or raise it to 5 µg/Nm^3 as it would be 5 times the LoQ (Eurelectric_739_747).* *7. Set BAT-AELs in the form of: < XX µg/Nm^3 (DK_175).*
EIPPCB assessment:	**1. <u>Monitoring</u>** **1.1. (+1.2. +1.3.) For periodic measurements of Hg, EN 13211 was validated for exhaust gases from waste incineration plants in the range of 1–500 µg/m^3. A limit of detection of 2.6 µg/m^3 (calculated for a sample gas volume of 50 l) is also given in the standard. For continuous measurements of Hg, the certified automated measurement system with the lowest certification range is reported to have a repeatability standard deviation at zero point of 0.2 % of the certification range, corresponding to a limit of quantification of 0.08 µg/m^3. Therefore, it seems as if Hg concentrations of < 1 µg/m^3 can be measured in some cases, but that the measurement uncertainty will be higher as such levels are close to the limit of detection/quantification. Commission Implementing Decision 2012/119/EU stipulates in Section 3.3 that it is acceptable to use an expression of the type '< X to Y' (i.e. '< X' for the lower end of the range, Y for the upper end), where the lower end of the range cannot be accurately defined, e.g. when the data reported in the information exchange is close to the detection limit.** **Reported data in questionnaires show 9 plants using continuous Hg monitoring (all of them of ≥ 300 MW$_{th}$), 41 plants using periodic sampling (variable number of samples from once/yr to 40/yr), and 7 plants estimating their Hg emissions.** **1.4. Monitoring Hg periodically several times/yr permits a better knowledge of the real performance of the plant as the behaviour of Hg throughout the plant is quite complex and may vary substantially at the duct level, as shown by some reported examples (e.g. Plant 77). Monitoring Hg 4 times/yr is a frequency consistent with the normal practice reported in the submitted questionnaires and would allow averaging over the year while enabling the relatively early detection of significant deviations. Nevertheless, in the case of very stable processes and low levels of Hg emissions, this frequency could be reduced.** **2. (+3.) The reassessment of available information shows that there are no correlated differences between Hg emissions and the type of coal combusted (subbituminous, bituminous or anthracite) that would justify different BAT-AELs for these different fuels.** **4. (+5.) See point 1 for the monitoring issue. Mercury was identified at the KOM as a key environmental issue for the review of the LCP BREF. Techniques to reduce emissions of Hg are commercially available and data are available regarding the achieved emission levels. BAT-AELs can thus be proposed. Proposals for BAT-AELs are discussed in the next tables. As the proposed BAT-AELs are derived mainly from the actual performance of plants using techniques the main purpose of which is the abatement of other pollutants, and as plants < 300 MW$_{th}$ operated in peak- and emergency-load modes may implement different or less efficient techniques, it is proposed that the BAT-AELs do not apply to existing plants operated in peak- and emergency-load modes.** **6. For periodic measurements of Hg, EN 13211 was validated for exhaust gases from waste incineration plants in the range of 1–500 µg/m^3. A limit of detection of 2.6 µg/m^3 (calculated for a sample gas volume of 50 l) is also given in the standard. For continuous measurements of Hg, the certified automated measurement system with the lowest certification range is reported to have a repeatability standard deviation at zero point of 0.2 % of the certification range, corresponding to a limit of quantification of 0.08 µg/m^3. Therefore, it seems as if Hg concentrations of < 1 µg/m^3 can be measured in some cases, but that the measurement uncertainty will be higher as such levels are close to the limit of detection/quantification.**

	Commission Implementing Decision 2012/119/EU stipulates in Section 3.3 that it is acceptable to use an expression of the type '< X to Y' (i.e. '< X' for the lower end of the range, Y for the upper end), where the lower end of the range cannot be accurately defined, e.g. when the data reported in the information exchange is close to the detection limit. **7. The BAT-AELs are set as ranges pursuant to the BREF Guidance (Commission implementing decision 2010/119/EU of 10.02.2012 laying down the rules on drawing up BREFs – see Section 3.3.1).**
EIPPCB proposal:	**1. Monitoring** **1.1. (+1.2. +1.3.) Keep the continuous monitoring of Hg for plants of ≥ 300 MW_{th}. Add a footnote allowing the monitoring frequency to be reduced when emissions are proven to be low over the long term, the frequency in that case being at each change of fuel characteristics that may impact the emissions, and at least twice/yr.** **1.4. For plants of < 300 MW_{th}, keep the monitoring frequency of 4 times/yr and add a footnote allowing its reduction when emissions are proven to be low over the long term, the frequency in that case being at each change of fuel characteristics that may impact the emissions, and at least once/yr.** **2. (+3.) Group all the coal-fired plants together, splitting them only by plant size and not by coal subcategories. Distinguish between BAT-AELs for 'coal-fired plants' and BAT-AELs for 'lignite-fired plants'.** **4. (+5.) Keep BAT-AELs for mercury emissions to air except for plants < 300 MW_{th} operated in peak- or emergency-load modes.** **6. Set '< 1 µg/Nm^3' as the lower end of the BAT-AEL ranges for mercury emissions to air.** **7. Keep using ranges to express the BAT-AELs.**

1.3.11.2 Table 10.8 – BAT-AELs for mercury – coal

Location in D1:	*p. 757 – Section 10.2.1.6*
Current text in D1:	**Table 10.8: BAT-associated emission levels for mercury emissions to air from the combustion of coal (anthracite and bituminous)**

Combustion plant rated thermal input (MW_{th})	BAT-AEL (µg/Nm^3)		Averaging period	Monitoring frequency
	New plants	Existing plants		
<300	0.5 – 5	1 – 10	Average of samples obtained during one year	Periodic measurement: 4 times/yr
>300	0.2 – 2	0.2 – 6	Yearly average	Continuous measurement

Summary of comments:	*1. Plants of < 300 MW_{th}* *Change the BAT-AELs to:* *1.1. Existing plants* • *1–9 µ/Nm^3 (EEB_130).* • *5–10 µg/Nm^3 (Eurelectric_740_741).* *1.2. New plants* • *1–10 µ/Nm^3(FI_53).* • *5–10 µg/Nm^3 (Eurelectric_740_741).* *2. Plants of > 300 MW_{th}* *Change the BAT-AELs to:* *2.1. Existing plants* • *0.2–4 µg/Nm^3 (EEB_130).* • *2–6 µg/Nm^3 (FR_106).* • *1–10 µg/Nm^3(FI_53).* • *5–10 µg/Nm^3 (Eurelectric_740_741).* *2.2. New plants* • *1–10 µ/Nm^3(FI_53).* • *5–10 µg/Nm^3 (Eurelectric_740_741).*

EIPPCB assessment:	**1. <u>Plants of < 300 MW_{th}</u>** **<u>New and existing plants</u>** **1.1. (+1.2.) The reassessment of the available data shows that seven (Plants 286, 689, 685, 213, 683, 687, 690, 407) out of the eight proposed plants of < 300 MW_{th} achieve emission levels below 9 µg/Nm^3 (as a yearly average) using the co-benefit of techniques used primarily for other pollutants. Additional information from EEB shows levels of Hg emissions of < 8.5 µg/Nm^3 (as an average of periodic samples over 3 years – Additional docs EEB-1 and EEB-2) for Plant 520. Furthermore, these plants do not apply mercury-specific abatement techniques that would allow them to reduce their Hg emissions even further.** **According to submitted data, the BAT-AEL ranges proposed in D1 can be achieved for new plants still using mainly the co-benefit of techniques used primarily for other pollutants [Additional information EEB-1 to EEB-5, UKTW26] (co-benefit of de-dusting, desulphurisation techniques alone and/or possible use of carbon sorbent injection or halogenated additives).** **No further rationale supported by evidence is given in the other comments requesting to increase the higher end of the BAT-AEL range.** **The upper end of the BAT-AEL range could thus be slightly reviewed for existing plants.** **2. <u>Plants of ≥ 300 MW_{th}</u>** **<u>Existing plants</u>** **2.1. EEB provided additional data (doc EEB-1) showing emission levels of 3 µg/Nm^3 instead of 6 µg/Nm^3 for Plant 141 as an average of periodic samples over 3 years for 2010 to 2012, and 1.75 µg/Nm^3 as short-term average estimation for Plant 493 (doc EEB-3). France reports an updated Hg average value for Plant 77 of 2.3 µg/Nm^3 as an average of periodic samples over 3 years for 2010 to 2012 (samples from 0.2 µg/Nm^3 to 6 µg/Nm^3). One can note that these plants do not apply mercury-specific abatement techniques that would allow them to reduce their Hg emissions even further.** **No further rationale supported by evidence is given in the other comments requesting to increase the higher end of the BAT-AEL range.** **The review of available data/information can thus lead to the slight modification of the BAT-AEL by increasing the lower end of the range and by decreasing the upper end of the range.** **<u>New plants</u>** **2.2. No rationale or evidence is submitted along with the comments.**
EIPPCB proposal:	*Reminder: Conclusions applicable to the combustion of coal, according to a proposal made in the assessment of general comments on BAT-AELs for mercury* **1. <u>Plants of < 300 MW_{th}</u>** **(1.1. +1.2.) Change the BAT-AELs for existing plants to 1–9 µg/Nm^3 as an average over the year. Keep the proposed BAT-AELs for new plants unchanged.** **2. <u>Plants of ≥ 300 MW_{th}</u>** **(2.1. +2.2.) Change the BAT-AELs to 1–4 µg/Nm^3 for existing plants and to 1–2 µg/Nm^3 for new plants as yearly averages.**

1.3.11.3 Table 10.9 – BAT-AELs for mercury – lignite

Location in D1:	*p. 757 – Section 10.2.1.6*
Current text in D1:	**Table 10.9: BAT-associated emission levels for mercury emissions to air from the combustion of sub-bituminous coal and lignite**

Combustion plant rated thermal input (MW_{th})	BAT-AEL (µg/Nm^3)		Averaging period	Monitoring frequency
	New plants	Existing plants		
<300	1 – 10	2 – 20	Average of samples obtained during one year	Periodic measurement: 4 times/yr

	> 300 | 0.5 – 5 | 0.5 – 10 | Yearly average | Continuous measurement
Summary of comments:	*1. Plants of < 300 MW_{th}* *Change the BAT-AELs to:* *1.1. Existing plants* • *1–9 µg/Nm^3 (EEB_130).* • *2–12 µg/Nm^3 (AT_67).* • *2–25 µg/Nm^3 (CZ_136, E&P_134).* *1.2. New plants* • *1–6 µg/Nm^3 (EEB_130).* *2. Plants of > 300 MW_{th}* *Change the BAT-AELs to:* *2.1. Existing plants* • *0.5–6 µg/Nm^3 (EEB_130).* • *5–20 µg/Nm^3 (EL_89, Eurelectric_748_943).* • *2–25 µg/Nm^3 (CZ_136, E&P_134).* *2.2. New plants* • *0.5–3 µg/Nm^3 (EEB_130).* • *0.5–10 µg/Nm^3 (EL_89, Eurelectric_748_943).*
EIPPCB assessment:	**1. Plants of < 300 MW_{th}** **New and existing plants** **1.1. (+1.2.) The reassessment of the available data shows that all three plants (Plants 25-1, 19, 22-1) of < 300 MW_{th} achieve Hg emissions below 7 µg/Nm^3 (as an average over the year) using the co-benefit of techniques primarily used for other pollutants. Furthermore, these plants do not use mercury-specific abatement techniques that would allow them to reduce Hg emissions even further. Referring also to the assessment on the BAT-AEL proposed for larger plants (see point 2. below), it can be concluded that Hg levels below 10 µg/Nm^3 (as an average over the year) are achievable for existing plants.** **The three plants that submitted information via questionnaires could be used for proposing the BAT-AEL: 1–7 µg/Nm^3 (as an average over the year).** **2. Plants of ≥ 300 MW_{th}** **New and existing plants** **2.1. (+2.2.) Lignite plants that submitted a questionnaire are not fitted with SCR (SCR may have a positive effect on Hg reduction). Based on the mission report from the site visits at the Lippendorf Plants (117-1/2), improvements have allowed levels of Hg emissions to be reduced below 10 µg/Nm^3 on a short-term basis, without the use of activated carbon injection (use of a system for separating further, in the WFGD tower, metals by TMT15 injection). According to suppliers (see EEB-1), this level of emissions is also achievable by injection of Brominated agents. Data showing plants performing at this level of emissions by co-benefiting from other implemented techniques are available.** **According to submitted data, the BAT-AEL ranges proposed in D1 can be achieved for new plants still using mainly the co-benefit of techniques used primarily for other pollutants. However, the potential offered by the implementation of mercury-specific abatement techniques is not fully considered as no plant uses Hg-specific techniques. A further reduction, e.g. down to 4 µg/Nm^3 (1/3 Hg emissions reduction), could be proposed, still using one or a combination of the BAT listed, including through co-benefits from using non-mercury-specific abatement techniques.** **No further rationales are given in the comments supporting other proposed BAT-AELs.**
EIPPCB proposal:	*Reminder: Conclusions applicable to the combustion of lignite, according to a proposal made in the assessment of general comments on BAT-AELs for mercury* **1. Plants of < 300 MW_{th}** **1.1. (+1.2.) Change the BAT-AELs for existing plants to 2–10 µg/Nm^3 and to 1–7 µg/Nm^3 for new plants.** **2. Plants of ≥ 300 MW_{th}** **2.1. (+2.2.) Change the BAT-AELs for existing plants to 1–10 µg/Nm^3 and to 1–4 µg/Nm^3 for new plants.**

1.4 Biomass and peat combustion

1.4.1.1 General issues

Location in D1:	*p. 759*
Current text in D1:	Whole section: BAT conclusions for the combustion of solid biomass and peat
Summary of comments:	1. *Separate CFB and BFB (FI_100) or give wide enough BAT-AEL ranges to cover both techniques (CEPI_61).* 2. *Divide applicability and BAT-AELs/BAT-AEELs to new plants and existing plants (FI_101, CEPI_62).* 3. *Consider separate sections and paragraphs for biomass and peat (Eurelectric_159).* 4. *Separate the BAT conclusion so it is transparent and specific divided in biofuel type: peat, wood and straw (DK_119_146).* 5. *Include BAT conclusions for plant which are firing a significant fraction of their fuel as biomass as well as for those plants which have completely converted to biomass (E&P_111, Eurelectric_112).* 6. *Include the technology of converted coal to biomass in this section as a separate form of generation (UK_81, Eurelectric_433).* 7. *Clarify in the text whether BATs and BAT-AELs are applicable to plants converted from coal. (FR_108, Eurelectric_130).*
EIPPCB assessment:	**1. The submitted biomass-fired plants assessed include pulverised combustion boilers, grate boilers and fluidised bed combustion boilers. Fluidised bed combustion boilers include circulating fluidised bed boilers (i.e. CFB boilers) and bubbling fluidised bed boilers (i.e. BFB boilers). In general, similar primary and secondary abatement techniques are installed in both types of boilers and there are example plants of both types in the proposed BAT-AEL ranges.** **2. The applicability of techniques can be tailored to the specificities of new and existing plants if deemed necessary and justified by the techno-economic information exchanged.** **3. (+4.) The mix of solid biomass and peat fuels (that is the different percentage of peat, woody or herbaceous biomass used by the plants) provided in the data collection is too heterogeneous to differentiate BAT conclusions in the two/three categories proposed.** **5. (+6. +7.) BAT-AEPLs (including BAT-AELs) are proposed for plants firing different types of fuels, independently of the fuel considered for the original design of the plant. Some plants converted from coal to biomass are identified in the data collection and in the information provided. Plants converted from coal usually need to be retrofitted to be able to operate with the new mix of fuels. Depending on the fuel used, some techniques may be more appropriate than others and the associated emission levels are proposed for plants firing different types of fuel.**
EIPPCB proposal:	**1. Do not include specific sections for BFB and CFB boilers in the BREF and in the BAT conclusions.** **2. Propose BAT-AELs for both new and existing plants.** **3. (+4.) Do not include specific sections on woody biomass, herbaceous biomass and peat in the BREF and in the BAT conclusions.** **5. (+6. +7.) Do not include a specific section covering plants that converted from coal to biomass in the BREF and in the BAT conclusions.**

1.4.2 BAT 25 – Energy efficiency

1.4.2.1 BAT 25 – Energy efficiency

<table>
<tr><td>Location in D1:</td><td>p. 759</td></tr>
<tr><td>Current text in D1:</td><td>25. In order to increase the energy efficiency of the combustion of solid biomass and/or peat, BAT is to use an appropriate combination of the techniques given in BAT 7 and to reduce the moisture content of the fuel by either or both of the techniques given below:
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a</td><td>Fuel specification in the supplier contract or internal document</td><td>The fuel supplier or the internal management adheres to the moisture (and size) specification in the contract or internal document</td><td>Applicable within the constraints given by the safe transportation of fuel (e.g. minimum moisture content of peat).</td></tr>
<tr><td>b</td><td>Press, steam or flue-gas drying</td><td>See description in Section 10.8</td><td>Generally applicable</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>1. <u>General</u>
1.1. Remove the techniques and refer to BAT 7. Leave only Table 10.10. (EPPSA_386).
1.2. Include 'Flue-gas condensation' technique (SE_39).
1.3. Include 'pelletising/use of (low moisture) pelleted fuel' technique (E&P_117, Eurelectric_128_57_161).
2. <u>Techniques</u>
2.1. <u>Technique a: Fuel specification in the supplier contract or internal document</u>
• Applicable within the constraints given by the safe storage, transportation and handling of the fuel (i.e. minimum moisture content of peat) (FI_56).
• Applicability exception for plants with flue-gas condensation equipment (Eurelectric_129).
2.2. <u>Technique b: Press, steam or flue-gas drying</u>
• Applicable within the constraints given by boiler design, fuels used and economical aspect (FI_102, CEPI_60).
• Applicability exception for plants with flue-gas condensation equipment (Eurelectric_129) when flue-gas condensation is used, BAT is not to reduce the moisture content (SE_38).</td></tr>
<tr><td>EIPPCB assessment:</td><td>1. <u>General</u>
1.1. As the techniques proposed are not specific to biomass combustion, there is no merit to keeping them in this BAT conclusion. See further assessment of each technique.
1.2. Flue-gas condensation is included in BAT 7 and described in Section 10.8 of the BAT conclusions.
1.3. 'Pelletising/use of (low moisture) pelleted fuel' may be included in the 'fuel drying' technique of Section 10.8 of the BAT conclusions.
2. <u>Techniques</u>
2.1. <u>Fuel specification in the supplier contract or internal document (a)</u>: the proposals made in the comments are already covered in the existing text. Generic technique not specific to biomass combustion.
2.2. <u>Press, steam or flue-gas drying (b)</u>: this technique does indeed refer to 'fuel predrying', which is already listed in BAT 7, and it is therefore not necessary to repeat it in this BAT conclusion The technique is described in Section 10.8 of the BAT conclusions as fuel drying. Wording modifications are needed in Section 10.8 for consistency with BAT 7.</td></tr>
<tr><td>EIPPCB proposal:</td><td>• Remove techniques (a) and (b) from BAT 25. As a consequence, BAT 25 becomes redundant and it is proposed to delete it.
• Change 'Fuel drying' technique in Section 10.8 of the BAT conclusions to 'Fuel predrying'.
• Keep proposing BAT- AEELs for the combustion of solid biomass and/or peat</td></tr>
</table>

1.4.2.2 Table 10.10 – BAT-AEELs for energy efficiency – solid biomass and/or peat

<table>
<tr><td>Location in D1:</td><td>p. 759</td></tr>
<tr><td>Current text in D1:</td><td>Table 10.10: BAT-associated energy efficiency levels for the combustion of solid biomass and/or peat
<table>
<tr><th colspan="2" rowspan="2">Type of combustion plant</th><th rowspan="2">Parameter</th><th rowspan="2">Unit</th><th>BAT-AEPL</th></tr>
<tr><th>Yearly average (LHV basis)</th></tr>
<tr><td rowspan="2">Generating only heat or CHP plants whose recoverable heat generation does not exceed the heat demand</td><td>Existing</td><td rowspan="2">Net total fuel utilisation</td><td rowspan="4">%</td><td>80 – 102</td></tr>
<tr><td>New</td><td>95 – 102</td></tr>
<tr><td rowspan="2">Generating only power or CHP plants whose recoverable heat generation exceeds the heat demand</td><td>Existing</td><td rowspan="2">Net electrical efficiency</td><td>28 to above 34</td></tr>
<tr><td>New</td><td>31 to above 34</td></tr>
</table></td></tr>
<tr><td></td><td><u>Net total fuel utilisation</u>
• Add a note on 102 % 'Use of low quality heat needed (CEPI_58).
• Change 'Net total fuel utilisation' – new plants to 90-102 % (CEPI_59).
• Change 'Net total fuel utilisation' – existing and new plants to 75-102 % (FI_57_ 58).
• Change 'Net total fuel utilisation' – existing and new plants to 75-95 % (Eurelectric_681_946_160).
• Change 'Net total fuel utilisation' to 90 - 102 % for new plants using straw (DK_122).
• Change 'Net total fuel utilisation' to 60 - 95 % for new and existing biomass fired CHP-plants. (PL_164).
<u>Net electrical efficiency</u>
• Set yearly average BAT-AEEL for biomass-fired plants converted from coal-fired plants at 34-40 % (E&P_114, Eurelectric_161) 35-40 % (Eurelectric_57).
• Revise the table to reflect Gross Net Energy Efficiency (E&P_116).
• It is unclear whether this table does apply (1) to co-combustion of biomass/coal and (2) to CHPs producing heat and power with a fluctuating ratio during the year depending on seasonal availability of biomass and local needs in terms of heat and power (as observed in small isolated systems). (FR_109).
• BAT-AEELs are overly ambitious, too simplistic and not consistent with information given in sections 5.2.2.2. (DK_121).</td></tr>
<tr><td>EIPPCB assessment:</td><td><u>General</u>
• Values proposed in D1 were based on yearly averages from the collected data. As per the assessment made in Section 1.1.9 of this BP, it is now proposed to define design-based BAT-AEELs.
• Special provisions for plants operating in emergency- and peak-load modes are assessed in Section 1.1.6 of this BP.
<u>Net total fuel utilisation</u>
• Design values reported by the TFEE are within 73 % (Plant 411) and 99 % (Plant 33). Plant 25-2 achieves lower (45 %) levels as it may be affected by the level of heat demand.
<u>Net electrical efficiency</u>
• The design values' net electrical efficiency range reported by the TFEE is 27.9-36.7 %. However, Plant 190 reports 38 % design Net electrical efficiency, which can be taken for the upper end of the range for new and existing plants.
• Plant 536 reports Design Net electrical efficiency of 33.7 %.
• Performance values for plants generating only power reported in the questionnaires from 2012 as yearly averages are in the range of 27.7 % to 36.1 % for energy efficiency.</td></tr>
<tr><td>EIPPCB proposal:</td><td>• Add a footnote indicating that the BAT-AEELs do not apply in the case of plants operated in peak- or emergency-load modes.
<u>Net total fuel utilisation</u>
• Change the proposed BAT-AEEL for new and existing plants to design values</td></tr>
</table>

	of 73–99 %. • **Add a footnote to the BAT-AEELs on net total fuel utilisation indicating that the levels may not be achievable in the case of an excessively low potential heat demand.** **Net electrical efficiency** • **Change the proposed BAT-AEEL on net electrical efficiency for existing plants to design values of 28 % to 38 %.** • **Change the proposed BAT-AEEL on net electrical efficiency for new plants to design values of 33.5 % to 38 %.**

1.4.3 BAT 26 – NO_X, NH_3 and CO emissions to air

1.4.3.1 BAT conclusion

<table>
<tr><td>Location in D1:</td><td>Section 10.2.2.3 - p. 760</td></tr>
<tr><td>Current text in D1:</td><td>26. In order to prevent or reduce NO_X emissions to air while limiting CO and NH_3 emissions to air in the combustion of solid biomass and/or peat, BAT is to use one or a combination of the techniques given below:
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>(Advanced) low-NO_X burners</td><td rowspan="6">See descriptions in Section 10.8</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Air staging combustion</td><td rowspan="2">Generally applicable</td></tr>
<tr><td>c.</td><td>Fuel staging (reburning)</td></tr>
<tr><td>d.</td><td>Flue-gas recirculation</td><td>Applicable to pulverised combustion and FBC boiler plants</td></tr>
<tr><td>e.</td><td>SCR</td><td>Not applicable in the high-dust configuration when using high-alkali fuel (e.g. straw)</td></tr>
<tr><td>f.</td><td>SNCR</td><td>Generally applicable</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>
1. <u>General</u>
1.1. Techniques are not generally applicable to existing boilers (CEPI_63).
1.2. Include Hybrid SCR/SNCR (Eurelectric_135).
2. <u>Techniques</u>
2.1. <u>Technique a ((Advanced) low-NO_X burners)</u>
• Not applicable to solid fuel combustion in BFB or CFB technology (FI_103).
• Not applicable to bubbling fluidised biomass boiler burning bark or residual forest biomass (CEPI_65).
• Applicable only for pulverized combustion (i.e. pellets) (DK_125).
2.2. <u>Technique c (Fuel staging (reburning))</u>
• Not applicable to existing boilers for solid fuel combustion (FI_104).
• Not applicable to BFB burning bark or residual forest biomass (CEPI_66).
• Only applicable for pulverised fuels (DK_126).
2.3. <u>Technique d (Flue-gas recirculation)</u>
• Generally applicable to new plants, in some cases for existing (FI_59).
• Revise applicability. For fluidised bed boilers is used primarily to control furnace temperature and is not injected in the burner (CEPI_67).
• Change to generally applicable (DK_127).
2.4. <u>Technique e (SCR)</u>
• For existing plants applicability may be limited due to boiler constraints and economic reasons (FI_105).
• Change to 'Generally applicable however only applicable in low dust tail end configuration when using high alkali fuels (e.g. straw)' (DK_128).
2.5. <u>Technique f (SNCR)</u>
• Generally applicable to new plants. For existing plants applicability may be limited due to boiler constraints. When quick load variations, suitable temperature window for all load points in existing BFB can be especially demanding (FI_106).
• Not general applicable if low ash fuels (Eurelectric_65_951_139).
• Generally applicable for BFB, CFB and GB. Not always applicable for pulverised combustion (DK_129).
• Not applicable in process industries because of quick changes demand of steam (CEPI 68, SE_40).
</td></tr>
</table>

EIPPCB assessment:	**1. General** **1.1. The retrofitting of existing plants is a practice that is exemplified in several plants of the data collection (e.g. Plants 466 and 14). Applicability restrictions are assessed technique by technique.** **1.2. Hybrid SCR/SNCR may be considered as the combination of SCR and SNCR techniques. Since BAT 26 is to use one or a combination of the given techniques, the comment is already addressed.** **1.3. Since low NO_X emission levels may be achieved when combustion optimisation is used, there is merit in including this technique in the list of BAT.** **1.4. The name of technique (b) in this BAT, i.e. 'Air staging combustion', has to be consistent throughout the document.** **2. Techniques** **2.1. (Advanced) low-NO_X burners (a)** • **Biomass Plants 423 (equipped with a BFB boiler) and 125 (equipped with a CFB boiler) use the technique.** • **The name of the technique has to be consistent throughout the BAT conclusions.** **2.2. Fuel staging (reburning) (c)** • **Example plants applying this technique have been provided in the data collection: Plants 378 (BFB boiler burning woody biomass) and 188 (BFB boiler burning biomass and peat); and Plant 13 (WBB burning woody biomass).** • **For consistency with other sections, the name of the technique should be 'Fuel staging'.** **2.3. Flue-gas recirculation (d)** • **The description of flue-gas recirculation in Section 10.8 of the BAT conclusions covers the technique objective to reduce NO_X emissions. However, the description can leave room for other ways of recirculating flue-gas. The technique is generally applicable. Example plants applying this technique have been provided, i.e. CFB Plant 455, WBB Plant 14, BFB Plant 473 and GB Plant 453.** **2.4. SCR (e)** • **As for any other technique, the installation of an SCR system in an existing plant entails design considerations that are not applicability restrictions per se, e.g. for SCR, in terms of layout, ductwork, flue-gas draft system and structure changes due to space limitations for the catalyst. The catalytic NOX reduction occurs within a temperature window and is influenced by the fuel mix (catalyst poison levels), the configuration (high- or low-dust) and the size/type of the catalyst.** • **The use of fuels with a high-alkali content has the potential to increment the catalyst deactivation rate. In this situation, it may be justified to carry out dust removal prior to the SCR.** • **Example plants of different sizes (e.g. Plant 14 – retrofitted; Plant 674 – 179 MW_{th}; and Plant 31 – 355 MW_{th}) using SCR are provided in the data collection. The number of plants of <100 MW_{th} using SCR is very limited.** • **Applicability restrictions for plants operating in emergency-load mode may be justified by the available information. The possibility to retrofit existing plants operated in peak-load modes may need to be assessed on a case-by-case basis.** **2.5. SNCR (f)** • **To work effectively, SNCR necessitates that the NO_X reduction takes place in a given temperature window, with adequate residence time and with good mixing of the ammonia/urea and the NO_X-containing flue-gas. A plant operating at partial loads may in specific cases imply being outside of this temperature window. The negative impact of load variations and boiler design can be offset by acting on the reagent type or droplet size, and/or the number of levels of reagent injection.** • **Combustion plants providing steam in the PP sector were considered for analysis of the effects of quick changes of load on the effectiveness of the SNCR system. There are example plants fitted with SNCR in the data collection reporting low NO_X emissions. Plant 666 reports 43 % load operating factor and Plant 667 reports 44 % load operating factor. If needed, this technique may also be combined with a slip catalyst (e.g. Plant 679 in the PP sector). However, the combination with a slip catalyst may not be cost-effective in the case of plants operated in emergency- and peak-**

	load modes. • **Reported plants fitted with SNCR burn different mixes of fuels (e.g. bark, chips, peat, forest residues, wood biomass in general) with different characteristics, e.g. in terms of ash content, they use different types of boilers (e.g. BFB, CFB and GF boilers) and operate at different loads (57 % to 107 %) in a variety of sectors (e.g. power, district heating, PP and chemical industry sectors).** • **The NO_X emissions reported by the plants of the data collection are not clearly correlated to the ash content of the fuel used.**
EIPPCB proposal:	**1. General** **1.1. Do not add for the all techniques a general applicability restriction to existing plants.** **1.2. Do not include the technique 'Hybrid SCR/SNCR' in the list of BAT.** **1.3. Add the technique 'Combustion optimisation' in the list of BAT.** **1.4. Change the name of the technique 'Air staging combustion' to 'Air staging'.** **2. Techniques** **2.1. (Advanced) low-NO_X burners (a)** • **Keep the technique's applicability as generally applicable.** • **Change the name of the technique to 'Low-NO_X burners (LNB)'.** **2.2. Fuel staging (reburning) (c)** • **Keep the technique's applicability as generally applicable.** • **Change the name of the technique 'Fuel staging (reburning)' to 'Fuel staging'.** **2.3. Flue-gas recirculation (d)** • **Change the applicability of the technique to generally applicable and modify the description in Section 10.8 of the BAT conclusions.** **2.4. SCR (e)** • **Add in the description of the technique that the use of high-alkali fuels may require installing SCR after the dust abatement system.** • **Add an applicability restriction for plants operating in emergency-load mode.** • **Add an applicability restriction for the retrofit of existing plants operating in peak-load mode.** • **Add an applicability restriction for plants of <100 MW_{th}.** **2.5. SNCR (f)** • **Add an applicability restriction in the case of plants operated in emergency- or peak-load modes with highly variable boiler loads.**

1.4.3.2 Table 10.11 – BAT-AELs for NO_X, CO and NH_3 – solid biomass and/or peat

1.4.3.2.1 Table 10.11 – General

Location in D1:	*Section 10.2.2.3 - p. 760*
Current text in D1:	**Table 10.11: BAT-associated emission levels for NO_X, NH_3 and CO emissions to air from the combustion of solid biomass and/or peat**

Combustion plant rated thermal input (MW_{th})	Pollutant	Unit	Monitoring frequency	BAT-AEL			
				New plant		Existing plant	
				Yearly average	Daily average	Yearly average	Daily average
50 – 100	NO_X	mg/Nm^3	Continuous measurement	70 – 200	120 – 260	70 – 250	120 – 310
100 – 300				50 – 130	100 – 220	50 – 140	100 – 220
>300				40 – 130	65 – 150	40 – 140	95 – 150
All	NH_3 ([1])			1 – 5	ND	1 – 5	ND
	CO			4 – 80	ND	4 – 80	ND
([1]) Ammonia emissions are associated with the use of SCR and SNCR							

Summary of comments:	1. *Load factors* • *Add a category for existing low load factor plants (Eurelectric_62).* 2. *Load modes* • *BAT-AELs only applicable to base load plants (E&P_125).* • *Include BAT-AELs for each load mode (IE_21).* • *Include a category for existing plants operating < 1500 h/year. Daily BAT-AEL < 495 mg/Nm^3 (FR_117).* 3. *Fuels* • *Consider rich-N containing biomass such as straw or grains. (FR_115).* • *Separate the table in three tables: peat, wood and straw (DK_131).* • *The upper end of the ranges is too low for wood and straw. (DK_132).* 4. *N_2O* • *Add BAT-AEL for N_2O (PT_21) e.g. 5-10 mg/Nm^3 for BFB, 5-20 mg/Nm^3 for CFB (DK_130).* 5. *Coal to biomass converted plants* • *Yearly average for biomass plant converted from coal should be 40 – 200 mg/Nm^3 and the daily average 95-220 mg/Nm^3. (Eurelectric_58_138, E&P_121, UK_82_83).*
EIPPCB assessment:	**1. Load factors** • **In general, the emissions from biomass- and/or peat-fired plants provided in the data collection do not show a clear correlation with the load factor. The load factor has been taken into account in the assessment based on the available techno-economic information (bulk information), the information exchanged at the intermediate TWG meeting of June 2014, and the achieved performances from the plant-specific data collected through questionnaires.** **2. Load modes** • **Load modes have been taken into account in the assessment for each pollutant based on the available techno-economic information (bulk information), the information exchanged at the intermediate TWG meeting of June 2014, and the achieved performances from the plant-specific data collected through questionnaires.** **3. Fuels** • **The proposal to distinguish BAT-AELs depending on the different biomass fuel used (especially with respect to N content) is not possible because, in general, the plants provided in the data collection report the use of a combination of different types of biomass (wood, straw and/or peat) and there are few example plants burning only peat or burning only straw.** • **Only considering the nitrogen content of the fuel, plants using N-rich biomass are expected to have higher NO_X emissions. However, the available information does not show clear differences in the emissions because there are more parameters involved (i.e. abatement techniques, type of combustion).** **4. N_2O** • **There are not enough data provided in the data collection to propose N_2O BAT-AELs.** • **The level of N_2O emitted depends mainly on the techniques used for controlling NO_X emissions, N_2O being a cross-media effect of some NO_X abatement techniques. Therefore BAT 27 is considered less relevant compared to BAT 26.** **5. Coal to biomass converted plants** • **A number of plants identified in the questionnaires as having partially or totally converted from coal to biomass would meet the proposed BAT-AELs, depending on the performance of the abatement techniques (Plants 378, 13, 31, and 14).**
EIPPCB proposal:	**1. Load factors** • **Do not add new categories for existing plants operating at low load factors.** **2. Load modes** • **Do not include new categories depending on the load mode operation but include the proposals through footnotes for each pollutant.** **3. Fuels** • **Keep the structure of the table by plant size and consider including fuel specificities through footnotes, if deemed necessary.** **4. N_2O**

	• **Remove BAT 27. Change the in the statement of BAT 26 that the techniques given are to prevent and/or reduce NO_X emissions to air while limiting CO and N_2O emissions to air.** • **Do not add BAT-AELs for N_2O emissions.** **5. Coal to biomass converted plants** • **Do not change the BAT.**

1.4.3.2.2 Table 10.11 – BAT-AELs for NO_X – plants ≤100 MW_{th}

<table>
<tr><td>Location in D1:</td><td>Section 10.2.2.3 - p. 760</td></tr>
<tr><td>Current text in D1:</td><td>Table 10.11: BAT-associated emission levels for NO_X, NH_3 and CO emissions to air from the combustion of solid biomass and/or peat
<table>
<tr><th rowspan="3">Combustion plant rated thermal input (MW_{th})</th><th rowspan="3">Pollutant</th><th rowspan="3">Unit</th><th rowspan="3">Monitoring frequency</th><th colspan="4">BAT-AEL</th></tr>
<tr><th colspan="2">New plant</th><th colspan="2">Existing plant</th></tr>
<tr><th>Yearly average</th><th>Daily average</th><th>Yearly average</th><th>Daily average</th></tr>
<tr><td>50 – 100</td><td>NO_X</td><td>mg/Nm^3</td><td>Continuous measurement</td><td>70 – 200</td><td>120 – 260</td><td>70 – 250</td><td>120 – 310</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>1. Plants of less than or equal to 100 MW_{th}
1.1. Existing plants – yearly average
• Change upper level to 300 mg/Nm^3 (FI_60).
1.2. Monitoring frequency
• Change to twice per year (CZ_139, E&P_137).</td></tr>
<tr><td>EIPPCB Assessment</td><td>1. Plants of less than or equal to 100 MW_{th}
1.1. Existing plants – yearly average
• Several plants of this category in the data collection report emissions below the value proposed in D1, with an equivalent full load operating factor ranging from 38 % to 112 % and representing the power, DH, chemical and PP sectors. Many of these plants fitted with primary techniques achieve yearly average emissions below 250 mg/Nm^3, which is the reference for setting the upper end of the yearly average BAT-AEL for existing plants.
1.2. Monitoring frequency
• All the biomass plants except one (that has a capacity of 49.7 MW_{th}) monitor NO_X emissions continuously. NO_X emissions need to be controlled continuously when using secondary abatement techniques to ensure proper operation of the techniques. In the case of plants of < 100 MW_{th} operating less than 1500 hours, where there are expected to be less emissions in terms of load over the course of the year, the monitoring may be periodic.</td></tr>
<tr><td>EIPPCB proposal:</td><td>1. Plants of less than or equal to 100 MW_{th}
1.1. Yearly averages for existing plants
• Keep the upper end of the BAT-AEL range at 250 mg/Nm^3.
1.2. Monitoring frequency
• Keep continuous monitoring for plants of 50–100 MW_{th}.
• Add a footnote for plants of < 100 MW_{th} operated in peak- or emergency-load modes mentioning the possibility of periodic monitoring with 2 samples/yr (for peak-load plants) and 1 sample/yr (for emergency-load plants) respectively.
• Add in the heading of the NO_X BAT-AEL for daily average: 'or average over the sampling period'.</td></tr>
</table>

1.4.3.2.3 Table 10.11 – BAT-AELs for NO_X – plants of 100–300 MW_{th}

<table>
<tr><td>Location in D1:</td><td>Section 10.2.2.3 - p. 760</td></tr>
<tr><td>Current text in D1:</td><td>Table 10.11: BAT-associated emission levels for NO_X, NH_3 and CO emissions to air from the combustion of solid biomass and/or peat
<table>
<tr><th rowspan="3">Combustion plant rated thermal input (MW_{th})</th><th rowspan="3">Pollutant</th><th rowspan="3">Unit</th><th rowspan="3">Monitoring frequency</th><th colspan="4">BAT-AEL</th></tr>
<tr><th colspan="2">New plant</th><th colspan="2">Existing plant</th></tr>
<tr><th>Yearly average</th><th>Daily average</th><th>Yearly average</th><th>Daily average</th></tr>
<tr><td>100 – 300</td><td>NO_X</td><td>mg/Nm^3</td><td>Continuous measurement</td><td>50 – 130</td><td>100 – 220</td><td>50 – 140</td><td>100 – 220</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>1. <u>Plants of 100–300 MW_{th}</u>
1.1. <u>New and existing plants – yearly average</u>
• < 180 mg/Nm^3 (Eurelectric_684_949_133).
• < 250 mg/Nm^3 for existing (FI_60, CEPI_71).
• < 160 mg/Nm^3 for new; <180 mg/Nm^3 for existing due to financial expenditures (PL_7_8).
1.2. <u>New and existing plants – daily average</u>
• <200 mg/Nm^3 (AT_72).</td></tr>
<tr><td>EIPPCB assessment:</td><td>1. <u>Plants of 100–300 MW_{th}</u>
1.1. <u>New and existing plants – yearly average</u>
• The reference technique for new plants in this size category is the use of SNCR combined with primary techniques (e.g. flue-gas recirculation and air staging techniques). All plants report NO_X emissions below 140 mg/Nm^3.
• Plant 25-2 is a CFB plant using only primary techniques that may be considered for setting the BAT-AELs for existing plants due to the possible difficulties of certain existing fluidised bed boilers to get the right temperature window in all loads. Plant 25-2 reports NO_X emissions below 180 mg/Nm^3.
• The proposal to change the upper end of the BAT-AELs due to financial expenditures is not accompanied by any supporting techno-economic information. It is shown in the data collection that a number of existing plants operate in the EU and achieve emissions below 180 mg/Nm^3.
• Plants 669 and 666 submitted by CEPI, supporting their comments, report NO_X emissions of 77 and 130 mg/Nm^3 respectively.
1.2. <u>New and existing plants – daily average</u>
• Plant 190, fitted with SNCR together with primary techniques, reported short-term emissions of 200 mg/Nm^3. That is the reference for the upper end of the BAT-AEL range for new plants.
• Following the same argument as for the yearly average, Plant 25-2, which is fitted with primary techniques (i.e. air staging and flue-gas recirculation) is the reference for setting the short-term average BAT-AEL as 220 mg/Nm^3.</td></tr>
<tr><td>EIPPCB proposal:</td><td>1. <u>Plants in the range 100–300 MW_{th}</u>
1.1. <u>Yearly averages for new and existing plants</u>
• Increase the proposed upper end of the yearly average BAT-AEL range for new plants from 130 to 140 mg/Nm^3.
• Increase the proposed upper end of the yearly average BAT-AEL range for existing plants from 140 to 180 mg/Nm^3.
1.2. <u>Daily averages for new and existing plants</u>
• Propose the upper end of the BAT-AEL range for new plants at 200 mg/Nm^3.
• Keep the proposed upper end of the BAT-AEL range for existing plants at 220 mg/Nm^3.</td></tr>
</table>

1.4.3.2.4 Table 10.11 – BAT-AELs for NO_X – plants of >300 MW_{th}

<table>
<tr><td>Location in D1:</td><td>Section 10.2.2.3 - p. 760</td></tr>
<tr><td>Current text in D1:</td><td>Table 10.11: BAT-associated emission levels for NO_X, NH_3 and CO emissions to air from the combustion of solid biomass and/or peat
<table>
<tr><th rowspan="3">Combustion plant rated thermal input (MW_{th})</th><th rowspan="3">Pollutant</th><th rowspan="3">Unit</th><th rowspan="3">Monitoring frequency</th><th colspan="4">BAT-AEL</th></tr>
<tr><th colspan="2">New plant</th><th colspan="2">Existing plant</th></tr>
<tr><th>Yearly average</th><th>Daily average</th><th>Yearly average</th><th>Daily average</th></tr>
<tr><td>>300</td><td>NO_X</td><td>mg/Nm^3</td><td>Continuous measurement</td><td>40 – 130</td><td>65 – 150</td><td>40 – 140</td><td>95 – 150</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>1. Plants more than 300 MW_{th}
1.1. New and existing plants – yearly average
• < 160 mg/Nm^3 for new; <180 mg/Nm^3 for existing due to financial expenditures (PL_7_8);
1.2. New and existing plants – daily average
• Change 200 mg/Nm^3 for existing. (FI_60, CEPI_71);</td></tr>
<tr><td>EIPPCB assessment:</td><td>1. Plants more than 300 MW_{th}
1.1. New and existing plants – yearly average
• The reference technique for new plants in this size category is the use of SCR and/or SNCR combined with primary techniques.
• Plant 42, a CFB boiler fitted with SNCR together with primary techniques, is proposed to be the reference for setting the yearly BAT-AEL for new plants. The plant reports yearly NO_X emissions of 136 mg/Nm^3.
• The retrofitted Plant 14 with SCR is proposed to be the reference for setting the yearly BAT-AEL for existing plants. This plant, a coal-fired plant converted to biomass, reports NO_X emissions of 158 mg/Nm^3.
• The proposal to change the upper end of the BAT-AEL range due to financial expenditures is not accompanied by any techno-economic information.
1.2. New and existing plants – daily average
• Plant 14, the reference plant for setting yearly BAT-AELs for existing plants, reports achieving short-term emissions below 200 mg/Nm^3.
• There is no comment on the daily average for new plants.</td></tr>
<tr><td>EIPPCB proposal:</td><td>1. Plants more than 300 MW_{th}
1.1. Yearly averages for new and existing plants
• Increase the proposed upper end of the yearly average BAT-AEL range for new plants from 130 to 140 mg/Nm^3.
• Increase the upper end of the yearly average BAT-AEL range for existing plants from 140 to 160 mg/Nm^3.
1.2. Daily averages for new and existing plants
• Keep the upper end of the BAT-AEL range for new plants at 150 mg/Nm^3.
• Increase the upper end of the BAT-AEL range for existing plants to 200 mg/Nm^3.</td></tr>
</table>

1.4.3.2.5 Table 10.11 - BAT-AELs for CO - solid biomass and/or peat

Location in D1:	*Section 10.2.2.3 - p. 760*
Current text in D1:	**Table 10.11: BAT-associated emission levels for NO_X, NH_3 and CO emissions to air from the combustion of solid biomass and/or peat**

Combustion plant rated thermal input (MW_{th})	Pollutant	Unit	Monitoring frequency	BAT-AEL			
				New plant		Existing plant	
				Yearly average	Daily average	Yearly average	Daily average
	CO	mg/Nm^3	Continuous measurement	4 – 80	ND	4 – 80	ND

Summary of comments:	1. *Yearly average - new and existing plants* • *Remove (CEPI_64, SE_68).* • *Set the following ranges: 20 - 200 mg/Nm^3 for woody biomass (untreated wood); 80 – 250 mg/Nm^3 for herbaceous biomass and bark (Eurelectric_685).* • *Remove or set the following ranges: 20 - 125 mg/Nm^3 for woody biomass; 80 - 250 mg/Nm^3 for herbaceous biomass and bark (Eurelectric_134_950).* • *Remove or change to 250 mg/Nm^3. Keep only the monitoring. (E&P_122, Eurelectric_59).* • *Exemption for straw fired; Power sector 50 and 100 MW_{th}: 50 – 150 mg/Nm^3. For BFB or stable processes with dry fuels; for wet straw in grate > 150 mg/Nm^3 (PL_9).* • *Set for new grate plants with wet fuels (i.e. straw) (>50 %): 375 mg/Nm^3; for forest biomass not below 200 mg/Nm^3 (DK_135).* • *Set AEPL, instead of AEL: 30-100 mg/Nm^3 for new plants. For existing CFB plants: 50-100 mg/Nm^3. For existing BFB plants <300 MW_{th}: 50-250 mg/Nm^3 and for plants >300 MW_{th}: 50-150 mg/Nm^3 (FI_60).* • *Set higher BAT-AELs for existing plants (SE_65, E&P_20).* • *Exemption for plant with frequent load changes (Eurelectric_132).* 2. *Daily average - new and existing plants* • *Provide short term (i.e. daily) for CO (AT_71).* • *Set 1000 or 2000 mg/Nm^3as daily averages for quick and repetitive changes in load (SE_69).* • *Change to 500 mg/Nm^3 (hourly average) for base load; No BAT-AEL for 'change load plants' (E&P_39, SE_65).*
EIPPCB assessment:	**1. Yearly average - new and existing plants** • **CO is one of the environmental parameters that the TWG decided to focus on at the KOM. As CO is a pollutant emitted to air BAT-AELs are proposed.** • **Due to trade-offs between NO_X and CO emissions, the priority is given to NO_X reduction in this LCP BREF review. Subsequently, CO levels and corresponding techniques are derived based on the set of well performing plants for NO_X emissions.** • **Since NO_X emissions are assessed depending on the size of the plants, it is consistent to analyse CO emissions for the same plant size categories. For plants of less than 100 MW_{th}, almost all the plants reporting NO_X emissions below the BAT-AELs for NO_X report emissions below 250 mg/Nm^3 of CO. For plants in the range of 100–300 MW_{th}, Plant 458 achieves emissions of 160 mg/Nm^3 and a number of plants report emissions below that value. For plants of more than 300 MW_{th}, all the plants report emissions below 50 mg/Nm^3.** • **Plants that are expected to have frequent load changes are included in the data collection (e.g. plants from PP sector) and therefore assessed together with the rest of plants. BAT-AELs.** **2. Daily average - new and existing plants** • **Regarding plants operated in peak- and in emergency-load modes, it may not be appropriate to set yearly averages, as for NO_X emissions, due to their being operated less than 1500 hours per year. It could therefore be proposed to exclude them from the BAT-AELs.**

	• **Only BAT-AELs expressed as a yearly average are proposed for CO emissions. This is to give more flexibility for achieving a good short-term and long-term performance for NO_X emissions, considering the possible variations of the combustion (i.e. fuel moisture, quick changes of load).** **3. <u>Monitoring frequency</u>** • **In the case of plants of <100 MW_{th} operated in emergency- or peak-load mode where less emissions in terms of load over the course of the year are expected, the monitoring may be periodic.**
EIPPCB proposal:	• **<u>Yearly average - new and existing plants</u>** • **Propose BAT-AEL for new and existing plants below 100 MW_{th} at 20–250 mg/Nm^3.** • **Propose BAT-AEL for new and existing plants of 100–300 MW_{th} at 15–160 mg/Nm^3.** • **Propose BAT-AEL for new and existing plants above 300 MW_{th} at 5–50 mg/Nm^3.** • **Exempt plants operating in peak- or emergency-load modes from the CO BAT-AELs.** • **<u>Daily average - new and existing plants</u>** • **Do not propose BAT-AEL for CO as a daily average.** • **<u>Monitoring frequency</u>** • **Change the monitoring frequency to periodic for plants of < 100 MW_{th} operating in emergency- or peak-load modes.**

1.4.3.2.6 Table 10.11 – BAT-AELs for NH_3 – solid biomass and/or peat

Location in D1: *Section 10.2.2.3 - p. 760*

Current text in D1:

Table 10.11: BAT-associated emission levels for NO_X, NH_3 and CO emissions to air from the combustion of solid biomass and/or peat

Combustion plant rated thermal input (MW_{th})	Pollutant	Unit	Monitoring frequency	BAT-AEL			
				New plant		Existing plant	
				Yearly average	Daily average	Yearly average	Daily average
All	NH_3 ([1])	mg/Nm^3	Continuous measurement	1 – 5	ND	1 – 5	ND
([1]) Ammonia emissions are associated with the use of SCR and SNCR							

Summary of comments:

1. *Yearly new and existing plants*
   - *Change new and existing to 10 mg/Nm^3 (E&P_22, Eurelectric_61) if flue condenser and scrubber or 20 mg/Nm^3 if not (CEPI_69).*
   - *Change new and existing range to 3-15 mg/Nm^3 (FI_116).*
   - *Keep BAT-AELs if SCR but if SNCR, set < 10 mg/Nm^3 (E&P_26_ 124) for plants without WFGD (DK_134) without flue-gas condenser and scrubber (SE_63).*
   - *Remove (IE_22).*
   - *Change the upper end of the range to 15 mg/Nm^3(Eurelectric_682_947, Eurelectric_136).*
   - *Higher BAT-AELs for existing plants (SE_65, E&P_20).*
2. *Daily new and existing plants*
   - *Provide short term (i.e. daily) for NH_3. (FR_116). Daily averages < 1 – 8 mg/Nm^3 (AT_71).*
   - *Set 20 mg/Nm^3(E&P_22, Eurelectric_136) with SNCR especially without flue-gas condenser and scrubber (SE_63).*
3. *NH_3 Monitoring*
   - *Not set continuous monitoring (Eurelectric_948) if SCR, if particulate collection and wet FGD, more than 90 % will be removed (E&P_120).*
   - *Set periodic monitoring, once per year (E&P_126, Eurelectric_63_136_158), not necessary continuous for WFGD (DK_133).*
   - *Set Continuous "or" periodic measurement (Eurelectric_683).*

EIPPCB assessment:

1. **Yearly average - new and existing plants**
   - **Since NO_X emissions are assessed based on the size of the plants, it is consistent to analyse NH_3 emissions for the same plant size categories. All plants in the data collection of <100 MW_{th} achieving emissions within the proposed BAT-AELs for NO_X reported NH_3 emissions of <10 mg/Nm^3, with and without using wet abatement techniques for SO_X reduction. In the case of plants of 100–300 MW_{th}, only one out of seven plants reported NH_3 emissions above 10 mg/Nm^3. For plants of ≥300 MW_{th}, all reported NH_3 emissions of < 6 mg/Nm^3. Since there are not many plants in this category, the use of SNCR to abate NO_X emissions may imply higher NH_3 emissions if not fitted with wet flue-gas desulphuration techniques.**
   - **NH_3 emissions are mainly reported by plants of the data collection that are fitted with SCR or SNCR and the emissions may be higher. Footnote ([1]) could be clarified to indicate that the BAT-AELs for NH_3 only apply when SCR and/or SNCR is used.**
2. **Daily average - new and existing plants**
   - **NH_3 is considered to merit less focus in this LCP BREF review than NO_X however key when using SNCR/SCR. Therefore, to reflect the optimisation of the secondary deNO_X technique in the long term, only yearly averaging periods are proposed for the BAT-AELs.**
3. **Monitoring**
   - **NH_3 emissions are linked to NO_X emissions, when SNCR and/or SCR are used, and to the good mixing of both compounds. Therefore it is appropriate to monitor NH_3 and NO_X emissions in the same way.**
   - **A number of plants that reported NH_3 emissions carry out continuous**

	measurement of NH_3. • **Plants fitted with dedusting devices along with wet FGD may have very low emission levels of NH_3, thus the requirement for NH_3 monitoring could be lower in such cases.**
EIPPCB proposal:	**1. <u>Yearly average - new and existing plants</u>** • **Change the BAT-AELs to <5–10 mg/Nm^3 for all size categories.** • **Indicate that the BAT-AELs for NH_3 are only applicable when the SNCR and/or SCR techniques are used.** • **The proposed BAT-AEL for NH_3 emissions to air is shown in BAT 4 bis** **2. <u>Daily average - new and existing plants</u>** • **Do not include BAT-AELs expressed as daily averages.** **3. <u>Monitoring</u>** • **Mention the possibility to apply periodic monitoring (at least once/yr) when using dedusting and wet FGD techniques and the levels of NH_3 are well within the proposed BAT-AELs.**

1.4.4 BAT 28 – SO_X, HCl and HF emissions to air

1.4.4.1 BAT conclusion

Location in D1:	*p.760*
Current text in D1:	**28. In order to prevent and reduce SO_X, HCl and HF emissions to air in the combustion of solid biomass and/or peat, BAT is to use one or a combination of the techniques given below.**

Technique		Description	Applicability
a	Fuel choice	By switching to a different biomass fuel (e.g. lower sulphur or lower chlorine fuel), the corresponding emissions are reduced.	The applicability is limited by the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State
b	Flue-gas condenser	See descriptions in Section 10.8	Applicable to plants serving a district heating network
c	Wet FGD		Applicable to plants using higher sulphur fuel
d	Boiler sorbent injection (in-furnace or in-bed)		Not applicable if an alkali sorbent substance is already contained in the fuel
e	DSI (Dry sorbent injection)	The technique is combined with dust abatement technique	Generally applicable

Summary of comments:	*1. Technique a: Fuel choice* • *Applicability restriction for existing: technical limitations; space constraints (FI_107, CEPI_74).* • *Include in the description: 'Participation of agricultural biomass shall not exceed 25 % by weight' for woody biomass design boilers (PL_151, Eurelectric_157).* *2. Technique c: Wet FGD* • *Add definition of higher sulphur fuel (FI_108).* *3. Technique d: Boiler sorbent injection* • *Sorbent injection is not functioning in all existing BFB (FI_109, CEPI_75).* *4. Technique e: Duct sorbent injection (DSI)* • *DSI is not functioning in all existing BFB boilers (CEPI_77).* • *Applicability for existing plants may be limited due to boiler constraints; Bag filter and new fans required (FI_110).* • *Applicability depends on the flue-gas temperature and composition of the gas (DK_136).* *5. New technique* • *Include Semi-dry absorption (SDA) (DK_141)*
EIPPCB assessment	**1. Fuel choice (a)** • **The choice of fuel is one of the main considerations when designing a combustion plant. Changes of fuel to reduce emissions are likely to trigger technical retrofits (e.g. for preparation of fuels for combustion) and will need to take into account the effects of the waste gases in the existing boiler. Adding general applicability restrictions due to space constraints, technical retrofitting and/or the fuel mix that are site-/plant-specific depending on the original design are not considered justified because there are plants that have overcome these difficulties.** **2. Wet FGD (c)** • **Wet FGD is a technique that can achieve good desulphuration rates. The technique can be used alone or in combination with other techniques to abate SO_2. However, the technique may be used not only when the fuel has a high sulphur content to abate SO_2, but also when the plant has high HCl and/or HF emissions (e.g. Plant 33). The fact that there is also the possibility of adding other sulphur compounds in the combustion with the purpose of neutralising other possible effects (e.g. corrosion), depending on the fuels, show that the applicability of this technique is not restricted to the use of fuel with a higher S content.** • **Applicability restrictions for plants operating in emergency-load mode may be justified by the available information. The technique may be site-specific in the case of retrofit of existing plants operated < 1500 h/yr.** **3. Boiler sorbent injection (d)** • **Boiler sorbent injection is an available technique for SO_2 abatement in BFB boilers, although not all BFB boilers are fitted with it because some use other techniques. There is no evidence of a general technical restriction to injecting limestone into the bed of a BFB boiler to reduce SO_X emissions (i.e. BFB Plant 188 is fitted with sorbent injection). The alkalinity of the fuel may be enough to reduce SO_X emissions to a certain level.** **4. Duct sorbent injection (DSI) (e)** • **Duct sorbent injection is an available technique for SO_2 abatement in BFB boilers, although not all the BFB boilers are fitted with it because some use other techniques.** • **This technique usually requires the use of a technique for dust abatement.** • **The effectiveness of the technique depends, among other parameters, on the composition of the waste gases, the temperature and/or the residence time. There is no general applicability restriction for this technique.** **5. New technique** • **Spray-dry absorption (SDA) is the name of a semi-dry technique for flue-gas desulphuration which may also be applicable for biomass combustion. Plant 489-3 is fitted with this technique.** **6. Flue-gas condenser** • **Flue –gas condenser may be used with other purposes than district heating (e.g. save fuel, reduce flue-gas emissions).**
EIPPCB proposal	**1. Fuel choice (a)** • **Keep technique unchanged.** **2. Wet FGD (c)** • **Change the applicability to 'Generally applicable'.**

	• **Include an applicability restriction for existing plants operating in emergency- or peak-load modes. The same for both of them??** **3. Boiler sorbent injection (d)** • **Change applicability to 'Generally applicable'.** **4. Duct sorbent injection (DSI) (e)** • **Correct the name of the technique and refer to the description in Section 10.8 of the BAT conclusions.** **5. New technique** • **Include spray-dry absorption (SDA) as a generally applicable technique.** **6. Flue-gas condenser (b)** • **Change applicability to 'Generally applicable'.**

1.4.4.2 Table 10.12 – BAT-AELs for SO_X, HCl and HF – solid biomass and/or peat

1.4.4.2.1 Table 10.12 – BAT-AELs for SO_X – solid biomass and/or peat

Location in D1: *p.761*

Current text in D1:

Table 10.12: BAT associated emission levels for SO_X, HCl, and HF emissions to air from the combustion of solid biomass and/or peat

Fuel (% in LHV basis)	Pollutant	Unit	Monitoring frequency	BAT-AEL		
				Average of samples obtained during one year	Yearly average	Daily average
Biomass or biomass / peat with peat % < 20	SO_X	mg/Nm³	Continuous measurement ([1])	-	1 – 50	8 – 70
Peat or biomass / peat with peat % ≥ 70				-	100 – 165	ND
20 ≤ peat % < 70					Intermediate, within the ranges given in the two lines above	ND

ND: Not Derived
([1]) Only SO_2 is continuously measured, SO_3 is periodically measured (e.g. during calibration)

Summary of comments:

1. *General*
- *Separate the table in three tables: peat, wood and straw. For each table, three different sizes 50-100, 100-300 and above 300 MW (DK_139_140).*
- *Dedicated range for biomass with different percentage of straw (IT_93).*
- *200 mg/Nm³ for rich-N content biomass such as straw or grains (FR_120).*
- *Re-evaluate upper limits to fit peat, wood and straw possibly divided after plant sizes. SO_X for straw combustion <100 mg/Nm³ with sorbent injection (DK_137).*

2. *Yearly and daily averages for biomass or biomass/peat with peat <20 %*

Yearly
- *Yearly existing plants: 100 mg/Nm³ (CEPI_73).*
- *Change to 10-100 (FI_61).*
- *Change to (1-80) (E&P_141, CZ_143).*
- *Change to <80 (Eurelectric_142).*
- *Change to 130 when agriculture biomass (PL_10).*

Daily
- *Change to (8-100) (E&P_141, CZ_143).*
- *Change to <100 (Eurelectric_142).*

3. *Yearly and daily averages for biomass or biomass/peat with peat ≥ 70 %*

Yearly
- *Yearly for existing plants: 300 mg/Nm³ (CEPI_73).*

	• *Change yearly to 300 mg/Nm^3(<300 MW); 200 mg/Nm^3 (>300 MW) (FI_61).* *Daily* • *Provide short term (i.e. daily) (AT_73).* • *Include daily BAT-AELs (FR_118).* *4. Monitoring* • *Change the measurement frequency below 100 MW$_{th}$ to twice a year due to increase in the costs of monitoring (CZ_142, E&P_140).* *5. Load mode and load factor* • *Existing plants operating < 1500 h/year, daily BAT-AEL of < 880 mg/Nm3 (FR_119).* *6. Coal to biomass plants* • *Yearly average BAT for biomass plant converted from coal: 1-200 mg/Nm^3 (E&P_128, Eurelectric_64, UK_84).*
EIPPCB assessment	**1. General** • **The proposal to distinguish BAT-AELs depending on the different biomass fuel used (especially with respect to N content) is not possible because, in general, the plants provided in the data collection report the use of a combination of different types of biomass (wood, straw and/or peat) and there are few example plants burning only peat or burning only straw.** • **Since some plants may be adding sulphur or sulphur-rich compounds to counterbalance the negative effects due to the alkalinity of certain fuels, the higher SO_X emissions in the flue-gases are not only linked to the S content of the fuel. To be consistent with the assessments and proposals made for other fuels and for other pollutants, a reassessment of the data has been carried out considering the different sizes of plants: plants of <100 MW_{th}, plants of 100–300 MW_{th}, and plants of ≥300 MW_{th}. BAT-AELs for new and existing plants can also be proposed.** **2. (+3.) Yearly and daily averages** • **Dry, semi-dry and wet abatement techniques proposed as BAT are applied and available for the three categories of biomass-firing plants, showing in general lower SO_X emissions compared to coal-firing plants. Considering that wet abatement techniques may be fitted not only for SO_X abatement but also for other pollutants (i.e. HCl) or for other purposes (i.e. flue-gas condenser) and the level of SO_X in the flue-gas may not be very high, the reported SO_X emissions are in general low. The use of wet FGD techniques could allow the achievement of good performances in the case of a higher content of SO_X in the flue-gases. In that case, for existing plants burning 100 % peat, the BAT-AELs could be the same for all size categories, the reference technique is the use of sorbent injection (see below the assessment for plants of <100 MW_{th}).** **Plants of <100 MW_{th}** • **The upper end of the yearly BAT-AEL range for existing plants is based on the use of sorbent injection in the boiler. Plant 190 (263 MW_{th}), which burns 100 % peat using this technique, reported 100 mg/Nm^3.** • **The upper end of the yearly BAT-AEL range for new plants is based on the use of the duct sorbent injection technique, for which emissions of <70 mg/Nm^3 are reported.** • **The upper end of the daily BAT-AEL range for existing plants is based on the short-term averages reported by the reference plant for the proposal of the yearly average (i.e. Plant 190), which reported emissions of <215 mg/Nm^3.** • **The upper end of the daily BAT-AEL range for new plants is based on the reference plant for existing plants between 100 and 300 MW_{th} (i.e. Plant 46), which reported emissions of <175 mg/Nm^3.** • **Plant 470 reported a yearly average slightly above 15 mg/Nm^3 and short-term emissions of about 30 mg/Nm^3 is the reference for the lower end of the yearly and daily BAT-AEL ranges.** **Plants of 100–300 MW_{th}** • **The upper end of the yearly BAT-AEL range for existing plants is based on the use of the duct sorbent injection technique. Plant 46 in this size category and Plant 108-1 in the < 100 MW_{th} category use the technique and achieve emissions below 70 mg/Nm^3.** • **The upper end of the yearly BAT-AEL range for new plants is based on the use of the spray-dry absorber technique. Plant 489-3 (69 MW_{th}) using the technique reported emissions of 50 mg/Nm^3.** • **The upper end of the daily BAT-AEL range for existing plants is based on the short-term emissions provided by Plant 46: 175 mg/Nm^3.** • **The upper end of the daily BAT-AEL range for new plants is based on Plant 655**

	(86 MW_{th}) using duct sorbent injection, which reported short-term averages around 85 mg/Nm^3. **• The plant that may be the reference for this category is Plant 682, with yearly average and short-term emissions below 10 mg/Nm^3 and 20 mg/Nm^3, respectively.** **Plants of ≥ 300 MW_{th}** **• The upper end of the yearly BAT-AEL range for existing plants is based on the performance of spray-dry absorbers. Plant 489-3 (69 MW_{th}) burning 55 % SW with a higher S content than peat is fitted with this technique and reports emissions of 50 mg/Nm^3.** **• The upper end of the yearly BAT-AEL range for new plants is based on an emissions reduction of 95 % applying WFGD, indicating that 35 mg/Nm^3 could be taken as a basis.** **• The upper end of the daily BAT-AEL range for existing plants is based on the short-term emissions reported by Plant 655 (i.e. 85 mg/Nm^3), a 86 MW_{th} plant using DSI, which reported yearly average emissions at the level of the BAT-AEL proposed above.** **• The upper end of the daily BAT-AEL range for new plants is based on Plant 42, which reports short-term emissions of about 70 mg/Nm^3.** **• The plant that could be the reference for this category is Plant 682 (134 MW_{th}), with yearly average and short-term emissions below 10 mg/Nm^3 and 20 mg/Nm^3 respectively.** **4. Monitoring** **• In the case of small plants or plants of < 100 MW_{th} operating less than 1500 hours, where lower emissions in terms of load over the course of the year are expected, the monitoring may be periodic.** **5. Load mode and load factor** **• Plants with low (i.e. about 40 %) and high (i.e. more than 100 %) equivalent full load operating factors have emissions within the proposed BAT-AEL ranges. There is no clear correlation between the load factor and the emissions reported.** **• Yearly averages may not be needed for plants operating in emergency- or peak-load modes as the operation throughout the year is limited to 1500 hours.** **6. Coal to biomass** **• Almost all the plants converted from coal to biomass would be within the proposed BAT-AEL ranges for SO_X emissions.**
EIPPCB proposal	**1. General** **• Do not distinguish BAT-AELs based on the different types of biomass fuel.** **• Propose BAT-AELs for new and existing plants according to the following size categories: plants of <100 MW_{th}, plants of 100–300 MW_{th}, and plants of ≥300 MW_{th}.** **• Specify with a footnote that for existing plants in all size categories burning 100 % peat the upper end of the yearly average of the BAT-AEL is 100 mg/Nm3 and the daily average is 215 mg/Nm3.** **2. (+3.) Yearly and daily averages** **2.1. Plants of <100 MW_{th}** **• Propose a yearly average BAT-AEL for new plants at 15–70 mg/Nm^3.** **• Propose a yearly average BAT-AEL for existing plants at 15–100 mg/Nm^3.** **• Propose a daily average BAT-AEL for new plants at 30–175 mg/Nm^3.** **• Propose a daily average BAT-AEL for existing plants at 30–215 mg/Nm^3.** **2.2. Plants of 100–300 MW_{th}** **• Propose a yearly average BAT-AEL for new plants at <10–50 mg/Nm^3.** **• Propose a yearly average BAT-AEL for existing plants at <10–70 mg/Nm^3.** **• Propose a daily average BAT-AEL for new plants at <20–85 mg/Nm^3.** **• Propose a daily average BAT-AEL for existing plants at <20–175 mg/Nm^3.** **2.3. Plants of ≥300 MW_{th}** **• Propose a yearly average BAT-AEL for new plants at <10–35 mg/Nm^3.** **• Propose a yearly average BAT-AEL for existing plants at <10–50 mg/Nm^3.** **• Propose a daily average BAT-AEL for new plants at <20–70 mg/Nm^3.** **• Propose a daily average BAT-AEL for existing plants at <20–85 mg/Nm^3.** **3. Monitoring** **• For plants of <100 MW_{th} operated in peak-load mode, propose periodic monitoring (twice/year), and for plants of <100 MW_{th} operated in emergency-load mode, propose monitoring as at least once every year.** **4. Load mode and factor** **• For plants operated in emergency- and peak-load modes, propose only daily**

	average BAT-AELs (or average over the sampling period). **5. Coal to biomass** • **Do not include special considerations for plants that have converted from coal to biomass.**

1.4.4.2.2 Table 10.12 – BAT-AELs for HCl – solid biomass and/or peat

Location in D1: *p.761*

Current text in D1:

Table 10.12: BAT associated emission levels for SO_X, HCl, and HF emissions to air from the combustion of solid biomass and/or peat

Fuel (% in LHV basis)	Pollutant	Unit	Monitoring frequency	BAT-AEL		
				Average of samples obtained during one year	Yearly average	Daily average
Biomass or biomass / peat (with peat % < 20), including straw with straw % < 25	HCl	mg/Nm³	Continuous measurement (1)	-	0.3 – 8	< 14
Straw ≈ 100 %				-	< 18	ND
25 ≤ straw % < 100				-	Intermediate, within the ranges given in the two lines above	ND

ND: Not Derived
(1) Only SO_2 is continuously measured, SO_3 is periodically measured (e.g. during calibration)

Summary of comments:

1. *General*
- *Separate the table in three tables: peat, wood and straw. For each table, three different sizes 50-100, 100-300 and above 300 MW (DK_137_139_140).*
- *Dedicated range for biomass with different percentage of straw (IT_93).*
- *All interval type limits should be replaced with upper limits and the requirements should be of type <x (Eurelectric_149).*
- *The lower end of the range may not be achievable using gas-gas heaters (DK_139, Eurelectric_149).*

2. *Yearly average*
- *200 mg/Nm³ for rich-N content biomass such as straw or grains (FR_120).*
- *Remove BAT-AEL. There is no HCl emissions associated with combustion of woody biomass fuel (CEPI_72, E&P_23, Eurelectric_146).*
- *Reconsider the BAT-AEL ranges too low. (Eurelectric_952).*
- *Consider setting BAT-AEPL, not BAT-AEL. For existing plants: <20 mg/Nm³. For new plants: <15 mg/Nm³ (FI_63).*
- *Add BAT-AEPL for peat >20 % (FI_62).*
- *HCl for straw combustion <30 mg/Nm³ with sorbent injection (DK_139)*

3. *Daily average*
- *Include daily BAT-AELs (FR_118).*

4. *Monitoring*
- *No continuous measurement, especially if flue-gas cleaning (Eurelectric_148_952).*
- *Change the frequency <100 MW_{th} to twice a year (CZ_142, E&P_140).*
- *Change the frequency to once/yr (FI_111, Eurelectric_68).*
- *Change the frequency to 1 time/year in the case of low emissions (e.g. behind wet FGD) (Eurelectric_688_954).*
- *Change continuous to periodic and add 'When can be demonstrated that there are no emissions it is not needed to monitor' (CEPI_78).*
- *Continuous monitoring is not applicable for woody biomass (Eurelectric_146) or change to once per year (SE_41).*
- *Change monitoring frequency for HCl to 4 times annually. (DK_138).*

	• *If co-firing the biomass (<20 %) with coal/lignite: HCl monitoring once per year (E&P_143, CZ_145).*

EIPPCB assessment	**1. General**
	• **It is not possible to distinguish BAT-AELs based on the different types of biomass fuel due to the different mix of fuels used by plants for which data are available. The assessment of available information allows the creation of different size categories: <100 MW_{th}, 100–300 MW_{th} and ≥300 MW_{th}.**
	• **As stated in the BREF Guidance, the environmental performance levels associated with BAT are expressed as ranges, rather than as single values, as a range can reflect the differences within a given type of installation that result in variations in the environmental performances achieved when applying BAT.**
	• **Plants still equipped with gas-gas heaters may experience leakages and condensations that could make it difficult for them to achieve emission values corresponding to the lower end of the BAT-AEL range proposed in D1. However, it should be noted that there is no evidence of this in the data collected because it is not indicated which plants are equipped with a GGH.**
	2. (+3.) Yearly and daily average
	• **Dry, semi-dry and wet abatement techniques proposed as BAT may be applied and are available for the three categories of biomass-firing plants. Wet abatement techniques may be fitted not only for HCl emissions abatement but also for other pollutants (i.e. SO_X) and/or for other purposes (i.e. flue-gas condenser). Therefore the use of wet FGD techniques could allow the achievement of good performances in the case of a high content of HCl in the flue-gases (e.g. burning straw). Plant 33, burning 100 % straw, is fitted with wet abatement techniques to abate HCl and reported emissions below 20 mg/Nm^3. This plant is considered the reference for setting yearly average BAT-AELs for plants burning 100 % straw, irrespective of the size. With respect to the daily average BAT-AEL, the emissions reported by Plant 46, i.e. <35 mg/Nm^3, can be considered the reference in the case of a high HCl content in the flue-gases.**
	• **Emissions may depend on the fuel mix but also on other factors (e.g. the use of sulphur-rich compounds to avoid negative effects due to the alkalinity of certain fuels). In such cases, emissions in the flue-gases are not only linked to the Cl content of the fuel. The content of HCl in the flue-gases is also linked with sulphur/chlorine or sulphur/alkali ratios.**
	  ○ **Plants of 50–100 MW_{th}**
	• **Yearly average. Plant 411, using the fuel choice technique, may be considered for setting the upper end of the BAT-AEL range for new plants. The upper end of the BAT-AEL range for existing plants could be based on Plant 505 (139 MW_{th}), which is fitted with DSI and reported emissions of 15 mg/Nm^3.**
	• **Daily average. For new plants, the short-term emissions reported by Plant 125, i.e. about 12 mg/Nm^3, are considered the reference for setting the upper end of the BAT-AEL. For existing plants, the average of the periodic measurements reported by Plant 424-2 (49 MW_{th}), i.e. 35 mg/Nm^3 is considered the reference for setting the upper end of the BAT-AEL.**
	  ○ **Plants of 100–300 MW_{th}**
	• **Yearly average. Almost all the plants burning only woody biomass reported emissions below 9 mg/Nm^3, i.e. Plant 25-2 using boiler sorbent injection. This value is considered the reference for setting the upper end of the BAT-AEL for existing plants. For new plants, the emissions reported by Plant 655, 86 MW_{th} plant fitted with DSI, i.e. 5 mg/Nm^3, can be considered the reference for setting the upper end of the BAT-AEL range.**
	• **Daily average. For new and existing plants, short-term emissions reported by Plant 655 are about 12 mg/Nm^3 and can be considered the reference for setting the upper end of the BAT-AEL.**
	  ○ **Plants of ≥300 MW_{th}**
	• **Yearly average. For new and existing plants, the reference considered for setting the upper end of the BAT-AEL is the emission reported by Plant 489-3 using SDA for SO_X abatement, i.e. 5 mg/Nm^3.**
	• **Daily average. SDA or wet abatement techniques appropriate for this size category are expected to achieve at least the same variability as using DSI, which is the technique used as the reference for setting the upper end of the BAT-AEL for plants in the 100–300 MW_{th} category.**
	4. Monitoring
	• **A number of plants of the data collection carry out continuous monitoring. Chemical reactions during the combustion of biomass that may affect HCl emissions are expected**

	to be more variable compared with other fuels such as coal. If the mix of biomass fuels allows the variability of the HCl emissions to be kept within the proposed BAT-AEL range or the plant uses abatement systems to ensure that the emissions achieved are below that range, the monitoring frequency does not need to be continuous. Therefore, a periodic measurement of twice per year seems adequate. • **Plants of < 100 MW_{th} operated in peak-load or emergency-load modes could have less stringent requirements in terms of monitoring, e.g. less frequent monitoring, given their limited time of operation and emission levels.** **5. Load mode and load factor** • **A yearly average BAT-AEL range may not be needed for plants operating in emergency- or peak-load modes as the operation throughout the year is limited to 1500 hours.** • **The load factor reported by the plants that would meet the proposed BAT-AEL ranges for HCl emissions is 44 % to 109 %, and there is not a clear correlation between the load factor and HCl emissions.** **6. Coal to biomass** • **There are plants in the data collection that converted from coal to biomass and that reported emissions in the proposed BAT-AEL ranges (e.g. Plants 25-2 and 31).**
EIPPCB proposal	**1. General** • **Do not distinguish BAT-AELs based on the different types of biomass fuel.** • **Set BAT-AELs for new and existing plants according to the following size categories: plants of <100 MWth, plants of 100–300 MW_{th}, and plants of ≥300 MW_{th}.** • **Add a footnote mentioning that the lower end of the BAT-AEL ranges for existing plants is difficult to achieve at plants fitted with wet FGD with a gas-gas heater.** **2. (+3.) Yearly and daily average** • **Specify with a footnote that for existing plants in all size categories burning 100 % high Cl content biomass such as straw the upper end of the yearly average of the BAT-AEL is 20 mg/Nm^3 and the daily average is 35 mg/Nm^3.** **2.1. Plants of 50–100 MW_{th}** • **Propose a yearly average BAT-AEL for new plants at <0.3–7 mg/Nm^3.** • **Propose a yearly average BAT-AEL for existing plants at 0.3–15 mg/Nm^3.** • **Propose a daily average BAT-AEL for new plants at 1–12 mg/Nm^3.** • **Propose a daily average BAT-AEL for existing plants at 1–35 mg/Nm^3.** **2.2. Plants of 100–300 MW_{th}** • **Propose a yearly average BAT-AEL for new plants at 0.3–5 mg/Nm^3.** • **Propose a yearly average BAT-AEL for existing plants at 0.3–9 mg/Nm^3.** • **Propose a daily average BAT-AEL for new plants at 1–12 mg/Nm^3.** • **Propose a daily average BAT-AEL for existing plants at 1–12 mg/Nm^3.** **2.3. Plants of ≥300 MW_{th}** • **Propose a yearly average BAT-AEL for new plants at 0.3–5 mg/Nm^3.** • **Propose a yearly average BAT-AEL for existing plants at 0.3–5 mg/Nm^3.** • **Propose a daily average BAT-AEL for new plants at 1–12 mg/Nm^3.** • **Propose a daily average BAT-AEL for existing plants at 1–12 mg/Nm^3.** **4. Monitoring** • **Keep continuous measurement with a footnote allowing its reduction when emissions are proven to be low over the long term, the frequency in that case being at each change of fuel characteristics that may impact the emissions, and at least twice/yr. Propose a different monitoring frequency for plants of 50–100 MWth operated in peak-load at twice/yr and in emergency-load modes, at once/yr.** **5. Load mode and factor** • **For emergency- and peak-load mode plants, propose only daily average BAT-AELs (or average over the sampling period).** **6. Coal to biomass** • **Do not include special considerations for plants that have converted from coal to biomass.**

1.4.4.2.3 Table 10.12 – BAT-AELs for HF – solid biomass and/or peat

<table>
<tr><td>Location in D1:</td><td>p.761</td></tr>
<tr><td>Current text in D1:</td><td>
Table 10.12: BAT associated emission levels for SO_X, HCl, and HF emissions to air from the combustion of solid biomass and/or peat
<table>
<tr><th rowspan="2">Fuel (% in LHV basis)</th><th rowspan="2">Pollutant</th><th rowspan="2">Unit</th><th rowspan="2">Monitoring frequency</th><th colspan="3">BAT-AEL</th></tr>
<tr><th>Average of samples obtained during one year</th><th>Yearly average</th><th>Daily average</th></tr>
<tr><td>All</td><td>HF</td><td>mg/Nm³</td><td>Periodic measurement 4 times/yr</td><td><0.01 – 0.8</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td>
1. <u>General</u>
• Separate the table in three tables: peat, wood and straw. For each table, three different sizes 50-100, 100-300 and above 300 MW (DK137_139_140).
• Dedicated range for biomass with different percentage of straw (IT_93).
• All interval type limits should be replaced with upper limits and the requirements should be of type <x (Eurelectric_149).
• The lower end of the range may not be achievable using gas-gas heaters (DK_139, Eurelectric_149).
2. <u>Average of samples obtained during one year</u>
• 200 mg/Nm^3 for rich-N content biomass such as straw or grains (FR_120).
• Remove BAT-AEL (E&P_23) for woody biomass (Eurelectric_146).
• Reconsider the BAT-AEL ranges (too low) (Eurelectric_952).
• BAT-AEPL, not AEL. For existing plants and new plants: <1 mg/Nm^3 (FI_63).
• Change upper BAT-AEL to < 2 mg/Nm^3 (Eurelectric_147).
• Include daily BAT-AELs (FR_118).
3. <u>Monitoring</u>
• Periodic measurement once/yr (FI_111, Eurelectric_69), in the case of low emissions (e.g. behind wet FGD) (Eurelectric_688_954); or calculation (Eurelectric_148); or at change of fuel type (DK_138).
• Change continuous to periodic and add "When can be demonstrated that there are no emissions it is no needed to monitor" (CEPI_78).
• Continuous monitoring not applicable for woody biomass (Eurelectric_146) or change to once a year (SE_41).
• If co-firing the biomass (<20 %) with coal/lignite: HF monitoring once per year. (E&P_143, CZ_145).
</td></tr>
<tr><td>EIPPCB assessment</td><td>
1. <u>General</u>
• It is not possible to distinguish BAT-AELs based on the different types of biomass fuel due to the different mix of fuels used by plants for which data are available. The comments have been assessed considering the different sizes of the plants, to be consistent with the assessment of comments and proposals made for other fuels and for SO_2.
• As stated in the BREF Guidance, the environmental performance levels associated with BAT are to be expressed as ranges, rather than as single values, as a range may reflect the differences within a given type of installation that result in variations in the environmental performances achieved when applying BAT.
2. <u>Average of samples obtained during one year</u>
Daily average BAT-AEL is appropriate for continuous monitoring.
2.1. <u>Plants of <100 MW_{th}</u>
• For existing plants, the upper end of the BAT-AEL range may be based on emissions reported by Plant 680, i.e. 1.3 mg/Nm^3. For new plants, the upper end of the BAT-AEL range may be based on emissions reported by Plant 1012, i.e. 1 mg/Nm^3.
2.2. <u>Plants of 100–300 MW_{th}</u>
• More than a half of the plants in this category reported HF emissions below 0.15
</td></tr>
</table>

	mg/Nm^3. Some of these plants apply abatement techniques for reducing SO_X emissions and others not. For existing plants, the upper end of the BAT-AEL range may be based on emissions reported by Plant 1012, i.e. 1 mg/Nm^3. For new plants, the upper end of the BAT-AEL range may be based on emissions reported by Plant 655, i.e. 0.8 mg/Nm^3. **2.3. Plants of ≥300 MW_{th}** • **Two plants reported HF emissions. Plant 31, burning 25 % herbaceous biomass and fitted with WFGD, reported emissions slightly below 0.3 mg/Nm^3, which could be used to set the upper end of the BAT-AEL range for new plants. Plant 1004 reported HF emissions of 0.5 mg/Nm^3.** **4. Monitoring** • **Even if some plants monitor the HF emissions continuously, there are a number of plant of the data collection perform periodic monitoring. Since not many plants reported HF emissions and in general the reported values are not very high compared to coal, it seems reasonable to propose periodic monitoring once per year.** **5. Load mode and load factor** • **A yearly average may not be needed for plants operating in emergency- or peak-load modes as the operation throughout the year is limited to 1500 hours.** • **The load factor reported by the plants that would meet the proposed BAT-AEL ranges for HF emissions is from 38 % to 109 %, and there is not a clear correlation between the load factor and the HF emissions.** **6. Coal to biomass** • **Four plants converted from coal to biomass report HF emissions, and all of them reported HF emissions in the proposed BAT-AEL ranges.**
EIPPCB proposal	**1. General** • **Do not distinguish BAT-AELs based on the different types of biomass fuel.** • **Propose BAT-AELs for new and existing plants according to the following plant categories: plants of <100 MW_{th}, plants of 100–300 MW_{th}, and plants of ≥300 MW_{th}.** • **Add a footnote mentioning that the lower end of the yearly BAT-AEL ranges for existing plants is difficult to achieve at plants fitted with wet FGD with a gas-gas heater.** **2. Average over the sampling period** **2.1. Plants of <100 MW_{th}** • **Propose BAT-AEL as an average over the sampling period for new plants at <0.01–1 mg/Nm^3.** • **Propose BAT-AEL as an average over the sampling period for existing plants at <0.01–1.3 mg/Nm^3.** **2.2. Plants of 100–300 MW_{th}** • **Propose BAT-AEL as an average over the sampling period for new plants at <0.01–0.8 mg/Nm^3.** • **Propose BAT-AEL as an average over the sampling period for existing plants at <0.01–1 mg/Nm^3.** **2.3. Plants of ≥300 MW_{th}** • **Propose BAT-AEL as an average over the sampling period for new plants at <0.01–0.3 mg/Nm^3.** • **Propose BAT-AEL as an average over the sampling period for existing plants at <0.01–0.5 mg/Nm^3.** **4. Monitoring** • **Change the periodic monitoring to once per year.** **5. Load mode and factor** • **For existing plants operated in emergency- and peak-load modes, propose BAT-AEL as an average over the sampling period to <0.01–1.3 mg/Nm^3.** **6. Coal to biomass** • **Do not include special considerations for plants that have converted from coal to biomass.**

1.4.5 BAT 29 – Dust and particulate-bound metals emissions to air

1.4.5.1 BAT conclusion

<table>
<tr><td>Location in D1:</td><td>p. 762</td></tr>
<tr><td>Current text in D1:</td><td>
29. In order to reduce dust and particulate-bound metals emissions to air in the combustion of solid biomass and/or peat, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Fuel choice</td><td>By switching to a different fuel or by modulating the fuel blending (e.g. lower sulphur or lower chlorine fuel), the corresponding emissions are reduced</td><td>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.</td></tr>
<tr><td>b.</td><td>Bag filter</td><td>See description in Section 10.8</td><td>Applicable within the constraints given by space availability</td></tr>
<tr><td>c.</td><td>High-performance electrostatic precipitator</td><td>See description in Section 10.8</td><td>Applicable within the constraints given by space availability.</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td>
1. <u>General</u>
• Separate the table in three tables specific to straw, peat and other biomass (DK_146).
• Add scrubber. Some plants have scrubber and ESP (CEPI_79, SE_43).
• Add ESP (UK_03).
2. <u>Fuel choice</u>
• The description refers to sulphur or chlorine but not to ash content or to those components of the fuel which are relevant (Eurelectric_156).
• Change text: By switching to a different fuel or by modulating the fuel blending (e.g. lower ash content), the corresponding emissions are reduced (DK_145).
3. <u>Bag filter</u>
• Generally applicable for new plants. Applicable for existing plants within constraints given by space availability (DK_143).
4. <u>High-performance electrostatic precipitator</u>
• Not applicable burning straw due to ash resistivity (DK_142).
• Generally applicable for new plants. Applicable for existing plants within constraints given by space availability (DK_143).
• ESP for combustion of wood, but not for firing straw (DK_146).
</td></tr>
<tr><td>EIPPCB assessment:</td><td>
1. <u>General</u>
• The proposed structure of the BAT allows the inclusion of applicability restrictions that are fuel-specific, if deemed necessary and supported by the information exchanged. Therefore, it seems unnecessary to create three different tables of techniques.
• Since some techniques used to abate other pollutants (e.g. SO_X) may have an effect on dust emissions (e.g. FGD systems), it seems appropriate to include them in the list of BAT.
2. <u>Fuel choice (a)</u>
• It is expected that dust emissions are more dependent on the ash content of the fuel than on the S or Cl content of the fuel and this could be mentioned in the description of techniques.
3. <u>Bag filter (b)</u>
• Space availability is always a design constraint to decide which technique (or combination of techniques) is most appropriate, not only for existing plants but also for new plants, and this is a site-specific issue. Examples of retrofitted plants with a bag filter are available (e.g. Plant 671).
4. <u>High-performance electrostatic precipitator (c)</u>
• As mentioned above for bag filters, space availability is always a design
</td></tr>
</table>

	constraint to decide which technique (or combination of techniques) is most appropriate, and this is a site-specific issue. • **Ash resistivity is an important parameter to take into account at the design stage of the ESP and/or techniques to increase the dust resistivity (i.e. SO_3 injection). The data collection shows that Plant 31 burns 25 % herbaceous fuel and Plant 686 burns 68 % herbaceous fuel and both are fitted with an ESP. Therefore, a general applicability restriction for plants burning straw does not seem to be justified.** • **The name of the technique could be changed to simply electrostatic precipitator (ESP) as the (high) level of performance of an ESP alone or in combination with other techniques would be determined by the BAT-AELs.**
EIPPCB proposal:	**1. General** • **Keep the list, description and applicability of BAT in one table.** • **Add dry, semi-dry or wet FGD techniques in the list of BAT and add an applicability restriction for wet FGD in plants operated in emergency- or peak-load modes.** **2. Fuel choice (a)** • **Amend the example in the description of the technique to indicate the use of fuels with low ash content.** **3. Bag filter (b)** • **Change the applicability to generally applicable.** **4. High-performance electrostatic precipitator (c)** • **Change the name of the technique to electrostatic precipitator (ESP).** • **Change the applicability to generally applicable.**

1.4.5.2 Table 10.13 – BAT-AELs for dust – solid biomass and/or peat

Location in D1:	*p. 762*
Current text in D1:	**Table 10.13 BAT-associated emission levels for dust emissions to air from the combustion of solid biomass and/or peat**

Type of plant	Pollutant	Unit	Monitoring frequency	BAT-AEL	
				Daily average	Yearly average
New	Dust	mg/Nm³	Continuous measurement	2 – 12	< 1 – 3
Existing				2 – 20	< 1 – 10

Summary of comments:	*1. General* • *Take into account the ranges of rated thermal input (PT_23).* • *The lower end of the ranges should be around 5 mg/Nm³ due to proper calibration (E&P_134, Eurelectric_71_689_955, UK_02, FI_64).* *2. Yearly averages* • *Change to 30 mg/Nm³ (50-100 MW) and to 20 mg/Nm³ (>100 MW) for existing plants (FI_64).* • *Change to 2-30 mg/Nm³ for existing plants (<100 MW) and to 2-20 mg/Nm³ (>100 MW) (CEPI_81).* • *Change to 15 mg/Nm³ with ESP (Eurelectric_150).* • *Existing plants with repetitive quick changes in load: 2-20 mg/Nm3; for old boilers with old ESP up to 30 mg/Nm³ (SE_22).* • *Change to 5 mg/Nm³ for new plants (DK_144).* • *Change to 10 mg/Nm³ for new plants (FI_64).* • *Change to 2-15 mg/Nm³ for new plants. (CEPI_81).* • *Change to 5 mg/Nm³ for new plants with bag filter; 10 mg/Nm³ with ESP (Eurelectric_689, 955).* • *Change BAT-AEL for new plants with repetitive quick load changes (SE_23).* *3. Daily averages* • *Daily for existing plants <=15 mg/Nm³ (AT_74).* • *Daily averages 38 – 47 mg/Nm³ (Eurelectric_150).*

	• *Daily for new <10 mg/Nm^3 (DK_144).* • *Yearly new to 10 (PL_11).* • *Yearly existing to 15 (PL_12).* • *Delete BAT-AEL daily average for process industry (SE_44).* *4. Load mode* • *Include BAT-AELs for each load mode (IE_24).* *5. Monitoring* • *Change the measurement frequency for sources below 100 MWth to twice a year (CZ_146, E&P_144).* • *Should be measured 2 times/year instead of continuously (CEPI_80).* *6. Coal to biomass* • *New and existing coal- or lignite-fired plants shifted to biomass only or biomass co-combustion, in line with the requirements for coal or lignite only (Eurelectric_151, Cefic_07).*
EIPPCB assessment:	**1. General** • **The information has been assessed considering the different sizes of the plants, to be consistent with the assessment and proposals made for other fuels and for other pollutants. Therefore, the following plant categories are proposed for setting BAT-AELs: plants of <100 MW_{th}, plants of 100–300 MW_{th}, and plants of ≥300 MW_{th}. BAT-AELs for new and existing plants are also proposed.** • **The lower end of the BAT-AEL range should take into consideration the fact that the reported values in the questionnaires are around or very close to the limit of detection (LoD) for dust of about 0.3 mg/Nm^3. The limit of quantification LoQ for dust of about 2 mg/Nm^3 seems a more appropriate value for setting the lower end of the BAT-AEL range.** **2. (+3.) Yearly and daily averages** **2.1. Plants of <100 MW_{th}** • **The use of dust abatement techniques are linked to solutions applied to abate other pollutants like SO_X. There are configurations of ESPs applied when using wet flue-gas desulphuration (i.e. Plants 473 and 1002). There are also configurations of bag filters when using DSI (i.e. Plant 125).** • **Around half of the plants in this category reported yearly averages below 5 mg/Nm^3 applying different techniques: bag filters and/or ESP with or without wet flue-gas desulphuration techniques. This value of 5 mg/Nm^3 could be used as the reference for the upper end of the yearly average BAT-AEL range for new plants.** • **Plant 489-1 fitted with a bag filter reported yearly average emissions of around 15 mg/Nm^3 and may be considered the reference for existing plants.** • **With respect to daily averages, one could take as a reference the short-term emissions reported by plants fitted with an ESP in this size category for setting BAT-AELs for existing plants, i.e. 24 mg/Nm^3 (based on Plant 13, 285 MW_{th}) and also consider emissions from plants of 100–300 MW_{th} for setting BAT-AELs for new plants, i.e. 20 mg/Nm^3 (based on Plant 423).** • **Plants from the PP sector, which are expected to have quick changes of load, would meet the proposed BAT-AEL range (i.e. Plants 671 and 672).** **2.2. Plants of 100–300 MW_{th}** • **About half of the plants that report dust emissions in this category are able to achieve emissions below 5 mg/Nm^3 with different combinations of techniques, ESP or bag filter, in combination with wet abatement techniques for desulphuration. This value could be used as the reference for setting the upper end of the yearly BAT-AEL range for new plants.** • **Plant 13, fitted with an ESP, is a plant converted from coal to biomass and reported emissions of around 12 mg/Nm^3. This emission level could be used as the reference for setting the upper end of the yearly BAT-AEL range for existing plants.** • **With respect to daily averages, Plant 190 burning peat and fitted with a bag filter is a reference plant that achieves yearly emissions below the yearly BAT-AEL for new plants and reported short-term emissions around 16 mg/Nm^3, which could be used as the reference for setting the upper end of the daily BAT-AEL range for new plants.** • **For existing plants, Plant 31 (355 MW_{th}) fitted with a combination of an ESP and wet FGD achieves yearly emissions below the yearly BAT-AEL for existing plants in this size category and reported short-term emissions of 18 mg/Nm^3, which could be used as the reference to set the upper end of the daily BAT-AEL range for existing plants.** • **Plants in the PP sector, which are expected to have quick changes of load, would**

	meet the proposed BAT-AEL (i.e. Plants 679 and 677). **2.3. Plants of ≥300 MW_{th}** • **Four plants using an ESP alone or in combination with wet FGD with similar performances to a bag filter reported yearly average emissions of <5 mg/Nm^3, which could be the reference for setting the upper end of the yearly BAT-AEL range for new plants.** • **Plant 31 is a coal plant converted to biomass fitted with an ESP and wet FGD that reported yearly emissions below 10 mg/Nm^3, which could be the reference for setting the upper end of the yearly BAT-AEL for existing plants.** • **Plant 14 achieves yearly emissions below the yearly BAT-AEL for new plants and reported short-term emissions below 10 mg/Nm^3, which could be used as the reference to set the upper end of the daily BAT-AEL range for new plants.** • **Plant 31 achieves yearly emissions below the yearly BAT-AEL for existing plants and reported short-term emissions of 18 mg/Nm^3, which could be used as the reference to set the upper end of the daily BAT-AEL range for existing plants.** **4. Load mode and load factor** • **Almost all the plants in the data collection are baseload operating plants. Two plants operated <4000 hours reported emissions in the proposed BAT-AEL ranges for plants less than 100 MW_{th}. Plants with low (i.e. about 40 %) and high (i.e. more than 100 %) equivalent full load operating factors have emissions within the proposed BAT-AEL ranges.** • **Yearly average BAT-AELs may not be needed for plants operating in emergency- or peak-load modes as the operation throughout the year is limited to 1500 hours.** **5. Monitoring** • **Almost all the plants in the data collection reported monitoring their dust emissions continuously except for four plants. Plants of <100 MW_{th} operated in peak-load or emergency-load modes could have less stringent requirements in terms of monitoring, e.g. periodic monitoring, given their more limited levels of emissions.** **6. Coal to biomass plants** • **There are a number of plants that have converted from coal to biomass that would meet the proposed BAT-AEL (i.e. Plants 670, 378, 29 and 14).**
EIPPCB proposal:	**1. General** • **Propose BAT-AELs for new and existing plants for the following plant categories: plants of <100 MW_{th}, plants of 100–300 MW_{th}, and plants of ≥300 MW_{th}.** • **Propose the lower end of all the BAT-AEL ranges at 2 mg/Nm^3.** **2. (+3.) Yearly and daily averages** **2.1. Plants of <100 MW_{th}** • **Propose a yearly average BAT-AEL for new plants at 2–5 mg/Nm^3.** • **Propose a yearly average BAT-AEL for existing plants at 2–15 mg/Nm^3.** • **Propose a daily average BAT-AEL for new plants at 2–20 mg/Nm^3.** • **Propose a daily average BAT-AEL for existing plants at 2–24 mg/Nm^3.** **2.2. Plants of 100–300 MW_{th}** • **Propose a yearly average BAT-AEL for new plants at 2–5 mg/Nm^3.** • **Propose a yearly average BAT-AEL for existing plants at 2–12 mg/Nm^3.** • **Propose a daily average BAT-AEL for new plants at 2–16 mg/Nm^3.** • **Propose a daily average BAT-AEL for existing plants at 2–18 mg/Nm^3.** **2.3. Plants of ≥300 MW_{th}** • **Propose a yearly average BAT-AEL for new plants at 2–5 mg/Nm^3.** • **Propose a yearly average BAT-AEL for existing plants at 2–10 mg/Nm^3.** • **Propose a daily average BAT-AEL for new plants at 2–10 mg/Nm^3.** • **Propose a daily average BAT-AEL for existing plants at 2–18 mg/Nm^3.** **6. Monitoring** • **Propose continuous monitoring except for plants of <100 MW_{th} operating in emergency- or peak-load mode: periodic measurement.** **7. Load mode and factor** • **For plants operated in emergency- or peak-load modes, propose BAT-AELs only as a daily average or as an average over the sampling period.** **8. Coal to biomass** • **Do not include special considerations for plants that have converted from coal to biomass.**

1.4.6 BAT 30 – Mercury emissions to air

1.4.6.1 BAT conclusion

<table>
<tr><td>Location in D1:</td><td>P.762</td></tr>
<tr><td>Current text in D1:</td><td>30. In order to prevent or reduce mercury emissions to air in the combustion of solid biomass and/or peat, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Activated carbon duct injection</td><td rowspan="2">See descriptions in Section 10.8</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Bag filter</td><td>Generally applicable for new plants. Applicable within the constraints given by space availability in existing plants</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>1. <u>General</u>
• This chapter should discuss BAT regarding PCDD/F emissions from the combustion of solid biomass and peat (AT_75).
• Add new technique: Use of low-Hg fuel (Eurelectric_72_155, E&P_135).
• Add new technique: Use of ESP (Eurelectric_72_ 154_ 360_ 690, E&P_137).
2. <u>Technique a: Activated carbon duct injection</u>
• This technique is not applicable when the fuel mercury content is low (FI_65).
• Review of available data to support the technique (Eurelectric_73).</td></tr>
<tr><td>EIPPCB assessment:</td><td>1. <u>General</u>
• There was a mistake in D1 including the graph regarding dioxins emissions instead of mercury. This will be corrected in the final draft of the BREF.
• The use of low-Hg fuel (i.e. Fuel choice) is a specific technique that can be used to reduce mercury emissions and this should be included in the list of BAT for biomass and/or peat combustion.
• The techniques for mercury abatement may be split into two categories: a list of techniques specifically aiming at reducing mercury emissions (i.e. Use of low-Hg fuel, Activated carbon duct injection), and a list of techniques primarily used to abate pollutants other than mercury and that provide co-benefits with regard to mercury emissions reduction (i.e. Dry, semi-dry or wet FGD system -e.g. sorbent injection, flue-gas condenser, wet scrubber-, bag filter and ESP).
• ESP may be added to the list of techniques used to reduce emissions of pollutants other than mercury but that have co-benefits for reducing mercury emissions.
2. <u>Activated carbon duct injection (a)</u>
• The use of fuels with a low Hg content may not necessitate the use of additional techniques to achieve a low level of mercury emissions. BAT 30 is presented as one or a combination of techniques.
• A number of plants report the use of activated carbon duct injection (e.g. Plants 505 and 125).</td></tr>
<tr><td>EIPPCB proposal:</td><td>1. <u>General</u>
• Split the techniques according to the two following categories:
○ techniques specifically aiming at reducing mercury emissions (i.e. Fuel choice - use of low-Hg fuel- and Activated carbon duct injection);
○ techniques primarily used to abate pollutants other than mercury and that provide co-benefits with regard to mercury emissions reduction (i.e. Bag filter, ESP, and FGD technique).
• Set an applicability restriction for 'Fuel choice' technique associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State.
• Set the applicability of the Activated carbon duct injection technique as generally applicable.
• Set the same applicability restrictions for the Bag filter, ESP and FGD techniques as those set for the use of these techniques for the other pollutants.
2. <u>Activated carbon duct injection (a)</u>
• Keep the technique as a specific technique to reduce mercury emissions.</td></tr>
</table>

1.4.6.2 Table 10.14 – BAT-AELs for mercury – solid biomass and/or peat

<table>
<tr><td>Location in D1:</td><td>P.762</td></tr>
<tr><td>Current text in D1:</td><td>Table 10.14: BAT-associated emission levels for mercury emissions to air from the combustion of solid biomass and/or peat
<table>
<tr><th rowspan="2">Pollutant</th><th rowspan="2">Unit</th><th colspan="2">BAT-AEL</th><th rowspan="2">Monitoring frequency</th></tr>
<tr><th>Average of samples obtained during one year</th></tr>
<tr><td>Mercury</td><td>µg/Nm^3</td><td>< 1 – 5</td><td>Periodic measurement: 1 time/yr</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>1. <u>General</u>
• There are conclusions on mercury but there are no data in the BREF to back this BAT-AEL (UK_4, E&P_138).
• Replace interval limits with an upper limit only. The lower limit of the Hg BAT-AEL is very low (DK_147).
• Remove (E&P_24, CEPI_82, Eurelectric_153) or it should be BAT AEPL (FI_66).
• Not applicable for woody biomass (SE_45, Eurelectric_153).
• Existing biomass installations with flue-gas cleaning achieve <10 µg/Nm^3 (CEPI_83).
• The proposed levels can be achieved with bag house filter, but in the case of existing plants with ESP, the given range is not technically possible (FI_117).
• Set BAT-AEL of 1 - 10 µg/Nm^3 for both new and existing plants (Eurelectric_691, 956).
2. <u>Monitoring</u>
• Do not require periodic measurement once/year. Allow alternative measures such as monitoring of fuel quality or the exemption from measurements in case of low emissions (Eurelectric_152).</td></tr>
<tr><td>EIPPCB assessment:</td><td>1. <u>General</u>
• Information about mercury in Chapter 5 of the BREF has been updated.
• As stated in the BREF Guidance, the environmental performance levels associated with BAT are to be expressed as ranges (rather than as single values) as a range may reflect the differences within a given type of installation that result in variations in the environmental performances achieved when applying BAT.
• For periodic measurements of Hg, EN 13211 was validated for exhaust gases from waste incineration plants in the range of 1–500 µg/m^3. A limit of detection of 2.6 µg/m^3 (calculated for a sample gas volume of 50 l) is also given in the standard. For continuous measurements of Hg, the certified automated measurement system with the lowest certification range is reported to have a repeatability standard deviation at zero point of 0.2 % of the certification range, corresponding to a limit of quantification of 0.08 µg/m^3. Therefore, it seems as if Hg concentrations of < 1 µg/m^3 can be measured in some cases, but that the measurement uncertainty will be higher as such levels are close to the limit of detection/quantification. Commission Implementing Decision 2012/119/EU stipulates in Section 3.3 that it is acceptable to use an expression of the type '< X to Y' (i.e. '< X' for the lower end of the range, Y for the upper end), where the lower end of the range cannot be accurately defined, e.g. when the data reported in the information exchange is close to the detection limit.
• Mercury was considered a key environmental issue at the KOM. As it is an emitted pollutant, BAT-AELs are proposed. Some levels of emissions can be significant, despite the implementation of techniques. In case of low emissions due to low content of mercury in the fuel, the monitoring frequency may be after substantial changes in the type of fuel used.
• All biomass plants reported emissions below the proposed 5 µg/Nm^3.
• The techniques used include specific ones for mercury removal and others that are mainly aiming at reducing other pollutants (e.g. ESP).</td></tr>
</table>

	• **As the proposed BAT-AELs are derived mainly from the performance of plants implementing techniques used for abating other pollutants, and that plants operated in peak- or emergency-load modes may implement different or less efficient techniques, it is proposed that the BAT-AELs do not apply to such existing plants.** **2. Monitoring** • **In the case of very stable processes and low levels of Hg emissions, the monitoring frequency could be reduced.**
EIPPCB proposal:	**1. General** • **Keep the BAT-AELs in a range format.** • **Keep the proposed lower end of the BAT-AEL range to <1 µg/Nm^3.** • **Keep the proposed upper end of the BAT-AEL range at 5 µg/Nm^3.** • **Include a footnote specifying that BAT-AELs do not apply to plants operating in emergency- or peak-load modes.** **2. Monitoring** • **Keep periodic monitoring (once/yr) as generic.** • **Add a footnote allowing the monitoring frequency to be after any significant change of fuel if after the fuel characterisation (see BAT 5), it is demonstrated that the emission levels are consistently within the BAT-AELs set.**

1.4.7 BAT 24 General environmental performance

Location in D1:	*p. 759*
Current text in D1:	**24. In order to improve the general environmental performance of the combustion of solid biomass and/or peat, BAT is to use a combination of the techniques given in BAT 4. and below.**

	Technique	Description	Applicability
a.	Fuel classification based on size and quality	The storage systems control and hold the biomass fuel according to quality and size	Applicable to biomass-fired plants

Summary of comments:	• *Introduce BAT conclusions for the management of pelletised biomass: BAT for biomass handling and storage means the design, construction and operation with all appropriate measures taken to minimize dust generation and to ensure that all dust emissions from all equipment are eliminated as far as possible. The key BAT principles are; dust emissions elimination, not just dust management; minimizing processes leading to fine particles of airborne biomass or local build-ups of dust and minimising dust (or pellet) build up within structures that are then subject to heat, the passage of moving parts or moisture (E&P_112_113_56_57).*
EIPPCB assessment:	• **Fuel classification based on size and quality may be more relevant to the fuel handling than to the general environmental performance. Proposal from the comments are more associated to prevent and/or reduce diffuse dust emissions than improving the general environmental performance of the combustion of solid biomass and/or peat.**
EIPPCB proposal:	• **Remove technique (a). As a consequence, BAT 24 becomes redundant and it is proposed to delete it.**

1.5 Liquid fuel combustion

Location in D1:	*p. 763*
Current text in D1:	Liquid fuels combustion
Summary of comments:	*<u>Cost-benefit impact instead of generally applicable</u>* 1. *Replace 'generally applicable' to allow the cost/benefit (E&P_142, Eurelectric_383, UK_9).* *<u>Emergency- and peak-load plants</u>* 2. *Exclude emergency plants (< 500 h/y) from the scope of the BREF. (E&P_143, EUROMOT_77_ 107, Eurelectric_384, UK_10).* 3. *Limit the applicability and add specific BAT-AEL for plants <1500 h/y (E&P_144, EUROMOT_78_108, Eurelectric_385, UK_11).* *<u>MIS and SIS</u>* 4. *Add a definition of MIS. Refer to the definitions of SIS and MIS located in Directive 2003/54/EC. Plants located in MIS (new and existing) should be excluded from the applicability of BAT conclusions (E&P_145, EUROMOT_80_109, EL_93, Eurelectric_386, UK_12).* 5. *Add definition of SIS. Add specific BAT and BAT-AEL for plants located in SIS (E&P_146, EUROMOT_110, EL_94, Eurelectric_387, UK_13, ES_56, EL_91).* 6. *The choice of liquid fuels of varying quality should be restricted depending on the location of the plant (specifically in small isolated systems) and on the costs associated. (E&P_152, Eurelectric_393, UK_19).* *<u>15-50 MWth</u>* 7. *Include a definition of a small unit (i.e. units between 15 and 50 MWth and covered by the BREF LCP according to the aggregation rule). Excluded them from the applicability of BAT (excepted for specific BAT, like fuel quality) and no CEMS for them (E&P_147, Eurelectric_388, UK_14).* *<u>Liquid biomass</u>* 8. *Expand this section with liquid biomass (E&P_149, Eurelectric_390, UK_16).* *<u>Back-up fuel</u>* 9. *The concept of 'emergency' or 'backup' fuel (<500h) should be considered and introduced within the BREF LCP (E&P_150, Eurelectric_391, UK_17).*
EIPPCB assessment:	**<u>Cost-benefit impact instead of generally applicable</u>** **1. According to the 'BREF Guidance', each BAT conclusion will contain a description of the technique to satisfy the environmental objective/benefit referred to and will include information to assess its applicability in the sector concerned. As long as the technique is already implemented in reference plants of the sector, it may be generally applicable.** **<u>Emergency- and peak-load plants</u>** **2. (+3.) Inclusion of plants operating in emergency- and peak-load mode was agreed in the KOM. Since the techniques proposed as BAT are neither prescriptive nor exhaustive, it is not appropriate to generally exclude those plants. Plants operating in emergency- or peak-load modes may have more emissions in terms of yearly load than other plants operating in mid-merit or baseload modes using the same or different fuels. Therefore, the load mode is systematically assessed for each fuel, type of LCP, pollutant and category when proposing BAT-AELs.** **<u>MIS and SIS</u>** **4. (+5. +6.) SIS was a technical issue on the agenda of the intermediate meeting held in Seville in June 2014. In this meeting, the way forward was concluded on: 1) additional complementary data/information from new and retrofitted engines with SCR on French islands should be submitted as soon as possible, and 2) the TWG will help to identify on the list of submitted questionnaires the ones corresponding to combustion plants located on SIS/MIS. Special conditions expressed in the comments may be considered as local specificities. The data collection includes several plants located on islands and therefore the performance and techniques used in plants located in these areas are taken into account. In general, the emissions from those plants do not show different levels as a result of being located in a small isolated system compared to those located on the mainland.** **<u>15–50 MW_{th}</u>** **7. See Section 1.1.2 of the BP on the scope.** **<u>Liquid biomass</u>**

	8. There is not enough information to expand the section to biomass liquid fuel (only one submitted questionnaire). **<u>'Back-up' fuel</u>** **9. The use of fuel during short periods of time <500h/y as a back-up can be considered as the operational mode of the plant emergency-load mode operation using a given fuel.** **<u>Definition of LFO</u>** **10. 'LFO' has been changed by 'Gas oil' (see Section 2.11 of the BP on definitions).**
EIPPCB proposal:	**<u>Cost-benefit impact instead of generally applicable</u>** **1. Keep the same structure of the BAT, including the possible applicability restrictions within the frame of the BREF Guidance.** **<u>Emergency- and peak-load plants</u>** **2. (+3.) Assess category by category according to the current structure in the liquid fuel combustion for boilers, engines and GT and subsequent categories. Remove from the introduction text to the tables the general statement excluding emergency plants from associated emission levels to BAT.** **<u>MIS and SIS</u>** **4. (+5. +6.) Do not include general exceptions for MIS and/or SIS. Assessed category by category according to the current structure in the liquid fuel combustion for boilers, engines and GT and subsequent categories.** **<u>15–50 MW_{th}</u>** **7. Do not set BAT-AELs for plants between 15 and 50 MW_{th}.** **<u>Liquid biomass</u>** **8. Do not propose BAT-AELs for liquid biomass fuels.** **'<u>Back-up' fuel</u>** **9. Include the use of fuel during short periods of time in the definition of load mode as emergency-load operating mode.** **<u>Definition of LFO</u>** **10. Change the references to 'Gas oil'**

1.5.1 HFO- and/or gas oil-fired boilers

Location in D1:	*p. 763*
Current text in D1:	HFO- and LFO-fired boilers
Summary of comments:	*1. Include the following text: '...these BAT-AELs do not address switching or start-up/shutdown periods' (ES_57).* *2. Split the BAT depending on the different fuels LFO and HFO (CEFIC_11_14_34).* *3. Include reserve plants in this section and set separate BAT-AELs for reserve plants <1500 hrs/year on a 5 years average. (FI_112).* *4. Bring clarifications on peak and emergency plants (FR_ 127)* *5. Exempt plants with minimal operating time <500 hours which only operate to secure the stability of the electricity grid from the BAT requirements (DK_160).* *6. Higher BAT-AEL for peak load plants with limited operation hours or limited residual lifetime should be incorporated in the BAT-conclusions. Daily averages should only apply if the plant is running for 12 hours or more (DK_161).* *7. Replace by combustion of commercial HFO and commercial LFO in boilers (CONCAWE_ 42).*
EIPPCB assessment:	**1. As per IED Article 3(13), the BAT-AELs have been derived for normal operating conditions according to submitted data, so it seems unnecessary to state it explicitly for each and every BAT-AEL of the BAT conclusions.** **2. The use of gas oil instead of HFO may be considered a technique (i.e. fuel choice). Plants using gas oil or HFO alone or a combination of the two are provided in the data collection.** **3. (+4. +5. +6.) At the KOM it was concluded to consider emergency-load, peak-load, mid-merit and baseload plants depending on the time spent in operation during the year (load mode). Reserve boilers, as expressed in the comments, may be considered as plants operating in emergency-load modes.** **7. 'Commercial' fuels and 'non-commercial' fuels with the same characteristics cannot be treated differently.**

EIPPCB proposal:	**1. Do not state explicitly that the BAT-AELs for HFO and gas oil boilers refer only to normal operating conditions.** **2. Do not add different categories depending on the use of gas oil or HFO.** **3. (+4. +5. +6.) Do not add specific considerations for 'reserve boilers' but for load mode operation.** **7. Do not add 'commercial' to HFO/gas oil.**

1.5.1.1 BAT 31 – Energy efficiency

1.5.1.1.1 BAT 31 – Energy efficiency

Location in D1:	*p. 763*
Current text in D1:	**31. In order to increase the energy efficiency of the HFO and LFO combustion in boilers, BAT is to use an appropriate combination of the techniques given in BAT 7 and below:**

	Technique	Description	Applicability
a	Preheating of fuel by using waste heat	See descriptions in Section 10.8	Generally applicable to HFO-fired boiler combustion plants
b	Regenerative feed-water heating by using recovered heat		Generally applicable for new plants, but plant-specific for existing plants
c	Supercritical steam parameters		Applicable to new boilers ≥ 300 MW_{th}
d	Preheating of combustion air by using recovered heat	See description in Section 10.8. If the preheating temperature is higher than 150 ºC, NO_X emissions tend to increase	Generally applicable

Summary of comments:	*General* *1. None of these techniques can be described as 'generally applicable' to existing plants because it may not be physically and/or economically feasible to install them (UK_5) Emergency plants should be excluded from these requirements. For peak load plants the requirement should not be 'general applicable' (Eurelectric_957_692) exclude plants located in SIS (EL_97, Eurelectric_398).* *2. Only applicable to base load plants (E&P_139).* *Technique a:* *3. Remove 'using waste heat' (PL_152).* *4. Change 'Applicable only to new plants under specific conditions, case-by-case' (EL_96, Eurelectric_399).* *Technique b:* *5. Change description of the technique to 'Feed water pre-heating using recovered heat' (FI_67).* *6. Remove 'generally applicable' (PL_153).*
EIPPCB assessment:	**All techniques are already included in BAT 7 and there is no merit to them being repeated in this section. The load/operation mode may influence the energy efficiency of the plant. Listed techniques are applicable to plants operated in emergency- or peak-load modes.**
EIPPCB proposal:	**Remove all the techniques of BAT 31; as a consequence, BAT 31 becomes redundant and it is proposed to delete it.**

1.5.1.1.2 Table 10.15 – BAT-AEELs for energy efficiency – HFO and/or gas oil

<table>
<tr><td>Location in D1:</td><td>p. 763</td></tr>
<tr><td>Current text in D1:</td><td>
Table 10.15: BAT-associated energy efficiency levels in the combustion of HFO and LFO in boilers
<table>
<tr><th colspan="2">Type of combustion plant</th><th>Parameter</th><th>Unit</th><th>BAT-AEPL
(yearly average, LHV basis)</th></tr>
<tr><td rowspan="2">Generating only heat or
CHP plants whose recoverable heat generation does not exceed the heat demand</td><td>New</td><td rowspan="2">Net total fuel utilisation</td><td rowspan="4">%</td><td>> 90</td></tr>
<tr><td>Existing</td><td>80 to above 96</td></tr>
<tr><td rowspan="2">Generating only power or CHP plants whose recoverable heat generation exceeds the heat demand</td><td>New</td><td rowspan="2">Net electrical efficiency</td><td>above 38</td></tr>
<tr><td>Existing</td><td>30 to above 38</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td>
1. Include text to state that current BAT Conclusions are only applicable to base load plant. Conclusion needs to be based on the preceding text in section 6.3.2.2. (E&P_14, Eurelectric_694_UK_7).
2. Exclude emergency plants (existing or new) and existing peak load plants. For old-fashion existing power plants of small size (below 50 MWth), net efficiencies are below 30 % Change the lower efficiency limit to 26 % or limit the applicability of these energy efficiency requirements. (Eurelectric_400).
3. Change of lower efficiency limit for existing plants to 26 % (EL_98).
4. The specified energy efficiency levels may not be feasible for low load plants (UK_8).
</td></tr>
<tr><td>EIPPCB assessment:</td><td>
<u>General</u>
• Values proposed in D1 were based on yearly averages from the collected data. As per the assessment made in Section 1.1.5 of this BP, it is now proposed to define design-based BAT-AEELs.
• Special provisions for plants operating in emergency- and peak-load modes are assessed in Section 1.1.3 of this BP.
<u>Net electrical efficiency</u>
• According to the available data, design values for net electrical efficiency reported by 5 plants commissioned up to and including 2010 were in the range of 35.6–37.4 %.
• Performance values for net electrical efficiency reported by the plants from the data collection generating only power or CHP are in the range of 26 % to 38 %.
<u>Net total fuel utilisation</u>
• No design values' Net total fuel utilisation is reported by the TFEE.
</td></tr>
<tr><td>EIPPCB proposal:</td><td>
• Change the proposed BAT-AEEL on net electrical efficiency for existing plants to design values of 35.6–37.4 %.
• Change the proposed BAT-AEEL on net electrical efficiency for new plants to design values of > 37.4 %.
• Keep the proposed BAT-AEEL on net total fuel utilisation for new and existing plants at design values of 80–96 %.
• Add a footnote to the BAT-AEELs on net total fuel utilisation indicating that the levels may not be achievable in the case of an excessively low potential heat demand.
• Add a footnote indicating that the BAT-AEELs do not apply in the case of plants operated in peak- or emergency-load modes.
</td></tr>
</table>

1.5.1.2 BAT 32 – NO_X, NH_3 and CO emissions to air

1.5.1.2.1 BAT conclusion

Location in D1:	*p. 764*

32. In order to prevent and reduce NO_X, NH_3 and CO emissions to air from HFO- and LFO-fired 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	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
b	Steam injection	See description in Section 10.8	Generally applicable
c	Air staging	See description in Section 10.8	Generally applicable
d	Fuel staging (reburning)	See description in Section 10.8	Generally applicable
e	Flue-gas recirculation	See description in Section 10.8	Generally applicable
f	Dry low NO_X burners	See description in Section 10.8	Generally applicable
g	Advanced computerised process control	See description in Section 10.8	Generally applicable
h	SCR	See description in Section 10.8	Not applicable to emergency mode
i	SNCR	See description in Section 10.8	Generally applicable

Summary of comments:

1. *General*
   - 1.1. *Exclude small (<50 MW_{th}), emergency (<1.500 hours) and low load factor plant (E&P_157, Eurelectric_669, UK_24).*
   - 1.2. *Exclude emergency plant. (Eurelectric_401, EL_100).*
   - 1.3. *Delete NH_3 in the title. There is no technique for NH_3 reduction (DK_162).*
2. *Techniques*
   - 2.1. *Technique a: Fuel choice*
     - *Remove technique. This technique is primarily used to reduce acidic gases (DK_ 163).*
   - 2.2. *Technique b: Steam injection*
     - *Change applicability to generally applicable for existing plants (PL_154).*
     - *Replace technique with Low air preheation. (DK_ 164).*
   - 2.3. *Technique c: Air staging*
     - *Air staging is not generally applicable (CONCAWE _44).*
   - 2.4. *Technique d: Fuel staging (reburning)*
     - *Add in the applicability 'Fuel staging for liquid firing may require a specific burner design' (CEFIC_229).*
     - *Fuel staging is not generally applicable (Concawe_45).*
   - 2.5. *Technique e: Flue-gas recirculation*
     - *FGR is not applicable when burning HFO (CEFIC_11).*
     - *Applicable through the use of specific burners with internal recirculation of flue-gas. Applicability may be restricted to retrofitting external flue-gas recirculation to units with forced/ induced draught mode of operation (CEFIC_230).*
     - *Add 'Generally applicable to new plants. Applicable to existing plants within the constraints given by boiler size and design, as well as chemical installation safety'. (CONCAWE _43).*
     - *Generally applicable. For retrofitting existing plants the energy efficiency can be reduced (DK_ 165).*
   - 2.6. *Technique f: Dry low-NO_X burners*
     - *Generally applicable. Retrofitting existing plants depends on adequate space in the combustion chamber (DK_166).*

	• *Applicability may be restricted for retrofitting existing plants where complexity depends on site specific conditions e.g. furnaces design, surrounding devices. (CEFIC_232).* *2.7. Technique h: SCR* • *Not applicable to emergency plants and to existing utility boilers where HFO is used as back up fuel or where the flue-gas duct cannot be modified. Retrofitting existing plants may be constrained or limited due to boiler design constraints (CEFIC_12_ 233, CONCAWE_46).* • *Add in the applicability restriction: '…and to plants that are installed in small isolated systems' (EL_99).* • *Not applicable to peak-load plants. (FI_68, Eurelectric_964).* • *Not applicable in MIS and in SIS without adapted infrastructure. (Eurelectric_401, EL_100)* *2.8. Technique i: SNCR* • *Retrofitting existing plants may be constrained or limited due to boiler design constraints. (CEFIC_13, CONCAWE_47)* • *Generally applicable for new plants. The applicability for retrofitting an existing plant may be constrained by the temperature window and the residence time (CEFIC_234).* • *Not applicable to emergency plants (DK_167, CONCAWE_47) to peak-load plants. (FI_68, Eurelectric_964) plants located in MIS and in SIS without adapted infrastructure. (Eurelectric_401, EL_100).*
EIPPCB assessment:	**1. General** **1.1. (+1.2.) Plants of <50 MW_{th} are not in the scope of the BREF (see Section 1.1.2 of the BP on scope), plants working <1500 hours (e.g. Plant 498) and plants reported as located in SIS (e.g. Plant 175) are fitted with different techniques mentioned in BAT 32.** **1.3. The purpose of BAT 32 is to prevent or reduce NO_X emissions to air while limiting CO and NH_3 emissions to air. A general new BAT on NH_3 emissions is added.** **2. Techniques** **2.1. Fuel choice (a)** • **One of the sources of NO_X emissions in flue-gases is the oxidation of the fuel-N. Nitrogen content for the HFO plants of the data collection is in a range 0.05 to 0.7 wt-%.** **2.2. Steam injection (b)** • **A number of plants of the data collection report the use of steam injection (i.e. Plants 262, 263, 468). As long as the techniques are not prescriptive, if the technique is fitted in existing plants, it may also be available for new plants, considering that only applying this technique would not be enough to achieve the BAT-AELs proposed for new plants.** • **'Low air preheation' technique is not reported in any submitted plant. There is not available information. The description of the steam injection technique in Section 10.8 of the BAT conclusions is modified to include the application of steam addition for boilers.** • **Steam injection can be included a more general technique, which is 'water/steam addition' technique. Applicability restrictions due to the availability of water may be added.** **2.3. Air staging (c)** • **The installation of the air staging technique entails design considerations that are not applicability restrictions per se. A number of plants provided in the data collections are fitted with air staging (e.g. Plants 498 and 258).** **2.4. Fuel staging (reburning) (d)** • **The installation of the fuel staging technique also entails design considerations that are not applicability restrictions per se. Plants provided in the data collections are fitted with fuel staging (e.g. Plants 70 and 83).** • **For consistency with other sections, the name of the technique could be 'Fuel staging'.** **2.5. Flue-gas recirculation (e)** • **A number of plants in the data collection (e.g. Plants 258 and 259) report the use of flue-gas recirculation. Not enough information is provided in the comments to propose applicability restrictions.** • **Flue-gas in this document refers to flue-gas from the combustion plant. The installation of the flue-gas recirculation technique entails design considerations**

	that are not applicability restrictions per se. **2.6. Dry low-NO_X burners (f)** • **The dry low-NO_X burners technique is renamed Low-NO_X burners technique (LNB) in the BREF and BAT conclusions.** • **Some plants of the data collection report the use of LNB (e.g. Plants 28 and 83).** • **The installation of the air staging technique entails design considerations that are not applicability restrictions per se.** **2.7. SCR (h)** • **The use of fuel during short periods of time <500h/y as a back-up can be considered as the operational mode of the plant emergency-load mode operation using a given fuel.** • **There are six plants fitted with SCR in the data collection. Four of them are located in Sicily and the other two are not located in SIS. Three of them are plants operating in peak-load mode. All of them are plants of ≥100 MW_{th}.** • **Applicability restrictions for plants operating in emergency-load mode and the retrofit of existing plants operating in peak-load mode may be justified by the available information.** **2.8. SNCR (i)** • **Even if there is no plant in the data collection fitted with this technique the installation of SNCR plants in two existing heavy fuel oil-fired boilers (32 MW_{th}) AarhusKarlshamn Denmark A/S show that the technique is available.** • **The negative impact of load variations and boiler design can be offset by acting on the reagent type or droplet size, and/or the number of levels of reagent injection. These parameters may however influence the achievable NO_X removal. If needed, this technique may also be combined with a slip catalyst. However, the combination with a slip catalyst may not be cost-effective in the case of plants operated in emergency- and peak-load modes.**
EIPPCB proposal:	**1. General** **1.1. (+1.2.) Do not include any general exclusion from the list of techniques due to size, load factor or location in SIS/MIS.** **1.3. Change the statement of BAT 32 to: 'In order to prevent and/or reduce NO_X emissions to air while limiting CO emissions to air in the combustion of HFO and/or gas oil in boilers, BAT is to use one or a combination of the techniques given below'.** **2. Techniques** **2.1. Keep technique (a) as it is.** **2.2. Change the name of the technique to 'Water/steam addition' including an applicability restriction due the availability of water.** **2.3. Keep technique (c) as it is.** **2.4. Keep technique (d) as it is.** **2.5. Change the name of the technique 'Fuel staging (reburning)' to 'Fuel staging'.** **2.6. Dry low-NO_X burners (f)** • **Change the name of the technique to Low-NO_X burners (LNB)** **2.7. SCR (h)** • **Add an applicability restriction for plants operating in emergency-load mode.** • **Add an applicability restriction for the retrofit of existing plants operating in peak-load mode.** • **Add an applicability restriction for plants of <100 MW_{th}.** **2.8. SNCR (i)** • **Add an applicability restriction in the case of plants operated in emergency- or peak-load modes with highly variable boiler loads.** **2.9. Advanced computerised process control (g)** • **Change the name of the technique to 'advanced control system' and its applicability for consistency throughout the BREF.**

1.5.1.2.2 Table 10.16 – BAT-AELs for NO_X, NH_3 and CO – HFO and/or gas oil

1.5.1.2.2.1 Table 10.16 – General

<table>
<tr><td>Location in D1:</td><td>p. 764</td></tr>
<tr><td>Current text in D1:</td><td>
Table 10.16: BAT-associated emission levels for NO_X NH_3 and CO emissions to air from the combustion of HFO and LFO in boilers
<table>
<tr><th colspan="2" rowspan="2">Type of combustion plant</th><th rowspan="2">Pollutant</th><th rowspan="2">Unit</th><th rowspan="2">Monitoring frequency</th><th colspan="2">BAT-AEL</th></tr>
<tr><th>Yearly average</th><th>Daily average</th></tr>
<tr><td rowspan="2">< 100 MW_{th}</td><td>Existing</td><td rowspan="4">NO_X</td><td rowspan="6">mg/Nm^3</td><td rowspan="6">Continuous measurement</td><td>75 – 270</td><td>ND</td></tr>
<tr><td>New</td><td>75 – 200</td><td>ND</td></tr>
<tr><td rowspan="2">≥ 100 MW_{th}</td><td>Existing</td><td>45 – 110</td><td>85 – 145</td></tr>
<tr><td>New</td><td>45 – 75</td><td>85 – 100</td></tr>
<tr><td colspan="2" rowspan="2">All</td><td>NH_3 ([1])</td><td>< 1 – 5</td><td>ND</td></tr>
<tr><td>CO</td><td>1 – 20</td><td>ND</td></tr>
<tr><td colspan="7">N.D. not determined
([1]) Ammonia emissions are associated with the use of SCR or SNCR</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td>
1. <u>General</u>
• Add before the HFO and LFO the word 'commercial' (SK_16).
• Ranges not consistent with the IED (50 to 100, 100 to 300, >300 MWth.) (EPPSA_393).
• Do a reassessment. There are few reference plants. Consider N-content of the fuel (CEFIC_14).
• When firing GTs on gas and gas oil together, use the LFO ELVs (E&P_148, UK_1).
2. <u>Monitoring</u>
• Monitoring based on thermal input (>100, 50-100 and <50 MW) (CEFIC_235).
• Only applicable to baseload operation. Continuous monitoring for boilers on standby fuels not appropriate (CEPI_85, E&P_161, UK_3).
• No continuous monitoring for emergency and peak-load plants (Eurelectric_696_961_406).
3. <u>Load mode</u>
• BAT-AELs only applicable to base load plant (E&P_160, UK_2).
• Add separate BAT-AELs for reserve use plants and peak load plants (CEPI_84) specific category for plants operating < 1500 h (FR_129).
• General exemption for emergency plants. Derogation for auxiliary boilers and peak load plants < 1500 h/year (Eurelectric_696_961_402_406).
4. <u>Small isolated systems (SIS)</u>
• Add a derogation for boilers located in SIS (Eurelectric_402).
• Add in the heading of the table: '...and that are not installed in small isolated systems...' (EL_101).
</td></tr>
<tr><td>EIPPCB assessment:</td><td>
1. <u>General</u>
• 'Commercial' fuels and 'non-commercial' fuels with the same characteristics cannot be treated differently.
• Ranges are defined based on the analysis of the provided plants' performance.
• The main parameters of the reference plants provided in the data collection depending on the pollutant are considered in the assessment, including the N content of the fuel. There is no clear correlation between this parameter and the NO_X emissions reported by the plants of the data collection.
• Since it is a common practice in several plants, a specific section in the BAT conclusions on multi-fuel firing simultaneously is added.
2. <u>Monitoring</u>
• The monitoring frequency is assessed for each size category, taking into consideration the load mode operation of the plant and the fuels used.
3. <u>Load mode</u>
• Plants operating less than 1500 hours may be excluded for the yearly average and only apply the daily average.
4. <u>Small isolated systems (SIS)</u>
• In the case of plants of <100 MW_{th}, none of them report in the questionnaire being located in SIS and in the case of plants of more than 100 MW_{th}, only Plant 175 reports that is located in a SIS, Crete. Plants located in Sicily (i.e. Plant 258) report a better performance regarding NO_X emissions than mainland plants. Plants 199 and 200 located in Sardinia do not link their emissions to their geographical position.
</td></tr>
</table>

EIPPCB proposal:	**1. General** • **Do not add 'commercial' to HFO and gas oil.** • **Keep the size categories in plants of <100 MW_{th} and plants of ≥100 MW_{th}.** • **Add a new section on multi-fuel-firing simultaneously.** **2. Monitoring** • **Analyse the monitoring for each category.** **3. Load mode** • **Include footnote excluding plants operating less than 1500 hours from the yearly average and only apply the daily average.** **4. Small isolated systems (SIS)** • **Do not include special considerations for SIS.**

1.5.1.2.2.2 Table 10.16 – BAT-AELs for NO_X – HFO and/or gas oil

Location in D1:	*p. 764*
Current text in D1:	**Table 10.16: BAT-associated emission levels for NO_X NH_3 and CO emissions to air from the combustion of HFO and LFO in boilers**

Type of combustion plant		Pollutant	Unit	Monitoring frequency	BAT-AEL	
					Yearly average	Daily average
< 100 MW_{th}	Existing	NO_X	mg/Nm^3	Continuous measurement	75 – 270	ND
	New				75 – 200	ND
≥ 100 MW_{th}	Existing				45 – 110	85 – 145
	New				45 – 75	85 – 100
N.D. not determined						

Summary of comments	*1. General* • *Reassess BAT-AELs for NO_X (FR_128).* *2. Less than 100 MWth - Yearly average* • *<350 mg/Nm^3 for plants <50 MW_{th} (Eurelectric_697_962).* • *<300 mg/Nm^3 for plants <50 MW_{th} (Eurelectric_405).* • *Change the range to (75-350) for existing plants (SK_5).* • *(300-400) for existing; (200-300) for new; 450 for peak-load and emergency (FI_69).* • *<400 mg/Nm3 for new and existing (EL_102).* • *400 mg/Nm3 (3 % O_2) monthly for boilers in SIS (Eurelectric_402).* • *270 mg/Nm3 for new (CEFIC_6).* *3. Less than 100 MWth – Daily average* • *Provide BAT-ELs for existing plants <100 MW_{th}: 50 - 300 mg/Nm^3 (AT_49).* • *Provide BAT-ELs for new plants <100 MW_{th}: 50 - 220 mg/Nm^3 (AT_50).* • *<440 mg/Nm3 for new and existing SIS (EL_102).* *4. More or equal to 100 MWth - Yearly average* • *Change range to (45-200) for existing plants (SK_7).* • *(150-200) for existing; (100-150) for new; 450 for peak-load and emergency (FI_69).* • *<400 mg/ for new and existing plants located in SIS (EL_102).* • *400 mg/Nm3 (3 % O_2) monthly for boilers in SIS. (Eurelectric_402).* *5. More or equal to 100 MWth - Daily average* • *Change range to (85-250) for existing plants (SK_6).* • *<440 mg/ for new and existing plants located in SIS (EL_102).* *6. Monitoring frequency* • *No CEMS for boilers < 100 MWth (Eurelectric_402).* • *No CEMS for boilers <50 MWth (Eurelectric_962_405, E&P_158_162, UK_4_25).* • *Twice per year for boilers <100 MWth (CZ_149, E&P_147).* • *No continuous monitoring for LFO-fired peak load boilers <50 MWth and <1500 hours (ETN_44).* • *Periodic monitoring for peak-load and emergency (FI_69).*
EIPPCB assessment:	**1. General** • **Reassessment of BAT-AELs is based on the available techno-economic information; information exchange provided with the comments and achieved performances from the plant-specific data collected through the questionnaires.**

	2. Plants of <100 MW_{th} - Yearly average • **Six out of nine plants of the data collection included in this category are of <50 MW_{th}. All plants are fitted only with primary techniques. None of these plants report in the questionnaires being located in small isolated systems.** • **Plants fitted only with primary techniques and using fuel with a low nitrogen content are the reference for this size category. Plant 83, achieving yearly average NO_X emissions of < 200 mg/Nm^3 is the reference for setting the upper end of the BAT-AEL range for new plants. Plant 28 (110 MW_{th}) reports a yearly average of 74 mg/Nm^3 burning gas oil and is the reference for setting the lower end of the BAT-AEL range for new plants.** • **Plant 412-1, reporting NO_X emissions of 265 mg/Nm^3, is the reference for setting the upper end of the BAT-AEL range for existing plants. Plant 83 reported 150 mg/Nm^3 as one NO_X emissions measurement and that is taken the reference for setting the lower end of the BAT-AEL range.** **3. Plants of <100 MW_{th} – Daily average** • **Daily averages for new plants are based on the short-term emissions reported by reference plants considered for the long-term averages (i.e. Plants 83 and 28). The maximum emission reported by Plant 83, i.e. slightly below 215 mg/Nm^3, is the reference for setting the upper end of the range, and the emission reported by Plant 28, i.e. 100 mg/Nm^3, for the lower end of the range.** • **Daily averages for existing plants are also based on the reference plants for yearly averages (i.e. Plant 412-2). The upper end of the BAT-AEL range for new plants is based on the same variability observed in the emissions reported by Plant 28 applied to the yearly average emissions reported by Plant 412-2, that is 365 mg/Nm^3. Plant 83 reporting maximum emissions of 210 mg/Nm^3 is the reference for setting the lower end of the BAT-AEL range for existing plants.** **4. Plants of ≥ 100 MW_{th} - Yearly average** • **The assessment is based on the performance of 19 submitted plants that reported yearly averages between 46 and 511 mg/Nm^3. Four plants have a capacity between 100 and 300 and report yearly averages in a range of 74 to 406 mg/Nm^3, therefore both categories 100–300 MW_{th} and ≥ 300 MW_{th} may be kept as one category for plants ≥ 100 MW_{th}. Only one plant reports being located in SIS in the questionnaire, i.e. Plant 175 located in Crete. It is stated in the questionnaire that the levels are high because of the N content of the fuel. Other plants located in Sicily (e.g. Plant 258) report a better performance regarding NO_X emissions than mainland plants.** • **Plants 258 and 259 using SCR and Plant 28 using LNB and fuel choice are the reference plants for setting the BAT-AEL range for new plants. These plants achieve emissions between 45 and 75 mg/Nm^3.** • **Plant 468 reporting yearly average emissions of 110 mg/Nm^3 is the reference plant for setting upper end of the BAT-AEL range for existing plants.** **5. Plants of ≥=100 MW_{th} - Daily average** • **The daily BAT-AEL range for existing plants is based on the short-term emissions achieved by Plant 262, i.e. 145 mg/Nm^3, and Plant 258, i.e. 85 mg/Nm^3.** • **The daily BAT-AEL range for new plants is based on the short-term emissions achieved by Plant 28, i.e. 100 mg/Nm^3, and Plant 258, i.e. 85 mg/Nm^3.** **6. Monitoring frequency** • **All the plants except one that has a capacity of less than 100 MW_{th} monitor NO_X emissions periodically. NO_X emissions need to be controlled continuously in the case of using secondary abatement techniques for their proper operation. In the case of plants of <100 MW_{th} operating less than 1500 hours, where less emission in terms of load are expected over the course of the year, the monitoring may be periodic.**
EIPPCB proposal:	**1. General** • **Reassessment has been done.** **2. Less than 100 MW_{th} – yearly average** • **Keep the proposed yearly BAT-AEL range for new plants at 75–200 mg/Nm^3.** • **Change the proposed yearly BAT-AEL range for existing plants to 150–270 mg/Nm^3.** **3. Less than 100 MW_{th} – daily average** • **Propose a daily BAT-AEL range for new plants of 100–215 mg/Nm^3.** • **Propose a daily BAT-AEL range for existing plants of 210–365 mg/Nm^3.** **4. More or equal than 100 MW_{th} - yearly averages** • **Keep the proposed yearly BAT-AEL range for new plants at 45–75 mg/Nm^3.** • **Keep the proposed yearly BAT-AEL range for existing plants at 45–110 mg/Nm^3.** **5. More or equal than 100 MW_{th} – daily average** • **Keep the proposed daily BAT-AEL range for new plants at 85–100 mg/Nm^3.** • **Keep the proposed daily BAT-AEL range for existing plants at 85–145 mg/Nm^3.**

	6. Monitoring frequency • **Keep continuous monitoring for plants of 50–100 MW_{th}.** • **Add a footnote for plants of < 100 MW_{th} operated in peak- or emergency-load modes mentioning the possibility of periodic monitoring with 2 samples/yr (for peak-load plants) and 1 sample/yr (for emergency-load plants) respectively.** • **Add in the heading of the NO_X BAT-AEL for daily average: 'or average over the sampling period'.**

1.5.1.2.2.3 Table 10.16 – BAT-AELs for CO – HFO and/or gas oil

<table>
<tr><td>Location in D1:</td><td>p. 764</td></tr>
<tr><td>Current text in D1:</td><td>Table 10.16: BAT-associated emission levels for NO_X NH_3 and CO emissions to air from the combustion of HFO and LFO in boilers
<table>
<tr><th rowspan="2">Type of combustion plant</th><th rowspan="2">Pollutant</th><th rowspan="2">Unit</th><th rowspan="2">Monitoring frequency</th><th colspan="2">BAT-AEL</th></tr>
<tr><th>Yearly average</th><th>Daily average</th></tr>
<tr><td>All</td><td>CO</td><td>mg/Nm^3</td><td>Continuous measurement</td><td>1 – 20</td><td>ND</td></tr>
<tr><td colspan="6">N.D. not determined</td></tr>
</table></td></tr>
<tr><td>Summary of comments</td><td>1. Yearly average
• Increase to 175 mg/m^3 (CZ_150, E&P_148).
• Distinguish in new and existing plants. The proposed CO BAT-AEL should only be applicable for new plants - although 50 mg/m^3 appears to be more appropriate. For existing plants (regardless of size) the upper BAT-AEL for CO should be 80 mg/m^3 (Eurelectric_695).
• Include additional size category for plants < 50 MW_{th} upper BAT-AEL of 80 mg/m^3 for CO (Eurelectric_697_962).
• Include additional size category for plants < 50 MWth upper BAT-AEL of 100 mg/m^3 for CO (Eurelectric_405).
• Modify range to 1- 50 mg/Nm3. The CO emission may increase when steam injection is used. Most of the plants apply combustion process control (CEFIC_238).
• Differentiate between new and existing plants for all size categories. 50 mg/m³ for new; 80 mg/m³ for existing (Eurelectric_970_404).
• CO BAT-AEPL 30-100 existing; 20-100 new; peak-load and emergency 200 (FI_69).
2. Daily average
• Provide short-term averages (AT_48).</td></tr>
<tr><td>EIPPCB assessment:</td><td>1. Yearly average
• CO is one of the environmental parameters that the TWG decided to focus on at the KOM.
• Due to trade-offs between NO_X and CO, priority is given to NO_X reduction in this review. Subsequently, CO levels and corresponding techniques are derived based on the set of well performing plants in terms of NO_X emissions.
• As NO_X emissions are assessed depending on the size of the plants, it is consistent to analyse CO emissions in the same size categories. For plants of < 100 MW_{th}, almost all the plants that report NO_X emissions below the proposed BAT-AELs for NO_X report CO emissions below 31 mg/Nm^3. For plants of ≥ 100 MW_{th}, all the plants report less than 20 mg/Nm^3.
• Since short-term BAT-AELs for CO are not proposed (see point 2. below), the long-term CO BAT-AELs do not cover plants operating in emergency- or peak-load modes.
2. Daily average
• Only a yearly average is proposed for BAT-AELs for CO, due to the trade-offs between NO_X and CO, considering the possible variations of the combustion.
3. Monitoring frequency
• In line with the monitoring of NO_X emissions in the case of plants of < 100 MW_{th} operating less than 1500 hours, where less emission in terms of load are expected over the course of the year, the monitoring may be periodic.</td></tr>
<tr><td>EIPPCB proposal:</td><td>1. Yearly average
• Change the proposed yearly average BAT-AEL range for plants of < 100 MW_{th} to 1–30 mg/Nm^3.
• Propose yearly average BAT-AEL range for plants of ≥ 100 MW_{th} to 1–20 mg/Nm^3.</td></tr>
</table>

	• **Do not apply CO BAT-AELs for peak- and emergency-load modes.** **2. <u>Daily average</u>** • **Do not set a daily average.** **3. <u>Monitoring frequency</u>** • **Keep continuous monitoring for plants of 50–100 MWth.** • **Add a footnote for plants of < 100 MWth operated in peak- or emergency-load modes mentioning the possibility of periodic monitoring with 2 samples/yr (for peak-load plants) and 1 sample /yr (for emergency-load plants) respectively.**

1.5.1.2.2.4 Table 10.16 – BAT-AELs for NH_3 – HFO and/or gas oil

<table>
<tr><td>Location in D1:</td><td>p. 764</td></tr>
<tr><td>Current text in D1:</td><td>Table 10.16: BAT-associated emission levels for NO_X NH_3 and CO emissions to air from the combustion of HFO and LFO in boilers
<table>
<tr><th rowspan="2">Type of combustion plant</th><th rowspan="2">Pollutant</th><th rowspan="2">Unit</th><th rowspan="2">Monitoring frequency</th><th colspan="2">BAT-AEL</th></tr>
<tr><th>Yearly average</th><th>Daily average</th></tr>
<tr><td>All</td><td>NH_3 ([1])</td><td>mg/Nm^3</td><td>Continuous measurement</td><td>< 1 – 5</td><td>ND</td></tr>
<tr><td colspan="6">N.D. not determined
([1]) Ammonia emissions are associated with the use of SCR or SNCR</td></tr>
</table></td></tr>
<tr><td></td><td>1. <u>Yearly average.</u>
• Increase the upper limit for the annual average emissions to 25 mg/Nm^3 (CZ_150, E&P_148).
• Change to <20 mg/Nm^3 (CEFIC_6).
• Modify range to < 5-15 mg/Nm^3. The ammonia slip is typically in the range of 2 – 10 ppm (1.4-7 mgNm^3) for SCR and for SNCR is in the range of 5 – 20 ppm (3 – 14 mg/Nm^3) (CEFIC_237).
• D1 proposed BAT-AELs are ok for SCR but when SNCR is used then < 10 mg/Nm^3 (E&P_27, SE_64).
• Delete or set 15 mg/m^3. (Eurelectric_698_963_403).
• Change the range to 2 - 12 mg/Nm^3 (SK_18).
2. <u>Daily average</u>
• Provide short-term averages. <1 - 8 mg/Nm^3 (AT_48).
• <20 mg/Nm3 when using SNCR (SE_64).
3. <u>Monitoring</u>
• The continuous monitoring is only relevant if operating a SCR/SNCR. (DK_168)
• Continuous or periodic (Eurelectric_698_963_403).</td></tr>
<tr><td>EIPPCB assessment:</td><td>1. <u>Yearly average</u>
• NH_3 emissions are mainly reported by plants of the data collection of more than 100 MW_{th}. The highest values are reported when they are fitted with SCR and all are below 5 mg/Nm^3. There is no plant in the data collection fitted with SNCR. Higher values than those reported using SCR are expected when using SNCR.
2. <u>Daily average</u>
• NH_3 is considered a less important pollutant in this review than NO_X, therefore only yearly averaging periods are proposed for BAT-AELs to give more flexibility in the operation of the plant on a short-term basis.
3. <u>Monitoring</u>
• NO_X emissions are proposed to be monitored continuously and the performance of the SCR and SNCR is linked to the use of ammonia. To keep the NO_X emissions below a certain level, continuous monitoring is proposed. One out of six plants applying SCR that provide NH_3 emissions values report them as continuous measurements.
• Plants fitted with dedusting devices along with wet flue-gas desulphuration may have very low levels of NH_3, thus the requirement for NH_3 monitoring could be lower in such cases.</td></tr>
</table>

EIPPCB proposal:	**1. Yearly new and existing plants** • **Propose yearly average BAT-AEL range of <5 – 10 mg/Nm^3.** • **Change footnote mentioning that the BAT-AEL for NH_3, and NH_3 monitoring are only applicable when the techniques SNCR and/or SCR are used.** • **The proposed BAT-AEL for NH_3 emissions to air is shown in BAT 4 bis** **2. Daily new and existing plants** • **Do not include a daily average BAT-AEL.** **3. Monitoring** • **Add a footnote mentioning the possibility to apply periodic monitoring (at least once/yr) when using dedusting and wet abatement techniques and the levels of NH_3 are well within the proposed BAT-AELs.**

1.5.1.3 BAT 33 – SO_X, HCl and HF emissions to air

1.5.1.3.1 BAT 33 – SO_X, HCl and HF emissions to air

Location in D1:	*p. 764*
Current text in D1:	**33. In order to prevent or to reduce SO_X, HCl and HF emissions to air from the combustion of HFO- and LFO-fired 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	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
b	Flue-gas condenser	See description in Section 10.8	Applicable to plants serving a district heating network
c	Wet FGD	See description in Section 10.8	Applicable to plants > 100 MW_{th}
d	DSI (Dry in-duct sorbent injection)	See description in Section 10.8. Commonly used in plants below 300 MW_{th}, in combination with a dedusting device (ESP, fabric filter)	Generally applicable
e	Spray-dry absorber (SDA)	See description in Section 10.8	Generally applicable to the combustion of fuels with a low or moderate sulphur content
f	Seawater FGD	See description in Section 10.8	Applicable to plants > 100 MW_{th}

Summary of comments:

1. General

1.1. Small <50 MW_{th} and emergency plants should be excluded from these requirements. Apart from fuel choice, none of the SO_2, HCl or HF control techniques are 'generally applicable' to existing plants below 50 MWth capacity and/or operating less than 1500 hours (UK_5, E&P_163, Eurelectric_703_966).

1.2. Exclude emergency plants. Secondary flue-gas treatments are not applicable in MIS and SIS without good infrastructures, for existing peak load plants and for small boilers (Eurelectric_407).

2. Techniques

2.1. Technique b: Flue-gas condenser

- *Add in applicability: there may be corrosion issues (CEFIC_239).*

2.2. Technique c: Wet FGD

- *FGD systems are not applicable to emergency plants and to existing utility boilers where HFO is used as back up fuel or where the flue-gas duct cannot be modified or where there are constraints given by space availability (CEFIC_15).*
- *Generally applicable for a new plant > 100 MW_{th}. For existing plants, the applicability of the technique may require significant space availability and/or complicated modifications to existing flue-gas piping systems (CEFIC_240, CONCAWE_49).*

2.3. Technique d: DSI (Dry in-duct sorbent injection)

	• *Modify description. ESP and fabric filters are not technically applicable for HFO firing boilers (FI_71).* • *Modify comment in applicability. Generally applicable for a new plant. Retrofitting to existing plants can be difficult because of space requirement for dedusting devices. (CEFIC_241) Constraints given by duct configuration, space availability, as well as installation safety (CONCAWE_48).* *2.4. Technique e: Spray-dry absorber (SDA)* • *Only for small plants. Limited if regenerated by-products can be sold. Retrofitting difficult due to the space for the absorber and dedusting devices (CEFIC_242).* *2.5. Technique f: Seawater FGD* • *Generally applicable for a new plant > 100 MW_{th}. For existing plants, the applicability of the technique may require significant space availability and/or complicated modifications to existing flue-gas piping systems (CEFIC_242).* • *Not applicable to plants <100 MW_{th}. Applicable to existing plants within the constraints given by duct configuration, space availability, as well as installation safety (CONCAWE_50).* • *Clarify if this technique is BAT if dedusting is not necessary to remove particles (DK_169).*

EIPPCB assessment:	**1. General** **1.1. Plants operating <1500 hours (e.g. Plant 468) are fitted with different techniques mentioned in BAT 33.** **1.2. SIS/MIS are considered in the assessment. Plant 175, not fitted with any technique, reports in the questionnaire being located in a small isolated system and it reports similar SO_X emissions to mainland plants (e.g. Plant 54) that are not fitted with any technique. For existing plants operating in peak-load and emergency-load modes, the secondary abatement techniques may have an economic effect as well as on the mainland. Secondary abatement techniques installation does not generally require better infrastructure than that required for the initial installation of the plant.** **2. Techniques** **2.1. Flue-gas condenser (b)** • **Example plants are submitted in the data collection (e.g. Plant 454). There is not enough information provided about general corrosion problems in the flue-gas condenser.** • **Flue –gas condenser may be used with other purposes than district heating (e.g. save fuel, reduce flue-gas emissions).** **2.2. Wet FGD (c)** • **The use of fuel during short periods of time (<500 h/y) as back-up can be considered as the operational mode of the plant (emergency-load mode operation) using a given fuel.** • **The installation of the Wet FGD technique also entails design considerations (e.g. space availability) that are not applicability restrictions per se. Several combustion plants have already been retrofitted with this technology.** • **There is no plant of less than 300 MW_{th} fitted with wet FGD in the data collection.** • **The technique may be site-specific in the case of retrofit of existing plants operated <1500 h/yr and too costly in case of plants operated <500h/yr.** **2.3. DSI (Dry in-duct sorbent injection) (d)** • **There are plants in the data collection fitted with abatement techniques for dust (Plant 70 is fitted with DSI and a bag filter). DSI does not need much space. General applicability restrictions due to space availability or duct configuration are not taken into account.** • **For consistency in the entire document, the technique is named Duct Sorbent Injection (DSI) and the description could be more generic.** **2.4. Spray-dry absorber (SDA) (e)** • **This technique may be more suitable for small plants than for bigger ones, because of the size of the absorber to cope with the flue-gas and the bag filter needed in the case of big plants. General applicability restrictions due to space availability are not considered for this technique, since it is applied in coal-firing plants up to 1500 MW_{th}.** **2.5. Seawater FGD (f)** • **The seawater FGD technique has the same applicability restrictions as WFGD.**
EIPPCB proposal:	**1. General** **1.1. (+1.2.) Include applicability restrictions for those techniques which are not considered applicable to plants operating in emergency- and peak-load modes.** **2. Techniques** **2.1. Flue-gas condenser (b)** • **Change applicability to 'Generally applicable'.** **2.2. Wet FGD (c)** • **Include an applicability restriction to the retrofit of existing plants operated in emergency -load modes.** • **Include an applicability restriction to the retrofit of existing plants operated in peak-load modes.** • **Change the applicability of the technique to generally applicable to plants of ≥ 300 MW_{th}.** **2.3. DSI (Dry in-duct sorbent injection) (d)** • **Keep generally applicable.** • **Change the name to Duct Sorbent Injection (DSI). Refer to the description of the technique in Section 10.8 adding that it is combined with dust**

	abatement techniques. **2.4. Spray-dry absorber (SDA) (e)** • **Change the applicability of the technique to generally applicable.** **2.5. Seawater FGD (f)** • **Include the same applicability restrictions than to technique (c), Wet FGD.**

1.5.1.3.2 Table 10.17 – BAT-AELs for SO_X, HCl and HF – HFO and/or gas oil

Location in D1:	*p. 765*
Current text in D1:	**Table 10.17: BAT associated emission levels for SO_X emissions to air from the combustion of HFO and LFO in boilers**

Type of combustion plant	Pollutant	Unit	Monitoring frequency	BAT-AEL	
				Yearly average	Daily average
Existing	SO_X	mg/Nm³	Continuous measurement ([1])	50 – 110 ([2])	<150 – 170
New				< 70	< 120

([1]) Only SO_2 is continuously measured, SO_3 is periodically measured (e.g. during calibration).
([2]) The low end of the range (e.g. <50 mg/Nm³) is achieved by combustion plants using LFO.

Summary of comments:	1. *<u>General</u>* • *Add before the HFO and LFO the word 'commercial' in the heading of the table (SK_17).* • *Set BAT-AELs for each type of fuel (i.e. HFO and LFO) (FR_130, Eurelectric_965).* • *Add in the title '…that are not installed in small isolated systems…' (EL_103).* • *Delete footnote 2 (Eurelectric_410, DK_172).* • *Clarify footnote 2 (BE_48).* 2. *<u>Size categories</u>* • *Exclude plants <50 MW_{th} (E&P_164, Eurelectric_704, UK_6).* • *Create a separated category for <50 MW_{th} (Eurelectric_967, 408).* • *Ranges too ambitious for plants <300 MW_{th}. (Eurelectric_701_965).* • *Consider different size categories (PT_26).* 3. *<u>SO_X yearly averages</u>* • *50-170 mg/Nm³ for existing plants (FI_70).* • *<175 mg/Nm³ using low sulphur fuels (< 0.1 %) for existing plants (Eurelectric_701, 965) using LFO (Eurelectric_410).* • *Change to 50-200 for existing plants (SK_15).* • *Indicate for existing plants that in case secondary techniques are not applicable values up to 1700 mg/Nm³ may occur (CONCAWE_51).* • *1700 mg/Nm3 for new and existing in SIS (EL_104, Eurelectric_408).* • *Only applicable to base load plant (E&P_167, UK_9).* 4. *<u>SO_X daily averages</u>* • *<140 mg/Nm³ for existing plants (AT_51).* • *Set higher ranges or a 90 percentile approach or monthly averages instead of daily (CEFIC_244).* • *<200 mg/Nm3 using low sulphur fuels (< 0.1 %) for existing plants (Eurelectric_701, 965) using LFO (Eurelectric_410).* • *Change to 150-300 for existing plants (SK_14).* • *Indicate for existing units that in case secondary techniques are not applicable values up to 1700 mg/Nm³ may occur (CONCAWE_51).* • *1700 mg/Nm3 for new and existing in SIS (EL_104, Eurelectric_408).* • *Only applicable to base load plant. (E&P_167, UK_9).* 5. *<u>Emergency and peak-load operating mode</u>* • *850 mg/Nm³(FI_70).* • *Exclude plants <1500 hours (Eurelectric_701_965, E&P_164, Eurelectric_704, UK_6).* • *Create a different category plants <1500 hours (Eurelectric_967, 408).* 6. *<u>Monitoring</u>* • *Change the measurement frequency for sources below 100 MWth to twice a year (CZ_152, E&P_150).* • *Plants <50 MW_{th} and emergency plants should be excluded from continuous*

	monitoring (E&P_164). • *Provide continuous SO_2 measurement only for HFO plants. For LFO plants provide 2 periodic measurements per year including determination of the fuel-S-content (Eurelectric_702_397).* • *Continuous emission monitoring of SO_2 for boiler (existing or new, whatever the size) burning LFO and not equipped with FGD is not required E&P_151, Eurelectric_392, UK_18) and can be replaced by an annual measurement including determination of the fuel-S-content (Eurelectric_409).* • *It is not necessary to measure SO_2 continuously when fuel with known sulphur content is used in a plant without FGD (DK_170).* • *There should be an input-output analysis, limited sulphur content in the fuel and maximal one measurement per oil delivery (Eurelectric_700_269).*
EIPPCB assessment:	**1. <u>General</u>** • **'Commercial' fuels and 'non-commercial' fuels with the same characteristics cannot be treated differently.** • **Plants using one or combination of gas oil and HFO are provided in the data collection. HFO-firing plants often need to apply secondary techniques while gas oil-firing plants may be considered a technique in itself (i.e. fuel choice).** • **As far as combustion technology installed on the mainland may be similar to the technology installed on islands, the techniques to abate the emissions are also available. Since the BAT-AEL proposals are linked to the techniques proposed as BAT, there is insufficient support to exclude the plants located in SIS.** • **The lower end of the range is achieved not only by combustion plants using gas oil but also using HFO with abatement techniques. Therefore it seems unnecessary to include footnote ([2]).** **2. <u>Size categories</u>** • **All plants applying secondary abatement techniques for SO_X have a capacity of more than 300 MW_{th}. Therefore it is worth performing the assessment for plants below and above that capacity.** **3. <u>SO_X yearly averages</u>** **<u>Plants of <300 MW_{th}</u>** • **For new and existing plants, the reference for setting the upper end of the BAT-AEL range is based on the use of fuel with 0.1 % sulphur content, i.e. 175 mg/Nm^3 according to the comments.** **<u>Plants of ≥ 300 MW_{th}</u>** • **Plant 468 achieves SO_X emissions of 50 mg/Nm^3 and Plant 263 achieves SO_X emissions of 110 mg/Nm^3, both of them applying wet FGD are the reference for setting the yearly BAT-AEL range for existing plants.** • **For new plants the upper end of the range corresponds to the value proposed in D1, 50 mg/Nm^3, and the lower end of the range corresponds to a reduction rate of 98 % with 0.1 wt-% sulphur content in the fuel, i.e. 35 mg/Nm^3.** **4. <u>SO_X daily averages</u>** **<u>Plants of <300 MW_{th}</u>** • **The reference for the upper end of the BAT-AEL range for new and existing plants is based on the use of fuel with 0.1 % sulphur, i.e. 200 mg/Nm^3, as proposed in the comments.** **<u>Plants of >= 300 MW_{th}</u>** • **Plant 468 achieves SO_X emissions of 150 mg/Nm^3 and Plant 263 achieves SO_X emissions of 175 mg/Nm^3, both of them applying wet FGD are the reference for setting the daily BAT-AEL range for existing plants.** • **For new plants, the upper end of the range corresponds to the value proposed in D1, 120 mg/Nm^3 and the lower end of the range corresponds to 30 % of the variation applied to the proposed lower end of the range for the yearly average, i.e. 50 mg/Nm^3.** **5. <u>Emergency- and peak-load operating mode</u>** • **Yearly averages may not be needed for plants operating in emergency- or peak-load modes as the operation throughout the year is limited to 1500 hours.** **6. <u>Monitoring frequency</u>** • **Plants of < 100 MW_{th} operated in peak-load or emergency-load modes could have less stringent requirements in terms of monitoring, e.g. periodic monitoring.**
EIPPCB proposal:	**1. <u>General</u>** • **Do not add 'commercial' to HFO/gas oil.** • **Do not split the BAT-AELs for HFO and gas oil.** • **Do not include in the title '…that are not installed in small isolated systems…'**

	• **Remove footnote ([2]).** **2. <u>Size categories</u>** • **Propose BAT-AELs for plants of <300 MW_{th} and BAT-AELs for plants of ≥300 MW_{th}.** **3. <u>SO_X yearly averages</u>** **<u>Plants of <300 MW_{th}</u>** • **Propose a yearly average BAT-AEL range for existing plants of 50–175 mg/Nm^3.** • **Propose a yearly average BAT-AEL range for new plants of 50–175 mg/Nm^3.** • **<u>Plants more than 300 MW_{th}</u>** • **Propose a yearly average BAT-AEL range for existing plants of 50–110 mg/Nm^3.** • **Propose a yearly average BAT-AEL range for new plants of 35–50 mg/Nm^3.** **4. <u>SO_X daily averages</u>** **<u>Plants of <300 MW_{th}</u>** • **Propose a daily average BAT-AEL range for existing plants of 150–200 mg/Nm^3.** • **Propose a daily average BAT-AEL range for new plants of 150–200 mg/Nm^3.** **<u>Plants of ≥ 300 MW_{th}</u>** • **Propose a daily average BAT-AEL range for existing plants of 150–175 mg/Nm^3.** • **Propose a daily average BAT-AEL range for new plants of 50–120 mg/Nm^3.** **5. <u>Emergency and peak-load operating mode</u>** • **Propose only a daily average.** **6. <u>Monitoring frequency</u>** • **Plants operating in peak-load mode and of <100 MW_{th}: periodic measurements (at least twice/ year).** • **Plants operating in emergency-load mode and of <100 MW_{th}: periodic measurements (at least once/ year).**

1.5.1.4 BAT 34 – Dust and particulate-bound emissions to air

1.5.1.4.1 BAT 34 – Dust and particulate-bound emissions to air

<table>
<tr><td>Location in D1:</td><td>p. 765</td></tr>
<tr><td>Current text in D1:</td><td>
34. In order to reduce dust and particulate-bound metal emissions to air from the combustion of HFO and LFO in boilers, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Techniques</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Fuel choice</td><td>See description in Section 10.8</td><td>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.</td></tr>
<tr><td>b.</td><td>ESP</td><td>See description in Section 10.8</td><td rowspan="3">Generally applicable to new plants. Applicable to existing plants within the constraints given by space availability</td></tr>
<tr><td>c.</td><td>Bag filter</td><td>See description in Section 10.8</td></tr>
<tr><td>d.</td><td>ESP + Wet FGD</td><td>See description in Section 10.8</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td>
1. <u>General</u>
1.1. Exclude emergency and plants <50 MWth. Apart from fuel choice, none of the dust control techniques are ‘generally applicable’ to existing plants < 50 MWth and/or <1500 hours (UK_7, E&P_165, Eurelectric_705_968).
1.2. Exclude emergency plants. Secondary flue-gas treatments are not applicable in MIS and SIS without good infrastructures, for existing peak load plants and for small boilers (Eurelectric_411).
1.3. Dedusting systems are not applicable to emergency plants and to existing utility boilers where HFO is used as back up fuel or where the flue-gas duct cannot be modified or where there are constraints given by space availability (CEFIC_17).
2. <u>Techniques</u>
2.1. Technique b: ESP
• Not applicable with HFO and unlikely applicable with LFO (FI_72).
2.2. Technique c: Bag filter
• Not applicable with HFO and unlikely applicable with LFO (FI_72).
• Add in the applicability column for bag filter that constrains in HFO fired combustion plant occurs, due to unburnt compounds stickiness (IT_94).
2.3. Technique d: ESP + Wet FGD
• Not applicable with HFO and unlikely applicable with LFO (FI_72).
• The applicability may be limited in arid areas and in the case where the by-products from treatment (including e.g. waste water with a high level of salt) cannot be reused or appropriately disposed of (CEFIC_245).
2.4. New techniques
• Add possibility to use multicyclone (FI_72).
• Add CFB scrubber (EPPSA_397).
</td></tr>
<tr><td>EIPPCB assessment:</td><td>
1. <u>General</u>
1.1. Plants of <50 MW_{th} and operating <1500 hours per year are fitted with more techniques than just fuel choice, e.g. Plant 83 is fitted with a multicyclone and low-ash fuel. Plants 70 and 468 are fitted with a bag filter and an ESP respectively.
1.2. Plants located in SIS/MIS are considered in the assessment. Plant 175, fitted with an ESP, reports in the questionnaire being located in a small isolated system and it achieves lower dust emissions than mainland plants (e.g. Plant 54) that are also fitted with an ESP.
1.3. The use of fuel during short periods of time (<500 h/y) as a back-up can be considered as the operational mode of the plant (emergency-load mode operation) using a given fuel.
2. <u>Techniques</u>
2.1. ESP (b)
</td></tr>
</table>

	• **A number of plants firing HFO in the data collection are fitted with an ESP (e.g. Plants 260 and 175).** **2.2. Bag filter (c)** • **Bag filters fitted with oil repellent are commercially available. Plants of the data collection burning HFO are fitted with bag filters (i.e. Plant 70).** **2.3. ESP + WFGD (d)** • **A number of plants are fitted with ESP+WFGD in the data collection (e.g. Plant 258).** • **Since some techniques focused on abating other pollutants (i.e. SO_X) may have an effect on the dust content, it seems appropriate to include them but not linked directly with an ESP or another specific technique for dust abatement.** • **Water availability or by-products disposal are important parameters to consider when taking a decision about the wet abatement techniques to use, which is site-specific.** **2.4. New techniques** • **Multicyclones are used in some plants of the data collection.** • **A CFB scrubber could be included in a more general technique to abate SO_X.**
EIPPCB proposal:	**1. General** • **Do not include any applicability restriction due to the size or load mode of the plants or for plants located in small isolated systems.** **2. Techniques** • **Change the ESP and bag filter techniques to generally applicable.** • **Include Dry, semi-dry or wet FGD system.** • **Remove ESP+WFGD technique.** • **Include cyclones as generally applicable.**

1.5.1.4.2 Table 10.18 – BAT-AELs for dust – HFO and/or gas oil

Location in D1: *p. 766*

Current text in D1:

Table 10.18: BAT-associated emission levels for dust emissions to air from the combustion of HFO and LFO in boilers

Type of combustion plant	Pollutant	Unit	BAT-AEL		Monitoring frequency
			Yearly average	Daily average	
New	Dust	mg/Nm^3	< 1 – 6	ND	Continuous measurement
Existing, all but emergency plants			< 1 – 10 ([1])	7 – 15	
N.D. not determined ([1]) The low–end of the range (e.g. < 1) is achieved by combustion plants using low-ash LFO					

Summary of comments:	1. *Split LFO and HFO* • *Set BAT-AELs for each kind of fuel (FR_132).* 2. *SIS* • *Add in the title '…that are not installed in small isolated systems…' (EL_105).* • *Create a separated category for SIS (Eurelectric_412).* 3. *Footnote 1* • *Delete (Eurelectric_706).* • *Clarify (BE_49).* 4. *Load mode and size* • *Small <50 MW_{th} and emergency plants (1500 h) should be excluded from the upper end of the ranges (E&P_168_172).* • *Create a separated category for small <50 MW_{th} and plants <1500 hours. Exclude emergency plants (Eurelectric_970_708_412).* • *Definition of AEL based in the rated thermal input of combustion plants (PT_27).* • *Set 30 mg/Nm3 for plants between 50 and 100 MW_{th} and 25 mg/Nm3 for plants between 100 and 300 MW_{th} (FI_73).* 5. *Monitoring* • *Change the measurement frequency for sources below 100 MW_{th} to twice per year (CZ_156, E&P_154).* • *Plants <50 MW_{th} and emergency plants (<1500h) should be excluded from continuous monitoring (UK_10_14, Eurelectric_970_708).* • *Not continuous monitoring below 100 MW_{th} (Eurelectric_413).* • *Enable the use of the soot level for LFO as an alternative to the monitoring of dust emissions (Eurelectric_706_270_413).* 6. *Dust yearly averages existing* • *5-10 mg/Nm3 (FI_73).* • *<25 mg/Nm3 for plants situated in SIS (EL_108).* • *Change the upper end of range to <=20. The value less than 1 mg/Nm3 for the lower end of the range is not measurable (SK_26).* • *Change to 5-50 mg/Nm^3 (CEFIC_246).* • *Increase lower end of the range (Eurelectric_706).* 7. *Dust yearly averages new* • *Change to 5-25 mg/Nm3 (CEFIC_246).* • *Change to 5-10 mg/Nm3 (FI_73).* • *Increase lower end of the range (Eurelectric_706).* • *<25 mg/Nm3 for plants situated in SIS (EL_108).* • *Change the upper end of range to <=10. The value less than 1 mg/Nm3 for the lower end of the range is not measurable (SK_24).* 8. *Dust daily averages existing* • *Change to 5-50 mg/Nm^3 (CEFIC_247).* • *Change to <=25 the dust from the boilers depends on the process, e.g. during the boiler sootblowing (SK_25).* • *<40 mg/Nm3 for plants situated in SIS (EL_108).* 9. *Dust daily averages new* • *Provide daily averages. According to applicability of secondary measures, < 10 mg/Nm^3 (AT_52).* • *Change to 5-25 mg/Nm3 (CEFIC_247).* • *40 mg/Nm3 for plants situated in SIS (EL_108).*
EIPPCB assessment:	**1. Split gas oil and HFO** • **Six plants fire gas oil and twenty plants fire HFO. Gas oil plants report less ash content in the fuel. The use of gas oil instead of HFO can be considered a technique (i.e. Fuel choice).** **2. SIS** • **Plant 175 is located in Crete. It reports similar values to others situated on the mainland because of the use of abatement techniques that would allow the plant to achieve the values proposed in D1.** **3. Footnote 1** • **Plants 28, 412-1 and 412-2 burning gas oil report dust emissions above 1 mg/Nm^3, therefore the statement of footnote ([1]) cannot be generalised.** **4. Load mode and size** • **The values reported in the data collection do not show a clear correlation between the emissions and the load mode of the plant.**

	• **A number of plants of ≥300 MW_{th} use an ESP or bag filter and all use wet abatement techniques for SO_X. Therefore, it is worth performing the assessment for plants below and above 300 MW_{th}.** **5. <u>Monitoring</u>** • **Plants of < 100 MW_{th} operated in peak-load or emergency-load modes could have less stringent requirements in terms of monitoring, e.g. periodic monitoring.** • **No method that correlates the soot level with dust emissions is provided. Therefore the soot level for gas oil cannot be proposed as an alternative to dust monitoring.** **6. <u>Dust yearly averages existing plants</u>** **<u>Plants less than 300 MW_{th}</u>** • **The lower end of the BAT-AEL range is based on a general assessment of the LoD.** • **Plant 290, reporting almost 20 mg/Nm^3 in the questionnaire, is the reference using the fuel choice technique for setting the upper end of the BAT-AEL range for existing plants.** **<u>Plants more than 300 MW_{th}</u>** • **The lower end of the BAT-AEL range is based on a general assessment of the LoD.** • **Plant 468, using the ESP technique, achieves dust emissions of around 10 mg/Nm^3. This is the reference for setting the upper end of the BAT-AEL range for existing plants.** **7. <u>Dust yearly averages new plants</u>** **<u>Plants less than 300 MW_{th}</u>** • **The lower end of the BAT-AEL range for new plants is based on the same assessment as for existing plants made in the previous point.** • **Plant 28, achieving dust emissions below 15 mg/Nm^3 using gas oil, is the reference for setting the upper end of the BAT-AEL range for new plants.** **<u>Plants more than 300 MW_{th}</u>** • **The upper end of the BAT-AEL range for new plants is set considering the use of abatement techniques for SO_X in combination with an ESP or bag filter as the reference technique. Plant 263 achieves dust emissions of 6 mg/Nm^3.** **8. <u>Dust daily average existing plants</u>** **<u>Plants less than 300 MW_{th}</u>** • **The upper end of the BAT-AEL range for existing plants is set considering plants burning gas oil, e.g. Plant 412-2, reporting 25 mg/Nm^3.** **<u>Plants of ≥300 MW_{th}</u>** • **The upper end of the BAT-AEL range for existing plants could be based on the short-term average achieved by plants using only an ESP. Plant 175 (136 MW_{th}) using only an ESP reports dust emissions below 15 mg/Nm^3.** **9. <u>Dust daily average new plants</u>** **<u>Plants less than 300 MW_{th}</u>** • **The upper end of the BAT-AEL range for new plants is set considering fuel choice and multicyclones. Plant 1009, fitted with these techniques, achieves dust emissions of 18 mg/Nm^3.** **<u>Plants of ≥300 MW_{th}</u>** • **The upper end of the BAT-AEL range for existing plants is based on the short-term averages achieved by plants using an ESP and wet abatement techniques. Plant 263 reports in the questionnaire short-term dust emissions of 11 mg/Nm^3.**
EIPPCB proposal:	**1. Do not propose different BAT-AELs for gas oil and HFO.** **2. Do not propose different BAT-AELs for SIS.** **3. Delete footnote ([1]).** **4. <u>Load mode and size</u>** • **For emergency- and peak-load plants, propose only a daily average or average of the periodic measurements.** • **Split BAT-AELs for plants rated more than 300 MW_{th} and less than that capacity.** **5. <u>Monitoring</u>** • **For peak-load plants less than 100 MW_{th}, periodic monitoring at least twice/year, for emergency-load plants less than 100 MW_{th}, at least once/year.** **6. <u>Dust yearly averages existing</u>** • **Propose a yearly average BAT-AEL range for plants of <300 MW_{th} of 2–20 mg/Nm^3.** • **Propose a yearly average BAT-AEL range for plants of ≥300 MW_{th} of 2–10 mg/Nm^3.** **7. <u>Dust yearly averages new</u>** • **Propose a yearly average BAT-AEL range for plants of <300 MW_{th} of 2–15 mg/Nm^3.**

	• **Propose a yearly average BAT-AEL range for plants of ≥300 MW_{th} of 2–6 mg/Nm^3.** **8. Dust daily average existing** • **Propose a daily average BAT-AEL range for plants of <300 MW_{th} of 7–25 mg/Nm^3.** • **Propose a daily average BAT-AEL range for plants of ≥300 MW_{th} of 7–15 mg/Nm^3.** **9. Dust daily average new** • **Propose a daily average BAT-AEL range for plants of <300 MW_{th} of 7–18 mg/Nm^3.** • **Propose a daily average BAT-AEL range for plants of ≥300 MW_{th} of 7–10 mg/Nm^3.**

1.5.2 HFO- and/or gas oil-fired engines

Location in D1:	*p. 767*
Current text in D1:	HFO-fired engines section
Summary of comments:	1. *Remove BAT-AELs associated with diesel engines (ES_29).* 2. *Provide BAT-AELs for LFO (FR_126) and dual-fuel engines (E&P_169, Eurelectric_415_646, UK_11).* 3. *Consider only the main fuel of dual fuel engines (E&P_170, Eurelectric_416, UK_12).* 4. *Include exclusion for LFO fired engines. (E&P_173, UK_15).* 5. *Consider the type of diesel engines: two-stroke and four-stroke engines; slow (< 300 rpm) / medium (300-1200 rpm) / high speed (> 1200 rpm); more and less than 20 MWth. (E&P_175, Eurelectric_419, UK_17).* 6. *Not include plants number 362, 363, 364 and 365 to derive BAT and BAT-AELs because they considered 'a case study' (E&P_176, EL_107, Eurelectric_420, UK_18) only limited data available (MT_17).* 7. *Redraft BAT-AELs. NO_X BAT-AELs are based on data from one plant and CO BAT-AEL from another (E&P_177, UK_19, Eurelectric_421, MT_17).* 8. *Set specific BAT conclusions for plants located in SIS and MIS (EL_106, E&P_171, Eurelectric_417, UK_13).* 9. *No CEMS in MIS. Replace by periodic monitoring (twice a year) (E&P_174, Eurelectric_418, UK_16).* 10. *Derive specific BATs and BAT-AELs for emergency plants (FR_133).* 11. *Exempt plants <500 hours which only operate for the stability of the grid. Residual life time should be reflected in the BAT-conclusions (DK_173).* 12. *Set higher BAT-AEL for peak load plants with limited operation hours or limited residual lifetime. Daily averages should only apply, if the plant is running for 12 hours or more (DK_174).* 13. *BAT conclusions are only applicable to base load plant (E&P_173, UK_15).*
EIPPCB assessment:	**1. It was agreed at the KOM to create a subsection for engines within each section dedicated to a specific liquid fuel.** **2. Engines burning gas oil alone or in combination with HFO are provided (e.g. Plants 497, 543-1). The use of gas oil instead of HFO may be considered a technique (i.e. fuel choice).** **3. (+4.) The headings specify the type/s of fuel covered by the BAT and BAT-AELs. Other types of multi-fuel firing are dealt with in Chapter 1.12.** **5. The type of engine, the speed and the size are included in the assessment to propose BAT-AELs. There is no general correlation between the mentioned characteristics of the engines and the emissions reported in the questionnaires for setting different BAT and BAT-AELs.** **6. (+7. +8. +9.) BAT-AELs have been revised considering the comments and available information. Plants 362, 363, 364 and 365 were commissioned in 2012. Reassessment of the data and the proposals made in this document include around 6000 hours working under normal operating conditions in 2013 for each of these plants. Most of questionnaires submitted correspond to engines located on islands. More considerations about MIS and SIS are found in the assessment of the comments on the whole chapter on liquid fuels combustion.** **10. (+11. +12.) A number of plants operating as peak-load, mid-merit and baseload plants are provided. All these plants are included in the assessment to propose BAT-AELs as concluded in the KOM. Plants operating in emergency- and peak-load modes are considered in the assessment for each pollutant and category.** **The assessment of lifetime is plant-specific and is included in cost-benefit assessments performed at plant level and assessed by the competent authorities. BAT-AELs are proposed for normal operating conditions without specifying a minimum number of operating hours per day.**
EIPPCB proposal:	**1. Keep BAT-AELs for engines.** **2. (+3. +4.) Change the scope and the headings to gas oil and HFO engines.** **5. Do not split BAT and/or BAT-AELs for the different types, speeds and/or sizes of engines.** **6. (+7. +8. +9.) Include all the plants and available information in the assessment.** **10. Include load mode considerations category by category.**

1.5.2.1 BAT 35 – Energy efficiency

1.5.2.1.1 BAT 35 – Energy efficiency

<table>
<tr><td>Location in D1:</td><td>p. 766</td></tr>
<tr><td>Current text in D1:</td><td>35. In order to increase the energy efficiency of HFO combustion in reciprocating engines, BAT is to use an appropriate combination of the techniques given in BAT 7 and below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Preheating of fuel using waste heat</td><td>See description in Section 10.8</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Preheating of combustion air using waste heat</td><td>See description in Section 10.8. If preheating temperature is higher than 150 ºC, NO_X emissions tend to increase</td><td>Generally applicable</td></tr>
<tr><td>c.</td><td>Combined cycle</td><td>See description in Section 10.8.</td><td>Generally applicable to new plants. Applicable for existing base load plants within the constraints given by the plant configuration</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td><u>General</u>
1. These techniques should be considered as 'non applicable' for emergency plants (E&P_178, Eurelectric_422).
<u>Technique b:</u>
2. Remove technique. (ES_58, Euromot_85_57, E&P_179, UK_20, MT_22_18, Eurelectric_423).
<u>Technique c:</u>
3. Change applicability to 'Applicability dependent on local conditions and economically and technical feasibility' (Euromot_85_57).
4. Only generally applicable for new diesel engines (E&P_180, Eurelectric_424) depending on other possible uses of exhaust flue-gases energy (EL_112) depending on the capacity of generating enough steam with the appropriated conditions (ES_59).</td></tr>
<tr><td>EIPPCB assessment:</td><td>Techniques (a) and is already included in BAT 7 and there is no merit to it being repeated in this section.
Technique (b), preheating of combustion air, may lead to a decreased output and higher fuel consumption of an engine.
Technique (c), the applicability restriction regarding the load mode should be clarified in that the techniques would not be applicable to new or existing plants that could be operated in peak- or emergency-load modes. The economic viability may be limited for existing engines in the case of constrained steam cycle design.</td></tr>
<tr><td>EIPPCB proposal:</td><td>Remove techniques (a) and (b).
Keep technique (c) changing the applicability restrictions:
in case of operation in emergency- and peak-load modes for new plants,
due to the steam cycle design,
due to the plant layout (space) in the case of retrofit at existing plants.</td></tr>
</table>

1.5.2.1.2 Table 10.19 – BAT-AEELs for energy efficiency – HFO and/or gas oil

<table>
<tr><td>Location in D1:</td><td>p. 766</td></tr>
<tr><td>Current text in D1:</td><td>Table 10.19: BAT-associated energy efficiency levels in the combustion of HFO in engines
<table>
<tr><th colspan="2">Type of combustion plant</th><th>Parameter</th><th>Unit</th><th>BAT-AEPL (Yearly average, LHV basis)</th></tr>
<tr><td rowspan="2">Generating only power or CHP plants whose recoverable heat generation exceeds the heat demand</td><td>Existing</td><td rowspan="2">Net electrical efficiency</td><td rowspan="2">%</td><td>40 – 48</td></tr>
<tr><td>New</td><td>45 to above 48</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>1. Remove the word 'above' in all cases (UK_21).
2. Exclude emergency plants. Existing engines 38 – 45 % New engines 40 – 48 % (E&P_181, Eurelectric_425, EL_109_110).
3. Net electrical efficiency of 48 % for a HFO Rankine cycle power plant seems to be achievable only if a combined cycle is foreseen (IT_103).
4. A single cycle engine electrical efficiency for new plants should start from 40 % (Euromot_86_58).
5. A typical net electrical efficiency for a large medium speed Diesel engine is 42 % to 44 % where 44 % is generally applicable to new machines (MT_11_13).</td></tr>
<tr><td>EIPPCB assessment:</td><td><u>General</u>
• Values proposed in D1 were based on yearly averages from the collected data. As per the assessment made in Section 1.1.5 of this BP, it is now proposed to define design-based BAT-AEELs.
• Special provisions for plants operating in emergency- and peak-load modes are assessed in Section 1.1.3 of this BP.
<u>Net electrical efficiency</u>
• According to the available data, design values on net electrical efficiency reported by 25 plants commissioned up to and including 2010 were in the range 13.9–48.5 %. Four plants commissioned after 2010 report design values in that range (i.e. 48.1 %).
• No plant reports 13.9 % as its net electrical efficiency. Plants 428-3 reports 13.9 % gross electrical efficiency.
• Plant 427-2 reports the lowest net electrical efficiency, which is 39.4 %.</td></tr>
<tr><td>EIPPCB proposal:</td><td>• Change the proposed BAT-AEEL on Net electrical efficiency for existing plants to design values of 39.4 % to 48 %.
• Change the proposed BAT-AEEL on Net electrical efficiency for new plants to design values of > 48 %.
• Add a footnote indicating that the BAT-AEELs do not apply in the case of plants operated in peak- or emergency-load modes.</td></tr>
</table>

1.5.2.2 BAT 36 and BAT 37 – NO_X, NH_3, CO and unburnt carbon emissions to air

1.5.2.2.1 BAT 36 – NO_X emissions to air

<table>
<tr><td>Location in D1:</td><td>p. 767</td></tr>
<tr><td></td><td>36. In order to prevent or reduce NO_X emissions to air from the combustion of HFO in reciprocating engines, BAT is to use one or a combination of the techniques described in BAT 7 and below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Good maintenance of the engine</td><td></td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Low-NO_X combustion concept</td><td>See description in Section 10.8</td><td>Applicable to new plants</td></tr>
<tr><td>c.</td><td>Water injection</td><td>See description in Section 10.8</td><td>Not applicable during water shortages</td></tr>
<tr><td>d.</td><td>Humid air injection (HAM)</td><td>See description in Section 10.8</td><td>Generally applicable</td></tr>
<tr><td>e.</td><td>SCR</td><td>See description in Section 10.8</td><td>Not applicable to emergency mode plants</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>1. <u>Technique c: water injection</u>
• It may not be technically feasible in existing plants. Possibility of producing quality water required and the availability of space in the existing units and installations (ES_61).
• Add 'Technique applied so far only in some ships' (EUROMOT_87).
• Remove technique or move it to emerging techniques. Not enough references. (EL_114, EUROMOT_59, E&P_183, UK_22, Eurelectric_426).
2. <u>Technique d: Humid air injection (HAM)</u>
• Add 'Only few references exist, applicability dependent on engine type' (EUROMOT_87).
• Remove technique or move it to emerging techniques. Not enough references. Corrosion problems in plants with load variations (EL_114, EUROMOT_59, E&P_184, UK_23, Eurelectric_427).
3. <u>Technique e: SCR</u>
• Applicability it should be noted that the appropriateness of applying this technique (ES_60).
• It may not be technically feasible in existing plants. Requires voluminous installations (ES_62_63)
• Not BAT for plants with frequent start and stops, i.e. peaking plants due to operational temperature restrictions. In existing plants space availability for SCR might be restricted. Infrastructure for SCR reagent supply and disposal. (EUROMOT_87_54, EL_114).
• Add the limitations given in BREF LCP (2006) and D1 LCP Chapter 6 (EL_113).
• Applicability of SCR should be limited to mainland base load plants located in places with good infrastructures for SCR reagent supply and disposal. (UK_24, Eurelectric_428).
• Two stroke engines are not adapted to SCR because of the low temperature of the exhaust gas (E&P_175, Eurelectric_419, UK_17).
4. <u>Other techniques</u>
• Add Miller cycle technique (ES_64).
• Start of injection retard and air - fuel mixing optimisation (i.e. slide fuel valves) (UK_25, EL_114, Eurelectric_429, E&P_186).</td></tr>
<tr><td>EIPPCB assessment:</td><td>1. <u>(+2.) Water injection (c) and Humid air injection (HAM) (d)</u>
• 'Water injection' and Humid air injection (HAM)' techniques may be included in 'Water/steam addition' as it is more generic. Both of the techniques decrease the temperature in the combustion chamber. Engine providers state in their portfolio a number of hours testing this technique in ships and in power plants.
• There may be technical constraints in retrofitting existing old technology engines due to major modifications that may be needed to the fuel injection system due to the thermal input to the engine being reduced. This technique consumes significant</td></tr>
</table>

	quantities of water, above all if used in baseload/mid-merit load modes. Therefore, there should be enough water available near the plant for using the technique. **3. <u>SCR (e)</u>** • **The data collection consists of more than 30 plants. Almost all of them are located on islands (e.g. Madeira, Malta, Lesvos, Azores). About ten plants are fitted with SCR and six of them are using the technique.** • **A number of comments (e.g. E&P_176) note the construction of 54 large diesel engines with DENOX systems launched by EDF (FRANCE) in Corsica, La Reunion, the Antilles. Information about the emissions of those plants was requested (Intermediate meeting June 2014 – ways forward).** • **Information about examples of retrofitted engines are available, e.g. 'Yara case Study_SCR Lampedusa' provided by EEB.** • **Applicability restrictions for plants operating in emergency-load mode and the retrofit of existing plants operating in peak-load mode may be justified by the available information in other sections.** • **In existing plants, space availability for SCR may be a constraint.** **4. <u>Other techniques</u>** • **The 'Miller cycle', 'Start of injection retard' and 'air - fuel mixing optimisation' techniques are related to 'Low-NO_X combustion concept in diesel engines' technique. The description in Section 10.8 is modified to include this consideration. The applicability of the technique may be generalised to existing plants.** • **Exhaust-gas recirculation technique is documented in the BREF. The manufactures offer this option in the portfolio. Its applicability to four-stroke engines is under study.** • **Good maintenance of the engine, as for any other type of combustion plant is covered by BAT 1 and BAT 4.** **5. <u>BAT statement</u>** • **BAT 7 aims at energy efficiency and does not address NO_X emissions reduction.**
EIPPCB proposal:	**1. <u>(+2.) Water injection (c) and Humid air injection (HAM) (d)</u>** • **Replace techniques (c) and (d) with 'Water/steam addition' technique.** • **Change the applicability to recognise that there are constraints related to water availability.** • **Add an applicability restriction to existing plants due to the modification in the injection systems.** **3. <u>SCR (e)</u>** • **Change the applicability to indicate constraints for existing plants operated in peak-load mode.** • **Include an applicability restriction to the retrofitting of existing plants due to the availability of sufficient space.** **4. <u>Other techniques</u>** • **Modify description of 'Low-NO_X combustion concept in engines', modify the name of the technique in the table and the applicability to 'Generally applicable'.** • **Add exhaust-gas recirculation (EGR) technique with an applicability restriction for four-stroke engines.** • **Remove technique (a) 'Good maintenance of the engine'.** **5. <u>BAT statement</u>** • **Modify the heading, removing the reference to BAT 7.**

1.5.2.2.2 BAT 37 – CO and unburnt carbon emissions to air

<table>
<tr><td>Location in D1:</td><td>p. 767</td></tr>
<tr><td></td><td>37. In order to reduce CO and unburnt carbon emissions to air from the combustion of HFO in reciprocating engines, BAT is to ensure complete combustion by using one or a combination of the techniques given in BAT 4 and below:
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Good engine design</td><td>See description in Section 10.8</td><td>Applicable to new plants</td></tr>
<tr><td>b.</td><td>Good maintenance of the combustion system</td><td>See description in Section 10.8</td><td>Generally applicable</td></tr>
<tr><td>c.</td><td>Process control techniques</td><td>Process control techniques, based on accurate monitoring and well-optimised system to reduce emissions of CO and NO_X</td><td>Applicable to new plants</td></tr>
<tr><td>d.</td><td>Oxidation catalysts</td><td>See description in Section 10.8</td><td>Not applicable to emergency plants</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>1. Technique c: Process control techniques
• Remove technique (E&P_187, UK_26, Eurelectric_430).
2. Technique e: Oxidation catalysts
• Remove (E&P_188, UK_27, Eurelectric_431, MT_23_19, EUROMOT_140).
• Include applicability to plants that are installed in SIS (EL_115).</td></tr>
<tr><td>EIPPCB assessment:</td><td>1. Process control techniques (c)
• 'Process control techniques', as well as 'Good engine design' technique can be included in the combustion optimisation.
2. Oxidation catalysts (d)
• Techniques for controlling the combustion and therefore the CO emissions are more limited in engines than in other type of plants (e.g. boilers). Techniques are neither exhaustive nor prescriptive.
3. General
• The wording of the BAT statement has to be consistent with the updated BAT 4.
• Techniques (a) and (b) 'Good design' and 'Good maintenance of the engine, as for any other type of combustion plant are covered by BAT 1 and BAT 4.</td></tr>
<tr><td>EIPPCB proposal:</td><td>1. Process control techniques (c)
• Remove technique.
2. Oxidation catalysts (d)
• Keep technique.
3. General
• Modify wording of the BAT statement removing 'ensure complete combustion'.
• Remove technique (a) and technique (b)
• Include technique 'Combustion optimisation' as generally applicable and make the reference to the description in Section 10.8.</td></tr>
</table>

1.5.2.2.3 Table 10.20 – BAT-AELs for NO_X, NH_3, CO – HFO

1.5.2.2.3.1 Table 10.20 – General

<table>
<tr><td>Location in D1:</td><td>p. 767</td></tr>
<tr><td>Current text in D1:</td><td>
Table 10.20: BAT-associated emission levels for NO_X, NH_3 and CO emissions to air from the combustion of HFO in reciprocating engines
<table>
<tr><th colspan="2" rowspan="2">Type of engine</th><th rowspan="2">Pollutant</th><th rowspan="2">Unit</th><th rowspan="2">Monitoring frequency</th><th colspan="3">BAT-AEL</th></tr>
<tr><th>Yearly average</th><th>Daily average</th><th>Average of samples obtained during one year</th></tr>
<tr><td rowspan="2">All but emergency plants</td><td>Existing</td><td rowspan="2">NO_X</td><td rowspan="5">mg/Nm^3</td><td rowspan="4">Continuous measurement</td><td>90 – 250</td><td>ND</td><td>-</td></tr>
<tr><td>New</td><td>< 140</td><td>< 150</td><td>-</td></tr>
<tr><td colspan="2" rowspan="3">All but emergency plants</td><td>NH_3 ([1])</td><td>< 5</td><td>ND</td><td>-</td></tr>
<tr><td>CO</td><td>50 – 100</td><td>ND</td><td>-</td></tr>
<tr><td>TOC</td><td>Periodic measurement</td><td>-</td><td>-</td><td>10 – 40</td></tr>
<tr><td colspan="8">([1]) Ammonia emissions are associated with the use of SCR.</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td>

Add in the heading of the table: '…and that are not installed in small isolated systems…' (EL_116_117_118).
Add in the heading that BAT-AELs suitable only for base load plants with a good infrastructure (EUROMOT_88).
Provide BAT-AELs based on spot measurements (AT_54).
Indicate the NO_X emission levels achievable with each technique (ES_65) with SCR technology (AT_55).
Indicate the CO emission levels achievable with each technique (ES_66).
Reassess BAT-AELs (FR_134).

</td></tr>
<tr><td>EIPPCB assessment:</td><td>

The proposed BAT-AELs are based on techniques used in plants located in 'small isolated systems'.
The load mode operation is reassessed in this document considering the comments and the additional information provided.
It is not necessary to set two different BAT-AELs depending on the type of average. To avoid misunderstandings, it is proposed to structure the table differently.
The emission levels linked to each technique are described in other chapters of the BREF, usually in the 'Current consumption and emission levels' and 'Techniques to consider in the determination of BAT' sections.
BAT-AELs are reassessed considering the comments and the additional information provided.

</td></tr>
<tr><td>EIPPCB proposal:</td><td>

Do not exclude plants located in small isolated systems from the table.
Modify the structure of the table.

</td></tr>
</table>

1.5.2.2.3.2 Table 10.20 – BAT-AELs for NO_X – HFO

Location in D1:	*p. 767*
Current text in D1:	**Table 10.20: BAT-associated emission levels for NO_X, NH_3 and CO emissions to air from the combustion of HFO in reciprocating engines**

Type of engine		Pollutant	Unit	Monitoring frequency	BAT-AEL		
					Yearly average	Daily average	Average of samples obtained during one year
All but emergency plants	Existing	NO_X	mg/Nm^3	Continuous measurement	90 – 250	ND	-
	New				< 140	< 150	-

Summary of comments:

1. *Yearly averages*
   - *New (monthly): Base load plant (< 20 MW_{th}: 225; > 20 MW_{th}: 190) Peak load plant/ Plants in remote area/small islands with restricted infrastructure, provided GLC in order application of primary feasible NO_X abatement technique: [Dual Fuel (DF) Engine: 1850 mg/Nm^3; Diesel engine: > 20 MW_{th}: 1850; < 20 MW_{th}: 1460/1300*. *Only available on limited engine types with certain cylinder configurations and thus not suitable as a universal limit, prerequisite 2-stage turbocharging. No BAT-AELs for emergency plants (FI_152, EUROMOT_111_60).*
   - *Existing (monthly): Base load plant: 750 if SCR can be retrofitted (space available, needed infrastructure existing) otherwise same limit as below. Peak load plants/ Plants in remote area/small islands with restricted infrastructure, provided GLC in order application of primary feasible NO_X abatement technique: Dual Fuel (DF) and diesel engine: 2000 mg/Nm^3; No BAT-AELs for emergency plants (FI_152, EUROMOT_111_60).*
   - *New (monthly): Base load plants: 225 mg/Nm^3; For Peak load or mid-merit plants and plants in SIS: < 20 MW_{th}: 1300; > 20 MW_{th} and Dual fuel Engine: 1850 mg/Nm^3 (E&P_189, UK_28, Eurelectric_432).*
   - *Existing monthly: Base load plants where SCR can be retrofitted (space available etc.): 750 mg/Nm^3; For existing peak load or mid-merit plants and plants in SIS: 2000 mg/Nm^3; For existing plants in MIS: plant < 20 MW_{th}: 1800 mg/Nm^3; > 20 MW_{th}: 2550 mg/Nm^3 (E&P_189, UK_28, Eurelectric_432).*
   - *Include for new plants in SIS where SCR cannot be applied: 15-20 MW_{th}: 1300 mg/Nm^3; >20 MW_{th}: 1850 mg/Nm^3 (EL_119).*
   - *Include for existing plants in SIS where SCR cannot be applied: 15-20 MW_{th}: 1800 mg/Nm^3; >20 MW_{th}: 2550 mg/Nm^3 (EL_120).*
2. *Daily averages*
   - *Provide daily averages (AT_53) 248 mg/Nm^3 at 15 % O_2 (FR_135).*
3. *Monitoring*
   - *No CEMS for plants < 100 MW_{th} but biannually (FI_152, EUROMOT_60).*
   - *No CEMS but periodic measurement twice per year in MIS (E&P_189, UK_28, Eurelectric_432).*

EIPPCB assessment:	**1. Yearly averages** • **Proposals from the comments are for monthly averages instead of yearly averages as was proposed in D1. The data provided in the questionnaires for long-term averaging periods are yearly averages. Deriving or supporting proposals for monthly averages with the yearly data provided does not seem straightforward.** • **All the plants except one (i.e. Plant 176, 112 MW_{th}, 2-stroke single fuel) provided in the data collection are configured as one or more 4-stroke engines between 15 and 50 MW_{th}. There is no clear correlation in the data collection between the NO_X emissions and the size of the plant. Plants applying secondary abatement techniques (e.g. SCR) for NO_X achieve yearly averages from 118–131 mg/Nm^3. The yearly average NO_X emission range of plants from the data collection that are not using any secondary abatement technique is 1377–2442 mg/Nm^3 when burning HFO and 1145–1718 mg/Nm^3 when burning gas oil alone or in combination with HFO.** • **For new plants, the range is based on the performance of the SCR system fitted in the plants of the data collection. Plant 363, using SCR, reports NO_X emissions below 140 mg/Nm^3. This plant is the reference for setting the upper end of the BAT-AEL. The lower end of the range is based on the reduction using the SCR technique in plants burning gas oil (reduction of 90 % on the emissions achieved by Plant 497), i.e. 115 mg/Nm^3.** • **For existing plants, the higher end of the range is based on a minimum rated efficiency of a SCR retrofit of 75 %. All plants not fitted with any abatement technique report values below 2500 mg/Nm^3, therefore the NO_X emissions achieved would be 625 mg/Nm^3, which is the reference for setting the upper end of the BAT-AEL range. The lower end of the range is based on the performance of existing plants, i.e. Plant 362 reports yearly average of 125 mg/Nm^3.** • **For plants operating in emergency- or peak-load modes, since the retrofit with an SCR may be too costly, the reference techniques are fuel choice (i.e. Plant 497) and primary techniques (e.g. Plant 427-8) and the emission range may be from 1150 to 1900 mg/Nm^3.** **2. Daily averages** • **For existing plants, the lower end of the range is based on the short-term emissions reported by the reference plant for setting the lower end of the yearly average BAT-AEL for existing plants (Plant 362 reports 150 mg/Nm^3). The upper end of the daily average BAT-AEL is based on the average difference between yearly average values and the short-term emissions reported in the data collection by the plants fitted with SCR in this range, that is around 20 %.** • **For new plants, the reference for the upper end of the BAT-AEL range is based on the short-term emissions reported by the plants fitted with SCR, i.e. Plant 363 achieves emissions around 160 mg/Nm^3. For the lower end of the range it is considered the same average difference between long- and short-term averages as for the existing yearly average. Applying the 25 % to the lower end of the range for yearly average results in 145 mg/Nm^3.** **3. Monitoring frequency** • **Continuous monitoring for plants fitted with an end-of-pipe technique is necessary to control the efficiency of the abatement system.** • **Plants operated in emergency- or peak-load modes could have less stringent requirements in terms of monitoring, e.g. periodic monitoring.**
EIPPCB proposal:	**1. Yearly averages** • **Propose a yearly average BAT-AEL range for new plants of 115–140 mg/Nm^3.** • **Propose a yearly average BAT-AEL range for existing plants of 125–625 mg/Nm^3.** • **Propose a BAT-AEL range for plants operated in emergency- or peak-load modes or existing plants (1150–1900 mg/Nm^3).** **2. Daily averages** • **Propose a daily average BAT-AEL range for new plants of 145–160 mg/Nm^3.** • **Propose a daily average BAT-AEL range for existing plants of 150–750 mg/Nm^3.** **3. Monitoring frequency** • **Keep continuous monitoring.** • **Include a footnote for plants operated in emergency- or peak-load modes: periodic monitoring.**

1.5.2.2.3.3 Table 10.20 – BAT-AELs for CO – HFO

<table>
<tr><td>Location in D1:</td><td>p. 767</td></tr>
<tr><td>Current text in D1:</td><td>Table 10.20: BAT-associated emission levels for NO_X, NH_3 and CO emissions to air from the combustion of HFO in reciprocating engines
<table>
<tr><th rowspan="2">Type of engine</th><th rowspan="2">Pollutant</th><th rowspan="2">Unit</th><th rowspan="2">Monitoring frequency</th><th colspan="3">BAT-AEL</th></tr>
<tr><th>Yearly average</th><th>Daily average</th><th>Average of samples obtained during one year</th></tr>
<tr><td>All but emergency plants</td><td>CO</td><td>mg/Nm^3</td><td>Continuous measurement</td><td>50 – 100</td><td>ND</td><td>-</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>Provide daily averages (AT_53, FR_135).
Provide BAT-AELs based on spot measurements (AT_54).
BAT-AEPLs instead of BAT-AELs (FI_145).
In MIS, no CEMS for CO, but only periodic measurement (E&P_190,-EUROMOT_112_81, UK_29, EL_122, Eurelectric_433).</td></tr>
<tr><td>EIPPCB assessment:</td><td>CO is one of the environmental parameters that the TWG decided to focus on at the KOM.
Due to trade-offs between NO_X and CO emissions, the priority is given to NO_X reduction in this review. Subsequently, CO levels and corresponding techniques are derived based on the set of well performing plants for NO_X emissions. Furthermore, only a yearly average is proposed for BAT-AELs to give more flexibility in the operation of the plant on a short-term basis.
The monitoring of CO emissions is proposed to be continuous, so that the yearly average is applicable instead of the average of samples obtained during one year as in the case of periodic monitoring.
Continuous monitoring is carried out in a number of SIS. The proposal to change from continuous to periodic measurement for plants located in MIS is not sufficiently supported.
The set of well performing plants for NO_X emissions reports CO emissions in a range of 94–104 mg/Nm^3 while the continuously measured range for the whole data set is 44–174 mg/Nm^3, in both cases the application of end-of-pipe techniques is not reported.
Since short-term BAT-AELs for CO are not proposed, the long-term CO BAT-AELs does not cover plants operating in emergency- or peak-load modes.</td></tr>
<tr><td>EIPPCB proposal:</td><td>Do not propose daily averages.
Change proposed yearly average BAT-AEL range to 50–175 mg/Nm^3.
Keep continuous monitoring.
Do not propose CO BAT-AELs for peak- and emergency-load modes.</td></tr>
</table>

1.5.2.2.3.4 Table 10.20 – BAT-AELs for NH_3 – HFO

<table>
<tr><td>Location in D1:</td><td>p. 767</td></tr>
<tr><td>Current text in D1:</td><td>Table 10.20: BAT-associated emission levels for NO_X, NH_3 and CO emissions to air from the combustion of HFO in reciprocating engines
<table>
<tr><th rowspan="2">Type of engine</th><th rowspan="2">Pollutant</th><th rowspan="2">Unit</th><th rowspan="2">Monitoring frequency</th><th colspan="3">BAT-AEL</th></tr>
<tr><th>Yearly average</th><th>Daily average</th><th>Average of samples obtained during one year</th></tr>
<tr><td>All but emergency plants</td><td>NH_3 ([1])</td><td>mg/Nm^3</td><td>Continuous measurement</td><td>< 5</td><td>ND</td><td>-</td></tr>
<tr><td colspan="7">([1]) Ammonia emissions are associated with the use of SCR.</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>
Provide daily averages (AT_53, FR_135).
Provide BAT-AEL's based on spot measurements (AT_54).
Continuous monitoring in case of SCR/SNCR techniques (DK_175).
Remove or increased to 10 mg/Nm^3(15 % O_2). Biannually periodic measurement. (FI_146, E&P_191, EUROMOT_113_82, UK_30, Eurelectric_434).
</td></tr>
<tr><td>EIPPCB assessment:</td><td>
The monitoring of NH_3 emissions is proposed to be continuous, so that the yearly average is applicable instead of the average of samples obtained during one year, which is applicable for periodic monitoring.
When NO_X is continuously monitored, it seems logical to also continuously monitor NH_3 when using SCR techniques.
Reported data show continuously monitored emissions from 4 to 9 mg/Nm^3, so the proposal to change the upper range of the level to 10 mg/Nm^3 is consistent with the data.
NH_3 is considered a less important pollutant in this review than NO_X, therefore only a yearly average is proposed for BAT-AELs to give more flexibility in the operation of the plant on a short-term basis.
</td></tr>
<tr><td>EIPPCB proposal:</td><td>
Propose yearly average BAT-AEL range to 5 -10 mg/Nm^3.
Do not propose a daily average BAT-AEL for NH_3.
Change footnote ([1]) that the BAT-AEL for NH_3, and NH_3 monitoring are only applicable when the techniques SNCR and/or SCR are used.
Add a footnote mentioning the possibility to apply periodic monitoring (at least once/yr) when using dedusting and wet abatement techniques and the levels of NH_3 are well within the proposed BAT-AELs.
</td></tr>
</table>

1.5.2.2.3.5 Table 10.20 – BAT-AELs for TOC – HFO

<table>
<tr><td>Location in D1:</td><td>p. 767</td></tr>
<tr><td>Current text in D1:</td><td>Table 10.20: BAT-associated emission levels for NO_X, NH_3 and CO emissions to air from the combustion of HFO in reciprocating engines
<table>
<tr><th rowspan="2">Type of engine</th><th rowspan="2">Pollutant</th><th rowspan="2">Unit</th><th rowspan="2">Monitoring frequency</th><th colspan="3">BAT-AEL</th></tr>
<tr><th>Yearly average</th><th>Daily average</th><th>Average of samples obtained during one year</th></tr>
<tr><td>All but emergency plants</td><td>TOC</td><td>mg/Nm^3</td><td>Periodic measurement</td><td>-</td><td>-</td><td>10 – 40</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>Set BAT-AEPLs instead of BAT-AELs (FI_145).
Provide a minimum monitoring frequency monitoring of TOC (BE_50).
Set periodic measurements twice per year for plants located in SIS (EL_121).</td></tr>
<tr><td>EIPPCB assessment:</td><td>There is no EN standard available for the measurement of TOC in stack emissions (including particulate organic matter). Instead, EN 12619 specifies a method for the measurement of gaseous and vaporous organic substances, expressed as TVOC (total volatile organic carbon). Annex B 3 of EN 12619 describes that the measurement of TVOC instead of TOC is generally accepted in the industry and by competent authorities, even though the IED prescribes the measurement of TOC (for waste (co-)incineration).
Half of the plants monitor TOC emissions, all of them using periodic measurements.
A monitoring frequency of twice per year is applied by the majority of the engines of the data collection. For two measurements per year, the average the sampling period seems more appropriate than the average of samples obtained during one year.</td></tr>
<tr><td>EIPPCB proposal:</td><td>Rename TOC as TVOC.
Change the BAT-AEL to the average over the sampling period.
Indicate the minimum number of samples: twice per year.</td></tr>
</table>

1.5.2.3 BAT 38 – SO_X, HCl and HF emissions to air

1.5.2.3.1 BAT conclusion

<table>
<tr><td>Location in D1:</td><td>p. 767</td></tr>
<tr><td></td><td>38. In order to reduce SO_X, HCl and HF emissions to air from the combustion of HFO in reciprocating engines, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Fuel choice</td><td>See description in Section 10.8. Low-ash, low-asphaltene and low-sulphur fuel</td><td>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.</td></tr>
<tr><td>b.</td><td>Process control</td><td>See description in Section 10.8.</td><td>Generally applicable.</td></tr>
<tr><td>c.</td><td>DSI with bag filter</td><td>See description in Section10.8.</td><td>Not applicable to emergency plants</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>1. <u>Technique a: Fuel choice</u>
The choice of liquid fuels of different quality should be restricted depending on the location of the plant (specifically in small isolated systems) and on the costs associated</td></tr>
</table>

	(UK_2_31, E&P_192, Eurelectric_435). • *Add in the applicability 'as also transportation constraints, especially significant for isolated systems such as islands where Diesel Engines are used' (EL_123).* *2. Technique b: Process control* • *Remove technique (Euromot_97).* *3. Technique c: DSI with bag filter* • *It may not be technically feasible in existing plants. It requires voluminous installations (ES_67).* • *Remove technique. Not generally applicable due to temperature restrictions (FI_151, Euromot_96).* • *FGD bag filter type not generally applicable to all new HFO engine plants (Euromot_89_61).* • *DSI with bag filter is an emerging technique. It is not applicable to existing and new diesel engines located in SIS. (UK_3, E&P_193, EL_124, Eurelectric_436).* • *Bag FGD / ESP not applicable to all HFO engine installations (Euromot_90).* *4. New technique* • *Add wet FGD (EPPSA_398).*
EIPPCB assessment:	**1. Fuel choice (a)** • **Availability of different types of fuel is already referred to in the applicability of the technique. Eight plants from the data collection located on islands use HFO below 0.8 wt-% S content. Description of the technique may be modified for consistency with other sections.** **2. Process control (b)** • **There is not much supporting information to justify keeping the technique.** **3. DSI with bag filter (c)** • **As for any other technique, the installation of dry sorbent injection (DSI) in an existing plant entails design considerations that are not applicability restrictions per se, e.g. space limits.** • **DSI is a well-known desulphuration technique used in different types and sizes of combustion plants in the data collection (e.g. Plant 46, 200 MW_{th}, solid fuels; Plant 70, 177 MW_{th} HFO boiler; Plant 362, 77 MW_{th} HFO engine).** • **DSI increases the dust in the flue-gases, so that it is usually necessary to consider the techniques used for dust abatement. Although the example plants for engines are fitted with a bag filter, other techniques may be used (i.e. ESP). Therefore it seems inappropriate to specify the type of abatement technique for dust.** • **The technique is generally applicable in boilers burning solid and liquid fuels. There is no support to consider differently the applicability of this technique in boilers and engines operating in emergency-load mode.** • **The DSI with bag filter proposal has been supported by the SO_X removal technique installed in Plants 362, 363, 364 and 365 located in small isolated systems. DSI is described in Section 10.8.** **4. New technique** • **There are plants using the Wet FGD technique to abate SO_X emissions (e.g. Sanko plant in Turkey – information to be included).** • **The technique may be site-specific in the case of retrofit of existing plants operated < 1500 h/yr and too costly in case of plants operated <500 h/yr.**
EIPPCB proposal:	**1. Fuel choice (a)** • **Keep the technique. Remove 'Low ash, low-asphaltene and low sulphur fuel' from the description.** **2. Process control (b)** • **Remove the technique.** **3. DSI with bag filter (c)** • **Change the name of the technique to Duct sorbent injection (DSI).** • **Make reference to the description of the technique in Section 10.8 adding that it may be combined with dust abatement techniques.** • **Change applicability to 'Generally applicable'.** **4. New technique** • **Add wet FGD technique. Not applicable to plants operated < 500 h/yr. Add applicability restrictions for retrofitting existing combustion plants operated in peak-load mode.**

1.5.2.3.2 Table 10.21 – BAT-AELs for SO_X, HCl and HF

Location in D1:	*p. 767*

Table 10.21: BAT associated emission levels for SO_X emissions to air from the combustion of HFO in reciprocating engines

Type of engine		Pollutant	Unit	Monitoring frequency	BAT-AEL	
					Yearly average	Daily average
All but emergency plants	Existing	SO_X	mg/Nm³	Continuous measurement ([1])	100 – 200	ND
	New				< 100	< 110
([1]) Only SO_2 is continuously measured, SO_3 is periodically measured (e.g. during calibration)						

Summary of comments:

1. *General*
- *Indicate the SO_x emission levels achievable with each technique (ES_68).*
- *Replace 'All but emergency plants' with 'All but emergency plants and plants installed in small isolated systems' (EL_125).*

2. *Monitoring frequency*
- *Biannually in plants burning oil with a known sulphur content. Plants < 100 MW_{th} exempted from CEMS. (FI_147, Euromot_83).*
- *No CEMS but periodic measurements twice a year for plants in SIS (UK_4, E&P_194, Eurelectric_437).*
- *Change monitoring frequency to periodic measurements twice per year (EL_126).*

3. *Yearly average for existing plants*
- *Existing base load plant > 100 MW_{th}: Range: 110-200 mg/Nm³ (15 % O_2) monthly (UK_4, E&P_194, Eurelectric_437) if FGD can be retrofitted (space issue, etc.), infrastructure existing (FI_147, Euromot_83).*
- *Base load plant > 100 MW_{th}: Range: 110-300 mg/Nm³ (15 % O_2) monthly, if FGD can't be retrofitted (space issue, etc.), no infrastructure existing (FI_147, Euromot_83_114).*
- *Base load plant > 100 MW_{th}: 110 mg/Nm³ (15 % O_2) monthly (Euromot_114, UK_4, E&P_194, Eurelectric_437).*
- *For plants < 100 MW_{th} in general and peak load plants: Range: 110-300 mg/Nm³ (15 % O_2) monthly or 0.5 wt-% S HFO (FI_147, Euromot_83_114).*
- *For plants < 100 MW_{th} in general and peak load plants: Range: 110-590 mg/Nm³ (15 % O_2) monthly or 1.0 wt-% S HFO if 0.5 wt-% S HFO not available (FI_147, Euromot_83_114).*
- *For plants < 100 MW_{th} in general and peak load plants: Range: 110-300 mg/Nm³ (15 % O_2) monthly where 0.5 wt-% S HFO is commercially available (UK_4, E&P_194, Eurelectric_437).*
- *For plants in SIS, corresponding to 1.0 wt-% S HFO: 110- 590 mg/Nm³ (15 % O_2) monthly (UK_4, E&P_194, Eurelectric_437).*
- *For plants in SIS, <590 mg/Nm³(EL_125).*

4. *Yearly average for new plants*
- *Base load plant > 100 MW_{th}: 110 mg/Nm³ (15 % O_2) monthly (FI_147, Euromot_83_114, UK_4, E&P_194, Eurelectric_437).*
- *Base load plant > 100 MW_{th}: Range: 110-300 mg/Nm³ (15 % O_2) monthly, if FGD can't be retrofitted (space issue, etc.), no infrastructure existing (FI_147, Euromot_83_114).*
- *For plants < 100 MW_{th} in general and peak load plants: Range: 110-300 mg/Nm³ (15 % O_2) monthly or 0.5 wt-% S HFO (FI_147, Euromot_83_114).*
- *For plants < 100 MW_{th} in general and peak load plants: Range: 110-590 mg/Nm³ (15 % O_2) monthly or 1.0 wt-% S HFO if 0.5 wt-% S HFO not available (FI_147, Euromot_83_114).*
- *For plants < 100 MW_{th} in general and peak load plants where 0.5 wt-% S HFO is commercially available: Range: 110-300 mg/Nm³ (15 % O_2) monthly (UK_4, E&P_194, Eurelectric_437).*
- *For plants in SIS, corresponding to 1.0 wt-% S HFO: 110- 590 mg/Nm³ (15 % O_2) monthly (UK_4, E&P_194, Eurelectric_437).*

	• *For plants in SIS, <590 mg/Nm^3(EL_125).* *5. Daily average for existing plants* • *Please provide BAT-AELs on a daily basis for SO_x emissions for existing reciprocal engines firing HFO. 80 - 220 mg/Nm^3 (daily average) (AT_56) < 622 mg/Nm3 availability of fuels with a S-content < 0.9 %. Caribbean Sea and Indian Ocean (FR_136_137).*
EIPPCB assessment:	**1. General** • **The emission levels linked to each technique are described in other chapters of the BREF, usually in the 'Current consumption and emission levels' and 'Techniques to consider in the determination of BAT' sections. The BAT-AELs may be achieved using one or a combination of the techniques given in BAT 38.** • **The data collection includes plants located in small isolated systems and therefore the performance and techniques used in those plants are taken into account. BAT-AELs are based on well performing plants located in SIS.** • **For consistency with other sections and the available information, plants operating less than 1500 hours may be excluded for the yearly average and only apply the daily average, but not exclude the emergency plants for all BAT-AELs.** **2. Monitoring frequency** • **Plants of <100 MW_{th} located in small isolated systems fitted with the DSI technique monitor emissions continuously for an appropriate control of the technique.** • **For those plants that may meet the BAT-AELs only due to the fuel used could monitor the emissions periodically.** • **Plants operated in emergency- or peak-load modes could have less stringent requirements in terms of monitoring, e.g. periodic monitoring.** **3. Yearly average for existing plants** • **Proposals from the comments are for monthly averages instead of yearly averages. The data provided in the questionnaires for long-term averaging periods are yearly averages. Deriving or supporting proposals for monthly averages with the yearly average provided does not seem straightforward.** • **Almost all the information collected through the questionnaires is about engines of <100 MW_{th}.** • **The reference technique for existing plants is fuel choice. A number of plants (i.e. Plants 177, 178) reported SO_X emissions below 200 mg/Nm^3 burning 0.8 wt-% sulphur content HFO.** **4. Yearly average for new plants** • **The reference for setting the upper end of the BAT-AEL range for new plants is the performance of a number of plants (e.g. Plants 362, 363) using the DSI technique. These plants reported in the questionnaires SO_X emissions below 100 mg/Nm^3.** • **The lower end of the yearly average BAT-AEL range for new plants is based on the use of wet FGD with a desulphuration efficiency of 90 % with the combustion of 0.7 wt-% S fuel, therefore 45 mg/Nm^3 may be achieved.** **5. Daily average for existing plants** • **The maximum emissions reported by Plant 430 taking into consideration the difference with the yearly average is the reference for setting the upper end of the daily average BAT-AEL range for existing plants.** • **The lower end of the daily average BAT-AEL range is based on the emissions achieved by plants from the data collection using DSI. Plant 362 reported in the questionnaire short-term emissions of 105 mg/Nm^3.** **6. Daily average for new plants** • **Short-term emissions reported by the plants fitted with DSI are below 110 mg/Nm^3.** • **The lower end of the range may be set based on the 30 % variability of the yearly average applying wet FGD, i.e. 60 mg/Nm^3.**
EIPPCB proposal:	**1. General** • **Do not indicate in the table the SO_X emission levels achievable with each technique.** • **Do not exclude plants installed in small isolated systems.** • **Do not exclude plants operated in emergency mode for all BAT-AELs. Include exemption for existing plants operated in emergency- and peak-load mode for the yearly BAT-AEL.** • **Remove the general exemption for emergency plants.** **2. Monitoring frequency** • **Include a footnote monitoring frequency may be reduced to once every three months if it is demonstrated that the emission levels are consistently within the BAT-AELs set due to the fuel used. In these specific cases, periodic measurements could be carried out each time when a change of the fuel characteristics may have**

	an impact on the emissions. • **Include a footnote for plants operated in emergency- or peak-load modes: periodic monitoring.** **3. Yearly average for existing plants** • **Do not split between size categories.** • **Keep the proposed yearly average BAT-AEL range for existing plants at 100–200 mg/Nm^3.** **4. Yearly average for new plants** • **Propose yearly average BAT-AEL range for new plants to 45–100 mg/Nm^3.** **5. Daily average for existing plants** • **Propose daily average BAT-AEL range for existing plants to 105–235 mg/Nm^3.** **6. Daily average for new plants** • **Propose daily average BAT-AEL range for new plants to 60–110 mg/Nm^3.**

1.5.2.4 BAT 39 – Dust and particulate-bound emissions to air

1.5.2.4.1 BAT conclusion

Location in D1:	*p. 768*
	39. In order to prevent or reduce dust and particulate-bound metals emissions from the combustion of HFO in reciprocating engines, BAT is to use one or a combination of techniques given below.

	Technique	Description	Applicability
a.	Fuel choice	See description in Section 10.8. Low-ash, low-asphaltene and low-sulphur fuel	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
b.	Process control	See description in Section 10.8	Generally applicable
c.	Bag filter	See description in Section 10.8	Generally applicable to new plants. Not applicable to emergency plants. Applicable to existing plants within the constraints given by space availability
d.	ESP	See description in Section 10.8	

Summary of comments:	*1. Technique a: Fuel choice* • *The choice of liquid fuels of different quality should be restricted depending on the location of the plant (specifically in small isolated systems) and on the costs associated (UK_8, E&P_198, Eurelectric_438).* *2. Technique c and d: Bag filter and ESP* • *Bag FGD / ESP not generally applicable to all HFO engine installations. Bag filters have a temperature restriction (Euromot_62, FI_140).* • *Bag filter and ESP are generally not applicable to peak load plants and plants located in SIS (UK_9, E&P_199, Eurelectric_439_440) to emergency (EL_129).*
EIPPCB assessment:	**1. Fuel choice (a)** • **The ash content in HFO varies from 0.029 to 0.1 wt-% in plants from the data collection. A general restriction cannot be made in terms of availability of the fuel for engines located in SIS. Costs depend on many factors (e.g. the liquid fuel market distribution). Refinery plants are also located in SIS, e.g. Tenerife. Description of the technique may be modified for consistency with other sections.** **2. Bag filter (c) and ESP (d)** • **As for any other technique, the installation of an ESP and/or bag filter in an existing plant entails design considerations that are not applicability restrictions per se, e.g. space limits.** • **Bag filters with a high temperature resistance are available.** • **Applicability restriction for plants operating in emergency-load mode is given in D1** **3. Other techniques** • **Multicyclones may be used with high-temperature flue-gases.** • **Techniques that are being used to abate other pollutants (i.e. SO_X) may have an**

	effect on the dust content in the fuel. • **There is not enough information available to keep the 'Process control' technique as a BAT.**
EIPPCB proposal:	**1. Fuel choice (a)** • **Keep the technique. Remove 'Low ash, low-asphaltene and low sulphur fuel' from the description.** **2. Bag filter (c) and ESP (d)** • **Keep both techniques as BAT.** • **Do not include an applicability restriction relating to space availability.** **3. Other techniques** • **Include the multicyclones technique.** • **Include Dry, semi-dry or wet FGD system.** • **Remove technique (b), 'process control'.**

1.5.2.4.2 Table 10.22 – BAT-AELs for dust – HFO and/or gas oil

Location in D1:	*p. 769*
	Table 10.22: BAT-associated emission levels for dust emissions to air from the combustion of HFO in reciprocating engines

Type of engine	Pollutant	Unit	BAT-AEL		Monitoring frequency
			Yearly average	Daily average	
New	Dust	mg/Nm^3	1 – 5	6 – 12	Continuous measurement
Existing, all but emergency mode			1 – 10	ND	

Summary of comments:	*1. General* • *Indicate the dust emission levels achievable with each technique (ES_69).* • *Not set BAT-AELs for emergency plants (FI_148, Euromot_84_115, E&P_200, UK_10, Eurelectric_441).* • *Replace: 'All but emergency plants' with: 'All but emergency plants and plants installed in small isolated systems' (EL_130).* *2. Yearly average for existing plants* • *<50 mg/Nm^3 monthly for base load > 300 MW_{th}, 85 - 100 % of MCR if space available and infrastructure exist (FI_148, Euromot_84_115, E&P_200, UK_10, Eurelectric_441).* • *<75 mg/Nm^3 monthly for other than base load > 300 MW_{th} 85 - 100 % of MCR (FI_148, Euromot_84_115, E&P_200, UK_10).* • *<75 mg/Nm^3 monthly for MIS (Euromot_115, E&P_200, UK_10, Eurelectric_441).* • *<100 mg/Nm^3 for SIS (EL_130).* *3. Yearly average for new plants* • *<30 mg/Nm^3 monthly for base load plant > 300 $MW_{th,}$ 85 - 100 % of MCR (FI_148, Euromot_84_115, E&P_200, UK_10, Eurelectric_441).* • *<50 mg/Nm^3 monthly for other than base load plant > 300 MW_{th}, 85 - 100 % of MCR (FI_148, Euromot_84_115, E&P_200, UK_10, Eurelectric_441).* • *<75 mg/Nm^3 for SIS (EL_130).* *4. Daily average for existing plants* • *Provide BAT-AELs on a daily basis for dust emissions for existing reciprocal engines firing HFO: <1 - 15 mg/Nm^3(AT_58).* *5. Daily average for new plants* • *Provide BAT-AELs on a daily basis for dust emissions for new <10 mg/Nm^3(AT_57).* *6. Monitoring frequency* • *Exclude plants < 100 MW_{th} from CEMS. Monitor biannually. (FI_148, Euromot_84).* • *Exclude plants located in MIS from CEMS. Periodic measurements twice a year (Euromot_115, E&P_200, UK_10, Eurelectric_441).* • *Change monitoring frequency 'periodic measurements twice per year' (EL_131).*

EIPPCB assessment:	**1. General** • **The emission levels linked to each technique are described in other chapters of the BREF, usually in the 'Current consumption and emission levels' and 'Techniques to consider in the determination of BAT' sections. The BAT-AELs may be achieved using one or a combination of the techniques given in BAT 39.** • **The data collection includes plants located in small isolated systems and therefore the performance and techniques used in those plants are taken into account. BAT-AELs are based on well performing plants located in SIS.** • **For consistency with other sections and the available information, plants operating less than 1500 hours may be excluded for the yearly average and only apply the daily average, but not exclude the emergency plants for all BAT-AELs.** **2. Yearly average for existing plants** • **BAT-AELs are based on the performance of engines that have less than 111 MW_{th}. It is not expected that adding more engines in plants more than 300 MW_{th} will result in a different performance.** • **The limit of quantification (LoQ) for dust of about 2 mg/Nm^3 seems a more appropriate value for setting the lower end of the range.** • **Almost all the information collected through the questionnaires is about engines of <100 MW_{th}.** • **The reference technique for existing plants is fuel choice. Plants 180 and 428-10 report dust emissions below 20 mg/Nm^3 firing HFO without using any second abatement technique.** **3. Yearly average for new plants** **4. The reference technique for new plants is the use of a bag filter. Plants 362, 363, 364 and 365, fitted with bag filters, achieve dust emissions from 4 to 7 mg/Nm^3. Daily average for existing plants** • **The upper end of the daily average for existing plants is based on variations reported by the plants fitted with a bag filter applied to the reference plants taken for setting the yearly BAT-AEL, i.e. 40 mg/Nm^3.** **5. Daily average for new plants** • **Plants 362, 363, 364 and 365 are the reference for the yearly average. Short-term emissions reported by these plants are below 15 mg/Nm^3.** **6. Monitoring frequency** • **Plants that are fitted with a bag filter monitor the emissions continuously.** • **Plants operated in peak-load or emergency-load modes could have less stringent requirements in terms of monitoring, e.g. periodic monitoring. Propose periodic measurement for plants operating in peak-load and emergency-load modes.**
EIPPCB proposal:	**1. General** • **Do not indicate in the table the dust emission levels achievable with each technique.** • **Do not change the heading of the table to exclude plants installed in small isolated systems.** • **Remove the general exemption for emergency plants.** **2. Yearly average for existing plants** • **Propose a yearly average BAT-AEL range for existing plants to 2–20 mg/Nm^3.** **3. Yearly average for new plants** • **Propose a yearly average BAT-AEL range for new plants to 2–7 mg/Nm^3.** **4. Daily average for existing plants** • **Propose a daily average BAT-AEL range for existing plants to 6–40 mg/Nm^3.** **5. Daily average for new plants** • **Propose a daily average BAT-AEL range for new plants to 6–15 mg/Nm^3.** **6. Monitoring** • **Include a footnote monitoring frequency may be reduced to once every three months if it is demonstrated that the emission levels are consistently within the BAT-AELs set due to the fuel used. In these specific cases, periodic measurements could be carried out each time when a change of the fuel characteristics may have an impact on the emissions.** • **Include a footnote for plants operated in emergency- or peak-load modes: periodic monitoring.**

1.5.3 Gas oil-fired gas turbines

Location in D1:	*p. 769*
Current text in D1:	General comments to LFO-fired gas turbines.
Summary of comments:	1. *Exclude emergency plants from the requirements of this section (ES_71, FI_74, E&P_195, Eurelectric_709_971, UK_5).* 2. *Include text to state that current BAT Conclusions are only applicable to base load plant and that the AEL applicable to mid merit and peaking plant are (unless specifically noted in this document) to be determined by the relevant competent authority. (E&P_196, UK_6).* 3. *Enable separate classification of back-up fuel (oil) and main fuel (gas) with respect to the load mode. The concept of 'emergency' (or backup) fuel should be introduced. (Eurelectric_972_710_442).* 4. *Add clarification that the given BAT-AELs are only applicable above 70 % load. (Eurelectric_973_711_433, EL_133).*
EIPPCB assessment:	**1. (+2.) A number of plants operating as peak-load, mid-merit and baseload plants are provided. All these plants are included in the assessment to propose BAT-AELs as concluded in the KOM. Plants operating in emergency- and peak-load modes are considered in the assessment for each pollutant and category.** **3. The use of fuel during short periods of time (<500h/y) as a back-up can be considered as the operational mode of the plant (emergency-load mode operation) using a given fuel.** **4. The emission levels reported in the questionnaires are either for a turbine load of > 70 % in the case of periodic measurement, or without a minimum turbine load in the case of continuous measurement. BAT-AELs are applied in normal operating conditions**
EIPPCB proposal:	• **Do not exclude emergency plants from this section.** • **Do not include the concept of emergency or back-up fuel.** • **Do not include a general exception to the applicability of the BAT-AELs.**

1.5.3.1 BAT 40 – Energy efficiency

1.5.3.1.1 BAT 40 – Energy efficiency

Location in D1:	*p. 769*
Current text in D1:	**40. In order to increase the energy efficiency of the LFO combustion in gas turbines, BAT is to use an appropriate combination of the techniques given in BAT 7 and below.**

	Technique	Description	Applicability
a	Double reheat	See description in Section 10.8	Generally applicable to new gas turbines
b	Combined cycle (CCGT)	See description in Section 10.8	Applicable to new gas turbines

Summary of comments:	*General* 1. *Exclude emergency plants (FI_75) and peak load plants (Eurelectric_444).* 2. *Exclude plants in SIS (EL_132).* 3. *This conclusion appears contrary to the contents of table 6.32, and is not consistent (E&P_197).* *Technique a:* 4. *Remove. (EPPSA_396, Eurelectric_445).* *Technique b:* 5. *This BAT should be deleted (or a similar BAT for OCGT should be added) (Eurelectric_446).*

EIPPCB assessment:	**General** • **The listed techniques are applicable to plants located in small isolated systems and/or operated in emergency- or peak-load modes.** • **Table 6.32 of the BREF needs to be updated.** **Technique a** • **Technique (a) may be considered to be included in technique (a) of BAT 7, 'Ultra-supercritical steam conditions'. Therefore, there is no merit to it being repeated in this section.** **Technique b** • **Applicability of technique (b) the technique is applicable for baseload turbines, meaning Open-cycle could be operated in peak- or emergency-load modes without a combined cycle. The applicability restriction regarding the load mode should be clarified in that the techniques would not be applicable to new plants that could be operated in peak- or emergency-load modes. The economic viability may be limited in the case of constrained steam cycle design.**
EIPPCB proposal:	**Remove technique (a)** **Keep technique (b) changing the applicability restrictions:** • **in case of operation in emergency- and peak-load modes for new plants,** • **due to the steam cycle design,** • **due to the plant layout (space) in the case of retrofit at existing plants.**

1.5.3.1.2 Table 10.23 – BAT-AEELs for energy efficiency – gas oil

Location in D1:	*p. 769*
Current text in D1:	**Table 10.23: BAT-associated energy efficiency levels of existing base-load and mid-merit LFO-fired gas turbines**

Type of gas turbine		Parameter	Unit	BAT-associated environmental performance levels
Open cycle	Existing	Net electrical efficiency	%	25 to above 31
	New			above 31
Combined cycle	Existing			33 to above 44
	New			above 40

Summary of comments:	1. *Combined cycle GT and open-cycle GT are complementary in use and should not be only compared in terms of energy efficiency (EL_134).* 2. *These efficiency ranges need to be set such that they reflect operating regimes (E&P_203).* 3. *Add the following footnote '…not applicable for emergency plants (<500h/y)' (IT_104).* 4. *BAT-AEL for energy efficiency should only be defined for mid-merit and base-load plants (Eurelectric_447).*
EIPPCB assessment:	**General** • **Values proposed in D1 were based on yearly averages from the collected data. As per the assessment made in Section 1.1.5 of this BP, it is now proposed to define design-based BAT-AEELs.** • **Special provisions for plants operating in emergency- and peak-load modes are assessed in Section 1.1.3 of this BP.** **Net electrical efficiency** • **The design values on net electrical efficiency reported by three open-cycle gas turbines commissioned before 2010 are up to 35.7 %. Design values are expected to be higher than the performance values reported in the questionnaires (i.e. 25 %) considering Plant 174 for the lower end of the range for open-cycle gas turbines.** • **The design value on net electrical efficiency reported by one combined cycle gas turbine commissioned up to and including 2010 is 44 %. The performance value reported through the questionnaires by Plant 446 is above 44 %. Design values are expected to be higher than the performance values reported in the questionnaires (i.e. 33 %) considering Plant 173-a for the lower end of the range for combined cycle gas turbines.** • **Footnote ([1]): see the assessment made in Section 2.11.(definitions) of this background paper regarding the emergency plants.**
EIPPCB proposal:	• **Change the proposed BAT-AEEL on Net electrical efficiency for existing open-cycle gas turbines to design values of 25–35.7 %.**

	• **Change the proposed BAT-AEEL on Net electrical efficiency for new open-cycle gas turbines to design values of > 35.7 %.** • **Change the proposed BAT-AEEL on Net electrical efficiency for existing combined cycle gas turbines to design values of 33–44 %.** • **Change the proposed BAT-AEEL on Net electrical efficiency for new and existing combined cycle gas turbines to design values of > 44 %.** • **Add a footnote indicating that the BAT-AEELs do not apply in the case of plants operated in peak- or emergency-load modes.**

1.5.3.2 BAT 41 and BAT 42– NO_X and CO emissions to air from the combustion of gas oil in gas turbines

1.5.3.2.1 BAT 41– NO_X emissions to air from the combustion of gas oil in gas turbines

<table>
<tr><td>Location in D1:</td><td>p. 769</td></tr>
<tr><td>Current text in D1:</td><td>
41. In order to prevent and reduce NO_X emissions to air from the combustion of LFO in gas turbines, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a</td><td>Water or steam addition</td><td>See description in Section 10.8</td><td>Not applicable during water shortages in dry areas</td></tr>
<tr><td>b</td><td>Advanced low-NO_X burners for liquid fuels</td><td>See description in Section 10.8</td><td>Applicable to turbine models for which the low-NO_X burners are available on the market</td></tr>
<tr><td>c</td><td>SCR</td><td>See description in Section 10.8</td><td>Not applicable to emergency plants. Applicable within the constraints given by space availability</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td>
1. <u>General</u>
• Exclude emergency plants (FI_76, EL_135, Eurelectric_448).
• Exclude OCGT emergency and peaking load mode plant from applicable techniques (IE_25, EL_135, Eurelectric_448).
2. <u>Technique a: Water or steam addition</u>
• Include text to stating that current BAT Conclusions are only applicable to base load plant (E&P_202, UK_12).
• Exclude emergency plants (Eurelectric_716_978).
3. <u>Technique c: SCR</u>
• SCR is not generally applicable for LFO fired gas turbines – poisoning of catalysts occurs. Only when limited use of LFO in multi-fuel firing with gas, then applicable (EU Turbines_76).
• Secondary flue-gas treatments (i.e. SCR, SNCR) are not applicable in MIS and in SIS with not adapted infrastructure (EL_135_136, Eurelectric_448).
• Modify applicability: 'Technical and economic viability for all plant types will depend on both the space available for installation and market conditions' (E&P_204_205, UK_14, Eurelectric_449).
</td></tr>
<tr><td>EIPPCB assessment:</td><td>
1. <u>General</u>
• Since the techniques proposed as BAT are neither prescriptive nor exhaustive, it is not appropriate to explicitly exclude those plants working in emergency- or peak-load mode. However, the load mode is assessed when proposing BAT-AELs.
2. <u>Water or steam addition (a)</u>
• Example plants of the data collection are fitted with water addition. A number of plants applying this technique operate in emergency- or peak-load modes. Therefore it seems inappropriate to propose an applicability restriction for these operational modes. The name of the technique and applicability due to water availability are homogenised.
3. <u>SCR (c)</u>
• In general, the SCR technique requires certain conditions (e.g. the right temperature to avoid being polluted due to formation of ammonium bisulphate) due to the fuel used, flue-gas temperatures and other operating parameters not only in liquid fuel GTs but also in the combustion of other fuels with other techniques.
• A number of plants in the US use SCR (e.g. Shoreham plant in New York, 46 MW_{th}). Catalyst providers offer products to operate in the flue-gas temperatures reported by plants of the data collection.
• Market conditions as an applicability restriction seems too generic and variable over time.
• Applicability restrictions for plants operating in emergency-load mode and the retrofit of existing plants operating in peak-load mode may be justified by the available information in other sections.
• The space availability may be a constraint for the retrofitting of existing plants.
</td></tr>
</table>

	4. Advanced low-NO_X burners for liquid fuels (b) • **The name of the technique has to be consistent throughout the BAT conclusions.**
EIPPCB proposal:	**1. General** • **Do not include any general exclusion for plants operating in emergency- or peak-load modes.** • **Modify the wording of the BAT statement** **2. Water or steam addition (a)** • **Change the name of the technique to 'Water/steam addition'.** • **Do not include an applicability restriction to water or steam addition in plants operating in emergency-load mode.** • **Change the applicability to refer to the availability of the water.** **3. SCR (c)** • **Change the applicability to indicate constraints for existing plants operated in peak-load mode.** • **Modify the applicability restriction due to space availability in case of the retrofitting of existing plants.** **4. Advanced low-NO_X burners for liquid fuels (b)** • **Change the name of the technique to 'Low-NO_X burners (LNB)'.**

1.5.3.2.2 BAT 42 – CO emissions to air from the combustion of gas oil in gas turbines

Location in D1:	*p. 770*
Current text in D1:	**42. In order to reduce carbon monoxide (CO) emissions to air from the combustion of LFO in gas turbines, BAT is to achieve complete combustion by applying one or a combination of the techniques given in BAT 4 and below**

	Technique	Description	Applicability
a	Oxidation catalysts	See description in Section 10.8	Not applicable to emergency plants. Applicable within the constraints given by space availability

Summary of comments:	• *No applicable for LFO fired gas turbines. (EU Turbines_77).* • *Modify applicability: 'Technical and economic viability for all plant types will depend on both the space available for installation and market conditions' (UK_15, Eurelectric_450)* • *Add an applicability constraint for plants installed in small isolated systems (EL_137).*
EIPPCB assessment:	• **Techniques for controlling the combustion and therefore the CO emissions are more limited in gas oil GT than in other type of plants (e.g. boilers). Techniques are neither exhaustive nor prescriptive.** • **The space availability may be a constraint for the retrofitting of existing plants.** • **For consistency with other fuels, combustion optimisation could be added as a new technique and the wording of the BAT statement changed to not make any reference to BAT 4.**
EIPPCB proposal:	• **Keep technique (a).** • **Add 'Combustion optimisation' and modify the wording of the BAT statement.** • **Modify the applicability restriction due to space availability in case of the retrofitting of existing plants.**

1.5.3.2.3 Table 10.24 – BAT-AELs for NO_X, NH_3 and CO – gas oil

<table>
<tr><td>Location in D1:</td><td>p. 770</td></tr>
<tr><td>Current text in D1:</td><td>
Table 10.24: BAT associated emission levels for NO_X, NH_3 and CO emissions to air from LFO-fired gas turbines
<table>
<tr><th colspan="2" rowspan="2">Type of gas turbine</th><th rowspan="2">Pollutant</th><th rowspan="2">Unit</th><th rowspan="2">Monitoring frequency</th><th colspan="2">BAT-AEL</th></tr>
<tr><th>Yearly average</th><th>Daily average</th></tr>
<tr><td rowspan="2">All but emergency mode</td><td>New</td><td rowspan="2">NO_X</td><td rowspan="4">mg/Nm³</td><td rowspan="4">Continuous measurement</td><td>20 – 40</td><td>ND</td></tr>
<tr><td>Existing</td><td>< 90</td><td>30 – 250</td></tr>
<tr><td colspan="2" rowspan="2">All</td><td>NH_3 ([1])</td><td>< 1 – 5</td><td>ND</td></tr>
<tr><td>CO</td><td>6 – 60</td><td>ND</td></tr>
<tr><td colspan="7">([1]) Ammonia emissions are associated with the use of SCR technique.</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td>

No BAT-AEL's if <500 hours per year (ES_72, ETN_78, Eurelectric_451) and in SIS (EL_138).
Include footnote: 'LFO back up use in gas fired gas turbines belongs to emergency load mode' (FI_12).
Include justified BAT-AELs for each load mode (IE_26).
Include a note that AELs only apply above 70 % load (IE_27, ETN_78, EL_139).

1. <u>NO_X yearly new</u>

40 – 90 mg/Nm³ for monthly average (VDMA_14, ETN_78).
<90 mg/Nm^3 (ETN_51).
<50 mg/Nm³ (Eurelectric_713_975) for monthly (Eurelectric_452).
<90 mg/Nm³ for peak load monthly (Eurelectric_452).
Change lower end of the range because SCR is not generally applicable (EU Turbines_76).

2. <u>NO_X yearly existing</u>

< 120 mg/Nm³ for monthly average (VDMA_14, ETN_78).
150 mg/Nm³ for peak load monthly (Eurelectric_452)
> 90 mg/Nm^3 (E&P_206, UK_16).
550 mg/Nm³ in MIS (and SIS with water shortages load), >70 % (Eurelectric_139_452).
1150 mg/Nm³ for in MIS (and SIS with water shortages load) load <70 % (Eurelectric_452).

3. <u>NO_X daily new</u>

Please provide BAT-AELs on a daily basis for NO_X emissions of new gas turbines firing LFO (AT_59, FR_140).
< 100 mg/Nm3; existing peak plants: 220 mg/Nm^3 (FR_139).

4. <u>NO_X daily existing</u>

No BAT-AELs for daily (ETN_78).
< 100 mg/Nm3; existing peak plants: 220 mg/Nm^3 (FR_139).
600 mg/Nm³ for SIS (Eurelectric_139).

5. <u>Monitoring</u>

Once per year for plants in MIS (SIS with water shortages) (Eurelectric_452_453, EL_140).

6. <u>CO</u>

Propose different values for new and existing turbines; BAT-AEL for CO 100 for existing turbines (ES_73) 80 mg/Nm^{3}for existing. (Eurelectric_713, 975) monthly (Eurelectric_453).
Provide BAT-AELs on a daily basis for CO (AT_60, FR_140).
No continuous monitoring for emergency plant (FI_77, E&P_201, Eurelectric_712_974, UK_11).
Monitoring once per year for plants in MIS (SIS with water shortages) (Eurelectric_452_453, EL_140).

7. <u>NH_3</u>

No BAT-AELs (ETN_78, Eurelectric_454).
Provide daily BAT-AELs (FR_140). <1 - 8 mg/Nm^3 (AT_60).
No continuous monitoring (Eurectric_715, 977) for emergency plant (FI_77, E&P_201,

</td></tr>
</table>

	Eurelectric_712_974, UK_11). • *monitoring 'Only applicable if operated with SCR/SNCR' (DK_177).*
EIPPCB assessment:	• **The available information does not allow proposing BAT AELs for NO_X emissions below the IED levels.** • **BAT-AELs for CO emissions are usually proposed taking into account the BAT-AELs for NOX emissions, which are not proposed for gas oil GT.** • **NH_3 emission BAT-AELs are covered by BAT4 bis.**
EIPPCB proposal:	• **Do not propose BAT-AELs for NO_X and CO emissions. Remove Table 10.24.**

1.5.3.3 BAT 43 – SO_X and dust emissions to air

Location in D1:	*p. 771*
Current text in D1:	**BAT 43. In order to reduce SO_X and dust emissions to air from the combustion of LFO in gas turbines, BAT is to use the techniques given in BAT 4..** **BAT-associated emissions levels** The BAT-associated emission levels for SO_X and dust from the combustion of LFO in gas turbines that are not emergency plants are given in Table 10.25 **Table 10.25: BAT associated emission levels for SO_X and dust emissions to air from the combustion of LFO in gas turbines**

Type of gas turbine		Pollutant	Unit	Monitoring frequency	BAT-AEL Yearly average
All but emergency mode	Existing	dust	mg/Nm³	Continuous measurement	1 – 4
		SO_X		Continuous measurement ([1])	1 – 35
	New	Dust		Continuous measurement	1 – 2
		SO_X		Continuous measurement ([1])	1 – 20

([1]) Only SO_2 is continuously measured, SO_3 is periodically measured (e.g. during calibration). Continuous monitoring fuel sulphur content and correlating it with SO_X emissions is an alternative monitoring method possible if only primary techniques are implemented.

Summary of comments:	1. <u>SO_x</u> • *Remove BAT-AEL. (EU Turbines_79, ES_74, EL_141).* • *'For smaller plants the use of commercially available low Sulphur LFO is BAT'. (UK_17, E&P_207).* • *Provide BAT-AELs on a daily basis (FR_141).* • *Add footnote to the upper end for existing: 'In case secondary techniques are not applicable higher values may occur' (CONCAWE_52).* <u>SO_X monitoring</u> • *Replace in footnote (1) 'continuous monitoring of fuel sulphur content' by 'periodic monitoring of fuel sulphur content' (Eurelectric_457, EL_142).* • *2 periodic measurements per year + determination of the fuel-S-content. (Eurelectric_398_718, EL_141).* • *No continuous measurement of sulphur content in fuel (DK_179).* • *Enable exemptions from CEM (Eurelectric_272_717).* • *No CEMS (EU Turbines_79, ES_74, EL_141).* • *Plants <50 MW_{th} and emergency plants should be excluded from continuous monitoring (E&P_208, UK_18).* 2. <u>Dust</u> • *Provide BAT-AELs on a daily basis (FR_141).* • *Delete. Dust emissions are not relevant in GT. Liquid fuels in GT is not in the IED (EU Turbines_79, ES_74, EL_141).*

	Dust monitoring • *No CEMS for emergency (DK_179).* • *Continuous monitoring <100 MW_{th} not required. For plants in MIS, no dust CEMS but periodic measurements twice per year (Eurelectric_456).* • *No CEMS (EU Turbines_79, ES_74, EL_141).* • *Plants <50 MW_{th} and emergency plants should be excluded from continuous monitoring. (E&P_208, UK_18).* • *The soot number 2 has to be set - at least - as alternative (Eurelectric_272_717) for plants >100 (Eurelectric_456).*
EIPPCB assessment:	**1. SO_X** • **No plants in the data collection report the use of secondary abatement techniques. The S content of the fuel varies from 0.001 to 0.1 wt-%. Plant 446 monitors SO_X emissions continuously and reports 35 mg/Nm^3 burning gas oil around 0.08 wt-% sulphur. The emission reported by this plant is the reference for setting the lower end of the yearly average BAT-AEL range.** • **The use of gas oil with higher sulphur content (0.10 wt-% sulphur) could mean up to 60 mg/Nm^3 SO_2 emissions.** • **For the daily average, the range proposed BAT-AELs for boilers burning gas oil is 150–200 Nm^3, which would mean 50–66 mg/Nm^3 at 15 % O_2.** • **Since the BAT-AELs are based on the fuel choice with a S content below 0.1 wt-%, the BAT-AELs could be the same for new as for existing plants.** • **Plants operating in emergency- or peak-load modes could apply only daily averages, considering the limited emissions during the year.** **Monitoring** • **Since the technique proposed is fuel choice, the monitoring could be periodic instead of continuous.** • **The monitoring frequency for plants operating in emergency- or peak-load modes could be lower than for plants operating more than 1500 h/yr.** • **Continuous monitoring of the fuel is not a suitable alternative to the continuous monitoring of SO_X emissions.** **2. Dust** • **The lower end of the BAT-AEL range is based on a general assessment of the LoD.** • **The upper end of the range for new and existing plants is based on the use of gas oil, and the plants of the data collection do not report any secondary abatement technique.** • **Only one plant (i.e. Plant 499) reports yearly emissions above 5 mg/Nm^3 at 15 % O_2.** • **For the daily average, less variation is expected in a gas turbine than in a boiler, which means 10 mg/Nm^3 is considered appropriate.** • **Plant 446 achieves the proposed values and is located in a SIS.** **Monitoring** • **Plants operated in peak-load or emergency-load modes could have less stringent requirements in terms of monitoring, e.g. periodic monitoring, given their more limited levels of emissions.** • **The monitoring frequency for plants operating in emergency- or peak-load modes could be lower than for plants operating more than 1500 h/yr.** • **No method that correlates the soot level with dust emissions is provided. Therefore the soot level cannot be proposed as an alternative to dust monitoring for gas oil.** **3. General** • **The fuel choice technique can be included in BAT 43 instead of referring to BAT 4 which is more general.**
EIPPCB proposal:	**1. SO_2** • **Propose yearly BAT-AELs for new and existing plants of 35–60 mg/Nm^3.** • **Propose daily BAT-AELs for new and existing plants of 50–66 mg/Nm^3.** • **For emergency- and peak-load plants, propose only daily average or average of the periodic measurements.** • **Plants operated in peak-load mode: periodic measurements (i.e. twice/year).** • **Plants operated in emergency-load mode: periodic measurements (i.e. once/ year).** • **Include a footnote monitoring frequency may be reduced to once every three months if it is demonstrated that the emission levels are consistently within the BAT-AELs set due to the fuel used. In these specific cases, periodic measurements could be carried out each time when a change of the fuel characteristics may have an impact on the emissions.** • **Include a footnote for plants operated in emergency- or peak-load modes: periodic**

	monitoring. **2. <u>Dust</u>** • **Propose yearly BAT_AELs for new and existing plants of 2–5 mg/Nm^3.** • **Propose daily BAT-AELs for new and existing plants of 2–10 mg/Nm^3.** • **For emergency- or peak-load mode plants, propose only daily average or average of the periodic measurements.** • **Plants operated in peak-load mode: periodic measurements (i.e. twice/year).** • **Plants operated in emergency-load mode: periodic measurements (i.e. once/year).** **3. <u>General</u>** • **Add the 'Fuel choice' technique, with an applicability restriction associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State.**

1.6 Natural gas combustion

1.6.1 BAT 44 and 45 – Energy efficiency

1.6.1.1 BAT 44 – Energy efficiency

<table>
<tr><td>Location in D1:</td><td>p. 771 - Section 10.4.1.1</td></tr>
<tr><td>Current text in D1:</td><td>44. In order to increase the energy efficiency of natural gas combustion, BAT is to use one or a combination of the techniques described in BAT 7 and of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>CHP readiness</td><td>See description in Section 10.8.</td><td>Applicable to new gas turbines, including CCGTs</td></tr>
<tr><td>b.</td><td>Regenerative feed-water heating</td><td>See description in Section 10.8.
The regenerative stream can be generated by the boiler or the steam turbine.</td><td>Generally applicable</td></tr>
<tr><td>c.</td><td>Combined cycle (CCGT)</td><td>Energy efficiency optimisation refers to the efficiency of the total combined cycle and not only to the gas turbine</td><td>Applicable to new gas turbines and to existing base load open-cycle gas turbines, provided there is enough available space</td></tr>
</table>
{[This BAT conclusion is based on information given in Section 7.1.4.2.}</td></tr>
<tr><td>Summary of comments:</td><td><u>General</u>
1. Include open-cycle gas turbines as another BAT, at least in emergency and peak-load mode (IE_28, UK_21, E&P_211, Eurelectric_470).
<u>Technique a (CHP readiness)</u>
2. This technique is only applicable if there is a need for heat and the cost/benefit analysis as required by the article 14 of the Energy efficiency Directive 2012/27/EU is positive, (IT_110, MT_20_24, ETN_41, EUTurbines_81, Eurelectric_468_980).
3. This technique is also applicable to engines and boilers (COGEN_7).
<u>Technique b (Regenerative feed-water heating)</u>
4. This technique is not applicable to gas turbines (Eurelectric_981, EUTurbines_81, Marcogaz_22).
5. This technique is not applicable to hot water boilers used in district heating but only to steam boilers (FI_79, Eurelectric_981).
6. This technique should be generally applicable to existing plants only after a cost/benefit analysis (EL_144, IT_111, Eurelectric_469).
7. This technique is not applicable to CCGTs with economizers (EL_144, IT_111, Eurelectric_469) or with pre-heaters (UK_25).
8. This technique maybe constrained by the space availability in the boiler house for existing plants (EL_144, CEPI_90).
<u>Technique c (Combined cycle (CCGT))</u>
9. The applicability of this technique may be constrained by the plant layout (space), the steam cycle design, and the economics (IT_112, EUTurbines_81).
10. Water availability and extreme weather conditions should be added as applicability restrictions (EL_145, IT_112, Eurelectric_470).
11. This technique is not applicable to mechanical drive (ETN_68).</td></tr>
<tr><td>EIPPCB assessment:</td><td><u>General</u>
1. As indicated under the Applicability of technique (c) (i.e. combined cycle gas turbine), the technique is applicable for baseload gas turbines, meaning that open-cycle gas turbines could be operated in peak- or emergency-load modes without a combined cycle. However, given the applicability restriction wording for technique (c), there is a need to emphasise the fact that CCGT do not apply in the case of emergency- and peak-load modes.
<u>CHP readiness (a)</u>
2. Article 14 of the Energy Efficiency Directive (2012/27/EU) requires a cost-benefit assessment for converting existing/new projected combustion plants to high-efficiency cogeneration and efficient district heating and cooling plants, and that this assessment is reviewed periodically (every 5 years) depending on the potential</td></tr>
</table>

	for heat demand. Technique (a) is different as it concerns including options in the plant design that will enable it to be converted into a cogeneration plant with much lower costs, should there be enough heat demand. By nature this technique still applies when there is no heat demand. **3. CHP readiness can also be applied to engines and boilers. The applicability could be reviewed accordingly and consistency with the applicability of BAT 7.t should be ensured.** **Regenerative feed-water heating (b)** **4. (+7.) In the case of CCGTs equipped with economisers, the flue-gas heat is already recovered. However, waste heat could be recovered from the steam turbine.** **5. This technique is not applicable to hot water boilers where no steam is generated.** **6. (+8.) The applicability of the technique will depend on the plant configuration and on the amount of recoverable heat.** **7. This technique is already listed in BAT 7.** **CCGT (c)** **9. (to 11.) No evidence supports the general lack of economic viability of this technique for plants operated in baseload or mid-merit load modes. The applicability restriction regarding the load mode should be clarified in that the techniques would not be applicable to new plants that could be operated in peak- or emergency-load modes. The economic viability may be limited in the case of constrained steam cycle design. Water shortage is not considered a major issue to be indicated as a general constraint as the steam cycle works in a closed loop. The use of CCGTs in the mechanical drive sector is not very common but there are examples of such plants (e.g. Plants 311, 337), thus it cannot be considered that the technique is not generally applicable for such purposes. The technique name could be changed to combined cycle as engines may also apply it.**
EIPPCB proposal:	**General** **1. Do not add 'open-cycle gas turbine' as a new technique. Include in the applicability of technique (c): 'Not applicable to emergency- and peak-load modes'.** **CHP readiness (a)** **2. (+3.) Remove the technique as it is already mentioned in BAT 7. See also assessment in Section 2.14 of this BP. Include engines and boilers in the applicability of the technique in BAT 7. Add that there should be a realistic potential for the future use of heat in the vicinity of the plant.** **Regenerative feed-water heating (b)** **2. (to 8.) Remove the technique. Change the applicability in BAT 7 to indicate that there are restrictions for existing plants.** **CCGT (c)** **9. (to 11.) Change the technique name to 'combined cycle'. Change the description to only make reference to a more detailed description in Section 10.8. Change the applicability to indicate applicability restrictions:** • **in case of operation in emergency- and peak-load modes for new plants,** • **due to the steam cycle design,** • **due to the plant layout (space) in the case of retrofit at existing plants.**

1.6.1.2 BAT 45 – Energy efficiency

Location in D1:	*p. 771 - Section 10.4.1.1*
Current text in D1:	**BAT45 - In order to use energy efficiently, BAT is to use expansion turbines to recover the energy content of the pressurised supplied fuel gases.**
Summary of comments:	*1. This technique is only applicable to large applications with continuous flows (CEFIC_57_248).* *2. The applicability of this technique depends on the gas supply pressure and the gas turbine inlet pressure requirement. (UK_19_23_26, E&P_209_213, Eurelectric_720).* *3. This technique is usually only a technically and economically feasible option for boilers or engines operated in base load. (DK_180, EL_146, Eurelectric_471_983).* *4. Limit the applicability to new plants (IT_113).*
EIPPCB assessment:	**1. No evidence supports the comment. Even if example plants of 460 MW_{th} reported the use of the technique this does not mean it is not applicable for smaller ones.** **2. The applicability of the technique depends on the recoverable energy which in turn depends on the gas supply pressure and on the gas turbine inlet pressure.** **3. Example gas turbines reported the use of such expansion turbines (e.g. Plants 11-1/2). No evidence supports the restriction of the applicability to only baseload modes. One can however notice that this is also linked to the amount of recoverable energy.** **4. There is no reason for differentiating between new and existing plants for the application of this technique.**
EIPPCB proposal:	**1. (to 4.) Add the technique description. Add an applicability restriction: 'The applicability may be limited by the amount of recoverable energy'.**

1.6.1.3 Table 10.26 – BAT-AEELs for energy efficiency – natural gas

1.6.1.3.1 Table 10.26 – General

Location in D1: *p. 771/772 - Section 10.4.1.1*

Current text in D1:

Table 10.26: BAT-associated environmental performance levels for the energy efficiency of natural gas fired combustion plants

Type of combustion plant	BAT-AEPL for energy efficiency (yearly average)		
	Net electrical efficiency (%)		Net total fuel utilisation (%)
	New plants	Existing plants	
Gas engine			
Gas engine ([1])	42 to above 46.5	35 – 44	-
CHP gas engines ([2])	-	-	56 – 78
Gas–fired boiler			
Gas–fired boiler only producing electricity and gas-fired boilers whose recoverable heat generation exceeds the heat demand	40 to above 42	38 – 40	-
Gas–fired boiler only producing heat and gas-fired boilers whose recoverable heat generation does not exceed the heat demand	-	-	78 – 95
Open cycle gas turbine			
Gas turbine	36 to above 41	28 – 39	-
Combined cycle gas turbine (CCGT)			
CCGT for electricity generation only ([3])	48.5 to above 58	45 – 58	-
CHP CCGT plants (50 – 600 MW_{th}) whose recoverable heat generation exceeds the heat demand	42 to above 46	40 – 46	-
CHP CCGT plants (50 – 600 MW_{th}) whose recoverable heat generation does not exceed the heat demand ([2])	-	-	60 – 95

	CHP CCGT plants (> 600 MW_{th}) whose recoverable heat generation exceeds the heat demand: 50 – 51 | 44 – 51 | - | CHP CCGT plants (> MW_{th}) whose recoverable heat generation does not exceed the heat demand (2): - | - | 80 – 92 (1) Electrical efficiency applies for plants producing power only and for plants whose recoverable heat generation exceeds the heat demand. (2) The energy efficiencies in CHP plants are very much dependent upon the specific situation and the local demand of electricity and heat. (3) Not applicable for Emergency mode plants (< 500 h/yr).
Summary of comments:	*General* *1. Add BAT-AEELs for transmission and storage gas-fired plants based on commissioning values (IT_123, ETN_29, Eurelectric_985, Marcogaz_24).* *2. The proposed BAT-AEELs may not be reachable for older boilers (CEFIC_250).* *3. Decrease the lower end of the ranges to account for wider load mode operation and load ranges (SP_76).*
EIPPCB assessment:	**General** **1. There are almost no data available from the submitted questionnaires in 2012. Additional information has been submitted via the task force on energy efficiency (TFEE) with design net mechanical efficiencies between 25 % and 41 % from a set of 19 plants. With the exception of two plants with efficiency levels of 25 % and 29 %, all the others have efficiency levels above 33.5 %. Example plants commissioned more recently are able to achieve levels higher than 36.5 % (e.g. Plants 335, 336, 341). The way of calculating energy efficiency in the case of mechanical drive applications has been described in the questionnaire used to submit data in 2012.** **2. There is no evidence supporting the comment.** **3. BAT-AEELs are now proposed based on 'design' values (see Section 1.1.5). Thus load variations do not affect the proposed levels.**
EIPPCB proposal:	**General** **1. Propose BAT-AEELs for transmission and storage gas-fired plants at 33.5–41 % for existing plants and 36.5–41 % for new plants. Clarify the reference conditions for mechanical drive energy efficiency in 'General considerations' based on the definition used in the questionnaire.** **2. Do not set applicability restrictions for old boilers.** **3. Do not consider load variations in the proposed BAT-AEELs based on 'design' values.**

1.6.1.3.2 Table 10.26 – BAT AEELs for energy efficiency – natural gas

Location in D1:	*p. 771/772 - Section 10.4.1.1*
Current text in D1:	**Table 10.26: BAT-associated environmental performance levels for the energy efficiency of natural gas fired combustion plants**

Type of combustion plant	BAT-AEPL for energy efficiency (yearly average)		
	Net electrical efficiency (%)		Net total fuel utilisation (%)
	New plants	Existing plants	
Gas engine			
Gas engine (1)	42 to above 46.5	35 – 44	-
CHP gas engines (2)	-	-	56 – 78
Gas–fired boiler			
Gas–fired boiler only producing electricity and gas-fired boilers whose recoverable heat generation exceeds the heat demand	40 to above 42	38 – 40	-
Gas–fired boiler only producing heat and gas-fired boilers whose recoverable heat generation does not exceed the heat demand	-	-	78 – 95
Open cycle gas turbine			
Gas turbine	36 to above 41	28 – 39	-
Combined cycle gas turbine (CCGT)			

	CCGT for electricity generation only ([3])	48.5 to above 58	45 – 58	-
	CHP CCGT plants (50 – 600 MW_{th}) whose recoverable heat generation exceeds the heat demand	42 to above 46	40 – 46	-
	CHP CCGT plants (50 – 600 MW_{th}) whose recoverable heat generation does not exceed the heat demand ([2])	-	-	60 – 95
	CHP CCGT plants (> 600 MW_{th}) whose recoverable heat generation exceeds the heat demand	50 – 51	44 – 51	-
	CHP CCGT plants (> MW_{th}) whose recoverable heat generation does not exceed the heat demand ([2])	-	-	80 – 92
	(1) Electrical efficiency applies for plants producing power only and for plants whose recoverable heat generation exceeds the heat demand. (2) The energy efficiencies in CHP plants are very much dependent upon the specific situation and the local demand of electricity and heat. (3) Not applicable for Emergency mode plants (< 500 h/yr).			
Summary of comments:	*1. Open-cycle gas turbines (OCGT)* *1.1. Exclude OCGT <50 MW_{th} operated in emergency mode from the proposed AEELs (UK_27, ETN_28, Eurelectric_722_986, E&P_217); limit the applicability to baseload plants (UK_27, E&P_217).* *1.2. Apply also the footnote ([1]) (Marcogaz_45_113) and footnote ([3]) (Eurelectric_474) to this plant category.* *1.3. Alternative BAT-AEELs:* *1.3.1. Existing OCGT* *1. 28–35 % for plants 15–50 MW_{th} (EUTurbines_82).* *1.3.2. New OCGT* *2. 30–41 % (OGP_70).* *3. 30–36 % for plants 15–50 MW_{th} (EUTurbines_82).* *2. Combined cycle gas turbines (CCGT)* *2.1. Alternative BAT-AEELs for electricity generation only:* *2.1.1. Existing plants* *4. 39–52 % for plants 15–50 MW_{th} (EUTurbines_82).* *2.1.2. New plants* *5. 48.5–60 % (EUTurbines_82).* *6. 55–58 % as measured efficiency (EEB_68).* *7. 42–55 % for plants 15–50 MW_{th} (EUTurbines_82).* *2.2. Alternative electrical efficiency BAT-AEELs for CHP plants* *2.2.1. Considerations should be given to allow for part-load operation while matching variable process steam demands in CHP mode (CEFIC_49).* *2.2.2. Apply the footnote ([2]) to the CHP cases whose recoverable heat generation exceeds the heat demand (Eurelectric_475_724_988).* *2.2.3. Existing plants of 50–600 MW_{th}* *8. 30–46 % (OGP_68).* *2.2.4. New plants of 50–600 MW_{th}* *9. 30–46 % (OGP_68).* *2.2.5. Existing plants of >600 MW_{th}* *10. 34–51 % (OGP_68).* *2.2.6. New plants of >600 MW_{th}* *11. 34–51 % (OGP_68).* *12. 45–51 % for new plants (PL_165).* *2.3. Alternative net total fuel utilisation BAT-AEELs for CHP plants* *2.3.1. Plants of 50–600 MW_{th}: correct the higher end of the range to 92 % (Eureleectric_476_725_989).* *2.3.2. Plants of >600 MW_{th}: change the range to 70–92 % to take into consideration process plants (OGP_69).* *2.4. Footnote ([3]): include the emergency 'mode' to this footnote (Eurelectric_988).*			
EIPPCB assessment:	**1. Open-cycle gas turbines (OCGT)** **1.1. (+1.3.) Data are not available for small plants (< 50 MW_{th}) in any mode There is no rationale/evidence attached to the comments supporting the new proposed BAT-AEELs for plants 15–50 MW_{th}. See the proposal in Section 2.9. not to apply BAT-AEELs to plants operated in peak- or emergency-load**			

	modes. **Information has been submitted via the TFEE with design net electrical efficiencies between 33 % and 41.5 % for existing plants. Data were reported for two plants commissioned after 2010 but with levels at the lower end of the range corresponding to existing plants, without accompanying questionnaires. Therefore they are not considered for proposing the lower end of the range for new plants.** **1.2. Footnote ([1]) gives clarification about the application of 'Net electrical efficiency'. It is thus generic and could be better located just beside 'Net electrical efficiency' in the heading of the corresponding column. See point 1.1. above about the operation in emergency-load mode corresponding to footnote ([3]).** **2. <u>Combined cycle gas turbines (CCGT)</u>** **2.1. <u>CCGT producing power only</u>** **No data/information were submitted for plants of < 50 MW_{th}, thus no conclusions can be derived for such plants. No further rationale/evidence attached to the comment support the proposed levels.** **Information has been submitted via the TFEE with design net electrical efficiencies for existing plants between 32.8 % and 59.7 %. However, it was not possible to link the lower level of the range with a plant that submitted a questionnaire. The lowest value that could be linked with the list of reference plants is 47 % (Plant 360). Net electrical efficiencies provided for plants commissioned after 2010 are between 57 % and 60.5 %.** **2.2. <u>CCGT CHP plants – Net electrical efficiency</u>** **2.2.1. BAT-AEELs are now proposed based on 'design' values (see Section 1.1.5). Thus load variations do not affect the proposed levels and the proposed net electrical efficiency BAT-AEELs are aligned with those proposed for CCGTs generating only electricity as the performance test is performed in the same conditions, without heat generation.** **2.2.2. Footnote ([2]) applies to all CHP cases where the potential local demand for heat is too low to achieve the proposed levels for net total fuel utilisation. It could thus be moved just beside 'Net total fuel utilisation' in the heading of the corresponding column. Furthermore, it could be slightly reformulated for consistency throughout the BAT conclusions. It does not apply to the generation of only power.** **2.2.3. (to 2.2.7) See the assessment in 2.2.1. regarding the alignment of performance with plants generating only electricity. The comments suggesting lowering the lower end of the range are not supported by evidence and refer sometimes to 'typical plants' whilst the BREF aims at dealing with BAT plants.** **2.3. <u>CCGT CHP plants – Total fuel utilisation</u>** **2.3.1. The higher end of the range is derived from the available data at plant level collected in 2012, as the 'design' efficiency levels provided through the TFEE in 2014 are less comprehensive. The lower end of the range can however be aligned with the lower end of the reported 'design' values at 67 % for 50–600 MW_{th} plants. The higher ends of the ranges may need to be aligned between the categories 50–600 MW_{th} and ≥ 600 MW_{th}, at the level of 95 % achieved at smaller plants.** **2.3.2. Process plants are considered in the assessment for setting the proposed BAT-AELs. No further rationale/evidence supports the submitted comment.** **2.4. Footnote ([3]): see the assessment made in Section 2.11. (definitions) of this background paper regarding the emergency plants.** **3. <u>CHP gas engines</u>: Additional information has been provided by the TFEE with a 'design' net total fuel utilisation of 84.5 % from Plant 186 (wrongly reported as 43.2 % in the TFEE conclusions).** **4. <u>Gas boilers</u>: Four plants were included in the TFEE design efficiency data collection performed in 2014 with the only levels in CHP mode between 87 % and 95 %. These levels are within the range proposed in D1 (78–95 %). Furthermore, data from a recent plant combusting process gases from the iron and steel industry can be used for revising the proposed net electrical efficiency BAT-AEEL (See BP section 1.7.9).**
EIPPCB proposal:	**1. <u>Open-cycle gas turbines (OCGT)</u>** **1.1. (+1.3.) Change the proposed BAT-AEEL for new plants to 36–41.5 %. Change the proposed BAT-AEEL for existing plants to 33–41.5 %. Change the name of**

	plant category to: 'Gas turbine ≥ 50 MW_{th}'. **1.2. Move footnote ([1]) just beside 'Net electrical efficiency' in the heading of the corresponding column.** **2. <u>Combined cycle gas turbines (CCGT)</u>** **2.1. <u>CCGT producing power only</u>** **Change the name of plant category to: 'CCGT plants ≥ 50 MW_{th} for electricity generation only'.** **Change the proposed BAT-AEELs for existing plants to 47–60 %, and to 57–60.5 % for new plants.** **2.2. <u>CCGT CHP plants – Net electrical efficiency</u>** **2.2.1. Do not specify restrictions linked to the load variability. Align the proposed net electrical efficiency BAT-AEELs with those proposed for plants generating electricity only.** **2.2.2. Move footnote ([2]) just beside 'Net total fuel utilisation' in the heading of the corresponding column. Reformulated the footnote consistently throughout the BAT conclusions.** **2.2.3. (to 2.2.7.) Keep the lower end of the ranges for CHP CCGT plants.** **2.3. <u>CCGT CHP plants – Net total fuel utilisation</u>** **2.3.1. (+2.3.2.) Propose BAT-AEEL for plants of ≥ 600 MW_{th} to 80–95 %. Change the BAT-AEEL for plants of 50–600 MW_{th} to 67–95 %.** **2.4. The BAT-AEELs are not applicable to plants operated in emergency- or peak-load modes.** **3. Change the proposed net total fuel utilisation BAT-AEEL for CHP gas engine to: 56–85 %.** **4. Change the proposed net electrical efficiency BAT-AEEL for new boilers to 40–42.5 %.** **5. Reorganise and simplify the BAT-AEELs table to have the net electrical efficiency, net total fuel utilisation and net mechanical energy efficiency BAT-AEELs reported on the same line with footnotes in the heading of the columns mentioning that 1) net electrical efficiency BAT-AEELs apply to CHP plants and plants generating only power, 2) net mechanical energy efficiency BAT-AEELs apply to mechanical drive plants, and 3) net total fuel utilisation BAT-AEELs apply to CHP plants and plants generating only heat.**

1.6.2 BAT 46 – NO_X emissions to air from boilers

<table>
<tr><td>Location in D1:</td><td>p. 772 - Section 10.4.1.2</td></tr>
<tr><td>Current text in D1:</td><td>
46. In order to reduce NO_X emissions to air from the combustion of natural gas in boilers, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Air and fuel staging</td><td>See descriptions in Section 10.8. Air staging (over fire air) is often associated with low-NO_X burners</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Flue-gas recirculation</td><td>See description in Section 10.8.</td><td>Generally applicable</td></tr>
<tr><td>c.</td><td>(Ultra) Low-NO_X burners ((U)LNB)</td><td>See description in Section 10.8.</td><td>Retrofit may be limited for older plants due to boiler design constraints</td></tr>
<tr><td>d.</td><td>Selective Catalytic Reduction (SCR)</td><td>See description in Section 10.8.</td><td>Retrofitting existing plants may be constrained by the availability of significant space. Not applicable for emergency plants. For peak-load plants, the economic viability may depend on the energy market conditions</td></tr>
<tr><td>e.</td><td>Selective Non Catalytic Reduction (SNCR)</td><td>See description in Section 10.8.</td><td>Not applicable to emergency plants</td></tr>
<tr><td>f.</td><td>Advanced computerised process control</td><td>See description in Section 10.8. This technique is often used in combination with other techniques or may be used alone for very well-tuned emergency plants.</td><td>Generally applicable</td></tr>
</table>
{This BAT conclusion is based on information given in Section 7.1.4.3}
</td></tr>
<tr><td>Summary of comments:</td><td>
<u>Technique a (air and/or fuel staging)</u>
1. The applicability may be limited in the case of older plants due to boiler design constraints (CEFIC_19, CONCAWE_53, Eurelectric_479); in the case of existing plants, due to boiler size and type, technical constraints and cost of retrofit (EL_149, IT_120).
2. Split between the techniques 'air staging' and 'fuel staging' (CEFIC_252).
3. Mention the following applicability constraints: "reduction in boiler capacity may be required in smaller plants for air staging'; 'OFA applicability is limited to large boilers'; 'fuel staging is only retrofittable on large boilers' (CEFIC_253).
<u>Technique b (flue-gas recirculation)</u>
4. Add an applicability constraint linked to the space availability and to the need to change sometimes the burners, in case of existing plants (Marcogaz_46).
5. The applicability may be limited in the case of older plants due to boiler design constraints (CEFIC_20); in the case of existing plants, due to the boiler size and type, technical constraints, chemical installation safety (CONCAWE_54) and cost of retrofit (EEL_150, IT_121, Eurelectric_480).
6. This technique is not applicable for peak-load plants (FI_80).
<u>Technique c ((ultra-)low-NO_X burners ((U)LNB))</u>
7. The applicability may be limited in the case of existing plants where complexity depends on site specific conditions (CEFIC_253), or due to space constraints (AT_42).
8. Remove 'Ultra' from the technique name as there is no distinction made in the definition in Section 10.8. (EPPSA_399).
<u>Technique d (SCR)</u>
9. This technique is not applicable in the case of plants operated in emergency- (CEFIC_255) or peak-load mode (FI_80, Eurelectric_481); it is only applicable to base-load plants (IT_122); the applicability is limited in the case of all operating modes due to economic constraints (UK_28, E&P_218).
10. The BAT conclusions should include the description of benefits, trade-offs and cross-media effects (Eurelectric_481_726_990); the boiler foundation design should also be considered in terms of applicability (Eurelectric_481_482).
11. There is no example plant fitted with SCR in Chapter 7 supporting the proposal of SCR as a BAT (FR_148).
<u>Technique e (SNCR)</u>
12. This technique is not applicable for emergency (CEFIC_256, CONCAWE_55) and peak-load plants (FI_80, Eurolectric_481_482); the technique is only applicable to base-load plants (IT_122).
</td></tr>
</table>

	13. Add an applicability restriction: 'within the constraints given by the boiler size and design' (CEFIC_21, CONCAWE_55). *14. The applicability may be constrained by the requirement for a temperature window and the residence time to be reached by reactant injection (CEFIC_256).* *15. Retrofitting existing plants is constrained by the availability of significant space in the boiler gas path (UK_29, E&P_220).* *New technique* *16. Include 'cold combustion air' as another BAT conclusion. A description is given with the comment (EPPSA_400).* *17. Add 'air preheat removal' as another BAT conclusion (CEFIC_254).*
EIPPCB assessment:	**Air and/or fuel staging (a)** **1. (to 3.) The applicability of air staging may be limited in the case of very old small boilers. However, for bigger old plants, the technique has been applied, as shown in example plants (e.g. Plants 513, 288). Fuel staging is applicable to plants of ≥ 50 MW_{th} as shown in example plants (e.g. Plants 215, 657). Differentiation between both techniques therefore seems unnecessary.** **Flue-gas recirculation – FGR (b)** **4. (to 6.) FGR has been retrofitted in a lot of different situations. There may be some design considerations in the case of retrofits at old plants in cluttered environments, e.g. for utility boilers or when there is a need to upgrade the burners. However, example plants commissioned in the 1980s/90s in different industrial sectors, and even one plant commissioned in 1959 in the oil refining sector (Plant 67), reported using FGR (e.g. Plants 67, 325), including plants operated in peak-load mode (e.g. Plant 203). This technique is not considered to be too costly to prevent its use even in such a load mode.** **(Ultra-) Low-NO_X burners ((U)LNB)) (c)** **7. (+8.) There may be some design considerations in the case of retrofits at old plants in cluttered environments, e.g. for utility boilers. However, 25 plants out of the 32 that submitted information reported the use of (U)LNB. These existing plants belong to very different industries (oil refining, chemical industry, district heating, food and drink, power, pulp and paper industries), showing that these challenges can generally be overcome. Small plants of down to 15 MW_{th} were retrofitted with LNB (e.g. Plant 65 first commissioned in 1974). D1 mentioned the applicability limitation in the case of older plants due to boiler design constraints. This limitation is not really about the applicability but about the achievable performance. The definition of 'Ultra' LNB is included in that of LNB in Section 10.8.** **SCR (d)** **9. (+11.) A plant is generally able to achieve low NO_X emission levels using only primary techniques. SCR can still be considered BAT for those cases where this is not possible. Emergency-load mode is excluded in D1 in the applicability. There is no evidence in the comments that such a technique is not economically viable for other load modes. However, it can be expected that, as in the case of coal combustion, the retrofit applicability for plants operated in peak-load mode may need to be assessed on a case-by-case basis. There may be technical constraints for applying the technique, e.g. on the design of the foundations, but they can usually be overcome in the case of boilers, as shown through the numerous examples of coal-fired boilers of ≥ 100 MW_{th} fitted with SCR, including in terms of space availability. This technique can also be used in a 'reduced' format in combination with SNCR, at a global cost lower than if using a full SCR system.** **10. According to the BREF Guidance, information on benefits, trade-offs and cross-media effects should not be included in the BAT conclusions but in the previous descriptive chapters of the BREFs.** **SNCR (e)** **12. (to 15.) For plants operated with many start-ups, shutdowns or highly variable loads, meeting the appropriate temperature window may be challenging. The issue of space availability in the boiler gas path or boiler size and design is related to the technical constraints of ensuring a minimum residence time within a given temperature range, as the technique alone does not require a lot of space. The injection of ammonia/urea by means of different levels of injectors with different lengths, using an appropriate reactant can help solve the problem of the temperature window. The combination with a 'slip' SCR technique could help complete the NO_X reduction process if the residence time is not long enough; however, this combination may not be cost-effective in the case of plants operated in peak-or emergency-load modes. The capital cost is much lower than for the SCR technique and the operational cost is directly linked to the amount of chemical used,**

	which makes it suitable for plants operated in peak-load or emergency-load modes except in the case of variable loads. **New technique** **16. (+17.) The proposed techniques (i.e. 'cold combustion air' and 'air preheat removal') are similar and could be covered with the name 'reduction of the combustion air temperature'. They have a positive effect on the level of thermal NO_X generated. They are generally applicable, as the application only to 'boilers not requiring regenerative air heaters to maximise boiler efficiency' proposed by EPPSA would not fit with the general need to improve the energy efficiency for all combustion plants. However, there may be some constraints linked to the process needs in the case of utility boilers. The technique is already described in the BREF Section 3.3.3.3.4.**
EIPPCB proposal:	**Air and/or fuel staging (a)** **1. (to 3.) Keep the applicability as 'generally applicable', and add in the description (Section 10.8.3) that some old small boilers may require a capacity reduction to allow the space for air staging.** **Flue-gas recirculation (b)** **4. (to 6.) Keep the technique as 'generally applicable'.** **(Ultra-)low-NO_X burners) (c)** **7. (+8.) Change the applicability to 'generally applicable' and move the information about boiler design constraints to the description in Section 10.8.3. Change the name of the technique to Low-NO_X burners (LNB).** **SCR (d)** **9. (to 11.) Change the applicability to reflect that there may be technical and economic constraints for retrofitting plants operated in peak-load mode. Add an applicability restriction linked to the plant size for plants of < 100 MW_{th}, consistently with other types of boilers and remove the restriction linked to space availability.** **SNCR (e)** **12. (to 15.) Change the applicability restriction to mention only restrictions in the case of plants operated in peak- or emergency-load modes with high boiler load variations.** **New technique** **16. (+17.) Add the new technique 'reduction of the combustion air temperature' to the list of BAT. Add its description in Section 10.8 of the BAT conclusions. Set the applicability of this technique to 'generally applicable' within the constraints given by the process needs.** **Advanced computerised process control** **18. Change the name of the technique to 'advanced control system' and its applicability for consistency throughout the BREF.**

1.6.3 BAT 47 – NO_X and NH_3 emissions to air from turbines

<table>
<tr><td>Location in D1:</td><td>p. 773 - Section 10.4.1.2</td></tr>
<tr><td>Current text in D1:</td><td>
47. In order to reduce NO_X emissions to air from the combustion of natural gas in gas turbines while limiting NH_3 slip in the case of SCR use, BAT is to use one or a combination of the techniques given below:
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Dry low-NO_X burners (DLN)</td><td>See description in Section 10.8.</td><td>Applicability may be limited in case of very old turbine (retrofitting package not available) or when steam/water injection systems are installed</td></tr>
<tr><td>b.</td><td>Selective Catalytic Reduction (SCR)</td><td>See description in Section 10.8.</td><td>Retrofitting existing plants may be constrained by the availability of significant space.
Not applicable to emergency mode plants. For peak-load plants, the economic viability may depend on the energy market conditions</td></tr>
<tr><td>c.</td><td>Water or steam injection</td><td>See description in Section 10.8.
Used in existing gas turbines and when a retrofit DLN package is not available</td><td>Generally applicable</td></tr>
<tr><td>d.</td><td>Advanced computerised process control</td><td>See description in Section 10.8.
This technique is often used in combination with other techniques or may be used alone for very well-tuned emergency plants operated in emergency mode</td><td>Generally applicable</td></tr>
<tr><td>e.</td><td>Low-load design concepts</td><td>Adaptation of the process control and related equipment for keeping good combustion efficiency when the demand in energy is varying, e.g. by improving the inlet airflow control capability or by splitting the combustion process in decoupled combustion stages</td><td>Applicable depending on the gas turbines design</td></tr>
<tr><td>f.</td><td>Low-NO_X burners (LNB)</td><td>See description in Section 10.8.</td><td>Generally applicable to supplementary firing for heat recovery steam generators (HRSG) in case of combined cycle plants (CCGTs)</td></tr>
</table>
{This BAT conclusion is based on information given in Section 7.1.4.3}
</td></tr>
<tr><td>Summary of comments:</td><td>
<u>General</u>
1. Structure the BAT conclusions according to the following parameters: size, hours of operation, load factor, economic situation (ES_31).
2. None of these techniques is economically viable for plants <150 MW_{th} (ES_31).
<u>Technique a (DLN)</u>
3. Revise the wording to make clear that it may not always be possible or cost-effective to fit DLN to existing plants (UK_32, CEPI_94, E&P_223).
4. Technique (d) could be directly combined with technique (a) as advanced computerised process control is used in all DLN systems (EUTurbines_83_84).
<u>Technique b (SCR)</u>
5. This technique is not applicable to CCGT with post combustion due to too high temperatures (CEPI_95).
6. Extend the applicability restriction on economic viability to all operating modes (UK_30, E&P_221, Eurelectric_483).
7. The applicability of this technique may also be limited by the appropriate temperature range of exhaust gas, the economic comparison assessment with other options such as DLN implementation, the number of operating hours, the remaining plant lifetime (IT_124, Eurelectric_991).
8. The technique is not applicable to gas turbines used in gas transmission and storage
</td></tr>
</table>

	(IT_124). *9. The applicability seems to be limited to plants >600 MW_{th} based on information from Chapter 7 (FR_147).* *10. Add applicability restrictions linked to the gas turbine foundation design (EL_151, Eurelectric_483).* *11. The technique is not applicable in the case of peak-load modes and open-cycle gas turbines (EL_151, Eurelectric_483).* *12. Be more precise regarding the space availability 'in the HRSG' constraint (EUTurbines_83).* *Technique c (water or steam injection)* *13. This technique is not applicable in the case of water shortages (EUTurbines_83).* *14. The applicability may be constrained by the risk of corrosion for existing plants and it can lead to the loss of guarantee (CEPI_96).* *15. The applicability may be limited due to constraints on design, availability of (production unit for) treated water; retrofitting of existing plants may be constrained by high temperatures and by variable turbine's loads (IT_125).* *16. For mechanical drive gas turbines used in gas transmission and storage, this technique is not applicable (IT_125).* *17. This technique is not to be recommended as BAT for new plants (PL_157).* *18. This technique may be used also in some new gas turbines where DLN burners do not assure both emissions respect and necessary flexibility (Eurelectric_484).* *Technique d (advanced computerised process control)* *19. It seems not commensurate to install such a technique to plants operated <500 h/yr. With conventional DLN technique, there is no such a technique in place (IT_126).* *20. Add a general constraint link to the space availability and to the number of operating hours (Marcogaz_46).* *Technique f (LNB)* *21. The applicability to existing plants needs to be checked with a cost/benefit analysis (EL_152. Eurelectric_485).* *22. Add a general constraint link to the space availability and to the number of operating hours (Marcogaz_46).*
EIPPCB assessment:	**General** **1. (+2.) These comments (which are repeated throughout the BAT conclusions chapter of the BREF) are considered too general to propose concrete amendments to the BAT conclusions. Correlations are sought for each type of plant and fuel. See the EIPPCB email dated 05.12.2013 for more details.** **DLN (a)** **3. The economic viability of retrofitting DLN to existing plants is demonstrated through many examples; the wording used regarding the applicability of the technique already clearly sets the cases where it may not be possible to retrofit existing plants (availability of an appropriate DLN retrofit package). No further information/rationale accompanies the comments.** **4. The BAT statement already includes the possibility to use 'one or a combination of the techniques given', including the advanced control system. The techniques mentioned are neither exhaustive nor prescriptive.** **SCR (b)** **5. (+11. +12.) Catalyst solutions are available including for use at open-cycle gas turbines with high-temperature flue-gases (D1 Ref. 27 and additional information EIPPCB-01/02).** **6. SCR has been and is being implemented in gas turbine retrofits in many countries around the world, confirming this is an economically viable technique (D1 Ref. 27).** **7. (+9. +10. +11.) The remaining plant lifetime, the cost-benefit assessment and the design of the foundations are aspects to be considered on a case-by-case basis for deciding upon the technique to select for controlling the NO_X emissions. They cannot be considered to generally limit the applicability of SCR. From a submitted document UKTWG10 including information on the cost of the retrofit of a SCR system at a CCGT, it can be expected that this technique may be costly in the case of plants operated in peak-load mode and even more so for plants operated in emergency-load mode. Regarding the size of plants where SCR is implemented, bulk information and example plants of a capacity down to < 100 MW_{th} have been reported (e.g. Plant 305 is 91 MW_{th} or see doc. Ref 27 or additional information EIPPCB-06). The temperature window is an important parameter for this technique to operate properly. Different solutions enable the plant to cope with the temperature such as the use of a SCR bypass when the temperature is too low (levels of NO_X generated are also lower than at full load), the proper location of the**

	SCR system and/or the use of special catalysts (see docs Ref 27, additional information EIPPCB-01/02/05/08). **8. The techno-economic restrictions for applying SCR to turbines are considered to be of the same nature regardless of the industrial sector in which the technique is used. In the case of mechanical drive use, the limited number of hours or the difficulties of keeping the flue-gas in the right temperature window could be possible reasons for not applying the technique. These applicability constraints have been assessed in the previous point.** **<u>Water or steam injection (c)</u>** **13. This technique consumes significant quantities of water, above all if used in baseload/mid-merit load modes. Therefore, there should be enough water available near the plant for using the technique.** **14. Water/steam injection may induce more material stress in the combustion chamber; this is recognised as a potential cross-media effect, however this does not prevent the general applicability of the technique.** **15. (+19.) There is no additional information provided about the design, space or temperature constraints that would prevent the retrofit of this technique. The lack of guarantee by the manufacturer is not considered a technical constraint. The technique is flexible and adjustable to the load variations.** **16. The techno-economic restrictions for applying SCR to turbines are of the same nature regardless of the industrial sector in which the technique is used. In the case of mechanical drive use, the lack of water nearby could be considered a possible reason for not applying the technique.** **17. (+18.) The performance of the technique is limited by the water/fuel ratio; DLN systems allow much lower levels of emissions to be achieved than water/steam injection. Furthermore, the use of a dry technique will prevent the consumption of water. The technique description already mentions that the technique is used in existing plants and in cases where no DLN retrofit package is available. Techniques are neither prescriptive nor exhaustive.** **<u>Advanced computerised process control (d)</u>** **19. (+ 20) According to a supplier association, DLN solutions include advanced computerised process control. No economic study was provided supporting the comment; however there may be challenges in retrofitting older plants. Techniques are neither exhaustive nor prescriptive.** **<u>LNB (f)</u>** **21. (+ 22) The statement is considered too general and no economic information has been provided. The cost-benefit analysis is performed at site level to select the best option and takes into account all relevant parameters for a given plant. Techniques are neither exhaustive nor prescriptive.**
EIPPCB proposal:	**<u>DLN (a)</u>** **3. (+4.) Keep the description and applicability of the DLN technique unchanged.** **<u>SCR (b)</u>** **5. (to 12.) Change the applicability to indicate constraints for existing plants operated in peak-load mode.** **<u>Water or steam injection (c)</u>** **13. (to 18.) Change the applicability to recognise that there are constraints imposed by water availability. Change the name of the technique to 'Water/steam addition' for consistency throughout the BREF and BAT conclusions.** **19. <u>(and 20) Advanced computerised process control (d)</u>** **Change the name of the technique to 'advanced control system' and its applicability for consistency throughout the BREF.** **21. <u>(and 22) LNB (f)</u>** **Keep the applicability unchanged.**

1.6.4 BAT 48 – NO_X emissions to air from engines

<table>
<tr><td>Location in D1:</td><td>p. 773/774 - Section 10.4.1.2</td></tr>
<tr><td>Current text in D1:</td><td>48. In order to reduce NO_X emissions to air from the combustion of natural gas in engines, BAT is to use one or a combination of the techniques given below:
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Lean-burn concept</td><td>See description in Section 10.8.
Generally used in combination with SCR</td><td>Applicable to new gas-fired engines.</td></tr>
<tr><td>b.</td><td>Advanced lean-burn concept</td><td>See description in Section 10.8</td><td>Applicable to new gas-fired engines but not to spark ignited engines.</td></tr>
<tr><td>c.</td><td>Selective Catalytic Reduction (SCR)</td><td>See description in Section 10.8</td><td>Retrofitting existing plants may be constrained by the availability of significant space.
Not applicable to emergency mode plants. For peak-load plants, the economic viability may depend on the energy market conditions</td></tr>
<tr><td>d.</td><td>Advanced computerised process control</td><td>See description in Section 10.8
This technique is often used in combination with other techniques or may be used alone for very well-tuned emergency plants operated in emergency mode</td><td>Generally applicable</td></tr>
</table>
{This BAT conclusion is based on information given in Section 7.1.4.3}</td></tr>
<tr><td>Summary of comments:</td><td><u>General</u>
1. Structure the BAT conclusions according to the following parameters: size, hours of operation, load factor, economic situation (ES_32).
2. None of these techniques is economically viable for plants <150 MW_{th} (ES_32).
<u>Technique b (advanced lean-burn concept)</u>
3. This technique is only applicable to SG type engines and not to DF type engines (EUROMOT_64_93).
<u>Technique c (SCR)</u>
4. Extend the applicability constraint link to market conditions to the market of the produced goods when the combustion plant supplies in heat an industrial facility (IT_129).
5. This technique is not applicable to peak-load plants (Eurelectric_486).
6. Include more details on cross-media effects in the technique description (Eurelectric_486).
7. Add an applicability constraint linked to the engine foundation design (Eurelectric_486).</td></tr>
<tr><td>EIPPCB assessment:</td><td><u>General</u>
1. (+2.) These comments (which are repeated throughout the BAT conclusions chapter of the BREF) are considered too general to propose concrete amendments to the BAT conclusions. Correlations are sought for each type of plant and fuel. See the EIPPCB email dated 05.12.2013 for more details.
<u>Advanced lean-burn concept (b)</u>
3. Section 3.3.3.3.9 of D1 mentions that the advanced lean-burn technique does not yet apply to dual-fuel(DF)-type engines but to spark plug or other ignited (SG)-type engines. This could be reflected in the applicability.
<u>SCR (c)</u>
4. (to 7.) The technique is not applicable to plants operated in emergency-load mode as indicated in D1. Cross-media effects are not mentioned in the BAT conclusions but, where relevant, in the chapters of the BREF describing the techniques, except when they restrict the applicability of techniques. There is no evidence of technical constraints apart from those already mentioned in D1. The implementation of SCR may require technical challenges to be overcome, e.g. on the design of the foundations. Plant 504 is fitted with SCR for use in dual mode (95 % gas and 5 % diesel, or diesel only); the performance achieved is limited by the space available.</td></tr>
</table>

	After reviewing the available information (see Chapter 3.3.3.3.11 of the BREF on SCR) and submitted comments, there is no evidence that such a technique is not generally economically viable for peak-load plants. The example Plant 504, which is operated 2000 h/yr, was retrofitted with SCR. From the technical point of view, a plant that will operate very few hours (e.g. less than two hours per shift) with many start-ups/shutdowns (e.g. one to three per day) may face difficulties to reach the optimum system efficiency if the load varies a lot as it would then require a special catalyst design that may not be economically viable for peak-load plants.
EIPPCB proposal:	**Advanced lean-burn concept (b)** **3. Add an applicability restriction to reflect that the technique is only applicable to spark plug or other ignited (SG)-type engines.** **SCR (c)** **4. (to 7.) Modify the applicability restriction to indicate that there may be techno-economic restrictions to retrofitting existing plants operated in peak-load mode.** **Advanced computerised control system (d)** **8. Change the name of the technique to 'advanced control system' and its applicability for consistency throughout the BREF.**

1.6.5 BAT 49 – CO emissions to air

Location in D1:	*p. 774 - Section 10.4.1.2*
Current text in D1:	**49. In order to reduce CO emissions to air from the combustion of natural gas, BAT is to use one or a combination of the techniques given below:**

Technique		Description	Applicability
a.	Complete combustion		
	1. Good furnace/combustion chamber design		Applicable to new plants
	2. Use of high performance monitoring		Generally applicable
	3. Maintenance of the combustion system		Generally applicable
b.	Well optimised system to reduce emissions of NO_X		Generally applicable
c.	Advanced automated process control	See description in Section 10.8.	Generally applicable
d.	Application of oxidation catalysts	See description in Section 10.8.	Generally applicable

{This BAT conclusion is based on information given in Section 7.1.4.3}

Summary of comments:	*General* 1. *CO BAT-AELs exceed the requirements set in the IED for existing CCGTs (ES_33).* 2. *Structure the BAT conclusions according to the following parameters: size, hours of operation, load factor, economic situation (ES_34).* 3. *None of these techniques is economically viable for plants <150 MW_{th} (ES_34).* *Technique a (complete combustion)* 4. *Remove this technique as there is a contradiction between NO_X reduction and CO reduction (Marcogaz_49).* 5. *Technique a2 (use of high performance monitoring) should be removed as this technique has no value when the plant burns clean fuels (CEFIC_258).* 6. *Technique a3 (maintenance of the combustion system) should be removed as this technique has no value when the plant burns clean fuels (CEFIC_258).* *Technique b (well optimised system to reduce emission of NO_X)* 7. *Remove this technique as there is a contradiction in between CO and NO_X emissions (UK_15, Eurelectric_992).* 8. *Replace NO_X by CO in the technique name (MT_14, Eurelectric_487).* *Technique c (advanced computerised process control)* 9. *Remove the technique as it has only a very minor impact on CO emissions (CEFIC_259).* 10. *The applicability may be limited in the case where there would be a need to change the entire control system and thus a cost/benefit analysis would be needed (Eurelectric_488).* *Technique d (application of oxidation catalyst)* 11. *Add general constraint link to the space availability, number of operating hours (Marcogaz_35, CEFIC_260), remaining lifetime (Marcogaz_50_124) and sulphur content for existing plants.* 12. *The applicability may be constrained by energy market conditions for all operating modes (EL_153, IT_131, UK_11, E&P_235, Eurelectric_489).* 13. *Include a description of this technique in Chapter 7 (FR_152).*
EIPPCB assessment:	**General** **1. CO BAT-AELs are proposed based on the assessment of the submitted data.** **2. The structure of BAT-AELs takes into consideration the proposed parameters if correlations are found based on the assessment of available information.** **3. Rationales regarding the economic viability of all the techniques for plants of < 150 MW_{th} are assessed separately for each category of plant.** **Complete combustion (a)** **4. As complete combustion is only an idealistic target, the name of the technique could be changed to 'combustion optimisation', which also encompasses the principle of reaching a compromise between NO_X and CO emissions.** **5. (+6.) Techniques a.2 and a.3 are important even if the plant burns clean fuels as they relate to the control of the combustion and its stability over time, which helps control CO emissions.** **Well optimised system to reduce emissions of NO_X (b)** **7. (+8.) The technique indeed refers to the system to reduce emissions of NO_X and not emissions of CO. The increase in CO emissions when reducing NO_X emissions is expected to be lower when the NO_X abatement technique is well optimised/tuned than when this is not the case.** **Advanced automated process control (c)** **9. (+10.) The control of the combustion by regulating the important parameters that drive it is very important and requires the use of automated process control as much as possible. This technique is efficiently implemented when the devices fitted at the plant enable its use, and thus, for older plants, its full implementation may require a revamping of the combustion system in place.** **Application of oxidation catalysts (d)** **11. (to 13.) There are much fewer operational constraints compared to SCR. The temperature window is wider, thus the possibilities to install the technique in the right place are greater, and there is no associated chemical injection. Plants operated in emergency-load mode reported using the technique (e.g. Plants 162, 164). When combusting natural gas, the issue of sulphur conversion is not relevant. Techniques are neither prescriptive nor exhaustive. The technique will be described in Section 3.3.3 of the BREF.**

EIPPCB proposal:	**General** **1. (to 3.) Keep BAT conclusion on CO and set BAT-AELs for CO based on the assessment of the available information.** **Complete combustion (a), Well optimised system to reduce emissions of NO_X (b), Advanced automated process control (c)** **4. (to 10.) Change the name of the technique to 'Combustion optimisation'. Remove techniques (b) and (c) as the technique description has been changed in Section 10.8.3 and includes now the techniques (a), (b), (c). Keep the technique generally applicable.** **Application of oxidation catalysts (d)** **11. (to 13.) Do not modify the description of the technique.**

1.6.6 BAT-AELs for NO_X and CO emissions

1.6.6.1 Table 10.27 – BAT-AELs for NO_X and CO – gas turbines

1.6.6.1.1 General

Location in D1: *p. 774 - Section 10.4.1.2*

Current text in D1:

Table 10.27: BAT-associated emission levels for NO_X and CO emissions to air from the combustion of natural gas in gas turbines

Type of gas turbine	BAT-AEL (mg/Nm^3)			Monitoring frequency
	NO_X (daily average)	NO_X (yearly average)	CO (yearly average)	
Open-cycle gas turbines				
New gas turbines ([1])	7 – 50	6 – 35	3 – 40	Continuous measurement
Existing gas turbines (excluding mechanical drive) – All but emergency mode	7 – 75	6 – 50	3 – 40	Continuous measurement or PEMS
Existing gas turbines for mechanical drive – All but emergency mode	7 – 85	6 – 60	3 – 40	Continuous measurement or PEMS
Existing gas turbines – Emergency mode ([2])	NA	44 – 125	5 – 80	Continuous measurement or PEMS
CCGTs				
New dual fuel CCGT – Natural gas mode	15 – 25	9 – 20	1 – 5	Continuous measurement
Existing dual fuel CCGT – Natural gas mode	15 – 55	10 – 50	1 - 50	Continuous measurement
New single fuel CCGT > 600 MW_{th}	18 – 35	10 – 25	1 - 15	Continuous measurement
Existing single fuel CCGT > 600 MW_{th}	18 – 50	10 – 35	1 - 30	Continuous measurement
New single fuel CCGT 50 – 600 MW_{th}	15 – 35	10 – 25	1 - 15	Continuous measurement
Existing single fuel CCGT 50 – 600 MW_{th} with fuel utilisation < 75 %	35 – 55	10 – 45	1 - 15	Continuous measurement
Existing single fuel CCGT 50 – 600 MW_{th} with fuel utilisation > 75 %	35 – 85	25 – 75	1 - 30	Continuous measurement

	([1]) The higher end of the ranges is achieved when the plants operate on peak mode. ([2]) The lower end of the NO_X range can be achieved with water injection or dry low-NO_X premix burners.
Summary of comments:	<u>General</u> 1. *State clearly that the table applies only to plants combusting natural gas (CEFIC_261).* 2. *Remove BAT-AELs on CO as it's not a pollutant of high environmental relevance (UK_10_14, SK_11, CEPI_92, ETN_27, EUTurbines_86, Marcogaz_30, E&P_234_238) or is already covered as a fall-back position by the IED ELVs (Eurelectric_495).* 3. *Remove BAT-AELs for existing gas turbines in emergency mode (UK_12, Marcogaz_38_48_127, Eurelectric_493_7287) or replace the NO_X BAT-AEL in concentration by an emitted mass flow per year e.g. 20 tNO_X/yr (German regulation) (Marcogaz_38).* 4. *Limit the applicability of BAT-AELs to base-load plants (E&P_226_236) and mid-merit mode (IT_153_154).* 5. *Change the applicability restriction from emergency plants to peak-load plants (Eurelectric_727).* 6. *The turbine load factor is not mentioned in the proposed BAT-AELs (CEFIC_12_35); BAT-AELs should be set with such a factor > 70 % (EL_155, IE_30, SK_11, ES_17_33, OGP_64, ETN_67, Eurelectric_719_979, Marcogaz_37_44_48_132_133) when using a DLN (IT_132, Eurelectric_499), and for load factors < 70 % (IT_137, Eurelectric_499).* 7. *Set BAT-AEPLs as specific emissions in g/GJ or g/kWh (EUTurbines_85); include an efficiency factor for all CCGTs and all OCGTs like the one applying in the Annex V to the IED: for single cycle gas turbines having an efficiency greater than 35 % – determined at ISO baseload conditions – the emission limit value for NO_X shall be 50xη/35 where η is the gas turbine efficiency at ISO baseload conditions expressed as a percentage (EUTurbines_85, ETN_47).* 8. *There is a need to clarify how the proposed BAT-AELs apply to dual fuel turbines. In this respect a dual fuel fired turbine could be defined in the definitions (ETN_19_61, Eurelectric_504_728); dual fuel and single fuel CCGTs should be in the same category. There is no justification in the BREF why dual fuel fired plants would emit less than single fuel fired plants when using natural gas (UK_20_23, E&P_244_247, Eurelectric_505_735).* 9. *There is no distinction between gas turbines alone and gas turbines with heat recovery steam generator (HRSG) or with duct burners (supplementary firing), unlike in the 2006 LCP BREF (PT_33, CEFIC_5).* 10. *Set BAT-AELs for CHP plants other than CCGTs (CEFIC_41). At least, the following two categories would be needed: (1) existing single fuel CHP 50-600 MW_{th} with fuel utilisation < 75 %; and (2) existing single fuel CHP 50-600 MW_{th} with fuel utilisation > 75 % (FR_149).* 11. *Identify specifically CHPs as distinct from gas turbines and CCGTs. Apply the same principle for CHP gas turbines and CCGTs turbines based on a differentiation from the total fuel utilisation level (> 75 %) (CEFIC_67).* 12. *Split the ranges into 'whole range' and 'only range with primary measures' (EUTurbines_85); set BAT-AEPLs for plants fitted with water/steam injection (CEFIC_4_65).* 13. *Clarify the meaning of 'lower end of the ranges' that is mentioned in the footnote (BE_51).* 14. *Add a footnote to the upper NO_X BAT-AEL for existing plants indicating: "When only primary techniques can be applied higher levels may occur" (concawe_56).* 15. *Increase the lower end of the CO ranges to 10 mg/Nm^3 (Eurelectric_500).* 16. <u>*Alternative NH_3 levels*</u> • *< 25 mg/Nm^3 (CZ_160, E&P_158).* • *< 5 mg/Nm^3 (Eurelectric_514).* <u>*Averaging period*</u> 17. *Define a yearly average only for plants performing a continuous monitoring (Marcogaz_36).* 18. *Add daily average BAT-AELs for CO (AT_23, PT_65, SK_11, Marcogaz_48_129).* 19. *Provide only monthly averages for CO (EUTurbines_85).* <u>*Monitoring*</u> 20. *PEMS is missing for new gas turbines (IT_134, UK_17, ETN_37, Marcogaz_48_125) including single fuel CCGTs (Eurelectric_400_490_730).* 21. *Change the monitoring for emergency mode from continuous to periodic (Marcogaz_128, IT_133).* 22. *Adjust the monitoring based on thermal input: >100 MW_{th}, 50–100 MW_{th} and <50 MW_{th} (CEFIC_262_267). For plants <100 MW_{th}, PEMS should be allowed.* 23. *Replace continuous monitoring by PEMS (CEPI_86) and make both options possible (CEPI_98).* 24. *Exclude emergency plants from any monitoring requirement (UK_3, E&P_226, Eurelectric_731).* 25. *Change the monitoring to 2 times/yr for gas turbines <100 MW_{th} (EL_154, Eurelectric_729).* 26. *Add periodic monitoring as a possibility (SK_11).* 27. *Change continuous NH_3 monitoring to periodic (UK_22, Eurelectric_514_999).*

EIPPCB assessment:	**General** **1. The BAT-AEL tables apply to plants combusting natural gas as it is stated in the introductory paragraph of Section 10.4.1.** **2. CO was selected as one of the environmental parameters to focus on by the TWG at the KOM. CO** **3. Based on the information exchanged, there are some technically and economically viable techniques that could be applied to plants operated in peak- or emergency-load mode.** **4. As agreed at the KOM, and depending on the information available and data collected, these modes can be assessed and BAT-AELs proposed if justified. Related information has been submitted through the questionnaires (number of operating hours, equivalent full load factor).** **5. BAT-AELs are defined based on collected information and data and the BAT-AELs proposed in this BP for discussion consider the levels achieved by peak-load plants.** **6. Emission levels reported in the questionnaires are either for a turbine load of > 70 % in the case of periodic measurement, or without a minimum turbine load in the case of continuous measurement.** **7. The use of specific loads or of a correction factor taking into consideration the energy efficiency of the plant would allow further improvement in energy efficiency while keeping the same level of environmental protection with respect to air emissions if we consider it through the load of pollutant per MW_{el} produced. Achieving higher energy efficiency levels in the future would require increasing the combustion temperature thus generating higher levels of NO_X emissions.** **8. Dual fuel turbines are identified in D1 as a subcategory of gas turbines and BAT-AELs are proposed when these are operated in gas mode, as emission data were available for these plants in the questionnaires. However, NO_X emissions are not affected by the dual fuel configuration of the plant compared with a single fuel configuration when operated on gas mode. Thus, dual fuel-fired plants and single fuel-fired plants could be merged in the same size categories. There would thus be a need to add a footnote explaining that the BAT-AELs also apply to dual fuel gas turbines when operated in gas mode. No data have been made available for dual fuel turbines when running on oil. Emission levels achieved by well performing liquid-fuel-fired turbines not fitted with DLN are within 145–250 mg/Nm^3 (See available data in the section related to liquid fuel combustion).** **9. (to 11.) The difference between gas turbines with/without HRSG is reflected in the difference between OCGT/CCGT as no example OCGT used in CHP mode has been submitted. Supplementary firing and CHP gas turbines have not been considered as there was no clear correlation between these features and the achieved performances, which turn out to be similar to those from gas turbines without supplementary firing or not operated in CHP mode, with the exception of CCGTs used in CHP mode with a total fuel utilisation of > 75 %, which showed differences in terms of techniques/emissions.** **12. There cannot be multiple BAT-AELs depending on the techniques used as the BREF should conclude on what the BAT are for each plant category. However, when there is a need or merit to inform about different levels of performance depending on the implemented techniques, footnotes could be added to mention which technique allows the higher or the lower ends of the BAT-AEL range to be reached.** **13. The 'lower end of the range' refers to the lower part of the range and should be evaluated in each specific situation. The purpose is not to set precise levels associated to the use of a technique but to mention roughly that the corresponding achievable levels will not be at the higher level of the range proposed as the technique used would allow the best performance within a set of proposed techniques. This expression is widely used in already adopted BAT conclusions and is in accordance with dispositions in the BREF Guidance.** **14. Water/steam injection is often not the reference technique used for proposing BAT-AELs as dry techniques can achieve much lower emission levels. The techniques indicated in the BAT conclusions are neither prescriptive nor exhaustive. Available data show that water/steam injection can achieve relatively low levels of emissions, sometimes similar to those achieved using dry techniques when used alone or when combined with another technique (e.g. SCR). The BAT-AELs are generally based on the implementation of primary techniques.** **15. The lower ends of the BAT-AELs for CO are set based on data collected at plant level that prove to be much lower than 10 mg/Nm^3.** **NH_3 slip** **16. The BAT-AELs for NH_3 are proposed based on data collected at plant level and bulk information. After reviewing the available information, and given the BAT-AELs proposed for NO_X emissions in the BAT conclusions, levels of NH_3 emissions are expected to be lower than 10 mg/Nm^3 for new and existing plants when using SCR.**

	Averaging period **17. The yearly average is defined for plants carrying out continuous monitoring. The average over the year is defined for plants carrying out periodic monitoring with a minimum number of samples performed in a year (e.g. at least three). The average over the sampling period is defined for plants carrying out periodic monitoring with less than three samples per year.** **18. (and 19.) Only BAT-AELs expressed as a yearly average are proposed for CO emissions. This is to give more flexibility for achieving a good short-term and long-term performance for NO_X emissions, considering the possible variations of the combustion (e.g. fuel moisture, quick changes of load).** **Monitoring** **19. (to 27.) The appropriate monitoring of NO_X, CO and NH_3 emissions is assessed based on available information and for each category of plant. In general, PEMS has been proposed for existing plants where this type of monitoring may have been a widespread existing practice, or in the case of plants operated in emergency-load mode, to avoid these particular cases having to change their type of monitoring system. The implementation of continuous monitoring is much easier in the case of new plants where the change/upgrade of an existing system is not required. Continuous monitoring is considered as BAT in the 2006 LCP BREF. All recently built plants of ≥ 50 MW_{th} use continuous monitoring. However, continuous monitoring systems may not be economically justified in the case of plants operating in emergency-load mode, or environmentally justified in the case of plants of < 100 MW_{th} where emission levels prove to be stable and low.**
EIPPCB proposal:	**General** **1. Keep the introductory statement of Section 10.4.1.** **2. Keep BAT-AELs for CO emissions.** **3. Keep o proposing BAT conclusions for plants operated in peak- or emergency load mode based on primary techniques.** **4. (+5.) Assess the load for each plant category.** **6. Do not set a minimum turbine load associated to the proposed BAT-AELs in the case of continuous measurement; set a minimum turbine load of 70 % in the case of periodic measurement for gas turbines.** **7. Keep expressing BAT-AELs in concentrations and propose a correction factor for new plants with high energy efficiency (See section 1.6.6.1.2 of this BP).** **8. Merge the dual fuel- and single fuel-fired CCGTs in the same plant size categories; add a footnote mentioning that the BAT-AELs apply to dual fuel gas turbines when operated in gas mode. Add a footnote mentioning that the BAT-AEL is 145–250 mg/Nm^3 for dual fuel plants when running on oil in emergency-load mode.** **9. (to 11.) Do not create separate categories for turbines with/without supplementary firing or for CHP turbines, except the one already proposed (turbines with total fuel utilisation of > 75 %, which are CHP plants). Change the name of 'gas turbine' to 'open-cycle gas turbine (OCGT)' to make it clear that it is not a CCGT.** **12. Do not propose differentiated BAT-AELs depending on the techniques implemented. Assess by category the merit of specifying which technique (or combination of techniques) could allow the lower and/or upper ends of the proposed BAT-AEL ranges to be achieved in order to give the reader more information, and, if needed, add relevant information through appropriate footnotes.** **13. Do not define further what 'the lower end of the range' means.** **14. Do not add a footnote related to higher levels of emissions when only primary techniques are used.** **15. Set the lower end of the BAT-AELs for CO based on available data, category by category, with < 5 mg/Nm^3 as the general lower end of the range for consistency throughout the BAT conclusions.** **NH_3 slip** **16. Change the BAT-AEL for NH_3 slip to: < 5–10 mg/Nm^3. The proposed BAT-AEL for NH_3 emissions to air is shown in BAT 4 bis** **Averaging periods** **17. (to 19.) Keep expressing BAT-AELs as 1) yearly averages when continuous monitoring is used, 2) averages over the year when monitoring periodically with more than three samples/year is used, 3) averages over the sampling period when monitoring periodically with less than three samples/year is carried out.** **18. Do not set daily average BAT-AELs for CO emissions.** **Monitoring** **20. (to 27.) As a general rule, keep continuous monitoring for gas turbines ≥ 50 MW_{th}, except when PEMS proves to be a common practice at existing plants.**

	For plants operated in peak- or emergency-load modes, set periodic monitoring for plants of < 100 MW_{th} with a minimum frequency of twice/yr for peak-load plants and once/yr for emergency-load plants.

1.6.6.1.2 Table 10.27 – BAT-AELs for NO_X and CO – gas turbines

Location in D1: *p. 774 - Section 10.4.1.2*

Current text in D1:

Table 10.27: BAT-associated emission levels for NO_X and CO emissions to air from the combustion of natural gas in gas turbines

Type of gas turbine	BAT-AEL (mg/Nm^3)			Monitoring frequency
	NO_X (daily average)	NO_X (yearly average)	CO (yearly average)	
Open-cycle gas turbines				
New gas turbines ([1])	7 – 50	6 – 35	3 – 40	Continuous measurement
Existing gas turbines (excluding mechanical drive) – All but emergency mode	7 – 75	6 – 50	3 – 40	Continuous measurement or PEMS
Existing gas turbines for mechanical drive – All but emergency mode	7 – 85	6 – 60	3 – 40	Continuous measurement or PEMS
Existing gas turbines – Emergency mode ([2])	NA	44 – 125	5 – 80	Continuous measurement or PEMS
CCGTs				
New dual fuel CCGT – Natural gas mode	15 – 25	9 – 20	1 – 5	Continuous measurement
Existing dual fuel CCGT – Natural gas mode	15 – 55	10 – 50	1 - 50	Continuous measurement
New single fuel CCGT > 600 MW_{th}	18 – 35	10 – 25	1 - 15	Continuous measurement
Existing single fuel CCGT > 600 MW_{th}	18 – 50	10 – 35	1 - 30	Continuous measurement
New single fuel CCGT 50 – 600 MW_{th}	15 – 35	10 – 25	1 - 15	Continuous measurement
Existing single fuel CCGT 50 – 600 MW_{th} with fuel utilisation < 75 %	35 – 55	10 – 45	1 - 15	Continuous measurement
Existing single fuel CCGT 50 – 600 MW_{th} with fuel utilisation > 75 %	35 – 85	25 – 75	1 - 30	Continuous measurement

([1]) The higher end of the ranges is achieved when the plants operate on peak mode.
([2]) The lower end of the NO_X range can be achieved with water injection or dry low-NO_X premix burners.

Summary of comments:

NO_X emissions

Existing (open-cycle) gas turbines excluding mechanical drive and emergency-load mode – yearly average

1. *< 150 mg/Nm^3 for peak-load plants (FI_81).*
2. *The lower end of the range could only be achieved by smaller turbines or with SCR. New generation gas turbine suppliers only guarantee 30 mg/Nm^3 for NO_X emissions (IT_141, Eurelectric_497).*

	3. 50–75 mg/Nm^3 as monthly average with primary techniques only (EUTurbines_85). *4. 25–75 mg/Nm^3 as monthly average for the whole range (EUTurbines_85).* *5. 20–35 mg/Nm^3 for yearly average (AT_27).* *Existing (open-cycle) gas turbines excluding mechanical drive and emergency-load mode – daily average* *6. 10–50 mg/Nm^3 for daily average (AT_27).* *Existing mechanical drive gas turbines excluding emergency-load mode* *7. 7–60 mg/Nm^3 for daily averages based on fig 7.29 and as data from Plant 164 are incomplete (AT_31).* *8. 6–55 mg/Nm^3 for yearly averages based on fig 7.29 and as data from Plant 164 are incomplete (AT_32).* *Existing open- and combined cycle gas turbines – emergency-load mode* *9. Limit the applicability to plants operated between 50–500 h/yr (AT_29)* *10. Set daily averages to 25–140 mg/Nm^3 (AT_24_134).* *11. 44–110 mg/Nm^3 for yearly average (AT_25).* *New open-cycle gas turbines* *12. Increase the levels to 30 – 50 mg/Nm^3 for mechanical drive turbines as the minimum supplier guarantee of 30 mg/Nm^3 applies in a range that cannot always be obtained due to operating conditions of the gas grid (Marcogaz_47_48_121).* *13. The lower end of the range could only be achieved by smaller turbines or with SCR. New generation gas turbine suppliers only guarantee 30 mg/Nm^3 for NO_X emissions (IT_141, Eurelectric_497).* *14. 25–45 mg/Nm^3 as monthly average with primary techniques only (EUTurbines_85).* *15. 10–45 mg/Nm^3 as monthly average for the whole range (EUTurbines_85).* *CCGTs* *16. The size categorisation is questionable (ref to 600 MW_{th}) (IT_143).* *17. Include also BAT-AELs for CCGT > 600 MW_{th} with fuel utilisation > 75 % (IT_146, EURELECTRIC_507).* *18. Include a category for CCGTs with efficiency > 55 % (IT_147, Eurelectric_508).* *All existing CCGTs* *19. 50–75 mg/Nm^3 as monthly average with primary techniques only (EUTurbines_85).* *20. 25–75 mg/Nm^3 as monthly average for the whole range (EUTurbines_85).* *21. Keep the IED ELVs as higher end of the BAT-AELs range for CCGTs with fuel utilisation < 75 % (PL_159).* *22. Some older CCGTs may face problems to achieve NO_X levels < 50 mg/Nm^3 based on constructor assessment (PT_62).* *Existing single fuel CCGTs of > 600 MW_{th}* *23. 35–75 mg/Nm^3 (E&P_228).* *24. 10–50 mg/Nm^3 (Eurelectric_995).* *25. 10–50 mg/Nm^3 as yearly average (SP_79, UK_19, E&P_243).* *26. 18–40 mg/Nm^3 as daily average (AT_36)* *Existing single fuel CCGTs 50–600 MW_{th}* *27. It seems that BAT-AELs are higher for higher loading rather than the other way round (MT_13_15).* *28. Replace the 'fuel utilisation' parameter by a constant parameter such as the 'rated plant efficiency' (PL_158).* *With fuel utilisation < 75 %* *29. 35–75 mg/Nm^3 for daily average (CEFIC_63).* *30. 10–50 mg/Nm^3 for yearly average to keep flexibility at plant level and fit with the IED ELV (CEFIC_63, ETN_48).* *31. Apply the same BAT-AELs for plants > 75 % fuel utilisation as the ones set to CCGT having a fuel utilisation < 75 % as it's not possible to distinguish between these two categories (ETN_63, Eurelectric_401_732).* *With fuel utilisation> 75 %* *32. 35–60 mg/Nm^3 for daily average (AT_20).* *33. 25–55 mg/Nm^3 for yearly average (AT_21). Plants 155 and 375 could be fitted with an SCR.* *All new CCGTs* *34. 25–45 mg/Nm^3 as monthly average with primary techniques only (EUTurbines_85).* *35. 10–45 mg/Nm^3 as monthly average for the whole range (EUTurbines_85).* *New single fuel CCGTs of > 600 MW_{th}* *36. 18–55 mg/Nm^3 for daily average (EL_158, SP_78, UK_18_24, E&P_242_248, Eurelectric_513_736_998).* *37. 10–50 mg/Nm^3 for yearly average (UK_9, E&P_233).*

	CO emissions *Existing (open-cycle) gas turbines* *38. < 100 mg/Nm^3 (would still allow the use of water/steam injection) (CEFIC_68).* *39. 25–50 mg/Nm^3 as monthly average with primary measures only (EUTurbines_85).* *40. 2–50 mg/Nm^3 as monthly average for the whole range (EUTurbines_85).* *41. Increase the higher end of the range as it would not be possible to achieve NO_X levels of 50 mg/Nm^3 with CO levels below 40 mg/Nm^3 with water/steam injection (CEFIC_3).* *Existing (open-cycle) gas turbines - All but emergency-load mode* *42. < 50 mg/Nm^3 as daily average (SK_11).* *Existing mechanical drive excluding emergency-load mode* *43. < 100 mg/Nm^3 as daily average (SK_11).* *New (open-cycle) gas turbines* *44. 20–40 mg/Nm^3 as monthly average with primary techniques only (EUTurbines_85).* *45. 2–40 mg/Nm^3 as monthly average for the whole range (EUTurbines_85).* *46. < 100 mg/Nm^3 as daily average (SK_11).* *All existing CCGTs* *47. 25–50 mg/Nm^3 as monthly average with primary measures only (EUTurbines_85).* *48. 2–50 mg/Nm^3 as monthly average for the whole range (EUTurbines_85).* *Existing CCGTs of > 600 MW_{th}* *49. 1–65 mg/Nm^3 (ES_80).* *Existing CCGTs 50–600 MW_{th}* *50. BAT-AELs are higher for greater plants (> 600 MW_{th}) rather than the other way round (Eurelectric_501).* *With fuel utilisation < 75 %* *51. 1–50 mg/Nm^3 (CEFIC_63).* *52. < 100 mg/Nm^3 (ETN_48).* *All new CCGTs* *53. Re-assess the proposed BAT-AELs as it is not clear how they were derived from the questionnaires (FR_156).* *54. 20–40 mg/Nm^3 as monthly average with primary measures only (EUTurbines_85).* *55. 2–40 mg/Nm^3 as monthly average for the whole range (EUTurbines_85).* *New dual fuel CCGTs* *56. Align the levels with those of bigger plants CCGTs > 600 MW_{th} to 1–15 mg/Nm^3 (Eurelectric_506).* *Footnotes* *57. Delete footnote ([1]) as levels of emission depend on the age and size of the plant and not on the yearly operation hours (Marcogaz_39), or as it may lead to confusion when the plant is not operated in peak-load mode (SK_12).* *58. Delete footnote ([2]) as turbines operated in emergency mode are not in the scope of the IED Chapter III (SK_13).* *59. Add a footnote linking the low NO_X and/or low CO emissions (EL_156, FR_154, Marcogaz_47_120, CEFIC_112, Eurelectric_503).* *60. Ad a footnote limiting the applicability of the BAT-AELs in the case of short period of operation in fresh air mode (like maintenance stops on electrical generator) (CEFIC_110).* *61. Add a footnote on all BAT-AELs that covers the gas quality and give more flexibility in the higher values of the ranges in order to take into account changes in supplied gas quality (Eurelectric_478).*
EIPPCB assessment:	**Existing open-cycle gas turbines excluding mechanical drive applications and turbines operated in emergency-load mode** **1. (to 6. +38. to 42.)** **1.1. NO_X emissions (1. to 6.): Few plants submitted plant-specific data through questionnaires, and these are operated in peak-load mode. Plants used for mechanical drive applications, expected to perform worse with respect to NO_X emissions, can also be considered in the assessment. Plants 16 and 11/2 fitted with DLN burners are used for proposing the BAT-AELs for existing plants operated in baseload and mid-merit load modes. Reviewing the short-term emission data available, the higher end of the BAT-AEL range could also be decreased to 55 mg/Nm^3 based on data from plants achieving this level (Plants 16, 491, 343, 335), compared to 75 mg/Nm^3 in D1. Plants using water injection (491, 229, 490) could be**

taken as a reference for setting an alternative higher end of the range of about 80 mg/Nm^3 at plants operated in peak-load mode. However, expressing BAT-AELs as a yearly average may not be justified for these operating modes as the operation throughout the year would be limited to 1500 hours.

1.2. CO emissions (37. to 41.): CO emission levels achieved with DLN systems are below 40 mg/Nm^3, while higher CO emission levels of about 80 mg/Nm^3 (Plant 491) could be reached when water injection is used.

Existing mechanical drive gas turbines excluding turbines operated in emergency-load mode

7. (+8. +43.)

7.1. NO_X emissions (7. +8.): The reassessment of available information and data confirms the yearly BAT-AELs proposed in D1. For short-term averages, the review of the available data show levels of emissions below 65 mg/Nm^3 for the corresponding well performing plants using DLN. Plants operated in peak-load mode can use the same techniques as plants operated in other load modes (e.g. Plants 338, 340, 342). However, expressing BAT-AELs as a yearly average may not be justified for these operating modes as the operation throughout the year would be limited to 1500 hours.

7.2. CO emissions (42.): There is no evidence-based rationale supporting the request to increase the higher end of the BAT-AEL range. Reported CO emissions are below 40 mg/Nm^3.

Existing (open- and combined cycle) gas turbines – emergency-load mode

9. (to 11.)

NO_X and CO emission levels achieved by plants operated less than 50 hours/yr are within the BAT-AEL ranges proposed in D1 (Plants 164 and 165). For this plant category, it is proposed to keep within the BAT techniques the optimisation of the combustion equipment represented by Plant 251, without the need to necessarily upgrade to DLN or water injection. Periodic monitoring once/yr with a BAT-AEL expressed as an average over the sampling period seems more appropriate than continuous monitoring with a yearly average-based BAT-AEL. The review of available data shows NO_X emission levels between 60 mg/Nm^3 and 140 mg/Nm^3.

New open-cycle gas turbines

12. (to 15. +44. to 46.)

12.1. NO_X emissions (12. to 15.) The review of submitted data shows that about ten existing plants, including plants used for mechanical drive applications, reported emissions within the BAT-AEL ranges proposed in D1. Information submitted in the comments mentions supplier guarantees of 30 mg/Nm^3. Some new generation gas turbines can achieve lower emission levels, as low as 18 mg/Nm^3 guaranteed by the supplier (Additional information – EIPPCB-09). The lower end of the BAT-AEL range is achieved by small turbines. This could be mentioned in a footnote. No example plants were reported to use SCR, but examples in the US where SCR is used show performances largely within the proposed BAT-AELs (Additional information – EIPPCB-01-02/05).

12.2. CO emissions (44. to 46.) levels as low as 3 mg/Nm^3 have been achieved with primary techniques. However, the lower end of the BAT-AEL range could be set as < 5 mg/Nm^3 for consistency with other proposals. All the existing plants considered for setting the NO_X BAT-AELs have CO emissions of < 40 mg/Nm^3.

12.3. As the proposed levels could be achieved with primary techniques alone, the general reasoning is also valid for peak- and emergency-load modes. However, expressing BAT-AELs as a yearly average may not be justified for these operating modes as the operation throughout the year would be limited to 1500 hours.

CCGTs – General - NO_X emissions

16. 600 MW_{th} is the figure used for splitting the plants as, from a general assessment of the large number of plants that submitted a questionnaire, it was noticed that these plants were generally performing better than smaller ones. No further rationale or evidence supports the submitted comment for an alternative plant categorisation.

17. In the large set of plants that reported information, very few plants of ≥ 600 MW_{th} have a total fuel utilisation above 75 %. Most of them nevertheless achieve emissions within the BAT-AEL ranges proposed in the paragraph 23. below. Nevertheless, one can note the impact the high level of heat supply has on NO_X emissions, through e.g. Plant 49, which could be used as a reference for proposing a different higher end of the BAT-AEL range for this kind of plant (48 mg/Nm^3).

18. In the large set of plants that reported data, all the CCGTs that achieve a level of electrical efficiency of > 55 % also achieve levels of NO_X emissions below 50 mg/Nm^3 and, for all but one plant (10 out of 11), within the proposed BAT-AEL ranges.

All existing CCGTs

19. (to 22. for NO_X emissions +47. to 48. for CO emissions)
The BAT-AELs are defined based on the available data/information for each gas turbine category. There is no evidence-based rationale supporting a general higher-end of the BAT-AEL range of 75 mg/Nm^3.

Existing single fuel CCGTs of ≥ 600 MW_{th} excluding emergency-load mode

23. (to 26. +49.)
There is no evidence-based rationale supporting the comments for a higher end of the yearly BAT-AEL range at 50 mg/Nm^3 or 75 mg/Nm^3. The reassessment of available data once the single and dual fuel-fired plants have been merged shows a large majority of plants with yearly emission levels between 10 mg/Nm^3 and 40 mg/Nm^3 using mainly DLN burners, and sometimes SCR. Regarding the lowering of the higher end of the daily BAT-AEL down to 40 mg/Nm^3, data from several plants with daily NO_X emissions above 40 mg/Nm^3 were reported and can be considered within the set of well performing plants such as Plants 256, 257, 436-1/2 with daily emission levels as high as 47 mg/Nm^3.
Regarding CO emissions, it can be confirmed that all the well performing plants reported CO levels below 30 mg/Nm^3. Plant 440 (characterised by a low equivalent full load of about 58 %) reported emissions of about 50 mg/Nm^3 as a yearly average.

Existing single fuel CCGTs 50–600 MW_{th} excluding emergency-load mode

27. (to 28.) The indications '< 75 %' or '≥ 75 %' refer to the 'net total fuel utilisation' as defined in the glossary, meaning the energy generated by the plant divided by the energy of the fuel as input. This does not refer to the load (percentage of the maximum capacity) of the combustion plant. The wording could be improved to avoid this misunderstanding. The impact the overall efficiency has on the level of NO_X emitted depends on the real level of heat generated and thus on the net total fuel utilisation as defined in the glossary, and not only on the corresponding rated level.

Existing single fuel CCGTs 50–600 MW_{th} with net total fuel utilisation below 75 % excluding emergency-load mode

29. (to 31. for NO_X emissions +50. to 52. for CO emissions) The proposed BAT-AELs are based on the collected data. There is no additional evidence-based rationale supporting the proposal for BAT-AELs of 10–50 mg/Nm^3. Existing plants with a high level of heat generated (e.g. with a total net fuel utilisation above 75 %) have NO_X emission levels that may be higher than plants generating only power, which cannot be identified for plants generating less heat. Regarding CO emission levels, despite the low levels achieved by the set of well performing plants of this size, it could make sense to align the BAT-AELs with those of bigger plants, as the same levels of CO emissions may be generally expected.

Existing single fuel CCGTs 50–600 MW_{th} with net total fuel utilisation above 75 % excluding plants operated in emergency-load mode

32. (+33.) Example plants that have been retrofitted or operated since the end of the 1990s reported NO_X emission levels below 55 mg/Nm^3 as a yearly average with dry techniques. Plants fitted with water/steam injection may also be further retrofitted with SCR, achieving NO_X emissions well below 55 mg/Nm^3. Should it not be possible to further retrofit a plant operated in peak-load mode, then the reference level for proposing the higher end of the BAT-AEL range for NO_X emissions could be based on Plants 153 and 375 at about 75 mg/Nm^3. Regarding the daily average for NO_X, after a review of the available data, Plant 1006 could be used for proposing the higher end of the BAT-AEL range at 80 mg/Nm^3.
Regarding CO emission levels, despite the low levels achieved by the set of well performing plants of this size, it could make sense to align the BAT-AELs with those of bigger plants, as the same levels of CO emissions may be generally expected.

All new CCGTs

34. (to 37.) NO_X emissions: The review of available information shows that using LNB or SCR at new plants allows to achieve emission levels from 30 mg/Nm^3 down to few mg/Nm^3 are able to achieve: there are guarantees available from suppliers to achieve NO_X emissions of 9 or 15 ppm NO_X, without SCR, and down to a few ppm of NO_X with SCR. Examples of recently built plants or of plants retrofitted and operated for several years show that they can maintain these low emission levels when the plants are well maintained, and without the need for using SCR. In order to further take into account the possible increase in NO_X emissions linked to the increase in firing temperature when more efficient technologies become available whilst still using primary techniques, a correction

	factor could be used for these new turbines to allow higher NO_X emissions when increasing the (electrical) energy efficiency above 55 %. This reasoning can also apply to the case of new OCGT for electrical energy efficiency above 39 %. **53. (to 56.) <u>CO emissions</u>: The comments are not supported by evidence-based rationale. After reviewing the available data from the set of questionnaires, it can be noticed that plants achieving NO_X emission levels lower than 30 mg/Nm^3 achieve also CO emission levels lower than 30 mg/Nm^3.** **<u>Footnotes</u>** **57. <u>Footnote ([1])</u>: for a given size, the emission levels achieved by plants operated in peak-load mode mainly depend on the technique implemented. The lower end of the BAT-AEL ranges can be achieved with primary techniques. There is no evidence that the achieved levels are different when plants operate in peak-load or baseload modes. Thus, footnote ([1]) does not give clear additional information.** **58. <u>Footnote ([2])</u>: this footnote is attached to the category of plants operated in emergency-load mode as long as this category exists.** **59. From the assessment of available data and information, there is no <u>correlation between the levels of NO_X and CO</u> emitted. However, trying to decrease the level of NO_X emitted by fine-tuning an existing technique without upgrading/replacing it with a better performing one may lead to higher CO emissions.** **60. In a CCGT, the boiler may be in operation thanks to its autonomous set of burners even when the turbine does not operate (<u>fresh air mode</u>). In this case, the BAT conclusions and BAT-AELs that apply are those related to boilers. This could be better explained in a footnote.** **Fuel quality evolution is difficult to consider beforehand. The BAT-AELs are expressed in the form of ranges to take into consideration the wide spectrum of different operational parameters, including the different types of fuels. The natural gas definition is already included in the IED (see footnote ([1]) of Table 6 in part 1 of Annex V to the IED).**
EIPPCB proposal:	**1. (to 6. +38. to 42.) <u>Existing open-cycle gas turbines excluding plants operated in emergency-load mode and mechanical drive applications</u>** **1.1. Keep the yearly <u>NO_X BAT-AELs</u> and change the proposed daily BAT-AELs to 7–55 mg/Nm^3 in general. Add a footnote mentioning that the higher end of the daily BAT-AELs for NO_X is 80 mg/Nm^3 when plants operate in peak-load mode. Add a footnote mentioning that yearly BAT-AELs do not apply when plants operate in peak-load mode.** **1.2. Change the proposed yearly <u>CO BAT-AELs</u> to < 5–40 mg/Nm^3. Add a footnote mentioning that the higher end of the BAT-AELs is 80 mg/Nm^3 when plants are fitted with water injection for NO_X reduction. Do not set CO BAT-AELs when plants operate in peak-load mode. Add a footnote mentioning the possibility of reaching higher yearly levels of CO of up to 50 mg/Nm^3 in the case of operation at low load (see paragraph 23.).** **7. (+8. +43.) <u>Existing gas turbines for mechanical drive applications excluding plants operated in emergency-load mode</u>** **7.1. Keep the proposed yearly NO_X BAT-AELs and change the daily BAT-AELs to 7–65 mg/Nm^3. The proposed levels also apply in the case of CCGTs. Add a footnote mentioning that yearly BAT-AELs do not apply when plants operate in peak-load mode.** **7.2. Change the yearly CO BAT-AELs to < 5–40 mg/Nm^3. Do not set CO BAT-AELs when plants operate in peak-load mode. The proposed levels also apply in the case of CCGTs. Add a footnote mentioning the possibility of reaching higher yearly levels of CO of up to 50 mg/Nm^3 in the case of operation at low load (see paragraph 23.).** **9. (to 11.) <u>Existing (open- and combined) cycle gas turbines – emergency-load mode</u>** **Propose NO_X BAT-AEL to 60–140 mg/Nm^3 expressed as a daily average or as an average over the sampling period, with a monitoring frequency of once/yr or the use of PEMS. Remove the CO BAT-AEL.** **12. (to 15. +44. to 46.) <u>New (open-cycle) gas turbine</u>: Keep the proposed yearly BAT-AEL for NO_X for all the applications and change the CO yearly BAT-AEL to < 5–40 mg/Nm^3. Add a footnote mentioning that the NO_X and CO yearly BAT-AELs do not apply when plants operate in peak-load mode.** **<u>CCGTs – NO_X emissions</u>** **16. Keep the size categorisation as it is.**

	17. Create a new category for existing CCGTs of ≥ 600 MW_{th} with a net total fuel utilisation ≥ 75 % and propose the yearly BAT-AEL at 10–50 mg/Nm^3 and a daily BAT-AEL of 18–65 mg/Nm^3. **18. Do not propose general separate BAT-AELs for plants achieving a net electrical efficiency greater than 55 %. See for new plants proposal 35.** **All existing CCGTs** **19. (to 22. +47. to 48.): Propose BAT-AELs for NO_X and CO based on the available information and data.** **Existing CCGTs ≥ 600 MW_{th} (*total fuel utilisation of < 75 %)* excluding plants operated in emergency-load mode – NO_X emissions** **23. (to 26. +49.): Change the NO_X yearly BAT-AEL to 10–40 mg/Nm^3 and keep the proposed NO_X daily BAT-AEL as it is. Change the proposed CO yearly BAT-AEL to < 5–30 mg/Nm^3 and add a footnote mentioning the possibility of reaching higher yearly levels of CO of up to 50 mg/Nm^3 in the case of operation at low load. This proposal can be generalised for all the types of existing turbines. Add a footnote mentioning that the NO_X and CO yearly BAT-AELs do not apply when plants operate in peak-load mode.** **Existing CCGTs of < 600 MW_{th} excluding plants operated in emergency-load mode** **27. (+28.) Replace 'fuel utilisation' by 'net total fuel utilisation' in the plant categories. Add a footnote mentioning the possibility of reaching higher yearly levels of CO of up to 50 mg/Nm^3 in the case of operation at low load (see paragraph 23.).** **Existing CCGTs of < 600 MW_{th} with a net total fuel utilisation below 75 % excluding plants operated in emergency-load mode** **29. (to 31. +50. to 52.) Keep the proposed NO_X yearly and hourly BAT-AELs. Align the CO BAT-AELs with those of plants of ≥ 600 MW_{th}. Add a footnote mentioning that NO_X and CO yearly BAT-AELs do not apply when plants operate in peak-load mode.** **Existing CCGTs of < 600 MW_{th} with a net total fuel utilisation above 75 % excluding plants operated in emergency-load mode** **32. (+33.) Change the proposed NO_X yearly BAT-AEL to 25–55 mg/Nm^3.** **Add a footnote to set the higher end of the BAT-AEL range at 75 mg/Nm^3 in the event that it would not be possible to further retrofit a plant operated in peak-load mode due to techno-economic reasons.** **Change the proposed NO_X daily BAT-AEL to 35–80 mg/Nm^3.** **Change the proposed CO yearly BAT-AELs to < 5–30 mg/Nm^3.** **Add a footnote mentioning that NO_X and CO yearly BAT-AELs do not apply when plants operate in peak-load mode.** **All new CCGTs** **34. (to 37.) NO_X emissions: merge and change the ranges for all new CCGTs to 10–30 mg/Nm^3 as the yearly BAT-AEL and 15–40 mg/Nm^3 as the daily BAT-AEL.** **35. Add a footnote to indicate that a correction factor may be applied to the higher end of the range, corresponding to [higher end] x EE / 55 where EE is the net electrical energy efficiency of the plant determined at ISO baseload conditions.** **36. Also add a footnote for new OCGTs to indicate that a correction factor may be applied to the higher end of the range, corresponding to [higher end] x EE / 39 where EE is the net electrical energy efficiency of the plant determined at ISO baseload conditions.** **53. (to 56.) CO emissions: change the yearly BAT-AELs to < 5–30 mg/Nm^3.** **Footnotes** **57. Delete footnote ([1]).** **58. Keep footnote ([2]).** **59. Add a footnote mentioning that fine-tuning an existing technique to reduce further NO_X emissions may lead to CO emission levels at the higher end of the BAT-AEL range for CO.** **60. Add a footnote applying to all CCGTs, mentioning that when the boiler of a CCGT operates alone (the gas turbine does not operate), the BAT-AELs that apply are those related to boilers.** **Do not add an additional footnote for the fuel quality variation.**

1.6.6.2 Table 10.28 – BAT-AELs for NO_X and CO – boilers and engines

1.6.6.2.1 General

<table>
<tr><td>Location in D1:</td><td>p. 775 - Section 10.4.1.2</td></tr>
<tr><td>Current text in D1:</td><td>
Table 10.28: BAT-associated emission levels for NO_X and CO emissions to air from the combustion of natural gas in boilers and engines
<table>
<tr><th rowspan="2">Type of combustion plant</th><th colspan="3">BAT-AEL (mg/Nm^3)</th><th rowspan="2">Monitoring frequency</th></tr>
<tr><th>NO_X (daily average)</th><th>NO_X (yearly average)</th><th>CO (yearly average)</th></tr>
<tr><td colspan="5">Boilers</td></tr>
<tr><td>New boilers</td><td>NA</td><td>10 – 60</td><td>1 – 5</td><td>Continuous measurement</td></tr>
<tr><td>Existing boiler</td><td>85 – 110</td><td>50 – 100</td><td>1 – 15</td><td>Continuous measurement</td></tr>
<tr><td colspan="5">Gas engines</td></tr>
<tr><td>New gas engine</td><td>NA</td><td>20 – 75</td><td>30 – 100</td><td>Continuous measurement</td></tr>
<tr><td>Existing gas engines</td><td>NA</td><td>20 – 100</td><td>30 – 100</td><td>Continuous measurement</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td>
<u>General</u>
1. State clearly that the table apply to plants combusting only natural gas (CEFIC_266).
2. The table only refers to lean burn type engines (SG and DF types). This information should be added in the title (FI_144, Euromot_70_100_118).
3. GD engines should have their own BAT-AELs (FI_144, Euromot_70_100).
4. Modify the levels of NH_3 to <10 mg/Nm^3 (FI_144).
5. Create separate BAT-AELs for peak-load engines (FI_144).
6. The proposed values are for normal running. It should be specified that the ranges do not apply for emergency- or peak-load mode (IT_155_157_158_159).

<u>Averaging period</u>
7. Provide daily averages for CO emissions (AT_19).
8. There should only be a NO_X daily BAT-AEL for gas-fired plants <100 MW_{th} (Eurelectric_738_1000).

<u>Monitoring</u>
9. Change monitoring frequency for plants <100 MW_{th} to 2/yr (CZ_163, FI_144, E&P_161, Eurelectric_738_1000).
10. Change monitoring frequency to periodic monitoring (CEPI_99).
11. Adjust monitoring based on thermal input: >100 MW_{th}, 50–100 MW_{th} and <50 MW_{th} (CEFIC_267). For plants <100 MW_{th}, PEMS should be allowed.
12. Change monitoring to 2/yr for peak-load plants (FI_144).

<u>Footnotes</u>
13. Add a footnote linking the low NO_X and/or low CO emissions (FR_155).
14. Include a footnote regarding supplementary firing: "For gas turbines and CCGT equipped with supplementary firing of natural gas in the HRSG an upper BAT-AEL for NO_X of 100 mg/m^3 applies for new and existing plants with respect to the supplementary firing in the HRSG and to the operation of the HRSG in fresh-air mode." (Eurelectric_1002).
</td></tr>
<tr><td>EIPPCB assessment:</td><td>
<u>General</u>
1. The assessment has been made considering plants burning more than 95 % natural gas for conclusions applying to natural gas combustion. This is stated in the introductory paragraph of Section 10.4.1.
2. (+3.) Assessed information is related to SG- and DF-type engines, and not GD-type engines. Thus emission levels are only proposed for such engine types and this would be worth clarifying this in the statement of the BAT conclusion and BAT-AELs.
4. For boilers, the only data available related to NH_3 emissions are the data related to Plant 62-1 which continuously monitors NH_3 slip, but with the SCR not working when natural gas is combusted. Plants (one turbine and five boilers) burning iron and steel process gases in Voestalpine (Austria) submitted additional information on NH_3 slip, which is controlled with periodic monitoring; all of the last 84 measurements being below 10 mg/Nm^3) (see additional information – AT-01). Engines equipped with SCR (example Plants 353, 354, 504) have NH_3 emissions below 10 mg/Nm^3, with Plant 504 operated 2000 hours/yr in dual fuel mode at an equivalent full load factor of 63 %. This is also consistent with the assessment made for
</td></tr>
</table>

	turbines. **5. As a general assessment, engines operated in peak- or emergency-load modes achieve an equivalent level of emissions to when operated in other load modes; should it not be possible to use the SCR technique for plants operated in emergency-load mode with many start-ups/shutdowns and operating conditions with a highly variable load, it would be necessary to set alternative BAT-AELs, taking as the reference a plant not operated with SCR, e.g. Plant 186-1 which reported emission levels of about 175 mg/Nm^3 (maximum of periodic samples). However, yearly average BAT-AELs may not be justified for these modes as the operation throughout the year would be limited to 1500 hours.** **6. For boilers: example plants fitted with primary techniques, operated in emergency- or peak-load modes, achieve the levels proposed in D1. For engines, see point 5. above. However, yearly average BAT-AELs may not be justified for these modes as the operation throughout the year would be limited to 1500 hours.** **Averaging periods** **7. This a generic issue. Already dealt with in other sections.** **8. (to 12.) The averaging period issue is linked to the type of monitoring frequency agreed. Should the monitoring not be continuous, an average of the measurements over the year (if enough are performed) could then be proposed. Regarding the boilers, in the 2006 LCP BREF, continuous monitoring applies for all plants,. NO_X and CO are generally the only pollutants monitored at gas-fired boilers. Out of the 11 plants of between 50 and 100 MW_{th} that submitted a questionnaire, 7 are monitoring the NO_X emissions continuously, whereas for plants below 50 MW_{th}, 6 plants out of 8 perform periodic monitoring with frequencies between once/yr and 24/yr. Plants operated in peak- or emergency-load modes also carry out periodic monitoring for half of them. Regarding the engines, the reference plants that submitted a questionnaire are all below 50 MW_{th} and monitor NO_X and CO emissions continuously or at least three times/yr. These reference plants are all operated at least in mid-merit mode. The scope proposes not to cover plants < 50 MW_{th} (see Section 1.1.2 of this BP).** **Footnotes** **13. From the assessment of available data and information, there is no correlation between the levels of NO_X and CO emitted, when comparing the different plants and techniques. However, trying to decrease the level of NO_X emitted by fine-tuning an existing technique without upgrading/replacing it with a better performing one may lead to higher CO emissions.** **14. When the HRSG of a CCGT is used as an integral part of the CCGT (supplementary firing mode), its emissions are covered by the BAT applying to CCGTs as the assessment takes this mode into consideration. When the HRSG is operated alone, it is by definition and by design considered a boiler and the conclusions that apply are the ones of this Section. A proposal (number 60) for clarification is suggested in the Section 1.6.6.1.2 of this BP.**
EIPPCB proposal:	**General** **1. Keep the general introductory statement of Section 10.4.1 regarding the type of fuel covered by the section.** **2. (+3.) Add a footnote to explicitly mention that the BAT-AELs apply only to SG- and DF-type engines. Do not set BAT-AELs for GD-type engines.** **4. Change the BAT-AELs for NH_3 slip to < 5–10 mg/Nm^3.** **5. Add a footnote concerning engines operated in emergency-load mode that could not be fitted with SCR for techno-economic reasons, for which the higher end of the BAT-AEL range is 175 mg/Nm^3 as an average over the sampling period. Add a footnote mentioning that yearly BAT-AELs do not apply when plants operate in peak- or emergency-load modes.** **6. Do not set differentiated BAT-AELs for emergency- and peak-load modes.** **Averaging period** **7. Generic issue.** **8. (to 12.) Keep the continuous monitoring for plants of ≥ 50 MW_{th} with adaptations when plants are operated in peak- or emergency load modes.** **Footnotes** **13. Add a footnote mentioning that fine-tuning an existing technique to decrease NO_X emissions may lead to higher levels of CO emissions.** **14. Modify the CCGT definition in the acronyms and in the definition of the BAT conclusions to mention that it includes the case where supplementary firing is used. Include in the definition of 'boiler' of the BAT conclusions the HRSG when it is operated in 'fresh air' mode.**

1.6.6.2.2 Table 10.28 – BAT-AELs for NO_X and CO – boilers and engines

Location in D1: *p. 775 - Section 10.4.1.2*

Current text in D1:

Table 10.28: BAT-associated emission levels for NO_X and CO emissions to air from the combustion of natural gas in boilers and engines

Type of combustion plant	BAT-AEL (mg/Nm^3)			Monitoring frequency
	NO_X (daily average)	NO_X (yearly average)	CO (yearly average)	
Boilers				
New boilers	NA	10 – 60	1 – 5	Continuous measurement
Existing boiler	85 – 110	50 – 100	1 – 15	Continuous measurement
Gas engines				
New gas engine	NA	20 – 75	30 – 100	Continuous measurement
Existing gas engines	NA	20 – 100	30 – 100	Continuous measurement

Summary of comments:

NO_X emissions

Boilers

1. *Upper limit would require the use of ULNB and FGR which might not be always possible due to design constraints (CEFIC_23).*
2. *Add a footnote specifying that higher NO_X emissions may occur when air preheating is applied (CEFIC_2).*

Existing boilers – Alternative proposals

3. *80–100 mg/Nm^3 for yearly average with correction for CO levels (FI_82).*
4. *50–100 mg/Nm^3 for yearly average with correction for CO levels (PL_182, Eurelectric_515).*
5. *50–200 mg/Nm^3 for yearly average as boilers fitted with air pre-heating cannot achieve 100 mg/Nm^3 (CEFIC_2).*
6. *85–150 mg/Nm^3 for daily average (CEFIC_64).*
7. *Only new plants are able to comply with the proposed daily range (OGP_67).*

New boilers – Alternative proposals

8. *10–80 mg/Nm^3 for yearly average (AT_17, Eurelectric_739_1001).*
9. *20–80 mg/Nm^3 for yearly average (PL_182, Eurelectric_515).*
10. *75–90 mg/Nm^3 for daily average (AT_16).*
11. *Set daily BAT-AELs (NL_64) with as a minimum the values from the IED ELVs (FR_158).*

Engines

12. *Set daily BAT-AELs with as minimum the values from the IED ELVs (AT_18, FR_158).*

CO emissions

Boilers

Existing boilers – Alternative proposals

13. *10–100 mg/Nm^3 (FI_82, CEFIC_64).*
14. *< 50 mg/Nm^3 (Eurelectric_1001).*
15. *10–50 mg/Nm^3 (PL_182, E&P_28, Eurelectric_515_739).*

New boilers – Alternative proposals

16. *<50 mg/Nm^3 (Eurelectric_1001).*
17. *10–50 mg/Nm^3 (PL_182, E&P_28, Eurelectric_515_739).*

EIPPCB assessment:

NO_X emissions

Boilers

1. **Example plants show that retrofitting existing plants with LNB allows achieving emission levels below 100 mg/Nm^3 to be achieved. When the design constraints prevent the retrofit with LNB, others BAT can be considered.**
2. **Example plants with preheated combustion air have been retrofitted with LNB and reported emission levels within the proposed range. It should also be noted that the reduction of the combustion air temperature is now proposed to be added to the list of BAT.**

Existing boilers – Alternative proposals

3. **(to 7.) Example boilers achieve NO_X emission levels well below 80 mg/Nm^3, with short-term emissions below 110 mg/Nm^3. The existing 2006 LCP BREF already set 50 mg/Nm^3 as the lower end of the range. Available data on CO emission levels have been considered**

	for proposing the corresponding BAT-AELs. **New boilers – Alternative proposals** **8. (+9.) Newly built plants can be fitted with efficient (U)LNB able to reach very low NO_X emissions, far below 80 mg/Nm^3, including smaller plants. One of the best performing plants for which a questionnaire was submitted is a retrofitted boiler first commissioned in 1959 in the oil refining sector, which reported emissions of 60 mg/Nm^3. Newly built plants are able to perform much better (see Section BREF 7.1.4.3.1).** **10. (+11.) The level of short-term emissions from several well performing existing plants, e.g. Plants 67, 517, 21-2 and 114-3, could be used for proposing daily BAT-AELs for new boilers.** **Engines** **12. The review of available data from well performing plants shows short-term emission levels between 55 and 110 mg/Nm^3.** **CO emissions - boilers** **13. (to 17.) BAT-AELs for CO are proposed taking into consideration well performing plants regarding NO_X emissions. CO emissions are generally very low regardless of the size of the plant, and of the industrial sector the plant belongs to or of the load mode the plant operates in. The reassessment of available data shows CO emission levels of up to 36 mg/Nm^3. For new plants, higher CO levels that could be achieved may be reflected by Plant 517 (12.4 mg/Nm^3).**
EIPPCB proposal:	**NO_X emissions** **Boilers** **Existing boilers** **1. (to 7.) Keep the proposed BAT-AEL range.** **New boilers** **8. (to 11.) Keep the proposed yearly BAT-AEL and propose a daily BAT-AEL of < 85 mg/Nm^3.** **Engines** **12. Propose a daily BAT-AEL for existing gas engines of 55–110 mg/Nm^3.** **CO emissions - boilers** **13. (to 17.) Change the proposed BAT-AELs as follow: < 5–15 mg/Nm^3 for new boilers, < 5–40 mg/Nm^3 for existing boilers.**

1.6.7 BAT 50 – NMVOC and CH_4 emissions to air from engines

Location in D1:	*p. 775 - Section 10.4.1.2*
Current text in D1:	**50. In order to reduce non-methane volatile organic compounds (NMVOC) and methane (CH_4) emissions to air from the combustion of natural gas in spark ignited lean burn gas (SG) and dual fuel (DF) engines, BAT is to ensure complete and stable combustion conditions and/or to apply oxidation catalysts.** The BAT–associated emission levels for NMVOC and CH_4 are presented in Table10.29. **Table10.29: BAT-associated emission levels for NMVOC and CH_4 emissions to air from the combustion of natural gas in SG or DF engines** Note to the TWG: based on data to be finalised / completed **Pollutant** | **BAT-AEL (average of samples obtained during one year – mg/Nm^3)** | **Monitoring frequency** NMVOC | 4 – 40 | Periodic measurements: 4 times/yr CH_4 | 200 – 400 | Periodic measurements: 4 times/yr *{This BAT conclusion is based on information given in Section 7.1.4.3}*
Summary of comments:	*General* *1. BAT conclusions on NMVOC and methane are missing for gas turbines (NO_25) and boilers (PT_34).* *2. NMVOC could be replaced by formaldehyde (HCHO) as a surrogate (FI_150, EUROMOT_94_116).* *3. Delete (Marcogaz_40_51_134) or update the proposed BAT-AELs (Eurelectric_740).* *4. The conclusions do not apply to DF-type engines (EUROMOT_94).*

	5. Remove conclusions on CH_4 as already covered by the ETS scheme (MT_25). *Monitoring* *6. The measurement method to be used for CH_4 monitoring is: US EPA Method 320 (FTIR) (FI_149).* *7. The measurement method to be used for HCHO monitoring is: US EPA Method 320 (FTIR) or US EPA Method 323 (wet chemical method) (FI_159).* *8. Set the monitoring frequency at 2/yr (FI_149, Eurelectric_740).* *NMVOC emissions – Alternative proposal* *9. < 23 mg/Nm^3 for HCHO as average over the year (FI_150).* *CH_4 emissions – Alternative proposals* *Existing plants* *10. Set a BAT-AEL at < 560 mg/Nm^3 calculated as C at MCR (Maximum Continuous Rating) engine load with efficiency correction upwards/downwards starting from 30 % electrical efficiency, corresponding to todays' good pipeline gas quality (FI_149).* *New Plants* *11. For SG types, set a BAT-AEL at < 600 mg/Nm^3 calculated as C at full engine load (MCR) when gas quality is similar to the current Dutch pipeline quality (FI_149).* *12. For DF types, set a BAT-AEL at < 560 mg/Nm^3 calculated as C at MCR (Maximum Continuous Rating) engine load with efficiency correction upwards/downwards starting from 30 % electrical efficiency, corresponding to todays' good pipeline gas quality (FI_149).*
EIPPCB assessment:	**General** **1. Some data on methane and NMVOC emissions have been submitted for turbines and boilers. The monitoring of these emissions is not performed systematically, unlike in the case of engines. According to the collected information available, the level of CH_4 and NMVOC emissions from boilers and turbines tends to be at least an order of magnitude lower than for engines.** **2. NMVOC emissions include NMHC emission (that may have been monitored instead of NMVOC in the data reported in the questionnaires) which is usually monitored with the FID technique, and alcohols and aldehydes emission, for which a surrogate is formaldehyde (HCHO). NMHC includes mainly ethane and propane, which are not very reactive and thus quite difficult to oxidise. Alcohols and aldehydes are hazardous compounds that can be oxidised with oxidation catalysts. HCHO is a good surrogate for the VOC part of NMVOC emissions that could be oxidised.** **3. CH_4 slip and VOC emissions have been identified as key pollutants for the review of the LCP BREF (see KOM report Sections 3.4 and 4.4).** **4. Available information and data from the bulk information and questionnaires refer only to SG-type engines.** **5. CH_4 is a greenhouse gas included in the list of Annex II to Directive 2003/87/EC on the EU Emissions Trading System. However, only the greenhouse gases from activities mentioned in Annex I are subject to the issues of permits, allocation and allowances according to Article 3.h of this Directive. Only CO_2 is covered for combustion plants.** **Monitoring** **6. (to 8.) Monitoring methods for CH_4 used by the operators who submitted a questionnaire, based on FID measurement, are not challenged by the TWG. The general principle presented in BAT 3 on monitoring about the use of European standards applies here. Monitoring at least once per year seems an appropriate frequency for these pollutants as the conditions are standard (at MCR) and the quality of fuel does not vary a lot throughout the year.** **NMVOC** **9. Data on HCHO emissions are scarce but references can be found in the bulk information and in the current BREF. The reference level (i.e. BAT-AEL) of 23 mg/Nm^3 is set in the BAT conclusions of the current BREF. A 2007 Danish study (Additional information – Euromot-01) reported levels below 5 mg/Nm^3 achieved by using VOC catalysts. According to suppliers' commercial information, emission levels achievable by available techniques are around 2 mg/Nm^3 with a catalyst.** **CH_4** **10. (to 12.) After reviewing the available data and bulk information (surveys from NL (additional information – Euromot-02) and DK (additional information – Euromot-02) and questionnaires), it can be observed that all SG-type engines performing well achieve CH_4 emission levels between 185 mg/Nm^3 and 500 mg/Nm^3 expressed as C at 15 % O_2. No data have been reported for other engine types. The monitoring minimum frequency could be proposed at once per year at MCR (maximum continuous rate). The yearly**

	average electrical efficiency for these plants operated in CHP mode, except Plant 166, is between 39 % and 44 %. No rationale has been provided as to why new plants would have levels of CH_4 emissions higher than 500 mg/Nm^3.
EIPPCB proposal:	**General** **1. Do not propose BAT-AELs for boilers and turbines on CH_4 and NMVOC emissions.** **2. Propose BAT-AELs for HCHO instead of NMVOC.** **3. Keep BAT-AELs for unburnt or partially burnt carbons.** **4. (+5.) Limit the BAT-AELs for CH_4 to SG-type engines.** **Monitoring** **6. (to 8.) Do not specify a US EPA method for the monitoring. Change the monitoring frequency for all types of engines to once/yr.** **NMVOC** **9. Propose a BAT-AEL for HCHO (formaldehyde) of 2–15 mg/Nm^3 as an average over the sampling period.** **CH_4** **10. (to 12.) Modify the proposed BAT-AELs for CH_4 to 185–500 mg/Nm^3 (expressed as C at 15 % O_2) as an average over the sampling period for new and existing SG-type engines, with a minimum periodic monitoring of once per year at MCR.** **Do not propose BAT-AELs for the other engine types but propose the same level of monitoring.**

1.7 Combustion of iron and steel process gases

1.7.1 BAT 52 – NO_X and CO emissions to air from boilers

<table>
<tr><td>Location in D1:</td><td>p. 778 - Section 10.4.2.2</td></tr>
<tr><td>Current text in D1:</td><td>
52. In order to reduce NO_X emissions to air from the combustion of iron and steel process gases in boilers, only or in combination with other gaseous fuels and/or liquid fuels, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Specially designed low-NO_X burners</td><td>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)</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Air staging</td><td>See description in Section 10.8</td><td>Generally applicable</td></tr>
<tr><td>c.</td><td>Fuel staging</td><td>See description in Section 10.8</td><td>Generally applicable</td></tr>
<tr><td>d.</td><td>Flue-gas recirculation</td><td>See description in Section 10.8</td><td>Generally applicable</td></tr>
<tr><td>e.</td><td>Selective Catalytic Reduction (SCR)</td><td>See description in Section 10.8</td><td>Retrofitting existing plants may be constrained by significant space availability</td></tr>
<tr><td>f.</td><td>Selective Non Catalytic Reduction (SNCR)</td><td>See description in Section 10.8</td><td>Generally applicable</td></tr>
<tr><td>g.</td><td>Advance computerised process control</td><td>See description in Section 10.8. This technique is used in combination with other techniques</td><td>Generally applicable</td></tr>
</table>
{This BAT conclusion is based on information given in Section 7.3.4.2}
</td></tr>
<tr><td>Summary of comments:</td><td>
1. <u>Specially designed LNB (technique a)</u>: Add an applicability restriction for the size (IT_163_176, Eurelectric_524_539).
2. Add an applicability restriction for the use of SNCR <u>(technique f)</u> regarding the impact of variable loads and the changes in fuel quality (Eurofer_172).
3. Add applicability restrictions for the use of SNCR/SCR <u>(techniques e/f)</u> regarding the load modes, the special foundation design for SCR, the strong variability of process gases quantity and quality and the cross-media effects linked to the use of ammonia use (IT_164, Eurelectric_525).
</td></tr>
<tr><td>EIPPCB assessment:</td><td>
1. <u>Specially designed LNB (a)</u>: In the case of older plants, the efficiency of retrofitted LNB may be influenced by the boiler design. This information can be added to the description (Section 10.8.3). The name of the technique may be simplified for consistency with other sections of the BAT conclusions.
2. <u>SNCR (f)</u>: Combustion plants burning iron and steel process gases are subject to variable loads and changes in fuel quality and availability, which mainly affects the combustion when the plant operates at lower loads. The possibility of using a specially designed reactant and several levels of injection may be limited by the complexity of the possible mixtures in the combustion chamber.
3. <u>SNCR/SCR (e and f)</u>: Operating for few hours with changing fuels and loads may not allow the SNCR or SCR techniques to operate properly. The design of the foundations is a local issue and cross-media effects are not reported in the conclusions. If necessary, SNCR may also be combined with a slip catalyst (SCR); however, this combination may be costly in the case of plants operated in peak-load mode.
</td></tr>
<tr><td>EIPPCB proposal:</td><td>
1. <u>Specially designed LNB (a)</u>: change the name of the technique to Low-NO_X burners (LNB); add in the description of the technique (Section 10.8.3) that the performance of retrofitted LNB may be affected by the boiler design in the case of old plants
2. (+3.) <u>SNCR/SCR (e and f)</u>: add an applicability restriction to indicate that the applicability of SNCR may be limited in the case of frequent fuel changes and frequent load variations for peak-load mode, and that the technique is not applicable for emergency-load mode.
Add applicability restrictions for SCR to reflect that the technique is not applicable for plants operated in emergency-load mode and that there are restrictions for plants operated in peak-load mode. Add an applicability restriction linked to the
</td></tr>
</table>

	size (≥ 100 MW_{th}) for consistency with other boilers. **4. Advanced computerised control system (g): change the name of the technique to 'Advanced control system' and its applicability for consistency throughout the BREF.**

1.7.2 BAT 53 – NO_X and CO emissions to air from CCGTs

Location in D1:	*p. 778 - Section 10.4.2.2*
Current text in D1:	**53. In order to reduce NO_X emissions to air from the combustion of iron and steel process gases and natural gas in CCGTs, BAT is to use one or a combination of the techniques given below.** {This BAT conclusion is based on information given in Section 7.3.4.2}

	Technique	Description	Applicability
a.	Dry low-NO_X burners (DLN)	See description in Section10.8	Applicability may be limited in the case of a very old turbines (retrofitting package not available) or when steam/water injection systems are installed.
b.	Low-NO_X burners (LNB)	See description in Section 10.8.	Generally applicable to supplementary firing for heat recovery steam generators (HRSG)
c.	Selective Catalytic Reduction (SCR)	See description in Section 10.8	Retrofitting existing plants may be constrained by the availability of significant space
d.	Water or steam injection	See description in Section 10.8	Generally applicable
e.	f. Advanced computerised process control	See description in Section 10.8. This technique is used in combination with other techniques	Generally applicable

Summary of comments:	*1. Technique a (DLN)* *1.1. Add an applicability restriction in the case of use of high reactive gas such as hydrogen (EUTurbines_88).* *1.2. DLN burners used for natural gas combustion are not applicable for burning I&S process gases. Specific Low-NO_X burners are necessary, which needs water or steam when operated with natural gas only (IT_165, Eurelectric_778).* *2. Technique b (LNB): any modification of existing plants has to take into account the specific conditions of the plant (operating hours, available space, technical constraints etc.) (IT_166, Eurelectric_527).* *3. Technique c (SCR):* *3.1. The use of SCR is only applicable to non-peak-load plants (IT_167, Eurelectric_528).* *3.2. Cross-media effects should be more highlighted (IT_167, Eurelectric_528).* *3.3. There are other applicability issues to be considered: foundations design, fuel quality variability, economic viability for existing plants that requires permanent heating or the flue-gas before the SCR (IT_167, Eurelectric_528, Eurofer_171).* *4. Technique d (water/steam injection): Clarify the technical description when the burners designed for I&S process gases are used only for natural gas (IT_168, Eurelectric_529).*
EIPPCB assessment:	**1. DLN (a)** **1.1. The applicability should include limitations linked to the burning of highly reactive iron and steel process gases such as COG in the turbine.** **1.2. DLN burning I&S process gases differ from the ones burning only natural gases. This may be added to the description.** **2. LNB (b): The specific conditions of each plant have to be considered at local level.** **3. SCR (c)** **3.1. Out of the 8 plants that submitted a questionnaire at plant level, only one is operated < 1500 h/yr and is fitted with SCR (Plant 008). However, consistent with other applications, SCR may not be generally economically viable for retrofitting existing plants operated in peak-load mode and even less so in the case of plants operated in emergency-load mode.** **3.2. Cross-media effects are described in the 'Techniques to consider in the determination of BAT' section of the BREF, pursuant the Guidance document**

	provisions. **3.3. The design of the foundations can be is part of the limitations linked to the plant configuration and mainly to the space availability; fuel variability has less impact in the case of CCGTs as the turbine requires more stable combustion conditions than boilers, thus the fuel is better selected or cleaned before combustion; economic viability is to be considered at local level as two out of eight plants in the submitted questionnaires are fitted with SCR. There is no additional information on economic viability for the sector provided.** **7. Water/steam injection (d) is used in the gas turbine when using natural gas. This could be better described in the technique description. The technique requires water availability.**
EIPPCB proposal:	**1. DLN (a)** **1.1. Add an applicability restriction: 'Applicable within the constraints given by the reactiveness of iron and steel process gases such as COG'.** **1.2. Add in the description: 'DLN that combust iron and steel process gases differ from the ones that combust only natural gas'.** **2. LNB (b): Do not change the applicability.** **3. SCR (c): Do not change the description proposed in D1. Add an applicability restriction linked to the techno-economic viability in the case of peak-load mode. Add that the technique is not applicable in the case of plants operated in emergency load-mode.** **4. Water/steam injection (d): Change the name of the technique to 'Water/steam addition' for consistency throughout the BREF and BAT conclusions. Add in the description: 'Water/steam addition is generally used in gas turbines using DLN for iron and steel process gases, when combusting natural gas.' Add an applicability restriction linked to the water availability.** **5. Advanced computerised control system (f): change the name of the technique to 'Advanced control system' and its applicability for consistency throughout the BREF.**

1.7.3 BAT 54 – CO emissions to air

<table>
<tr><td>Location in D1:</td><td>p. 779 - Section 10.4.2.2</td></tr>
<tr><td>Current text in D1:</td><td>54. In order to reduce CO emissions to air from the combustion of iron and steel process gases, only or in combination with other gaseous fuels and/or liquid fuels, or with natural gas in CCGTs BAT is to apply one or a combination of the following techniques:
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Complete combustion</td><td></td><td></td></tr>
<tr><td>b.</td><td>Good furnace/combustion chamber design</td><td></td><td>Applicable to new plants</td></tr>
<tr><td rowspan="2"></td><td>1. Use of high performance monitoring</td><td></td><td>Generally applicable</td></tr>
<tr><td>2. Maintenance of the combustion system</td><td></td><td>Generally applicable</td></tr>
<tr><td>c.</td><td>Advanced computerised process control</td><td>See description in Section 10.8</td><td>Generally applicable</td></tr>
<tr><td>d.</td><td>Well optimised system to reduce emissions of NO_X</td><td></td><td>Generally applicable</td></tr>
<tr><td>e.</td><td>Oxidation catalysts</td><td>See description in Section 10.8</td><td>Applicable to CCGTs</td></tr>
</table>
{This BAT conclusion is based on information given in Section 7.3.4.2}</td></tr>
<tr><td>Summary of comments:</td><td>1. Technique b.1. (use of high-performance monitoring): mention that the technique refers to the monitoring of CO (AT_123, Eurofer_175, SE_93).
2. Technique c (well optimised system to reduce emissions of NO_X): Replace NO_X by CO in the name of the technique (Eurofer_176).
3. Technique d (Oxidation catalysts): the applicability of the technique is constrained by the level of sulphur in the fuel, the need of enough space and the impact of load on the efficiency (IT_171, Eurelectric_532).</td></tr>
<tr><td>EIPPCB assessment:</td><td>1. (+2.) Use of high-performance monitoring (b.1) and Well optimised system to reduce emissions of NO_X (c): For a given combustion system, NO_X and CO emissions are interrelated. However, optimising the system used for reducing NO_X emissions allows also the level of CO emissions to be limited to a certain extent. Thus the parameters to be monitored for controlling the level of CO emissions include both the CO and NO_X generated in the combustion chamber.
3. Oxidation catalysts (d): The proposed applicability constraints are taken from Table 7.12 in the section on 'Techniques to consider in the determination of BAT'.</td></tr>
<tr><td>EIPPCB proposal:</td><td>1. (and 2.) Use of high-performance monitoring (b.1), Well optimised system to reduce emissions of N_{OX} (c): For consistency with other fuels' combustion, change the name of technique (a) to 'combustion optimisation'. Remove techniques (b) and (c) as the technique description has been changed in Section 10.8.3 and includes now the techniques (a), (b), (c). Keep the technique generally applicable.
3. Oxidation catalysts (d): Add applicability constraints: 'Applicability may be limited by lack of space, the load requirements and the sulphur content of the fuel'.</td></tr>
</table>

1.7.4 Table 10.32 – BAT-AELs for NO_X and CO – I&S process gases

Location in D1: *p. 779 - Section 10.4.2.2*

Current text in D1:

Table 10.32: BAT-associated emission levels for NO_X and CO emissions to air from the combustion of iron and steel process gases, only or in combination with other gaseous fuels and/or liquid fuels in boilers, or, with natural gas in CCGTs

Plant type	O_2 reference level (%)	BAT-AEL (mg/Nm^3) (1)			Monitoring frequency
		NO_X (daily average)	NO_X (yearly average)	CO (yearly average)	
New boilers	3	22 – 100	15 – 65	1 – 25	Continuous measurement
Existing boiler	3	22 – 160	20 – 100	1 – 100	Continuous measurement
CCGTs	15	30 – 120	20 – 100	1 – 20	Continuous measurement
(1) Emissions from plants combusting a mixture of gases with an equivalent LHV > 20 MJ/Nm^3 are expected to emit at the higher end of the ranges					

Summary of comments:

1. *General:*
   - 1.1. *Specify achievable levels depending on the implemented technique (AT_120, Eurofer_2014).*
   - 1.2. *Provide daily averages for CO (AT_121_124).*
   - 1.3. *Set separate BAT-AELS for new/existing CCGTs (IT_173, Eurelectric_534).*
   - 1.4. *Proposed BAT-AELs should take into account the variability in fuel mix from one year to another (Eurelectric_277_741), and the fuel mix ratios, especially in case of liquid fuel usage (IT_172, Eurelectric_533).*
   - 1.5. *Set higher BAT-AELs for 'back-up plants (< 2000 h/yr)(Eurelectric_538).*
   - 1.6. *Change monitoring frequency to 4 times/yr for plants < 50 MW_{th} (Eurofer_178).*
2. *NO_X BAT-AELS*

   Change the BAT-AELs to:
   - 2.1. *Existing boilers – yearly average*
     - *20–140 mg/Nm^3 (Eurelectric_537).*
     - *< 100 mg/Nm^3 with SCR and < 140 mg/Nm^3 with other techniques (Eurofer_230).*
   - 2.2. *Existing boilers - daily average*
     - *20–125 mg/Nm^3 (NL_69).*
     - *22–200 mg/Nm^3 (Eurelectric_537).*
     - *Set different BAT-AELs depending on the combusted process gas (Eurofer):*
       - *BFG or BOF: < 105 mg/Nm^3 in case of 100 % participation;*
       - *COG: < 325 mg/Nm^3 in case of 100 % participation;*
       - *auxiliary fuels: higher end of BAT-AELs defined elsewhere in this BREF depending on the fuel, size of the plant and operational hours,*
       - *formula combining the previous levels for the mixtures: **1.05 x %TI BFG + 3.25 x %TI COG + 1.05 x % TI BOFG + ngnox x %TI NG + clnox x %TI Coal + olnox x %TI Oil, at 3 % O_2,** where ngnox = upper NO_X emission for NG fired boilers, clnox = upper NO_X emission for coal fired boilers, olnox = upper NO_X emission for oil fired boilers and %TI is the thermal input from each process gas or auxiliary fuel as a percentage.*
   - 2.3. *New boilers – yearly average*
     - *Set the same BAT-AELs as for existing boilers (Eurofer).*
   - 2.4. *CCGT yearly average*
     - *< 30 mg/Nm^3 with SCR or < 65 mg/Nm^3 with other techniques (Eurofer).*
     - *20 – 60 mg/Nm^3 for yearly (NL_68).*
     - *< 65 mg/Nm^3 (AT_119).*
     - *30 – 400 mg/Nm^3 as monthly average and add a footnote 'For LHV > 7MJ/kg dilution needed' (EUTurbines_89).*
   - 2.5. *CCGT daily average*
     - *< 80 mg/Nm^3 (AT_119).*
     - *< 80 mg/Nm^3 (Eurofer).*
3. *CO BAT-AELs*

   Change the BAT-AELs to:
   - 3.1. *New boilers*
     - *< 100 mg/Nm^3 (Eurofer).*
   - 3.2. *CCGTs*

	• *1 – 30 mg/Nm^3 as yearly 'target' (AT_124).* • *< 50 mg/Nm^3 (Eurofer).* *4. Footnotes* *4.1. Footnote (1) should also mention that higher N content in the fuel leads to achieve the higher end of the range (IT_175, Eurelectric_432_536_742, Eurofer_180_181).* *4.2. Add a footnote associated with the new proposed higher end of the daily BAT-AEL for boilers fitted with other techniques than SCR that allow achieving levels up to 250 mg/Nm^3 when burning higher rates of COG (up to > 95 % COG with coal) (Eurofer).* *Add a footnote for plants using SCR to limit the NH_3 slip to < 10 mg/Nm^3 based on periodic measurements of half/hour performed once/yr (Eurofer).*
EIPPCB assessment:	**1. General** **1.1. The environmental performance of each technique is described in the general or specific sections on 'Techniques to consider in the determination of BAT'. Examples of achieved performance are plotted in graphs in the same sections, showing the implemented techniques. BAT-AELs are not in the form of separate levels depending on the techniques used but in the form of a single, inclusive range.** **1.2. CO is one of the key environmental parameters that the TWG agreed to work on at the KOM. Due to trade-offs between NO_X and CO, priority is given to NO_X reduction in this review. Subsequently, CO levels and corresponding techniques are derived based on the set of well performing plants for NO_X emissions. Only a yearly average is proposed for BAT-AELs to give more flexibility in achieving a good short-term and long-term performance for NO_X emissions.** **1.3. The possibility to propose separate BAT-AELs for new/existing CCGTs is assessed in the specific corresponding paragraphs below.** **1.4. The proposed BAT-AELs already take into account the variety of situations in terms of fuel mix expressed through the submitted questionnaires for a representative year between 2009 and 2011 (see questionnaire question 3.2.1), representative of the sector, and the environmental performance achieved by the implemented techniques. The liquid fuel combustion is included in the assessment when used as an auxiliary fuel, to propose yearly and daily averages. See further the discussions on proposals below.** **1.5. This reassessment takes into account the specific cases of different load regimes, including plants operated in peak- or emergency-load modes. There is only one plant, out of the 62 questionnaires submitted, that is operated about 1000 h/yr, the others being operated more than 3850 h/yr.** **1.6. One questionnaire out of the eight regarding plants of < 50 MW_{th} reports periodic monitoring whilst the other questionnaires report continuous monitoring for the other plants. The specificity of these plants having variable fuel quality and quantities may justify continuous monitoring.** **2. NO_X BAT-AELs** **2.1. Existing boilers - yearly average** **The reassessment of available data confirms the levels proposed in D1 based on the implementation of SCR, or a combination of primary techniques including LNB.** **An alternative assessment is proposed in support of the submitted comments; it considers three different techniques: SCR, LNB, and other BAT, tending to be inclusive of all the plants.** **The proposed BAT-AELs cover the combustion of any kind of mixture of I&S process gases BFG-COG-BOF together with natural gas or other auxiliary liquid fuels like gas oil/HFO, which share is usually low.** **In the case of a high proportion of COG in the fuel mixture, which could lead to higher NO_X levels being generated at the boiler outlet, the application of the appropriate (combination of) technique(s) (e.g. additional primary technique, or SCR, or combination of SNCR/SCR) is deemed possible.** **Regarding the peak-load and emergency-load modes, the same primary techniques can generally apply as in the case of other load modes and enable the proposed BAT-AELs to be met, however a yearly average may not be needed for these modes as their operation throughout the year is limited to 1500 hours.** **2.2. Existing boilers – daily averages** **The sector is specific as the composition and quantities of fuels/process gases that can be combusted vary from one day to another and within the same day. An assessment has been proposed in support of the submitted comments based on the collection of extensive daily average emissions data depending on the COG load in the fuel mixture. The outcome tends to show a relationship between the level of NO_X emissions and the level of COG combusted. However, this assessment does not link the achieved emissions with the implemented techniques, thus making it difficult to consider further.** **The reassessment of available data, considering data provided via the RAI for the averaging period issue, confirms the BAT-AEL proposed in D1 (22–160 mg/Nm^3) for plants combusting mainly (> 95 %) iron and steel process gases. This is based on**

	the analysis of the whole set of data for plants implementing SCR or LNB with another primary technique, and taking as a reference e.g. Plants 601-1, 606 and 601-5 that combust yearly average levels of COG of > 27 %, for which 95 % of hourly values are representative of the 'worst' situations in which the NO_X emissions are mainly driven by the COG combustion. **The checking of additional daily data submitted by Eurofer shows that those plants fitted with BAT with yearly emission levels below 100 mg/Nm^3 generally have daily emission values below 160 mg/Nm^3, but there are a few days in the year when the COG participation could be very high and/or where the level of H_2 in this COG may be very high.** **For plants combusting liquid auxiliary fuels with higher participation, the levels of NO_X emitted when combusted (alone or in combination with iron and steel process gases) are similar to those that would be emitted by plants of the same size combusting only these fuels and operated in peak- or emergency-load modes.** **2.3. <u>New boilers – yearly/daily average</u>** **There is no rationale challenging the BAT-AEL proposed in D1. Based on the implementation of SCR and/or a combination of primary techniques, and considering the levels of emissions achieved at existing plants, the range proposed in D1 is deemed as corresponding to BAT for new plants. However, daily BAT-AELs may be higher when using auxiliary liquid/solid fuels.** **2.4. <u>CCGT yearly average</u>** **Multiple BAT-AELs that would depend on each applied technique cannot be proposed. The proposed range is inclusive of all techniques (or combinations of techniques) that are considered BAT. However, a footnote could mention that the lower end of the range is achieved when using SCR (See Section 3.3.1 of the BREF Guidance) as this is clearly reflected in the reported emission data. The fuels that can be combusted need to comply with the plant design and supplier recommendations to avoid turbine deterioration. These recommendations cannot be mentioned in the BAT conclusions. The reassessment of available data and information shows emission levels different to those proposed in D1 (higher reported NO_X levels for plants not operated in peak-load mode of 50 mg/Nm^3) as NO_X emission data from Plant 373 were corrected. Regarding peak-load and emergency-load modes, the same primary techniques can apply as in the case of other load modes, however a yearly average may not be needed for these modes as their operation throughout the year is limited to 1500 hours.** **According to available data, new plants can be fitted with SCR, DLN and/or LNB depending on the fuel(s) used and on the targeted performance, with yearly NO_X emissions within 20–35 mg/Nm^3.** **2.5. <u>CCGT daily average</u>** **The reassessment of available information and data for plants fitted with BAT shows short-term emission levels that can vary up to 68 mg/Nm^3 [Additional information – Eurofer-01]. For plants operated in peak- or emergency-load modes, updated data from Plant 008, with a maximum daily average of 79 mg/Nm^3, can be used as a reference.** **According to the available data, new plants can be fitted with SCR, DLN and/or LNB depending on the fuel(s) used and on the targeted performance, with daily NO_X emissions within 30–50 mg/Nm^3.** **3. <u>CO BAT-AELs</u>** **3.1. <u>New boilers</u>: all boilers fitted with the proposed BAT achieving NO_X yearly emissions below 65 mg/Nm^3 (proposed as the higher end of the BAT-AEL range) achieve yearly levels of CO emissions below 35 mg/Nm^3..** **3.2. <u>CCGTs</u>: the levels proposed in D1 reflect the set of reported available data, including Plant 008 which is operated in peak-load mode.** **3.3. Regarding plants operated less than 1500 hours per year, it may not be appropriate to set yearly averages, as for NO_X emissions.** **4. <u>Footnotes</u>** **4.1. There is no evidence attached to the comments or from the collected data showing a correlation between the N content of the fuel and the level of NO_X emissions.** **4.2. See point 2. above for the assessment regarding daily averages for high levels of COG combusted.** **The BAT-AEL table did not include NH_3 emission levels when SCR is used, though it does for other applications. Reported NH_3 slip levels are very low (< 0.3 mg/Nm^3) with periodic monitoring performed once/yr. As NO_X emissions are proposed to be controlled continuously, and NH_3 slip is directly linked to the level of NO_X emissions, it is proposed to apply the same monitoring frequency for NH_3 as for NO_X, except when the emitted levels are shown to be very low and stable where a periodic monitoring of once/yr could be performed. The levels could be set consistently with the ones proposed for natural gas firing.**

EIPPCB proposal:	**1. General** **1.1. Do not split the BAT-AELs depending on the technique implemented.** **1.2. Propose only yearly CO BAT-AELs.** **1.3. See further details in the specific corresponding paragraph below regarding separate proposals for new/existing plants.** **1.4. (+1.5.) See further details in the proposals on BAT-AELs regarding the load modes and the use of different fuels/process gases.** **1.6. Keep the proposed continuous monitoring for plants of < 50 MW_{th}, with a possibility to move to periodic monitoring (once/yr) when the monitored emissions are shown to be at the lower end of the range on a medium/long-term basis.** **2. NO_X BAT-AELs** **2.1. Do not change the proposed yearly BAT-AELs for existing boilers. Add a footnote: 'The yearly BAT-AELs do not apply to plants operated in peak- or emergency-load modes'.** **2.2. Do not change the proposed daily BAT-AEL for existing boilers. Add a footnote mentioning that the higher end of the BAT-AEL range may be different on days when auxiliary liquid fuels are used. Add another footnote: 'The higher end of the range may be exceeded a few days per year in the case of plants not fitted with SCR when using a high share of COG and/or combusting COG with a relatively high level of H_2. In this case the higher end of the range is 220 mg/Nm^3'.** **2.3. Keep the proposed levels for new boilers. Add the same footnote for daily average as the one proposed in 2.2. above corresponding to the use of auxiliary fuels.** **2.4. Create two separate categories for new and existing plants. Change the proposed yearly BAT-AEL for existing CCGTs to 20–50 mg/Nm^3. Add a footnote that the lower end of the range is achieved when using SCR and an additional one for the yearly averages that are not applicable to plants operated in peak- and emergency-load modes'. Propose yearly BAT-AEL for new CCGTs at 20–35 mg/Nm^3.** **2.5. Change the proposed daily BAT-AEL for existing CCGTs to 30–70 mg/Nm^3 and add a footnote that plants operated in peak- or emergency-load modes have a higher end of BAT-AEL set at 80 mg/Nm. Propose yearly BAT-AEL for new CCGTs at 30–50 mg/Nm^3.** **3. CO BAT-AELs** **3.1. Change the proposed yearly BAT-AELs for new boilers to < 5–35 mg/Nm^3.** **3.2. Propose yearly BAT-AELs for CCGTs at < 5–20 mg/Nm^3.** **3.3. Add a footnote mentioning that the CO BAT-AELs do not apply to peak- and emergency-load modes.** **4. Footnotes** **4.1. Do not change footnote ([1]).** **4.2. See the proposal for adding footnotes in the above proposal 2.2. for high levels of COG combusted.** **4.3. Instead of a footnote to the table, a generic BAT is proposed for NH_3 (see new BAT 4 bis) with a BAT-AEL of < 5–10 mg/Nm^3 defined as a yearly average associated with continuous monitoring (BAT 3 ter).**

1.7.5 BAT 56 – SO_X emissions to air

<table>
<tr><td>Location in D1:</td><td>p. 780 - Section 10.4.2.3</td></tr>
<tr><td>Current text in D1:</td><td>56. In order to reduce SO_X emissions to air from the combustion of iron and steel process gases in boilers, only or in combination with other gaseous fuels and/or liquid fuels, BAT is to use a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Coke oven gas pretreatment at the iron and steel facility</td><td>Use of one of the following techniques:
• desulphurisation by absorption systems;
• wet oxidative desulphurisation</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Process gas management system and auxiliary fuel choice</td><td>See description in Section 10.8.
Use, as much as the iron and steel work allows 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:
  • BFG with S < 10 mg/Nm^3;
  • coke oven gas with S < 300 mg/Nm^3;
and auxiliary fuels such as
  • natural gas;
  • liquid fuels with S-content ≤ 0.4 % (in boilers).
Use of a limited amount of fuels containing higher S-content.</td><td>Generally applicable</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>1. <u>Technique a</u>: add an applicability restriction linked to the availability of space and economic viability of this technique (IT_177, Eurelectric_540).
2. <u>Technique b</u>
2.1. Add an applicability restriction: 'Applicability strongly connected to process gases availability and quality variability' (IT_178, Eurelectric_541, Eurofer_186_187).
2.2. Geographical location has to be taken into account (Eurofer_189).
2.3. The levels of S content in BFG and COG quoted are not in line with the BAT conclusions of the iron and steel BREF (Eurofer_184_186_190_196).
2.4. State clearly that the quoted levels of BFG and COG are not generally achievable (AT_126).
2.5. Explain the meaning of 'limited' in the 'use of limited amount of fuels containing higher S-content' (Eurofer_25).</td></tr>
<tr><td>EIPPCB assessment:</td><td>1. <u>COG pretreatment (a)</u>: this technique is considered BAT in the iron and steel BREF without mentioning any applicability restriction; most of the plants that submitted a questionnaire implement COG pretreatment at the iron- and steel-works.
2. <u>Process gas management and auxiliary fuel choice (b)</u>
2.1. The process gas/fuel management is very dependent on the steelworks configuration. This fact is already embedded in the description through the sentence: 'as much as the iron- and steel-works allow it'.
2.2. Local conditions can only be taken into consideration at the local level in accordance with IED Art. 15(4) and not through the BAT conclusions.
2.3. (2.4.) The levels used in the technique description are clearly mentioned as examples ('e.g. … such as'), and are taken from the assessment of available data. Used as examples, they do not contradict the conclusions of the iron and steel BREF and give some insights into ways of achieving the proposed BAT-AELs.
2.5. No amount of auxiliary fuel is given as an example for quantifying the 'limited' amount of such fuel in the diet, as this is very site-specific and also depends on the iron and steel process gases combusted.</td></tr>
<tr><td>EIPPCB proposal:</td><td>1. Do not change the applicability of <u>technique (a).</u>
2. Do not change the description and applicability of <u>technique (b)</u>.</td></tr>
</table>

1.7.6 Table 10.34 – BAT-AELs for SO_X – I&S process gases

<table>
<tr><td>Location in D1:</td><td>p. 780/781 - Section 10.4.2.3</td></tr>
<tr><td>Current text in D1:</td><td>
The SO_X concentrations associated with BAT from the combustion of iron and steel process gases, only or in combination with other gaseous fuels and/or liquid fuels in boilers, or with natural gas in CCGTs, are given in Table 10.34..

Table 10.34: BAT-associated emission levels for SO_X emissions from the combustion of iron and steel process gases, only or in combination with other gaseous fuels and/or liquid fuels in boilers, or with natural gas in CCGTs
<table>
<tr><th rowspan="2">Type of combustion plant</th><th rowspan="2">Pollutant</th><th rowspan="2">O_2 reference level (%)</th><th rowspan="2">Monitoring frequency</th><th colspan="2">BAT-AEL</th></tr>
<tr><th>Daily average (mg/Nm^3)</th><th>Yearly average (mg/Nm^3)</th></tr>
<tr><td>Boiler</td><td>SO_X</td><td>3</td><td>Continuous measurement (1)</td><td>50 – 200 (2)</td><td>25 – 150</td></tr>
<tr><td>CCGT</td><td>SO_X</td><td>15</td><td>Continuous measurement (1)</td><td>20 – 60</td><td>10 – 35</td></tr>
<tr><td colspan="6">(1) Only SO_2 is continuously measured, SO_3 is periodically measured (e.g. during calibration).
(2) Higher levels can be expected when HFO/LFO or other non-conventional liquid fuels with high sulphur content are combusted.</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td>
1. <u>General</u>: the fuel mix variations, from one year to another, or with the use of liquid fuels, should be better reflected in the BAT-AELs (Eurelectric_278_743, IT_179_542).
2. <u>Monitoring</u>: add the possibility to monitor the sulphur content in the process gases as defined in the BAT-15 of the iron and steel BREF (AT_130, Eurofer_231).
3. <u>BAT-AELs – Boilers – daily average</u>
Set different BAT-AELs depending on the combusted process gas (Eurofer):
• BFG: < 150 mg/Nm^3 in case of 100 % participation;
• COG: < 425 mg/Nm^3 in case of 100 % participation;
• BOF: < 35 mg/Nm^3 in case of 100 % participation;
• auxiliary fuels: higher end of BAT-AELs defined elsewhere in this BREF depending on the fuel, size of the plant and operational hours,
• formula combining the previous levels for the mixtures: 1.50 x %TI BFG + 4.25 x %TI COG + 0.35 x % TI BOFG + ngso2 x %TI NG + clso2 x %TI Coal + olso2 x %TI Oil, at 3 % O_2, where ngso2 = upper SO_2 emission for NG fired boilers, clso2 = upper SO_2 emission for coal fired boilers, olso2 = upper SO_2 emission for oil fired boilers and %TI is the thermal input from each process gas or auxiliary fuel as a percentage.
4. <u>CCGT</u>
Alternative BAT-AELs are proposed:
4.1. <u>Existing plants - yearly average</u>
• 10–50 mg/Nm^3 (AT_129).
4.2. <u>Existing plants - daily average</u>
• 20–70 mg/Nm^3 (AT_128).
• 20–71 mg/Nm^3 (Eurofer).
5. <u>Footnote (2)</u>: The lack of information about the levels expected when combusting other fuels make this footnote difficult to implement (BE_52).
</td></tr>
<tr><td>EIPPCB assessment:</td><td>
<u>General</u>
1. The reported emission levels reflect the variety of situations in terms of fuel mix expressed through the submitted questionnaires for a representative year between 2009 and 2011 (see questionnaire question 3.2.1), typical of the sector, and the environmental performance achieved by the implemented techniques over a long time period. Liquid fuel is included in the assessment as an auxiliary fuel. See the assessment on BAT-AELs below for further details.
<u>Monitoring</u>
2. BAT 15 of the iron and steel BREF considers the discontinuous monitoring of relevant process gas components/pollutants, and not the continuous monitoring at the stack of SO_2 emissions for process gas-fired plants. This is not in line with the minimum requirements set by the IED (see Annex V, part 3). The variation in fuel quality and quantities may have an impact on SO_2 emissions that require close monitoring that could be difficult to offset with PEMS-type or indirect systems.
<u>BAT-AELs</u>
</td></tr>
</table>

	3. Boilers – daily average: An assessment has been provided in support of the submitted comment, based on the collection of extensive daily average emissions data depending on the COG-BFG loads in the fuel mixture. The outcome tends to show a relationship between the SO_2 emissions and the level of COG combusted. However, this assessment does not link the achieved emissions with the implemented techniques, thus making it difficult to consider further. **The reassessment of available data, considering data provided via the RAI for the averaging period issue, confirms the BAT-AEL proposed in D1 (50–200 mg/Nm^3) for plants combusting mainly iron and steel process gases. This is based on the analysis of the whole set of data for plants implementing BAT, and taking as a reference Plants 144-1 and 004 that combust levels of COG of > 20 %, for which 95 % of hourly values is representative of the 'worst' situations in which the SO_2 emissions are mainly driven by the COG combustion. The checking of additional daily data submitted by Eurofer shows that those plants fitted with BAT with yearly emission levels below 150 mg/Nm^3 have daily emission values below 200 mg/Nm^3,** **For plants combusting liquid auxiliary fuels at higher proportions, the levels of SO_X emitted after combustion are assumed to be similar to those that would be emitted by plants of the same size combusting only these fuels and operated in peak- or emergency-load modes. Thus, a footnote could be added linking the daily average to the higher end of the corresponding BAT-AELs on days when substantial quantities of such fuel are used.** **4. CCGT** **4.1. Yearly average: the reassessment of the submitted data and of additional data attached to comment AT_129 for Plant 001 in the years 2011 and 2012 (yearly emissions of 41–43 mg/Nm^3) show SO_X emission levels slightly higher than the higher end of the BAT-AEL proposed in D1.** **4.2. Daily average: the level of emissions on a short-term basis can also be slightly revised based on the revision suggested for the yearly averaged emissions (see above).** **5. Footnote ([2]): given the assessment made in point 3. above, it is proposed to remove the previous footnote ([1]).**
EIPPCB proposal:	**1. General: see details in BAT-AEL proposals below.** **2. Monitoring: keep the continuous monitoring for SO_2 except in the case of plants of < 100 MW_{th} operated in peak- and emergency-load modes where periodic monitoring can be considered (twice/yr for peak-load mode, once/yr for emergency-load mode).** **3. Do not change the proposed daily BAT-AEL for boilers. Add a footnote mentioning that the higher end of the BAT-AEL range may be different on days when auxiliary liquid fuels are used.** **4. Change the yearly BAT-AEL for CCGT to 10–45 mg/Nm^3 and the daily BAT-AEL for CCGT to 20–70 mg/Nm^3. Add a footnote mentioning that 'The yearly BAT-AELs do not apply to plants operated in peak- and emergency-load modes'.** **5. Remove the previous footnote ([2]).**

1.7.7 BAT 58 – Dust emissions to air

Location in D1:	*p. 781/782 - Section 10.4.2.4*
Current text in D1:	**58. In order to reduce dust emissions to air from the combustion of iron and steel process gases, only or in combination with other gaseous, liquid, and or solid fuels, 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 fuels with averaged low dust or ash content	Generally applicable

<table>
<tr><td></td><td>
<table>
<tr><td>b.</td><td>Blast furnace gas pretreatment at the iron and steel plant</td><td>Use of one or a combination of primary (e.g. deflectors, dust catchers, cyclones, electrostatic precipitators) and/or secondary dedusting techniques (cyclones, venturi scrubbers, hurdle-type scrubbers, venturi scrubbers, annular gap scrubbers, wet electrostatic precipitators, disintegrators)</td><td>Generally applicable if blast furnace gas is combusted</td></tr>
<tr><td>c.</td><td>Basic oxygen furnace gas pretreatment at the iron and steel plant</td><td>Use of one or a combination of dedusting techniques (e.g. deflectors in combination with venturi-type scrubbers or dry or wet ESP)</td><td>Generally applicable if basic oxygen furnace gas is combusted</td></tr>
<tr><td>d.</td><td>ESP</td><td rowspan="2">See descriptions in Section 10.8. Can be combined with WFGD for enhanced dust reduction</td><td rowspan="2">Applicable to plants combusting coal and to plants combusting liquid fuels in a significant proportion (>10-15 % of the yearly fuel input) with high ash content.</td></tr>
<tr><td>e.</td><td>Bag filter</td></tr>
</table>
{This BAT conclusion is based on information given in Section7.3.4.4}
</td></tr>
<tr><td>Summary of comments:</td><td>
1. <u>General</u>: include in the applicability the need to perform a cost/benefit analysis for fuel pre-treatment and end-of-pipe techniques (IT_184, Eurelectric_547).
2. <u>Technique a (fuel choice/management):</u> add an applicability restriction: 'Applicability strongly connected to process gases availability and quality variability' (IT_183, Eurelectric_545).
3. <u>Technique b (BF gas pretreatment)</u>: Recopy exactly the BAT 64 of the iron and steel BREF (Eurofer_26_196).
4. <u>Technique c (BOF gas pretreatment)</u>: Recopy exactly the BAT 76 of the iron and steel BREF (Eurofer_27_196).
5. <u>Techniques d and e (ESP, Bag filter)</u>: Do not mention the possible combination with WFGD in the description as WFGD is not related to dust reduction (Eurofer_198).
</td></tr>
<tr><td>EIPPCB assessment:</td><td>
1. <u>General</u>: pretreating the BF and BOF process gases at the steelworks is seen as BAT in the iron and steel BREF (BAT 64 and BAT 76) and considered generally applicable. The use of an ESP or bag filter is also an option, mainly when co-combusting oil as auxiliary fuel, when applicability restrictions are the same as in the case of plants burning predominantly these fuels. The share of auxiliary fuels requiring the use of such end-of-pipe techniques depends on a lot of parameters and is therefore indicative. A cost-benefit analysis is done at each site to select the best option(s). No further economic information is submitted in the comments.
2. <u>Fuel choice/management (a)</u>: the process gas quality and quantity are very dependent on the steelworks' configuration. This fact is not visible enough in the description. It is proposed to modify it accordingly. The choice of auxiliary fuels is however more disconnected from the steelworks' operation. The general applicability restriction corresponding to the fuel availability used throughout all the conclusions can also be used in this case.
3. (+4.) <u>Pretreatment of BF gas and BOF gas (b and c):</u> The technique names used in the iron and steel BREF can be copied. BAT conclusions are a standalone document.
5. <u>ESP and bag filter (d and e):</u> WFGD has a positive effect on dust reduction. However, WFGD is not mentioned for SO_X reduction in this section.
</td></tr>
<tr><td>EIPPCB proposal:</td><td>
1. <u>General</u>: remove the information on a fuel input threshold for applicability of <u>techniques (d) to (e)</u>. Replace the words 'coal' and 'liquid fuels' with 'auxiliary fuels' in the applicability.
2. <u>Fuel choice/management (a)</u>: Change the description to: 'Use of a combination of fuels and process gases with averaged low dust or ash content, as much as the iron- and steel-works allows it'. Add in applicability: '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.'
3. (+4.) <u>Pretreatment of BF gas and BOF gas (b and c)</u>: Change the techniques'
</td></tr>
</table>

	descriptions to those in the iron and steel BREF. **5. ESP and bag filter (d and e): Remove the mention of the combination with WFGD from the technique description.**

1.7.8 Table 10.36 – BAT-AELs for dust – I&S process gases

Location in D1: *p. 782 - Section 10.4.2.4*

Current text in D1:

Table10.36: BAT-associated emission levels for dust emissions to air from the combustion of, or multi-gaseous fuel combustion, including iron and steel process gases

Combustion plant	Fuel diet	Dust BAT-AEL (mg/Nm^3) (1)			O_2 reference level (%)	Monitoring frequency
		Daily average	Yearly average	Average of samples obtained during one year		
Boiler	Iron and steel process gas(es), alone or in combination with other gaseous fuels	2 – 15	< 1 – 7	-	3	Continuous measurement
CCGT		-	-	< 1 – 4	15	Periodic measurement: 4 times/yr
Boiler	Iron and steel process gas(es) with liquid fuels, alone or in combination with other gaseous fuels	8 – 45 (1)	2 – 15	-	3	Continuous measurement
	Iron and steel process gas(es) with coal, alone or in combination with other gaseous and or/liquid fuels	4 – 25	1 – 15	-	6	Continuous measurement

(1) The upper end of the range (15 – 45 mg/Nm^3) is expected to be achieved when firing liquid fuels.

Summary of comments:

1. *General*
   - 1.1. *The fuel mix variations, from one year to another, or with the use of liquid fuels, should be better reflected in the BAT-AELs (Eurelectric_279_548_744, IT_185).*
   - 1.2. *Set separate BAT-AELs for new and existing plants (IT_186, Eurelectric_549).*
   - 1.3. *Do not set frequency associated to periodic monitoring (Eurelectric_550).*
   - 1.4. *The monitoring is already described in the BAT 15, 61, 75 and 76 of the iron and steel BREF (AT_131, Eurofer_196_200_202_203).*
   - 1.5. *Reduce the monitoring to 4 times/yr for plants <50 MW_{th} (Eurofer_201).*
2. *BAT-AELs*
   - 2.1. *Alternative proposal (Eurofer) for daily average for boilers utilising iron and steel making process gases BFG, COG and BOF gas:*
     - *+/- NG: < 20 mg/Nm³, at 3 % O_2,*
     - *+ oil: < 45 mg/Nm³, at 3 % O_2,*
     - *+ coal: < 25 mg/Nm³, at 3 % O_2.*
   - 2.2. *Alternative proposal (Eurofer) for daily average for CCGT utilising iron and steel making process gases BFG, COG and BOF gas: < 5 mg/Nm^3.*
3. *Footnote (1): Clarify if the levels mentioned in the footnote refer only when firing liquid fuels or also when firing mixtures of process gases and liquid fuels (BE_53).*

EIPPCB assessment:

1. General

1.1. The proposed BAT-AELs take into account the variety of situations in terms of fuel mix expressed through all the submitted questionnaires for a

	representative year between 2009 and 2011 (see questionnaire question 3.2.1), typical of the sector, and the environmental performance achieved by the implemented techniques. Liquid fuel is included in the assessment as an auxiliary fuel. See for further details the assessment on BAT-AELs below. **1.2. The BAT-AELs are mainly set based on techniques (auxiliary fuel choice or pretreatment of process gases at the steelworks) with which it is not expected that new plants will perform better than existing plants (e.g. no separate corresponding BAT conclusions for new/existing plants in the iron and steel BREF for process gas treatment).** **1.3. Proposing a measurement frequency refines the monitoring associated with BAT-AELs based on the processes/fuels/techniques used and is in line with the BREF Guidance (Section 3.1).** **1.4. The IED sets as a minimum requirement the continuous monitoring of dust for plants of ≥ 100 MW_{th}.** **1.5. For consistency with the other plant categories, the monitoring frequency could be proposed to twice/yr for plants of < 50 MW_{th}, to twice/yr for plants of < 100 MW_{th} operated in peak-load mode and to once/yr for plants of < 100 MW_{th} operated in emergency-load mode.** **2. <u>BAT-AELs</u>** **2.1. The reassessment of available data confirms the proposal of 2–15 mg/Nm^3 as the daily average when the plant burns gaseous fuels. No further evidence-based rationale submitted with the comments supports new higher ends of the BAT-AELs. The other levels proposed in D1 are consistent with the submitted comment. For plants combusting liquid auxiliary fuels in higher proportions, the levels of dust emitted when combusted (alone or in combination with iron and steel process gases) are the same as those emitted by plants of the same size combusting only these fuels and operated in peak- or emergency-load modes.** **2.2. The achieved dust emission levels are low and not far from the limits of detection of the monitoring devices. After reassessing the available data, it can considered that the daily reported data are lower than < 5 mg/Nm^3.** **3. <u>Footnote ([1])</u>: The combustion of auxiliary fuels is assessed in point 2.1. above, from which an alternative footnote is proposed.**
EIPPCB proposal:	**4. <u>General</u>** **4.1. (+1.2.) Keep the proposed BAT-AELs and do not set separate levels between new/existing plants.** **1.3. Keep the proposals for a monitoring frequency, where appropriate.** **1.4. (+1.5.) Change the monitoring at CCGT to 'continuous measurement' and add a footnote to all the applications that: 'the monitoring frequency can be reduced to twice/yr for plants of < 50 MW_{th}, to twice/yr for plants of < 100 MW_{th} operated in peak-load mode and to once/yr for plants of < 100 MW_{th} operated in emergency-load mode'.** **2. <u>BAT-AELs</u>** **2.1. Keep the proposed daily BAT-AELs that correspond to boilers burning mainly gaseous fuels. Delete the levels proposed for boiler combustion with iron and steel process gases combined with liquid fuels. Add a footnote to the remaining proposed levels for boilers mentioning that higher levels may be achieved on days when auxiliary liquid fuels are used.** **2.2. Propose a <u>daily or average over the sampling period BAT-AEL for CCGTs</u> at < 2–5 mg/Nm^3 and remove the proposed BAT-AEL expressed as average of samples obtained during one year.** **3. <u>Footnote ([1])</u>: Delete the previous footnote ([1]) and the BAT-AEL proposals for co-combustion of liquid fuels.**

1.7.9 Tables 10.30 and 10.31 – BAT-AEELs for energy efficiency – boilers and CCGTs

Location in D1: *p. 777 - Section 10.4.2.1*

Current text in D1:

Table 10.30: BAT-associated environmental performance levels for energy efficiency of the combustion of iron and steel process gases in boilers, only or in combination with other gaseous and/or liquid fuels

Plant type	BAT-AEPL (% - yearly average)	
	Net electrical efficiency	Net total fuel utilisation (CHP plants)
Multi-fuel firing gas–boilers producing power only and multi-fuel firing gas–boilers whose recoverable heat generation exceed the heat demand	25 – 40	-
Multi-fuel firing gas–boilers producing heat only and multi-fuel firing gas–boilers whose recoverable heat generation does not exceed the heat demand ([1])	-	50 – 84
([1]) The wide range of energy efficiencies in CHP plants is very much dependent on the specific situation and the local demand of electricity and heat.		

Table10.31: BAT-associated environmental performance levels for energy efficiency of the combustion of iron and steel process gases and natural gas in CCGTs

Plant type		Parameter	Unit	BAT-AEPL (yearly average, LHV basis)
CHP CCGTs whose recoverable heat generation does not exceed the heat demand		Net total fuel utilisation	%	60 – 82
Generating only power or CHP CCGTs whose recoverable heat generation exceeds the heat demand	Existing	Net electrical efficiency		38.5 – 45
	New			above 44

Summary of comments:

1. <u>General</u>
   - 1.1. *The BAT-AEELs for plants combusting process gases with coal are missing (Eurofer_15).*
   - 1.2. *Replace the first plant category by:' Multi-fuel firing gas–boilers producing power only and multi-fuel firing gas–boilers producing power and whose recoverable heat generation exceeds the heat demand' (AT_117, Eurofer_168, SE_91).*
   - 1.3. *Replace the second plant category by: 'Multi-fuel firing gas–boilers producing heat only and multi-fuel firing gas–boilers producing power and whose recoverable heat generation does not exceed the heat demand' (AT_118, Eurofer_169, SE_92).*

EIPPCB assessment:	**1. General** **1.1. BAT-AEELs for plants combusting process gases with coal are covered by the Section 1.12 of this BP paper.** **1.2. (+1.3.) As per the assessment made in Section 1.1.5 of this BP, it is now proposed to define design-based BAT-AEELs. In the case of CHP plants, performance tests regarding net electrical efficiency and net total fuel utilisation could then be performed separately and both parameters would apply then to these plants regardless of whether or not the heat generation exceeds the heat demand. Information has been submitted via the TFEE with design net electrical efficiencies between 32.5 % (Plant 361) and 42.5 % (Plant 15) recently commissioned. Proposed levels for gas-fired boilers can also be used as background information for proposing BAT-AEEL ranges based on design efficiency (see Table 10.26 of the BAT conclusions and Section 1.6.1 of this BP). Data from Plant 15 can also be used for reviewing the upper end of the range for new natural gas-fired boilers. Regarding gas turbines firing process gases from the iron and steel industry, only one example of additional design net electrical energy efficiency was reported: Plant 360 with 47 % compared with the yearly value of 43.9 % reported in 2012. Plant 008 was reporting a yearly average net electrical efficiency of 45 %. Compared with natural gas firing (see Section 1.6.1 and the BAT-AEELs in Table 10.26 of the BAT conclusions), net electrical energy efficiency levels are expected to be slightly lower as the calorific value of the fuel combusted may be lower in the case of blast furnace gas combustion.**
EIPPCB proposal:	**1. General** **1.1. See further detail in Section 1.12 of this BP on multi-fuel firing.** **1.2. Change the proposed net electrical efficiency BAT-AEEL for existing boilers to 32.5–40 % and for new boilers to 40–42.5 %. Change the net electrical efficiency for existing plants to 43–48 % and for new plants to > 47 %.** **2. Reorganise and simplify the BAT-AEEL table to have the net electrical efficiency and net total fuel utilisation BAT-AEELs reported on the same line with footnotes in the heading of the columns mentioning that 1) net electrical efficiency BAT-AEELs apply to plants generating only power and to CHP plants, and 2) net total fuel utilisation BAT-AEELs apply to CHP plants and to plants generating only heat. Add a footnote excluding plants operated in peak- or emergency-load modes, as proposed in Section 1.1.3 of this BP.**

1.8 Combustion of gaseous fuels on offshore platforms

1.8.1 BAT 59 – General environmental performance

<table>
<tr><td>Location in D1:</td><td>p. 783 - Section 10.4.3</td></tr>
<tr><td>Current text in D1:</td><td>
59. In order to improve the general environmental performance of the combustion of gaseous and/or liquid fuels on offshore platforms, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Techniques</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Minimise the 'spinning reserve'</td><td></td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Fuel choice</td><td>Provide a fuel gas supply from a point in the topside oil and gas process which offers a minimum range of fuel gas combustion parameters, e.g. calorific value, etc. and minimum concentrations of sulphurous compounds to minimise SO_2 formation. For liquid distillate fuels, preference is given to low sulphur fuels.</td><td>Generally applicable</td></tr>
<tr><td>c.</td><td>Load control</td><td>Operate multiple generator or compressor sets at load points which minimise pollution</td><td>Generally applicable</td></tr>
<tr><td>d.</td><td>Control pressure losses</td><td>Optimise and maintain inlet and exhaust systems in a way that keeps the pressure losses as low as possible</td><td>Generally applicable</td></tr>
<tr><td>e.</td><td>Process optimisation</td><td>Optimise the process in order to minimise the mechanical power requirements</td><td>Generally applicable</td></tr>
<tr><td>f.</td><td>Heat recovery</td><td>Utilisation of gas turbine / engine exhaust heat for platform heating purposes</td><td>Generally applicable</td></tr>
<tr><td>g.</td><td>Injection timing</td><td>Optimise injection timing</td><td>Applicable for engines</td></tr>
<tr><td>h.</td><td>Power integration of multiple fields</td><td>Use of a central power source to a number of participating installations located at different fields</td><td>Applicability depends on the location of the different fields and on the organisation of the different participating installations</td></tr>
</table>
{This BAT conclusion is based on information given in Sections 7.4.4.1, 7.4.4.2 and 3.3.4}
</td></tr>
<tr><td>Summary of comments:</td><td>
<u>Technique a (Minimise the 'spinning reserve')</u>
1. Add a description: 'When running with spinning reserve for operational reliability reasons, the number of additional turbines should be minimised, aside from during exceptional circumstance' (OGP_71).
<u>Technique b (Fuel choice)</u>
2. Modify the description to mention the possible safety issue linked to the use of Ultra Low Sulphur Diesel (ULSD) (OGP_72).
<u>Technique f (Heat recovery)</u>
3. Modify the applicability regarding existing plants as the retrofit may be constrained by availability of retrofitting package, complexity of the platform organisation and the space availability. The economic viability is also mentioned, including for new plants, as it may depend on the process heat demand on the platform. (NO_26, IT_188, Eurelectric_552, OGP_73).
<u>Technique h (Power integration of multiple fields)</u>
4. Include in the applicability the time factor as an additional organisational limiting factor (OGP_74).
</td></tr>
</table>

EIPPCB assessment:	**1. Minimise the 'spinning reserve' (a): the proposed description could be used.** **2. Fuel choice (b): the safety issue has to be handled appropriately, but does not represent a restriction to the technique's applicability. It would be better to describe it in the cross-media effects in Section 7.4.4.1.** **3. Heat recovery (f): Heat recovery may be constrained on offshore platforms by heat demand and platform layout (space).** **4. Power integration of multiple fields (h): The time factor is important in terms of possible integration between several platforms; it can be included within the organisational issues of each installation.**
EIPPCB proposal:	**1. Minimise the 'spinning reserve' (a): add the following description: 'When running with spinning reserve for operational reliability reasons, the number of additional turbines is minimised, except in exceptional circumstances'.** **2. Fuel choice (b): modify Section 7.4.4.1 in order to mention the safety issue linked to the use of ULSD.** **3. Heat recovery (f): Add an applicability restriction in case of existing plants, related to the level of heat demand and the plant layout (space).** **4. Power integration of multiple fields (h): Add, at the end of the applicability restriction, a reference to the time factor as an additional organisational limitation.**

1.8.2 BAT 60 – NO_X emissions

Location in D1:	*Section 10.4.3 – p. 783*
Current text in D1:	**60. In order to prevent and 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). Applicability may be limited for existing gas turbines by availability of retrofitting package, complexity of the platform organisation and space availability.
	b. Lean-burn concept	See description in Section 10.8	Generally applicable to new gas-fired engines.
	c. Low-NO_X burners	See description in Section 10.8	Generally applicable to boilers
	d. Advanced computerised process control	See description in Section 10.8	Generally applicable

Summary of comments:	*Technique a (DLN)* *1. This technique is only applicable to plants operated at an appropriate load. The technique is not applicable or in very few cases to dual fuel machines, or in case of wide variation in fuel gas composition (OGP_75_76_78).* *2. Add the cost constraint to the applicability restrictions (DK_26).*
EIPPCB assessment:	**DLN (a)** **1. The technique is widely applied to dual fuel plants, at least mainland ones. Fuel quality is a limiting factor for the use of DLN burners; BAT 59 includes fuel choice as a technique for improving the general environmental performance of plants on offshore platforms. There are solutions available for operating plants at a lower load (see BREF Section 7.1.4.3.4); however, retrofitting packages may not always be available from all suppliers.** **2. The cost of retrofit of DLN depends on the plant complexity, which is already mentioned in the current applicability.**

EIPPCB proposal:	**DLN (a)** **1. (+2.) Add in the applicability a limitation related to the fuel quality variations and include a reference to the availability of retrofitting packages for low load operation.** **Advanced computerised process control (d)** **2. Change the name of the technique to 'advanced process control' and its applicability for consistency throughout the BREF.**

1.8.3 Table 10.37 - BAT-AELs for NO_X and CO – offshore platforms

<table>
<tr><td>Location in D1:</td><td>Section 10.4.3 – p. 784</td></tr>
<tr><td>Current text in D1:</td><td>Table 10.37: BAT-associated emission levels for NO_X and CO emissions to air from the combustion of gaseous fuels in open-cycle gas turbine on offshore platforms
<table>
<tr><th rowspan="2">Plant type</th><th colspan="3">BAT-AEL (mg/Nm^3)</th><th rowspan="2">Monitoring frequency</th></tr>
<tr><th>NO_X (daily average)</th><th>NO_X (yearly average)</th><th>CO (yearly average)</th></tr>
<tr><td>New gas turbines</td><td>5 - 50</td><td>6 - 40</td><td>< 50</td><td>Continuous measurement or PEMS</td></tr>
<tr><td>Existing gas turbines(1)</td><td>ND</td><td>6 - 125</td><td>< 100</td><td>Continuous measurement or PEMS</td></tr>
<tr><td colspan="5">(1) The lower end of the range is achieved with last generation of DLN burners</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td><u>General</u>
1. Introduce a BAT-AEL for diesel (liquid fuel) as 44 % of the combustion plants operated on offshore platforms are of the dual fuel type, combusting oil when the gas production is not fully operational (start-up or shutdown of the fields). Values of 65–1000 ppm of NO_X emissions are quoted based on supplier technologies (NO_29).
2. Express the conclusions only for turbine loads > 70 % as in the IED Chapter 3 (OGP_78_79).
3. Monitoring is not in line with requirements set by the IED of only continuously monitor plants > 100 MW_{th} (OGP_81). Allow the possibility to use factors (NO_27).
4. BAT-AELs for boilers and engines are missing (IT_187, Eurelectric_551).
<u>New gas turbines</u>
5. Review the BAT-AELs for consistency with onshore turbines (IT_189).
6. Increase the lower end of the ranges as otherwise this would mean the installation of SCRs (Eurelectric_558).
7. 50–400 mg/Nm^3 for NO_X emissions and 40–400 mg/Nm^3 for CO emissions as the available gases may not be compatible with a use in DLN burners (EUTurbines_90).
8. Change CO levels to < 75 mg/Nm^3 at load > 70 %, as when plants operate at loads below 50 % CO emissions could increase up to 450–2000 mg/Nm^3 (OGP_80).
<u>Existing gas turbines</u>
9. Review the BAT-AELs according to available data submitted along with the comment (DK_27).
10. 60–400 mg/Nm^3 for NO_X emissions and 50–400 mg/Nm^3 for CO emissions – monthly averages (EUTurbines_90).
11. Increase the lower end of the ranges as otherwise this would mean the installation of SCRs (Eurelectric_558).
12. Propose daily average BAT-AEL for NO_X (AT_43).
13. Change the yearly average for NO_X to 6–400 mg/Nm^3 for loads >70 % and single fuel turbines (OGP_77).
<u>Footnotes</u>
14. Add a footnote mentioning that the proposed values are only achievable for DLE gas turbines running on natural gas only with stable gas composition (OGP_78).</td></tr>
<tr><td>EIPPCB assessment:</td><td><u>General</u>
1. <u>Liquid combustion</u>: no data have been made available for dual fuel turbines when running on oil. Emission levels achieved by well performing liquid-fuel-fired turbines not fitted with DLN are within 145–250 mg/Nm^3 (See available data in the section related to liquid fuel combustion).
2. <u>(+3.) Monitoring</u>: Plants operated on offshore platforms implement alternative monitoring (e.g. PEMS) due to operations in difficult conditions. In case of performing periodic monitoring at plants not fitted with DLN, the level of emissions is very dependent on the turbine load. Reported data from DK (Additional information – DK-01/02) show measurements performed not necessarily performed at full load. In the case of plants fitted with DLN, periodic measurements are performed at a turbine load of > 70 %.
4. No data/information were provided from boiler and engines operated on offshore platforms.
<u>New gas turbines</u>
5. (to 7.) The review of proposed values for new gas turbines on the mainland and</td></tr>
</table>

	recently commissioned turbines in DK (Additional information – DK-01/02) on offshore platforms show short-term NO_X emission levels of about 7–50 mg/Nm^3 when fitted with DLN. Should the DLN not be able to be implemented due to poor fuel quality, the higher end of the range could then be set at 245 mg/Nm^3 rounded at 250 mg/Nm^3 based on the data provided by DK, with suppliers' guaranteed values corresponding to existing plants. **8. Given the variable quality of the fuel to be combusted, the CO emission level is higher than in mainland applications. Thus the proposal to set a higher end at 75 mg/Nm^3 is deemed reasonable compared to the range set for mainland application (6–40 mg/Nm^3) and given the information reported in the OGP report (Additional information – OGP-01).** **Existing gas turbines** **9. (to 13.) According to the data provided by DK, plants operated with an equivalent full load factor of < 80 % achieve NO_X emission levels of < 100–290 mg/Nm^3. Plants operated with higher loads may emit more but are candidates for DLN retrofit. Plants fitted with DLN operated at high load achieve NO_X emission levels of < 50 mg/Nm^3. No evidence-based rationale supports CO emission levels as high as 400 mg/Nm^3.** **Footnotes** **14. The range is proposed to be changed for existing plants. The lower end corresponds to the use of DLN, not only the 'last generation of' DLN.**
EIPPCB proposal:	**1. Liquid combustion: include a NO_X 'average over the sampling period' BAT-AEL of 145–250 mg/Nm^3 for dual fuel plants when running on oil.** **2. (+3.) Monitoring: Change the monitoring frequency to periodic monitoring with a frequency of at least once every year or use of PEMS.** **5. (to 7.) Change the proposed NO_X BAT-AELs for new gas turbines to 7–50 mg/Nm^3. Add a footnote related to cases where a DLN may not be applicable, e.g. due to poor quality fuel, the higher end of the range is proposed to be set at 245 mg/Nm^3'.** **8. Propose a CO BAT-AEL for new gas turbines of < 75 mg/Nm^3.** **9. (to 13.) Change the proposed NO_X BAT-AELs for existing gas turbines to < 50–290 mg/Nm^3 for a turbine load of about 70 %.** **14. Footnote ([1]): delete the specification of 'last generation of' DLN burners from the footnote.**

1.9 Combustion of process fuels from the chemical industry

Location in D1:	*Section 10.5.1 – p. 785–790*
Current text in D1:	*Entire section*
Summary of comments:	*General* *1. BAT conclusions should apply to (utility) boilers only, consistently with the collected data (CEFIC_24_31_269_270_282_293_296_298_300_304, PT_39).* *2. Consistently with the collected data, BAT conclusions should be split according to:* • *load (base load only, emergency plants excluded) (CEFIC_270_2)* • *fuel (composition, prevalence of liquid or gas) (CEFIC_2)* *3. In some cases there is no information given in section 8.2 to trace back BAT-AEPLs. There is no technical reason to discard some data. Upper limit should not be lower than ELVs given in IED-Annex V. Upper-end should be based on general applicable technique. Number of reference plants is too low to derive accurately BAT-AELs. Statistical derivation should be adopted, and the basis and representativeness of plants used for derivation should be clarified. (CEFIC_20_26_29_32_99_275_283).* *4. Consistency with REF BREF: the BAT-AEL for LCP in petro-chemical industry would be lower than for combustion plants in refinery (CEFIC_43).*
EIPPCB assessment:	**1. Conclusions have been derived for boilers and GT (e.g. Plants 279, 280) provided through the data collection.** **2. See the general considerations on methodology in Section 2.8. In the section of the BATC for the combustion of process fuels, the following issues are discussed and a solution is proposed in each subsection specific to a BAT or a BAT-AEL:** **2.1. For load modes, in this subsector the focus is not on peak- and emergency-load modes: data collected show yearly total operating hours above 4000. However, the applicability of proposed BAT and the achievable emission levels when plants are operated in such modes are assessed by pollutant in the following sections.** **2.2. For gas-only vs liquid-gas fuel mixtures, wherever evidence was provided by data/information, a split in the BAT-AELs is proposed.** **3. In addition to the general considerations on methodology, it is worth stressing that the BREF Guidance, in particular Sections 1.1.2 and 2.3.7.1, apply. These BREF Guidance sections specify that information on techniques for a given (sub)-sector can be used in deriving BAT for other (sub)-sectors. In some cases for a given subsector, only information qualifying the specificities of the subsectors is provided while general information is taken from other chapters/BREFs. When no specific restriction for a subsector is demonstrated, general technique performances may be used, as is done in some cases for the combustion of process fuels from the chemical industry.** **4. The BREF series is constantly checked to both derive useful information from comparable sectors and for consistency, as explained in the previous point. Whenever the data collection shows specific performances for the sector under analysis, different associated levels are identified.**
EIPPCB proposal:	**1. Do not substitute 'combustion plants' with 'boilers'.** **2. On splitting the BAT conclusions:** **2.1. The appropriateness of the proposed BAT-AELs for plants operated in peak- or emergency-load modes is assessed by pollutant.** **2.2. Gas-predominant vs liquid-predominant fuels are represented where needed by means of a split in the BAT-AELs (e.g. for NO_X); and in the case of nitrogen-rich fuels, with a specific footnote.** **3. (+4.) See the specific sections for a detailed discussion on each associated level.**

1.9.1 General environmental performance in the combustion of process fuels from the chemical industry

1.9.1.1 BAT 62 – General environmental performance

<table>
<tr><td>Location in D1:</td><td>Section 10.5.1.1 – p. 785</td></tr>
<tr><td>Current text in D1:</td><td>62. In order to improve the general environmental performance of the combustion plants using chemical industry process fuels, including the mixtures with other fuels, BAT is to ensure stable and increased combustion conditions by the techniques listed below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>NC fuel pretreatment</td><td>Perform fuel pretreatment at the chemical installation to improve the performances of fuel combustion.</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Advanced computerised control system</td><td>See description in Section 10.8</td><td>Generally applicable</td></tr>
<tr><td>c.</td><td>Process control</td><td>Combination of primary measures</td><td>Generally applicable</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>1. <u>General:</u> as not all the techniques can be applied, replace the text with 'by using one or a combination of the techniques listed below' (CEFIC_271).
2. <u>Technique a (NC fuel pretreatment)</u>: pretreatment is not always generally applicable for existing plants, clarify the description and applicability restrictions (CEFIC_93_272). Non-commercial fuel is typically fired as it is, i.e. without any pretreatment that would generate waste (CEFIC_18).</td></tr>
<tr><td>EIPPCB assessment:</td><td>1. <u>General:</u> Techniques listed in this BAT are already included in BAT 4. Subsets of the techniques listed in this conclusion could be BAT.
2. <u>NC fuel pretreatment (a)</u>: The pretreatment of the fuel could be performed on-site or off-site the combustion plant, being generally applicable; in some cases, pretreatment is not possible or would add significant cross-media effects, such as wasted resources. Pretreatment is a general technique that does not need to be described further. The description could include the 'environmental' performance improvement that aims the technique. The name of the technique needs to be modified for consistency of fuel naming throughout the section.
3. <u>Techniques b (advanced computerised control system) and c (Process control):</u> Both techniques are covered by 'advanced control system' technique, which is already included in BAT 4.</td></tr>
<tr><td>EIPPCB proposal:</td><td>1. <u>General:</u> Refer in the statement to techniques listed in BAT 4 in combination with the techniques given in this BAT.
2. <u>NC fuel pretreatment (a)</u>: Change the technique name to 'Pretreatment of the process fuel from the chemical industry'. Include 'environmental' in the description of the technique and replace the pretreatment at the 'chemical installation' with 'on and/or off the site of the combustion plant' keeping the technique generally applicable.
3. <u>Techniques b (advanced computerised control system) and c (Process control):</u> Remove both techniques.</td></tr>
</table>

1.9.1.2 BAT 63 – General environmental performance

Location in D1:	*Section 10.5.1.1 – p. 785*
Current text in D1:	**63. In order to improve the general environmental performance of the combustion plants using chemical industry process fuels, including the mixtures with other fuels, BAT is to perform fuel characterisation and ultimate analysis with the frequency and elements indicated in BAT 5. BAT is to integrate the outcome of the characterisation and analysis onto the advanced computerised process control system.**
Summary of comments:	1. *The benefits of the (costly and of difficult implementation for existing plants) requirement to perform fuel characterisation as per BAT 5 are unclear. It is only relevant for the compounds present in the fuel; if there is a flue-gas continuous measurement, there is no added benefit from the fuel characterisation. The type of analysis is different for gaseous fuels and liquid fuels (CEFIC_94_273).* 2. *Replace the sampling frequency with 'Once every 6 months and after significant changes to the fuel' with footnotes:* *([1]) Monitoring frequencies may be adapted if, after a period of one year, the data series clearly demonstrate a sufficient stability;* *([2]) N and S monitoring in fuel is not applicable when continuous measurements of NO_X and SO_X are carried out at the stack (CEFIC_273).*
EIPPCB assessment:	• **BAT 63 is already covered by BAT 5. There is no merit for them being redundant.**
EIPPCB proposal:	• **Remove BAT 63.**

1.9.2 Energy efficiency in the combustion of process fuels from the chemical industry

1.9.2.1 BAT 64 – Energy efficiency

Location in D1:	*Section 10.5.1.2 – p. 785*
Current text in D1:	**64. In order to increase the energy efficiency of the combustion plants using chemical industry process fuels, including mixtures with other fuels, BAT is to use one or a combination of the techniques given in BAT 7 and below:** **Technique** / **Description** / **Applicability** a. Heat recovery by cogeneration (CHP) / See description in Section 10.8 / Generally applicable
Summary of comments:	1. *<u>General</u>: The BAT-conclusion 64 is inconsistent. It is stated that CHP is generally applicable, so this should be BAT in all cases and should thus always be implemented. In table 10.38 on the other hand, energy efficiency levels are included for plants generating only heat and plants generating only power (BE_54).* 2. *<u>Technique a (CHP)</u>: 'heat recovery by cogeneration' is not generally economic and generally limited by available heat sink. Retrofitting may not be possible. Moreover, this technique is already listed in BAT 7 (CEFIC_274).*
EIPPCB assessment:	1. **<u>General:</u> techniques in BAT conclusions are not prescriptive; for example, a plant operator can choose the techniques listed in the BAT conclusions or other equivalent techniques not listed in the BAT conclusions. See Section 2.8..** 2. **<u>CHP (a)</u>: the technique is indeed already listed in BAT 7 to which this conclusion makes reference.**
EIPPCB proposal:	• **Remove technique (a); as a consequence, BAT 64 becomes redundant and it is proposed to delete it.**

1.9.2.2 Table 10.38 – BAT-AEELs for energy efficiency – process fuels from the chemical industry

<table>
<tr><td>Location in D1:</td><td>Section 10.5.1.3 – p. 786</td></tr>
<tr><td>Current text in D1:</td><td>
Table 10.38: BAT-associated energy efficiency levels in the combustion plants using chemical industry process fuels, including their mixture with other fuels
<table>
<tr><th colspan="2">Type of plant</th><th>Parameter</th><th>Unit</th><th>BAT-AEPL (yearly average, LHV basis)</th></tr>
<tr><td rowspan="2">Generating only heat or CHP plants whose recoverable heat generation does not exceed the heat demand</td><td>New</td><td rowspan="2">Net total fuel utilisation</td><td rowspan="3">%</td><td>> 90</td></tr>
<tr><td>Existing</td><td>80 to above 96</td></tr>
<tr><td rowspan="2">Generating only power or CHP plants whose recoverable heat generation exceeds the heat demand</td><td>New</td><td rowspan="2">Net electrical efficiency</td><td>above 38</td></tr>
<tr><td>Existing</td><td>30 to above 38</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td>

<u>Upper level of the ranges</u>: 96 % seems too high for the net total fuel utilisation. A more realistic value would be 90 %. The net electrical efficiency from 30 to 38 % seems high. Data from plants listed in the figure 8.6 show lower values max at 89 %. Lower electricity efficiency is also provided in the same chapter. The range given in Chapter 8.2 for fuel utilisation is 14 to 92 % and electricity efficiency 10-18 %. Review the BAT-AEEL range in line with data collection (CEFIC_20_32_275).
Most power plants deliver ancillary services for the electricity market where load are pending, plants (especially CHP) have frequent start-up/shutdown and the electrical efficiency is thus not always close to nominal values. Change "Yearly average" to "Nominal". (DK_90)

</td></tr>
<tr><td>EIPPCB assessment:</td><td>
<u>General</u>

Values proposed in D1 were based on yearly averages from the collected data. As per the assessment made in Section 1.1.5 of this BP, it is now proposed to define design-based BAT-AEELs.
Special provisions for plants operating in emergency- and peak-load modes are assessed in Section 1.1.3 of this BP.

<u>Net electrical efficiency and net total fuel utilisation</u>

No plants report design values on net electrical efficiency or on net total fuel utilisation.
Plants firing fuels from chemical processes usually report firing in combination with HFO, gas oil and/or NG.
The BAT-AEELs set for HFO and/or gas oil boilers may also be the reference when firing fuels from chemical processes in combination with them.
The BAT-AEELs set for NG boilers may also be the reference when firing fuels from chemical processes in combination with them.

</td></tr>
<tr><td>EIPPCB proposal:</td><td>
<u>General</u>

Add a footnote to the BAT-AEELs on net total fuel utilisation indicating that the levels may not be achievable in the case of an excessively low potential heat demand.
Add a footnote indicating that the BAT-AEELs do not apply in the case of plants operated in peak- or emergency-load modes.

<u>Net electrical efficiency and net total fuel utilisation</u>

Propose a BAT-AEEL on net electrical efficiency for existing plants using process fuels from the chemical industry including when mixed with HFO, gas oil and/or other liquid fuels at design values of 35.6 – 37.4 %.
Propose a BAT-AEEL on net electrical efficiency for new plants using process fuels from the chemical industry including when mixed with HFO, gas oil and/or other liquid fuels at design values of > 37.4 %.
Propose a BAT-AEEL on net total fuel utilisation for new and existing plants using process fuels from the chemical industry including when mixed with HFO, gas oil and/or other liquid fuels at design values of 80–96 %.
Propose a BAT-AEEL on net electrical efficiency for existing plants using process fuels from the chemical industry including when mixed with natural gas and/or other gaseous fuels at design values of 38–40 %.
Propose a BAT-AEEL on net electrical efficiency for new plants using process fuels from the chemical industry including when mixed with natural gas and/or other gaseous fuels at design values of 40–42.5 %.

</td></tr>
</table>

	• **Propose a BAT-AEEL on net total fuel utilisation for new and existing plants using process fuels from the chemical industry including when mixed with natural gas and/or other gaseous fuels at design values of 78–95 %.**

NO_X, NH_3 and CO emissions to air from the combustion of process fuels from the chemical industry

1.9.3 NO_X, NH_3 and CO emissions to air from the combustion of process fuels from the chemical industry

1.9.3.1 BAT 65 – NO_X, NH_3 and CO emissions

Location in D1:	*Section 10.5.1.3 – p. 786*
Current text in D1:	**65. In order to reduce NO_X, NH_3 and CO emissions from the combustion plants using chemical industry process fuels, including the mixtures with other fuels, BAT is to use one or a combination of the techniques given below:**

Technique		Description	Applicability
a.	(Advanced) low-NO_X burners	See description in Section 10.8	Generally applicable
b.	Air staging combustion	See description in Section 10.8	Generally applicable for new plants. Applicable to existing plants within the constraints given by furnace size and design.
c.	Fuel staging (reburning)	See description in Section 10.8	Generally applicable.
d.	Flue-gas recirculation	See description in Section 10.8	Generally applicable to new plants. Applicable to existing plants within the constraints given by furnace size and design, as well as chemical installation safety.
e.	SNCR	See description in Section 10.8	
f.	SCR	See description in Section 10.8	Generally applicable for new plants. Applicable to existing plants within the constraints given by duct configuration, space availability, as well as chemical installation safety.

Summary of comments:

1. *<u>General:</u> reference REF BREF for applicability of techniques a, b, c and use the applicability of technique b also for a and c (CEFIC_96_276_277_278).*
2. *<u>Technique a ((advanced) low-NO_X burners)</u>*
   - *Low-NO_X burners' real performance on actual application in petrochemicals LCP installations is much lower than vendor claim (CEFIC_97).*
   - *The effectiveness of LNB alone in oil service is limited. Reference REF BREF. Restrict for site specific cases, due to space requirements or furnace design (CEFIC_276).*
3. *<u>Technique b (air staging combustion)</u>*
   - *Use the following applicability restriction: 'The air staging techniques may require a reduction in plant capacity to allow the space for air staging. OFA is not generally applicable; it is only used on large equipment' (CEFIC_277).*
4. *<u>Technique c (fuel staging)</u>*
   - *Use the following applicability restriction: 'Fuel staging for mixed or liquid firing may require specific burner design. Applicability is very limited on a retrofit basis to only the largest equipment for fuel staging' (CEFIC_278).*
5. *<u>Technique e (SNCR)</u>*
   - *SNCR generally leads to corrosion problem in retrofitted boilers where tubes are of carbon steel (CEFIC_33).*
   - *Use the following applicability restriction for SNCR: 'Generally applicable for a new plant. Not applicable to plants operated at high turndown' (CEFIC_279).*
   - *The applicability of SNCR on existing plants is questionable (FR_143).*
6. *<u>Technique f (SCR)</u>*
   - *Use the following applicability restriction for SCR: 'Generally applicable for a new unit. Not applicable to plants operating at high turndown, when they do not operate a high rate normally (e.g. in the case of plants operating in emergency mode)' (CEFIC_280).*
7. *<u>Other techniques</u>: some techniques (as in the case of LFO/HFO-fired boiler and NG-fired boilers) are missing:*
   - *Steam injection: generally applicable but may increase CO emission;*
   - *Advanced computerised control: generally applicable;*

	• *Fuel choice: requires sufficient availability of different types of fuel, and an alternate route for the process fuel (CEFIC_281).*
EIPPCB assessment:	**1. General: Techniques a, b and c are described within the LCP BREF, including when used in the petrochemical sector; a detailed assessment of applicability restrictions for each technique is done in the following points.** **2. (Advanced) low-NO_X burners (a): For retrofitting existing boilers with LNB, furnace design and space requirements (e.g. in relation to surrounding devices) can create difficulties that could lead, in very specific cases, to significant modifications. LNB are used often in combination with other primary techniques, including when gas oil/HFO are used (e.g. Plants 299V, 75-1V). The conclusion states 'one or a combination of the techniques'. The description of the technique (Section 10.8.3 of the BAT conclusions) may be amended to include information on these difficulties. The definition of LNB in the description already includes the advanced types of LNB.** **3. Air staging (b): Plants of any size can implement air staging, including below 100 MW_{th} (521V – 85 MW_{th}). For some old smaller plants there may be some difficulties in using this technique due to the need to reduce the combustion plant capacity to allow the space for air staging. This can be reported in the description.** **4. Fuel staging (c): Several plants implement fuel staging (e.g. Plants 534-1, 535-2); however, the retrofit may be less efficient in old smaller plants; a specific burner design might be needed to meet the need for specific liquid fuel mixtures.** **5. SNCR (e): Corrosion problems in retrofitting are unwanted but manageable operational issues. Plants have implemented the same technique while tackling the corrosion problems. The general section on SNCR in the BREF can be updated to include this information. The impact of load variations and boiler design can be offset by acting on the reagent type or droplet size, and /or the number of levels of reagent injection. These parameters may however influence the achievable NOX removal efficiency. If necessary, this technique may also be combined with a slip catalyst; however, this combination may not be cost-effective in the case of plants operated in emergency- and peak-load modes. Boiler design and/or boiler size constraints are not specific to this sector.** **6. SCR (f): The retrofit applicability for plants operated in peak-load mode may need to be assessed on a case-by-case basis. For consistency with the applicability restriction for this technique when firing HFO and/or gas oil, or natural gas alone, the applicability of this technique for plants of <100 MW_{th} is taken into account when those fuels are used in combination with the process fuels from the chemical industry.** **7. Other techniques: the lists in BAT conclusions are never exhaustive. Other techniques could be used, for example:** **• water or steam injection could be used,** **• advanced computerised control is normally used,** **• fuel choice could be used to replace liquid fuel with a gaseous fuel containing less nitrogen.** **8. Flue-gas recirculation (d): There is no specific reason to mention the constraints related to furnace size and design in the applicability.**
EIPPCB proposal:	**1. General: Do not reference the REF BREF in the BAT conclusion.** **2. (Advanced) low-NO_X burners (a): Update the description in Section 10.8.3 to mention the possible performance limitation in the case of retrofits at existing plants. Delete '(advanced)'.** **3. Air staging (b): Change the applicability to 'generally applicable', and add in the description (Section 10.8.3) that some old small boilers may require a capacity reduction to allow the space for air staging.** **4. Fuel staging (c): Remove '(reburning)' from the name of the technique for consistency throughout the BAT conclusions. Indicate in the description that fuel staging for fuel mixtures with liquid fuels may require a specific burner design. Add in the general description of the technique (Section 10.8.3) that the retrofit of the technique may be less efficient in the case of small boilers than in the case of bigger ones.** **5. SNCR (e): Keep SNCR, and the wording 'one or a combination of the techniques…' in the conclusion statement. Update information in the general section of the BREF on SNCR to include the tackling of the possible corrosion problems. Specify that it is not applicable to plants operated in emergency-load mode. Remove the mention of constraints linked to furnace size and design. Add an applicability restriction to indicate that the applicability of SNCR may be limited in the case of plants operated in peak-load mode with frequent fuel changes and frequent load variations.** **6. SCR (f): Keep SCR. Specify that it is not applicable to plants operating in emergency-load mode. Add an applicability restriction for plants operated in peak-load mode: 'There may be technical and economic restrictions for retrofitting existing plants operated in peak-load mode'. Add an applicability restriction for plants of <100 MW_{th}.** **7. Other techniques: Add fuel choice, water/steam addition and advanced control system with their standard applicability statement.** **8. Flue-gas recirculation (d): Remove the mention of constraints linked to furnace size and**

	design.

1.9.3.2 Table 10.39 – BAT-AELs for NO_X, NH_3 and CO – process fuels from the chemical industry

Location in D1:	*Section 10.5.1.3 – p. 786*
Current text in D1:	**Table 10.39: BAT-associated emission levels for NO_X from the combustion plants using chemical industry process fuels, including the mixtures with other fuels**

Fuel	Pollutant	Unit	BAT-AEL		Monitoring frequency
			Yearly average	Daily average	
Mixture of gases and/or liquids	NO_X	mg/Nm^3	70 – 200 (1)(2)	90 – 250 (1)(2)	Continuous measurement
	NH_3		<1 – 5 (3)	ND	
	CO		< 1 – 20	ND	

(1) The lower end of the range is associated with the use of gas- fuel blends (H_2 up to 72 % vol in gases).
(2) With the exception of nitrogen-rich liquid-prevailing fuel blends (N up to 24 % w/w in liquids) where the upper end of the yearly average range is 380 mg/Nm^3 and no value is determined for daily average.
(3) Ammonia emissions are associated with the use of SCR and SNCR

Summary of comments:	<u>NO_X</u> 1. *Split the ranges for new and existing plants (CEFIC_283).* 2. *Load factor correction is missing (CEFIC_283).* 3. *Split the ranges: one range for 100 % gaseous fuels and one range for mixtures of gas/liquid fuels (CEFIC_98_283_284, NL_72, FR_145).* 4. *<u>Adjust the ranges</u> (CEFIC_283_284):* • *<u>100 % gaseous fuels</u>:* i. *yearly NO_X for new plants: 70-100 mg/Nm^3.* ii. *yearly NO_X for existing plants: 70-290 mg/Nm^3; use Plants 73 and 521 (NO_X up to 200 mg/Nm^3) for the upper end.* iii. *daily NO_X for existing plants: 100-400 mg/Nm^3.* • *<u>mixtures of gas/liquid fuels</u>:* i. *yearly NO_X for existing plants: 80 – 450 mg/Nm^3.* ii. *daily NO_X for existing plants: 100 – 500 mg/Nm^3.* • *There is no technical reason to discard the spread, variability in composition and load are typically bringing high variations in NO_X emissions as per BREF chapter 8 (FR,_144, CEFIC_283).* 5. *<u>N-rich fuel</u>: clarify the nitrogen content correlation with the ranges and the N-content for the plant taken into account to derive the upper end of the range (FR_145, CEFIC_27).* 6. *<u>H_2-rich fuels</u>: with H_2-rich fuels, NO_X emissions are not at the lower end but rather in the middle of the range, due to higher flame temperature. The plants used in the plots burning H_2-rich fuels are new plants designed for the fuel and this should be reported. Use plants 73 and 521 (NO_X up to 200 mg/Nm^3) (PT_37, CEFIC_98_284).* 7. *<u>Daily average</u>: provide BAT-AELs on a daily basis regardless of fuel composition (AT_79).* 8. *Indicate achievable emissions levels with SNCR/SCR (AT_80).* <u>NH_3 and CO</u> 9. *<u>NH_3 BAT-AEL range</u>: the ammonia slip is typically in the range of 2–10 ppm (1.4-7 mgNm^3) for SCR and for SNCR is in the range of 5–20 ppm (3 – 14 mg/Nm^3). The higher levels are associated with higher inlet NO_X concentrations, higher NO_X reduction rates and the ageing of the catalyst and the lower end of the range is associated with the use of the SCR technique. Real operation requires higher ammonia slip (as catalyst ages or during start-up/load changes) (CEFIC_54_285).* 10. *<u>CO range</u>: upper CO value from the data collection on a yearly basis is 22.5 mg/Nm^3 for plant 527. In the data collection, CO is low. In REF BREF, higher value is mentioned. Modify the range to 1- 50 mg/Nm^3 (CEFIC_286).* 11. *Indicate BAT-AELs on a daily basis for CO and NH_3 emissions (AT_78).*
EIPPCB assessment:	<u>**NO_X**</u> **1. The split between new and existing plants can be done consistently with the other**

	sections, although not many plants are new in this subsector. **2. Load factor correlation is not apparent from the collected LCP data, high and low equivalent full loads are present. A method (Concawe report 1/9) is proposed by CEFIC to estimate the emission factor for a given fuel considering multiple correction factors; it is not applicable for deriving BAT-AELs that are derived from real data rather than from estimated or corrected data. In the REF BREF no specific considerations on combustion boilers' load are retained in the BAT conclusions for combustion plants. The split by gas-only vs mixtures with liquids is technically valid (the data show some differences between the two groups), appropriate and consistent with rest of the BREF and other BREFs.** **3. (+4.) Some plants (75-2V, 519V, 73V, 521V, 529) are not retained as BAT because they show very high short-term variations: even in the presence of fuel variability leading to high NO_X production in untreated flue-gas, a properly operated end-of-pipe technique would limit the variation in the treated flue-gas. Another case (61V) is considered unusual because of the extreme composition of the fuel, as suggested in the TWG comments; it is therefore not considered when deriving the normal range. Nevertheless, the aforementioned plants demonstrate that it is also possible to use end-of-pipe techniques when using process fuels. Plant 521V is not considered since when firing NG only its emissions are above the proposed BAT-AEL range for NG-fired boilers; burning a third of H_2 does not substantially change its emissions. The REF BREF is also considered in the absence of more specific data. The following plants are considered: Gas-only: 374V for new, 477V for existing; mixtures with liquids: 154-3 for new, 425-1V for existing. The lower end of the range and/or short-term range for new plants are derived by also considering information from comparable subsectors: boilers firing HFO, gas oil, NG, RFO.** **5. N-rich fuels: Plant 61V reports a liquid fuel with 24 wt-% N. Due to these extreme conditions, this plant is not considered for deriving the BAT-AEL range, but it is considered for a footnote. All the other plants report levels of N in liquid fuel that are more or less close to a typical range for HFO (0.5–0.6 wt-%). A similar footnote was also proposed in the REF BREF. By introducing the footnote, no additional correlation is needed with the nitrogen content in fuel.** **6. H_2-rich fuels: Plants firing gaseous fuels rich in H_2 have been used in the data set; there is no need to indicate specificities for them since no special correlation is apparent. Although a slight increase (e.g. Plant 521V) is shown for H_2 it is also possible to introduce adequate techniques to mitigate this effect.** **7. Daily BAT-AELs can be proposed when sufficient data are available.** **8. Specific indications on techniques are only appropriate if supported by data. In the case of this subsector, the data are too limited on the implementation of the two suggested techniques.** **<u>NH_3 and CO</u>** **9. Available data (Plants 61V and 75-2V) for the yearly average of ammonia are below 5 mg/Nm^3, even with extreme high inlet NO_X concentration. However, consistency with the other subsectors is also important since available data are limited in this subsector for plants implementing SCR/SNCR.** **10. The CO data for Plant 527 are adjusted to 22 mg/Nm^3 (data were reported in vol-ppm).** **11. There are no adequate data to derive CO and NH_3 BAT-AELs on a short-term basis, and CO flexibility is also needed to prevent NO_X peaks typical of the sector.**
EIPPCB proposal:	**<u>NO_X</u>** **1. Propose a split between new and existing plants for NO_X emissions.** **2. Do not consider a load correction factor.** **3. Propose a split between gas-only and mixtures with liquids.** **4. Propose the following NO_X emissions BAT-AELs:** • **Propose a yearly BAT-AEL range for new plants firing a mixture of gases and liquids of 30–85 mg/Nm^3.** • **Propose a yearly BAT-AEL range for existing plants firing a mixture of gases and liquids of 80–290 mg/Nm^3.** • **Propose a daily BAT-AEL range for new plants firing a mixture of gases and liquids of 50–110 mg/Nm^3.** • **Propose a daily BAT-AEL range for existing plants firing a mixture of gases and liquids of 100–330 mg/Nm^3.** • **Propose a yearly BAT-AEL range for new plants firing only gases of 20–80 mg/Nm^3.** • **Propose a yearly BAT-AEL range for existing plants firing only gases of 70–180 mg/Nm^3.** • **Propose a daily BAT-AEL range for new plants firing only gases of 30–100**

	mg/Nm^3. • **Propose a daily BAT-AEL range for existing plants firing only gases of 85–210 mg/Nm^3.** **5. Adjust the footnote regarding N-rich fuels to use the data collected for the LCP BREF review and at the same time ensure consistency with the REF BREF.** **6. Remove the footnote on H_2 has been and do not propose an alternative footnote.** **7. Propose daily BAT-AELs for NO_X (as detailed above).** **8. Do not propose specific levels associated only with SCR/SNCR.** **NH_3 and CO** **Adjust the NH_3 emission level consistently with the other subsectors where SCR/SNCR is used to < 5–10 mg/Nm^3. The proposed BAT-AEL for NH_3 emissions to air is shown in BAT 4 bis.** **9. Change the proposed CO upper end of the BAT-AEL range to 30 mg/Nm^3.** **10. Propose yearly averages, rather than daily averages, for the CO and NH_3 BAT-AELs.**

1.9.4 SO_X, HCl and HF emissions to air from the combustion of process fuels from the chemical industry

1.9.4.1 BAT 66 – SO_X, HCl and HF emissions

Location in D1:	*Section 10.5.1.4 – p. 787*
Current text in D1:	**66. In order to reduce SO_X, HCl and HF emissions from the combustion plants using chemical industry process fuels, including the mixtures with other fuels, BAT is to use one or a combination of the techniques given below.**

	Technique	Description	Applicability
a.	WFGD	See description in Section 10.8	Generally applicable for new plants. Applicable to existing plants within the constraints given by duct configuration, space availability, as well as chemical installation safety.
b.	Wet scrubber	See description in Section 10.8 The wet scrubbing removes HCl and HF when no WFGD is used to remove SO_X	
c.	Furnace sorbent injection	See description in Section 10.8	
d.	DSI (Dry in-duct sorbent injection)	See description in Section 10.8	
e.	Spray-dry absorber (SDA)	See description in Section 10.8	
f.	Sea water FGD	See description in Section 10.8	

Summary of comments:	*General* *1. New additional description needs to be added between item c-d; see description in Section 10.8 (EPPSA_401).* *2. Add the technique 'Fuel choice' with applicability 'Requires sufficient availability of different types of fuel, and an alternate route for the process fuel' (CEFIC_288).* *Technique a (wet FGD)* *3. Mention applicability restrictions to new plants < 100 MW_{th} and to existing plants due to the constraints given by duct configuration, the significant space availability required, as well as chemical installation safety. The applicability may be limited in arid areas and in the cases where the by-products from treatment (including e.g. wastewater with high level of salts) cannot be reused or appropriately disposed of (CEFIC_289).* *Technique b (wet scrubber)* *4. This technique is not different from wet flue-gas desulphurisation; delete (CEFIC_290).* *Technique e (SDA)* *5. Add applicability restrictions in the case of smaller facilities where the applicability is limited to the case where regenerated by-products can be sold (CEFIC_291).* *Technique f (seawater FGD)*

	6. Add seawater scrubber applicability restrictions (CEFIC_292): • *for new plants > 100 MW_{th}.* • *Applicable to existing plants within the constraints given by duct configuration, the significant space availability required, as well as chemical installation safety.* • *An efficient particulate abatement technique is generally necessary before seawater scrubbing* • *Need a large amount of seawater available.* • *Applicable only for low sulphur fuel.*
EIPPCB assessment:	**General** **1. Techniques are already described in BREF Section 10.8., however some naming harmonisation is needed.** **2. The technique lists in BAT conclusions are never exhaustive or prescriptive. Fuel choice could be used to achieve a reduced level of sulphur in the fuel and therefore in the flue-gas.** **WFGD (a)** **3. Sulphur comes mainly from HFO use; as also indicated in the chapter on HFO-fired boilers, WFGD is mainly applicable to plants above 300 MW_{th}. Retrofitting may require substantial piping revamping and adequate space. As per the BREF Guidance, it is not appropriate to detail all specific local conditions that can limit the applicability.** **Wet scrubber (b)** **4. WFGD is more specific to sulphur removal than wet scrubbing.** **SDA (e)** **5. The technique is typically used in small plants for which it is economically viable. The possibility of selling the residues is only increasing the economic performance of the technique but there is no proof that it determines its applicability (see BREF Section 3.3.3.2.6).** **Seawater FGD (f)** **6. Same assessment as for WFGD.**
EIPPCB proposal:	**General** **1. Harmonise techniques' names to: 'Boiler sorbent injection' and 'Duct sorbent injection (DSI)'.** **2. Add the technique 'Fuel choice'.** **WFGD (a)** **3. The technique is mainly applicable to plants of ≥ 300 MW_{th}; for existing plants, it is applicable within the constraints related to the duct configuration and the significant space availability required. The applicability for plants operated in emergency- or peak-load modes is the same as for other types of boiler.** **Wet scrubber (b)** **4. Keep both WFGD and wet scrubbing as described in BREF Section 10.8.** **SDA (e)** **5. Do not change the applicability restrictions of SDA.** **Seawater FGD (f)** **6. Keep the same applicability as for WFGD.**

1.9.4.2 Table 10.40 – BAT-AELs for SO_X – process fuels from the chemical industry

<table>
<tr><td>Location in D1:</td><td>Section 10.5.1.4 – p. 787</td></tr>
<tr><td>Current text in D1:</td><td>Table 10.40: BAT associated emission levels for SO_X, from the combustion plants using chemical industry process fuels, including the mixtures with other fuels
<table>
<tr><th rowspan="2">Pollutant</th><th rowspan="2">Unit</th><th rowspan="2">Monitoring frequency</th><th colspan="2">BAT-AEL</th></tr>
<tr><th>Yearly average</th><th>Daily average</th></tr>
<tr><td>SO_X</td><td>mg/Nm³</td><td>Continuous measurement</td><td>10 – 110</td><td>90 – 200</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>1. The upper end of the BAT -AEL daily range should take into account the spread of submitted data with primary techniques (fuel choice). In this case, for plant 73 the upper range is 317 mg/Nm^3 due to variability in fuel composition. Based on the cost effective application of end-of-pipe abatement techniques such as dry scrubbing in the case were fuels with high S-content are used, SO_X emission values around 600-700 mg/Nm^3 could be achievable. In the refinery BREF the range proposed is 35-600 mg/Nm^3 for multi-fuel firing. Data spread reflects the wide range of process fuels in the chemical industry (CEFIC_295).
2. Emission levels are very dependent on the applicability of the BAT and on the type of fuel burnt. Clarification is needed about the range of applicability for BAT. What to do where a FGD system is not feasible (CEFIC_29).
3. Include a footnote related to the upper end of BAT-AEL range for existing plants to account for the higher SO_2 emissions that may occur when secondary techniques cannot be applied (CONCAWE_59).
4. SO_X continuous monitoring is overkill. When using e.g. fuel from a steam cracker there is no sulphur present. Analysis is then not required (CEFIC_77_100).</td></tr>
<tr><td>EIPPCB assessment:</td><td>General considerations
None of the assessed plants are operated in peak- or emergency-load modes.
1. Process fuels from the chemical industry and distillation residues from oil and gas refining are not demonstrated to have a similar sulphur content. A number of cases (e.g. Plants 297, 425-1, 425-2) demonstrate that with an appropriate fuel choice it is possible to achieve 200 mg/Nm^3.
2. Other cases (Plants 519V, 75-1V and 75-2V) reaching higher emission levels are not retained because they exceed the proposed levels due to the use of HFO and not because of using a process fuel generated by the installation. HFO contains seven times more sulphur than the process fuel in Plants 75-1V and 75-2V. Those plants could adopt the fuel choice technique.
3. In most of the cases, fuel choice enables the proposed BAT-AELs to be met. In cases where high-S process fuels are used, FGD or other end-of-pipe techniques could be used. In the case of use of auxiliary fuels, the levels of SO_X emitted when combusted simultaneously with process fuels from the chemical industry are the same as or lower than those emitted by plants of the same size combusting only these fuels and that are operated in peak- or emergency-load modes.
4. Monitoring: The continuous monitoring of SO_2 is a minimum requirement set by the IED for plants of ≥ 100 MW_{th}.</td></tr>
<tr><td>EIPPCB proposal:</td><td>1. (to 3.) General: Keep the proposed levels; add a footnote for the daily BAT-AEL for possible higher levels in the case of combusting auxiliary fuels.
4. Monitoring: Keep consistency with the SO_2 monitoring proposed for the other types of plants.
5. For consistency with other cases, indicate that 'The yearly BAT-AELs do not apply to plants operated in peak- or emergency-load modes'.</td></tr>
</table>

1.9.4.3 Table 10.41 – BAT-AELs for HCl and HF – process fuels from the chemical industry

<table>
<tr><td>Location in D1:</td><td>Section 10.5.1.4 – p. 787-788</td></tr>
<tr><td>Current text in D1:</td><td>Table 10.41: BAT associated emission levels for HCl and HF from the combustion plants using chemical industry process fuels, including the mixtures with other fuels
<table>
<tr><th rowspan="2">Pollutant</th><th rowspan="2">Unit</th><th rowspan="2">Monitoring frequency</th><th>BAT-AEL</th></tr>
<tr><th>Average of samples taken during one year</th></tr>
<tr><td>HCl</td><td rowspan="2">mg/Nm³</td><td rowspan="2">Periodic measurements 4times/yr</td><td>< 1 – 8</td></tr>
<tr><td>HF</td><td>< 0.1 – 2</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>1. Insufficient data to support the proposed levels. Most of plants have no permit limit because F and Cl are present in very low amounts in process fuels from chemical industry. There is no benefit to have these BAT-AELs for HF and HCl in the BREF. This should be addressed on a case by case basis by MS. (CEFIC_101_297)</td></tr>
<tr><td>EIPPCB assessment:</td><td><u>General considerations:</u>
None of the assessed plants are operated in peak- or emergency-load modes.
1. HCl and HF are considered key environmental issues. There is no standard fuel composition for the process fuel from the chemical industry. Where data are lacking, see the assessment made in the introductory table of Section 1.9. Emission levels set for waste co-incineration, where the fuel composition may also be very variable, are used as a background reference for proposing BAT-AELs in this sector.
2. The monitoring frequency can be reduced if it can be proven that the emission levels are low and stable.</td></tr>
<tr><td>EIPPCB proposal:</td><td>1. Change the BAT-AELs according to the levels proposed for waste co-incineration.
2. Add a footnote for reducing the monitoring frequency in cases when it can be proven that emissions are low and stable.</td></tr>
</table>

1.9.5 Dust and particulate-bound metals emissions to air from the combustion of process fuels from the chemical industry

1.9.5.1 BAT 67 – Dust and particulate-bound metals emissions

<table>
<tr><td>Location in D1:</td><td>Section 10.5.1.5 – p. 788</td></tr>
<tr><td>Current text in D1:</td><td>67. In order to reduce emissions of dust, particulate-bound metals, and trace species from the combustion plants using chemical industry process fuels, including the mixtures with other fuels, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Fuel choice</td><td>See description in Section 10.8 By switching to a different fuel or modulating the fuel blending, the corresponding emissions are reduced.</td><td>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.</td></tr>
<tr><td>b.</td><td>Bag filter</td><td>See description in Section 10.8</td><td rowspan="2">Applicable within the constraints given by space availability.</td></tr>
<tr><td>c.</td><td>High-performance electrostatic precipitator</td><td>See description in Section 10.8</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>1. <u>General</u>: The entire conclusion may not be applicable for gas firing as the dust emission is low by nature. The conclusion and tables are thus not relevant for FG fired equipment (CEFIC_104).
2. <u>Technique a (fuel choice):</u> fuel choice is not feasible in an integrated chemicals site. The produced fuels from certain plants at site have to be used, thus no free choice to replace by NG. Mention that this restricts the applicability in chemicals plants (CEFIC_105).
3. <u>Techniques b and c (bag filters and ESP):</u> bag filters and electrostatic precipitator are not applicable in existing plants, as they raise the delta P. Mention this under applicability: constraints given by …existing equipment capacity and operating conditions (CEFIC_103).</td></tr>
<tr><td>EIPPCB assessment:</td><td>1. <u>General:</u> consistently with other subsectors (e.g. I&S case for gas-only), gas-only is covered.
2. <u>Fuel choice (a):</u> fuel choice is applied by the majority of the assessed plants for this subsector regarding auxiliary fuels. In the case of process fuels from chemical plants, the availability of fuel with a low ash or dust content will depend on the fuel management at the chemical site. Fuel choice is more related to the plant than to the energy policy of the Member State.
3. <u>Bag filter and ESP (b and c):</u> as also indicated by CEFIC's June 2014 (LCP BREF Rationale for revision of sections 8.2, 10, 10.1, 10.5 proposal), secondary techniques (e.g. ESP) are used in existing utility boilers when primary measures are not sufficient. A lot of examples in all sectors show that such devices have been retrofitted to plants of all sizes, indicating that the application of BAT is not restricted by ΔP or operating conditions. The requirement of space availability is also therefore not general but may be associated to very local specificities.
4. Other techniques: Since some techniques focused on abating other pollutants (i.e. SO_X) may have an effect on the dust content, it seems appropriate to include them.</td></tr>
<tr><td>EIPPCB proposal:</td><td>1. <u>General</u>: keep the BAT conclusion for all types of fuels.
2. <u>Fuel choice (a):</u> change the description of the technique to indicate the use of a combination of process fuels from the chemical plant and auxiliary fuels with averaged low dust or ash content, as much as the chemical plant allows it. Remove from the applicability that it may be impacted by the energy policy of the Member State.
3. <u>Bag filter and ESP (b and c):</u> change the applicability to 'generally applicable'.
4. Include Dry, semi-dry or wet FGD system.</td></tr>
</table>

1.9.5.2 Table 10.42 – BAT-AELs for dust – process fuels from the chemical industry

Location in D1:	*Section 10.5.1.5 – p. 788*
Current text in D1:	**Table 10.42: BAT-associated emission levels for dust emissions to air from the combustion plants using chemical industry process fuels, including mixtures with other fuels**

Type of plant	Pollutant	Unit	BAT-AEL		Monitoring frequency
			Yearly average	Daily average	
New	Dust	mg/Nm^3	< 1 – 5	ND	Continuous measurement
Existing			< 1 – 10	< 20	

Summary of comments:	1. *Yearly BAT-AELs (CEFIC_299):* • *For gaseous fuels in mg/Nm^3: new (2–5) and existing (2–10).* • *For multi-fuel firing in mg/Nm^3: new (5–25) and existing (5–50).* 2. *Daily BAT-AELs: < 1 – 10 mg/Nm^3 for new plants (daily average) (AT_81).* 3. *General: values are very dependent on the applicability of the BAT and the type of fuel burnt. What to do where a de-dusting system is not feasible (CEFIC_30).*
EIPPCB assessment:	**1. Yearly BAT-AELs: The plants in the data collection do not adopt end-of-pipe techniques. An appropriate choice of fuel and/or available end-of-pipe techniques (e.g. ESP) would allow the achievement of the level indicated based on the reduction efficiency mentioned in the BREF (Section 3.3.3.1).** **2. Daily BAT-AELs: new plants are expected to have emissions to air within the range of emissions corresponding to HFO-fired boilers. When plants covered by this section combust liquid fuels as auxiliary fuels (alone or in combination with process fuels from the chemical industry), the levels of dust emitted in the short term are similar to or lower than the levels emitted when such auxiliary fuels are combusted alone in plants combusting only these fuels operated in peak- or emergency-load modes.** **3. In general, dedusting equipment can be installed.**
EIPPCB proposal:	**1. (+ 3.) Keep the levels consistent with other subsectors (e.g. I&S multi-fuel boilers) and raise the lower end: existing 2–15 mg/Nm^3 as the yearly BAT-AEL range, and 2–25 mg/Nm^3 as the daily BAT-AEL range (Plant 297).** **2. Define a daily BAT-AEL for new plants at 2–10 mg/Nm^3. Add a footnote allowing for a higher daily BAT-AEL when auxiliary liquid fuels are used.**

1.9.5.3 Table 10.43 – BAT-AELs for particulate-bound metals – process fuels from the chemical industry

Location in D1:	*Section 10.5.1.5 – p. 788*
Current text in D1:	**Table 10.43: BAT-associated emission levels for particulate-bound metals and trace species emissions to air from the combustion plants using chemical industry process fuels, including mixtures with other fuels**

Pollutant	Unit	BAT-AEL	Monitoring frequency
		Average of samples obtained during one year	
Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V	mg/Nm^3	0.05 – 0.2	Periodic measurement: 4 times/yr

Summary of comments:	1. *Monitoring: instead of a periodic measurement of metals, it should be allowed to calculate the metal emission from the determination of metals in the fuels (CEFIC_79).* 2. *General: few plants could provide all the emission for all the metals listed. Not enough data were submitted to support the proposed BAT-AEL. It does not make sense to measure Sb, As. This should be addressed on a case-by-case basis (CEFIC_106_301).*
EIPPCB assessment:	**1. Considering the type of fuels burnt (liquid and or gas), their origin and their respective concentrations, the levels of metals are deemed sufficiently covered through the BAT-AELs proposed for dust reduction.**
EIPPCB proposal:	**1. Delete the BAT-AELs for particulate-bound metals (BREF Table 10.43).**

1.9.6 Mercury emissions to air from the combustion of process fuels from the chemical industry

1.9.6.1 BAT 68 – Mercury emissions

<table>
<tr><td>Location in D1:</td><td>Section 10.5.1.6– p. 788-789</td></tr>
<tr><td>Current text in D1:</td><td>68. In order to reduce mercury emissions to air from the combustion plants using chemical industry process fuels, including the mixtures with other fuels, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a</td><td>Bag Filter</td><td>See description in Section 10.8</td><td rowspan="4">Generally applicable for new plants. Applicable to existing plants within the constraints given by duct configuration, space availability, as well as chemical installation safety.</td></tr>
<tr><td>b</td><td>ESP</td><td>See description in Section 10.8</td></tr>
<tr><td>c</td><td>SCR</td><td>See description in Section 10.8</td></tr>
<tr><td>d</td><td>FGD technique (e.g. wet limestone scrubbers, spray dryer scrubbers or dry sorbent injection)</td><td>See descriptions in Section 10.8</td></tr>
<tr><td>e</td><td>Carbon sorbent (e.g. activated carbon) injection in the flue-gas</td><td>See description in Section 10.8</td><td></td></tr>
<tr><td>f</td><td>Fuel pretreatment</td><td>Fuel washing, blending and mixing in order to reduce the Hg content</td><td>Applicability requires previous survey for characterising the fuel and for estimating the potential effectiveness of the technique</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>1. <u>Technique d (FGD):</u>
• Applicability of wet scrubbing may be limited in arid areas and to cases where the by-products from treatment (including e.g. wastewater with high level of salts) cannot be reused or appropriately disposed of. (CEFIC_302).
• Insert circulating fluid bed scrubber (e.g. wet limestone scrubbers, spray dryer scrubbers, circulating dry scrubber (CDS) circulating fluid bed scrubbers or dry sorbent injection) (EPPSA_402).
2. <u>Technique f (Fuel pretreatment)</u>: applicability requires previous survey for characterising the fuel and for estimating the potential effectiveness of the technique (CEFIC_303).</td></tr>
<tr><td>EIPPCB assessment:</td><td>1. The techniques are already included as BAT in other conclusions for this subsector.
2. The techniques listed are not exhaustive; however, an additional example of FGD can be given in its short description.</td></tr>
<tr><td>EIPPCB proposal:</td><td>1. Delete BAT 68.
2. Add 'circulating fluidised bed scrubber' in Section 10.8 of the BREF.</td></tr>
</table>

1.9.6.2 Table 10.44 – BAT-AELs for mercury – process fuels from the chemical industry

<table>
<tr><td>Location in D1:</td><td>Section 10.5.1.6 – p. 789</td></tr>
<tr><td>Current text in D1:</td><td>Table 10.44: BAT-associated emission levels for mercury from the combustion plants using chemical industry process fuels
<table>
<tr><th rowspan="2">Pollutant</th><th rowspan="2">Unit</th><th colspan="2">BAT-AEL</th><th rowspan="2">Monitoring frequency</th></tr>
<tr><th>Average of samples obtained during one year</th></tr>
<tr><td>Mercury</td><td>µg/Nm^3</td><td colspan="2">0.1 – 8</td><td>Periodic measurement: 4 times/yr</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>1. No data are available on Hg emissions; Hg normally is not present in chemicals fuels. Therefore, a BAT-AEL for mercury cannot be derived. It should be addressed on a case-by-case basis. A further check should indicate whether mercury is relevant and for what fuels as used in chemicals (CEFIC_107_305).</td></tr>
<tr><td>EIPPCB assessment:</td><td>1. Considering the types of fuel burnt (liquid and or gas) and their origin, the level of mercury is not considered a priori a key issue in a focused approach for this subsector.</td></tr>
<tr><td>EIPPCB proposal:</td><td>1. Delete the BAT-AELs for mercury (BREF Table 10.44).</td></tr>
</table>

1.9.7 TOC, dioxins and furans emissions to air from the combustion of process fuels from the chemical industry

1.9.7.1 BAT 69 – TOC, dioxins and furans emissions

<table>
<tr><td>Location in D1:</td><td>Section 10.5.1.7 – p. 789</td></tr>
<tr><td>Current text in D1:</td><td>69. In order to reduce TOC, dioxins and furans emissions to air from the combustion plants using chemical industry process fuels, including the mixtures with other fuels, BAT is to use one or a combination of the techniques given in BAT 4 and below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a</td><td>Activated carbon injection / reactor</td><td>See description in Section 10.8</td><td rowspan="3">Generally applicable for new plants. Applicable to existing plants within the constraints given by duct configuration, space availability, as well as chemical installation safety.</td></tr>
<tr><td>b</td><td>SCR</td><td>See description in Section 10.8 – The SCR is adapted and larger in comparison with an SCR only used for NO_X reduction</td></tr>
<tr><td>c</td><td>Rapid quenching through wet scrubbing / FG condenser</td><td>See description of wet scrubbing / FG condenser in Section 10.8</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>1. <u>Technique c</u>: applicability of wet scrubbing may be limited in arid areas and in cases where the by-products from treatment (including e.g. wastewater with high level of salts) cannot be reused or appropriately disposed of (CEFIC_306).</td></tr>
<tr><td>EIPPCB assessment:</td><td>1. As per the BREF Guidance, it is not appropriate to detail all specific local conditions that can limit the applicability.</td></tr>
<tr><td>EIPPCB proposal:</td><td>1. Do not include specific local conditions in BAT 69.</td></tr>
</table>

1.9.7.2 Table 10.45 – BAT-AELs for dioxins and furans – process fuels from the chemical industry

<table>
<tr><td>Location in D1:</td><td>Section 10.5.1.7 – p. 789</td></tr>
<tr><td>Current text in D1:</td><td>Table 10.45: BAT-associated emission levels for dioxins and furans emissions to air from the combustion plants using chemical industry process fuels, including the mixtures with other fuels
<table>
<tr><th rowspan="2">Pollutant</th><th rowspan="2">Unit</th><th colspan="2">BAT-AEL</th><th rowspan="2">Monitoring frequency</th></tr>
<tr><th>Average of samples obtained during one year</th></tr>
<tr><td>Dioxins and furans</td><td>pg_{I-TEQ}/Nm^3</td><td>1 – 100</td><td>Periodic measurement: 2 times/yr</td></tr>
<tr><td>TOC</td><td>mg/Nm^3</td><td>1 – 10</td><td>Periodic measurement: 2 times/yr</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td><u>General</u>:
1. Dioxins, furans and TOC are likely not relevant for fuels at chemicals sites. Periodic measurement is therefore not required, unless proven by study (CEFIC_108).
<u>TOC</u>
2. Measuring the TOC periodically (2x/year) makes no sense, due to the continuously change of the composition of the fuel mix. Delete the measuring frequency for TOC (CEFIC_80).
3. TOC is not a clear parameter. Some plants measure NMVOC and CH_4 and some has TOC but the new standard EN 12619:2012 gives a definition for total volatile organic carbon (TVOC) as a sum of all gaseous and vaporous organics expressed as total carbon. Review parameter. No BAT-AEL can really be derived as there are few data and may not use the same standard. Although the Directives prescribe the measurement of TOC (Total Organic Carbon) the FID analyser actually measures TVOC (Total Volatile Organic Carbons). Reference: ROM under development. Delete TOC BAT-AEL. (CEFIC_308).
<u>Dioxins/furans</u>
4. BAT -AEL has been set in the document although there is no data available from the data collection from process fuels in chemical industry because there are not expected to emit dioxins/furans. Delete BAT-AEL for Dioxins /Furans (CEFIC_21_307).
5. It is not stated which is the reference period for dioxin measurements. According to EN norms this is minimum 6 hours and maximum 8 hours. Include information on sampling period for dioxin measurements (BE_55).</td></tr>
<tr><td>EIPPCB assessment:</td><td><u>General</u>
1. Dioxins and furans are relevant environmental issues for plants firing process fuels with a significant amount of chlorine.
<u>TOC</u>
2. In this case, consistency with other close subsectors (co-incineration) is sought: the variability of fuel would entail additional monitoring of the emissions for possible pollutants.
3. There is no EN standard available for the measurement of TOC in stack emissions (including particulate organic matter). Instead, EN 12619 specifies a method for the measurement of gaseous and vaporous organic substances, expressed as TVOC (total volatile organic carbon). Annex B 3 of EN 12619 describes that the measurement of TVOC instead of TOC is generally accepted in the industry and by competent authorities, even though the IED prescribes the measurement of TOC (for waste (co)incineration).
<u>Dioxins/furans</u>
4. No data being available, consistency with other subsectors has been sought (co-incineration due to the variability of process fuels).
5. BAT 3 ter specifies that monitoring performed in accordance with available EN standards is BAT. As the monitoring frequency is 'at least twice every year', the averaging period needs to be modified.</td></tr>
<tr><td>EIPPCB proposal:</td><td><u>General</u>
1. Restrict the dioxins and furans BAT-AEL to those plants using fuel derived from chemical installations where chlorinated substances are involved in the process generating the fuel.
<u>TOC</u></td></tr>
</table>

	2. Keep consistency with the levels agreed for co-incineration, by aligning the levels, taking into account differences in the oxygen reference level. **3. Rename TOC as TVOC.** **Dioxins/furans** **4. Keep the proposed BAT-AELs and associated monitoring. Change the averaging period to 'average over the sampling period'.**

1.10 Waste co-incineration

Location in D1:	*Section 10.6 – p. 791*
Current text in D1:	*No text*
Summary of comments:	*1. Add a new BAT conclusion for waste quality control: 4 techniques are proposed (AT_96).* *2. Cover all the possible combinations of waste with all the fuels covered by the scope (FI_11); liquid combustion is not covered (DK_147).* *3. Include references to the Waste Incineration BREF and Chapter IV of the IED (Eurits_3); insert a reference to the mixing formula of the Annex VI part 4 (1) to the IED (Eurits_4).*
EIPPCB assessment:	**1. BAT 70 already includes a 'waste pre-acceptance and acceptance' technique that is very similar to the technique proposed, which corresponds to BAT 11 of the Cement and Lime BREF for waste co-incineration in cement kilns. Elements of that BAT 11 could be added to BAT 70 technique (a) to complete it.** **2. BAT conclusions have been proposed for representative activities identified through the submitted data. BAT conclusions may be generally applicable for any kind of waste co-incineration (e.g. BAT 70) or correspond to 'real-life' activities, i.e. coal- or lignite-waste co-incineration of any kind of waste (solid or liquid), and biomass- or peat-waste co-incineration.** **3. Reference to the Waste Incineration BREF is already included under the Scope section of the BAT conclusions. The BREF is drafted pursuant to Chapter II of the IED, and not Chapter IV which includes the mixing formula.**
EIPPCB proposal:	**1. Add to the description of technique (a) of BAT 70: 'Apply quality assurance systems for each waste load to guarantee the characteristics of the wastes to be co-incinerated and to control the values of defined critical parameters'.** **2. Keep the proposed structure for the BAT conclusions and BAT-AELs.** **3. Do not add a reference to Chapter IV of the IED.**

1.10.1 BAT 70 – General environmental performance

<table>
<tr><td>Location in D1:</td><td>Section 10.6.1.1 – p. 791</td></tr>
<tr><td>Current text in D1:</td><td>70. In order to improve the general environmental performance of combustion plants co-incinerating wastes, to ensure stable combustion conditions, and to reduce emissions to air, BAT is to use a combination of the techniques listed in BAT-4 and of the techniques given below.
<table>
<tr><th colspan="2">Techniques</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Waste pre-acceptance and acceptance</td><td>Implement a procedure for receiving any waste at the combustion plant according to the corresponding BAT from the Waste Treatment Industries BREF. Acceptance criteria are set for critical parameters such as heating value, water content, ash content, chlorine and fluorine content, sulphur content, nitrogen content, PCB, metals (volatile (Hg, Tl, Pb, Co and Se) and non-volatile (e.g. V, Cu, Cd, Cr, Ni)) and phosphorus and alkaline content (when using animal by-products).</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Waste choice</td><td>Careful selection of waste type and mass flow, together with limiting the percentage of the most polluted waste that can be co-incinerated. Limit Hg and chlorine entering the combustion process as elevated components of the waste</td><td>Generally applicable</td></tr>
<tr><td>c.</td><td>Waste drying</td><td>On-site or off-site pre-drying of the waste before introducing it into the combustion chamber, with a view to maintaining the high performance of the boiler</td><td>Applicability may be limited by insufficient recoverable heat from the process, by the required combustion conditions, or by the waste moisture content.</td></tr>
<tr><td>d.</td><td>Waste pretreatment</td><td>See techniques described in the Waste Treatment Industries and Waste Incinerator BREFs, including milling, pre-combustion in fluidised bed boilers, pyrolysis, gasification, etc.</td><td>Applicability may depend on the plant size and configuration, on the type of waste, and on the space availability</td></tr>
<tr><td>e.</td><td>Waste mixing with the main fuel</td><td>Effective mixing between waste and the main fuel, as an heterogeneous or poorly mixed fuel stream or an uneven distribution may influence the ignition and combustion in the boiler and has to be prevented</td><td>Mixing is only possible when the grinding behaviour of the fuel and waste are more or less the same or when the amount of waste is very small compared to the main fuel flow</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td>1. Add a technique (f) related to the minimum operating conditions of temperature and residence time for the waste co-incineration (EURITS_5).</td></tr>
<tr><td>EIPPCB assessment:</td><td>1. There is no mention in the BREF of the minimum operating conditions needed for waste co-incineration. These requirements are already included in Article 50 of the IED and there is no need to repeat them in the BREF.
2. The levels of emissions are of the same or of a lower magnitude than when these plants do not co-incinerate wastes. BAT conclusions and BAT-AELs apply in the same way when these plants are co-incinerating wastes. The emissions of polluting substances in the part of the flue-gases resulting from waste co-incineration should not be higher than those resulting from the application of BAT for the incineration of waste.</td></tr>
<tr><td>EIPPCB proposal:</td><td>1. Do not add a technique referring to minimum operating conditions.
2. Add in the introduction of Section 10.6 of the BAT conclusions that when co-incinerating waste, the BAT-AELs set out in the fuel-specific sections apply in relation to those fuels, as well as in relation to the mix of those fuels and the waste co-incinerated and taking into account BAT 70 bis. Add BAT 70 bis. mentioning that in order to prevent increased emissions from the co-incineration of waste in combustion plants, BAT is to take appropriate measures to ensure that the emissions of polluting substances in the part of the flue gases resulting from waste</td></tr>
</table>

	co-incineration are not higher than those resulting from the application of BAT for the incineration of waste defined in the WI BREF.

1.10.2 BAT 71 – General environmental performance in waste co-incineration

Location in D1:	*Section 10.6.1.1 – p. 791*
Current text in D1:	**71. In order to reduce diffuse emissions to air and odorous substances from the storage and handling of waste to be co-incinerated, BAT is to use a combination of the techniques listed in BAT-9 and of the related BAT in the Waste Treatment Industries BREF.** *{This BAT conclusion is based on information given in Section 9.4.1}*
Summary of comments:	*No comment submitted*
EIPPCB assessment:	**BAT 71 is already covered by BAT 1 (xv) incorporating a dust management plan in the EMS and BAT 1 (xvii) incorporating an odour plan for co-incineration of malodorous substances.**
EIPPCB proposal:	**Remove BAT 71.**

1.10.3 BAT 72 – General environmental performance in waste co-incineration

Location in D1:	*Section 10.6.1.1 – p. 792*
Current text in D1:	**72. In order to minimise the impact on by-product and residues recycling from the waste co-incineration in combustion plants, BAT is to maintain the quality of gypsum, ashes and slag and other residues and by-products at the same level as those occurring without the co-incineration by using one or a combination of the techniques listed in BAT-70 and/or by restricting the co-incineration to waste fractions with pollutant concentrations similar to primary fuels.** *{This BAT conclusion is based on information given in Section 9.4.6}*
Summary of comments:	*1. Remove 'combustion plants' from the statement as it is not well defined (SE_27).* *2. Change 'at the same level as' in the statement by 'at a level that the quality requirement comply with' (Eurelectric_44_745_1004).* *3. Do not refer to the quality of ashes (Eurelectric_124).*
EIPPCB assessment:	**1. Only waste co-incineration taking place in combustion plants is covered by the scope.** **2. (+3.) The use of waste as fuels may lead to the concentration of higher loads of pollutants within residues, changing their quality, but this change may be to an extent that is limited compared with the acceptance criteria defined for their recycling. By-products are included in the residues, according to the definition of residues.**
EIPPCB proposal:	**1. Do not remove 'combustion plants' from the statement.** **2. (+3.) Change the BAT statement to indicate that BAT is to maintain a good quality of gypsum, ashes and slags as well as other residues, in line with the requirements set for their recycling when the plant is not co-incinerating waste. Remove 'by-products' from the statement.**

1.10.4 BAT 73 – Energy efficiency

Location in D1:	*Section 10.6.1.2 – p. 792*
Current text in D1:	**73. In order to increase the energy efficiency of combustion plants co-incinerating waste, BAT is to use one or a combination of the techniques listed in BAT 7, BAT 18, BAT 24, BAT 25, and BAT 82 depending on the main fuel(s) combusted and of the plant configuration.** **BAT-associated environmental performance levels** The BAT-associated energy efficiency levels are the ones given in Table 10.10 for biomass- and peat-fired combustion plants co-incinerating waste, and the ones given in Table 10.2 for coal- and lignite-fired plants co-incinerating waste.
Summary of comments:	*1. There is very limited evidence in Chapter 9 that energy efficiency can be maintained at the same level as without co-incineration (DK_153).*
EIPPCB assessment:	**1. Values proposed in D1 were based on yearly averages from the collected data. As per the assessment made in Section 1.1.5 of this BP, it is now proposed to define design-based BAT-AEELs. Information has been submitted via the TFEE with design net electrical efficiencies of plants that co-incinerated waste from the 2012 questionnaires (e.g. Plant 121, 142, 211, 123 and 219). The net electrical efficiencies reported by these plants are inside the ranges proposed. The co-incineration should not affect negatively the environmental of the plant as the purpose of combusting wastes is to produce energy. There is no more evidence supporting the comment.** **2. BAT 24 does not include any technique to improve the energy efficiency, BAT 25 is already removed and BAT 82 is for gasification.**
EIPPCB proposal:	**1. Keep the BAT-associated environmental performance levels.** **2. Remove BAT 24, BAT 25 and BAT 82 from the BAT 73 statement.**

1.10.5 BAT 74 – NO_X, N_2O, NH_3 and CO emissions to air from waste co-incineration in coal- and/or lignite-fired combustion plants

Location in D1: *Section 10.6.1.3 – p. 792*

Current text in D1:

74. In order to prevent and/or reduce NO_X emissions to air while limiting CO and NH_3 emissions from waste co-incineration in coal- and lignite-fired combustion plants, BAT is to use one or a combination of the techniques given in BAT 19 and of the technique below.

	Technique	Description	Applicability
a.	Circulating fluidised bed boiler	See description in Section 10.8	Applicable for new plants and when firing waste that can be fragmented to the fraction size necessary to create a fluidised bed

The BAT-associated emission levels for NO_X and CO and NH_3 are given in Table 10.46.

Table 10.46: BAT-associated emission levels for NO_X, CO and NH_3 emissions to air from waste co-incineration in coal- and lignite-fired combustion plants

Combustion plant rated thermal input (MW_{th})	BAT-AEL for NO_X (yearly average – mg/Nm^3)		BAT-AEL for NO_X (daily average – mg/Nm^3)		BAT-AEL for CO (yearly average – mg/Nm^3)	BAT-AEL for NH_3 ([1]) (yearly average – mg/Nm^3)	Monitoring frequency
	New plants	Existing plants	New plants	Existing plants			
< 100	100 – 200	100 – 270	ND		10 – 100	< 6	Continuous measurement
100 – 300	100 – 150	100 – 180	ND		10 – 100	< 6	

	> 300 FBC (coal-lignite) and PC lignite firing: 50 – 150 | 50 – 180 | 140 – 220 | 12 – 80 | < 6 > 300 PC coal firing: 65 – 100 | 65 – 180 | 80 – 125 | 80 – 220 | 1 – 55 | < 6 ([1]) Ammonia emissions are associated with the use of SCR and SNCR.
Summary of comments:	1. *Delete the technique BAT-74 (a) as it is not well supported by related information in Chapter 9 (DK_155).* 2. *Delete daily BAT-AELs (DK_157).* 3. *Do not set BAT-AELs for NO_X, CO, NH_3, SO_2 and dust emissions to air for waste co-incineration different from the ones set for the combustion of the main fuels (Eurelectric_45_280_746).* 4. *Provide daily NO_X BAT-AELs for all plant sizes:* *4.1. Plants of < 100 MW_{th}* • *80–220 mg/Nm^3 for new plants (AT_85).* • *80–300 mg/Nm^3 for existing plants (AT_85).* *4.2. Plants of 100–300 MW_{th}* • *80–170 mg/Nm^3 for new plants (AT_85).* • *80–200 mg/Nm^3 for existing plants (AT_85).* 5. *Change the NH_3 BAT-AEL to < 15 mg/Nm^3 (Eurelectric_45_280), or to < 20 mg/Nm^3 (FR_160).* 6. *Delete the continuous measurement for NH_3 emissions (Eurelectric_45_280_746).*
EIPPCB assessment:	**1. CFB boiler is a combustion process. Using it may be enough to achieve quite a low level of emissions, as in the general case of coal- and/or lignite-fired combustion (plants of < 100 MW_{th}). The use of such a process is already mentioned in BAT 17 thus rendering technique (a) of BAT 74 redundant.** **2. (to 6.) Co-incineration plants combusting coal and/or lignite have been plotted together. The levels of NO_X, CO, N_2O and NH_3 emissions are of the same or of a lower magnitude than when these plants do not co-incinerate wastes (Table 10.3). Table 10.3 of the BAT conclusions has been updated and now contains daily BAT-AELs for all combustion plant sizes. It has been added in the introduction of Section 10.6 of the BAT conclusions that when co-incinerating waste, the BAT-AELs set out in the fuel-specific sections apply in relation to those fuels, as well as in relation to the mix of those fuels and the waste co-incinerated and taking into account BAT 70 bis., which has been included.**
EIPPCB proposal:	**1. Remove technique (a). As a consequence, BAT 74 becomes redundant and it is proposed to delete it.** **2. (to 6.) Remove Table 46.**

1.10.6 BAT 75 - NO_X, N_2O, NH_3 and CO emissions to air from waste co-incineration in biomass- and/or peat-fired combustion plants

Location in D1:	*Section 10.6.1.3 – p. 793*
Current text in D1:	**75. In order to prevent and/or reduce NO_X emissions to air while limiting CO and NH_3 emissions from the waste co-incineration in biomass- and peat-fired combustion plants, BAT is to use one or a combination of the techniques given in the BAT 26 and of the technique given below.** **Technique** | **Description** | **Applicability** a. Circulating fluidised bed boiler | See description in Section 10.8 | Applicable for new plants and when firing waste that can be fragmented to the fraction necessary to create fluidised bed *{This BAT conclusion is based on information given in Section 9.4.4}* The BAT-associated emission levels for NO_X, NH_3 and CO are given in Table 10.47. **Table 10.47: BAT-associated emission levels for NO_X from the co-incineration of waste in biomass- and peat-fired combustion plants**

Combustion plant rated thermal input (MW_{th})	Pollutant	Unit	Monitoring frequency	BAT-AEL			
				New plant		Existing plant	
				Yearly average	Daily average	Yearly average	Daily average
50 – 100	NO_X	mg/Nm^3	Continuous measurement	70 – 200	120 – 260	70 – 250	120 – 310
100 – 300				50 – 130	100 – 220	50 – 140	100 – 220
>300				40 – 130	65 – 150	40 – 140	95 – 150
All	NH_3 ([1])					<1 – 7	ND
	CO					4 – 80	ND

([1]) Ammonia emissions are associated with the use of SCR and SNCR.

Summary of comments:

1. *BAT 75*
- *Include the possibility of converting existing plants. CFBB exclude other techniques (E&P_249, UK_25).*
- *Change text to '...given in the BAT 26 and/or of the technique given below' (AT_82).*
- *Remove BAT 75(a) not clear from Section 9.4.4. (DK_158).*

2. *Table 10.47*

2.1. General
- *Don´t set BAT-AEL because insufficient documentation in Chapter 9. No plants over 200 MW_{th}. Only CFB boiler (DK_159).*
- *Delete table 10.47 and refer to table 10.11 include a comment that co-incineration plants are included (Eurelectric_403, 46) Boilers using biomass and small parts of the fuels mix is waste from e.g. recovered paper, the same levels as the chapter 10.2.2 (CEPI_102).*

2.2. NO_X 50-100 MWth
- *Change to 300 mg/Nm^3 (CEPI_101).*
- *Change yearly average to <= 150 mg/Nm^3 (AT_89).*
- *Change daily average to <= 200 mg/Nm^3 (AT_88).*

2.3. NO_X 100-300 MWth
- *Change to 250 mg/Nm^3 (CEPI_101, E&P_250).*
- *Change yearly average to <= 150 mg/Nm^3 (AT_89).*
- *Change daily average to <= 200 mg/Nm^3 (AT_88).*

2.4. NO_X > 300 MWth
- *Change to 200 mg/Nm3 (CEPI_101).*

2.5. NH_3
- *Change to 10 mg/Nm3 if the boiler has a flue condensator or scrubber. If not, 20 mg/Nm3 (CEPI_100).*
- *Provide short term (i.e. daily) for new plants <1 - 8 mg/Nm3 (AT_86).*
- *Provide long term (i.e. yearly) for new plants <1 - 5 mg/Nm3 (AT_87).*
- *Set 10 mg/Nm3 yearly and 20 mg/Nm3daily BAT-AELs when using SNCR. D1 proposals are o.k. when using SCR (SE_66).*
- *Delete continuous monitoring (Eurelectric_403_46).*
- *Raise upper BAT-AEL to 15 mg/m3 (Eurelectric_825_33).*

2.6. CO
- *Provide short term for new plants (i.e. daily) (AT_86).*
- *Provide long term for new plants (i.e. yearly) (AT_87).*
- *Delete BAT-AEL as a yearly average value for CO (SE_ 71).*
- *Change BAT-AEL for boilers with quick and repetitive changes in load for CO as daily average value to 1000 or 2000 mg/Nm^3 (SE_ 71).*

2.7. N_2O
- *Add BAT-AEL for N_2O e.g. 5-10 mg/Nm^3 for BFB, 5-20 mg/Nm^3 for CFB (DK_154).*

EIPPCB assessment:

1. BAT 75
- **CFB boiler is a combustion process. CFB boilers may perform better with respect to NO_X emissions than other types of boilers. However, depending on the performance of the primary and/or secondary abatement techniques the NO_X emissions from a CFB boiler may be similar to another type of boiler (i.e. Plant 671 is a BFB boiler that report similar NOX emissions to Plant 672 which is a CFB boiler).**

2. Table 10.47
- **The data collection of biomass co-incineration plants consists of 16 plants with a capacity below 206 MW_{th}. Five of them are CFB boilers, six are BFB boilers and five are grate/other boilers. It is considered that enough information is available to propose BAT-AELs.**
- **Co-incineration plants combusting biomass and/or peat have been plotted together. The levels of NO_X, CO and NH_3 emissions are of the same or of a lower magnitude**

	than when these plants do not co-incinerate wastes (Table 10.26). Table 10.26 of the BAT conclusions has been updated. It has been added in the introduction of Section 10.6 of the BAT conclusions that when co-incinerating waste, the BAT-AELs set out in the fuel-specific sections apply in relation to those fuels, as well as in relation to the mix of those fuels and the waste co-incinerated and taking into account BAT 70 bis., which has been included. • **Same comments have been posted in the section of biomass for this table and Table 10.26 has been updated. The table contains yearly and daily BAT-AELs for new and existing plants of all sizes.** • **Considerations for N_2O are given in Chapter 1.4.2 and are valid here too.**
EIPPCB proposal:	**1. BAT 75** • **Remove technique (a). As a consequence, BAT 75 becomes redundant and it is proposed to delete it.** **2. Table 10.47** • **Remove Table 10.47.**

1.10.7 BAT 76 - SO_X, HCl and HF emissions to air from waste co-incineration in coal- and/or lignite-fired combustion plants

1.10.7.1 BAT 76 – List of techniques

Location in D1:	*Section 10.6.1.4 – p. 793*
Current text in D1:	**76. In order to prevent and/or reduce SO_X, HCl and HF emissions to air from waste co-incineration in coal- and lignite-fired combustion plants, BAT is to apply one or a combination of the techniques listed in BAT 21 and of the technique given below.** **Technique** / **Description** / **Applicability** a. Waste selection / limitation — Selection of waste streams with low S, Cl, F content. Limitation of the amount of waste to be co-incinerated — Generally applicable within the constraints associated with the types of waste to be co-incinerated, which may be impacted by the waste management policy of the local / national competent authority. *{This BAT conclusion is based on information given in Section 9.4.4}*
Summary of comments:	*1. Add the CFB scrubber in the list of techniques (EPPSA_404).*
EIPPCB assessment:	**1. The CFB dry scrubber technique is proposed to be added as BAT in BAT 21 (see Section 1.3.5 this BP), and BAT 21 is explicitly referred to in the BAT statement of BAT 76.**
EIPPCB proposal:	**1. Keep technique (a) in BAT 76 unchanged.**

1.10.7.2 Table 10.48 – BAT-AELs for SO_X – coal and/or lignite

<table>
<tr><td>Location in D1:</td><td>Section 10.6.1.4 – p. 793</td></tr>
<tr><td>Current text in D1:</td><td>
Table 10.48: BAT-associated emission levels for SO_X emissions to air from waste co-incineration in coal- and lignite-fired combustion plants with coal and lignite S content < 3 %
<table>
<tr><th rowspan="2">Combustion plant rated thermal input (MW_{th})</th><th colspan="4">BAT-AEL (mg/Nm^3) ([3])</th><th rowspan="2">Monitoring frequency</th></tr>
<tr><th>New plants (yearly average)</th><th>Existing plants (yearly average)</th><th>New plants (daily average)</th><th>Existing plants (daily average)</th></tr>
<tr><td>50 – 100</td><td>150 – 200</td><td>150 – 400</td><td rowspan="2">ND</td><td rowspan="2">ND</td><td rowspan="4">Continuous measurement [(2)]</td></tr>
<tr><td>100 – 300</td><td>80 – 150</td><td>80 – 200</td></tr>
<tr><td>>300 (Pulverised combustion)</td><td>10 – 75</td><td>10 – 130</td><td>25 – 110</td><td>25 – 220</td></tr>
<tr><td>>300 (Fluidised bed boilers) ([1])</td><td>20 – 150</td><td>20 – 180</td><td colspan="2">ND</td></tr>
<tr><td colspan="6">([1]) Lower end of the range is achieved with a highly efficient wet FGD system. The higher end can be achieved with boiler / in-bed sorbent injection.
([2]) Only SO_2 is continuously measured, SO_3 is periodically measured (e.g. during calibration).
([3]) When low-S waste is co-incinerated, the lower SO_X emissions should be expected, e.g. a plant co-incinerating more than 30 % (LHV basis) low-S waste emits at the lower end of the given ranges.</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td>
1. Do not set BAT-AELs for NO_X, CO, NH_3, SO_2 and dust emissions to air for waste co-incineration different from the ones set for the combustion of the other fuels (Eurelectric_47_748_1005).
2. Information in Chapter 9 does not enough support the proposed BAT-AELs (DK_162).
3. Set daily BAT-AELs for all sizes (AT_90).
4. The footnote ([3]) is too vague to be properly applied (BE_56).
</td></tr>
<tr><td>EIPPCB assessment:</td><td>
1. (+2.+3.) Co-incineration plants combusting coal and/or lignite have been plotted altogether. The levels of SO_X emissions are of the same or of a lower magnitude than when these plants do not co-incinerate wastes (Table 10.5). Table 10.5 of the BAT conclusions has been updated. It has been added in the introduction of Section 10.6 of the BAT conclusions that when co-incinerating waste, the BAT-AELs set out in the fuel-specific sections apply in relation to those fuels, as well as in relation to the mix of those fuels and the waste co-incinerated and taking into account BAT 70 bis., which has been included. Table 10.5 is proposed to be updated and contains daily BAT-AELs for all sizes for existing plants. Not enough information was available for proposing BAT-AELs for new plants.
4. Footnote ([3]) does not properly reflect all the possible situations where the level of SO_X emitted may not only depend on the sulphur content of the waste, but also on its participation in the combustion compared to other fuels, on the S content of the other fuels or on the level of reduction efficiency of the desulphurisation technique implemented. It is thus of no added value to keep such a footnote.
</td></tr>
<tr><td>EIPPCB proposal:</td><td>1. (to 4.) Delete Table 10.48</td></tr>
</table>

1.10.7.3 Table 10.49 – BAT-AELs for HCl and HF – coal and/or lignite

<table>
<tr><td>Location in D1:</td><td>Section 10.6.1.4 – p. 794</td></tr>
<tr><td>Current text in D1:</td><td>Table 10.49: BAT-associated emission levels for halogen emissions to air from waste co-incineration in coal- and lignite-fired combustion plants
<table>
<tr><th>Pollutant</th><th>BAT-AEL (mg/Nm^3)</th><th>Monitoring frequency</th></tr>
<tr><td>HCl</td><td><1 – 5</td><td>Continuous measurement</td></tr>
<tr><td>HF</td><td><0.1 – 2</td><td>Continuous measurement</td></tr>
</table></td></tr>
<tr><td>Summary of comments:</td><td><u>General</u>
1. The averaging period of reference is missing in the table (AT_91_92, DK_164, CEFIC_13_36 Eurelectric_749).
2. Do not set BAT-AELs for HCl and HF emissions to air for waste co-incineration different from the ones set for the combustion of the other fuels (Eurelectric_48_749_1006).
<u>Alternative proposals</u>
3. <u>HCl</u>
• < 5 mg/Nm^3 (DK_163).
• 25–100 mg/Nm^3 as yearly average for CFB plants fitted with dry techniques (Eurelectric_49_750_1007).
4. <u>HF</u>
• < 3 mg/Nm^3 (DK_163).
<u>Monitoring</u>
5. Change from continuous to periodic measurement (4/yr or 2/yr, or 1/yr after a wet FGD) (DK_163, Eurelectric_50_751_1008).
6. Change to periodic measurement for HF if there is a treatment step for HCl (SE_73, E&P_26).</td></tr>
<tr><td>EIPPCB assessment:</td><td><u>General and BAT-AELs</u>
1. (to 4.) Co-incineration plants combusting coal and/or lignite have been plotted altogether. The levels of SO_X emissions are of the same or of a lower magnitude than when these plants do not co-incinerate wastes (Table 10.6). Table 10.6 of the BAT conclusions has been updated. It has been added in the introduction of Section 10.6 of the BAT conclusions that when co-incinerating waste, the BAT-AELs set out in the fuel-specific sections apply in relation to those fuels, as well as in relation to the mix of those fuels and the waste co-incinerated and taking into account BAT 70 bis., which has been included. The specific case of CFB boilers is also covered (see also the assessment in Section 1.3.7).
<u>Monitoring</u>
5. (+6.) The chlorine and fluorine content may be much more variable in the wastes than in the fuel, hence the proposal for continuous monitoring. Nevertheless, in the case of a very stable process and a low level of emissions, the monitoring frequency could be reduced.</td></tr>
<tr><td>EIPPCB proposal:</td><td>1. (to 4.) Remove Table 10.49.
5. (+6.)Add a footnote allowing the monitoring frequency to be reduced when emissions are proven to be low over the long term, the frequency in that case being at each change of fuel and/or waste characteristics that may impact the emissions, with a frequency of at least twice/yr.</td></tr>
</table>

1.10.8 BAT 77 - SO_X, HCl and HF emissions to air from waste co-incineration in biomass- and/or peat-fired combustion plants

Location in D1:

Section 10.6.1.4 – p. 794

Current text in D1:

77. In order to prevent and/or reduce SO_X and halogen emissions to air from waste co-incineration in biomass- and peat-fired combustion plants, BAT is to use one or a combination of the techniques listed in BAT 28 and of the techniques given below.

	Technique	Description	Applicability
2.	Waste selection / limitation	Selection of waste streams with low S, Cl, F content. Limitation of the amount of waste to be co-incinerated	Generally applicable within the constraints associated with the types of waste to be co-incinerated, which may be impacted by the waste management policy of the local / national competent authority
3.	Semi-dry absorber (SDA)	See description in Section 10.8	Generally applicable

Table 10.50: BAT associated emission levels for SO_X, HCl, and HF emissions to air from the co-incineration of waste in biomass- and peat-fired combustion plants

Fuel (% in yearly and LHV basis)	Pollutant	Unit	Monitoring frequency	BAT-AEL	
				Yearly average	Daily average
Peat % in the fuel-waste feed < 20 %	SO_X	mg/Nm³	Continuous measurement (1)	1 – 50	8 – 70
Peat % in the fuel-waste feed ≥ 70 %				100 – 165	ND
20 ≤ Peat % in the fuel-waste feed < 70				Intermediate, within the ranges given in the two lines above	ND
Straw % in the fuel-waste feed < 25 %	HCl			1 – 8	3 – 12
Straw % in the fuel-waste feed ≅ 100 %				<18	ND
25 ≤ Straw % in the fuel-waste feed < 100				Intermediate, within the ranges given in the two lines above	ND
All	HF			<0.01 – 0.8	ND

Summary of comments:

1. <u>Table 10.50</u>

1.1. <u>General</u>

- *Delete the first three rows concerning SO_x in table 10.50 and refer to table 10.12 instead (Eurelectric_752_1009_1011_51_754).*
- *BAT-AELs should be given also for co-incineration at multi-fuel boilers firing coal, wood biomass and peat (FI_84).*
- *Amend the table according to the analysis provided in Chapter 9.4.4. (AT_93).*

1.2. <u>SO_X</u>

- *Set yearly <= 50 mg/Nm^3 for peat in fuel waste fuel feed < 20 % (AT_94).*
- *Set daily <= 130 mg/Nm^3 for peat in fuel waste fuel feed < 20 % (AT_94).*
- *Delete daily average. No evidence in Chapter 9 (DK_165).*

1.3. <u>HF</u>

- *Set HF < 1 mg/Nm^3 (DK_165).*
- *Change to periodic measurement once a year (CEPI_104).*
- *Add a footnote that the continuous measurement should only be carried out if necessary*

	(AT_83). • *Continuous measurement by: 4 times/year - 1 time per year in the case of low emissions (e.g. behind the wet FGD) (Eurelectric_753_1010).* • *Periodic measurement only if there is treatment step for HF (SE_74).* *1.4. HCl* • *Add a footnote that the continuous measurement should only be carried out if necessary (AT_83).* • *Continuous measurement by: 4 times/year - 1 time per year in the case of low emissions (e.g. behind the wet FGD) (Eurelectric_753_1010).* • *Set < 20 mg/Nm^3 for straw fired plants regardless of straw fraction (DK_165).*
EIPPCB assessment:	**1. Table 10.50** • **Biomass co-incineration plants have been considered in the assessment of biomass plants. Co-incineration plants combusting coal and/or lignite have been plotted altogether. The levels of SO_X, HCl and HF emissions are of the same or of a lower magnitude than when these plants do not co-incinerate wastes (Table 10.12). Table 10.12 of the BAT conclusions has been updated and it was added Table 10.12 bis. It has been added in the introduction of Section 10.6 of the BAT conclusions that when co-incinerating waste, the BAT-AELs set out in the fuel-specific sections apply in relation to those fuels, as well as in relation to the mix of those fuels and the waste co-incinerated and taking into account BAT 70 bis., which has been included.** • **The chlorine and fluorine content may be more variable in the wastes than in the fuel, hence the proposal for continuous monitoring. If the mix of biomass fuels allows the variability of the HCl and HF emissions to be kept below the proposed BAT-AEL range or the plant uses abatement systems to ensure that the emissions achieved are within that range, the monitoring frequency may be periodic, in line with the assessment made for plants firing biomass only (and not co-incinerating waste).** **2. BAT 77** • **The SDA technique is proposed to be added to the list of BAT in BAT 28, and BAT 28 is explicitly referred to in the BAT statement of BAT 77.**
EIPPCB proposal:	**1. Table 10.50** • **Remove Table 10.50.** • **Add a footnote allowing the reduction of the HCl and HF monitoring frequency when emissions are proven to be low over the long term, the frequency in that case being at each change of fuel and/or waste characteristics that may impact the emissions, with a frequency of at least twice/yr.** **2. BAT 77** • **Remove technique (b) from BAT 77.**

1.10.9 BAT 78 – Dust and particulate-bound metals emissions to air from waste co-incineration in coal- and/or lignite-fired combustion plants

Location in D1:	*Section 10.6.1.5 – p. 795*
Current text in D1:	**Table 10.51: BAT-associated emission levels for metals emissions to air from waste co-incineration in coal- and lignite-fired combustion plants**

BAT-AEL (average of samples obtained during one year)		Monitoring frequency
Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V (mg/Nm^3)	Cd+Tl (µg/Nm^3)	
0.025 – 0.2	0.1 – 6	Periodic measurements: 4 times/yr

Summary of comments:	*General* *1. BAT-AEL for Zn when co incinerating sewage sludge is missing, even though it is BAT according to BAT 3 to monitor Zn emission when sewage sludge is co-incinerated (DK_168).* *BAT-AELs* *2. Increase the upper end of the BAT-AEL ranges to take into consideration more configurations than the ones submitted as reference plants (Eurelectric_285_52_755).* *3. Set different BAT-AELs for plants < 300 MW_{th} and for plants > 300 MW_{th} (Eurelectric_285_52_755).*

	Monitoring *4. Change the monitoring frequency to 2 or 1/time(s)/yr if last measured values are below 75- 50 % of the higher end of the BAT-AEL (unless significant changes to the plant operation and permitted waste flows occur)(CEPI_105, Eurelectric_285_52_755_756_1012_53).* *5. The monitoring frequency should be changed to 2 times/yr, aligned with the one of the IED (DK_169_171, FI_85, E&P_27).*
EIPPCB assessment:	**General** **1. The BAT-AEL for Zn when co-incinerating sewage sludge is missing because there are only a few example plants that provided Zn measurements and only in one case was the plant identified as burning sewage sludge (Plant 672).** **BAT-AELs** **2. (+3.) After reviewing the available data, it could be considered appropriate to split the BAT-AELs for metals (Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V) and for Cd+Tl into two different categories: for plants of < 300 MW_{th} and for plants ≥ 300 MW_{th}, as the efficiency of the techniques implemented may be different for capturing particle-bound metals.** **Monitoring** **4. (+5.) The proposed monitoring of four times/yr matches the common practice reported in plants of ≥ 300 MW_{th}. However, the periodic monitoring in plants of < 300 MW_{th} is reported to be performed only between once and five times/yr. A reduced monitoring frequency could thus be proposed for these plants. In general, and in the case of a very stable process and a low level of emissions, the frequency could be reduced even more.**
EIPPCB proposal:	**General** **1. Do not propose BAT-AELs for Zn emissions.** **BAT-AELs** **2. (+3.) Propose the following BAT-AELs for Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V:** • **Plants ≥ 300 MW_{th}: 0.0025–0.2 mg/Nm^3;** • **Plants of < 300 MW_{th}: 0.004–0.5 mg/Nm^3.** **Propose the following BAT-AELs for Cd+Tl:** • **Plants ≥ 300 MW_{th}: 0.1–8 µg/Nm^3;** • **Plants of < 300 MW_{th}: 0.4–12 µg/Nm^3.** **Monitoring** **4. Keep the monitoring frequency unchanged for plants of ≥ 300 MW_{th}; set a monitoring frequency of twice/yr in the case of plants of < 300 MW_{th}; and adjust the averaging period accordingly. Add a footnote allowing the monitoring frequency to be reduced when emissions are proven to be low over the long term, the frequency in that case being at each change of fuel and/or waste characteristics that may impact the emissions, with a frequency of at least once/yr. Add a footnote mentioning that the minimum frequency may be reduced to twice per year in the case of plants operated in peak-load mode, and to once per year for plants operated in emergency-load mode.**

1.10.10 BAT 79 – Dust and particulate-bound metals emissions to air from waste co-incineration in biomass- and/or peat-fired combustion plants

Location in D1: *Section 10.6.1.5 – p. 795*

Current text in D1:

79. In order to reduce dust and particulate-bound metal emissions to air from waste co-incineration in biomass- and peat-fired combustion plants, BAT is to use one or a combination of the techniques given below.

	Technique	Description	Applicability
d.	Fuel / waste choice	By switching to a different fuel/waste or modulating the fuel/waste blending (e.g. lower ash or lower chlorine fuel/waste) the corresponding emissions can be reduced	Applicable within the constraints associated with the availability of different types of fuel/waste, which may be impacted by the energy and waste management policies of the Member State
e.	Bag filter	See description in Section 10.8	Applicable within the constraints given by space availability
f.	High-performance electrostatic precipitator	See description in Section 10.8	
g.	Activated carbon injection / reactor	See description in Section 10.8	Applicable for further metal reduction
h.	Wet FGD	See description in Section 10.8	Applicable in combination with other dedusting devices (e.g. bag filter or ESP), when used for desulphurisation

Table 10.52: BAT-associated emission levels for particulate-bound metal emissions to air from waste co-incineration in biomass and peat-fired combustion plants

BAT-AEL (average of samples obtained during one year)		Monitoring frequency
Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V (mg/Nm^3)	Cd+Tl ($\mu g/Nm^3$)	
0.075 – 0.3	0.8 – 22 ([1])	Periodic measurements: 4 times/yr
([1]) The higher end of the range is achieved when co-incinerating waste containing high levels of Cd+Tl (e.g. 5 – 6 mg/kg) in a high share (e.g. > 60 % - LHV basis)		

Summary of comments:

Table 10.52

1. *Merge Tables 10.51 and 10.52. The reason for measuring heavy metals is the potentially elevated metal content in the waste (Eurelectric_756_1012_53).*
2. *BAT-AEL for Zn when co incinerating sewage sludge is missing, even though it according to BAT 3 is BAT to monitoring Zn emission when sewage sludge is co-incinerated (DK_167).*
3. *Change the monitoring frequency to 2 times / year (CEPI_106).*
4. *Add '1 time/year if the operator can prove that the emissions are low (e.g. < 50 % of the emission limit value.)' (Eurelectric_756_1012_53).*
5. *Limit emissions of Cd and Tl to BAT lev; specify in the footnote that a high share can cause a higher end of the range (22) (NL_74).*
6. *Clarify what is meant with the higher end, high levels and a high share (BE_57).*

EIPPCB assessment:

1. **Biomass waste co-incineration plants are plotted together with only biomass and multi-fuel biomass plants. The performance of the techniques is assessed considering the emission levels reported by biomass plants as a basis and not those**

	of other types of plants (i.e. coal). **2. A BAT-AEL for Zn when co incinerating sewage sludge has not been proposed because there are only a few example plants that reported Zn emissions and only in one case was the plant identified as burning sewage sludge (i.e. Plant 672).** **3. (+4.) The monitoring frequency is usually periodic, and consists of taking a few samples, two or four times/yr in most cases. In the case of a very stable process and a low level of emissions, the frequency could be reduced.** **5. (+6.) All biomass plants including co-incinerating and multi-fuel plants reported Cd+Tl emissions below 4 µg/Nm^3, except Plant 72 burning 100 % waste, that reported 21 µg/Nm^3 with a high content of Cd+Tl in the fuel. Since this plant is not in the scope of the BREF, it cannot be taken into account.** **7. The BAT for dust reduction has been reassessed in section 1.4.4. of the BP considering also biomass co-incineration and multi-fuel plants, resulting in a proposed revised Table 10.13. Techniques that are more specific to metal emissions reduction can be kept in BAT 79.**
EIPPCB proposal:	**1. Do not merge Table 10.51 and Table 10.52.** **2. Do not include a BAT-AEL for Zn emissions.** **3. (+4.) Consistently with coal-fired plants, keep the monitoring frequency to at least four times per year for plants of ≥ 300 MW_{th} and to at least twice per year for plants of < 300 MW_{th}. Add a footnote allowing the monitoring frequency to be reduced when emissions are proven to be low over the long term, the frequency in that case being at each change of fuel and/or waste characteristics that may impact the emissions, with a frequency of at least once/yr. Add a footnote mentioning that the frequency can be reduced to twice per year in the case of plants operated in peak-load mode, and to once per year for plants operated in emergency-load mode.** **5. (+6.) Change the upper end of the BAT-AEL range for Cd+Tl to 5 µg/Nm^3.** **7. Remove techniques (e), (f), (g) and (h) from BAT 79. Refer in the statement of BAT 79 to BAT 29.**

1.10.11 BAT 80 – Mercury emissions to air

Location in D1: *Section 10.6.1.6 – p. 796*

Current text in D1:

80. In order to reduce mercury emissions to air from waste co-incineration in biomass-, peat-, coal- and lignite-fired combustion plants, BAT is to use one or a combination of the techniques listed in BAT-23 and of the technique given below.

	Technique	Description	Applicability
a.	Waste stream control	Selection of waste with a low Hg content, blended with the fuel in order to obtain an homogeneous mixture, and in a limited amount in order to avoid additional Hg emissions	Applicable within the constraints associated with the waste management strategy agreed at the local / national level

{This BAT conclusion is based on information given in Section 9.4.4}

The BAT-associated emission levels for mercury in coal- and lignite-fired combustion plants co-incinerating waste are the ones given in Table 10.8 and Table 10.9.

The BAT-associated emission levels for mercury in biomass- and peat-fired combustion plants co-incinerating waste are presented in Table 10.53.

Table 10.53: BAT-associated emission levels for mercury emissions to air from waste co-incineration in biomass- and peat-fired combustion plants

Pollutant	Unit	BAT-AEL	Monitoring frequency
		Average of samples obtained during one year	
Mercury	µg/Nm^3	0.2 – 10	Periodic measurements: 4 times/yr

Summary of comments:

Table 10.53

1. *Change the lower end of the range from 0.2 to 1 µg/Nm^3 (Eurelectric_757_286_54).*
2. *Change the monitoring frequency from 4 times/yr to 2 or 1 time(s)/yr if last measured value is below 75 / 50 % of the higher end of the BAT-AELs (CEPI_107).*
3. *The monitoring frequency could be fixed according to the Hg content in the fuel (e.g. 1 time/year if fuel analysis shows that emissions are less than 20 % of the higher end of the BAT-AELs) (Eurelectric_757_286_54).*
4. *BAT for monitoring frequency is at least 2-4 times a year (DK_172).*

EIPPCB assessment:

1. **EN standards for monitoring mercury emissions at stack level cover measurements down to 1 µg/Nm^3 for total mercury. For periodic measurements of Hg, EN 13211 was validated for exhaust gases from waste incineration plants in the range of 1–500 µg/m^3. A limit of detection of 2.6 µg/m^3 (calculated for a sample gas volume of 50 l) is also given in the standard. For continuous measurements of Hg, the certified automated measurement system with the lowest certification range is reported to have a repeatability standard deviation at zero point of 0.2 % of the certification range, corresponding to a limit of quantification of 0.08 µg/m^3. Therefore, it seems as if Hg concentrations of < 1 µg/m^3 can be measured in some cases, but that the measurement uncertainty will be higher as such levels are close to the limit of detection/quantification. Commission Implementing Decision 2012/119/EU stipulates in Section 3.3 that it is acceptable to use an expression of the type '< X to Y' (i.e. '< X' for the lower end of the range, Y for the upper end), where the lower end of the range cannot be accurately defined, e.g. when the data reported in the information exchange is close to the detection limit.**
2. **(to 4.) Biomass co-incineration plants and biomass plants have been plotted together. The levels of mercury emissions are of the same or of a lower magnitude than when these plants do not co-incinerate wastes. It has been added in the introduction of Section 10.6 of the BAT conclusions that when co-incinerating waste, the BAT-AELs set out in the fuel-specific sections apply in relation to those fuels, as well as in relation to the mix of those fuels and the waste co-incinerated and taking into account BAT 70 bis., which has been included. The emissions of mercury reported by co-incinerating plants are similar to those of plants that are not co-incinerating. In the case of a very stable process and a low level of emissions, the frequency of monitoring could be reduced.**

EIPPCB proposal:

1. **Change the lower end of the BAT-AEL range to 1 mg/Nm^3.**
2. **(to 4.) Delete Table 10.53. Keep the monitoring frequency to at least four times per year.**

	Add a footnote allowing the monitoring measurement frequency to be reduced when emissions are proven to be low over the long term, the frequency in that case being at each change of fuel and/or waste characteristics that may impact the emissions, with a frequency of at least once/yr.

1.10.12 BAT 81 – TOC, dioxins, and furans emissions to air

Location in D1: *Section 10.6.1.7 – p. 796*

Current text in D1:

81. In order to reduce TOC, dioxins, and furans emissions to air from waste-co-incineration in biomass-, peat-, coal- and lignite-fired combustion plants, BAT is to use a combination of the techniques listed in BAT 4 and of the techniques given below.

	Technique	Description	Applicability
a	Activated carbon injection / reactor	See description in Section 10.8	Applicable to biomass- and peat-fired combustion plants
b	SCR	See description in Section 10.8 – The SCR is adapted and larger in comparison with an SCR only used for NO_X reduction	Generally applicable
c	Rapid quenching through wet scrubbing / FG condenser	See description of wet scrubbing / FG condenser in Section 10.8	Generally applicable

The BAT-associated emission levels for dioxins and furans emissions to air are given in Table 10.54.

Table 10.54: BAT-associated emission levels for TOC, dioxins and furans emissions to air from the waste co-incineration in biomass-, peat-, coal- and lignite-fired combustion plants

Type of combustion plant	Pollutant	Unit	BAT-AEL	Averaging period	Monitoring frequency
Biomass- and peat- combustion plant	PCDD/F	$ng^{I\text{-}TEQ}/Nm^3$	< 0.002 – 0.03	Periodic measurement	Periodic measurements: 2 times/yr
Biomass-, peat-, coal- and lignite-fired combustion plant	TOC	mg/Nm^3	< 0.1 – 3	Yearly average	Continuous measurement
			0.5 – 4.5	Daily average	

Summary of comments:

1. *PCDD/F emissions*
   - 1.1. *Set levels for coal- or lignite-combustion (DK_173).*
   - 1.2. *Change the measurement frequency to 1/yr if the last measurement is below 50 % of the higher end (CEPI_108, Eurelectric_759).*
   - 1.3. *Alternative proposals*
     - *< 0.03 ng/Nm³ (DK_173).*
     - *< 0.1 ng/Nm³ (Eurelectric_56).*
     - *0.01-0.1 ng/Nm³(FR_122).*
2. *TOC emissions*
   - 2.1. *Replace the yearly average by an average over the sampling period (Eurelectric_287_758).*
   - 2.2. *Change the upper end of the average to 10 mg/Nm³(FR_161, Eurelectric_287_758).*
   - 2.3. *Remove the provision to measure TOC (Eurelectric_406).*

EIPPCB assessment:

1. **PCDD/F emissions**
   - **1.1. PCDD/F emission levels are plotted for coal and/or lignite combustion. They are deemed low enough for not proposing BAT-AELs, except when co-incinerating wastes.**
   - **1.2. In general, and in the case of a very stable process and a low level of emissions, the monitoring frequency could be reduced to once per year.**
   - **1.3. All biomass plants in the data collection reported emissions below 0.03 ng I-TEQ/Nm³ except Plants 672, 489-1 489-2 which reported emissions between 0.14 and 0.58 ng I-TEQ/Nm³. Since these values are above the ELV in their corresponding permits, they have been considered erroneous in the filling-in of the questionnaires. For coal or lignite co-incineration plants, the levels are kept**

	< 0.012 mg/Nm^3. Since the source of the PCDD/F is the waste, BAT-AELs cover also coal or lignite co-incineration plants. The 'Active carbon injection' technique is not only applicable to biomass but also to coal. **2. <u>TOC emissions</u>** **There is no EN standard available for the measurement of TOC in stack emissions (including particulate organic matter). Instead, EN 12619 specifies a method for the measurement of gaseous and vaporous organic substances, expressed as TVOC (total volatile organic carbon). Annex B 3 of EN 12619 states that the measurement of TVOC instead of TOC is generally accepted in the industry and by competent authorities, even though the IED prescribes the measurement of TOC (for waste (co-)incineration).** **2.1. (+2.4.) Most of the plants that reported TOC emissions use continuous measurement (and it is the minimum requirement set by the IED for TOC). Thus the BAT-AELs could be expressed as yearly averages.** **2.2. (+2.3.) A review of all available data from the questionnaires (e.g. Plant 668 reports yearly average <5 mg/Nm^3 and short term emissions about 15 mg/Nm^3)..**
EIPPCB proposal:	**1. <u>PCDD/F emissions</u>** **1.1. Set the same PCDD/F emission levels for coal and/or lignite combustion as for biomass combustion.** **1.2. Add a footnote allowing the <u>monitoring</u> frequency to be reduced when emissions are proven to be low over the long term, the frequency in that case being at each change of fuel and/or waste characteristics that may impact the emissions, with a frequency of at least once/yr.** **1.3. Keep the proposed BAT-AEL range at < 0.002–0.03 ng I-TEQ/Nm^3.** **1.4. Change the applicability of 'Activated carbon injection' to generally applicable.** **2. <u>TOC emissions</u>** **Rename TOC as TVOC.** **2.1. (+2.4.) Keep the BAT-AEL expressed as a yearly average, and keep continuous monitoring.** **2.2. (+2.3.) Change the yearly BAT-AEL range to < 0.1–5 mg/Nm^3 and the daily BAT-AEL to 0.5–15 mg/Nm^3.**

1.11 Gasification and IGCC plants

1.11.1 BAT 82 – Energy efficiency

<table>
<tr><td>Location in D1:</td><td>Section 10.7.1.1 – p. 798</td></tr>
<tr><td>Current text in D1:</td><td>
82. In order to increase the energy efficiency of the IGCC and gasification plants, BAT is to use one or a combination of the techniques described in BAT 7 and of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Heat recovery from the gasification process</td><td>As the syngas needs to be cooled down to be further cleaned, energy can be recovered for producing additional steam to be added to the steam turbine cycle, enabling additional electrical power to be produced</td><td>Applicable to IGCC plants and to plants connected to boilers with syngas pretreatment requiring cooling down of the syngas temperature.</td></tr>
<tr><td>b.</td><td>Integration of gasification and combustion blocks</td><td>The plant can be designed with full integration of the air supply unit (ASU) and the gas turbine, all the air fed to the ASU being supplied (extracted) from the gas turbine compressor</td><td>Applicability limited to IGCC plants by the flexibility needs of the integrated plant to quickly provide the grid with electricity when the renewable power plant is shutting down.</td></tr>
<tr><td>c.</td><td>Dry feedstock feeding system</td><td>Use of a dry system for feeding the fuel to the gasifier, in order to improve the energy efficiency of the gasification process</td><td>Applicable to new plants</td></tr>
<tr><td>d.</td><td>High temperature and pressure gasification</td><td>Use of gasification technique with high temperature and pressure operating parameters, in order to enable the maximum carbon conversion rate</td><td>Applicable to new plants</td></tr>
<tr><td>e.</td><td>Design improvements</td><td>Design improvements, such as:
geometry modification of the draught tube dip tube;
modification of the system attack serpentine cooling of the process burners;
geometry modification of the neck and throat gasifier refractory;
installation of an expander to recover energy from the syngas pressure drop before combustion.</td><td>Applicable to existing IGCC plants</td></tr>
</table>
{This BAT conclusion is based on information given in Sections 4.3.4, 4.3.1.1 and 3.3.4}
</td></tr>
</table>

Summary of comments:	*1. General* *1.1. Clarify that these conclusions do not apply to gasification plants linked to refining of mineral oil and gas (IT_192).* *1.2. BATs 82 to 85 do not generally apply to the case of gasifiers used to produce syngas that replaces another fuel in a boiler (DK_93).* *1.3. Add the following technique in the list: 'Two-stage gasification with char recycling' (Eurelectric_554).*
EIPPCB assessment:	**1. General** **1.1. Gasification and IGCC plants linked to the refining of mineral oil and gas are covered by the REF BREF. The scope of the BAT conclusions of the LCP BREF is not clear enough on this.** **1.2. BAT 83 to 85 are specific to IGCC plants. There are no BAT-AEPL proposed for the combustion of syngas in the case where this syngas replaces another fuel, due to the lack of available data for such cases. BAT 82 applies to gasifiers connected to boilers (e.g. techniques a, c, d). Furthermore, listed techniques are neither prescriptive nor exhaustive.** **1.3. The proposed technique is not described in D1 and there is no proposed description attached to the comment. Listed techniques are neither prescriptive nor exhaustive.**
EIPPCB proposal:	**1. General** **1.1. Add in the scope of the BREF and of the BAT conclusions the exclusion of gasification of fuels and combustion of syngas when linked to the refining of mineral oil and gas.** **1.2. Do not change the applicability of the techniques.** **1.3. Do not add the technique 'two-stage gasification with char recycling'.**

1.11.2 Table 10.55 – BAT-AEELs for energy efficiency – gasification and IGCC plants

Location in D1:	*Section 10.7.1.1 – p. 799*
Current text in D1:	**BAT-associated environmental performance levels** The BAT-associated net electrical efficiency levels are given in Table 10.55. **Table 10.55: BAT-associated environmental performance levels for the energy efficiency of gasification and IGCC plants**

Type of plant	BAT-AEPL (yearly average – LHV basis)		
	Net electrical efficiency (%) of the IGCC plant		Net total fuel utilisation (%) of the gasification plant – New and existing plants
	New plants	Existing plants	
Gasification plant connected to a boiler without prior syngas treatment			> 98
Gasification plant connected to a boiler with prior syngas treatment			> 91
IGCC plants		34 - 46	> 91

Summary of comments:	*1. Shift these conclusions to the chapter on emerging techniques (Eurelectric_288_760, Euracoal_164).* *2. Add a footnote mentioning that for determining the net total fuel utilisation in the case of gasification plant connected to a boiler with or without prior syngas treatment, the syngas produced should be considered as LHV (Eurelectric_288_760, Euracoal_164).* *3. Clarify the boundaries used for determining the net total fuel utilisation (IT_193).* *4. These conclusions are not applicable when using biomass and nutrient recycling from the gasification by-products for their fertiliser value (DK_92).*

EIPPCB assessment:	**1. IGCC is a process not widely used but it has been used for a number of years now gasifying coal or refining residues. It was described in the 2006 LCP BREF and is recognised as a process in the refinery sector in the REF BREF. IGCC includes techniques mentioned in BAT 82 for increasing energy efficiency. These techniques cannot be considered as emerging.** **2. (+3.) The net total fuel utilisation for gasification plants is not well defined in the BAT conclusions, unlike for combustion plants. It is proposed to add a specific definition (see proposal).** **4. The main purpose of gasification of a given feedstock in a gasification plant is presumably to produce energy and secondly to reuse the by-products as much as possible. No further rationale/evidence is attached to the comment about the impact that the practice of gasifying biomass for reusing the by-products as fertiliser would have on energy efficiency.**
EIPPCB proposal:	**1. Keep BAT-AEELs on energy efficiency for IGCC plants.** **2. (+3.) Add a definition in the BREF and in the BAT conclusions for 'Net total fuel utilisation of a gasification plant'; add 'feedstock' as a possible input in the definition of 'Net electrical efficiency' and mention that these definitions apply to combustion plants and IGCC.** **3. Do not add an applicability restriction in the case of biomass gasification or recycling of nutrients.**

1.11.3 BAT 83 and Table 10.56 – NO_X and CO emissions to air

Location in D1: *Section 10.7.1.2 – p. 799/800*

Current text in D1:

83. In order to prevent or reduce NO_X emissions while limiting CO emissions to air from IGCC plants, BAT is to use one or a combination of the techniques given below.

	Technique	Description	Applicability
a.	Dry low-NO_X burners for the combined-cycle gas turbine	See description in Section 10.8.	Applicable to new plants and on a case-by-case basis for existing plants, depending on the availability of a retrofittable package. Not applicable for H-syngas content > 25 % Note to TWG: please confirm/comment
b.	Syngas dilution with waste nitrogen from the air supply unit (ASU)	The ASU separates the oxygen from the nitrogen in the air, in order to supply high quality oxygen to the gasifier. The waste nitrogen from the ASU is reused to cool down the combustion temperature in the gas turbine, by being premixed with the syngas before combustion	Applicable when an ASU is used for the gasification process
c.	Steam injection in the gas turbine combustion chamber	See description in Section 10.8. Some intermediate pressure steam for the steam turbine is reused for this purpose	Generally applicable
d.	SCR	See description in Section 10.8	Generally applicable to new and existing coal PC plant > 100 MW_{th}, in combination with other primary techniques
e.	Complete combustion, along with good furnace design, the use of high performance monitoring and automated process control techniques, and maintenance of the combustion system.		Generally applicable

{This BAT conclusion is based on information given in Section 4.3.1.1}

BAT-associated emission levels

The BAT-associated emission levels for NO_X and CO are presented in Table 10.56.

Table 10.56: BAT-associated emission levels for NO_X and CO emissions to air from IGCC plants

Combustion plant rated thermal input (MW_{th})	BAT-AEL for NO_X (yearly average - mg/Nm^3)		BAT-AEL for NO_X (daily average - mg/Nm^3)		BAT-AEL for CO (yearly average - mg/Nm^3)	Monitoring frequency
	New plants	Existing plants	New plants	Existing plants		
≥ 100	10 - 25	12 - 45	1 – 35	1 - 60	< 1 - 5	Continuous measurement

Summary of comments:

1. *Technique c (steam injection in the gas turbine combustion chamber): this technique is only applicable to existing plants as it is outdated when considering new plants (PL_161).*
2. *The BAT-AELs should be removed, as the technique is emerging (Euracoal_165, Eurelectric_289_761).*

EIPPCB assessment:	**1. <u>Steam injection in the gas turbine combustion chamber (c)</u>: a technique which is applicable (technically and economically) to existing plants is in principle also applicable to new plants. However, the performance to be achieved for new plants may not be achievable by steam injection, at least alone. The BAT statement mentions 'one or a combination of techniques…'. The techniques are neither prescriptive nor exhaustive. The technique requires enough water to be implemented.** **2. IGCC is a process not widely used but it has been used for a number of years now gasifying coal or refining residues. It was described in the current (2006) LCP BREF and is recognised as a process in the refinery sector through the REF BREF. The process includes techniques mentioned in BAT 83 for reducing emissions of NO_X to air whilst keeping CO emissions controlled. These techniques cannot be considered emerging.**
EIPPCB proposal:	**1. <u>Steam injection in the gas turbine combustion chamber (c)</u>: Change the name of the technique to 'Water/steam addition' for consistency throughout the BREF; add to the applicability that the technique applies to gas turbines, and the restriction due to water availability.** **2. Keep the proposed <u>BAT-AELs</u>.** **3. Change the name and description of technique (e) to 'combustion optimisation' for consistency with the name of this technique in other sections.** **4. Change the name of technique (a) for consistency with other sections of the BREF to 'Dry low-NO_X burners (DLN)'. Add in the applicability the fact that the technique applies only to gas turbines.** **5. Update the applicability of SCR consistently with applicability restrictions to other gas turbines (BAT 47).**

1.11.4 BAT 84 and BAT-AEL – SO_X emissions to air

Location in D1:	*Section 10.7.1.3 – p. 801*
Current text in D1:	**84. In order to prevent and/or reduce SO_X emissions to air from IGCC plants, BAT is to use the technique given below.** **Technique** / **Description** / **Applicability** a. Acid gas removal (AGR) / Sulphur compounds from the feedstock of a gasification process are removed from the syngas via an AGR e.g. including a (HCN/)COS hydrolysis reactor and the absorption of H_2S using a solvent such as MDEA amine. Sulphur is then recovered as either liquid or solid elemental sulphur (e.g. through a Claus unit), or as sulphuric acid, depending on market demands / Generally applicable *{This BAT conclusion is based on information given in Section 4.3.1.1}* **BAT-associated emission levels** The BAT-associated emission levels for SO_X are 3 – 16 mg/Nm^3, expressed as yearly averages. Only SO_2 is continuously measured, SO_3 is periodically measured (e.g. during calibration).
Summary of comments:	*1. <u>Technique a (acid gas removal (AGR))</u>: this technique may not be generally applicable in the case of biomass IGCC plants (DK_98).*
EIPPCB assessment:	**1. <u>Acid gas removal (AGR) (a)</u>: Biomass IGCC plants may not apply this technique due to the very low initial sulphur content in biomass.**
EIPPCB proposal:	**1. <u>Acid gas removal (AGR) (a):</u> add an applicability restriction in the case of biomass IGCC plants due to the very low sulphur content in biomass.**

1.11.5 BAT 85 and Table 10.57 – Dust, metal, ammonia and halogen emissions to air

Location in D1:

Section 10.7.1.4 – p. 801/802

Current text in D1:

85. In order to reduce dust, metal ammonia and halogen emissions to air from IGCC plants, BAT is to use one or a combination of the techniques given below:

Technique		Description	Applicability
a.	Syngas filtration	Filters used are fly ash cyclones, bag filters, ESP and/or candle filters to remove fly ash and unconverted carbon.	Generally applicable for dust removal. Bag filters and ESP are applicable for syngas temperature up to 400 °C.
b.	Syngas tars and ash recirculation to the gasifier	Tars and ash with a high carbon content generated in the raw syngas, are separated in cyclones and recirculated to the gasifier	Applicable for dust removal, in the case of a low syngas temperature at the gasifier outlet (1100 ºC)
c.	Syngas washing	Syngas passes through a water scrubber, where chlorides, ammonia, particles and halides are separated	Generally applicable, downstream of other dedusting technique(s)

{This BAT conclusion is based on information given in Section 4.3.1.1}

BAT-associated emission levels

The BAT-associated emission levels for dust and particulate-bound metal emissions to air are given in Table 10.57.

Table 10.57: BAT-associated emission levels for dust and metal emissions to air from IGCC plants

Combustion plant rated thermal input (MW_{th})	BAT-AEL			Monitoring frequency
	Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V (mg/Nm^3) (Average of samples obtained during one year)	Hg ($\mu g/Nm^3$) (Average of samples obtained during one year)	Dust (mg/Nm^3) (yearly average)	
≥ 100	< 0.025	< 0.12	0.4 – 2.5	Dust: continuous measurement Metals: periodic measurements once/yr

Summary of comments:

1. *The BAT-AELs should be removed, as the technique is emerging (Euracoal_166_167_, Eurelectric_290_291_292_762_763_764).*
2. *Remove the metals BAT-AEL as metals are captured with dust emissions (Eurelectric_290_762, Euracoal_166).*
3. *Remove the Hg BAT-AEL as it depends on the fuel used (Eurelectric_291_763, Euracoal_166).*

EIPPCB assessment:

1. **IGCC is a process not widely used but it has been used for a number of years now gasifying coal or refining residues. It was described in the current (2006) LCP BREF and is recognised as a process in the refinery sector through the REF BREF. BAT 85 describes the techniques for the emission reduction of various pollutants. There is no submitted comment related to these techniques; so they cannot be considered emerging. The proposed emission level range for dust monitoring could be modified.**
2. **(+3.) The levels of metals, including Hg emitted to the air depend on both the type and quality of fuel/feedstock, which may sometimes be poor in the case of gasification, and also on the techniques used to reduce not only the level of dust emissions in general but also to target some particulate-bound metals that may be in excess and/or Hg emissions. Generally, the levels of mercury and other metals emitted at the outlet are low due to the high efficiency of appropriate BAT. Appropriate monitoring enables the control of the proper functioning of these techniques. By default, a monitoring frequency of once every year seems**

	appropriate. The BAT-AEL for Hg may be reviewed to take into account the assessment made on monitoring in Section 1.3.10 for coal combustion.
EIPPCB proposal:	**1. (to 3.) Keep the proposed BAT-AELs but change the dust BAT-AEL to: '< 2.5 mg/Nm^3'. Change the type of averaging periods in the case of periodic monitoring to: 'Average over the sampling period'. Change the BAT-AEL for Hg to < 1 µg/Nm^3 consistently with other lower end of the range in case of mercury emissions.** **4. The technical operational information related to the techniques is moved from applicability to the description where it fits better.**

1.12 Other multi-fuel firing issues

Location in D1:	*Section 10.5 – p. 785*
Current text in D1:	*No text*
Summary of comments:	*General* *1. Define rules for using BAT-AELs in the case of multi-fuel firing (e.g. solid and liquid) (SE_75, CEPI_11).* *Solid multi-fuel firing* *2. BAT conclusions for solid multi-fuel firing (coal, wood biomass and peat) are missing; they shall be added. (FI_83, Eurelectric_553_648, FR_73_84, PL_50).* *3. The coverage of the BAT-AELs should be increased to cover all fuel combinations within the scope of the BREF (FI_11).* *4. Include dedicated section on co-combustion of coal and biomass (Eurelectric_680, Euracoal_161_131).* *5. Set the IED Annex V limits for plants, where investment process leading to ecologisation of operation was already initiated, to the end of lifetime of corresponding ecologisation (CH_141).* *Other multi-fuel firing* *6. Cover the multi-fuel firing between coal and industrial process gases (Eurelectric_645) and biomass (FI_54).* *7. Boilers using coal as main fuel and supplemented with iron and steel process gases should be excluded from the section on iron and steel process gases and dealt with in the multi-fuel firing Section (SE_97, Eurofer_162_166_167_173_182). Short-term averages should be proposed for such plants (AT_125).*
EIPPCB assessment:	**1. (to 6.) The multi-fuel firing may be simultaneous or non-simultaneous. BAT conclusions and BAT-AEPLs are proposed when independently combusting fuels covered in Sections 10.2, 10.3 and 10.4.1. Sections 10.4.2 and 10.5.1 on the combustion of iron and steel process gases and process fuels from the chemical industry cover the simultaneous multi-fuel firing of these fuels with other gaseous and/or liquid fuels. For other mixtures of the aforementioned fuels combusted simultaneously, the techniques applicable for the combustion of each individual fuel-type apply to the combustion of the mixture of fuels. The mixing rule applying to ELVs set in article 40 of the IED may apply also to the case of BAT-AELs. It is not deemed necessary to repeat these rules in the BAT conclusions.** **7. Reported data from plants combusting iron and steel process gases show two types of plants: plants combusting mainly iron and steel gases mixed with a limited a limited amount of auxiliary gaseous or liquid fuels, and plants combusting mainly coal and/or lignite mixed with iron and steel process gases in small proportion. The former type of plant may be covered by a standalone section as the plants behave in a similar way whereas the later type of plants behave more like coal-fired plants used in a multi-fuel firing configuration, as described in the above paragraph 1.**
EIPPCB proposal:	**1. (to 6.) Do not set specific BAT conclusions for simultaneous combustion of fuels other than those included in Sections 10.4.2 and 10.5.1.** **7. Limit the scope of the section on iron and steel process gases combustion to those fuels mixed with other gaseous and/or liquid fuels.**

2 ITEMS NOT PROPOSED FOR DISCUSSION DUE TO THE NEED TO FOCUS ON MOST OUTSTANDING ISSUES AND TO THE TIME CONSTRAINTS FOR THE FINAL TWG MEETING

2.1 Drawing up of a formal Draft 2 before the final TWG meeting

Location in D1:	*Whole document*
Current text in D1:	Whole document
Summary of comments:	*Draft 2 is necessary:* 1. *should there be proposed modification to conclusions (E&P_57, CZ_57),* 2. *for a better regulation (SE_57),* 3. *because the methodology is not clear enough or needs to be improved/discussed (DE_27_140, ETN_140, EUTurbines_2, UK_106, PL_1, EL_1, Eurelectric_187, E&P_1, IE_1, FR_75),* 4. *as not enough time is given for commenting (ETN_140, EUTurbines_2_3),* 5. *as conclusions are not aligned with the IED Chapter III and Annex V (ETN_69, UK_106, IE_1),* 6. *as separate categories for plants <50 MW_{th} are missing(UK_106),* 7. *as applicability should be reviewed for existing plants and different load modes (UK_106),* 8. *in order to reconsider economic issues (UK_106, PL_1, EL_1, Eurelectric_187, E&P_1, ETN_140, EUTurbines_2),* 9. *as there is an increase in monitoring burden (UK_106),* 10. *as D1 is incomplete and/or a lot of comments have been submitted (SP_3_4, UK_106, AT_7, NO_1, Eurelectric_187_461_1036, EL_1, PL_1, E&P_1, CEFIC_22, CZ_2, Marcogaz_1, EUROMOT_91),* 11. *because there are no proven techniques to achieve AEPLs (PL_1, E&P_1).* 12. *Some comments are submitted without any rationale (COGEN_1, Euracoal_87, Eurelectric_125).*
EIPPCB assessment:	**1. See the EIPPCB email to the TWG dated 05.12.2013, available in BATIS at: Forums > Large Combustion Plants > Review of the LCP BREF 2011- > 0 Messages to the TWG**
EIPPCB proposal:	**1. A review process including only one formal draft (D1) before holding the plenary Final TWG Meeting is appropriate and sufficient for completing the review work at the LCP TWG level.**

2.2 Consistency of the proposed BAT conclusions with the IED Chapter(s) 3 (4) and Annex V (VI)

Location in D1:	*Chapter 10*
Current text in D1:	No text
Summary of comments:	*1. <u>General</u>* *1.1. Great potential disparity in the interpretation of some issues (averaging period, applicability of IED ELVs in case of derogations, definition of emergency and peak load plants, remaining plant lifetimes, uncertainty of measurement, monitoring regimes) for permit purposes, operation modes (DK_148, UK_68, IE_2, SE_53, E&P_2, Eurelectric_840)* *1.2. Use the definitions of new/existing plants of the IED for the BREF (PT_10)* *1.3. Definitions in general are the same as the ones of the IED or may be specific to the BREF. Use only the IED definitions (PL_66) or include all definitions (similar and different ones) in the BREF (SE_11)* *1.4. Connect the list of fuels/wastes covered by the scope with the applicable IED regime (Chapter 3 or Chapter 4 of the IED for combustion plants and incineration) (PL_59_61).* *2. <u>Transitional and special arrangements</u>* *2.1. Lack of consideration of temporary or permanent derogations for setting BAT conclusions (Isolated systems according to IED art. 34, limited lifetime acc. IED art. 33, higher ELVs for plants operated <1500 h/yr which were granted a permit before 2002) (EL_2_6_95, CZ_130, FR_78_79, PL_6_12_14, E&P_12_14_129, Eurelectric_620_389_714_976, ETN_52, E&P_139_148, UK_15)* *2.2. Modify definition of existing plant to exclude the ones subject to the transitional derogations of the IED (Art. 32 - 35) (Eurelectric 574_853, Euracoal_97) or include footnotes in the BAT conclusions to have them explicitly excluded (CZ_116, E&P_115)* *2.3. Include in the BREF a possibility for plants firing indigenous fuels to use desulphurisation rates instead of concentrations limits, according to IED article 31 (Eurelectric_47_714_748_1005, Euracoal_154).* *3. <u>BAT-AELs differ from ELVs</u>* *3.1. Include clarifications when BAT-AELs differ from what is stated in Chapters 3 and 4 and Annexes V and VI (SE_7_81, CEFIC_14_ 16_18_42), or align the higher end of the BAT-AEL ranges with the ELVs set in the Annexes V and VI to the IED (CZ_50_160, FR_101_102_103_110_111_112, PL_6_52_54_143, UK_4, CEFIC_9_10_32_33, Eurelectric_60_92_493_631, Euracoal_154, CZ_153_157, E&P_144_148_151_155_158_227, PT_26, UK_86) or exclude from the BAT the plants that were recently retrofitted to comply with the IED (CZ_115_119_129, E&P_128) or remove BAT-AELs when there are no ELVs for the same pollutant in the IED (ES_50_54, PL_32)* *4. <u>Monitoring</u>* *4.1. Include the periodic monitoring for plants <100 MW_{th} instead of continuous monitoring, for consistency with IED (CZ_108_124_157_159, PL_140_144, IT_135, PT_103, Eurelectric_720, E&P_14_30_108_123_140, ETN_13, Marcogaz_48_126, CZ_142, SE_12)* *4.2. The monitoring frequency differs from the one of the IED for mercury emissions to air (EL_88, PL_148_150, Eurelectric_106_107, E&P_105, PT_103)* *4.3. Add footnote referencing to IED derogations for monitoring if the operator can prove that the SO_2 emissions can under no circumstances be higher than the prescribed emission limit values (E&P_130, eurelectric_687_67_953_145).* *4.4. Apply only the monitoring requirements of the IED (DE_30).*
EIPPCB assessment:	**These topics are related to the implementation of the IED. This item is not included in the mandate of the LCP BREF TWG. Derivation of BAT conclusions and BAT-AEPLs is performed according to Commission Implementing Decision 2012/119/EU. The use of different parameters to those used/defined in the IED is possible as other parameters can reflect common practices/definitions in the BREF series or be linked to the data/information available/submitted in the information exchange process.** **The sole purpose of the definitions in the BREF and in the BAT conclusions is for**

	the use of the BREFs and BAT conclusions and they do not in any way represent an interpretation of the IED. Furthermore, the sentence 'For the purpose of these BAT conclusions, the following definitions apply' in the general introduction of the BAT conclusions allows for introducing only the definitions different to those of the IED. The intermediate informal TWG meeting held in Seville in June 2014 allowed discussions on the main issues of concern regarding the consistency between the IED Chapter 3 and Annex V and the BREF.
EIPPCB proposal:	• **No generic change proposed. Assessment BAT by BAT according to the detailed submitted comments and available data/information.** • **See DG ENV FAQ on BAT conclusions' applicability for plants benefiting from derogation according to IED Articles 32 to 35.** • **See the presentations delivered at the TWG intermediate informal meeting held on 17-18.06.2014 and the associated ways forward available on BATIS at: Forums > Large Combustion Plants > Review of the LCP BREF 2011- > 09 Informal intermediate TWG meeting.**

2.3 Missing sections, techniques or BAT-AELs

Location in D1:	*Chapter 10*
Current text in D1:	No text
Summary of comments:	*1. Missing sections* *1.1. Add an individual section in Chapter 10 related to district heating plants with thermal power input < 200 MW_{th} (E&P_11, PL_11).* *1.2. Liquid biomass is missing (CEPI_13).* *1.3. The conclusions may not be representative enough of the petrochemical sector (CEFIC_83).* *1.4. Add a section (BATc) on dioxin emissions from coal-fired power plants (FR_8).* *2. Techniques* *2.1. Circulating dry scrubber is a BAT that should be considered each time SDA has been considered as BAT (EPPSA_5_420).* *3. BAT-AELs* *3.1. Tin (metal) is not covered (DE_30_171).* *3.2. Set BAT-AELs for dioxins in coal combustion (FR_104).* *3.3. Review the BAT-AELs for including up-to-date performance regarding CFB and BFB boilers (Eurelectric_619).* *3.4. Separate BAT-AELs should be set for plants located in small isolated systems (EL_9, Eurelectric_635, PT_47).*
EIPPCB assessment:	**1. Missing sections** **1.1. As far as the BAT conclusions are concerned, district heating plants of < 200 MW_{th} have been considered within the set of similar plants from the technical point of view, and the applicability of BAT has been assessed based on the available information and on the detailed comments submitted, for each category of plant, and for each pollutant.** **1.2. Not enough information was made available to the TWG to propose BAT conclusions on liquid biomass-fired plants.** **1.3. Combustion plants used in the chemical sector are covered by the LCP BREF scope, including plants operated in the petrochemical sector (decision taken at the KOM). Opportunities were given to submit appropriate plant level data and bulk information. More than 70 plants operated in this sector submitted data through questionnaires.** **1.4. Emissions of dioxins are mainly from biomass plants according to KOM conclusions (report Section 3.4) – Not the main concern for such plants.** **2. Techniques** **2.1. Techniques considered BAT are assessed for each fuel and plant size depending on the available information. The list of techniques is neither exhaustive nor prescriptive. According to information provided by EPPSA (Additional information EPPSA-02 and EPPSA-03), the technique has been mainly applied to coal/lignite/waste-fired plants.** **3. BAT-AELs** **3.1. Tin has not specifically been identified as a key environmental parameter and no data were submitted through the questionnaires or bulk information. The proposed list of metals in D1 is based on the list of metals for co-incineration included in Annex VI of the IED.** **3.2. Dioxins emissions to air have been assessed in the case of coal and/or lignite combustion. BAT-AELs were not proposed as the emissions are deemed relatively low and other more relevant pollutants need to be tackled with priority.** **3.3. All available CFB and BFB plants provided in the data collection have been included in the assessment for proposing BAT-AELs.** **3.4. SIS was one of the technical issues on the agenda of the intermediate meeting held in Seville in June 2014. This meeting concluded on the way forward: 1) additional complementary data/information from new and retrofitted engines with SCR on French islands should be submitted as soon as possible, and 2) the TWG will help identify on the list of submitted questionnaires the ones corresponding to combustion plants located on SIS/MIS. Special conditions expressed in the comments may be considered as local specificities. The data collection includes several plants located on islands and therefore the**

	performance of plants located in these areas is taken into account in order to propose BAT and BAT-AEPLs.
EIPPCB proposal:	**1. <u>Missing sections</u>** **1.1. Do not create a specific section for DH plants in the BAT conclusions. Assess case by case the need to address DH-specific aspects in the BAT conclusions, e.g. via footnotes for the general BAT-AELs or by adding information under the applicability of techniques.** **1.2. Do not include BAT conclusions specific to liquid biomass-fired plants.** **1.3. Keep combustion plants operated in the (petro) chemical sector in the scope.** **1.4. Do not create an additional section on dioxins for coal-fired plants.** **2. <u>Techniques</u>** **2.1. Include the circulating dry scrubber in the list of BAT for SO_X reduction as long as it is supported by available information.** **3. <u>BAT-AELs</u>** **3.1. Do not propose BAT-AELs for tin.** **3.2. Do not propose BAT-AELs for dioxins emissions to air from the combustion of coal and/or biomass.** **3.3. (and 3.4) Do not propose general separate BAT-AELs for CFB/BFB boilers and for plants located in SIS. Include on a case by case basis, depending on the outcome of the assessment and, if needed, information related to such combustion plants.**

2.4 Implementation issues

Location in D1:	*Whole BREF*
Current text in D1:	None
Summary of comments:	1. *Energy efficiency* 1.1. *Add an explanation on how to deal with the energy efficiency data in Chapter 10 for the purpose of permitting (NL_42).* 1.2. *BAT-AEPLs should be indicative and not compulsory, in accordance with the IED article 19(2). Provide indications accordingly in the general considerations (EL_10).* 2. *Aggregation rules* 2.1. *Add in the general consideration a paragraph linking the use of BAT-AELs defined in the BREF and the use of ELVs defined in the IED in case of aggregated units (SE_25).* 3. *BAT-AEPLs* 3.1. *Give indications on how the BAT-AEPLs shall be transformed into binding emission limit values (CZ_65, Euracoal_173, E&P_65).* 3.2. *The BAT-AEPL statements should mention that it's up to the competent authorities to set the ELVs in the permits (PL_51).* 3.3. *Add to the general considerations that the compliance with BAT-AELs should be based on validated averages (EL_12).* 3.4. *Set a 40 % uncertainty for HCl and HF with a view of complying with validated ELVs related to these pollutants (CZ_E&P_66_67).* 3.5. *Insert a statement that BAT-AELs may not be applied in the case where the requirements of the IED articles 31 to 35 are fulfilled (Euracoal_107, Eurelectric_585_865).* 3.6. *The conclusions should state that when derogation is granted based on the IED article 15(3), these BAT-AELs do not apply (Eurelectric_652).*
EIPPCB assessment:	**The BREF and BAT conclusions do not aim at interpreting the IED or at describing how the BAT conclusions should be implemented. If needed, the Commission may issue FAQ providing information or guidance on the IED. BAT-AELs and BAT-AEPLs are concepts described in the IED and in Commission Implementing Decision 2012/119/EU.**
EIPPCB proposal:	**Do not include in the LCP BREF and BAT conclusions provisions related to their implementation.**

2.5 BAT 1 - Environmental management system (EMS)

Location in D1:	*Page 740*
Current text in D1:	**1. In order to improve the overall environmental performance of large combustion plants, BAT is to implement and adhere to an environmental management system (EMS) that incorporates all of the following features:** i. commitment of the management, including senior management; ii. definition of an environmental policy that includes the continuous improvement of the installation by the management; iii. planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment; iv. implementation of procedures paying particular attention to: (a) structure and responsibility (b) training, awareness and competence (c) communication (d) employee involvement (e) documentation (f) efficient process control (g) maintenance programmes (h) emergency preparedness and response (i) safeguarding compliance with environmental legislation; v. checking performance and taking corrective action, paying particular attention to: (a) monitoring and measurement (see also the Reference Document on the General Principles of Monitoring) (b) corrective and preventive action (c) maintenance of records (d) independent (where practicable) internal and external auditing in order to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained; vi. review of the EMS and its continuing suitability, adequacy and effectiveness by senior management; vii. following the development of cleaner technologies; viii. consideration for the environmental impacts from the eventual decommissioning of the installation at the stage of designing a new plant, and throughout its operating life; ix. application of sectoral benchmarking on a regular basis. Specifically for Large Combustion Plants sector, it is also important to consider the following potential features of the EMS: x. identify risk points for fuels subject to self-ignition and survey accordingly the fuel storage areas. **Applicability** The scope (e.g. level of details) and nature of the EMS (e.g. standardised or non-standardised) is generally related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have.
Summary of comments:	*General* • *Remove the BAT (CEFIC_25, DE_29). Management systems are generally accepted (EUTurbines_71). Technology-related BREF conclusions should not address organisational structures such as the Environmental Management System (Eurelectric_869_192).* *ii. definition of an environmental policy that includes the continuous improvement of the installation by the management* • *This definition should be limited to the minimum requirements of ISO14001 and EMAS and should not seek to add additional requirements to these standards (UK_12, E&P_17).*

	iv. (d) implementation of procedures paying particular attention to: employee involvement • *Certification of an EMS should be an option for the operator, and that decision should be based on a cost-benefit analysis, to be developed by the operator (PT_75).* • *Remove. This is not a requirement of ISO14001 (UK_13, E&P_18).* *vii. following the development of cleaner technologies* • *Remove. It is not a requirement of either EAMS or ISO 14001 (UK_13, E&P_18).* *ix. application of sectoral benchmarking on a regular basis.* • *Remove. It is not a requirement of EMAS or ISO14001 (UK_13, E&P_18).* *x. identify risk points for fuels subject to self-ignition and survey accordingly the fuel storage areas.* • *Remove. It is not part of an environmental management system (CEFIC_190, CEPI_26, Eurelectric_870).* • *Modify by identify risk points for fuels subject to self-heating/self-ignition and survey accordingly the fuel storage areas (FI_14).*
EIPPCB assessment:	**For consistency with the BREF series, the conclusion on environmental management systems is common to all BAT conclusions documents. The latest changes need to be reflected.** **The changes are the addition of 'recruitment' in BAT 1. iv(b), replacing 'efficient' with 'effective' in BAT 1.iv.f, updating the cross reference to the Reference Report on Monitoring of emissions to air and water from IED-installations (ROM) in BAT 1. v(a).** **A reference to specific features, mentioned in other individual BAT, which could be a relevant part of the EMS is added at the end of BAT 1. The following new items with references have been added, together with an introductory sentence:** **xi. quality assurance programme to ensure that the characteristics of all fuels are fully determined and controlled (mentioned in BAT 5);** **xii. Management plan regarding other than normal operating conditions (OTNOCs) (mentioned in techniques 6 and 6 bis);** **xiii. waste management plan (with techniques mentioned in BAT 13);** **xiv. environmental safety management system to identify and plan to prevent and deal with unplanned emissions to the environment.** **xv. dust management plan;** **xvi. noise management plan (with techniques mentioned in BAT 14);** **xvii. odour management plan;**
EIPPCB proposal:	**Include the modifications listed above.**

2.6 BAT 15 – Prevention of soil and groundwater contamination

Location in D1:	*p. 748*
Current text in D1:	**15. In order to prevent soil and groundwater contamination from the unloading, storage and handling of solid fuels and additives, BAT is to implement prevention measures including:** a. Storing fuels on sealed surfaces with drainage and drain collection and water treatment by settling-out b. Collecting and treating before discharge: i. any leakages from the point of generation, collection, handling, storage, and transport of waste; ii. surface run-off (rainwater) from fuel storage areas that washes fuel particles away (i.e. the settling-out portion is treated).
Summary of comments:	*1. General* *1.1. Remove the BAT. It should be part of EFS BREF (Eurelectric_572).* *1.2. Applicable to new plants only (E&P_66, UK_61, Eurelectric_573).* *1.3. Add b.iii.: sub-surface drainage (E&P_66, UK_61, Eurelectric_573).* *2. Technique a. Storing fuels on sealed surfaces with drainage and drain collection and water treatment by settling-out* *2.1. Replace with 'Where fuels and additives are used, technical measures shall be adopted so to eliminate their impact on the quality of water' (E&P_80) or 'When storing fuels and additives, technical measures to eliminate the possibility of affecting water quality must be taken if necessary, regarding the surface of the storage area'. (CZ_80).* *2.2. Replace with 'Storing fuels on surfaces which are either sealed or engineered to prevent groundwater contamination. Drain collection of water and appropriate water treatment' (E&P_66, UK_61, Eurelectric_573, EL_58).* *2.3. Add 'Except when the underground water was analysed during a significant period and no impact was observed' (PT_60).* *2.4. Add 'in case of risk of soil/groundwater contamination' (Eurofer_223).* *2.5. Difficult to retrofit existing plant with sealed surfaces for large solid fuel storage e.g. coal yard Review text as draft guidance document has been published (IE_15).* *2.6. Not generally applicable, e.g. for coal and lignite storage sites (Euracoal_135, Eurelectric_917_574_638).* *2.7. Similar groundwater protection is achieved than using sealed surfaces (ES_38).* *2.8. Add applicability 'Storing fuels on sealed surfaces is not always needed, depends on fuel properties. Collection and treatment off run-off water is dependent on the degree of contamination of run-off water (low concentration) and/or the size of the WWTP'. (CEPI_47).* *2.9. Clarify which type of fuels are meant (BE_45).* *2.10. Remove due to insufficient documentation or amend with 'Storing fuel on sealed surfaces with drainage collection and water treatment by settling out, depending on the local conditions (e.g. if the storage of fuel represent a risk of contaminating proper soil and usable ground water)' (DK_111).* *2.11. Add '...and water treatment by settling-out and oil separation' (CEPI_57).* *3. Technique b. Collecting and treating before discharge: i. any leakages from the point of generation, collection, handling, storage, and transport of waste;* *3.1. BAT 15b (i) is too wide depending on how waste is interpreted. Bottom ash is often stored outdoors on unpaved areas or paved areas without collection and treatment of surface water. Bottom ash has a very low content of heavy metals. Also gypsum (bad gypsum) - and sometimes fly ash (e.g. during the financial crisis) is stored outdoors without cleaning of the surface water / leachate (DK_114).* *3.2. Remove. There is no surface run-off water in the cases of lignite storage yards due to high water absorption capacity of the fuel. (EL_59)* *4. Technique b. Collecting and treating before discharge: ii. from fuel storage areas that washes fuel particles away (i.e. the settling-out portion is treated).* *4.1. Remove (Eurelectric_575).* *4.2. BAT 15b (ii) is more or less a repetition of BAT 15a. (DK_113).*

EIPPCB assessment:	• **Remove all or part of the BAT conclusion (comments 1.1, 2.10, 3.2, 3.3). Soil and groundwater contamination is more widely related to uncontrolled and/or unplanned (accidental) discharges. This contamination may be difficult and costly to mitigate. IED Article 14(1)(b) and (c) requires permit conditions to include measures to protect soil and groundwater (Article 14(1)(b)). The EMS BAT conclusion could be a good option for including a flexible proposal to deal with soil/groundwater contamination.** • **Not generally applicable/risks not equal (comments 1.1, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 3.1, 3.2). As the risks related to the soil/groundwater contamination may vary from one site to another, there is a need to take a risk-based approach to all materials and situations.** • **Clarify, enhance, add techniques/extend scope (comments 1.3, 2.1, 2.2, 2.11). More details of techniques are found in the EFS BREF. The proposal requires a general risk-based approach to applying suitable techniques to the specific installation, rather than a more detailed one and/or for a few specific issues.** • **Clarification of fuels covered (comment 2.9). The contamination risk is not only dependent on fuel type. Other materials are handled and stored, i.e. additives (included), by-products and wastes, which should also be considered.** • **Review in light of site baseline report guidance (EC Guidance 2014/C 136/03), (comment 2.5). This guidance clarifies that the baseline report is only to establish the possibility and state of contamination from hazardous substances. It does not deal with current activities or pollution prevention. It is required for all installations for the first permit review after 7 January 2013.** **Other sources** • **IED Annex III requires that the BAT be determined to prevent accidents and minimise their consequences for the environment.** • **The LCP Kick-Off-Meeting (KOM) (Section 6 of the meeting report) acknowledged potential soil contamination and that health and safety aspects of the BREF could be improved on.** • **Other unplanned releases are relevant including possible fires and explosions releasing contaminants to air. Particular attention should be given to the risk of self-heating and to self-ignition of fuels.** • **Spillages, leakages, firefighting, etc. can also cause contamination of surface water.** • **Because of these risks, some LCPs are subject to Directive 2012/18/EC (Seveso III Directive), which requires a major accident prevention policy (MAPP) and a safety management system (SMS) designed for the protection of human health and the environment.**
EIPPCB proposal:	**Remove BAT 15 and include provisions in BAT 1 on an environmental and safety management system that is:** • **risk-based to minimise unnecessary effort;** • **in line with requirements for site baseline reports.**

2.7 BAT 16 – Design and decommissioning

Location in D1:	*p. 748*
Current text in D1:	**16. In order to prevent pollution upon decommissioning, BAT is to use the following techniques for new plants.** Design considerations for end-of-life plant decommissioning: a. considering the environmental impact from the eventual decommissioning of the installation at the stage of designing a new plant, as forethought makes decommissioning easier, cleaner and cheaper; b. considering the environmental risks for the contamination of land (and groundwater) and the generation of large quantities of solid waste; preventive techniques are process-specific but general considerations may include: i. avoiding underground structures; ii. incorporating features that facilitate dismantling; iii. choosing surface finishes that are easily decontaminated; iv. using an equipment configuration that minimises trapped chemicals and facilitates drain-down or cleaning; v. designing flexible, self-contained units that enable phased closure; vi. using biodegradable and recyclable materials where possible.
Summary of comments:	• *Remove this technique. Not be relevant for planning, building and operating large power plants because their influence would probably be contra productive to efficiency and low emission concepts. (Eurelectric_639_245_576, DK_115, Euracoal_15).* • *Include as a BAT a study of the state of contamination of soil and groundwater before and after the decommissioning process, to determinate the state of contamination of the site and the impacts of decommissioning process (PT_15).*
EIPPCB assessment:	• **Consideration of the environmental impacts of the eventual decommissioning of the installation at the stage of designing a new plant, and throughout its operating life is addressed in BAT 1 (viii), making BAT 16 redundant.**
EIPPCB proposal:	• **Remove BAT 16.**

2.8 Deriving BAT and BAT-AEPLs

Location in D1:	*Whole Chapter 10*
Current text in D1:	No text
Summary of comments:	1. *Clarify the methodology for selecting BAT, for determining the lower and the upper values of each BAT-AEL, and for considering the conditions when they apply. (AT_5, BE_6_58, CZ_13_14_68_97_105_111_128_133_140_144_148_151_154_155, DE_11_14_18_39_42_46, EL_11, IT_106_145_174, NL_33_66, NO_23, PL_8_56, PT_104_105_106, SE_70_78_99, EP_12_13_21, UK_3_16_23_69_73_94, CEFIC_1_3_4_5_13_14_20_24_32_77_82_268_235, CEPI_1,E&P_3_6_8_13_14_25_68_80_88_97_105_111_127_131_135_137_138_142_145_146_149_152_153_154_155_156_237, ETN_24_40_49, EURACOAL_44_45_46_88_179, Eurelectric_50_51_52_53_85_98_266_396_397_459_460_462_463_535, 564_621_641_677_727_839, Eurofer_2_17_18_20_23_24_132_158_161, EUROMOT_92, FI_3, FR_75_113_125, IT_58_92_95)* 2. *BAT-AELs should be set/considered in relation to all the parameters simultaneously (CZ_68, Euracoal_43_174, Eurelectric_49_394_459_622_674, Eurofer_161, Euroheat and Power_9_68, IT_96, NL_66, PL_9, UK_20).* 3. *Yearly averages or percentiles used to set lower and upper ends of the ranges of BAT-AEL should be increased to take into consideration the variability of the values collected (EL_60, Eurelectric_623_675).* 4. *BAT applicability, BAT-AELs and BAT-AEPLs cannot be elaborated considering only questionnaire data. Other parameters should be taken into account (guaranteed performance, year-to-year variability, energy market scenario, etc.) (DK_99, Eurelectric_395_642)* 5. *Consider local conditions and plant size when determining BAT (EUROMOT_94_95).* 6. *We appreciate the highly transparent revision process (i.e. questionnaires on BATIS, clear indication within the document, plots) of the BREF LCP (AT_8).* 7. *Introduce a "comparative BAT assessment / conditional BAT ranking" for new projects (EEB_150).* 8. *Economic issues and/or cross-media effects need to be better considered (EL_3_7, Euracoal_174, Eurelectric_627, EUTurbines_4, UK_1_26_70, PL_57, OGP_56).* 9. *Derive BAT and the upper end of the BAT-AEL ranges only from best performing plants. Not all data submitted should be accepted as BAT. In the USA, only the 10-15 % best performing are considered BAT (DK, EEB).*
EIPPCB assessment:	• **The process for deriving BAT and BAT-AEPLs is described in the BREF Guidance (i.e. Commission Implementing Decision 2012/119/EU laying down the rules concerning guidance on the collection of data and on the drawing up of BAT reference documents) and the Preface of D1. The holding of the final TWG meeting is part of this process.** • **Clarifications on the issue were circulated to the TWG in the EIPPCB email dated 05.12.2013 especially on how the information/data provided were used to draw up D1.** • **Cross-relationships between pollutants, availability of data from proposed reference plants, availability of additional bulk information, climatic conditions, plant size, and techno-economic applicability have been reviewed and considered in the assessment, and, when deemed necessary, for making proposals in light of the detailed comments submitted.** • **Based on data/information provided since the start of the LCP BREF review, elements for discussion are provided in the BP for each BAT.**
EIPPCB proposal:	**Decide on each BAT and BAT-AEPL at the final TWG meeting, using the EIPPCB assessment and proposal as the starting point for the discussion.**

2.9 Structure and presentation of information in the LCP BREF

Location in D1:	*Whole document*
Current text in D1:	No text
Summary of comments:	*1. Structure of the BREF* *1.1. The structure of the BREF is not 'completely in line' with the Guidance (Eurelectric_304).* *1.2. Harmonise the structures of the BAT conclusions and the BREF itself (BE_60).* *1.3. The BREF should include in only one chapter the combustion of conventional and unconventional fuels in the chemical sector. (CEFIC_1_23_114).* *2. Graphs in the 'Techniques to consider in the determination of BAT' sections* *2.1. Include information on the type of short-term averages (e.g. hourly, daily) that are reported in the graphs (AT_9, BE_6).* *2.2. Clearly separate in the graphs data reported from periodic monitoring and data reported from continuous monitoring (AT_68).* *3. Format of BAT conclusions, BAT-AELs and BAT-AEPLs* *3.1. The ranges are sometimes unclear: 'x to above y' or '< x' (ETN_1, Eurelectric_643).* *3.2. All interval type limits should be replaced with upper limits and the requirements should be of type <x (Eurelectric_137).* *3.3. Remove the word 'above' in the expression of some BAT-AEEL upper ends (E&P_182).* *3.4. Clarify that BAT-AELs for NH_3 are only valid if SCR or SNCR is used (BE_31).* *3.5. Include very detailed information when the lower end of the range is set based on one specific plant (Eurelectric_624).* *3.6. Change the statements by using systematically and consistently 'an appropriate' before mentioning the list of techniques (Eurelectric_864).* *3.7. Insert the description of each technique instead of referring to the Section 10.8 (UK_22, E&P_212).*
EIPPCB assessment:	**1. Structure of the BREF** **1.1. The structure of D1 is in line with the general principles set out in Section 2.2. of the BREF Guidance (Commission implementing decision 2012/119/EU of 10.02.2012 laying down rules concerning guidance on the drawing up of BREFs) that gives flexibility when the BREF covers 'different subsectors' which is the case here with the different fuel-specific chapters.** **1.2. The use of the BREF and of its conclusions is improved if the BAT conclusions and the supporting information in the previous chapters are aligned.** **1.3. The structure of the BREF is based on fuel type used, regardless of the sector that the combustion plants belong to. In the case of energy supply at chemical plants, plants burning 'conventional' fuels are covered by the corresponding chapters (e.g. liquid fuels or natural gas combustion). Should there be specificities linked to the combustion of such fuels for supplying chemical plants, they are described in the corresponding chapters. Plants burning process fuels from the chemical sector deserve a separate section/chapter.** **2. Graphs in the 'Techniques to consider in the determination of BAT' sections** **Important contextual information e.g. on averaging period, monitoring, load modes and load factors, age of the plants, is included with the graphs in order to help understanding and analysis. The way information is presented could still be optimised before the release of the final draft of the revised LCP BREF. In order to facilitate the discussions at the final TWG meeting, standalone documents including graphs containing data from all the plants that submitted a questionnaire (including tables with important contextual information) will be made available to the TWG in advance of the final TWG meeting. The graphs and contextual information presented in the various sections entitled 'Techniques to consider in the determination of BAT' of the revised LCP BREF will be updated after the final TWG meeting to reflect the decisions taken by the TWG.** **3. Format of BAT-AE(P)Ls and BAT conclusions** **3.1. (to 3.3.) As stated in the BREF Guidance (Commission implementing decision 2012/119/EU of 10.02.2012 laying down rules concerning guidance on the drawing up of BREFs), the environmental performance levels associated with**

	BAT are to be expressed as ranges (rather than as single values) as a range may reflect the differences within a given type of installation that result in variations in the environmental performances achieved when applying BAT. Section 3.3 of the BREF Guidance gives provisions for expressing correctly BAT-AE(P)Ls. **3.2. There is a footnote to the BAT-AELs on NH_3 to inform about its applicability only when SCR and/or SNCR are used.** **3.3. According to Section 3.3.1 of the BREF Guidance, *'information can be added* [to the BAT-AEL range] *to explain under what conditions the lower end of the range can be achieved or to reflect different performances of different techniques*'.** **3.4. The BAT conclusion statements are usually in the form of using 'one or a combination of' techniques or 'a combination of' techniques when at least two of the quoted techniques would be needed to achieve the proposed BAT-AEL. As the list of techniques is a 'toolbox', the appropriateness of the techniques is site-dependent and implicitly already included in both aforementioned statements. The use of 'appropriate' before these statement is possible when there is an intent to stress that not all the techniques apply at the same time and that the selection should be done very carefully, on a site by site basis (e.g. when no BAT-AE(P)Ls are associated with a list of techniques).** **3.5. When a technique is repeated several times throughout the BREF, its description is in general located in Section 10.8 and reference is made to it in the description cell of the different BAT tables concerned. When it is not repeated and the description is quite simple, it can be reported directly in the BAT table.**
EIPPCB proposal:	**1. <u>Structure of the BREF and BAT conclusions</u>** **1.1. Keep the general structure of the BAT conclusions and of the BREF.** **1.2. Align as much as possible the order of the BAT conclusions with the order of the supporting information in the BREF.** **1.3. Keep the proposed structure for covering combustion plants supplying energy at chemical plants.** **2. <u>Graphs in the 'Techniques to consider in the determination of BAT' sections</u>** **Provide graphs showing the plotting of both short-term and long-term emission data, along with tables on the associated averaging periods and monitoring, as working documents for the final TWG meeting.** **Update, after the final TWG meeting, the graphs in the various 'Techniques to consider in the determination of BAT' sections of the revised LCP BREF with the associated introductory text including an update of the contextual information according to the decisions taken at the final TWG meeting.** **3. <u>Format of BAT-AE(P)Ls and BAT conclusions</u>** **3.1. (to 3.3.) Keep the format stipulated in the BREF Guidance to express the BAT-AE(P)Ls as ranges.** **3.4. See new BAT 4 bis.** **3.5. When deemed necessary by the TWG, specify how (i.e. using which technique(s)) the lower/higher ends of the BAT-AE(P)L ranges can be achieved.** **3.6. Do not use the word 'appropriate' systematically or extensively in the BAT conclusion statements.** **3.7. Keep the description of techniques in Section 10.8 when they are complex or repetitive, along with a cross reference in the BAT tables concerned.**

2.10 Use of SO_X and/or SO_2 in the BREF

Location in D1:	*Whole Chapter 10*
Current text in D1:	No text
Summary of comments:	*General* *1. Change SO_X to SO_2 in the whole document as the provided data refer to SO_2 and not to SO_X (FI_90, IT_57_180_182, ES_21, UK_11, CEPI_19, E&P_11, Euromot_76_106, Eurelectric_545).* *2. SO_X is not consistent with the parameters defined for ELVs in the IED Annex V (PT_90); SO_3 levels of emissions are low.* *3. SO_3 cannot be continuously monitored (EL_8, Eurelectric_96_578_633_653_712_857_927, Euracoal_100, CEFIC_78).* *4. SO_3 is not relevant in lignite-fired plants where only primary measures are used for NO_X reduction (no SCR) and WFGD is used (EL_76).* *5. For biomass, focus solely on SO_2 for biomass, rather than on SO_X (E&P_129, Eurelectric_141, 66).* *6. For liquid fuel in engines, SO_3 is not relevant when only primary techniques are used; SO_3 is only relevant when SCR is used (EL_127).* *Monitoring* *7. Keep monitoring of SO_3 once/yr (PL_140, Eurelectric_720).* *8. Remove SO_3 monitoring as there is only a minor SO_2 oxidation during the combustion of coal, and a large part of the generated SO_3 condenses on the fly-ash or is removed together with SO_2 (DK_133).* *9. Delete the footnotes on monitoring in the tables related to BAT conclusions on SO_X (PL_139, Eurelectric_144).* *10. For liquid fuel in engines, change the footnote on monitoring in the related BAT-AEL tables to 'Only SO_2 is continuously measured, SO_3 is periodically measured (e.g. 1 time/year)' (EL_128).*
EIPPCB assessment:	**General** **1. (to 6.) Most of the plant-specific questionnaires submitted do indeed refer to SO_2 emission values and not to SO_X expressed as the sum of SO_2 and SO_3. CEMS routinely measure only SO_2. According to the comments submitted, SO_3 emissions are expected to be small, representing generally 1-2 % of the total sulphur emitted, or up to 5 % when SCR is used.** **Monitoring** **7. (to 10.) SO_3 is not systematically monitored and emission levels were not reported. However, SO_2 can be oxidised to SO_3 in non-negligible amounts when SCR is used.**
EIPPCB proposal:	**General** **1. (to 6.) Replace SO_X with SO_2 in the BAT-AEL tables (and in all the tables of the BREF where SO_X emission data are reported) but keep the reference to SO_X in the BAT statements.** **Monitoring** **7. (to 10.) Remove the footnote related to SO_3 monitoring associated to the BAT-AELs for SO_X emissions. Add in BAT 5 the periodic monitoring of SO_3 once a year when SCR is used.**

2.11 Definitions

Location in D1:	*P. 735 – Chapter 10 – Definitions*
Current text in D1:	No text
Summary of comments:	1. Fuels 1.1. *There is no definition of '**Non-commercial fuel**' (E&P_62, CZ_62) – Proposal to add it, as 'Fluid or gaseous residuals of chemical production process that are solely or as mixed together with other commercial fuel used for own consumption in particular installation.'* 1.2. *Detail the definitions of different types of '**Coal/lignite**' if used (PL_69).* 1.3. *Specify that LFO/HFO are '**Commercial**' products (CONCAWE_33, EL_8_9).* 1.4. *Further detail the definitions of '**LFO**' and '**HFO**' (PL_77_78, Eurelectric_669_670, CONCAWE_34_36); the LFO definition should explicitly include 'gasoil', 'diesel oil', 'distillate oil' that are expressions also used in the BREF (PT_73).* 1.5. *Modify the definition of the '**Chemical process fuels**' to cover its combustion in a Plant with a different operator than the chemical installation (PT_9_35)* 1.6. *Introduce '**Natural gas**' and '**Other gases**' definitions (PL_37).* 1.7. *Introduce the definition of '**Emergency fuel**' or '**Back-up**' fuels (Eurelectric_638).* 2. Energy 2.1. *Modify the definition of '**Net electrical efficiency**' to: 'Ratio between the net electrical output of the plant expressed as fuel input (fuel lower heating value) at the combustion plant boundaries.' (DK_62, PL_71, Eurelectric_575_653_665_854. Euracoal_98).* 2.2. *The definition of '**Net electrical efficiency**' ignores imported works power (DK_65, UK_4, E&P_8) or should not include the auxiliaries consumption (IT_61).* 2.3. *Modify the definition of '**Net total fuel utilisation**' to subtract the imported energy (DK_66).* 2.4. *Modify the definition of '**Recoverable heat**' to: 'Difference between the fuel energy thermal input and the sum of the net electrical output expressed as energy and net thermal input.' (DK_64, PL_73, UK_56, E&P_9, Eurelectric_576_666_855).* 2.5. *Indicate the rules to determine the net heat in the definition of '**Recoverable heat**' (Eurelectric_654, IT_62).* 2.6. *Introduce a definition of 'Combustion plant whose **main purpose is heat production**' (Eurelectric_687).* 3. Plant/Installation/Process 3.1. *The definition of '**Emergency plant** / mode' should be consistent with the IED (PL_68, Eurelectric_577_667) or avoid any confusion on the nature of the plant (interpretation of what is an emergency plant, could also be called reserve plant in district heating) (FI_89, IT_64, Eurelectric_856, Marcogaz_3_37_94).* 3.2. *The definition of '**Emergency mode**' should also include the situation when a plant uses an alternative fuel for <500 h/yr (UK_5, PT_72, E&P_10).* 3.3. *Add definitions for '**Industrial installation**', '**Combustion installation**' and '**Combustion unit**' (Eurelectric_655), or for '**Installation**' (FR_62, SE_16, IT_60, E&P_32) and for '**unit**' (FR_62, SE_24).* 3.4. *Modify the definition of '**Combustion plant**' to include the aggregation rule of the IED articles 28 and 29 (PL_67, ETN_38, Marcogaz_34).* 3.5. *The definition of '**Combustion plant**' should show more clearly that the perimeter of one plant corresponds to the one determined by the monitoring analyser, as used in the questionnaire (FR_62, CEFIC_26).* 3.6. *The definition of '**Combustion plant**' should be modified to include the cases where the flue-gases of different units are treated at unit level before being mixed and released to air (PT_71).* 3.7. *Include, in the perimeter of the '**New plant**' definition the plant's accessories, to avoid to consider 'new' an existing combustion plant that would be replaced by a new one but would keep the same accessories (Marcogaz_36, ETN_39). Partial upgrading of an existing plant should not be considered as new plant (ETN_53).* 3.8. *Improve the definition of '**New plant**' to include plants under construction when the BREF will be published (CZ_61, E&P_15_35_61, Eurelectric_630, ETN_22), being more precise on the type of permit mentioned (PL_1_15), or setting a pivot date (UK_2, E&P_5) or referring to the date of application for a permit and not to its granting (PL_187), clarify which facilities are considered "new and existing" (ES_15).* 3.9. *Expand the definition of '**Boiler**' by adding: 'device intended for production of high*

	parameter steam used for steam turbine drive, production of steam for technology purposes or production of hot water used for indoor heating' (PL_74). *3.10. Develop further the definitions of process furnaces and heaters that are mentioned in the definition of '**Boiler**' (PL_75).* *3.11. Include a definition of '**Turbines for mechanical drive**' (IT_63, Marcogaz_35_92).* *3.12. Split the definition of '**Post-combustion plant**' into two definitions: the first one would refer to after-burning of unburned fuels volatile compounds and the second one would refer to raising the temperature of the flue-gas (PL_76, Eurelectric_668).* *3.13. Include definitions for '**Waste incineration**' and '**Waste co-incineration**' plants (SE_28).* *3.14. Include a definition of '**Combustion**' (SE_16).* *4. Averages* *4.1. The definition of '**Yearly average**' should be modified to fit with different monitoring requirements throughout Europe (e.g. sometimes based on daily average instead of hourly averages) and include 'valid' for the data to be considered for the average (Eurelectric_587_868, Euracoal_102).* *4.2. Modify the definition of '**Daily average**' according to last approved BREFs (IT_66). If the definition is different, provide additional explanation (NL_34).* *4.3. Include guidance on how to deal with OTNOCs in the definitions of '**Daily and Monthly averages**' (SE_83).* *4.4. Remove 'weighted according to the daily flows' from the definition of '**average of samples obtained during one year**' in the case of emissions to water (FI_13).* *5. Monitoring* *5.1. Modify the definition of '**Continuous measurement**' to 'Direct measurement of the emission concentrations in waste gases using a 'continuous emission monitoring system' (CEM) permanently installed on site' (Marcogaz_38).* *5.2. Include in the '**Continuous measurement**' definition the PEMS-type measurement (Marcogaz_4, ETN_35, Eurelectric_858) and/or the definition of 'Indirect monitoring of emissions to air' (CONCAWE_37).* *5.3. Include in the '**PEMS**' definition the possibility to discontinuously monitor the parameters (PL_84).* *5.4. Modify the definition of '**Periodic measurement**' to consider the maximum and not the average value of 3 consecutive measurements (DE_31_172).* *5.5. The definition of '**Periodic measurement**' requires an average of 3 consecutive half hour measurements which is not always in line with practices throughout Europe (e.g. in case of limited operation, measurement of dioxins and furans, or of dust after fabric filter systems) (PL_83, UK_6, E&P_11, Euracoal_101, ETN_36, Eurelectric_668, Marcogaz_39).* *5.6. Include the possibility of time proportional sampling in the definition of '**Periodic measurement**' for water emissions in case of stable flow (CONCAWE_38).* *5.7. Add a definition for '**Indirect monitoring of emissions to air**' (CEFIC_188).* *6. Waste – By-products – residues* *6.1. Include a clear definition or the concepts 'residues', 'by-products' and 'waste' (DK_87).*
EIPPCB assessment:	**1. Fuels** **1.1. Non-commercial fuel is not explicitly referred to in the BAT conclusions but is included in the definition of 'Chemical industry gaseous and/or liquid process fuels'. The modification proposed for non-commercial fuel does not bring further clarity to the definition of process fuels from the chemical industry.** **1.2. The new proposed BAT conclusions for the combustion of coal and/or lignite no longer contain coal and/or lignite subcategories.** **1.3. 'Commercial' fuels and 'non-commercial' fuels with the same characteristics cannot be treated differently. Refinery fuels are clearly excluded from the scope.** **1.4. The plants from the data collection report in the questionnaires the use of 'Liquid fuel – Gas oil/light fuel oil – diesel'. Definitions may be based on the definitions given in Directive 2012/33/EU of 21 November 2012 amending Council Directive 1999/32/EC.** **1.5. The BREF covers the technical aspects of chemical process fuels combustion regardless of the location and operator of the combustion plant.** **1.6. Natural gas is already defined in the IED. The other gases identified in the conclusions are mainly chemical industry gaseous process fuels, iron and steel process gases, and other gaseous fuels (hydrogen-containing gas and syngas, excluding raw biogas, landfill gas and mine gas) according to the scope.**

	Defining these gases by their characteristics in a definition is almost impossible as they are very site-specific and do not share similar characteristics. **1.7. 'Emergency fuel' and 'back-up fuel' are not used for setting BAT conclusions or BAT-AELs.** **2. Energy** **2.1. (+2.2.) The current definition does not clearly state that the imported energy (e.g. for running the auxiliaries) should be subtracted from the electricity produced.** **2.3. The current definition does not clearly state that the imported energy should be subtracted from the energy produced.** **2.4. (+2.5.) 'Recoverable heat' is not any more used in the BAT conclusions.** **2.6. The use of 'combustion plant whose main purpose is heat production' is a mistake would have needed to be replaced by 'combustion plant whose recoverable heat generation does not exceed the heat demand' (text accompanying Figure 5.24 and Table 10.2 in D1), to be consistent with the rest of the same wordings in D1. However, it is proposed, according to the assessment on the type of conclusions for energy efficiency (see Section 1.1.5), to remove these mentions in the tables on energy efficiency BAT-AEELs.** **3. Plant/Installation** **3.1. There is no definition of emergency plant/mode in the IED. However, some plants are identified in the IED with the following wording 'Gas turbines (or engines) for emergency use that operate less than 500 operating hours'. The change to only 'emergency-load mode' could be considered to avoid discussions on the nature of the plants. This could also be considered for the other modes.** **3.2. The emergency-load mode refers to the combustion of any kind of fuel, be it the 'main' fuel or an 'auxiliary' one. This needs to be clear in the definition of each load mode.** **3.3. 'Installation' is already generically defined in IED Article 3(3). 'Industrial installation' and 'combustion installation' are not used in the BAT conclusions. There are no specific BAT conclusions for 'combustion units' even if they are mentioned in the definition of 'combustion plant' for the purpose of the aggregation rule.** **3.4. (to 3.6) As assessed in Section 1.1.2 of this BP on the scope, aggregation rules of the IED could also apply in the case of the LCP BREF.** **3.7. Only the 'complete replacement of a combustion plant' is considered as a new plant, and not the partial upgrades. This principle has already been applied in other BREFs (e.g. REF, PP).** **3.8. The definition of a 'new plant' uses the permit issuance as a clear milestone for differentiating between new and existing plants and is the standard text used in the last BREFs reviewed/drafted. As long as the permit is not issued, the project can undergo modifications as a result of its assessment by the competent authority.** **3.9. (+3.10) 'Boiler' is defined in the BAT conclusions mainly to allow differentiation in these conclusions between turbines, engines and boilers. The purpose is not to describe what a boiler is and its intended purpose, as this is already done through the scope and the definition of 'combustion plant'. Process furnaces and heaters are already further defined in the definitions.** **3.11. Turbines used for mechanical drive are included within the turbines category which is not further defined. They may be subject to different conclusions depending on the achieved performances, but this is reflected whether in the BAT conclusions or in the BAT-AELs without further need for definition.** **3.12. The definition of 'post-combustion plant' here is voluntary not exhaustive as it aims at detailing the plants covered/not covered by the scope where post-combustion plants are mentioned.** **3.13. Waste incineration and waste co-incineration plants are already defined in the IED and so there is no need to repeat the definitions in the BAT conclusions.** **3.14. Combustion as a process is already defined as 'fuel oxidation' within the 'Combustion plant' definition.** **4. Averages** **4.1. In the case of continuously measured pollutants, hourly averages are available regardless of the requirement set in the permit (hourly or daily averages). Furthermore, the compliance criteria of the IED include a criterion on the 95th percentile of hourly averages. The invalid data should be excluded from the average. 'Validation' concept of data refers to another issue discussed in Section 1.1.4 of this BP.**

	4.2. Consistency in wording with already approved BREFs is to be sought. **4.3. As per IED Article 3(13), the BAT-AELs have been derived for NOC, according to submitted data. Very little contextual information has been provided regarding the type of OTNOC to be considered in combustion plant operations. This information is available in Section 3.1.16 of the BREF but cannot be used in the BAT conclusions.** **4.4. The yearly average is flow-weighted of short-term average of samples. BAT-AELs for emissions to water has been reformulated in the section about General considerations.** **5. <u>Monitoring</u>** **5.1. (+5.2.) It is suggested to keep the proposed definition for the purpose of this BREF, which corresponds to direct monitoring by definition, and which is also the definition approved in last reviewed BREFs (e.g. REF, PP). For the purpose of this BREF, PEMS is defined separately, as it is identified as another type of monitoring in the BAT conclusions.** **5.3. PEMS is a monitoring technique based on continuous monitoring of parameters. When the measurement of these parameters is not performed continuously, it is then another type of indirect monitoring.** **5.4. According to the JRC Reference Report on monitoring (ROM REF) (Section 3.3.4.2, p.24), the result of a measurement is the average over the sampling period.** **5.5. BREFs aim at homogenising best practices throughout Europe. The definition of 'Periodic measurement' in D1 is consistent with the monitoring referred to in the ROM REF (draft) and its Section 4.2.2.3.10 states: *'at least 30-minutes sampling duration; at least three consecutive measurements in one measurement series'*. For certain substances which are normally emitted at low levels (e.g. dioxins and furans), the sampling duration can be higher than 3 measurements of half an hour. In case of specific operational constraints, these should be clearly agreed and mentioned at the level of the BAT-AELs concerned.** **5.6. Time-proportional sampling provides the same estimation as flow-proportional sampling when the water flow proves to be stable.** **5.7. Indirect monitoring is not defined here, as it is not used in the BAT conclusions.** **6. <u>Waste – By-products – Residues</u>** **6.3. The Waste Framework Directive gives definitions of 'By-products' and 'waste'; it does not give, however, a definition for 'Residues'. The latter could be defined for the purpose of the LCP BREF.**
EIPPCB proposal:	**1. Do not introduce a new definition for commercial or non-commercial fuels. Replace 'LFO' with 'Gas oil' and include the definition. Change the definition of 'Heavy fuel oil'. Modify the definition of process fuels from the chemical industry to cover the cases where the plant is operated by a different operator to that of the Chemical plant. Do not define 'other gases'.** **2. Modify the definition of Net electrical efficiency according to the Eurelectric proposal. Do the same for Net fuel utilisation where the imported energy should be subtracted. More detailed explanations are provided in the BREF Section 2.7.3. Delete the mentions 'whose main purpose is heat/electricity generation' in the energy efficiency BAT-AEEL tables. Do not add additional definitions for installations.** **3. Change the definitions regarding the load modes to 'emergency-, peak-, mid-merit- or baseload modes' and do not refer any more to the plant type. Add 'for a given fuel' to the definitions of load modes. Change the definition of 'combustion plant', to include the concept of aggregation rule of the IED article 29. Change in the BAT-AEL tables 'Combustion plant rated thermal input' to 'Combustion plant total rated thermal input'. Modify the 'new plant' definition to refer to the environmental permit more explicitly.** **4. Add 'valid' before hourly average and add a definition of 'valid (hourly average)'. Change the definition of daily average to the one proposed in the REF or PP BREFs and given as an example in the draft ROM REF (Table 3.2). Do not include details on OTNOC.** **5. <u>Monitoring</u>** **Keep the 'Continuous measurement' and 'PEMS' definitions as they are. Do not add a definition for 'Indirect monitoring'. Change the 'periodic measurement' definition by mentioning the possibility for longer sampling duration in the case of certain substances, and the possibility of time-proportional sampling in the case of a stable flow for emissions to water.**

	6. Include the following definition for 'residues' in the Glossary: 'Substances generated by the activities covered by the scope of this document, as waste or by-products.'

2.12 General considerations

Location in D1:	*P. 738 – General considerations*
Current text in D1:	**General considerations** **Expression of emission levels associated with the Best Available techniques (BAT – AELs)** Unless stated otherwise, emission levels associated with the best available techniques (BAT-AELs) for emissions to air given in these BAT conclusions are expressed: • as either mass of emitted substances per volume of waste gas under standard conditions (273.15 K, 101.3 kPa), after deduction of water vapour content (dry gas), expressed in the units g/Nm^3, mg/Nm^3, $\mu g/Nm^3$ or ng/Nm^3 • at a standardised O_2 content of: o 6 % for solid fuels, waste co-incineration, multi-fuel firing of solid fuel with gaseous and/or liquid fuels; o 3 % for combustion plants, other than gas turbines and engines combusting liquid and/or gaseous fuels; o 15 % for gas turbines and engines combusting liquid and/or gaseous fuels, and for multi-fuel fired IGCC plants. • without subtraction of uncertainty. Where emission levels associated with the best available techniques (BAT-AELs) are given for different averaging periods, all of those BAT-AELs apply. Unless stated otherwise, BAT-AELs for emissions to water given in these BAT conclusions are given without subtraction of uncertainty as mass of emitted substances per volume of waste water, expressed in the units g/l, mg/l or µg/l. Unless stated otherwise, the techniques identified in these BAT conclusions are generally applicable.
Summary of comments:	1. *Reference conditions* 1.1. *Include the precision that these BAT conclusions apply to normal operating conditions, unless otherwise stated (BE_32, SE_82, Euracoal_105, Eurelectric_582_626_673_862, E&P_6).* 1.1. *The standardised O_2 content for waste co-incineration may be different from 6 %, and should take account of the mixing rules (Euracoal_103, Eurelectric_580_672_860).* 2. *Table on interface with other BREFs* 2.1. *Include the FDM BREF in the list (FR_59).* 2.2. *Include the REF BREF in the list (SK_21).* 3. *Energy efficiency* 3.1. *The expression of BAT-AEELs is not addressed unlike the expression of BAT-AELs (Euracoal_106, Eurelectric_583_863).* 4. *BAT-AELs* 4.1. *The sentence about application of both averaging periods should be removed as this is out of the mandate of the TWG (FI_91, CEPI_24).* 5. *Applicability of the BAT conclusions* 5.1. *The general applicability is not always true and may be challenged (UK_9, PL_91, E&P_16, EUROMOT_104)* 5.2. *Define the meaning of 'generally applicable' (IE_11, ETN_23).* 5.3. *The general BAT conclusions of Section 10.1 should be removed as they are not specific enough to each type of combustion plants (ES_23).*
EIPPCB assessment:	**1. Reference conditions** **1.1. Article 3 (13) of the IED already states that BAT-AELs correspond to the application of BAT in normal operating conditions. The BAT conclusions may however also contain conclusions related to other than normal operating conditions pursuant to provisions in Articles 14 and 15 of the IED and to the provisions in Section 3.1 of the BREF Guidance.**

	1.2. The O_2 reference level for co-incineration is based on submitted data at plant level that correspond mainly to solid fuel combustion where the O_2 reference is 6 %; it also corresponds to the oxygen reference level used for expressing the BAT-AELs. Another reference level can be used in permits depending on the situation, adapting the BAT-AELs to the new O_2 reference level used accordingly. This could be facilitated by including in the BAT conclusions the standard formula used in other recently adopted BAT conclusions. **2. Table on interface with other BREFs** **2.1. (+2.2.) The purpose of the BREF table under the Scope of the BAT conclusions is to inform the reader of other (B)REFs that are relevant for the activities covered by the BAT conclusions.** **3. Energy efficiency** **3.1. According to Section 3.3.1. of the BREF Guidance (Commission Implementing Decision 2012/119/EU of 10.02.2012 laying down rules concerning guidance on the drawing up of BREFs), reference conditions must be unambiguously defined. This also applies for the expression of BAT-AEELs.** **4. BAT-AELs** **4.1. Such a sentence goes beyond the mandate of the TWG (as exemplified recently in the case of the PP BREF). DG ENV will develop an FAQ on this point.** **5. Applicability of BAT conclusions** **5.1. (+5.2.) The applicability of techniques is an element of the BAT conclusions. As per Section 3.2.3 of the BREF Guidance, BAT are considered generally applicable unless otherwise stated. Where there are restrictions on the applicability of techniques, this is explicitly mentioned in the BAT conclusions. Applicability restrictions are assessed BAT conclusion by BAT conclusion based on the information exchanged by the TWG, including the comments received on D1. There is no need to repeat provisions from the BREF Guidance in the BREF.** **5.3. General BAT conclusions apply to all the plants covered under the Scope, unless otherwise stated. The comment submitted is not supported by evidence-based rationale.**
EIPPCB proposal:	**1. Reference conditions** **1.1. Do not add details regarding normal operating conditions.** **1.2. Maintain the O_2 reference level of D1.** **1.3. Add the standard formula used in recently adopted BAT conclusions on reference oxygen content.** **2. Table on interface with other (B)REFs** **2.1. (+2.2.) Do not add FDM and REF BREFs to the BREF table.** **3. Energy efficiency** **3.1. Add description of the BAT-AEELs under the General considerations (see proposal in the BAT conclusions).** **4. BAT-AELs** **4.1. Remove the sentence about the application of both averaging periods.** **5. Applicability of BAT conclusions** **5.1. (+5.2.) Do not define 'generally applicable' and include, where deemed necessary, information under the Applicability of techniques.** **5.3. Keep the general BAT conclusions covered by Section 10.1.**

2.13 BAT 4 – General environmental performance

<table>
<tr><td>Location in D1:</td><td>P. 741 – Section 10.1.3</td></tr>
<tr><td>Current text in D1:</td><td>
4. In order to improve the general environmental performance of combustion plants and to reduce their emissions to air of CO and unburnt substances, BAT is to ensure complete combustion through stable combustion conditions and to use an appropriate combination of the techniques given below:
<table>
<tr><th colspan="2">Techniques</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Fuel blending and mixing</td><td>Ensure stable combustion conditions by mixing different qualities of a same fuel type (e.g. biomass)</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Fuel choice</td><td>Select or switch to another fuel(s) with a better environmental profile (with e.g. low S or Hg content) amongst the available fuels</td><td>Applicable within the constraints given by the energy policy of the Member State</td></tr>
<tr><td>c.</td><td>Multi-fuel firing</td><td>Replace part of a fuel by another fuel with a better environmental profile (e.g. use coal and syngas from biomass gasification instead of coal only)</td><td>Ratio of replaced fuel may be limited by configuration of the existing plant and its associated achieved level of performance</td></tr>
<tr><td>d.</td><td>Advanced computerised control system</td><td>Use of advanced computerised control system to enable achieving a high performance of the boiler with improving combustion conditions to support the reduction of emissions. this also includes high-performance monitoring</td><td>Generally applicable</td></tr>
<tr><td>e.</td><td>Good design of the combustion equipment</td><td>Good design of furnace, combustion chambers, burners,…</td><td>Generally applicable to new plants</td></tr>
<tr><td>f.</td><td>Good design and operation of the ammonia injection system</td><td>Good design and operation of the ammonia injection system to enable achieving an homogenous NH_3/NO_X mixture, that favours the NO_X reduction reaction while limiting the NH_3 slip</td><td>Applicable in the case of using SNCR/SCR techniques</td></tr>
<tr><td>g.</td><td>Maintenance of the combustion system</td><td>See description in Section 10.8.</td><td>Generally applicable</td></tr>
</table>
{This BAT conclusion is based on information given in Section 5.1.4.2}
</td></tr>
</table>

Summary of comments:	1. <u>General</u> 1.1. *There is no need for blending, mixing or switching of fuels if the ELVs are reached and the circumstances are unfavourable, and in case of use of lignite firing from nearby open cast mine (EL_16_17, Euracoal_116, Eurelectric_206_598_880).* 1.2. *The statement '…to use one or a combination of the techniques given below' should be modified as not all the techniques can necessarily be applied at plant level (CEFIC_196).* 1.3. *In the statement, an '...appropriate combination of...' needs to be defined (UK_23, E&P_28).* 1.4. *Add an applicability restriction for techniques a, b, c, (PT_51) and e, f for existing plants regarding the limitations due to the plant configuration and design (FI_94, CEPI_20).* 1.5. *This list of techniques refers to information only available for coal/lignite firing (ref below the table to Section 5.1.4.2) (Eurofer_10).* 2. <u>Technique a (fuel blending and mixing)</u> 2.1. *The technique is not always applicable in biomass-fired plant and its applicability may depend on the configuration of the individual plant (DK_81, Euracoal_117, Eurelectric_207_599_881).* 2.2. *Remove the example within brackets (Pl_103).* 3. <u>Technique b (fuel choice)</u> 3.1. *Limit the applicability in the case of combustion of industrial process fuels (CEFIC_86_197) ' Applicable within the fuel constraints given by the plant, its operating window and the integrated site's fuel balance'. Make a reference to BAT 74 of the iron and steel BREF (EUROFER_212).* 3.2. *The applicability is case specific (depends on availability of fuel, plant composition, etc.) (IT_72, CEPI_21).* 3.3. *Fuel choice with a better environmental profile may be limited by the other main characteristics of the fuel such as the heating value and the fraction of ash relative to the fuel input. (DK_82, Eurelectric_600_882).* 3.4. *This technique is not applicable for 'mine-mouth' combustion plants (Euracoal_120).* 3.5. *Add an applicability restriction linked to the availability of fuels (FR_65).* 3.6. *Add other applicability limitations due to technical constraints of changing the design fuel in an existing plant; transportation constraints, external costs and energy market safety issues (EL_22, Eurelectric_209).* 4. <u>Technique c (multi-fuel firing)</u> 4.1. *Syngas from biomass gasification does not per se have a better environmental profile than coal (Euracoal_118, Eurelectric_210_601_883)* 4.2. *Add an applicability restriction linked to alternative fuel availability (CEFIC_198).* 4.3. *This technique is limited in case of plants combusting iron and steel process gases as they have to burn these gases to recover their energy pursuant to BAT 74 of the iron and steel BREF (EUROFER_213).* 5. <u>Technique d (advanced computerised control system)</u> 5.1. *Clarify if the technique is only applied to boilers in the description (UK_24, E&P_29).* 5.2. *Limit the applicability in the case of old plants where the extensive implementation of this technique may be limited by technical constraints and/or increased costs (EL_23, Eurelectric_211).* 6. <u>Technique g (maintenance of the combustion system)</u> 6.1. *The technique description is missing in Section 10.8. (CEFIC_199, EUROFER_9).*

EIPPCB assessment:	**1. <u>General</u>** **1.1. (+1.2.) The BAT statement mentions 'an appropriate combination of…', which does not mean that all the suggested techniques should be implemented. Depending on each situation, the selection of an appropriate combination of techniques will lead the plant to improve its environmental performance within the given economical and technical constraints.** **1.3. 'Appropriate' is self-explanatory. The techniques will be chosen and implemented on a site-by-site basis.** **1.4. The configuration and design constraint is already mentioned for technique (c). Technique (e) is only applicable to new plants and technique (f) to plants fitted with SCR/SNCR, so to plants already fitted with the technique. In the case of technique (a), the blending and mixing of different qualities of the same fuel is not expected to be constrained by the plant configuration, even if implementing a solution may be more or less challenging. Choosing another type of fuel to be combusted (technique b) could however be constrained by the plant configuration/design.** **2. <u>Technique a (fuel blending and mixing)</u>** **2.1. Despite the fact that the way of implementing the technique may differ from one plant to another, requiring sometimes planned operations or the selection of an appropriate fuel to be blended, there is a priori no general restriction to its applicability, including in the case of biomass-fired plants.** **2.2. The first part of the technique description seems clear and does not need to be completed by additional examples.** **3. <u>Technique b (fuel choice)</u>** **Changing of fuel may lead to design considerations that will depend on the initial plant configuration and the expected new configuration. However, many examples show that it is possible, even in the cases of 'mine-mouth' combustion plants. The feasibility is plant- and operator-specific and may be constrained by availability of fuels, which may be impacted by the energy policy of the Member State. The applicability will also consider the full environmental profile of any alternative fuel. Finally, in industrial sites where process fuels are generated, the applicability has to take into account the integrated site's fuel balance. See also the assessment regarding the technique (c).** **4. <u>Technique c (multi-fuel firing)</u>** **4.1. The first part of the technique description seems clear and does not need to be completed by additional examples.** **4.2. (+4.3.) The applicability restrictions of fuel choice also apply for multi-fuel firing. Indeed multi-fuel firing can be considered as a sub-part of the 'fuel choice' technique'.** **5. <u>Technique d (advanced computerised control system)</u>** **5.1. The technique is applicable to all kinds of combustion processes.** **5.2. For very old plants the implementation of an advanced control system may be limited due to the difficulty to act on the control of main combustion parameters.** **5.3. The name and description of the technique can be simplified to avoid overlapping with two other techniques: 'process control' and 'combustion optimisation'.** **6. <u>Technique g (Maintenance of the combustion system)</u>** **6.1. The technique is self-explanatory and does not need to be further described in the list of techniques in Section 10.8. In the description, it could be added that the supplier's recommendations should be followed.** **7. <u>Technique f (Good design and operation of the ammonia injection system)</u>: the conclusions related to ammonia slip and to the use of the ammonia injection system when SCR/SNCR systems are applied are now grouped in a new BAT (BAT 4 bis).**

EIPPCB proposal:	**1. General** **Keep the list of techniques. Change the statement to 'BAT is to ensure an optimised conversion…' as the 'complete combustion' is an unreachable target. Add an applicability constraint linked to the configuration/design of existing plants for technique b (fuel choice).** **2. Technique a (fuel blending and mixing)** **Do not add an applicability restriction and remove the example given in brackets. Add in the description that the techniques also allow the reduction of the emission of pollutants.** **3. (+4.) Technique b (fuel choice) and technique c (multi-fuel firing)** **Merge the two techniques and update the description accordingly. Change the applicability to: 'Applicable within the constraints associated with the availability of different suitable types of fuel with a better environmental profile as a whole, which may be impacted by the energy policy of the Member State or by the integrated site's fuel balance'. Delete the example in brackets for multi-fuel firing.** **5. Technique d (advanced computerised control system)** **5.1. Change 'boiler' to 'combustion plant' in the technique description.** **5.2. Add an applicability limitation linked to the plant design.** **5.3. Change the name of the technique to 'advanced control system'.** **6. Technique g (Maintenance of the combustion system)** **6.1. Change the description to: 'Maintain the combustion system according to the supplier's recommendations and according to the environmental management system in place'.** **7. Technique f (Good design and operation of the ammonia injection system): Remove the technique.**

2.14 BAT 7 - Energy efficiency

2.14.1 General comments

Location in D1:	*P. 742 – Section 10.1.4*
Current text in D1:	**7. In order to increase the energy efficiency of combustion plants, BAT is to use an appropriate combination of the techniques given below.**

Technique		Description	Applicability
a.	Ultra supercritical steam conditions	Use of a steam circuit, including double or triple steam re-heat systems, in which steam can reach pressures of about 300 bar and temperatures of about 600°C	Applicable to new baseload plants above 300 MW_{th}
b.	Supercritical steam conditions	Use of a steam circuit, including steam re-heating systems, in which steam can reach pressures above 220.6 bar and temperatures above 374°C	Applicable to new baseload plants above 100 MW_{th}. Applicable for existing plants above 1000 MW_{th}. Applicability may be limited for existing plants below 1000 MW_{th} when the steam turbine cannot be adapted for the implementation of a double reheat cycle (e.g. material not resistant enough for supporting such pressure / temperature).
c.	Optimisation of the working medium conditions	Operate with the highest possible pressure and temperature of the working medium gas or steam	Generally applicable
d.	Optimisation of the steam cycle	Operate with the highest possible pressure drop in the low pressure end of the steam turbine through utilisation of the lowest possible temperature of the cooling water (fresh water cooling)	Generally applicable

	e.	Heat recovery by cogeneration (CHP)	Recovery of heat mainly from the steam cooling for producing hot water / steam which is used in industrial activities or in district heating. Additional recovery is possible from: • flue-gas • grate cooling • circulating bed	Generally applicable within the constraints given by the local power and heat demand
	f.	Regenerative feed-water heating	Preheat water in the steam circuit with recovered heat from the plant	Generally applicable to new and existing combined-cycle plants
	g.	Preheating of combustion air	Preheat combustion air by reusing part of the recovered heat	Applicable within the constraints given by the needs of NO_X emissions control
	h.	Steam turbine upgrades	Increase temperature and pressure of medium-pressure steam, addition of low-pressure turbine, modification of blade geometry	Generally applicable
	i.	Advanced computerised control system	Computerised control of the main combustion parameters, in order to improve the combustion efficiency	Applicable to new and existing plants
	j.	Cooling tower discharge	Discharge to air through a cooling tower and not via a dedicated stack	Applicable when the cooling tower is selected as the cooling system for new plants. Applicable to existing plants subject to existing material and location design constraints
	k.	Wet stack	Design of the stack in order to enable water vapour condensation from the saturated flue-gas and thus to avoid the need to use a flue-gas reheater after the wet FGD	Generally applicable to new and existing plants fitted with wet FGD
	l.	Fuel predrying	Reduction of fuel moisture content before combustion to improve combustion conditions	Applicable to the combustion of biomass, peat, and lignite within the constraints given by auto combustion risks (e.g. moisture content of peat is kept above 40 % during transport to the plant). Applicable on a-case-by case basis for the gasification of biomass depending on the gasification process
	m.	Fuel preheating	Preheating of fuel by using recovered heat	Applicable within the constraints given by the needs of NO_X emissions control
	n.	Complete combustion	Minimising the content of unburnt substances in gases and in solid combustion residues	Generally applicable
	o.	Heat accumulation	Heat accumulation storage in CHP mode	Applicable to CHP plants
	p.	Advanced materials	Use of advanced materials to reach high operating temperatures and pressures and thus to achieve increased steam / combustion process efficiencies	Only applicable for new plants
	q.	Minimisation of heat losses	Minimising residual heat losses e.g. through the slag and by isolating radiating sources	Applicable to solid-fuel-fired plants and to gasification / IGCC plants
	r.	Minimisation of energy consumption	Minimising the internal energy consumption by, e.g. scarification of the evaporator, greater efficiency of the feed water pump, etc.	Generally applicable
	s.	Flue-gas condenser	The flue-gas condenser is a heat exchanger recovering heat, where water is heated by the flue-gases before it is heated in the steam condensers. The vapour content in the flue-gases thus condense as it is cooled by the heating water	Generally applicable to CHP plants

	t. | CHP readiness | See description in Section 10.8. | Applicable to new plants when immediate opportunities for heat supply at the time of building are unavailable *{This BAT conclusion is based on information given in Section 3.3.4}*
Summary of comments:	1. *Energy efficiency is out of the scope of this BREF (CEFIC_89, ETN_46) and should be covered by another BREF (ETS or energy BREF) (E&P_28).* 2. *The general BAT conclusion 7 on energy efficiency should be deleted and replaced by BAT conclusions on energy efficiency for each type of fuel combusted or for each combustion process (IT_74_109, Eurelectric 217_467).* 3. *Change the applicability restrictions as follows: "At certain risks applicable for new plants." (CZ_77).* 4. *The supportive information for deriving this BAT is missing in the BREF descriptive sections (Eurofer_11).* 5. *Replace in the statement 'an appropriate combination' by 'one or a combination' (CEFIC_203).*
EIPPCB assessment:	**1. Energy efficiency is an issue that was included in the current BREF. The TWG agreed to look at this issue on the occasion of the BREF review and therefore decided to collect data on it at plant level by dedicating a special sheet in the questionnaire.** **2. (+5.) BAT 7 is quite general and all the listed techniques may not apply to all the cases. However, having this general BAT avoids having to repeat the long list of techniques for each fuel sector several times. The techniques listed are neither prescriptive nor exhaustive. In the end, each operator will use the appropriate techniques based on the specific situation of its plant. Thus, the word 'appropriate' seems here more suitable than the expression 'one or a combination of'.** **3. The list of techniques is neither prescriptive nor exhaustive. The list refers to available techniques according to the definition of BAT in the IED.** **4. This conclusion is based on information from Section 3.3.3.4 of the BREF.**
EIPPCB proposal:	**1. (+4.) Keep energy efficiency in the BREF and in the BAT conclusions.** **2. (+5.) Keep BAT 7 and add, where deemed necessary by the TWG, additional fuel-specific techniques at the level of the BAT conclusion on energy efficiency for each fuel type. Keep 'appropriate combination of techniques' in the BAT statement of BAT 7.** **3. Do not add a general applicability restriction linked to the risk of implementing a technique for new plants.**

2.14.2 Techniques a and b ((ultra) supercritical steam conditions)

Location in D1:	*P. 742 – Section 10.1.4*
Current text in D1:	

Technique		Description	Applicability
a.	Ultra supercritical steam conditions	Use of a steam circuit, including double or triple steam re-heat systems, in which steam can reach pressures of about 300 bar and temperatures of about 600°C	Applicable to new baseload plants above 300 MW_{th}
b.	Supercritical steam conditions	Use of a steam circuit, including steam re-heating systems, in which steam can reach pressures above 220.6 bar and temperatures above 374°C	Applicable to new baseload plants above 100 MW_{th}. Applicable for existing plants above 1000 MW_{th}. Applicability may be limited for existing plants below 1000 MW_{th} when the steam turbine cannot be adapted for the implementation of a double reheat cycle (e.g. material not resistant enough for supporting such pressure / temperature).

Summary of comments:	*Technique a (ultra-supercritical steam conditions)* *1.1. Limit the applicability to new base-load plants above 660 MW_{el}. The ultra-supercritical steam conditions for 300 MW_{th} plants are technically applicable but not economically viable (CZ_76, E&P_76).* *1.2. Limit the applicability to new base-load plants above 600 MW_{th} (EPPSA_357, E&P_21).* *1.3. The applicability threshold should be set at of 300 MW_{el} to be consistent with the information reported in Section 3.3.4.14 (FR_67).* *1.4. Limit the applicability to new base-load plants above 2000 MW_{th} (EL_27, Eurelectric_221).* *1.5. This technique is not applicable to process industries where the maximum steam pressure is around 120 bar (CEFIC_204).* *1.6. Modify the description to: 'Use of steam circuit, including double or triple re-heat systems, in which steam can reach pressures above 240 bar and temperatures exceeding 580 °C (EPPSA_356).* *1.7. Restrict the applicability for biomass subject to the risk of high temperature chlorine corrosion (Eurelectric_608, 890, 222).* *1.8. Change the technique description by removing the use of double or triple reheat as this is not a common practice (Eurelectric_220).* *2. Technique b (supercritical steam conditions)* *2.1. Limit the applicability to new base-load plants above 100–150 MW_{th} as the technique is not economically viable for being retrofitted at existing plants (ES_27_30).* *2.2. The applicability threshold should be set at of 350 MW_{el} to be consistent with the information reported in Section 3.3.4.14 (AT_14).* *2.3. Replace "applicable to new base load plants above 100 MW_{th}" by "applicable to new base load plants above 300 MW_{el}" (E&P_22).* *2.4. Check if the applicability threshold is 100 MW_{el} or 100 MW_{th} for new plants (FR_68).* *2.5. Change the thermal capacity threshold in the applicability for new plants to 600 MW_{th}. Retrofit to higher steam parameters is generally not feasible for existing plants. Retrofit to double reheat is not possible (EPPSA_359).* *2.6. The retrofit of sub-critical parameters to supercritical ones at existing plants is very limited (E&P_36, 38, UK_31 _ 33_34, Eurelectric_224).* *2.7. Remove the reference to size thresholds in the case of existing plants in the applicability restrictions (EL_28).* *2.8. This technique is only applicable for new plants or a total replacement of boiler and turbine in an existing plant (DK_107).* *2.9. This technique is not applicable to gas turbines or combustion engine plants with steam cycles (FI_25).* *2.10. The applicability of this technique to CCGT plant needs to be clarified; currently it states that this should be generally applicable (Eurelectric_225).* *2.11. This technique should be restricted when combusting biomass subject to a risk of high temperature chlorine corrosion (Eurelectric_223_609_891).* *2.12. Limit the applicability in the case of chemical or other industrial process plants which have steam & water open cycle or lower pressure and temperature steam parameters suitable for heat transfer process heating requirements (CEFIC_45_55_205).* *2.13. Modify the description as the level of temperature of the critical point is not significant for the definition of a supercritical boiler. A new proposal could be: 'Use of a steam circuit, including steam re-heating systems, in which steam can reach pressures above 220.6 bar' (EPPSA_358).*
EIPPCB assessment:	**1. Ultra-supercritical steam conditions (a)** **1.1. (to 1.4.) No supporting evidence is attached to the comments. Example plants of down to 800 MW_{th} (e.g. Plant 34 commissioned in 1998) implementing this technique are given in Section 3.3.4.14. EPPSA mentions the technical availability for levels down to 300 MW_{th} but questions the practical/economic viability below 600 MW_{th}. The applicability could thus be reviewed based on the proposal made by EPPSA.** **1.5. (+2.12.) Achieving high level steam parameters corresponding to ultra-supercritical steam conditions is not necessary when the purpose of the plant is to produce low-temperature steam in process industries.** **1.6. According to the available information, the definition could be changed to temperature above 580–600 °C and pressure above 250–300 bar.**

	1.7. In the event of high chlorine content in the fuel, there may be some challenges in achieving high temperature/pressure steam parameters due to the high-temperature chlorine corrosion. In some cases, some parts of the steam circuit were changed to enable the combustion of biomass. **1.8. Implementing a double or triple reheated steam system may not be necessary for achieving high steam parameters (e.g. Plant 253, 116). Thus this part of the description can be removed.** **2. <u>Supercritical steam conditions (b)</u>** **2.1. (to 2.8.) The steam turbine sets needs to be adapted in case of retrofit and this operation requires a full replacement of the boiler/turbine and connecting piping. Thus it should be limited to cases of substantial plant retrofits. Example plants down to 595 MW_{th} are supercritical (e.g. Plants 26, 34, 167 that are of < 1000 MW_{th}), according to the data set submitted through the questionnaires.** **2.9. (+2.10.) The technique does not apply to steam produced as CHP by turbines and engines.** **2.11. See the assessment in paragraph 1.7 of this section.** **2.13. The temperature level information is consistent with the information included in the BREF, even if the main driver for moving to the supercritical parameter is indeed the pressure.**
EIPPCB proposal:	**1. <u>Ultra-supercritical steam conditions (a)</u>** **1.1. (to 1.4.) Change the applicability to 'Only applicable to new baseload plants above 600 MW_{th}.'** **1.5. Add the following applicability limitation 'Not applicable when the purpose of the plant is to produce low steam temperatures and/or pressures in process industries'.** **1.6. (+1.8.) Modify the description to 'Use of a steam circuit in which steam can reach pressures above 250–300 bar and temperatures above 580–600 °C.'** **1.7. Add an applicability restriction: 'For plants burning biomass, the applicability may be constrained by high-temperature corrosion in the case of certain biomasses.'** **2. <u>Supercritical steam conditions (b)</u>** **2.1. (to 2.8.) Change the applicability to 'Only applicable to new baseload plants above 600 MW_{th} and to existing baseload plants in the case of substantial plant retrofits'.** **2.9. (+2.10.) Add an applicability restriction: 'Not applicable to gas turbines and gas engines producing steam in CHP mode'. Also add this applicability restriction to USC steam.** **2.11. Add an applicability restriction: 'For plants burning biomass, the applicability may be constrained by high-temperature corrosion.'** **2.12. Add the following applicability limitation 'Not applicable when the purpose of the plant is to produce low steam temperatures and or pressure in process industries'.** **2.13. Do not remove the information about temperature in the description.** **2.14. Merge techniques (a) and (b).**

2.14.3 Techniques c to g (optimisation of the working medium conditions, optimisation of the steam cycle, heat recovery by cogeneration (CHP), regenerative feed-water heating, preheating of combustion air)

Location in D1: *P. 742/743 – Section 10.1.4*

Current text in D1:

		Description	Applicability
c.	Optimisation of the working medium conditions	Operate with the highest possible pressure and temperature of the working medium gas or steam	Generally applicable
d.	Optimisation of the steam cycle	Operate with the highest possible pressure drop in the low pressure end of the steam turbine through utilisation of the lowest possible temperature of the cooling water (fresh water cooling)	Generally applicable
e.	Heat recovery by cogeneration (CHP)	Recovery of heat mainly from the steam cooling for producing hot water / steam which is used in industrial activities or in district heating. Additional recovery is possible from: • flue-gas • grate cooling • circulating bed	Generally applicable within the constraints given by the local power and heat demand
f.	Regenerative feed-water heating	Preheat water in the steam circuit with recovered heat from the plant	Generally applicable to new and existing combined-cycle plants
g.	Preheating of combustion air	Preheat combustion air by reusing part of the recovered heat	Applicable within the constraints given by the needs of NO_X emissions control

Summary of comments:

3. *Technique c (Optimisation of the working medium conditions)*
   - 3.1. *Change the name of the technique into "optimised steam parameters" (EPPSA_360).*
   - 3.2. *Modify the applicability restrictions to highlight the potential trade-offs between high efficiency and low NO_X emissions (Euracoal_175, Eurelectric_892).*
   - 3.3. *Insert "consistent with site demands". There are other constraints to operating at the highest possible pressure and temperature (CEPI_44, E&P_42, UK_37).*
4. *Technique d (optimisation of the steam cycle)*
   - 4.1. *This technique is only applicable in the case of steam turbines at the design and engineering phase of the plant (FI_26).*
   - 4.2. *Change the description text to: 'Operate with the lower turbine exhaust pressure through utilisation of the lowest possible temperature of the cooling water' as the use of 'pressure drop' can lead to misunderstandings (EPPSA_361).*
   - 4.3. *It is not clear what is meant with the sentence: 'highest possible pressure drop in the low pressure end of the steam turbine' (DK_103).*
   - 4.4. *Delete the precision given within brackets (fresh water cooling) in the description (Eurelectric_610, 893, 227) or be more exhaustive (PL_108).*
   - 4.5. *Operating at lowest possible cooling temperature, outside the design conditions, could lead to technical issues and negative effects in terms of energy efficiency (Eurelectric_228).*
5. *Technique e (Heat recovery by cogeneration (CHP))*
   - 5.1. *Change the text of the description by replacing 'from the steam cooling' by 'from the steam process' as steam extraction in several parts of the steam system is the normal practice when energy in different temperature is needed (FI_27, PL_109, Eurelectric_229).*
   - 5.2. *Remove the last part of the description as additional heat recovery is not always possible from every plant, if the unit is already designed and constructed for CHP (FI_28).*
   - 5.3. *Add an applicability constraint for plants on the gas grid linked to the unpredictable*

	operational profile of the supply of heat by the plant compressing the gas (Marcogaz_106_43). *5.4. This technique is only applicable to new plants (PL_112_113).* *5.5. This technique may be limited in case of acid dew point related problems (EL_36).* *6. Technique f (Regenerative feed-water heating)* *6.1. Rename this technique: 'Feed water pre-heating using recovered heat' as the proposed name is not commonly used by the industry (FI_29, EPPSA_363).* *6.2. This technique is not common in combined cycle plants (EL_30, Eurelectric_230)* *7. Technique g (preheating of combustion air)* *7.1. Air preheating should not be considered BAT if it leads to install an expensive technique for NO_X emissions control (CEFIC_19_46)* *7.2. Replace the source of heat mentioned in the description (recovered heat) by only the heat from the flue-gas (PL_110, Eurelectric_231).* *7.3. The applicability may also depend on the design of the combustion chamber (Eurelectric_232).*
EIPPCB assessment:	**3. Optimisation of the working medium conditions (c)** **3.1. The technique does not only refer to the steam parameters but to any working medium (including air, gas).** **3.2. (+3.3.) As the technique name is 'Optimisation of…', it implicitly includes the constraints associated. The description could however be more explicit on some of them like the 'energy demand' or 'the control of NO_X emissions'.** **4. Optimisation of the steam cycle (d)** **4.1. (+4.4.) The lowest achievable pressure/temperature level of the steam cycle is design-based, but the real achieved pressure /temperature level in the condenser will depend on the temperature of the cooling water, which is the meaning of this technique. There is no need to specify in bracket a type of cooling water as there may be several.** **4.2. (+4.3.) In order to avoid misunderstandings, the wording of the description could be improved (see proposal).** **4.4. The description within brackets can be preceded by 'e.g.' to clearly show that it is an example.** **4.5. The technique should be operated within the plant design. This could be further emphasised in the description.** **5. Heat recovery by cogeneration (CHP) (e)** **5.1. Heat can be extracted from several points of the steam system depending on the demand and on the configuration of the steam turbine.** **5.2. (+5.4.) The last part of the description indicates where heat can be recovered apart from the steam circuit, whether already implemented as in the case of existing CHP plants, or whether it is to be planned in the case of a new plant or retrofitted in existing plants. There is no rationale supporting the impossibility to retrofit existing plants.** **5.3. Recovering heat from gas compressors with an unpredictable operational profile is not easily implementable.** **5.5. Flue-gas condensing for heat recovery may face challenges related to remarkable acid dew point-related problems that can be overcome by an appropriate design solution (e.g. use of adequate materials).** **6. Regenerative feed-water heating (f)** **6.1. The technique can be renamed, to fit with the name most commonly used in the sector, as: 'Feed water preheating using recovered heat'.** **6.2. The fact that the technique is not common does not mean it is not applicable. No further rationale is submitted with the comment.** **6.3. Comments on applicability restrictions have also been assessed in the natural gas combustion section that are also valid in the general case (see Section 1.6.1.1 of this BP).** **6.4. See also the assessment made in Section 1.6.1 for natural gas combustion.** **7. Preheating of combustion air (g)** **7.1. The implementation of this technique, and thus its applicability, should take into consideration the requirements for NO_X emissions control. This is already expressed in the applicability in D1.** **7.2. No rationale supports the comment that would lead to a narrower description than the one proposed in D1.** **7.3. No evidence supports the comment. Techniques are neither prescriptive nor exhaustive. The specificities concerning specific boilers will be considered at local level.**

EIPPCB proposal:	**3. <u>Optimisation of the working medium conditions (c)</u>: Add at the end of the description: '…within the constraints associated with e.g. the control of NO_X emissions or the characteristics of energy demanded'.** **4. <u>Optimisation of the steam cycle (d)</u>: Change the description to: 'Operate with lower turbine exhaust pressure through utilisation of the lowest possible temperature of the condenser cooling water, within the design conditions.'** **5. <u>Heat recovery by cogeneration (CHP) (e):</u>** **5.1. Replace 'steam cooling' with 'steam system' in the description.** **5.3. Add an applicability restriction: 'The applicability may be limited in the case of gas compressors with an unpredictable operational heat profile'.** **6. <u>Regenerative feed-water heating (f)</u>: Change the technique name to 'Feed water preheating using recovered heat'. Add in applicability: 'Only applicable to steam circuits' and 'Applicability to existing plants may be limited due to constraints given by the plant configuration and the amount of recoverable heat. Not applicable to hot water boilers'.** **7. <u>Preheating of combustion air (g)</u>: Keep description and applicability as they are, modifying only slightly the wording for editorial improvements.**

2.14.4 Techniques h to k (steam turbine upgrades, advanced computerised control system, cooling tower discharge, wet stack)

Location in D1: *P. 743 – Section 10.1.4*

Current text in D1:

	Technique	Description	Applicability
h.	Steam turbine upgrades	Increase temperature and pressure of medium-pressure steam, addition of low-pressure turbine, modification of blade geometry	Generally applicable
i.	Advanced computerised control system	Computerised control of the main combustion parameters, in order to improve the combustion efficiency	Applicable to new and existing plants
j.	Cooling tower discharge	Discharge to air through a cooling tower and not via a dedicated stack	Applicable when the cooling tower is selected as the cooling system for new plants. Applicable to existing plants subject to existing material and location design constraints
k.	Wet stack	Design of the stack in order to enable water vapour condensation from the saturated flue-gas and thus to avoid the need to use a flue-gas reheater after the wet FGD	Generally applicable to new and existing plants fitted with wet FGD

Summary of comments:

8. *Technique h (Steam turbine upgrades)*
   - 8.1. *This technique is not applicable to industrial CHP plants where the plants are usually designed and sized based on heat demand purpose (FI_30, CEPI_30).*
   - 8.2. *Remove the technique as it is not feasible (EPPSA_ 364).*
   - 8.3. *Add 'when possible' in the applicability restriction as this technique may not be technically or economically viable (PT_54).*
   - 8.4. *Replace 'Generally Applicable' by 'Applicable where economically viable only' as steam turbine upgrades are not realistic for most existing plants unless there has been a radical shift in demand/steam conditions (UK_39, E&P_44).*
9. *Technique i (Advanced computerised control system)*
   - 9.1. *There may be technical restrictions for applying automations to existing plants (EL_31, Eurelectric_234).*
   - 9.2. *Delete 'advanced' since there is no definition of that word (Marcogaz_14).*
10. *Technique j (cooling tower discharge)*
   - 10.1. *This technique is not applicable in the case of existing once through cooling systems (AT_116, Eurofer_217).*
   - 10.2. *This technique concerns combustion plants fitted with desulphurisation system as mentioned in the description of the technique in Section 3.3.3.4.16 (CEFIC_207).*
   - 10.3. *This technique is not applicable to the chemical industry as the cooling water is generally further used in a chemical plant (CEFIC_208).*
   - 10.4. *The applicability is not clear regarding existing plants where experience proves that such retrofits are difficult (BE_35).*
   - 10.5. *Mention in the description that the discharge to air refers to the flue-gas (PL_111, Eurelectric_235).*
   - 10.6. *Modify the applicability to "Applicable when the cooling tower is selected as the cooling system for new and existing plants" and add "Not applicable for existing plants in case of once-through cooling systems" (SE_88).*
11. *Technique k (wet stack)*

   The applicability to existing plants should be assessed on a case by case basis (UK_40, E&P_45).

EIPPCB assessment:

8. **Steam turbine upgrades (h)**
   - 8.1. **(to 8.4.) Upgrading a steam turbine is a heavy and costly operation which is generally carried out in the event of a big shift in demand/steam conditions or in the case of a medium-long term decision on the expected lifetime of the plant.**
9. **Advanced computerised control system (i)**
   - 9.1. **See assessment in Section 2.13'General environmental performance' of this BP.**
   - 9.2. **Advanced here means the most up-to-date system in terms of automation, and does not require further definition.**
10. **Cooling tower discharge (j)**

	10.1. (+10.6.) The technique applies only when the cooling tower (which may also be 'once-through') is selected as the cooling system, be it at new or existing plants. **10.2. This technique applies to plants fitted with WFGD where reheating of the flue-gas may be required before release to air.** **10.3. If the water is further used in a chemical plant, the cooling system will not be a cooling tower. Clarifying that the technique applies only when the cooling tower is the selected system replies to the comment.** **10.4. No difficulty in retrofitting existing plants is reported in the BREF or in support of the comment.** **10.5. The description should specify that the technique is about the discharge of the flue-gas to air.** **11. Wet stack (k)** **11.1. No difficulty in retrofitting existing plants is reported in the BREF or in support of the comment. Techniques are neither prescriptive nor exhaustive.**
EIPPCB proposal:	**8. Steam turbine upgrades (h): Change the applicability to: 'Applicability may be limited by demand/steam conditions and/or limited plant lifetime.'** **9. Advanced computerised control system (i): Add an applicability restriction link to the plant design; change the name of the technique to 'advanced control system'.** **10. Cooling tower discharge (j):** **10.1. (to 10.6. except 10.5.) Add to applicability: 'Only applicable to plants fitted with WFGD where reheating of the flue-gas is necessary before release, and where the combustion plant cooling system is a cooling tower'.** **10.2. Change the description as follows: 'Release of emissions to air through a cooling tower and not via a dedicated stack'.** **11. Wet stack (k): Keep description and applicability as they are in D1.**

Techniques l to n (fuel predrying, fuel preheating, complete combustion)

<table>
<tr><td>Location in D1:</td><td>P. 743 – Section 10.1.4</td></tr>
<tr><td>Current text in D1:</td><td>
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>l.</td><td>Fuel predrying</td><td>Reduction of fuel moisture content before combustion to improve combustion conditions</td><td>Applicable to the combustion of biomass, peat, and lignite within the constraints given by auto combustion risks (e.g. moisture content of peat is kept above 40 % during transport to the plant). Applicable on a-case-by case basis for the gasification of biomass depending on the gasification process</td></tr>
<tr><td>m.</td><td>Fuel preheating</td><td>Preheating of fuel by using recovered heat</td><td>Applicable within the constraints given by the needs of NO_X emissions control</td></tr>
<tr><td>n.</td><td>Complete combustion</td><td>Minimising the content of unburnt substances in gases and in solid combustion residues</td><td>Generally applicable</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td>
12. <u>Technique l (fuel predrying)</u>
12.1. The minimum moisture content given in the applicability restriction for peat refers to fire and dust explosion risks throughout the whole delivery channel (FI_31).
12.2. This technique is applicable within the technical constraints of the boiler to fire dry fuel (FI_32).
12.3. This technique is not always technically or economically viable (CEPI_29).
12.4. This technique is not applicable to all biomass fuels (e.g. pelletised biomass) (E&P_43, UK_38, Eurelectric_238).
12.5. Add: "For existing plants, applicable within the constraints given by the needs for NO_X emission control and within the constraints of plant design (e.g. boiler geometry flue-gas design flow etc.). Predrying with low quality heat is not applicable to lignite plants" (EL_32, Eurelectric_236).
12.6. The technique would not apply to plants which are already mixing different biomass and peat fuels to get the appropriate moisture boiler design characteristics (Eurelectric_237).
13. <u>Technique m (fuel preheating)</u>
13.1. The applicability may be limited by the original technical structure of the boiler and the allowed temperatures (FI_33).
13.2. Modify the statement in the description to 'preheating of fuel by using low value heat available (CEFIC_209).
13.3. Add an applicability limitation for existing gas-fired plants due to operation and maintenance constraints (CEFIC_210).
13.4. This technique is only viable for large plants with liquid and gaseous fuels (EPPSA_365).
14. <u>Technique n (complete combustion)</u>
14.1. Remove the technique as this is a good general target which is the basis of design of firing system (FI_34).
14.2. Applicable within the constraints given by the needs of NO_X emissions control and design of combustion chamber of gas turbines (Marcogaz_13, FR_70, Eurelectric_240).
14.3. Change 'gases' by 'flue-gases' in the description (Eurelectric_240).
</td></tr>
<tr><td>EIPPCB assessment:</td><td>
12. <u>Fuel predrying (l)</u>
12.1. The 40 % minimum moisture quoted in the example in brackets does not only apply to the transport but to the whole delivery chain. This should be modified in the description.
12.2. (to 12.6.) The economic viability of implementing the technique may depend on the extra calorific value that can be generated from the fuel once dried. Technically, the boiler/gasifier and/or the burners and other plant elements may
</td></tr>
</table>

	need to be modified depending on the initial configuration and boiler/gasifier design. Depending on the plant configuration, these modifications may not be economically viable. NO_X emissions control through burners tuning or retrofit, or SCR upgrade if the generated level increases due to a higher temperature, also have to be considered but should not limit the implementation of the technique. **13. Fuel preheating (m)** **13.1. (+13.3.) The applicability is constrained by the design margins of the boiler, and by the need to control NO_X emissions. The constraint link to the maintenance is deemed minor.** **13.2. The original statement is wider than the one proposed in the comment and allows the voluntary (techniques are neither exhaustive nor prescriptive) use of any kind of recoverable heat.** **13.3. The comment is not supported by evidence or rationale.** **14. Complete combustion (n)** **14.1. 'Complete combustion' is an 'unreachable' target. 'Combustion optimisation' seems to be a better wording.** **14.2. The change of name now implicitly includes all the kinds of constraints that may interfere with the complete combustion, e.g. the need to control NO_X emissions. It is also included in the new proposed description of this technique in Section 1.13.1 of this BP.** **14.3. 'Flue-gases' is more precise than 'gases'.**
EIPPCB proposal:	**12. Fuel predrying (l)** **12.1. Change the text within brackets under applicability to: '(e.g. the moisture content of peat is kept above 40 % throughout the delivery chain)'.** **12.2. Add an applicability restriction: 'The retrofit of existing combustion/gasification plants may be restricted by the extra calorific value that can be obtained from the drying operation and by the limited retrofit possibilities offered by some boiler designs or plant configurations'. Remove the previous applicability restriction related to gasification process as this new one is inclusive.** **13. Fuel preheating (m): Change the applicability to: 'Generally applicable within the constraints related to the boiler design and to the need to control NO_X emissions'.** **14. Complete combustion (n):** • **Change the name of the technique to 'Combustion optimisation'.**

2.14.5 Techniques o to t (heat accumulation, advanced materials, minimisation of heat losses, minimisation of energy consumption, flue-gas condenser, CHP readiness)

Location in D1: *P. 743/744 – Section 10.1.4*

Current text in D1:

Technique		Description	Applicability
o.	Heat accumulation	Heat accumulation storage in CHP mode	Applicable to CHP plants
p.	Advanced materials	Use of advanced materials to reach high operating temperatures and pressures and thus to achieve increased steam / combustion process efficiencies	Only applicable for new plants
q.	Minimisation of heat losses	Minimising residual heat losses e.g. through the slag and by isolating radiating sources	Applicable to solid-fuel-fired plants and to gasification / IGCC plants
r.	Minimisation of energy consumption	Minimising the internal energy consumption by, e.g. scarification of the evaporator, greater efficiency of the feed water pump, etc.	Generally applicable
s.	Flue-gas condenser	The flue-gas condenser is a heat exchanger recovering heat, where water is heated by the flue-gases before it is heated in the steam condensers. The vapour content in the flue-gases thus condense as it is cooled by the heating water	Generally applicable to CHP plants
t.	CHP readiness	See description in Section 10.8.	Applicable to new plants when immediate opportunities for heat supply at the time of building are unavailable

Summary of comments:	*15. Technique o (heat accumulation)* *15.1. The applicability may be limited in the case of CHP plants depending on thermal load demand (EL_34, Eurelectric_242).* *15.2. The technique is not applicable in the case where heat consumption is low compared to the steam consumption (CEPI_27).* *16. Technique p (advanced materials)* *16.1. Add an applicability precision: 'At certain risks' as the installation using this BAT may be difficult to insure and finance (E&P_77).* *16.2. Delete "advanced" in the name of the technique since there is no definition of that word (Marcogaz_14).* *17. Technique q (minimisation of heat losses)* *17.1. Limit the applicability to new solid-fuels-fired plants as it may not be economically viable in existing plants (e.g. installation of an afterburner grate in the furnace bottom to minimize unburnt content in slag and slag temperature) (EL_35, Eurelectric_243).* *18. Technique r (minimisation of energy consumption)* *18.1. It is not clear what is meant by 'scarification' in the description (FI_36).* *18.2. Delete the examples (EPPSA_ 366).* *19. Technique s (flue-gas condenser)* *19.1. This technique is only applicable to CHP plants where there is sufficient local demand for low-temperature heat (DK_100, CEPI_36).* *19.2. Remove the technique from BAT techniques and shift it to emerging techniques as it is not commercially available (EPPSA_367).* *19.3. This technique cannot be implemented in all the cases in the iron and steel sector (EUROFER_218).* *19.4. Flue-gas condensing for heat recovery may be limited due to remarkable acid dew point-related problems (Eurelectric_244).* *20. Technique t (CHP readiness)* *20.1. The applicability may be limited in the cases where there is no heat load in some sectors / member states (EL_37, Eurelectric_245).* *20.2. This technique is not BAT as its implementation may entail additional CAPEX that may not be justified par uncertain future heat demand (E&P_CZ_58)*
EIPPCB assessment:	**15. Heat accumulation (o): The need to use a heat accumulator is associated to the thermal load demand, and may be independent of the amount of steam generated in a CHP plant.** **16. Advanced materials (p): The description is self-sufficient and is fuel- and combustion process-specific. As the technique is proposed as BAT, the advanced materials should be available and thus will not normally be a source of problem of insurance for the operator. The description could be improved to mention that the materials are proven.** **17. Minimisation of heat losses (q): There is no general constraint that could prevent an existing plant from reducing the heat losses, even if the extent of that reduction is plant-dependent. Furthermore, the techniques are neither prescriptive nor exhaustive.** **18. Minimisation of energy consumption (r): In order to avoid misunderstandings, the 'scarification of the evaporator' example can be deleted.** **19. Flue-gas condenser (s)** **19.1. (to 19.3.) The technique is applicable to CHP plants as long as there is enough demand for low-temperature heat. This also covers the cases in the iron and steel sector. An applicability restriction could be added to clarify this point.** **19.4. Flue-gas condensing for heat recovery may face challenges related to remarkable acid dew point-related problems that can be overcome by an appropriate design solution (e.g. use of adequate materials).** **20. CHP readiness (t):** **20.1. The aim of this technique is to make the future export of heat possible, thus, by nature, there is not yet any heat demand and so this cannot be a constraint to the applicability of the technique.** **20.2. No information is submitted about the extra CAPEX that may arise from the CHP readiness implementation. However, this technique could be applied where there is a realistic potential for the future use of heat in the vicinity of the combustion plant. The applicability could be modified accordingly.** **20.3. See also the assessment made in Section 1.6.1 of the BP on this technique.**
EIPPCB proposal:	**15. Heat accumulation (o): Add an applicability restriction: 'The applicability may be limited in the case of low heat load demand'.** **16. Advanced materials (p): Mention in the description that the materials are proven.**

	Include others minor editorial improvements. **17. Minimisation of heat losses (q): Do not change the description or the applicability.** **18. Minimisation of energy consumption (r): Change the description to: 'Minimising the internal energy consumption (e.g. greater efficiency of the feed water pump).'** **19. Flue-gas condenser (s): Change the applicability restriction to: 'Generally applicable to CHP plants provided there is enough demand for low-temperature heat.'** **20. CHP readiness (t): Change the applicability to: 'Only applicable to new plants where there is a realistic potential for the future use of heat in the vicinity of the plant'.**

2.15 Diffuse emissions

2.15.1 BAT 8 – VOC emissions from storage of liquid fuels

Location in D1:	*page 744*
Current text in D1:	**8. In order to reduce VOC emissions to air from the storage of liquid fuels, BAT is to use in storage tanks one of the techniques given below.**

a.	Sealing roof	The storage tanks are fitted with a floating roof equipped with high efficiency seals or a fixed roof tank connected to a vapour recovery system. High efficiency seals are specific devices for limiting the losses of vapour	Applicable to liquid-fuel-fi combustion plants
b.	Closed-loop system	For internal inspections, tanks have to be periodically emptied, cleaned, and rendered gas-free. This cleaning includes dissolving the tank bottom. Closed-loop systems that can be combined with end-of-pipe mobile abatement techniques prevent or reduce VOC emissions.	Applicable to liquid-fuel-fi combustion plants

Summary of comments:	*1. General* • *Delete section 10.1.5. Storage is covered under the EFS BREF. (Eurelectric_649, CEFIC_91_211).* • *Remove BAT 8 due to the very low vapour pressure of LFO and HFO (PL_17, E&P_17).* • *Include a corresponding description in the BREF and/or precise reference to other BREFs where it is described (Eurofer_12).* • *Exclude emergency and peak-load plants and reserve fuel storages (FI_37).* • *Specify the liquid fuels these techniques would be applied to (E&P_49).* • *Applicability is limited to storage of the liquid fuels (BE_36).* *2. Technique a (sealing roof)* • *Remove. This technique is not applicable even in refineries, for low volatility fuels such as LFO and HFO used in LCPs (EL_38).* • *Remove. The VOC emissions from the storage tanks of liquid fuel shall be minimised by selecting the type (e.g. fixed roof, floating roof) according to the vapour pressure of the fuel, equipped with appropriate fittings as described in the Storage BREF (CEFIC_212).* • *Not applicable to HFO or HFO/LFO storage facilities. This would require considerable investment. Normally fixed tank roofs are used (Eurelectric_611_895_246).* • *Specify that this is only applicable to high vapour pressure fuels. Vapour recovery systems or floating roof tanks are not necessary for most commercial fuels that have low vapour pressure (E&P_47_Eurelectric_249_250, CEPI_46).* • *Fixed roof tanks should be connected to a vapour recovery system only in the case of the storage of oil products that are volatile (CYPRUS_2).* *3. Technique b (closed loop system)* • *Remove the technique. It is not described in the chapter 6 of the BREF (CEFIC_213, Eurelectric_612_896_248).* • *There are some confusion between the name of the technique, its description and the fact it does apply only to HFO tanks (UK_44, EL_39_Eurelectric_247).* • *'Closed loop system' needs to be defined (E&P_48).* • *'Closed loop systems' is described is tank cleaning (E&P_17_49, PL_17).*
EIPPCB assessment:	**General** • **The vapour pressure of HFO and LFO is relatively low and therefore the VOC emissions to air from the storage are in general expected to be low. VOC emissions to air from the storage of liquid fuels, such as oil products and chemicals, are covered in Emissions from Storage BREF for liquids by tank-specific considerations.** • **Reference is already made to the EFS BREF in the table at the end of the scope.**
EIPPCB proposal:	• **Remove BAT 8.**

2.15.2 BAT 9 – Diffuse emissions to air, including odorous substances

Location in D1:	*page 744*
Current text in D1:	**9. In order to reduce diffuse emissions to air, including odorous substances, from the unloading, storage and handling of fuels, waste and additives, BAT is to:** **b. capture emissions nearest to the source;** **c. abate the captured pollutants;** **d. optimise the capture efficiency and subsequent cleaning;** **e. use the techniques given below.**

	Technique	Description	Applicability
a.	Minimise of the height of the fuel drop	Use loading and unloading equipment that minimises the height of the fuel drop to the stockpile (e.g. when storing fine wood material and dry peat)	Applicable to solid-fuel-fired combustion plants
b.	Storage water spray systems	Use water-spray systems in storage areas and/or stockpiles.	Applicable in sites where freezing does not occur. Not applicable to fuels with high surface moisture content

c.	Cover stockpiles	Cover stockpiles (e.g. of petroleum coke)	Generally applicable to solid-fuel-fired combustion plants
d.	Grass over long-term storage areas	Grow grass over long-term storage areas	Applicable when dusty fuel is supplied and handled
e.	Direct transfer of extracted fuels	Apply the transfer of extracted fuels via closed belt conveyors or trains directly to the on-site fuel storage area	Applicable to plants located near to mines providing the fuel
f.	Use cleaning devices for conveyor belts	Use cleaning devices for conveyor belts	Applicable to solid-fuel-fired combustion plants
g.	Optimise on-site transport	Rationalise on-site transport systems to minimise movements	Generally applicable
h.	Enclosed conveyors and protected transfer points	Use enclosed conveyors, pneumatic transfer systems, silos with well-designed, robust extraction, and filtration equipment on delivery, conveyor, and transfer points of dusty materials, e.g. dry peat, dusty biomass, coal, lignite, waste, lime, and limestone.	Not applicable to fuels with high surface moisture content
i.	Leak detection systems	Use leak detection systems and alarms	Applicable when natural gas is supplied and handled
j.	Air treatment of sewage sludge storages	Apply suction plants and subsequent cleaning devices to silos bunkers and hoppers storing sewage sludge. For abatement, the odorous air can be led directly to the combustion chamber or burner, where it can be used as combustion air.	Applicable to plants storing sewage sludge before co-incineration

The BAT reference document on Emissions from Storage (EFS BREF) contains BAT conclusions that are of relevance for combustion plants storing fuels, waste, and additives.

Summary of comments:

1. <u>General</u>

- *Delete section 10.1.5. Storage is covered under the EFS BREF. (Eurelectric_649, CEFIC_91_211).*
- *Delete the table in BAT 9 and replace it with a general requirement to undertake a risk assessment of the impact of fuel storage and handling and to minimise impacts to the environment from air-borne particulate and odours. An alternative would be to insert the phrase (in d) to use an appropriate combination of the techniques given below (E&P_46, UK_41, Eurelectric_251)*
- *The techniques are not generally applicable to gaseous fuels (Eurelectric_897).*
- *For existing plants, in particular for the elder ones, a case-by-case technical and economic analysis may have to be done in order to confirm applicability and cost-effectiveness of the techniques (PT_83).*
- *The statement should be 'one or a combination of the techniques given below' (Eurofer_219, IT_75, ES_31).*

2. <u>Technique a (minimise the height of the fuel drop)</u>

- *Change the description by 'Use techniques and equipment in loading, unloading and conveying that minimises the height of the fuel drop (e.g. when handling, moving and storing fine wood material and dry peat) 'Guidelines for storing and handling of solid biofuels' in BATIS) (FI_38).*
- *Include in the applicability restrictions '...with fuel moisture less than 30 %' (EL_40, Eurelectric_252).*

3. <u>Technique b (storage water spray systems)</u>

- *This technique is not applicable to fuels with high surface moisture content or to wood-pellets or other pelleted bio fuels; it may aggravate the risk for spontaneous ignition and furthermore it will reduce the thermal value of the bio-fuels. (Eurelectric_613_898_253)*
- *The applicability should be limited to solid, dusty fuels which are stored in open air (BE_38).*

4. <u>Technique c (cover stockpiles)</u>

- *Remove or add to applicability: 'in case of dusty fuels, not normally required for biomass*

	or coal. Biomass stockpiles must not be covered due to higher risk of self-ignition when covered' (FI_39, Eurelectric_614_899_255_257_615_900, Euracoal_122). • *This should not be applicable to biomass since biomass storage can be big without effect to the environment (CEPI_45).* • *Covering stockpiles may have a major impact on plant cost when large coal storages are required. For a 30-days storage, a 2x300 MW lignite plant requires a 200 x 300 m storage area (EPPSA_369).* • *Add an applicability restriction: 'Applicable to power plants firing solid fuels with low moisture content, without water spray system' (IT_75, EL_41).* • *The applicability should be limited to solid, dusty fuels which are stored in open air (BE_39).* • *The technique is no applicable to feedstocks ready for consumption in the near term for current needs (PL_115); it should only be applicable when a cost benefit analysis demonstrates a quantifiable benefit (Eurelectric_254).* • *Emissions from Storage BREF 2006, Section 5.3.1 notes that open storage may be the only option for long term storage of coal (EL_41).* • *Add to the applicability 'when possible' (PT_55).* *5. <u>Technique d (grass over long-term storage areas)</u>* • *Replace "grow grass" by "spray fixing additives" (Eurelectric_256).* *6. <u>Technique e (direct transfer of extracted fuels)</u>* • *Only the belt conveyors for the transfer of extracted fuels are closed (Eurelectric_616_123_258_901).* • *The applicability should be limited to solid, dusty fuels (BE_40).* • *Add to the applicability: 'Applicable for fuels with low moisture content (<30 %)' (EL_42, Eurelectric_259).* *<u>Technique f (use cleaning devices for conveyor belts)</u>* • *Add an applicability restriction: 'Applicable to power plants firing solid fuels with low moisture content' (EL_43, Eurelectric_577).* • *Include corresponding descriptions in the BREF and/or precise a reference to other BREFs where it is described, i.e. there is no description of cleaning devices for conveyor belts, either in D1 of the LCP BREF or in the EFS BREF (Eurofer_13).* • *Remove the technique as only the risk of fire should be considered (CEPI_42).* *<u>Technique g (optimise on-site transport)</u>* • *The applicability should be limited to solid, dusty fuels (BE_41).* *<u>Technique h (enclosed conveyors and protected transfer points)</u>* • *The applicability should be limited to solid, dusty fuels (BE_42).* • *Change the name of the technique to 'Storage silos, pneumatic transport, enclosed conveyors and protected transfer points' (PL_116, Eurelectric_261).* • *Define 'enclosed conveyors' (Eurelectric_260).* • *Add 'dry fog' (EPPSA_370).* *<u>Technique i (Leak detection systems)</u>* • *Leak detection system required at entrance to main facility where pressure reduced (CEFIC_47).* • *No leakage system should be required in case of use of odour gas (CEPI_41).* • *Delete the requirement. Use of leak detection systems and alarms are normally used for hazardous area enclosures as a backup to the basis of safety, dilution ventilation. (CEPI_48, E&P_51, UK_46) For outdoor scenarios or other situations not requiring forced ventilation, a portable IR gas detection camera would be a practical solution and assessed by an operator (Eurelectric_618_903_262, Euracoal_125).* *<u>Technique j Air treatment of sewage sludge storages</u>* • *If appropriate measurements are conducted and the emission values are not above the limits, treatment of the exhaust air is not necessary (Eurelectric_902_263, Euracoal_124).*
EIPPCB assessment:	**<u>General</u>** • **Diffuse emissions (e.g. dust) from the loading, unloading, storage, transport and/or handling of fuel and additives may be significant due to the large volume of fuel that is generally required in a large combustion plant.** • **The information gathered on the techniques applied by the sector is rather generic (i.e. not sector-specific), and most of the techniques are already listed in the EFS BREF.** • **The prevention and/or reduction of diffuse emissions may be incorporated as part of their environmental management.** • **An odour management plan is commonly applied in many industry sectors (e.g.**

	chemical, PP, waste management facilities). • **Odour emissions reduction could be implemented through the implementation of an odour management plan in case of co-incinerating plants due to the firing, loading, unloading, storage, transport and handling of waste (e.g. sewage sludge).**
EIPPCB proposal:	**General** • **The prevention and/or reduction of diffuse dust emissions from the loading, unloading, storage, transport and handling of fuels may be incorporated as part of their environmental management (BAT 1), including the identification of the most relevant dust emissions sources and the definition and implementation of appropriate actions and techniques to prevent or reduce dust emissions** • **The prevention and/or reduction of odour emissions from the loading, unloading, storage, transport and handling of fuels may be incorporated as part of their environmental management (BAT 1), including the identification of the most relevant odour emissions sources and the definition and implementation of appropriate actions and techniques to prevent or reduce odour emissions.** • **Remove BAT 9.**

2.16 BAT 10 – Water usage and waste water volume discharged

<table>
<tr><td>Location in D1:</td><td>page 745</td></tr>
<tr><td>Current text in D1:</td><td>
10 In order to reduce water consumption and the volume of contaminated water discharged into receiving waters, BAT is to use the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Avoid the use of potable water</td><td>Avoid the use of potable water for processes and abatement techniques</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Use water and drainage systems segregating contaminated water streams</td><td>Design of an industrial site with optimised water management, where each (potentially) contaminated water stream (from e.g. wet abatement, run-offs, etc.) is collected and treated separately, depending on the pollution content</td><td>Applicable to new plants. Applicable to existing plants within the constraints given by the configuration of the water circuits</td></tr>
<tr><td>c.</td><td>Maximise internal water recycling</td><td>Increase the number and/or capacity of water recycling systems when building new plants or modernising/revamping existing plants, e.g. implementing the reuse of cleaned waste water for FGD limestone slurry preparation</td><td>Applicable to new plants. Applicable to existing plants within the constraints given by the configuration of the water circuits</td></tr>
<tr><td>d.</td><td>Segregate/reuse non-contaminated water streams (e.g. once-through cooling water, rain water)</td><td>Design of an industrial site in order to avoid sending non-contaminated water to general waste water treatment system and to reuse as much as possible collected water internally for industrial/sanitary purpose in substitution of other raw water.</td><td>Applicable to new plants. Applicable to existing plants within the constraints given by the configuration of the water circuits</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td>
1. <u>General</u>
1.1. This BAT is not relevant for LCPs discharging their waste water to a shared waste water treatment plant on a multi-activity site (SE_19).
1.2. Include a general applicability restriction for pulp and paper mills, as the water consumption for the combustion plant is minor compared to the rest of the mill (CEPI_51).
1.3. Modify the BAT statement by referring to an appropriate combination of techniques instead of to all techniques (SE_79, UK_48, CEFIC_215, E&P_53, Eurelectric_264).
1.4. The techniques proposed as BAT are not described in other chapters of the BREF (DK_11, Eurofer_14, CEFIC_214).
1.5. Clarify at the beginning of the section if cooling tower blowdown is included or excluded (EPPSA_371).
2. <u>Techniques</u>
2.1. <u>Technique a: 'Avoid the use of potable water'</u>
• Add a definition for 'potable water' (DK_12).
• In some cases, potable water is the only resource available (ES_32, PL_117, Eurelectric_265_619_905).
• Change to 'Avoid use of potable water… where practicable' or 'Minimise use of potable water…..' as the use of other water resources could increase costs and cross-media effects (e.g. use of chemicals, waste generation) (E&P_55, UK_57).
• In the case of low water consumption due to the small plant size or due to high steam condensate return, the use of potable water is the most economical solution (CEPI_49).
• The term potable water comprises several water sources. Better refer more specifically to groundwater (except bank filtrate) and drinking water from the network (AT_110).
2.2. <u>Technique b: 'Use water and drainage systems segregating contaminated water streams'</u>
• Move technique b to BAT 11, as it reduces emissions, but not water usage (DK_13).
2.3. <u>Technique c: 'Maximise internal water recycling'</u>
• Water recycling is limited by the purity requirements of the recipient stream. Waste water from WFGD is usually not recycled due to its salinity (Eurelectric_589_620_906, DK_14). Instead the cooling water blowdown may be recycled to the WFGD (Eurelectric_590).
• Add an applicability restriction for once-through cooling systems, as in some cases they are the most appropriate solution (Eurofer_221_222, SE_89).
2.4. <u>Technique d: 'Segregate/reuse non-contaminated water streams (e.g. once-through cooling water, rain water)'</u>
• Add an applicability restriction for sea water used as cooling water, as it is generally
</td></tr>
</table>

	not treated and reused (Eurelectric_593, EL_44). • *Delete 'once-through', as the term indicates that recycling is not possible (DK_15, UK_50, E&P_56)* • *Add an applicability restriction for once-through cooling systems, as in some cases they are the most appropriate solution (SE_90).* *2.5. <u>New techniques</u>* • *Add a technique on the mixing of waste water from WFGD with coal/lignite ash, as described in Section 4.5.13 of the BAT chapter of the 2006 LCP BREF (EL_231).*
EIPPCB assessment:	**1. <u>General</u>** **1.1. (+1.2.) Even in the presence of a shared waste water treatment plant, it is often beneficial to reduce water consumption and the waste water volume. Instead of water consumption, it seems more appropriate to refer to water usage (see CWW BREF).** **1.3. Since none of the techniques listed in the revised table is generally applicable, it seems more appropriate to refer to 'one or a combination of techniques'.** **1.4. The background of each technique is missing in Chapter 3 of the BREF.** **1.5. A general reference to the ICS BREF is given at the beginning of the BAT conclusions. Nevertheless, the descriptive BAT on waste water segregation and water recycling mention cooling water. The proposed BAT-AELs apply to waste water from flue-gas treatment. Therefore, no further clarification is deemed necessary.** **2. <u>Techniques</u>** **2.1. <u>Technique a: 'Avoid the use of potable water'</u>.** **The production of water suitable for use in LCPs (e.g. for boilers) may require resources and chemicals, and generate waste, as is the case for the production of drinking water. The choice of the most appropriate raw water source (in terms of economics and overall environmental impact) very much depends on local conditions.** **2.2. <u>Technique b: 'Use water and drainage systems segregating contaminated water streams'</u>.** **Waste water segregation does not reduce water usage and the waste water volume.** **2.3. (+2.4.) <u>Technique c: 'Maximise internal water recycling' and technique d: 'Segregate/reuse non contaminated water streams (e.g. once-through cooling water, rain water)'</u>.** **Water is used for different purposes in LCP plants generating waste water with varying pollutant levels. Relatively uncontaminated water (e.g. from cooling water blowdown) can often be reused for other purposes requiring water of lower quality (e.g. for cleaning or flue-gas treatment). The recycling is limited by the quality requirements of the recipient stream and the water balance of the plant. Some waste water streams are usually not recycled (e.g. seawater used in cooling systems). The optimum choice of the cooling system depends on the local conditions. Waste water from WFGD is sometimes recycled after treatment (US EPA 2013).** **Technique (d) is covered by techniques (b) and (c).** **2.5. <u>New techniques</u>** **The addition of coal/lignite ash to waste water from WFGD results in a residue that is typically disposed of as waste. This prevents the recycling/reuse of the ash (proposed as BAT 13 d) and requires extra landfill volume.** **Evaporation of waste water is a technique that reduces water usage (see Section 1.2.3 of this BP).** **Dry ash handling is a technique described in Chapter 3 of the BREF (Optimisation of bottom ash quality) and proposed as new source performance standard by the US EPA.**
EIPPCB proposal:	**1. <u>General</u>** **1.1. (+1.2) Refer to water usage in the BAT statement.** **1.3. Refer to 'one or a combination of techniques' in the BAT statement.** **1.4. Add information on the techniques in Chapter 3 of the BREF.** **1.5. Do not add further clarifications on cooling water.** **2. <u>Techniques</u>** **2.1. <u>Technique a: 'Avoid the use of potable water'</u>.** • **Remove technique.** **2.2. <u>Technique b: 'Use water and drainage systems segregating contaminated water streams'</u>.** • **Formulate a separate BAT conclusion on waste water segregation with the**

	objective of reducing emissions to water (see CWW and WBP BREF). **2.3. Technique c: 'Maximise internal water recycling'.** • **Reformulate technique (c) in a more general way. Specify that the degree of recycling is limited by the water balance and the purity requirements of the recipient stream. Reformulate the applicability to clarify that the technique is not applicable to waste water from cooling systems operated with seawater or in once-through mode.** **2.4. Technique d: 'Segregate/reuse non contaminated water streams (e.g. once-through cooling water, rain water)'.** • **Remove technique.** **2.5. New techniques** • **Do not add the technique 'Addition of coal/lignite ash to WFGD waste water'.** • **Add the techniques 'evaporation' and 'dry ash handling'.**

2.17 Waste, by-products and residues management

2.17.1 BAT 12 – Waste management plan

Location in D1:	*p. 746 Section 10.1.7*
Current text in D1:	12. **In order to prevent, or where it is not practicable, to reduce waste generation, BAT is to adopt and implement a waste management plan that ensures that waste is, in order of priority, avoided, reused, recycled, recovered or safely disposed of.**
Summary of comments:	*Include the 'life-cycle thinking' consideration when setting the waste management options priorities, to be in line with the Waste Framework Directive (CEPI_53_54, FI_97_98)*
EIPPCB assessment:	**In order to reduce the overall size of the BAT conclusions and to ease their use, quoting the order of priority in the waste management options may not be needed as it is already included in the Waste Framework Directive.**
EIPPCB proposal:	**Remove the BAT 13 and keep only the statement in BAT 1 related to the need to implement a waste management plan.**

2.17.2 BAT 13 – Minimisation of waste generation

<table>
<tr><td>Location in D1:</td><td colspan="4">p. 746 Section 10.1.7</td></tr>
<tr><td>Current text in D1:</td><td colspan="4">13. In order to reduce the quantities of wastes from the combustion process and abatement techniques sent for disposal, BAT is to organise operations on the site so as to maximise, in order of priority:

13.1. the proportion of residues which arise as by-products;
13.2. waste reuse according to the specific requested quality criteria;
13.3. waste recycling;
13.4. other recovery,

by implementing on-site and/or off-site technical measures such as:
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>e.</td><td>Regeneration of spent catalysts</td><td>On-site catalyst regenerations (e.g. up to 4 times for SCR catalysts) restore some or all of the original performances, extending the service life of the catalyst to several decades. Regeneration is integrated in a catalyst management scheme</td><td>Generally applicable</td></tr>
</table></td></tr>
</table>

	f.	Energy recovery by waste reuse in the fuel mix	The residual energy-content of ash and sludges generated by the combustion of coal, lignite, heavy fuel oil, peat, or biomass can be recovered on site and/or off site when the waste has a residual calorific value. Energy recovery by on-site reuse in fuel mix is possible for e.g. sludge and carbon-rich ash	Applicable to plants that can accept waste in the fuel mix, and subject to the technical possibility of feeding the fuels into the combustion chamber
	g.	Reuse of the gypsum	Off-site reuse of the gypsum generated by the wet abatement of SO_X as a substitute of raw gypsum (e.g. as fillers in the plasterboard industry). The amount of limestone influences the purity of gypsum.	Applicable within the constraints given by the gypsum required quality, and health demand associated to a specific use
	h.	Reuse in the construction sector	Off-site reuse (of e.g. the residue of semi-dry desulphurisation processes, bottom ash) as a construction material (in e.g. road construction, concrete, cement industry)	Applicable within the constraints given by the material required quality (e.g. physical properties, content of harmful substances) associated to each specific use

Summary of comments:

General

1. *Include the flexibility of 'using an appropriate combination of the listed techniques' instead of the proposed text in D1 (UK_59, E&P_64, Eurelectric_579).*
2. *'Process quality optimisation system' in order to identify and implement improvement potential based on questionnaires 121 and 142 (Eurelectric_626).*
3. *'FGD washer and centrifuge' and 'dry ash conveyor' to improve the quality of gypsum and ash (Euracoal_129, Eurelectric_238_582_627).*
4. *Include the specific techniques to be used in case of implementation of ZLD (Zero Liquid Discharge) for waste water management (PL_123, Eurelectric_609).*
5. *Add some other techniques to be more exhaustive (use of ash as fertiliser, optimisation of oxidation process, controlled thermal conversion, pyrolysis) or remove the list (CEPI_55, FI_99) Include technique for saline waste management from wastewater treatment processes (PL_120, Eurelectric_591).*
6. *Add a technique i. related to the reuse of sludge or waste in the combustion chamber together with the fuel (DK_85_86)*

Technique e (catalyst regeneration)

7. *Include an applicability limitation only to the cases where the performance of the regenerated catalyst can be guaranteed (CEFIC_48), or when the mechanical conditions allow it (PT_86).*
8. *Delete 'on-site' regeneration (EL_51, MT_10_12, PT_86, Euromot_56_84, Eurelectric_584_628_912).*

Technique g (gypsum reuse)

9. *Modify the description on the influencing parameter for a good quality gypsum which is the quality of the limestone used and not its amount (EPPSA_373, Eurelectric_586, 629_133_913, Euracoal_133).*
10. *Include also on site reuse of limestone in the description (EL_52, Eurelectric_585).*

Technique h (Reuse in construction sector)

11. *Include also the fly ash reuse (in concrete) in the description (Euracoal_134, Eurelectric_588_630_914).*
12. *Include also on site reuses in the description (EL_53, Eurelectric_587).*

Techniques g and h

13. *Include an applicability restriction linked to the market conditions (EL_52, PT_87_88, SP_35, Eurelectric_580_585).*

EIPPCB assessment:

General

1. **The list of techniques given is indicative, the text of the BAT saying '… such as'. However, it may be that all the techniques listed cannot be implemented simultaneously. The text needs to be clarified.**

Additional techniques

2. **The process quality optimisation system makes reference to the EMS (BAT1) and to the 'combustion optimisation' technique described and quoted in the conclusions on 'good environmental performance', and is not specific to waste management.**

	3. These techniques were not described in D1. They have been described in Section 3.3.7. However, they are part of the more global techniques (e) and (f) of the proposed BAT in D1. **4. This general BAT conclusion does not aim to cover all the specific detailed situations linked to the implementation of other given abatement techniques for air or water emissions. Should there be some issues related to such given techniques, they may be indicated as applicability restrictions associated to the techniques themselves.** **5. As indicated in the general considerations of the BAT conclusions, 'the techniques listed and described in these BAT conclusions are neither prescriptive nor exhaustive. Other techniques may be used that ensure at least an equivalent level of environmental protection'. See also the assessment in paragraph 2 above regarding the techniques linked to combustion process control. Finally, there is no description proposed for the proposed techniques.** **6. The proposed new technique is already covered by technique (f).** **Technique e (catalyst regeneration)** **7. There may be techno-economic situations where the regeneration of catalyst is not possible due to mechanical constraints or high requirements in terms of expected performance, and where the use of new catalyst is to be favoured.** **8. The on-site regeneration can lead to environmental problems or additional costs if the plant is not designed for that purpose; manufacturers may have better designed facilities for taking care of the spent catalysts.** **Technique g (gypsum reuse)** **9. It is indeed the quality of limestone used that could lead to a higher level of unreacted limestone present in the gypsum.** **10. The techniques listed and described in these BAT conclusions are neither prescriptive nor exhaustive. The description emphasises the solution where gypsum is produced to replace gypsum that would be otherwise quarried, thus preserving natural resources.** **Technique h (reuse in construction sector)** **11. Fly ash reuse is also to be favoured taking into consideration the limitations already mentioned in the proposed BAT conclusion, and thus could also be included in the description.** **12. The techniques listed and described in these BAT conclusions are neither prescriptive nor exhaustive. The construction sector can also offer uses on site and thus no specific distinction on/off site is needed.** **Techniques g and h** **13. The current downturn in the economy shows that the market may be less able to absorb some of the by-products generated by combustion plants.**
EIPPCB proposal:	**General** **1. Modify the statement by adding 'an appropriate combination of…'** **Additional techniques** **2. (+4. + 5. + 6.) Do not add other techniques.** **3. Do not add the details of the proposed techniques.** **Technique e (catalyst regeneration)** **7. Include an applicability restriction related to the mechanical condition of the catalyst and to its required performance.** **8. Delete 'on-site' from the description.** **Technique g (gypsum reuse)** **9. Modify the influencing factor, replacing the quantity with the quality of limestone used.** **10. Keep the off-site description.** **Technique h (Reuse in construction sector)** **11. Include 'fly ash' in the list of substances quoted in the description.** **12. Delete 'off site' in the description.** **Techniques g and h** **13. Include an applicability restriction linked to the market conditions for the reuse of generated by-products.** **14. Improve the wording by minor editorial changes.**

2.18 BAT 14 – Noise emissions

<table>
<tr><td>Location in D1:</td><td>p. 747</td></tr>
<tr><td>Current text in D1:</td><td>
14. In order to reduce noise emissions from relevant sources in combustion plants (e.g. boiler soot blowers, cutting-straw hammer-mills, fuel pneumatic transport to the burner), BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a</td><td>Strategic planning of the location of equipment, units and buildings</td><td>Noise levels can be reduced by increasing the distance between the emitter and the receiver and by using buildings as noise screens</td><td>Applicable to new plants. In the case of existing plants, the relocation of equipment and production units may be restricted by the lack of space or excessive costs</td></tr>
<tr><td>b</td><td>Noise-reduction programme</td><td>The noise-reduction programme includes identification of sources and affected areas, calculations and measurements of noise levels, identification of the most cost-effective combination of techniques, their implementation, and monitoring</td><td>Generally applicable</td></tr>
<tr><td>c</td><td>Operational and management techniques in buildings containing noisy equipment</td><td>This includes:
improved inspection and maintenance of equipment to prevent failures;
closing of doors and windows of covered areas;
equipment operated by experienced staff;
avoidance of noisy activities during night-time;
provisions for noise control during maintenance activities</td><td>Generally applicable</td></tr>
<tr><td>d</td><td>Low-noise equipment</td><td>This potentially includes:
compressors with ≤ 85 dB(A);
speed-controlled pumps;
avoidance of punched disks</td><td>Applicable to new equipment</td></tr>
<tr><td>e</td><td>Noise-reducers</td><td>Installation of noise-reducers on equipment and ducts</td><td>Generally applicable</td></tr>
<tr><td>f</td><td>Vibration insulation</td><td>Vibration insulation of machinery and decoupled arrangement of noise sources and potentially resonant components</td><td>Generally applicable</td></tr>
<tr><td>g</td><td>Enclose noisy equipment</td><td>Enclosure of noisy equipment in separate structures such as buildings or soundproofed cabinets where internal-external lining is made of impact-absorbent material</td><td>Generally applicable</td></tr>
<tr><td>h</td><td>Soundproof buildings</td><td>This potentially includes:
sound-absorbing materials in walls and ceilings;
sound-isolating doors;
double-glazed windows</td><td>Generally applicable</td></tr>
<tr><td>i</td><td>Noise abatement</td><td>Noise propagation can be reduced by inserting barriers between the emitters and receivers. Appropriate barriers include protection walls, embankments, and buildings</td><td>Applicable to new plants. In the case of existing plants, the insertion of obstacles may be restricted by the lack of space</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td><u>General</u>
1. Delete this BAT conclusion (Eurelectric_243_560_631).
2. Specify if the BAT conclusion is applicable to existing plants and the load mode operation (IE_14).
3. Add a general applicability restriction: 'The use of the specified techniques may be restricted by excessive costs' (DK_108).
4. Include 'Noise insulation at the facades of dwellings as an optional technique of noise</td></tr>
</table>

	abatement, especially for dwellings outside coherent urban areas' (DK_110). *5. The application of this BAT is subject to the need to comply with legal requirements (PT_57).* *<u>Technique b (Noise-reduction programme)</u>* *6. A noise reduction plan is just necessary, if there are any noise 'problems' LV exceeding (DE_35).* *7. Add I the description 'as appropriate to the local environment' (CEFIC_218).* *<u>Technique c (Operational and management techniques in buildings containing noisy equipment)</u>* *8. Change the demand of 'improved inspection and maintenance of equipment to prevent failures' to demand of "inspection and maintenance of equipment to prevent failures' (FI_43).* *9. Remove 'extra noise control of maintenance of noisy equipment' (FI_43).* *10. Add 'if possible' at the end of the sentence 'avoidance of noisy activities during night-time (CEFIC_219).* *<u>Technique d (Low-noise equipment)</u>* *11. Speed-controlled pumps depending on size of the plant (ES_37).* *12. The general requirements should be deleted or be clarified in detail (CEFIC_5_28, FI_44).* *13. Delete Speed-controlled pumps (EL_54, Eurelectric_565).* *<u>Technique e (Noise-reducers)</u>* *14. Applicable to new plants and equipment. Existing plants or equipment may have space or other design constraints that must be considered." (CEFIC_223).* *15. Applicable to new plants and to existing plants within the constraints of space availability (EL_55, Eurelectric_567).* *<u>Technique f (Vibration insulation)</u>* *16. Applicable to new plants and equipment. Existing plants or equipment may have space or other design constraints that must be considered." (CEFIC_224).* *<u>Technique g (Enclose noisy equipment)</u>* *17. Applicable to new plants and equipment. Existing plants or equipment may have space or other design constraints that must be considered." (CEFIC_225).* *18. Applicable to new plants and to existing plants within the constraints of space availability (EL_56, Eurelectric_568).* *<u>Technique h (Soundproof buildings)</u>* *19. Applicable to new plants and equipment. Existing plants or equipment may have space or other design constraints that must be considered. (CEFIC_275).* *20. Only applicable to new plants (CEPI_56, EL_57, Eurelectric_569).* *<u>Technique i (Noise abatement)</u>* *21. Change to 'Noise barriers' (Eurelectric_637_916_570).* *22. Applicable to new plants. The insertion of obstacles may be restricted by the lack of space (Eurelectric_916_571_109).*
EIPPCB assessment:	**<u>General</u>** **1. (+5.). According to Article 3(4) of the IED, noise emissions are covered by the IED. Noise emissions reduction could be carried out through the implementation of a noise management plan in conjunction with other noise-targeted techniques.** **2. (+3.) Prevention and/or reduction of noise emissions is a generic issue that cuts across the LCP sector. Applicability restrictions are discussed technique by technique.** **4. 'Noise insulation at the facades of dwellings' is similar to technique (h).** **<u>Technique b (Noise-reduction programme)</u>** **6. (+7.) The noise reduction programme could be part of a broader noise management plan, which has to take into consideration a list of parameters, including historical noise incidents and local conditions (e.g. distance to residential or other sensitive areas).** **<u>Technique c (Operational and management techniques in buildings containing noisy equipment)</u>** **8. (+9.) 'Improved inspection and maintenance of equipment' is consistent with recently adopted BAT conclusions for noise emissions (see CWW).** **10. The avoidance of noisy activities at night needs the addition of 'if possible', also for consistency with recently adopted BAT.** **<u>Technique d (Low-noise equipment)</u>** **11. (+12. +13.) The techniques listed are neither prescriptive nor exhaustive.** **<u>Techniques e (Noise-reducers), f (Vibration insulation), g (Enclose noisy equipment) and h (Soundproof buildings)</u>** **14. – 20. The techniques described in points e-h could be merged under a new technique named 'noise-control equipment' with applicability restrictions due to space requirements.**

	Technique i (Noise abatement) **21. (+22.) 'Noise abatement' describes the technique better than 'Noise barriers'. The term 'obstacles' in the description is more suitable than the term 'noise barrier'. Applicability restrictions are already in place.**
EIPPCB proposal:	**General and Technique b (Noise-reduction programme)** **1. (+5. +6. +7.) Include a new BAT conclusion on a noise management plan as part of the environmental management system (BAT 1). Add an applicability restriction in the new BAT when a noise nuisance is expected and/or substantiated. A noise reduction programme will be part of this plan. Also, rename technique (a) as: 'Appropriate location of equipment and buildings' to be consistent with recently adopted BAT conclusions. Remove technique (b).** **2. (+3.) Do not enter a general applicability restriction for the BAT conclusions but consider applicability of individual techniques.** **Technique c (Operational and management techniques in buildings containing noisy equipment** **8. (+9.) Change the description of the technique to: 'improved inspection and maintenance of equipment'.** **10. Add 'if possible' in the description of the technique 'avoidance of noisy activities at night'.** **Technique d (Low-noise equipment)** **11. (+12. +13.) Do not delete technique (d) (low noise equipment) but make the description more general.** **Techniques e (Noise-reducers), f (Vibration insulation), g (Enclose noisy equipment) and h (Soundproof buildings)** **14. – 20. Merge techniques e-f-g-h under a new technique named: 'noise control equipment' which includes noise and vibration insulation and soundproofing of buildings.** **Technique i (Noise abatement)** **21. (+22.) Change 'barriers' by 'obstacles' in the description of the technique.**

2.19 Description of techniques

2.19.1 General techniques

Location in D1:	*Section 10.8 – p. 803*
Current text in D1:	<table><tr><th>Technique</th><th>Description</th></tr><tr><td>Fuel choice</td><td>By switching to a different biomass fuel (e.g. lower sulphur, ash, nitrogen, fluorine or chlorine content in the fuel), the corresponding emissions are reduced</td></tr><tr><td>Multi-fuel firing</td><td>Replace part of a fuel by another fuel having better environmental profile (e.g. syngas from biomass gasification instead of coal)</td></tr><tr><td>Process control</td><td>Combination of primary measures: complete combustion, along with good furnace design, fuel choice, multi-fuel firing, the use of high performance monitoring and automated process control techniques, and maintenance of the combustion system</td></tr><tr><td>Complete combustion</td><td>Complete combustion, going along with good furnace design, the use of high performance monitoring and automated process control techniques, and maintenance of the combustion system</td></tr></table>
Summary of comments:	*Fuel choice* • *The description for the general technique "fuel choice" is limited to biomass fuels (Eurelectric_765_1013, Euracoal_168).* • *Include the use of HFO from steam cracking plants*
EIPPCB assessment:	**Fuel choice** • **Description has to be generic enough to be consistent throughout the document.** **Process control and Complete combustion**

	• **The three techniques 'process control', 'advanced computerised control system' and 'complete combustion' are overlapping and may be re-organised.**
EIPPCB proposal:	**Fuel choice** • **Change description to 'The use of fuel with a low content of potential pollution-generating compounds (e.g. low sulphur, ash, nitrogen, mercury, fluorine or chlorine content).** **Process control and complete combustion** • **Change the name and description of these two techniques to 'advanced control system' and 'combustion optimisation'. See the proposal for the descriptions in the draft BAT conclusions document.**

2.19.2 Energy efficiency

<table>
<tr><td>Location in D1:</td><td>Section 10.8 – p. 803</td></tr>
<tr><td>Current text in D1:</td><td>
<table>
<tr><th>Technique</th><th>Description</th></tr>
<tr><td>Ultra supercritical steam parameters</td><td>Use of a steam circuit, including double or triple steam reheat systems, in which steam can reach pressures about 300 bar and temperatures about 600°C</td></tr>
<tr><td>Supercritical steam parameters</td><td>Use of a steam circuit, including steam re-heating systems, in which steam can reach pressures above 220.6 bar and temperatures above 374°C</td></tr>
<tr><td>Heat recovery by cogeneration (CHP)</td><td>Recovery of heat mainly from the steam cooling for producing hot water / steam which is used in industrial activities or in district heating. Additional recovery are possible from:
flue gas
grate cooling
circulating bed</td></tr>
<tr><td>CHP readiness</td><td>A CHP-ready plant will include provision to allow the later export of a useful quantity of heat to an off-site heat load in a way that will achieve at least a 10 % reduction in primary energy usage when compared to the separate generation of the heat and power produced. It includes identifying and retaining access to specific points on the steam system from which steam can be extracted, as well as making sufficient space available to allow the later fitting of items such as pipework, heat exchangers, extra water demineralisation capacity, standby boiler plant and back-pressure turbines. Balance of plant systems and control/instrumentation systems are capable of upgrade. Later connection of backpressure turbine(s) is also possible</td></tr>
<tr><td>Regenerative feed-water heating</td><td>Preheating water in the steam circuit with recovered heat from the plant</td></tr>
<tr><td>Preheating of combustion air</td><td>Preheating combustion air by reusing part of the recovered heat</td></tr>
<tr><td>Steam turbine upgrades</td><td>Increased temperature and pressure of medium pressure steam, addition of low-pressure turbine, modification of blade geometry</td></tr>
<tr><td>Advanced computerised control system</td><td>Computerised control of the main combustion parameters in order to improve the combustion efficiency and completeness</td></tr>
<tr><td>Cooling tower discharge</td><td>Air emission release through a cooling tower and not via a dedicated stack</td></tr>
<tr><td>Wet stack</td><td>Design of the stack in order to enable the water vapour condensation from the saturated flue-gas and thus to avoid to use a flue-gas reheater after the wet FGD</td></tr>
<tr><td>Fuel specification in supplier contract or internal document</td><td>The fuel supplier or the internal management adheres to moisture (and size) specification in the contract or internal document.</td></tr>
<tr><td>Fuel drying (lignite, biomass, peat)</td><td>The moisture is reduced by mean of recovered heat (steam or flue-gas) or mechanical mean (Press) to the level required (e.g. 40 – 45 %) to achieve the optimal functioning of equipment (boiler, ESP), improve combustion conditions, increase the overall energy efficiency and avoid VOC direct emissions from the dryer.</td></tr>
<tr><td>Fuel pre-heating (gaseous, liquid fuels)</td><td>Pre-heating of fuel by using recovered heat</td></tr>
</table>
</td></tr>
</table>

	Flue-gas condenser	The flue-gas condenser is a heat exchanger where water is heated by the flue-gases before it is heated in the steam condensers. Vapour content in the flue-gases thus condense as it is cooled by the heating water. Flue-gas condenser is used both to increase the energy efficiency and to remove dust and SO_X from the flue gas.
	Steam double reheat	Improved plant performance is possible by employing a double, rather than single, steam reheats cycle
	Combined cycle	Combination of two or more thermodynamic cycles, e.g. a Brayton cycle (gas turbine/combustion engine) with a Rankine cycle (steam turbine/boiler), to convert heat loss from the flue-gas of the first cycle to useful energy by subsequent cycle(s)
	Process gas management system	Process gas management systems enable directing the fuel gases to the combustion plants, depending on the availability of these fuels and on the type of combustion plants in an integrated steelworks
Summary of comments:	*1. Ultra supercritical steam parameters* • *There is not a rigid definition of Ultra Supercritical (USC) conditions (EPPSA_407_409).* *2. Supercritical steam parameters* • *Change the temperature and pressure according to consolidated practice (EPPSA_407_409).* *3. Heat recovery by cogeneration (CHP)* • *High efficiency CHP is defined in EED 2012/27/EU as saving a minimum of 10 % primary energy savings but CHP is 'only' combined heat and power production (Cogen Europe_8).* • *Include a cross reference to the definition of Primary Energy Saving according to the 2012/27/UE should be reported together with harmonised efficiency reference values for separate production of electricity and heat (IT_196).* *4. Preheating of combustion air* • *Preheating combustion air needs to have a BAT-AEL between 200 and 225 mg/Nm3 (CEFIC_1).* *5. Fuel specification in supplier contract or internal document* • *The meaning of 'size' in this context should be explained (PT_94).* *6. Fuel drying (lignite, biomass, peat)* • *Fuel drying for lignite is emerging technology and not BAT (EPPSA_409).* *7. New technique: Gas-gas heater* • *Include gas gas heater as BAT as long as replacement for operational and economic reasons is not required*	
EIPPCB assessment:	**1. (+2.) Ultra-supercritical steam parameters + Supercritical steam parameters** • **According to the BREF (Section 3.3.4.14), USC steam parameters are not clearly defined. The following levels are often used as reference: pressure above 250–300 bar, and temperature above 580–600 °C. BAT 7 can also be updated accordingly.** **3. Heat recovery by cogeneration (CHP)** • **A minimum of 10 % primary energy savings is considered in the 'CHP readiness' technique.** **4. Preheating of combustion air** • **Cross-media effects of certain energy efficiency techniques may be overcome with NO_X emissions abatement techniques.** **5. Fuel specification in supplier contract or internal document** • **Size of the fuel is site-specific.** **6. Fuel drying (lignite, biomass, peat)** • **BAT 7 includes fuel predrying, which is described in the BAT, but not fuel drying.** **7. New technique: Gas-gas heater** • **Gas-gas heater technique is not included in BAT 7. It is not needed to include the description.** **8. Other techniques** • **Fuel preheating (gaseous, liquid fuels), Cooling tower discharge, Steam turbine upgrades are already described in BAT 7. Steam double reheat is not included in BAT 7, therefore the description is not needed.**	

EIPPCB proposal:	**1. Change the description of the 'Ultra-supercritical steam parameters' technique to 'The use of a steam circuit including reheat systems, in which steam can reach pressures above 250-300 bar and temperatures above 580-600 ºC'.** **2. Change the temperature in the 'Supercritical steam parameters' technique to > 540 ºC.** **3. Do not include a minimum primary savings to the 'Heat recovery by cogeneration' technique, which is now described in BAT 7.** **4. Do not make any change to the 'Preheating of combustion air' technique, which is now described in BAT 7.** **5. Do not make any change to the 'Fuel specification in supplier contract or internal document' technique.** **6. Remove** **7. Fuel drying (lignite, biomass, peat) technique.** **8. Do not include the description of Gas-gas heater.** **9. Remove the descriptions of Fuel preheating (gaseous, liquid fuels), Cooling tower discharge, Steam turbine upgrades, Steam double reheat techniques.**

2.19.3 NO_X and CO

Location in D1:	*Section 10.8 – p. 804*
Current text in D1:	

Technique	Description
Fuel choice	Choice of a fuel with low N content
Air-staging (OFA)	Creation of several combustion zones in the combustion chamber with different oxygen contents for controlling NO_X emissions and ensuring complete combustion. The technique involves sub-stoichiometric firing and the addition of the remaining air or oxygen into the furnace to complete combustion. Boosted OFA systems such as high pressure or multi-direction injection systems enhance the effect of this technique by preventing the formation of stratified laminar flow and enabling the entire furnace volume to be used more effectively for the combustion process
Flue-gas or exhaust-gas recirculation (FGR/EGR)	Recirculation of part of the flue-gas to the combustion chamber in replacement of part of fresh combustion air, having the double effect to cool the flame temperature and to limit the O_2 content for nitrogen oxidation, thus limiting the NO_X generation. It implies the reinjection of waste gas from the furnace into the flame to reduce the oxygen content and therefore the temperature of the flame. The use of special burners is based on the internal recirculation of combustion gases which cool the root of the flames and reduce the oxygen content in the hottest part of the flames
Low-NO_X burners (LNB)	The technique (including ultra- or advanced-low-NO_X burners) is based on the principles of reducing peak flame temperatures; boiler burners are designed to delay, but complete the combustion and increase the heat transfer (increased emissivity of the flame). The air/fuel mixing, reduce the availability of oxygen, and reduce the peak flame temperature thus retarding the conversion of fuel-bound nitrogen to NO_X and the formation of thermal NO_X, while maintaining high combustion efficiency. It may be associated with a modified design of the furnace combustion chamber. The design of ultra- or advanced-low-NO_X burners (ULNB) includes combustion staging (air/fuel) and flue-gas recirculation. Dry low-NO_X burners (DLN) are used in gas turbines
Low-NO_X combustion concept in diesel engines	In diesel engines, the central element of the 'low NO_X combustion' concept is the very late fuel injection timing in combination with cycle optimisation

Lean-burn concept	The control of peak flame temperature through lean-burn conditions is the primary combustion approach to limiting NO_X formation in gas engines. Lean combustion decreases the fuel/air ratio in the zones where NO_X is produced so that peak flame temperature is less than the stoichiometric adiabatic flame temperature, therefore suppressing thermal NO_X formation. The optimisation of this concept is called ' advanced lean-burn concept' and is still not applicable to dual fuel engines due to misfiring problems
Fuel staging (reburning)	The technique is based on the reduction of the flame temperature: a low impulse primary flame is developed in the port neck; a secondary flame covers the root of the primary flame reducing its core temperature
Combination of primary techniques for NO_X reduction	Combination of primary techniques: air staging including boosted overfire air, fuel staging, flue gas recirculation, LNB
Selective catalytic reduction (SCR)	Selective reduction of nitrogen oxides with ammonia or urea in the presence of a catalyst. The technique is based on the reduction of NO_X to nitrogen in a catalytic bed by reaction with ammonia (in general aqueous solution) at an optimum operating temperature of around 300 – 450 °C. One or two layers of catalyst may be applied. A higher NO_X reduction is achieved with the use of higher amounts of catalyst (two layers). The technique design can be modular, special catalyst can be used and/or preheating can be used to cope with low loads or with broad flue-gas temperature window
Selective non-catalytic reduction (SNCR)	Selective reduction of nitrogen oxides with ammonia or urea without catalyst. The technique is based on the reduction of NO_X to nitrogen by reaction with ammonia or urea at a high temperature. The operating temperature window is maintained between 900 and 1050 °C for optimal reaction
Combined SNCR + SCR	Combination of the SNCR and SCR techniques
Water/steam addition	Water or steam are used as diluents for reducing the combustion temperature in gas turbines and engines and the thermal NO_X formation, either by being premixed with the fuel prior to its combustion (fuel emulsion, humidification or saturation) or directly injected in the combustion chamber (water/steam injection)
Low excess air	The technique is mainly based on the following features: • minimisation of air leakages into the furnace • careful control of air used for combustion • modified design of the furnace combustion chamber
Combined techniques for NO_X and SO_X reduction	Use of complex and integrated abatement technique for combined reduction of NO_X, SO_X, and often other pollutants, from the flue-gas, e.g. activated carbon, $DESONO_x$ processes
Advanced computerised process control	See section 10.8.2
Low-NO_X combustion concept in engines	In diesel engines, the central element of the 'low NO_X combustion' concept is the very late fuel injection timing in combination with cycle optimisation, e.g. thanks to late exhaust valve closing in new two-stroke engine
Oxidation catalysts	Use of catalytic converter (precious metal in general such as palladium or platinum) where an oxidising reaction converts carbon monoxide (CO) and unburnt hydrocarbons (HC) to CO_2 and water vapour, using the O_2 contained in the flue-gas

	Circulating fluidised bed boiler (CFB boilers)	Fluidised bed combustion takes place with the injection of fuel into a hot turbulent bed, where combustion air has also been injected from the bottom of the fluidised bed boiler by fluidisation of the bed. The bed (sand) of particles, including fuel (between 1 and 3 % of the bed material), ash and sorbents, is fluidised by upwards flowing air in a furnace, and the bed temperature allows the fuel to burn. Due to the combustion temperatures of about 750 – 950 ºC and the long residence time, the burnout of the fuel is very high and, therefore, the related emissions of combustion products are relatively low. In CFB boilers, the small size of the bed particles induces their transportation through the furnace to the second pass of the boiler. These particles exiting the furnace are separated from the flue-gas flow by a cyclone or by other separation methods, and recirculated back to the fluidised bed
Summary of comments:	1. *Air-staging (OFA)* • *Remove paragraph 'Boosted OFA…for the combustion process' (EPPSA_410_411).* 2. *Flue-gas or exhaust-gas recirculation (FGR/EGR)* • *Flue-gas or exhaust-gas recirculation (FGR/EGR) is not always done over the burner or with a special burner. The description should leave room for other ways of recirculating flue-gas to the root of the flame (Eurelectric_556).* 3. *Lean-burn concept* • *Lean burn is not applicable to DF type lean burn engine types due to the pilot injection of a liquid fuel for the gas ignition, zones in flame front area with lamda 1 exist (FI_142, Euromot_65_95).* 4. *Fuel staging (reburning)* • *Change the description to "The technique is based on the reduction of flame temperature or localised hot spots in combustion with no flames (e.g. fluidised bed boilers)" (EPPSA_410).* 5. *Combination of primary techniques for NO_X reduction* • *Delete 'boosted' (EPPSA_412).* 6. *Selective catalytic reduction (SCR)* • *Change text about the number of layers of the catalyst cannot be limited to two (UK_29, PT_ 95, EPPSA_413, Euracoal_171).* 7. *Selective non-catalytic reduction (SNCR)* • *Add restriction to be considered in the context of the available temperature window in an existing boiler (UK_30, Euracoal_172).* • *The temperature range given for SNCR is not correct. Change text to 'The operating temperature window is preferably maintained between 850 and 1000°C for optimal reaction, but with some fuels it can be stretched somewhat below 750°C with reasonable performance' (EPPSA_410).* 8. *Water/steam addition* • *Remove technique (Euromot_65, FI_142, PL_162).* 9. *Low-NO_X combustion concept in engines* • *Remove technique (Euromot_65, FI_142).* 10. *Circulating fluidised bed boiler (CFB boilers)* • *describe briefly BFB and grate (travelling/vibrating etc.) boilers (IT_197)* 11. *New techniques* • *Update to current best practice including gravimetric feeders, dynamic classifiers, neural nets and optimisers (E&P_253, Eurelectric_767_1015, UK_28, Euracoal_170).* • *Include Combustor design technology (E&P_252, Eurelectric_766_1014, Euracoal_169).*	
EIPPCB assessment:	**1. Air-staging (OFA)** • **Boosted OFA is an option for achieving air staging that may be taken out of the description without affecting the understanding of the technique.** **2. Flue-gas or exhaust-gas recirculation (FGR/EGR)** • **There may be other ways of injecting flue-gas into the flame, besides through the burner, that are effective in lowering the flame temperature and O_2 content.** **3. Lean-burn concept** • **The description of the techniques does not require the inclusion of applicability restrictions.** **4. Fuel staging (reburning)** • **The description given for fuel staging does not need to be specific to certain**	

	technologies. • **For consistency with other sections, the technique could be named 'Fuel staging'.** **5. Combination of primary techniques for NO_X reduction** • **The deletion of 'boosted' does not affect the description and is consistent with the 'Air staging' technique description.** **6. Selective catalytic reduction (SCR)** • **The number of layers of the catalyst cannot be limited to two.** **7. Selective non-catalytic reduction (SNCR)** • **The description of a technique does not require the inclusion of applicability restrictions.** • **The temperature window may be corrected according to the proposal in the comment.** **8. Water/steam addition** • **As long as the technique is mentioned in the BAT, it has to be described.** **9. Low-NO_X combustion concept in engines** • **As long as the technique is mentioned in the BAT, it has to be described.** **10. Circulating fluidised bed boiler (CFB boilers)** • **As long as the technique is not mentioned in the BAT conclusions, it is not necessary to keep the technique in the descriptive chapter.** **11. New techniques** • **Including gravimetric feeders, dynamic classifiers, neural nets and optimisers means combustion optimisation, which is already included in the 'General techniques' description.** • **Combustor design technology may be included in combustion optimisation.** **12. Combined SNCR + SCR** • **BAT are usually expressed as 'one or a combination' of different techniques, therefore it seems unnecessary to include all possible combinations of techniques. The possible combination of SCR and SNCR can be added in the description of the SCR technique.** **13. Low-NO_X burners (LNB)** **The description of the technique may include a general sentence about the performance of the technique in the case of retrofitting an old plant.**
EIPPCB proposal:	**1. Air-staging (OFA)** • **Remove the references to boosted OFA from the description of the technique.** **2. Flue-gas or exhaust-gas recirculation (FGR/EGR)** • **Include in the description the possibility of using 'other provisions' to recirculate the flue-gases.** **3. Lean-burn concept** • **Remove the applicability of the advanced lean-burn concept from the description.** **4. Fuel staging (reburning)** • **Modify the description to make it more generic, including that the technique is based on the reduction of localised hot spots by the creation of several combustion zones in the combustion chamber with different injection levels of fuel and air, and removing details about the reduction of the flame temperature.** • **Change the name of the 'Fuel staging (reburning)' technique to 'Fuel staging'.** **5. Combination of primary techniques for NO_X reduction** • **Delete 'boosted' from the description.** **6. Selective catalytic reduction (SCR)** • **Modify the description in order not to limit the number of layers of the catalyst.** • **Add in the description that the combination of SCR and SNCR is known as 'slip' or 'in-duct' SCR.** **7. Selective non-catalytic reduction (SNCR)** • **Change the temperature window from '900–1050 °C' to '850–1000 °C'.** **8. Water/steam addition** • **Keep the technique description.** **9. Low-NO_X combustion concept in engines** • **Keep the technique description.** **10. Circulating fluidised bed boiler (CFB boilers)** • **Remove the description of the technique.** **11. New techniques** • **Do not include the gravimetric feeders, etc. description technique.** • **Include combustion optimisation** **12. Combined SNCR + SCR** • **Remove the technique.**

	13. Low-NO_X burners (LNB) • **Add in the description of the technique that the performance of the technique may be influenced by the boiler design when retrofitting old plants.**

2.19.4 SO_X, HCl and HF

Location in D1:	*Section 10.8 – p. 806*

Current text in D1:

Technique	Description
Fuel choice	Choice of a fuel with low S, Cl and F content
Multi-fuel firing	Replace part of a fuel by another fuel having better environmental profile (e.g. coal – biomass, coal – syngas from biomass gasification, instead of coal only)
Boiler sorbent injection (in-furnace or in-bed)	Boiler sorbent injection consists in the direct injection of a dry sorbent into the gas stream of the combustion chamber, or in the adjunction of magnesium- or calcium-based adsorbents to the bed of fluidised-bed. The surface of the sorbent particles reacts with the SO_2 in the flue-gas or in the fluidised-bed.
Dry sorbent injection (DSI)	Dry powder is introduced and dispersed in the flue-gas stream. The material reacts with the sulphur gaseous species to form a solid which has to be removed by filtration (bag filter or electrostatic precipitator)
Spray dry absorber (SDA)	A suspension/solution of alkaline reagent is introduced and dispersed in the flue-gas stream. The material reacts with the sulphur gaseous species to form a solid which has to be removed by filtration (bag filter or electrostatic precipitator)
Wet flue gas desulphurisation (Wet FGD)	Technique or ensemble of scrubbing techniques where sulphur is removed from flue-gases through various processes generally involving an alkaline sorbent for capturing SO_2 and transforming it into solid sulphur. In the wet scrubbing process, gaseous compounds are dissolved in a suitable liquid (water or alkaline solution). Simultaneous removal of solid and gaseous compounds may be achieved. Downstream of the wet scrubber, the flue-gases are saturated with water and a separation of the droplets is required before discharging the flue-gases. The resulting liquid has to be treated by a waste water process and the insoluble matter is collected by sedimentation or filtration
Seawater FGD	A specific non-regenerative type of scrubbing using alkalinity of the seawater as solvent where large amount of seawater is available. Requires generally an upstream abatement of dust.
Combined techniques for NO_X and SO_X reduction	Use of complex and integrated abatement technique for combined reduction of NO_X, SO_X, and often other pollutants, from the flue-gas, e.g. activated carbon, $DESONO_x$ processes
Wet scrubbing	Use of a liquid, typically water or water-based solution, to capture the acidic gas by absorption from the flue-gas.
Retrofit gas/gas heater	Replacement of the gas-gas heater downstream of the wet FGD by a multi-pipe heat extractor in order to avoid SO_X leakage, or remove it and discharge the flue-gas via a cooling tower or a wet stack.
Flue-gas condenser	See section 10.8.2
Process gas management system	See section 10.8.2

Summary of comments:

1. *Wet flue-gas desulphurisation (Wet FGD)*
- *Transformation of capture SO_2 into solid sulphur occurs only in a very limited number of wet FGD facilities. The great majority of wet FGD facilities for power plants transform the captured SO_2 into gypsum (PT_96).*

2. *Other techniques*
- *Include CFB (circulating fluidised bed) dry scrubber (EPPSA_415_416).*

EIPPCB assessment:	**1. Wet flue-gas desulphurisation (Wet FGD)** • **Since not all types of wet scrubber transform the SO_2 into gypsum, it seems better to keep it in a more generic description.** **2. New techniques** • **The description of CFB dry scrubber technique could be added.** **3. Other techniques** • **Retrofit gas/gas heater may be only described in BAT 21.**
EIPPCB proposal:	**1. Wet flue-gas desulphurisation (Wet FGD)** • **Do not change the description of the technique.** **2. New techniques** • **Include the description of Circulating fluidised bed (CFB) dry scrubber.** **3. Other techniques** • **Remove description of Retrofit gas/gas heater.**

2.19.5 Dust and metals including mercury

Location in D1:	*Section 10.8 – p. 807*
Current text in D1:	

Technique	Description
Fuel choice	Choice of a fuel with low ash or metals content
Cyclones	Dust control system using gravitational forces and able to process all types of flue-gases, in dry conditions.
Electrostatic precipitator (ESP)	Electrostatic precipitators operate such that particles are charged and separated under the influence of an electrical field. Electrostatic precipitators are capable of operating over a wide range of conditions. Abatement efficiency may depend on number of fields, residence time (size), catalyst properties, and upstream particles removal devices. They include in general between two to five fields for an improved efficiency. Most modern (high-performance) ESPs have up to seven fields.
Bag of Fabric filter	Bag or Fabric filters are constructed from porous woven or felted fabric through which gases are flowed to remove particles. The use of a bag filter requires a fabric material selection adequate to the characteristics of the flue-gas and the maximum operating temperature
Activated carbon injection	This process is based on the adsorption of pollutant molecules by the activated carbon. When the surface has adsorbed as much as it can, the adsorbed content is desorbed as part of the regeneration of the adsorbent
Boiler sorbent injection	See section –10.8.4 Co-benefit in dust/metals reduction
Dry or semi-dry FGD system (e.g. SDA, DSI)	See section – 10.8.4 Co-benefit in dust/metals reduction
Wet FGD (WFGD)	See section – 10.8.4 Co-benefit in dust/metals reduction
Carbon sorbent (e.g. activated carbon) injection in the flue-gas	Mercury absorption by carbon sorbents, such as activated carbon, with or without chemical treatment. The sorbent injection system can be enhanced by the addition of a supplementary bag filter.

Summary of comments:	*1. Electrostatic precipitator (ESP)* • *Particulate properties (size spectre, resistivity, etc.) impact to be added (FI_143_Euromot_46_66).*
EIPPCB assessment:	**1. Electrostatic precipitator (ESP)** • **Detailed information is given in other chapters of the BREF.**
EIPPCB proposal:	**1. Electrostatic precipitator (ESP)** • **Do not include information on the detailed impact of size or resistivity in the description.**

2.19.6 Emissions to water

<table>
<tr><td>Location in D1:</td><td>Section 10.8 – p. 807</td></tr>
<tr><td>Current text in D1:</td><td>
<table>
<tr><th>Technique</th><th>Description</th></tr>
<tr><td>Sedimentation</td><td>Sedimentation is a solid-liquid separation technique that utilises gravity to separate the insoluble metal complexes and solid particles from the liquid effluent</td></tr>
<tr><td>Flotation</td><td>Flotation techniques are used to separate large flocs or floating particles from the effluent by bringing them to the surface of the suspension</td></tr>
<tr><td>Filtration</td><td>It is the separation of solid from waste water effluent passing through a porous medium. Sand is the most commonly used filtering media</td></tr>
<tr><td>Flocculation, sedimentation, precipitation, neutralisation</td><td>The suspended matter can consist of large solids, settleable by gravity alone without any external aids, and non-settleable material, often colloidal in nature. Removal is then generally accomplished by coagulation, flocculation, and sedimentation. Precipitation is the formation of insoluble substances from dissolved matter and the chemicals added.</td></tr>
<tr><td>Softening, evaporation, crystallization</td><td>Evaporation of waste water is a distillation process where water is the volatile substance, leaving the concentrate as bottom residue to be disposed of. Crystallisation is closely related to precipitation. In contrast to precipitation, the precipitate is not formed by chemical reaction in the waste water, but is produced on seed material such as sand or minerals, working in a fluidised-bed process</td></tr>
<tr><td>Stripping, precipitation</td><td>Waste water stripping is an operation in which waste water is brought into contact with a high flow of a gas current in order to transfer volatile pollutants from the water phase to the gas phase. The pollutants are removed from the stripping gas so it can be recycled into the process and re-used.</td></tr>
</table>
</td></tr>
<tr><td>Summary of comments:</td><td><u>General</u>
• Review the applicabilities of the techniques for existing plants (Eurelectric_557).</td></tr>
<tr><td>EIPPCB assessment:</td><td>• This section only deals with descriptions of techniques. The applicabilities are discussed in Section 1.2.3 of this BP.
• Some techniques mentioned in the BAT to reduce emissions to water are missing (see also Section 1.2.3 of this BP).
• The descriptions of the techniques could be further harmonised on the basis of the recent CWW BREF review.</td></tr>
<tr><td>EIPPCB proposal:</td><td>• Add missing techniques and further harmonise the descriptions on the basis of the recent CWW BREF review.</td></tr>
</table>