Environment & Resources Authority

IPPC BAT Conclusions

COMMISSION IMPLEMENTING DECISION (EU) 2017/1442 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants.

In accordance with Article 14(3) of the Directive on Industrial Emissions 2010/75/EU (IED) ***"BAT conclusions shall be the reference for setting the permit conditions".***

Contents

General Considerations:

SCOPE

These BAT conclusions concern the following activities specified in Annex I to Directive 2010/75/EU:

— 1.1: Combustion of fuels in installations with a total rated thermal input of 50 MW or more, only when this activity takes place in combustion plants with a total rated thermal input of 50 MW or more.

— 1.4: Gasification of coal or other fuels in installations with a total rated thermal input of 20 MW or more, only when this activity is directly associated to a combustion plant.

— 5.2: Disposal or recovery of waste in waste co-incineration plants for non-hazardous waste with a capacity exceeding 3 tonnes per hour or for hazardous waste with a capacity exceeding 10 tonnes per day, only when this activity takes place in combustion plants covered under 1.1 above.

In particular, these BAT conclusions cover upstream and downstream activities directly associated with the aforementioned activities including the emission prevention and control techniques applied.

The fuels considered in these BAT conclusions are any solid, liquid and/or gaseous combustible material including:

— solid fuels (e.g. coal, lignite, peat),

— biomass (as defined in Article 3(31) of Directive 2010/75/EU),

— liquid fuels (e.g. heavy fuel oil and gas oil),

— gaseous fuels (e.g. natural gas, hydrogen-containing gas and syngas),

— industry-specific fuels (e.g. by-products from the chemical and iron and steel industries),

— waste except mixed municipal waste as defined in Article 3(39) and except other waste listed in Article 42(2)(a)(ii) and (iii) of Directive 2010/75/EU.

These BAT conclusions do not address the following:

— combustion of fuels in units with a rated thermal input of less than 15 MW,

— combustion plants benefitting from the limited life time or district heating derogation as set out in Articles 33 and 35 of Directive 2010/75/EU, until the derogations set in their permits expire, for what concerns the BAT-AELs for the pollutants covered by the derogation, as well as for other pollutants whose emissions would have been reduced by the technical measures obviated by the derogation,

— gasification of fuels, when not directly associated to the combustion of the resulting syngas,

- gasification of fuels and subsequent combustion of syngas when directly associated to the refining of mineral oil and gas,
- the upstream and downstream activities not directly associated to combustion or gasification activities,
- combustion in process furnaces or heaters,
- combustion in post-combustion plants,
- flaring,
- combustion in recovery boilers and total reduced sulphur burners within installations for the production of pulp and paper, as this is covered by the BAT conclusions for the production of pulp, paper and board,
- combustion of refinery fuels at the refinery site, as this is covered by the BAT conclusions for the refining of mineral oil and gas,
- disposal or recovery of waste in:
  - waste incineration plants (as defined in Article 3(40) of Directive 2010/75/EU),
  - waste co-incineration plants where more than 40 % of the resulting heat release comes from hazardous waste,
  - waste co-incineration plants combusting only wastes, except if these wastes are composed at least partially of biomass as defined in Article 3(31)(b) of Directive 2010/75/EU,

  as this is covered by the BAT conclusions for waste incineration.

Other BAT conclusions and reference documents that could be relevant for the activities covered by these BAT conclusions are the following:

- Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector (CWW)
- Chemical BREF series (LVOC, etc.)
- Economics and Cross-Media Effects (ECM)
- Emissions from Storage (EFS)
- Energy Efficiency (ENE)
- Industrial Cooling Systems (ICS)
- Iron and Steel Production (IS)
- Monitoring of Emissions to Air and Water from IED installations (ROM)
- Production of Pulp, Paper and Board (PP)
- Refining of Mineral Oil and Gas (REF)

— Waste Incineration (WI)

— Waste Treatment (WT)

GENERAL CONSIDERATIONS

Best Available Techniques

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.

Unless otherwise stated, these BAT conclusions are generally applicable.

Emission levels associated with the best available techniques (BAT-AELs)

Where emission levels associated with the best available techniques (BAT-AELs) are given for different averaging periods, all of those BAT-AELs have to be complied with.

The BAT-AELs set out in these BAT conclusions may not apply to liquid-fuel-fired and gas-fired turbines and engines for emergency use operated less than 500 h/yr, when such emergency use is not compatible with meeting the BAT-AELs.

BAT-AELs for emissions to air

Emission levels associated with the best available techniques (BAT-AELs) for emissions to air given in these BAT conclusions refer to concentrations, expressed as mass of emitted substance per volume of flue-gas under the following standard conditions: dry gas at a temperature of 273,15 K, and a pressure of 101,3 kPa, and expressed in the units mg/Nm3, µg/Nm3 or ng I-TEQ/Nm3.

The monitoring associated with the BAT-AELs for emissions to air is given in BAT 4

Reference conditions for oxygen used to express BAT-AELs in this document are shown in the table given below.

Activity	Reference oxygen level (OR)
Combustion of solid fuels	6 vol-%
Combustion of solid fuels in combination with liquid and/or gaseous fuels	
Waste co-incineration	
Combustion of liquid and/or gaseous fuels when not taking place in a gas turbine or an engine	3 vol-%
Combustion of liquid and/or gaseous fuels when taking place in a gas turbine or an engine	15 vol-%
Combustion in IGCC plants	

$$E_R = \frac{21 - O_R}{21 - O_M}(E_M)$$

Where:

E_R: emission concentration at the reference oxygen level O_R;

O_R: reference oxygen level in vol- %;

E_M: measured emission concentration;

O_M: measured oxygen level in vol- %.

For averaging periods, the following definitions apply

Averaging period	Definition
Daily average	Average over a period of 24 Hours of valid hourly measurements
Yearly average	Average over a period of one year of valid hourly measurements
Average over the sampling period	Average value of three consecutive measurements of at least 30 minutes each[1]
Average of samples obtained during one year	Average of the values obtained during one year of the periodic measurements taken with the monitoring frequency set for each parameter

BAT-AELs for emissions to water

Emission levels associated with the best available techniques (BAT-AELs) for emissions to water given in these BAT conclusions refer to concentrations, expressed as mass of emitted substance per volume of water, and expressed in µg/l, mg/l, or g/l. The BAT-AELs refer to daily averages, i.e. 24-hour flow-proportional composite samples. Time-proportional composite samples can be used provided that sufficient flow stability can be demonstrated.

The monitoring associated with BAT-AELs for emissions to water is given in BAT 5

Energy efficiency levels associated with the best available techniques (BAT-AEELs)

An energy efficiency level associated with the best available techniques (BAT-AEEL) refers to the ratio between the combustion unit's net energy output(s) and the combustion unit's fuel/feedstock energy input at actual unit design. The net energy output(s) is determined at the combustion, gasification, or IGCC unit boundaries, including auxiliary systems (e.g. flue-gas treatment systems), and for the unit operated at full load.

In the case of combined heat and power (CHP) plants:

[1] For any parameter where, due to sampling or analytical limitations, 30-minute measurement is inappropriate, a suitable sampling period is employed. For PCDD/F, a sampling period of 6 to 8 hours is used.

— the net total fuel utilisation BAT-AEEL refers to the combustion unit operated at full load and tuned to maximise primarily the heat supply and secondarily the remaining power that can be generated,

— the net electrical efficiency BAT-AEEL refers to the combustion unit generating only electricity at full load.

BAT-AEELs are expressed as a percentage. The fuel/feedstock energy input is expressed as lower heating value (LHV).

The monitoring associated with BAT-AEELs is given in BAT 2

Categorisation of combustion plants/units according to their total rated thermal input

For the purposes of these BAT conclusions, 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 and lower than 300 MW.

When a part of a combustion plant discharging flue-gases through one or more separate ducts within a common stack is operated less than 1 500 h/yr, that part of the plant may be considered separately for the purpose of these BAT conclusions. For all parts of the plant, the BAT-AELs apply in relation to the total rated thermal input of the plant. In such cases, the emissions through each of those ducts are monitored separately.

Applicability checklist

Kindly tick relevant sections which are applicable and will be under consideration in this assessment.

	Tick	Comment (where N/A) kindly indicate
1. GENERAL BAT CONCLUSIONS	Compulsory	
2. BAT CONCLUSIONS FOR COMBUSTIONS OF SOLID FUELS	☐	
2.1 BAT CONCLUSIONS FOR THE COMBUSTION OF COAL AND/OR LIGNITE	☐	
2.2 BAT CONCLUSIONS FOR THE COMBUSTION OF SOLID BIOMASS AND/OR PEAT	☐	
3. BAT CONCLUSIONS FOR THE COMBUSTION OF LIQUID FUELS	☐	
3.1. HFO- AND/OR GAS-OIL-FIRED BOILERS	☐	
3.2. HFO- AND/OR GAS-OIL-FIRED ENGINES	☐	
3.3. GAS-OIL-FIRED GAS TURBINES	☒	
4. BAT CONCLUSIONS FOR THE COMBUSTION OF GASEOUS FUELS	☐	
4.1. BAT CONCLUSIONS FOR THE COMBUSTION OF NATURAL GAS	☐	
4.2. BAT CONCLUSIONS FOR THE COMBUSTION OF IRON AND STEEL PROCESS GASES	☐	
4.3. BAT CONCLUSIONS FOR THE COMBUSTION OF GASEOUS AND/OR LIQUID FUELS ON OFFSHORE PLATFORMS	☐	
5. BAT CONCLUSIONS FOR MULTI-FUEL-FIRED PLANT	☐	
5.1. BAT CONCLUSIONS FOR THE COMBUSTION OF PROCESS FUELS FROM THE CHEMICAL INDUSTRY	☐	
6. BAT CONCLUSIONS FOR THE CO-INCINERATION OF WASTE	☐	
7. BAT CONCLUSIONS FOR GASIFICATION	☐	

Comparison Exercise with BAT

1. General BAT Conclusions

BAT conclusion		STATUS AT INSTALLATION: [ENTER NAME OF OPERATOR] DATE: [ENTER DATE OF ASSESSMENT] Applicability Assessment (describe how the technique applies or not to your installation)	STATE WHETHER IT IS IN PLACE OR STATE SCHEDULE FOR IMPLEMENTATION	ERA review	Enemalta reply
BAT 1 **Environmental Management System**	In order to improve the overall environmental performance, 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, by the management, of an environmental policy that includes the continuous improvement of the environmental performance of the installation; (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) recruitment, training, awareness and competence (c) communication (d) employee involvement (e) documentation (f) effective process control (g) planned regular maintenance programmes	These topics are all incorporated in the Environmental Management System which is certified to the latest ISO 14001 standard, currently ISO 14001:2015. The EMS is audited every year with a recertification every 3 years. Enemalta's EMS was first certified in the year 2011 and this year 2020 was the 3rd recertification of its EMS to ISO 14001 standard. *Attached find the latest recertification audit report with findings and comments issued by Bureau Veritas Hellas AE*	(i) **Implemented** (ii) **Implemented** (iii) **Implemented** (iv) **Implemented**	Noted. Kindly specify which aspects from (i) till (xvi) are in place. Kindly indicate status of implementation. Kindly provide : a) management plan referred to in point xi b) Waste management plan referred in point xii c) Plan mentioned in point xiii	a) Please refer to answers for BAT10 and BAT 11 b) Refer to Waste Management plan SOP-088 & SOP-029 DPS Waste Management c) Refer to DPS Emergency Response plan SOP-152

	(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 JRC Reference Report on Monitoring of emissions to air and water from IED-installations — ROM) (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, by senior management, of the EMS and its continuing suitability, adequacy and effectiveness; (vii) following the development of cleaner technologies; 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 including; (a) avoiding underground structures (b) incorporating features that facilitate dismantling (c) choosing surface finishes that are easily decontaminated (d) using an equipment configuration that minimises trapped chemicals and facilitates drainage or cleaning (d) designing flexible, self-contained equipment that enables phased closure (f) using biodegradable and recyclable materials where possible;	Please refer to above comments These topics are addressed in the various documents of the EMS such as the Environmental Improvement Programme, the Environmental Aspects Register, the Environmental Risks Register, SOPs and Work instructions. Annual reviews of the environmental aspect register to lower the overall computed factor addresses the improvements that need to be implemented in	**Implemented** **Implemented** **Currently N/A (refer to last column Enemalta reply)**	d) Plan mentioned in point xiv e) Noise management plan mentioned in point xv f) OTNOC plan	N/A Refer to SOP-207 Annual Noise Monitoring at DPS (Coordinated) Refer to SOP-234 Environmental Complaints Procedure (Co-ordinated) Gas turbines are currently being used as emergency plants. In case the status of the gas turbines reverts to normal operation certain cleaner technologies will be considered if economically feasible

	(ix) application of sectoral benchmarking on a regular basis. Specifically for this sector, it is also important to consider the following features of the EMS, described where appropriate in the relevant BAT: (x) quality assurance/quality control programmes to ensure that the characteristics of all fuels are fully determined and controlled (see BAT 9);	conjunction with the topics mentioned. However one has to keep in mind that Enemalta's plant at Delimara is an emergency plant and is only operated in situations where the remaining energy sources cannot meet the demand.	**Currently N/A** (refer to Enemalta reply) **Ongoing**		Shall gas turbine be used for normal operation, benchmarking will be considered
	(xi) a management plan in order to reduce emissions to air and/or to water during other than normal operating conditions, including start-up and shutdown periods (see BAT 10 and BAT 11);	These topics are reviewed during the Annual Management review. *A copy of the latest review is attached.* *A copy of the latest ISO 14001:2015 certificate is also attached* At this point one has to keep in mind the feasibility of the implementation of certain abatement processes for a plant that is only in operation a few hours per month Laboratory analysis accredited to ISO 17025 to determine that for each fuel consignment received a number of parameters are analysed to confirm that the quality of fuel received is within the specified limits or even better Opting for the cleanest source of energy generation through	**Ongoing**		Currently the gas turbines are being used as emergency plants. A maintenance schedule is in place. During maintenance, combustion (fuel/air ratio) is optimised to ensure optimum operation. Fuel is procured with a very low sulphur content normally less than 0.1% the limit as stipulated in the permit. If the gas turbines will revert to normal operation, then CEMS will be again installed in the stacks to monitor and record air emissions. With regards to emissions to seawater SOP -040 Procedure for

		dispatch ie to get the electricity via the interconnector were economically feasible. Our plant is being used in emergency conditions only and hence is not operating at the best efficiency Emissions to air are being calculated based on fuel burnt and number of operating hours are being logged Enemalta is monitoring the hours of operation not to exceed the limits specified in the legislation. Plants are being operated for maintenance purposes and emergency circumstances Sea-water discharge samples are collected with a frequency as per IPPC permit obligations and sent to a laboratory for analysis Comparison of results over a period of years to identify high readings (if any) to identify the root cause A schedule has been set up were once a week a gas turbine is switched on for approximately an hour			Seawater Discharge Analysis (Coordinated) and SOP-234 Environmental Complaints Procedure (Co-ordinated) are followed Discharge to water from Enemalta plant is very limited to when the combined cycle gas turbine operates in combined cycle mode since the steam turbine is used in this mode. Most of the time the gas turbines are being operated in open-cycle mode and so there is no water discharge.
	(xii) a waste management plan to ensure that waste is avoided, prepared for reuse, recycled or otherwise recovered, including the use of techniques given in BAT 16;	Regeneration of spent catalyst at DM plant. Seawater filtration is collected separately and sent for recycling	**Implemented and ongoing**		Please refer to SOP-088 Waste Management plan and SOP-029 DPS Waste Management SOP

	(xiii) a systematic method to identify and deal with potential uncontrolled and/or unplanned emissions to the environment, in particular:	Also a waste management plan is in place to address the method of disposal of waste generated			
	(a) emissions to soil and groundwater from the handling and storage of fuels, additives, by-products and wastes	Land and groundwater monitoring Certification of pipelines Certification of interceptors according to IPPC permit SOP-023 Chemical Procurement, Storage and Handling for DPS addresses also these issues	**Implemented and Ongoing**		Please refer to DPS Emergency Response Plan SOP-152
	(b) emissions associated with self-heating and/or self-ignition of fuel in the storage and handling activities;		**Ongoing**		
	(xiv) a dust management plan to prevent or, where that is not practicable, to reduce diffuse emissions from loading, unloading, storage and/or handling of fuels, residues and additives;	Hourly Air Quality Monitoring at Marsaxlokk for PM_{10} and $PM_{2.5}$ and heavy metal analysis including arsenic every quarter	**N/A**		
	(xv) a noise management plan where a noise nuisance at sensitive receptors is expected or sustained, including; (a) a protocol for conducting noise monitoring at the plant boundary (b) a noise reduction programme (c) a protocol for response to noise incidents containing appropriate actions and timelines (d) a review of historic noise incidents, corrective actions and dissemination of noise incident knowledge to the affected parties;	Annual noise monitoring as per IPPC permit obligations at identified Noise Sensitive Receptors (NSRs) Comparison of noise levels at the Noise Sensitive Receptors over a period of years and trending analysis Analysis of customer complaints over a period of years in connection with noise	**Implemented**		

	(xvi) for the combustion, gasification or co-incineration of malodourous substances, an odour management plan including: (a) a protocol for conducting odour monitoring (b) where necessary, an odour elimination programme to identify and eliminate or reduce the odour emissions (c) a protocol to record odour incidents and the appropriate actions and timelines (e) a review of historic odour incidents, corrective actions and the dissemination of odour incident knowledge to the affected parties. Where an assessment shows that any of the elements listed under items x to xvi are not necessary, a record is made of the decision, including the reasons.	Through customer complaints and authority and corrective actions implementation through ISO 14001 requirements Monitoring of customer complaints in connection with odour by EMS coordinator and IPPC coordinator. If complaints are reported analysis of root cause and confirmation of recurrences is carried out.	**Implemented**		Please refer to SOP-256 Procedure for Analysing, Reporting and following-up on odour complaints
	Applicability The scope (e.g. level of detail) and nature of the EMS (e.g. standardised or non-standardised) will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have.				
BAT 2 **Determine the net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the gasification.**	BAT is to determine the net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the gasification, IGCC and/or combustion units by carrying out a performance test at full load[2], according to EN standards, after the commissioning of the unit and after each modification that could significantly affect the net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the unit. 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.	In Enemalta's case given that the gas turbines are now being used as an emergency plant and operated for a few hours per month to avoid damage being done to the gas turbines one cannot talk about the efficiency of the gas turbine. These are definitely not being operated in the most efficient mode of operation. In the case of the combined cycle gas turbine since this is being operated for just a few hours per month, most of the	**Implemen-ted** (when operating under normal operating conditions)	Noted, however kindly provide the required performance tests. Enemalta to indicate what would be the energy efficiency in the event that the plant no longer remains as a back-up plant Kindly indicate status of implementation.	Since Enemalta is obliged to provide air emission figures to the public which are representa-tive of the actual operation of the gas turbine, the efficiency is indirectly reflected in these figures.

[2] In the case of CHP units, if for technical reasons the performance test cannot be carried out with the unit operated at full load for the heat supply, the test can be supplemented or substituted by a calculation using full load parameters.

<table>
<tr>
<td></td>
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<td>time it is being operated in open cycle mode and not in the combined cycle mode. This reduces further its efficiency.</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>BAT 3

monitor key process parameters relevant for emissions to air and water</td>
<td>BAT is to monitor key process parameters relevant for emissions to air and water including those given below.
<table>
<tr><th>Stream</th><th>Parameter(s)</th><th>Monitoring</th></tr>
<tr><td rowspan="3">Flue-gas</td><td>Flow</td><td>Periodic or continuous determination</td></tr>
<tr><td>Oxygen content, temperature, and pressure</td><td rowspan="2">Periodic or continuous measurement</td></tr>
<tr><td>Water vapour content(1)</td></tr>
<tr><td>Waste water from flue-gas treatment</td><td>Flow, pH, and temperature</td><td>Continuous measurement</td></tr>
</table>
(1) The continuous measurement of the water vapour content of the flue-gas is not necessary if the sampled flue-gas is dried before analysis.</td>
<td>Since the gas turbines are being used as an emergency plant the emissions are being calculated using the calculation method. Hence these parameters are not being measured.</td>
<td>N/A (as long as the calculation method is being utilised)</td>
<td>For marine discharge, monitoring in the permit will be maintained.

Noted, as per agreement with ERA the calculated method can continued to be utilised and the permit will reflected such an agreement. Notwithanding provisions for the monitoring of flue-gas parameters will need to remain in permit in the event that the plant is no longer considered as a back-up plant</td>
<td>Noted. Please refer to SOP-040 Procedure for Seawater Discharge Analysis (Coordinated)</td>
</tr>
<tr>
<td>BAT 4

Monitor emissions to air</td>
<td>BAT is to monitor emissions to air with at least the frequency given below 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.
<table>
<tr><th>Substance/Parameter</th><th>Fuel/Process/Type of combustion plant</th><th>Combustion plant total rated thermal input</th><th>Standard(s)[1]</th><th>Minimum monitoring frequency[2]</th><th>Monitoring associated with</th></tr>
<tr><td>NH_3</td><td>— When SCR and/or SNCR is used</td><td>All sizes</td><td>Generic EN standards</td><td>Continuous(3), (4)</td><td>BAT 7</td></tr>
</table></td>
<td></td>
<td>N/A (as long as the calculation method is being used)</td>
<td>Noted, the permit shall still reflect the need for monitoring in accordance to BAT, the Operator to propose standards for determination.</td>
<td>If the gas turbine will revert to normal operation CEMS will be installed and emissions measured</td>
</tr>
</table>

										according to EN standards. In the meantime, since the plant is being used as an emergency plant Air emissions will be determined using the calculation method. This method will utilise an emission factor given by the EMEP/EEA Air pollutant Emission inventory guidebook (latest edition) The EMEP/EEA guidebook supports reports of emissions data under the UNECE Convention on Long-range Transbound-ary Air Pollution (CLRTAP) and the EU National Emission
	NO_X	— Coal and/or lignite including waste co-incineration — Solid biomass and/or peat including waste co-incineration — HFO- and/or gas-oil-fired boilers and engines — Gas-oil-fired gas turbines — Natural-gas-fired boilers, engines, and turbines — Iron and steel process gases — Process fuels from the chemical industry — IGCC plants	All sizes	Generic EN standards	Continuous [3], [5]	BAT 20 BAT 24 BAT 28 BAT 32 BAT 37 BAT 41 BAT 42 BAT 43 BAT 47 BAT 48 BAT 56 BAT 64 BAT 65 BAT 73	N/A Emissions are calculated by means of the calculation method from fuel burnt			
		— Combustion plants on offshore platforms	All sizes	EN 14792	Once every year[6]	BAT 53				
	N_2O	— Coal and/or lignite in circulating fluidised bed boilers — Solid biomass and/or peat in circulating	All sizes	EN 21258	Once every year[7]	BAT 20 BAT 24				

		fluidised bed boilers								Ceilings Directive.
	CO	— Coal and/or lignite including waste co-incineration — Solid biomass and/or peat including waste co-incineration — HFO- and/or gas-oil-fired boilers and engines — Gas-oil-fired gas turbines — Natural-gas-fired boilers, engines, and turbines — Iron and steel process gases — Process fuels from the chemical industry — IGCC plants	All sizes	Generic EN standards	Continuous (3), (5)	BAT 20 BAT 24 BAT 28 BAT 33 BAT 38 BAT 44 BAT 49 BAT 56 BAT 64 BAT 65 BAT 73	Calculation Method formula does not cater for the calculation of CO emissions.		The Operator to propose a method for its estimation/ calculation.	CO emissions will be calculated similarly to NOx and dust using the emission factor for CO given by the EMEP/EEA emissions inventory (latest edition) for gas turbines using gas oil and multiplying this by the quantity of fuel burnt
		— Combustion plants on offshore platforms	All sizes	EN 15058	Once every year (6)	BAT 54				
	SO_2	— Coal and/or lignite including waste co-incineration —Solid biomass and/or peat including waste co-incineration	All sizes	Generic EN standards and EN 14791	Continuous (3), (8),(9)	BAT 21 BAT 25 BAT 29 BAT 34 BAT 39 BAT 50 BAT 57 BAT 66 BAT 67				

	— HFO- and/or gas-oil-fired boilers — HFO- and/or gas-oil-fired engines — Gas-oil-fired gas turbines — Iron and steel process gases — Process fuels from the chemical industry in boilers — IGCC plants				BAT 74
SO_3	— When SCR is used	All sizes	No EN standard available	Once every year	—
Gaseous chlorides, expressed as HCl	— Coal and/or lignite — Process fuels from the chemical industry in boilers	All sizes	EN 1911	Once every three months (3),(10), (11)	BAT 21 BAT 57
	— Solid biomass and/or peat	All sizes	Generic EN standards	Continuous (12), (13)	BAT 25
	— Waste co-incineration	All sizes	Generic EN standards	Continuous (3), (13)	BAT 66 BAT 67
HF	— Coal and/or lignite — Process fuels from the	All sizes	No EN standard available	Once every three months (3),(10), (11)	BAT 21 BAT 57

SO_2 emissions are dependent on percentage sulphur in the fuel. This sulphur content is confirmed through laboratory testing for each fuel consignment received and a weighted average is then calculated to be able to calculate the SO_2 emissions

Noted.

		chemical industry in boilers								
		— Solid biomass and/or peat	All sizes	No EN standard available	Once every year	BAT 25				
		— Waste co-incineration	All sizes	Generic EN standards	Continuous [3], [13]	BAT 66 BAT 67				
	Dust	— Coal and/or lignite — Solid biomass and/or peat — HFO- and/or gas-oil-fired boilers — Iron and steel process gases — Process fuels from the chemical industry in boilers — IGCC plants — HFO- and/or gas-oil-fired engines — Gas-oil-fired gas turbines	All sizes	Generic EN standards and EN 13284-1 and EN 13284-2	Continuous [3], [14]	BAT 22 BAT 26 BAT 30 BAT 35 BAT 39 BAT 51 BAT 58 BAT 75	Calculation method is used to calculate the mass of dust generated from the burning of gas-oil		Noted	
		— Waste co-incineration	All sizes	Generic EN standards and EN 13284-2	Continuous	BAT 68 BAT 69				
	,(Metals and metalloids except mercury (As, Cd, Co, Cr, Cu, Mn, Ni, Pb, Sb, Se, Tl, V, Zn)	— Coal and/or lignite — Solid biomass and/or peat — HFO- and/or gas-oil-fired boilers and engines	All sizes	EN 14385	Once every year[15]	BAT 22 BAT 26 BAT 30				
		— Waste co-incineration	$<$ 300 MW_{th}	EN 14385	Once every six months[10]	BAT 68 BAT 69	Heavy metals As, Cd, Pb, Ni and V are monitored every quarter through		Permit to be updated to reflect that such monitoring will	Noted

		$\geq$ 300 MW_{th}	EN 14385	Once every three months[16],[10]	
	— IGCC plants	$\geq$ 100 MW_{th}	EN 14385	Once every year[15]	BAT 75
Hg	— Coal and/or lignite including waste co-incineration	< 300 MW_{th}	EN 13211	Once every three months [10],[17]	BAT 23
		$\geq$ 300 MW_{th}	Generic EN standards and EN 14884	Continuous[13],[18]	
	— Solid biomass and/or peat	All sizes	EN 13211	Once every year[19]	BAT 27
	— Waste co-incineration with solid biomass and/or peat	All sizes	EN 13211	Once every three months[10]	BAT 70
	— IGCC plants	$\geq$ 100 MW_{th}	EN 13211	Once every year[20]	BAT 75
TVOC	— HFO- and/or gas-oil-fired engines — Process fuels from the chemical industry in boilers	All sizes	EN 12619	Once every six months [10]	BAT 33 BAT 59
	—Waste co-incineration with coal, lignite, solid biomass and/or peat	All sizes	Generic EN standards	Continuous	BAT 71
Formaldehyde	— Natural-gas in spark-ignited lean-burn gas and dual fuel engines	All sizes	No EN standard available	Once every year	BAT 45
CH_4	— Natural-gas-fired engines	All sizes	EN ISO 25139	Once every year [21]	BAT 45
PCDD/F	— Process fuels from the chemical industry in boilers — Waste co-incineration	All sizes	EN 1948-1, EN 1948-2, EN 1948-3	Once every six months [10],[22]	BAT 59 BAT 71

(1)Generic EN standards for continuous measurements are EN 15267-1, EN 15267-2, EN 15267-3, and EN 14181. EN standards for periodic measurements are given in the table.

(2) The monitoring frequency does not apply where plant operation would be for the sole purpose of performing an emission measurement.

filter analysis of PM_{10} through air quality monitoring		be required in the event that the plant no longer remains a back-up plant.

	(3) In the case of plants with a rated thermal input of < 100 MW operated < 1 500 h/yr, the minimum monitoring frequency may be at least once every six months. For gas turbines, periodic monitoring is carried out with a combustion plant load of > 70 %. For co-incineration of waste with coal, lignite, solid biomass and/or peat, the monitoring frequency needs to also take into account Part 6 of Annex VI to the IED. (4) In the case of use of SCR, the minimum monitoring frequency may be at least once every year, if the emission levels are proven to be sufficiently stable. (5) In the case of natural-gas-fired turbines with a rated thermal input of < 100 MW operated < 1 500 h/yr, or in the case of existing OCGTs, PEMS may be used instead. (6) PEMS may be used instead. (7) Two sets of measurements are carried out, one with the plant operated at loads of > 70 % and the other one at loads of < 70 %. (8) As an alternative to the continuous measurement in the case of plants combusting oil with a known sulphur content and where there is no flue- gas desulphurisation system, periodic measurements at least once every three months and/or other procedures ensuring the provision of data of an equivalent scientific quality may be used to determine the SO2 emissions. (9)In the case of process fuels from the chemical industry, the monitoring frequency may be adjusted for plants of < 100 MWth after an initial characterisation of the fuel (see BAT 5) based on an assessment of the relevance of pollutant releases (e.g. concentration in fuel, flue-gas treatment employed) in the emissions to air, but in any case at least each time that a change of the fuel characteristics may have an impact on the emissions. (10) If the emission levels are proven to be sufficiently stable, periodic measurements may be carried out each time that a change of the fuel and/or waste characteristics may have an impact on the emissions, but in any case at least once every year. For co-incineration of waste with coal, lignite, solid biomass and/or peat, the monitoring frequency needs to also take into account Part 6 of Annex VI to the IED. (11) In the case of process fuels from the chemical industry, the monitoring frequency may be adjusted after an initial characterisation of the fuel (see BAT 5) based on an assessment of the relevance of pollutant releases (e.g. concentration in fuel, flue-gas treatment employed) in the emissions to air, but in any case at least each time that a change of the fuel characteristics may have an impact on the emissions. (12) In the case of plants with a rated thermal input of < 100 MW operated < 500 h/yr, the minimum monitoring frequency may be at least once every year. In the case of plants with a rated thermal input of < 100 MW operated between 500 h/yr and 1 500 h/yr, the monitoring frequency may be reduced to at least once every six months. (13) If the emission levels are proven to be sufficiently stable, periodic measurements may be carried out each time that a change of the fuel and/or waste characteristics may have an impact on the emissions, but in any case at least once every six months. (14) In the case of plants combusting iron and steel process gases, the minimum monitoring frequency may be at least once every six months if the emission levels are proven to be sufficiently stable. (15) The list of pollutants monitored and the monitoring frequency may be adjusted after an initial characterisation of the fuel (see BAT 5) based on an assessment of the relevance of pollutant releases (e.g. concentration in fuel, flue-gas treatment employed) in the emissions to air, but in any case at least each time that a change of the fuel characteristics may have an impact on the emissions. (16) In the case of plants operated < 1 500 h/yr, the minimum monitoring frequency may be at least once every six months. (17) In the case of plants operated < 1 500 h/yr, the minimum monitoring frequency may be at least once every year. (18) Continuous sampling combined with frequent analysis of time-integrated samples, e.g. by a standardised sorbent trap monitoring method, may be used as an alternative to continuous measurements. (19) If the emission levels are proven to be sufficiently stable due to the low mercury content in the fuel, periodic measurements may be carried out only each time that a change of the fuel characteristics may have an impact on the emissions. (20) The minimum monitoring frequency does not apply in the case of plants operated < 1 500 h/yr. (21) Measurements are carried out with the plant operated at loads of > 70 %. (22) In the case of process fuels from the chemical industry, monitoring is only applicable when the fuels contain chlorinated substances. 17.8.2017 L 212/17 Official Journal of the European Union EN				
BAT 5 **monitor emissions to water from flue-gas treatment**	BAT is to monitor emissions to water from flue-gas treatment with at least the frequency given below 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.		**N/A**	Requested information is to be provided.	No flue gas treatment is being used and there are no emissions to water from

Substance/Parameter		Standard(s)	Minimum monitoring frequency	Monitoring associated with
Total organic carbon (TOC) (1)		EN 1484	Once every month	BAT 15
Chemical oxygen demand (COD) (1)		No EN standard available		
Total suspended solids (TSS)		EN 872		
Fluoride (F^-)		EN ISO 10304-1		
Sulphate (SO_4^{2-})		EN ISO 10304-1		
Sulphide, easily released (S^{2-})		No EN standard available		
Sulphite (SO_3^{2-})		EN ISO 10304-3		
Metals and mettaloids	As	Various EN standards available (e.g. EN ISO 11885 or EN ISO 17294-2)		
	Cd			
	Cr			
	Cu			
	Ni			
	Pb			
	Zn			
	Hg	Various EN standards available (e.g. EN ISO 12846 or EN ISO 17852)		

the gas turbines

<table>
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<table>
<tr><td>Chloride (Cl^-)</td><td>Various EN standards available (e.g. EN ISO 10304-1 or EN ISO 15682)</td><td></td><td></td></tr>
<tr><td>Total nitrogen</td><td>EN 12260</td><td></td><td></td></tr>
<tr><td colspan="4">(1) TOC monitoring and COD monitoring are alternatives. TOC monitoring is the preferred option because it does not rely on the use of very toxic compounds.</td></tr>
</table>
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<tr>
<td>BAT 6

General environmental and combustion performance</td>
<td>In order to improve the general environmental performance of combustion plants and to reduce emissions to air of CO and unburnt substances, BAT is to ensure optimised combustion and to use an appropriate 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 blending and mixing</td><td>Ensure stable combustion conditions and/or reduce the emission of pollutants by mixing different qualities of the same fuel type</td><td rowspan="2">Generally applicable</td></tr>
<tr><td>b</td><td>Maintenance of the combustion system</td><td>Regular planned maintenance according to suppliers' recommendations</td></tr>
<tr><td>c</td><td>Advanced control system</td><td>See description in Section 8.1</td><td>The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system</td></tr>
<tr><td>d</td><td>Good design of the combustion equipment</td><td>Good design of furnace, combustion chambers, burners and associated devices</td><td>Generally applicable to new combustion plants</td></tr>
<tr><td>e</td><td>Fuel choice</td><td>Select or switch totally or partially to another fuel(s) with a better environmental profile (e.g. with low sulphur and/or mercury content) amongst the available fuels, including in start-up situations or when back-up fuels are used</td><td>Applicable within the constraints associated with the availability of 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 in the case of combustion of industrial process fuels.</td></tr>
</table>
</td>
<td>A sample from each gasoil consignment received is sent to the laboratory for analysis of a number of parameters to confirm that the quality of fuel received is within the required specifications

Scheduled maintenance is carried out according to the manufacturer's recommendations, or earlier, if actual plant circumstances necessitate that the maintenance be carried out earlier than as specified by manufacturer for routine scheduled maintenance

Fuel with <0.1% Sulphur content is used and with certain specified parameters</td>
<td>Ongoing</td>
<td>Noted. Kindly indicate status of implementation.</td>
<td></td>
</tr>
</table>

	For existing combustion plants, the type of fuel chosen may be limited by the configuration and the design of the plant				
BAT 7 **reduce emissions of ammonia to air from the use of selective catalytic reduction (SCR) and/or selective non-catalytic reduction (SNCR)**	In order to reduce emissions of ammonia to air from the use of selective catalytic reduction (SCR) and/or selective non-catalytic reduction (SNCR) for the abatement of NO_X emissions, BAT is to optimise the design and/or operation of SCR and/or SNCR (e.g. optimised reagent to NO_X ratio, homogeneous reagent distribution and optimum size of the reagent drops). The BAT-associated emission level (BAT-AEL) for emissions of NH_3 to air from the use of SCR and/or SNCR is < 3–10 mg/Nm^3 as a yearly average or average over the sampling period. The lower end of the range can be achieved when using SCR and the upper end of the range can be achieved when using SNCR without wet abatement techniques. In the case of plants combusting biomass and operating at variable loads as well as in the case of engines combusting HFO and/or gas oil, the higher end of the BAT-AEL range is 15 mg/Nm^3.	N/A N/A	**N/A**	The Operator to confirm that usage of urea is not applicable to D2, D3, D4A, D4B, D5A, D5B.	Urea is not utilised in the operation of the open cycle gas turbines D2 and D3 and the combined cycle gas turbine D4A & D4B and D5A & D5B
BAT 8 **emission abatement systems**	In order to prevent or reduce emissions to air during normal operating conditions, BAT is to ensure, by appropriate design, operation and maintenance, that the emission abatement systems are used at optimal capacity and availability.		**N/A**	Kindly note that this section needs to be filled in.	It may not be economically feasible to install abatement at this point in time however monitoring of emissions (be it measured or calculated) to ensure compliance with ELVs is carried out.
BAT 9 **Quality assurance/quality control programmes for all the fuels used**	In order to improve the general environmental performance of combustion and/or gasification plants and to reduce emissions to air, BAT is to include the following elements in the quality assurance/quality control programmes for all the fuels used, as part of the environmental management system (see BAT 1): (i) Initial full characterisation of the fuel used including at least the parameters listed below and in accordance with EN standards. ISO, national or other international standards may be used provided they ensure the provision of data of an equivalent scientific quality;	Samples from each fuel consignment received are sent to a laboratory accredited to ISO 17025 standard in order to carry out a	**Ongoing**	Kindly note permit will be updated to reflect BAT requirements.	Noted

(ii) Regular testing of the fuel quality to check that it is consistent with the initial characterisation and according to the plant design specifications. The frequency of testing and the parameters chosen from the table below are based on the variability of the fuel and an assessment of the relevance of pollutant releases (e.g. concentration in fuel, flue-gas treatment employed);

(iii) Subsequent adjustment of the plant settings as and when needed and practicable (e.g. integration of the fuel characterisation and control in the advanced control system (see description in Section 8.1)).

Description

Initial characterisation and regular testing of the fuel can be performed by the operator and/or the fuel supplier. If performed by the supplier, the full results are provided to the operator in the form of a product (fuel) supplier specification and/or guarantee.

Fuel(s)	Substances/Parameters subject to characterisation
Biomass/peat	– LHV – Moisture
	– Ash – C, Cl, F, N, S, K, Na – Metals and metalloids (As, Cd, Cr, Cu, Hg, Pb, Zn)
Coal/lignite	– LHV – Moisture – Volatiles, ash, fixed carbon, C, H, N, O, S
	– Br, Cl, F
	– Metals and metalloids (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Tl, V, Zn)
HFO	– Ash – C,S, N, Ni, V
Gas oil	– Ash – N, C, S
Natural gas	– LHV – CH_4, C_2H_6, C_3, C_4+, CO_2, N_2, Wobbe index
Process fuels from the chemical industry [3]	– Br, C, Cl, F, H, N, O, S – Metals and metalloids (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Tl, V, Zn)

number of specific tests. The test results are compared with specified limits as stipulated for the gasoil fuel to be burnt in the gas turbines.

Yes these tests are performed for every

[3] The list of substances/parameters characterised can be reduced to only those that can reasonably be expected to be present in the fuel(s) based on information on the raw materials and the production processes.

	<table><tr><td>Iron and steel process gases</td><td>– LHV, CH_4 (for COG), C_XH_Y (for COG), CO_2, H_2, N_2, total sulphur, dust, Wobbe index</td></tr><tr><td>Waste [4]</td><td>– LHV – Moisture – Volatiles, ash, Br, C, Cl, F, H, N, O, S – Metals and metalloids (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Tl, V, Zn)</td></tr></table>	gasoil consignment received			
BAT 10 **Reduce emissions to air and/or to water during other than normal operating conditions (OTNOC)**	In order to reduce emissions to air and/or to water during other than normal operating conditions (OTNOC), BAT is to set up and implement a management plan as part of the environmental management system (see BAT 1), commensurate with the relevance of potential pollutant releases, that includes the following elements: — appropriate design of the systems considered relevant in causing OTNOC that may have an impact on emissions to air, water and/or soil (e.g. low-load design concepts for reducing the minimum start-up and shutdown loads for stable generation in gas turbines), — set-up and implementation of a specific preventive maintenance plan for these relevant systems, — review and recording of emissions caused by OTNOC and associated circumstances and implementation of corrective actions if necessary, — periodic assessment of the overall emissions during OTNOC (e.g. frequency of events, duration, emissions quantification/estimation) and implementation of corrective actions if necessary.	Environmental aspect register Each environmental aspect affecting the operation of the plant is considered with the respective impact/s from the aspect under consideration A Risk and Opportunities Analysis register has been also compiled according to the requirements of ISO14001:2015 Preventive maintenance schedule has been setup according to the manufacturer's recommendation	**Ongoing – Emissions to Air (refer to ENE reply)**	Kindly provided relevant SOP/plan. Kindly indicate status of implantation.	Emissions to Air Low load design concept is not applicable since there are long intervals between one start-up and and the next. A maintenance schedule is in place. During maintenance, combustion is optimised to ensure an optimum mix of fuel to air. If gas turbine reverts to normal operation CEMS will be installed.

[4] This characterisation is carried out without prejudice of application of the waste pre-acceptance and acceptance procedure set in BAT 60(a), which may lead to the characterisation and/or checking of other substances/parameters besides those listed here.

		These are reported in the Incident Report. Root cause is identified, and corrective action/s implemented to avoid recurrences Monitoring of analysis results of water, air quality and emissions by calculation and checking of any abnormal operations	**Ongoing – Emissions to water**		To note that the open cycle gas turbines (D2 and D3) do not discharge any emissions to water. There is seawater discharge when the Combined cycle gas turbine (D4B & D5B) is operating in combined cycle mode and only a very low volume of seawater is discharged when it is operating in open cycle mode (D4A & D5A).
BAT 11 **monitor emissions to air and/or to water during OTNOC**	BAT is to appropriately monitor emissions to air and/or to water during OTNOC. Description The monitoring can be carried out by direct measurement of emissions or by monitoring of surrogate parameters if this proves to be of equal or better scientific quality than the direct measurement of emissions. Emissions during start-up and shutdown (SU/SD) may be assessed based on a detailed emission measurement carried out for a typical SU/SD procedure at least once every year, and using the results of this measurement to estimate the emissions for each and every SU/SD throughout the year.	Analysis of seawater discharge and calculation of emissions through fuel burnt using calculation method	**Ongoing**	Noted, with respect to the calculation method, does the method of determination factor/ have an allowance for the determination of emissions during OTNOC. Kindly indicate status of implementation.	The calculation method is based on the total fuel burnt. Therefore, this will take into consideration all the fuel that is consumed during the

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td>operation of the gas turbines including the quantity that is consumed during start-up and shut-down.</td></tr>
<tr><td>BAT 12

Energy Efficiency</td><td>In order to increase the energy efficiency of combustion, gasification and/or IGCC units operated ≥ 1 500 h/yr, BAT is to use an appropriate 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>Combustion optimisation</td><td>See description in Section 8.2.
Optimising the combustion minimises the content of unburnt substances in the flue-gases and in solid combustion residues</td><td rowspan="4">Generally applicable</td></tr>
<tr><td>B</td><td>Optimisation of the working medium conditions</td><td>Operate at the highest possible pressure and temperature of the working medium gas or steam, within the constraints associated with, for example, the control of NO_X emissions or the characteristics of energy demanded</td></tr>
<tr><td>C</td><td>Optimisation of the steam cycle</td><td>Operate with lower turbine exhaust pressure by utilisation of the lowest possible temperature of the condenser cooling water, within the design conditions</td></tr>
<tr><td>D</td><td>Minimisation of energy consumption</td><td>Minimising the internal energy consumption (e.g. greater efficiency of the feed-water pump)</td></tr>
<tr><td>E</td><td>Preheating of combustion air</td><td>Reuse of part of the heat recovered from the combustion flue-gas to preheat the air used in combustion</td><td>Generally applicable within constraints related to the nee control NO_X emissions</td></tr>
<tr><td>F</td><td>Fuel preheating</td><td>Preheating of fuel using recovered heat</td><td>Generally applicable within constraints associated with boiler design and the need to co NO_X emissions</td></tr>
</table></td><td>Enemalta's gas turbines are being kept as an emergency plant and hence should be operated for less than 500hr/year.</td><td>N/A</td><td>Noted. Kindly indicate non-applicability. Kindly indicate status of implementation.</td><td>If the gas turbines revert to normal operation then techniques to increase energy efficiency will be considered if economically feasible.</td></tr>
</table>

G	Advanced control system	See description in Section 8.2. Computerised control of the main combustion parameters enables the combustion efficiency to be improved	Generally applicable to new units. The applicability to old units may be constrained by the need to retrofit the combustion system and/or control command system
H	Feed-water preheating using recovered heat	Preheat water coming out of the steam condenser with recovered heat, before reusing it in the boiler	Only applicable to steam circuits and not to hot boilers. Applicability to existing units may be limited due to constraints associated with the plant configuration and the amount of recoverable heat
I	Heat recovery by cogeneration (CHP)	Recovery of heat (mainly from the steam system) for producing hot water/steam to be used in industrial processes/activities or in a public network for district heating. Additional heat recovery is possible from: – Flue-gas – Grate cooling – Circulating fluidised bed	Applicable within the constraints associated with the local heat and power demand. The applicability may be limited in the case of gas compressors with an unpredictable operational heat profile
J	CHP readiness	See description in Section 8.2.	Only applicable to new units where there is a realistic potential for the future use of heat in the vicinity of the unit
K	Flue-gas condenser	See description in Section 8.2.	Generally applicable to CHP units provided there is enough demand for low-temperature heat
L	Heat accumulation	Heat accumulation storage in CHP mode	Only applicable to CHP plants. The applicability may be limited in the case of low heat load demand
M	Wet stack	See description in Section 8.2.	Generally applicable to new and existing units fitted with wet FGD
N	Cooling tower discharge	The release of emissions to air through a cooling tower and not via a dedicated stack	Only applicable to units fitted with wet FGD where reheating of the flue-gas is necessary before release,

			and where the unit cooling system is a cooling tower				
O	Fuel pre-drying	The reduction of fuel moisture content before combustion to improve combustion conditions	Applicable to the combustion of biomass and/or peat within the constraints associated with spontaneous combustion risks (e.g. the moisture content of peat is kept above 40 % throughout the delivery chain). The retrofit of existing 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				
P	Minimisation of heat losses	Minimising residual heat losses, e.g. those that occur via the slag or those that can be reduced by insulating radiating sources	Only applicable to solid-fuel-fired combustion units and to gasification/IGCC units				
Q	Advanced materials	Use of advanced materials proven to be capable of withstanding high operating temperatures and pressures and thus to achieve increased steam/combustion process efficiencies	Only applicable to new plants				
R	Steam turbine upgrades	This includes techniques such as increasing the temperature and pressure of medium-pressure steam, addition of a low-pressure turbine, and modifications to the geometry of the turbine rotor blades	The applicability may be restricted by demand, steam conditions and/or limited plant lifetime				
S	Supercritical and ultra-supercritical steam conditions	Use of a steam circuit, including steam reheating systems, in which steam can reach pressures above 220,6 bar and temperatures above 374 °C in the case of supercritical	Only applicable to new units of ≥ 600 MWth operated > 4 000 h/yr. Not applicable when the purpose of the unit is to produce low steam				

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<tr><td></td><td></td><td>conditions, and above 250 – 300 bar and temperatures above 580 – 600 °C in the case of ultra-supercritical conditions</td><td>temperatures and/or pressures in process industries.

Not applicable to gas turbines and engines generating steam in CHP mode.

For units combusting biomass, the applicability may be constrained by high-temperature corrosion in the case of certain biomasses</td></tr>
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<td>BAT 13

Water usage and emissions to water</td>
<td>In order to reduce water usage and the volume of contaminated waste water discharged, BAT is to use one or both of the techniques given below.
<table>
<tr><td colspan="2">Technique</td><td>Description</td><td>Applicability</td></tr>
<tr><td>a.</td><td>Water recycling</td><td>Residual aqueous streams, including run-off water, from the plant are reused for other purposes. The degree of recycling is limited by the quality requirements of the recipient water stream and the water balance of the plant</td><td>Not applicable to waste water from cooling systems when water treatment chemicals and/or high concentrations of salts from seawater are present</td></tr>
<tr><td>b.</td><td>Dry bottom ash handling</td><td>Dry, hot bottom ash falls from the furnace onto a mechanical conveyor system and is cooled down by ambient air. No water is used in the process.</td><td>Only applicable to plants combusting solid fuels.
There may be technical restrictions that prevent retrofitting to existing combustion plants</td></tr>
</table>
</td>
<td>N/A

Not applicable since in our case sea water is used for cooling</td>
<td>N/A</td>
<td>Noted</td>
<td></td>
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<tr>
<td rowspan="2">BAT 14

Segregation of waste water streams</td>
<td>In order to prevent the contamination of uncontaminated waste water and to reduce emissions to water, BAT is to segregate waste water streams and to treat them separately, depending on the pollutant content.</td>
<td></td>
<td>N/A</td>
<td rowspan="2">Noted.
Kindly indicate status of implementation.</td>
<td></td>
</tr>
<tr>
<td>Description

Waste water streams that are typically segregated and treated include surface run-off water, cooling water, and waste water from flue-gas treatment.

Applicability</td>
<td>Storm water run-off is being discharged at different outlets and where possible collected and stored to be used for</td>
<td>Ongoing</td>
<td></td>
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</table>

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<tr>
<td></td>
<td>The applicability may be restricted in the case of existing plants due to the configuration of the drainage systems</td>
<td>hydrant systems and watering of plants</td>
<td></td>
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<tr>
<td>BAT 15

Reduction of emissions to water from flue-gas treatment</td>
<td>In order to reduce emissions to water from flue-gas treatment, BAT is to use an appropriate combination of the techniques given below, and to use secondary techniques as close as possible to the source in order to avoid dilution.
<table>
<tr><th></th><th>Technique</th><th>Typical pollutants prevented/abated</th><th>Applicability</th></tr>
<tr><td colspan="4">Primary techniques</td></tr>
<tr><td>a.</td><td>Optimised combustion (see BAT 6) and flue-gas treatment systems (e.g. SCR/SNCR, see BAT 7)</td><td>Organic compounds, ammonia (NH_3)</td><td>Generally applicable</td></tr>
<tr><td colspan="4">Secondary techniques [5]</td></tr>
<tr><td>b.</td><td>Adsorption on activated carbon</td><td>Organic compounds, mercury (Hg)</td><td>Generally applicable</td></tr>
<tr><td>c.</td><td>Aerobic biological treatment</td><td>Biodegradable organic compounds, ammonium (NH_4^+)</td><td>Generally applicable for the treatment of organic compounds. Aerobic biological treatment of ammonium (NH_4^+) may not be applicable in the case of high chloride concentrations (i.e. around 10 g/l)</td></tr>
<tr><td>d.</td><td>Anoxic/anaerobic biological treatment</td><td>Mercury (Hg), nitrate (NO_3^-), nitrite (NO_2^-)</td><td>Generally applicable</td></tr>
<tr><td>e.</td><td>Coagulation and flocculation</td><td>Suspended solids</td><td>Generally applicable</td></tr>
<tr><td>f.</td><td>Crystallisation</td><td>Metals and metalloids, sulphate (SO_4^{2-}), fluoride (F^-)</td><td>Generally applicable</td></tr>
<tr><td>g.</td><td>Filtration (e.g. sand filtration, microfiltration, ultrafiltration)</td><td>Suspended solids, metals</td><td>Generally applicable</td></tr>
<tr><td>h.</td><td>Flotation</td><td>Suspended solids, free oil</td><td>Generally applicable</td></tr>
<tr><td>i.</td><td>Ion exchange</td><td>Metals</td><td>Generally applicable</td></tr>
<tr><td>j.</td><td>Neutralisation</td><td>Acids, alkalis</td><td>Generally applicable</td></tr>
<tr><td>k.</td><td>Oxidation</td><td>Sulphide (S^{2-}), sulphite (SO_3^{2-})</td><td>Generally applicable</td></tr>
</table>
</td>
<td>Ion-exchange resin is used for the production of demineralised water and this is regenerated several times before it loses its properties and</td>
<td>N/A

Ongoing</td>
<td>Kindly indicate status of implementation, as stated above permit will be updated to reflect the required ELVs in terms of marine discharges at a minimum, kindly indicate attainable ELV for inclusion in the permit</td>
<td>There is no flue-gas treatment for the gas turbines.</td>
</tr>
</table>

[5] The descriptions of the techniques are given in Section 8.6

l.	Precipitation	Metals and metalloids, sulphate (SO_4^{2-}), fluoride (F^-)	Generally applicable
m.	Sedimentation	Suspended solids	Generally applicable
n.	Stripping	Ammonia (NH_3)	Generally applicable

The BAT-AELs refer to direct discharges to a receiving water body at the point where the emission leaves the installation.

Table 1

BAT-AELs for direct discharges to a receiving water body from flue-gas treatment

Substance/Parameter		**BAT-AELs**
		Daily average
Total organic carbon (TOC)		20–50 mg/l (1)(2)(3)
Chemical oxygen demand (COD)		60–150 mg/l (1)(2)(3)
Total suspended solids (TSS)		10–30 mg/l
Fluoride (F^-)		10–25 mg/l (3)
Sulphate (SO_4^{2-})		1,3–2,0 g/l (3)(4)(5)(6)
Sulphide (S^{2-}), easily released		0,1–0,2 mg/l (3)
Sulphite (SO_3^{2-})		1–20 mg/l (3)
Metals and metalloids	As	10–50 µg/l
	Cd	2–5 µg/l
	Cr	10–50 µg/l
	Cu	10–50 µg/l
	Hg	0,2–3 µg/l
	Ni	10–50 µg/l
	Pb	10–20 µg/l
	Zn	50–200 µg/l

(1) Either the BAT-AEL for TOC or the BAT-AEL for COD applies. TOC is the preferred option because its monitoring does not rely on the use of very toxic compounds.
(2) This BAT-AEL applies after subtraction of the intake load.
(3) This BAT-AEL only applies to waste water from the use of wet FGD.
(4) This BAT-AEL only applies to combustion plants using calcium compounds in flue-gas treatment.
(5)The higher end of the BAT-AEL range may not apply in the case of highly saline waste water (e.g. chloride concentrations ≥ 5 g/l) due to the increased solubility of calcium sulphate.
(6) This BAT-AEL does not apply to discharges to the sea or to brackish water bodies.

has to be disposed of as waste

Neutralisation is used to neutralise acids by alkalis or vice-versa in the neutralising pit before discharging the resultant solution — **Ongoing**

Emission limit values are specified in the IPPC permit for waste water discharge to the sea. Samples are taken at a frequency as stipulated in the permit and sent to accredited laboratories for analysis — **Ongoing**

<table>
<tr>
<td>BAT 16

Waste Management</td>
<td>In order to reduce the quantity of waste sent for disposal from the combustion and/or gasification process and abatement techniques, BAT is to organise operations so as to maximise, in order of priority and taking into account life-cycle thinking:

a) waste prevention, e.g. maximise the proportion of residues which arise as by-products;
b) waste preparation for reuse, e.g. according to the specific requested quality criteria;
c) waste recycling;
d) other waste recovery (e.g. energy recovery),

by implementing an appropriate combination of techniques such as:

<table>
<tr><th></th><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Generation of gypsum as a by-product</td><td>Quality optimisation of the calcium-based reaction residues generated by the wet FGD so that they can be used as a substitute for mined gypsum (e.g. as raw material in the plasterboard industry). The quality of limestone used in the wet FGD influences the purity of the gypsum produced</td><td>Generally applicable within the constraints associated with the required gypsum quality, the health requirements associated to each specific use, and by the market conditions</td></tr>
<tr><td>b.</td><td>Recycling or recovery of residues in the construction sector</td><td>Recycling or recovery of residues (e.g. from semi-dry desulphurisation processes, fly ash, bottom ash) as a construction material (e.g. in road building, to replace sand in concrete production, or in the cement industry)</td><td>Generally applicable within the constraints associated with the required material quality (e.g. physical properties, content of harmful substances) associated to each specific use, and by the market conditions</td></tr>
<tr><td>c.</td><td>Energy recovery by using waste in the fuel mix</td><td>The residual energy content of carbon-rich ash and sludges generated by the combustion of coal, lignite, heavy fuel oil, peat or biomass can be recovered for example by mixing with the fuel</td><td>Generally applicable where plants can accept waste in the fuel mix and are technically able to feed the fuels into the combustion chamber</td></tr>
<tr><td>d.</td><td>Preparation of spent catalyst for reuse</td><td>Preparation of catalyst for reuse (e.g. up to four times for SCR catalysts) restores some or all of the original performance, extending the service life of the catalyst to several decades. Preparation of spent catalyst for reuse is integrated in a catalyst management scheme</td><td>The applicability may be limited by the mechanical condition of the catalyst and the required performance with respect to controlling NO_X and NH_3 emissions</td></tr>
</table>
</td>
<td>Waste oils from maintenance of plant and transformers are sent to approved waste contractors to be sent abroad for recovery
Plastic, paper, metal and glass are sent to waste contractor to be sent abroad for recycling
Batteries are sent for recycling through contractors
WEEE is collected and sent to contractor for recycling via WEEE scheme
And waste is collected and managed by approved waste contractor
Hazardous waste is collected and sent to approved contractor to be managed by contractor for recovery, recycling or disposal. This is usually sent abroad to facilities permitted to take this type of waste</td>
<td>Ongoing</td>
<td>Noted. Kindly indicate status of implementation and kindly see comments in BAT 1.</td>
<td>Noted</td>
</tr>
</table>

<table>
<tr>
<td></td>
<td>In order to reduce noise emissions, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th></th><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Operational measures</td><td>These include:
— improved inspection and maintenance of equipment
— closing of doors and windows of enclosed areas, if possible
— equipment operated by experienced staff
— avoidance of noisy activities at night, if possible
— provisions for noise control during maintenance activities</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Low-noise equipment</td><td>This potentially includes compressors, pumps and disks</td><td>Generally applicable when the equipment is new or replaced</td></tr>
<tr><td>c.</td><td>Noise attenuation</td><td>Noise propagation can be reduced by inserting obstacles between the emitter and the receiver. Appropriate obstacles include protection walls, embankments and buildings</td><td>Generally applicable to new plants. In the case of existing plants, the insertion of obstacles may be restricted by lack of space</td></tr>
<tr><td>d.</td><td>Noise-control equipment</td><td>This includes:
— noise-reducers
— equipment insulation
— enclosure of noisy equipment
— soundproofing of buildings</td><td>The applicability may be restricted by lack of space</td></tr>
<tr><td>e.</td><td>Appropriate location of equipment 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>Generally applicable to new plants. In the case of existing plants, the relocation of equipment and production units may be restricted by lack of space or by excessive costs</td></tr>
</table>
</td>
<td>DPS is located in an area that is quite some distance away from residential areas.

Annual noise monitoring carried out over the past years show that the measured levels at residential areas in the vicinity of the plant are well within the tolerable limits</td>
<td>Ongoing</td>
<td>Noted. Kindly indicate status of implementation and to note comments in BAT 1.</td>
<td></td>
</tr>
</table>

2. BAT CONCLUSIONS FOR COMBUSTIONS OF SOLID FUELS

2.1 BAT conclusions for the combustion of coal and/or lignite – **NOT APPLICABLE TO DPS GAS TURBINES**

Unless otherwise stated, the BAT conclusions presented in this section are generally applicable to the combustion of coal and/or lignite. They apply in addition to the general BAT conclusions given in Section 1.

<table>
<tr><th colspan="2">BAT conclusion</th><th>STATUS AT INSTALLATION: [ENTER NAME OF OPERATOR]

DATE: [ENTER DATE OF ASSESSMENT]

Applicability Assessment (describe how the technique applies or not to your installation)</th><th>STATE WHETHER IT IS IN PLACE OR STATE SCHEDULE FOR IMPLEMENTATION</th></tr>
<tr><td>BAT 18

General environmental performance</td><td>In order to improve the general environmental performance of the combustion of coal and/or lignite, and in addition to BAT 6, BAT is to use the technique given below.
<table><tr><th></th><th>Technique</th><th>Description</th><th>Applicability</th></tr><tr><td>a.</td><td>Integrated combustion process ensuring high boiler efficiency and including primary techniques for NO_X reduction (e.g. air staging, fuel staging, low-NO_X burners (LNB) and/or flue-gas recirculation)</td><td>Combustion processes such as pulverised combustion, fluidised bed combustion or moving grate firing allow this integration</td><td>Generally applicable</td></tr></table></td><td></td><td></td></tr>
<tr><td>BAT 19

Energy efficiency</td><td>In order to increase the energy efficiency of the combustion of coal and/or lignite, BAT is to use an appropriate combination of the techniques given in BAT 12 and below.
<table><tr><th></th><th>Technique</th><th>Description</th><th>Applicability</th></tr><tr><td>a.</td><td>Dry bottom ash handling</td><td>Dry hot bottom ash falls from the furnace onto a mechanical conveyor system and, after redirection to the furnace for reburning, is cooled down by ambient air. Useful energy is recovered from both the ash reburning and ash cooling</td><td>There may be technical restrictions that prevent retrofitting to existing combus</td></tr></table>
Table 2

BAT-associated energy efficiency levels (BAT-AEELs) for coal and/or lignite combustion</td><td></td><td></td></tr>
</table>

Type of combustion unit	BAT-AEELs [1][2]		
	Net electrical efficiency (%) [3]		Net total fuel utilisation (%) [3][4][5]
	New unit [6][7]	Existing unit [6][8]	New or existing unit
Coal-fired, ≥ 1 000 MW_{th}	45 – 46	33,5 – 44	75 – 97
Lignite-fired, ≥ 1 000 MW_{th}	42 – 44 [9]	33,5 – 42,5	75 – 97
Coal-fired, < 1 000 MW_{th}	36,5 – 41,5 [10])	32,5 – 41,5	75 – 97
Lignite-fired, < 1 000 MW_{th}	36,5 – 40 [11]	31,5 – 39,5	75 – 97

(1) These BAT-AEELs do not apply in the case of units operated < 1 500 h/yr.

(2) In the case of CHP units, only one of the two BAT-AEELs 'Net electrical efficiency' or 'Net total fuel utilisation' applies, depending on the CHP unit design (i.e. either more oriented towards electricity generation or towards heat generation).

(3) The lower end of the range may correspondent to cases where the achieved energy efficiency is negatively affected (up to four percentage points) by the type of cooling system used or the geographical location of the unit.

(4) These levels may not be achievable if the potential heat demand is too low.

(5) These BAT-AEELs do not apply to plants generating only electricity.

(6) The lower ends of the BAT-AEEL ranges are achieved in the case of unfavourable climatic conditions, low-grade lignite- fired units, and/or old units (first commissioned before 1985).

(7) The higher end of the BAT-AEEL range can be achieved with high steam parameters (pressure, temperature).

(8)The achievable electrical efficiency improvement depends on the specific unit, but an increase of more than three percentage points is considered as reflecting the use of BAT for existing units, depending on the original design of the unit and on the retrofits already performed.

(9) In the case of units burning lignite with a lower heating value below 6 MJ/kg, the lower end of the BAT-AEEL range is 41,5 %.

(10) The higher end of the BAT-AEEL range may be up to 46 % in the case of units of ≥ 600 MWth using supercritical or ultra-supercritical steam conditions.

(11) The higher end of the BAT-AEEL range may be up to 44 % in the case of units of ≥ 600 MWth using supercritical or ultra-supercritical steam conditions.

BAT 20

NO_X, N_2O and CO emissions to air

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

	Technique	Description	Applicability
a.	Combustion optimisation	See description in Section 8.3. Generally used in combination with other techniques	Generally applicable

b.	Combination of other primary techniques for NO_X reduction (e.g. air staging, fuel staging, flue-gas recirculation, low-NO_X burners (LNB))	See description in Section 8.3 for each single technique. The choice and performance of (an) appropriate (combination of) primary techniques may be influenced by the boiler design	
c.	Selective non-catalytic reduction (SNCR)	See description in Section 8.3. Can be applied with 'slip' SCR	The applicability may be limited in the case of boilers with a high cross-sectional area preventing homogeneous mixing of NH_3 and NO_X. The applicability may be limited in the case of combustion plants operated < 1 500 h/yr with highly variable boiler loads
d.	Selective catalytic reduction (SCR)	See description in Section 8.3	Not applicable to combustion plants of < 300 MW_{th} operated < 500 h/yr. Not generally applicable to combustion plants of < 100 MW_{th}. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr and for existing combustion plants of ≥ 300 MW_{th} operated < 500 h/yr
e.	Combined techniques for NO_X and SO_X reduction	See description in Section 8.3	Applicable on a case-by-case basis, depending on the fuel characteristics and combustion process

Table 3

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

Combustion plant total rated thermal input (MW_{th})	BAT-AELs (mg/Nm^3)			
	Yearly average		Daily average or average over the sampling period	
	New plant	Existing plant (1)	New plant	Existing plant (2)(3)
< 100	100–150	100–270	155–200	165–330
100–300	50–100	100–180	80–130	155–210

≥ 300, FBC boiler combusting coal and/or lignite and lignite-fired PC boiler	50 – 85	< 85 – 150 (4)(5)	80 – 125	140 – 165 (6)
≥ 300, coal-fired PC boiler	65 – 85	65 – 150	80 – 125	< 85 – 165 (7)

(1) These BAT-AELs do not apply to plants operated < 1 500 h/yr.

(2) In the case of coal-fired PC boiler plants put into operation no later than 1 July 1987, which are operated < 1 500 h/yr and for which SCR and/or SNCR is not applicable, the higher end of the range is 340 mg/Nm3.

(3) For plants operated < 500 h/yr, these levels are indicative.

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

(5) The higher end of the range is 175 mg/Nm3 for FBC boilers put into operation no later than 7 January 2014 and for lignite-fired PC boilers.

(6) The higher end of the range is 220 mg/Nm3 for FBC boilers put into operation no later than 7 January 2014 and for lignite-fired PC boilers.

(7) In the case of plants put into operation no later than 7 January 2014, the higher end of the range is 200 mg/Nm3 for plants operated ≥ 1 500 h/yr, and 220 mg/Nm3 for plants operated < 1 500 h/yr.

As an indication, the yearly average CO emission levels for existing combustion plants operated ≥ 1 500 h/yr or for new combustion plants will generally be as follows:

Combustion plant total rated thermal input (MW_{th})	**CO indicative emission level (mg/Nm^3)**
< 300	< 30–140
≥ 300, FBC boiler combusting coal and/or lignite and lignite-fired PC boiler	< 30–100 *(1)*
≥ 300, coal-fired PC boiler	< 5–100 *(1)*

(1) The higher end of the range may be up to 140 mg/Nm3 in the case of limitations due to boiler design, and/or in the case of fluidised bed boilers not fitted with secondary abatement techniques for NOX emissions reduction.

BAT 21

SO_X, HCl and HF emissions to air

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

	Technique	Description	Applicability
a.	Boiler sorbent injection (in-furnace or in-bed)	See description in Section 8.4	Generally applicable
b.	Duct sorbent injection (DSI)	See description in Section 8.4. The technique can be used for HCl/HF removal when no specific FGD end-of-pipe technique is implemented	
c.	Spray dry absorber (SDA)	See description in Section 8.4	
d.	Circulating fluidised bed (CFB) dry scrubber		
e.	Wet scrubbing	See description in Section 8.4. The techniques can be used for HCl/HF removal when no specific	

		FGD end-of-pipe technique is implemented	
f.	Wet flue-gas desulphurisation (wet FGD)	See description in Section 8.4	Not applicable to combustion plants operated < 500 h/yr. There may be technical and economic restrictions for applying the technique to combustion plants of < 300 MW_{th}, and for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr
g.	Seawater FGD		
h.	Combined techniques for NO_X and SO_X reduction		Applicable on a case-by-case basis, depending on the fuel characteristics and combustion process
i.	Replacement or removal of the gas-gas heater located downstream of the wet FGD	Replacement of the gas-gas heater downstream of the wet FGD by a multi-pipe heat extractor, or removal and discharge of the flue-gas via a cooling tower or a wet stack	Only applicable when the heat exchanger needs to be changed or replaced in combustion plants fitted with wet FGD and a downstream gas-gas heater
j.	Fuel choice	See description in Section 8.4. Use of fuel with low sulphur (e.g. down to 0,1 wt-%, dry basis), chlorine or fluorine content	Applicable within the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State. The applicability may be limited due to design constraints in the case of combustion plants combusting highly specific indigenous fuels

Table 4

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

Combustion plant total rated thermal input (MW_{th})	**BAT-AELs (mg/Nm^3)**			
	Yearly average		**Daily average**	**Daily average or average over the sampling period (2)**
	New plant	**Existing plant (1)**	**New plant**	**Existing plant**
< 100	150–200	150–360	170–220	170–400
100–300	80–150	95–200	135–200	135–220 (3)
≥ 300, PC boiler	10–75	10–130 (4)	25–110	25–165 (5)
≥ 300, Fluidised bed boiler	20–75	20–180	25–110	50–220

(1) These BAT-AELs do not apply to plants operated < 1 500 h/yr.
(2) For plants operated < 500 h/yr, these levels are indicative.
(3) In the case of plants put into operation no later than 7 January 2014, the upper end of the BAT-AEL range is 250 mg/Nm^3.
(4) The lower end of the range can be achieved with the use of low-sulphur fuels in combination with the most advanced wet abatement system designs.
(5) The higher end of the BAT-AEL range is 220 mg/Nm^3 in the case of plants put into operation no later than 7 January 2014 and operated < 1 500 h/yr. For other existing plants put into operation no later than 7 January 2014, the higher end of the BAT-AEL range is 205 mg/Nm^3.
(6) For circulating fluidised bed boilers, the lower end of the range can be achieved by using high-efficiency wet FGD. The higher end of the range can be achieved by using boiler in-bed sorbent injection.

For a combustion plant with a total rated thermal input of more than 300 MW, which is specifically designed to fire indigenous lignite fuels and which can demonstrate that it cannot achieve the BAT-AELs mentioned in Table 4 for techno-economic reasons, the daily average BAT-AELs set out in Table 4 do not apply, and the upper end of the yearly average BAT-AEL range is as follows:

(i) for a new FGD system: RCG × 0,01 with a maximum of 200 mg/Nm^3;

(ii) for an existing FGD system: RCG × 0,03 with a maximum of 320 mg/Nm^3;
in which RCG represents the concentration of SO_2 in the raw flue-gas as a yearly average (under the standard conditions given under General considerations) at the inlet of the SO_X abatement system, expressed at a reference oxygen content of 6 vol- % O_2.

(iii) If boiler sorbent injection is applied as part of the FGD system, the RCG may be adjusted by taking into account the SO_2 reduction efficiency of this technique (η_{BSI}), as follows: RCG (adjusted) = RCG (measured)/(1-η_{BSI}).

Table 5

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

Pollutant	Combustion plant total rated thermal input (MW_{th})	BAT-AELs (mg/Nm^3) Yearly average or average of samples obtained during one year	
		New plant	Existing plant (1)
HCl	< 100	1–6	2–10 (2)
	≥ 100	1–3	1–5 (2)(3)
HF	< 100	< 1–3	< 1–6 (4)
	≥ 100	< 1–2	< 1–3 (4)

(1)The lower end of these BAT-AEL ranges may be difficult to achieve in the case of plants fitted with wet FGD and a downstream gas-gas heater.
(2) The higher end of the BAT-AEL range is 20 mg/Nm3 in the following cases: plants combusting fuels where the average chlorine content is 1 000 mg/kg (dry) or higher; plants operated < 1 500 h/yr; FBC boilers. For plants operated < 500 h/yr, these levels are indicative.
(3) In the case of plants fitted with wet FGD with a downstream gas-gas heater, the higher end of the BAT-AEL range is 7 mg/Nm3.
(4) The higher end of the BAT-AEL range is 7 mg/Nm3 in the following cases: plants fitted with wet FGD with a downstream gas-gas heater; plants operated < 1 500 h/yr; FBC boilers. For plants operated < 500 h/yr, these levels are indicative.

BAT 22

Dust and particulate-bound metal emissions to air

In order to reduce dust and particulate-bound metal emissions to air from the combustion of coal and/or lignite, BAT is to use one or a combination of the techniques given below.

	Technique	Description	Applicability
a.	Electrostatic precipitator (ESP)	See description in Section 8.5	Generally applicable
b.	Bag filter		
c.	Boiler sorbent injection (in-furnace or in-bed)	See descriptions in Section 8.5. The techniques are mainly used for SO_X, HCl and/or HF control	
d.	Dry or semi-dry FGD system		

e.	Wet flue-gas desulphurisation (wet FGD)		See applicability in BAT 21

Table 6

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

Combustion plant total rated thermal input (MW_{th})	**BAT-AELs (mg/Nm^3)**			
	Yearly average		**Daily average or average over the sampling period**	
	New plant	**Existing plant** (1)	**New plant**	**Existing plant** (2)
< 100	2–5	2–18	4–16	4–22 (3)
100–300	2–5	2–14	3–15	4–22 (4)
300–1 000	2–5	2–10 (5)	3–10	3–11 (6)
≥ 1 000	2–5	2–8	3–10	3–11 (7)

(1) These BAT-AELs do not apply to plants operated < 1 500 h/yr.
(2) For plants operated < 500 h/yr, these levels are indicative.
(3) The higher end of the BAT-AEL range is 28 mg/Nm3 for plants put into operation no later than 7 January 2014.
(4) The higher end of the BAT-AEL range is 25 mg/Nm3 for plants put into operation no later than 7 January 2014.
(5) The higher end of the BAT-AEL range is 12 mg/Nm3 for plants put into operation no later than 7 January 2014.
(6) The higher end of the BAT-AEL range is 20 mg/Nm3 for plants put into operation no later than 7 January 2014.
(7) The higher end of the BAT-AEL range is 14 mg/Nm3 for plants put into operation no later than 7 January 2014.

BAT 23

Mercury emissions to air

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

	Technique	**Description**	**Applicability**
Co-benefit from techniques primarily used to reduce emissions of other pollutants			
a.	Electrostatic precipitator (ESP)	See description in Section 8.5. Higher mercury removal efficiency is achieved at flue-gas temperatures below 130 °C. The technique is mainly used for dust control	Generally applicable
b.	Bag filter	See description in Section 8.5. The technique is mainly used for dust control	Generally applicable
c.	Dry or semi-dry FGD system	See descriptions in Section 8.5. The techniques are mainly used for SO_X, HCl and/or HF control	Generally applicable
d.	Wet flue-gas desulphurisation (wet FGD)	See descriptions in Section 8.5. The techniques are mainly used for SO_X, HCl and/or HF control	See applicability in BAT 21
e.	Selective catalytic reduction (SCR)	See description in Section 8.3. Only used in combination with other techniques to enhance or reduce the mercury oxidation before capture in a subsequent FGD or dedusting system.	See applicability in BAT 20

		The technique is mainly used for NO_X control	
Specific techniques to reduce mercury emissions			
f.	Carbon sorbent (e.g. activated carbon or halogenated activated carbon) injection in the flue-gas	See description in Section 8.5. Generally used in combination with an ESP/bag filter. The use of this technique may require additional treatment steps to further segregate the mercury-containing carbon fraction prior to further reuse of the fly ash	Generally applicable
g.	Use of halogenated additives in the fuel or injected in the furnace	See description in Section 8.5	Generally applicable in the case of a low halogen content in the fuel
h.	Fuel pretreatment	Fuel washing, blending and mixing in order to limit/reduce the mercury content or improve mercury capture by pollution control equipment	Applicability is subject to a previous survey for characterising the fuel and for estimating the potential effectiveness of the technique
i.	Fuel choice	See description in Section 8.5	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

Table 7

BAT-associated emission levels (BAT-AELs) for mercury emissions to air from the combustion of coal and lignite

Combustion plant total rated thermal input (MW_{th})	BAT-AELs (µg/Nm^3)			
	Yearly average or average of samples obtained during one year			
	New plant		Existing plant (1)	
	Coal	lignite	coal	lignite
< 300	< 1–3	< 1–5	< 1–9	< 1–10
≥ 300	< 1–2	< 1–4	< 1–4	< 1–7

(1) The lower end of the BAT-AEL range can be achieved with specific mercury abatement techniques.

2.2 BAT conclusions for the combustion of solid biomass and/or peat – **NOT APPLICABLE TO DPS GAS TURBINES**

Unless otherwise stated, the BAT conclusions presented in this section are generally applicable to the combustion of solid biomass and/or peat. They apply in addition to the general BAT conclusions given in Section 1

<table>
<tr><th colspan="2">Bat conclusions</th><th>STATUS AT INSTALLATION: [ENTER NAME OF OPERATOR]

DATE: [ENTER DATE OF ASSESSMENT]

Applicability Assessment (describe how the technique applies or not to your installation)</th><th>STATE WHETHER IT IS IN PLACE OR STATE SCHEDULE FOR IMPLEMENTATION</th></tr>
<tr><td>Energy efficiency</td><td>Table 8
BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of solid biomass and/or peat
<table>
<tr><td rowspan="3">Type of combustion unit</td><td colspan="4">BAT-AEELs</td></tr>
<tr><td colspan="2">Net electrical efficiency (%)</td><td colspan="2">Net total fuel utilisation (%)</td></tr>
<tr><td>New unit</td><td>Existing unit</td><td>New unit</td><td>Existing unit</td></tr>
<tr><td>Solid biomass and/or peat boiler</td><td>33,5–to > 38</td><td>28–38</td><td>73–99</td><td>73–99</td></tr>
</table></td><td></td><td></td></tr>
<tr><td>BAT 24

NO_X, N_2O and CO emissions to air</td><td>In order to prevent or reduce NO_X emissions to air while limiting CO and N_2O emissions to air from 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>Combustion optimisation</td><td rowspan="5">See descriptions in Section 8.3</td><td rowspan="5">Generally applicable</td></tr>
<tr><td>b.</td><td>Low-NO_X burners (LNB)</td></tr>
<tr><td>c.</td><td>Air staging</td></tr>
<tr><td>d.</td><td>Fuel staging</td></tr>
<tr><td>e.</td><td>Flue-gas recirculation</td></tr>
</table></td><td>.</td><td></td></tr>
</table>

	f. Selective non-catalytic reduction (SNCR)	See description in Section 8.3. Can be applied with 'slip' SCR	Not applicable to combustion plants operated < 500 h/yr with highly variable boiler loads. The applicability may be limited in the case of combustion plants operated between 500 h/yr and 1 500 h/yr with highly variable boiler loads. For existing combustion plants, applicable within the constraints associated with the required temperature window and residence time for the injected reactants		
	g. Selective catalytic reduction (SCR)	See description in Section 8.3. The use of high-alkali fuels (e.g. straw) may require the SCR to be installed downstream of the dust abatement system	Not applicable to combustion plants operated < 500 h/yr. There may be economic restrictions for retrofitting existing combustion plants of < 300 MW_{th}. Not generally applicable to existing combustion plants of < 100 MW_{th}		

Table 9

BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of solid biomass and/or peat

Combustion plant total rated thermal input (MW_{th})	BAT-AELs (mg/Nm³)			
	Yearly average		Daily average or average over the sampling period	
	New plant	Existing plant (1)	New plant	Existing plant (2)
50–100	70–150 (3)	70–225 (4)	120–200 (5)	120–275 (6)
100–300	50–140	50–180	100–200	100–220
≥ 300	40–140	40–150 (7)	65–150	95–165 (8)

(1) These BAT-AELs do not apply to plants operated < 1 500 h/yr. (

2) For combustion plants operated < 500 h/yr, these levels are indicative.

(3) For plants burning fuels where the average potassium content is 2 000 mg/kg (dry) or higher, and/or the average sodium content is 300 mg/kg or higher, the higher end of the BAT-AEL range is 200 mg/Nm3.

(4) For plants burning fuels where the average potassium content is 2 000 mg/kg (dry) or higher, and/or the average sodium content is 300 mg/kg or higher, the higher end of the BAT-AEL range is 250 mg/Nm3.

(5) For plants burning fuels where the average potassium content is 2 000 mg/kg (dry) or higher, and/or the average sodium content is 300 mg/kg or higher, the higher end of the BAT-AEL range is 260 mg/Nm3.

<table>
<tr>
<td></td>
<td>
(6) For plants put into operation no later than 7 January 2014 and burning fuels where the average potassium content is 2 000 mg/kg (dry) or higher, and/or the average sodium content is 300 mg/kg or higher, the higher end of the BAT-AEL range is 310 mg/Nm3.

(7) The higher end of the BAT-AEL range is 160 mg/Nm3 for plants put into operation no later than 7 January 2014.

(8) The higher end of the BAT-AEL range is 200 mg/Nm3 for plants put into operation no later than 7 January 2014.

As an indication, the yearly average CO emission levels will generally be:

— < 30–250 mg/Nm^3 for existing combustion plants of 50–100 MW_{th}operated ≥ 1 500 h/yr, or new combustion plants of 50–100 MW_{th},

— < 30–160 mg/Nm^3 for existing combustion plants of 100–300 MW_{th}operated ≥ 1 500 h/yr, or new combustion plants of 100–300 MW_{th},

— < 30–80 mg/Nm^3 for existing combustion plants of ≥ 300 MW_{th} operated ≥ 1 500 h/yr, or new combustion plants of ≥ 300 MW_{th}.
</td>
<td></td>
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</tr>
<tr>
<td>BAT 25

SO_X, HCl and HF emissions to air</td>
<td>
In order to prevent or reduce SO_X, HCl and HF emissions to air from 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>Boiler sorbent injection (in-furnace or in-bed)</td><td rowspan="8">See descriptions in Section 8.4</td><td rowspan="6">Generally applicable</td></tr>
<tr><td>b.</td><td>Duct sorbent injection (DSI)</td></tr>
<tr><td>c.</td><td>Spray dry absorber (SDA)</td></tr>
<tr><td>d.</td><td>Circulating fluidised bed (CFB) dry scrubber</td></tr>
<tr><td>e.</td><td>Wet scrubbing</td></tr>
<tr><td>f.</td><td>Flue-gas condenser</td></tr>
<tr><td>g.</td><td>Wet flue-gas desulphurisation (wet FGD)</td><td>Not applicable to combustion plants operated < 500 h/yr.

There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr</td></tr>
<tr><td>h.</td><td>Fuel choice</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>
</table>

Table 10
</td>
<td></td>
<td></td>
</tr>
</table>

BAT-associated emission levels (BAT-AELs) for SO_2 emissions to air from the combustion of solid biomass and/or peat

Combustion plant total rated thermal input (MWth)	BAT-AELs for SO_2 (mg/Nm^3)			
	Yearly average		Daily average or average over the sampling period	
	New plant	Existing plant (1)	New plant	Existing plant (2)
< 100	15–70	15–100	30–175	30–215
100–300	< 10–50	< 10–70 (3)	< 20–85	< 20–175 (4)
≥ 300	< 10–35	< 10–50 (3)	< 20–70	< 20–85 (2)

(1) These BAT-AELs do not apply to plants operated < 1 500 h/yr.

(2) For plants operated < 500 h/yr, these levels are indicative.

(3) For existing plants burning fuels where the average sulphur content is 0,1 wt-% (dry) or higher, the higher end of the BAT-AEL range is 100 mg/Nm3.

(4) For existing plants burning fuels where the average sulphur content is 0,1 wt-% (dry) or higher, the higher end of the BAT-AEL range is 215 mg/Nm3.

(5) For existing plants burning fuels where the average sulphur content is 0,1 wt-% (dry) or higher, the higher end of the BAT-AEL range is 165 mg/Nm3, or 215 mg/Nm3 if those plants have been put into operation no later than 7 January 2014 and/or are FBC boilers combusting peat.

Table 11

BAT-associated emission levels (BAT-AELs) for HCl and HF emissions to air from the combustion of solid biomass and/or peat

Combustion plant total rated thermal input (MWth)	BAT-AELs for HCl (mg/Nm^3) (1)(2)				BAT-AELs for HF (mg/Nm^3)	
	Yearly average or average of samples obtained during one year		Daily average or average over the sampling period		Average over the sampling period	
	New plant	Existing plant (3)(4)	New plant	Existing plant (5)	New plant	Existing plant (5)
< 100	1–7	1–15	1–12	1–35	< 1	< 1,5
100–300	1–5	1–9	1–12	1–12	< 1	< 1
≥ 300	1–5	1–5	1–12	1–12	< 1	< 1

(1)For plants burning fuels where the average chlorine content is ≥ 0,1 wt-% (dry), or for existing plants co-combusting biomass with sulphur-rich fuel (e.g. peat) or using alkali chloride-converting additives (e.g. elemental sulphur), the higher end of the BAT-AEL range for the yearly average for new plants is 15 mg/Nm3, the higher end of the BAT-AEL range for the yearly average for existing plants is 25 mg/Nm3. The daily average BAT-AEL range does not apply to these plants.

(2) The daily average BAT-AEL range does not apply to plants operated < 1 500 h/yr. The higher end of the BAT-AEL range for the yearly average for new plants operated < 1 500 h/yr is 15 mg/Nm3.

(3) These BAT-AELs do not apply to plants operated < 1 500 h/yr.

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

(5) For plants operated < 500 h/yr, these levels are indicative.

BAT 26

Dust and particulate-bound metal emissions to air

In order to reduce dust and particulate-bound metal emissions to air from 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.	Electrostatic precipitator (ESP)	See description in Section 8.5	Generally applicable
b.	Bag filter		
c.	Dry or semi-dry FGD system	See descriptions in Section 8.5 The techniques are mainly used for SO_X, HCl and/or HF control	
d.	Wet flue-gas desulphurisation (wet FGD)		See applicability in BAT 25
e.	Fuel choice	See description in Section 8.5	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

Table 12

BAT-associated emission levels (BAT-AELs) for dust emissions to air from the combustion of solid biomass and/or peat

Combustion plant total rated thermal input (MW_{th})	BAT-AELs for dust (mg/Nm^3)			
	Yearly average		Daily average or average over the sampling period	
	New plant	Existing plant (1)	New plant	Existing plant (2)
< 100	2–5	2–15	2–10	2–22
100–300	2–5	2–12	2–10	2–18
≥ 300	2–5	2–10	2–10	2–16

(1) These BAT-AELs do not apply to plants operated < 1 500 h/yr.

(2) For plants operated < 500 h/yr, these levels are indicative.

BAT 27

Mercury emissions to air

In order to prevent or reduce mercury emissions to air from the combustion of solid biomass and/or peat, BAT is to use one or a combination of the techniques given below.

	Technique	Description	Applicability
Specific techniques to reduce mercury emissions			
a.	Carbon sorbent (e.g. activated carbon or halogenated activated carbon) injection in the flue-gas	See descriptions in Section 8.5	Generally applicable

b.	Use of halogenated additives in the fuel or injected in the furnace		Generally applicable in the case of a low halogen content in the fuel
c.	Fuel choice		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
Co-benefit from techniques primarily used to reduce emissions of other pollutants			
d.	Electrostatic precipitator (ESP)	See descriptions in Section 8.5. The techniques are mainly used for dust control	Generally applicable
e.	Bag filter		
f.	Dry or semi-dry FGD system	See descriptions in Section 8.5. The techniques are mainly used for SO_X, HCl and/or HF control	
g.	Wet flue-gas desulphurisation (wet FGD)		See applicability in BAT 25

The BAT-associated emission level (BAT-AEL) for mercury emissions to air from the combustion of solid biomass and/or peat is < 1–5 µg/Nm^3 as average over the sampling period.

3. BAT CONCLUSIONS FOR THE COMBUSTION OF LIQUID FUELS – **SECTION 3.3 IS APPLICABLE TO DPS GAS TURBINES**

The BAT conclusions presented in this section do not apply to combustion plants on offshore platforms; these are covered by Section 4.3

3.1. HFO- and/or gas-oil-fired boilers

Unless otherwise stated, the BAT conclusions presented in this section are generally applicable to the combustion of HFO and/or gas oil in boilers. They apply in addition to the general BAT conclusions given in Section 1

<table>
<tr><th colspan="2">Bat conclusions</th><th>STATUS AT INSTALLATION: [ENTER NAME OF OPERATOR]

DATE: [ENTER DATE OF ASSESSMENT]

Applicability Assessment (describe how the technique applies or not to your installation)</th><th>STATE WHETHER IT IS IN PLACE OR STATE SCHEDULE FOR IMPLEMENTATION</th></tr>
<tr><td>Energy efficiency</td><td>Table 13

BAT-associated energy efficiency levels (BAT-AEELs) for HFO and/or gas oil combustion in boilers
<table>
<tr><th rowspan="3">Type of combustion unit</th><th colspan="4">BAT-AEELs (1)(2)</th></tr>
<tr><th colspan="2">Net electrical efficiency (%)</th><th colspan="2">Net total fuel utilisation (%)</th></tr>
<tr><th>New unit</th><th>Existing unit</th><th>New unit</th><th>Existing unit (3)</th></tr>
<tr><td>HFO- and/or gas-oil-fired boiler</td><td>> 36,4</td><td>35,6–37,4</td><td>80–96</td><td>80–96</td></tr>
</table>
(1) These BAT-AEELs do not apply to units operated < 1 500 h/yr.
(2) In the case of CHP units, only one of the two BAT-AEELs ‘Net electrical efficiency’ or ‘Net total fuel utilisation’ applies, depending on the CHP unit design (i.e. either more oriented towards electricity generation or towards heat generation).
(3) These levels may not be achievable if the potential heat demand is too low.</td><td></td><td></td></tr>
<tr><td>BAT 28

NO_X and CO emissions to air</td><td>In order to prevent or reduce NO_X emissions to air while limiting CO emissions to air from the combustion of HFO and/or gas oil 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 staging</td><td rowspan="3">See descriptions in Section 8.3</td><td rowspan="3">Generally applicable</td></tr>
<tr><td>b.</td><td>Fuel staging</td></tr>
<tr><td>c.</td><td>Flue-gas recirculation</td></tr>
</table></td><td></td><td></td></tr>
</table>

d.	Low-NO_X burners (LNB)		
e.	Water/steam addition		Applicable within the constraints of water availability
f.	Selective non-catalytic reduction (SNCR)		Not applicable to combustion plants operated < 500 h/yr with highly variable boiler loads. The applicability may be limited in the case of combustion plants operated between 500 h/yr and 1 500 h/yr with highly variable boiler loads
g.	Selective catalytic reduction (SCR)	See descriptions in Section 8.3	Not applicable to combustion plants operated < 500 h/yr. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr. Not generally applicable to combustion plants of < 100 MW_{th}
h.	Advanced control system		Generally applicable to new combustion plants. The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system
i.	Fuel choice		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

Table 14

BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of HFO and/or gas oil in boilers

Combustion plant total rated thermal input (MW_{th})	**BAT-AELs (mg/Nm^3)**			
	Yearly average		**Daily average or average over the sampling period**	
	New plant	**Existing plant** (1)	**New plant**	**Existing plant** (2)
< 100	75–200	150–270	100–215	210–330 (3)
≥ 100	45–75	45–100 (4)	85–100	85–110 (5)(6)

(1) These BAT-AELs do not apply to plants operated < 1 500 h/yr.
(2) For plants operated < 500 h/yr, these levels are indicative.
(3) For industrial boilers and district heating plants put into operation no later than 27 November 2003, which are operated < 1 500 h/yr and for which SCR and/or SNCR is not applicable, the higher end of the BAT-AEL range is 450 mg/Nm3.
(4) The higher end of the BAT-AEL range is 110 mg/Nm3 for plants of 100–300 MWth and plants of ≥ 300 MWth that were put into operation no later than 7 January 2014.
(5) The higher end of the BAT-AEL range is 145 mg/Nm3 for plants of 100–300 MWth and plants of ≥ 300 MWth that were put into operation no later than 7 January 2014.
(6) For industrial boilers and district heating plants of > 100 MWth put into operation no later than 27 November 2003, which are operated < 1 500 h/yr and for which SCR and/or SNCR is not applicable, the higher end of the BAT-AEL range is 365 mg/Nm3.

As an indication, the yearly average CO emission levels will generally be:

— 10-30 mg/Nm^3 for existing combustion plants of < 100 MW_{th} operated ≥ 1 500 h/yr, or new combustion plants of <100 MW_{th},

— 10–20mg/Nm^3 for existing combustion plants of ≥ 100 MW_{th} operated ≥ 1 500 h/yr, or new combustion plants of ≥ 100 MW_{th}.

BAT 29

SO_X, HCl and HF emissions to air

In order to prevent or reduce SO_X, HCl and HF emissions to air from the combustion of HFO and/or gas oil in boilers, BAT is to use one or a combination of the techniques given below.

	Technique	Description	Applicability
a.	Duct sorbent injection (DSI)	See description in Section 8.4	Generally applicable
b.	Spray dry absorber (SDA)		
c.	Flue-gas condenser		
d.	Wet flue-gas desulphurisation (wet FGD)		There may be technical and economic restrictions for applying the technique to combustion plants of < 300 MW_{th}. Not applicable to combustion plants operated < 500 h/yr. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr
e.	Seawater FGD		There may be technical and economic restrictions for applying the technique to combustion plants of < 300 MW_{th}. Not applicable to combustion plants operated < 500 h/yr. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr
f.	Fuel choice		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

Table 15

BAT-associated emission levels (BAT-AELs) for SO_2 emissions to air from the combustion of HFO and/or gas oil in boilers

Combustion plant total rated thermal input (MW$_{th}$)	BAT-AELs for SO_2 (mg/Nm^3)			
	Yearly average		Daily average or average over the sampling period	
	New plant	Existing plant (1)	New plant	Existing plant (2)
< 300	50–175	50–175	150–200	150–200 (3)
≥ 300	35–50	50–110	50–120	150–165 (4)(5)

(1) These BAT-AELs do not apply to plants operated < 1 500 h/yr.
(2) For plants operated < 500 h/yr, these levels are indicative.
(3)For industrial boilers and district heating plants put into operation no later than 27 November 2003 and operated < 1 500 h/yr, the higher end of the BAT-AEL range is 400 mg/Nm3.
(4) The higher end of the BAT-AEL range is 175 mg/Nm3 for plants put into operation no later than 7 January 2014.
(5) For industrial boilers and district heating plants put into operation no later than 27 November 2003, which are operated < 1 500 h/yr and for which wet FGD is not applicable, the higher end of the BAT-AEL range is 200 mg/Nm3.

BAT 30

Dust and particulate-bound metal emissions to air

In order to reduce dust and particulate-bound metal emissions to air from the combustion of HFO and/or gas oil in boilers, BAT is to use one or a combination of the techniques given below.

	Technique	Description	Applicability
a.	Electrostatic precipitator (ESP)	See description in Section 8.5	Generally applicable
b.	Bag filter		
c.	Multicyclones	See description in Section 8.5. Multicyclones can be used in combination with other dedusting techniques	
d.	Dry or semi-dry FGD system	See descriptions in Section 8.5. The technique is mainly used for SO_X, HCl and/or HF control	
e.	Wet flue-gas desulphurisation (wet FGD)	See description in Section 8.5. The technique is mainly used for SO_X, HCl and/or HF control	See applicability in BAT 29
f.	Fuel choice	See description in Section 8.5	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

Table 16

	BAT-associated emission levels (BAT-AELs) for dust emissions to air from the combustion of HFO and/or gas oil in boilers		

BAT-associated emission levels (BAT-AELs) for dust emissions to air from the combustion of HFO and/or gas oil in boilers

Combustion plant total rated thermal input (MW$_{th}$)	BAT-AELs for dust (mg/Nm^3)			
	Yearly average		Daily average or average over the sampling period	
	New plant	Existing plant (1)	New plant	Existing plant (2)
< 300	2–10	2–20	7–18	7–22 (3)
≥ 300	2–5	2–10	7–10	7–11 (4)

(1) These BAT-AELs do not apply to plants operated < 1 500 h/yr.
(2) For plants operated < 500 h/yr, these levels are indicative.
(3) The higher end of the BAT-AEL range is 25 mg/Nm3 for plants put into operation no later than 7 January 2014.
(4) The higher end of the BAT-AEL range is 15 mg/Nm3 for plants put into operation no later than 7 January 2014.

3.2. HFO- and/or gas-oil-fired engines – **NOT APPLICABLE TO DPS GAS TURBINES**

Unless otherwise stated, the BAT conclusions presented in this section are generally applicable to the combustion of HFO and/or gas oil in reciprocating engines. They apply in addition to the general BAT conclusions given in Section 1.

As regards HFO- and/or gas-oil-fired engines, secondary abatement techniques for NO_X, SO_2 and dust may not be applicable to engines in islands that are part of a small isolated system or a micro isolated system, due to technical, economic and logistical/infrastructure constraints, pending their interconnection to the mainland electricity grid or access to a natural gas supply. The BAT-AELs for such engines shall therefore only apply in small isolated system and micro isolated system as from 1 January 2025 for new engines, and as from 1 January 2030 for existing engines.

<table>
<tr><th colspan="2">Bat conclusions</th><th>STATUS AT INSTALLATION: [ENTER NAME OF OPERATOR]

DATE: [ENTER DATE OF ASSESSMENT]

Applicability Assessment (describe how the technique applies or not to your installation)</th><th>STATE WHETHER IT IS IN PLACE OR STATE SCHEDULE FOR IMPLEMENTATION</th></tr>
<tr><td>BAT 31

Energy efficiency</td><td>In order to increase the energy efficiency of HFO and/or gas oil combustion in reciprocating engines, BAT is to use an appropriate combination of the techniques given in BAT 12 and below.

<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combined cycle</td><td>See description in Section 8.2</td><td>Generally applicable to new units operated ≥ 1 500 h/yr.

Applicable to existing units within the constraints associated with the steam cycle design and the space availability.

Not applicable to existing units operated < 1 500 h/yr</td></tr>
</table>

Table 17

BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of HFO and/or gas oil in reciprocating engines

<table>
<tr><th rowspan="3">Type of combustion unit</th><th colspan="2">BAT-AEELs (1)</th></tr>
<tr><th colspan="2">Net electrical efficiency (%) (2)</th></tr>
<tr><th>New unit</th><th>Existing unit</th></tr>
<tr><td>HFO- and/or gas-oil-fired reciprocating engine — single cycle</td><td>41,5–44,5 (1)</td><td>38,3–44,5 (1)</td></tr>
<tr><td>HFO- and/or gas-oil-fired reciprocating engine — combined cycle</td><td>> 48 (4)</td><td>No BAT-AEEL</td></tr>
</table>
</td><td></td><td></td></tr>
</table>

	(1) These BAT-AEELs do not apply to units operated < 1 500 h/yr. (2) Net electrical efficiency BAT-AEELs apply to CHP units whose design is oriented towards power generation, and to units generating only power. (3)These levels may be difficult to achieve in the case of engines fitted with energy-intensive secondary abatement techniques. (4) This level may be difficult to achieve in the case of engines using a radiator as a cooling system in dry, hot geographical locations.		
BAT 32 **NO_X, CO and volatile organic compound emissions to air**	In order to prevent or reduce NO_X emissions to air from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or a combination of the techniques given below. (see table below)		

	Technique	Description	Applicability
a.	Low-NO_X combustion concept in diesel engines	See descriptions in Section 8.3	Generally applicable
b.	Exhaust-gas recirculation (EGR)		Not applicable to four-stroke engines
c.	Water/steam addition		Applicable within the constraints of water availability. The applicability may be limited where no retrofit package is available
d.	Selective catalytic reduction (SCR)		Not applicable to combustion plants operated < 500 h/yr. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr. Retrofitting existing combustion plants may be constrained by the availability of sufficient space

BAT 33 **reduce emissions of CO and volatile organic compounds**	In order to prevent or reduce emissions of CO and volatile organic compounds to air from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or both of the techniques given below. (see table below)		

	Technique	Description	Applicability
a.	Combustion optimisation		Generally applicable
b.	Oxidation catalysts	See descriptions in Section 8.3	Not applicable to combustion plants operated < 500 h/yr. The applicability may be limited by the sulphur content of the fuel

Table 18

BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of HFO and/or gas oil in reciprocating engines

Combustion plant total rated thermal input (MW_{th})	BAT-AELs (mg/Nm^3)			
	Yearly average		Daily average or average over the sampling period	
	New plant	Existing plant (1)	New plant	Existing plant (2)(3)
≥ 50	115–190 (4)	125–625	145–300	150–750

(1)These BAT-AELs do not apply to plants operated < 1 500 h/yr or to plants that cannot be fitted with secondary abatement techniques.
(2) The BAT-AEL range is 1 150–1 900 mg/Nm3 for plants operated < 1 500 h/yr and for plants that cannot be fitted with secondary abatement techniques.
(3) For plants operated < 500 h/yr, these levels are indicative.
(4) For plants including units of < 20 MWth combusting HFO, the higher end of the BAT-AEL range applying to those units is 225 mg/Nm3.

As an indication, for existing combustion plants burning only HFO and operated ≥ 1 500 h/yr or new combustion plants burning only HFO,

— the yearly average CO emission levels will generally be 50–175 mg/Nm^3,

— the average over the sampling period for TVOC emission levels will generally be 10–40 mg/Nm^3.

BAT 34

SO_X, HCl and HF emissions to air

In order to prevent or reduce SOX, HCl and HF emissions to air from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or a combination of the techniques given below.

	Technique	Description	Applicability
a.	Fuel choice	See descriptions in Section 8.4	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.	Duct sorbent injection (DSI)		There may be technical restrictions in the case of existing combustion plants Not applicable to combustion plants operated < 500 h/yr
c.	Wet flue-gas desulphurisation (wet FGD)		There may be technical and economic restrictions for applying the technique to combustion plants of < 300 MW_{th}. Not applicable to combustion plants operated < 500 h/yr. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr

Table 19

BAT-associated emission levels (BAT-AELs) for SO_2 emissions to air from the combustion of HFO and/or gas oil in reciprocating engines

Combustion plant total rated thermal input (MW$_{th}$)	BAT-AELs for SO_2 (mg/Nm^3)			
	Yearly average		Daily average or average over the sampling period	
	New plant	Existing plant (1)	New plant	Existing plant (2)
All sizes	45–100	100–200 (3)	60–110	105–235 (3)

(1) These BAT-AELs do not apply to plants operated < 1 500 h/yr.
(2) For plants operated < 500 h/yr, these levels are indicative.
(3)The higher end of the BAT-AEL range is 280 mg/Nm3 if no secondary abatement technique can be applied. This corresponds to a sulphur content of the fuel of 0,5 wt-% (dry).

BAT 35

Dust and particulate-bound metal emissions to air

In order to prevent or reduce dust and particulate-bound metal emissions from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or a combination of the techniques given below.

Technique		Description	Applicability
a.	Fuel choice	See descriptions in Section 8.5	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.	Electrostatic precipitator (ESP)		Not applicable to combustion plants operated < 500 h/yr
c.	Bag filter		

Table 20

BAT-associated emission levels (BAT-AELs) for dust emissions to air from the combustion of HFO and/or gas oil in reciprocating engines

Combustion plant total rated thermal input (MW$_{th}$)	BAT-AELs for dust (mg/Nm^3)			
	Yearly average		Daily average or average over the sampling period	
	New plant	Existing plant (1)	New plant	Existing plant (2)
≥ 50	5–10	5–35	10–20	10–45

(1) These BAT-AELs do not apply to plants operated < 1 500 h/yr.
(2) For plants operated < 500 h/yr, these levels are indicative.

3.3. Gas-oil-fired gas turbines

Unless stated otherwise, the BAT conclusions presented in this section are generally applicable to the combustion of gas oil in gas turbines. They apply in addition to the general BAT conclusions given in Section 1.

<table>
<tr><th colspan="2">Bat conclusions</th><th>STATUS AT INSTALLATION: [ENTER NAME OF OPERATOR]
DATE: [ENTER DATE OF ASSESSMENT]
Applicability Assessment (describe how the technique applies or not to your installation)</th><th>STATE WHETHER IT IS IN PLACE OR STATE SCHEDULE FOR IMPLEMENTATION</th><th>ERA reply</th><th>Enemalta reply</th></tr>
<tr><td>BAT 36
Energy efficiency</td><td>In order to increase the energy efficiency of gas oil combustion in gas turbines, BAT is to use an appropriate combination of the techniques given in BAT 12 and below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combined cycle</td><td>See description in Section 8.2</td><td>Generally applicable to new units operated ≥ 1 500 h/yr.
Applicable to existing units within the constraints associated with the steam cycle design and the space availability.
Not applicable to existing units operated < 1 500 h/yr</td></tr>
</table>
Table 21
BAT-associated energy efficiency levels (BAT-AEELs) for gas-oil-fired gas turbines
<table>
<tr><th>Type of combustion unit</th><th colspan="2">BAT-AEELs (1)</th></tr>
<tr><th></th><th colspan="2">Net electrical efficiency (%) (2)</th></tr>
<tr><th></th><th>New unit</th><th>Existing unit</th></tr>
<tr><td>Gas-oil-fired open-cycle gas turbine</td><td>> 33</td><td>25–35,7</td></tr>
<tr><td>Gas-oil-fired combined cycle gas turbine</td><td>> 40</td><td>33–44</td></tr>
</table>
</td><td>Not applicable since Enemata’s plants are being classified as emergency plants and hence are to be operated <1500 h/yr

N/A</td><td>N/A</td><td>Noted on non-applicability, in the event that he plant would be operated 1 500 h/yr , what is the energy efficiency</td><td>Since Enemalta is obliged to provide air emission figures to the public which are representative of the actual operation of the gas turbines, the efficiency is indirectly reflected in these figures.</td></tr>
</table>

<table>
<tr>
<td></td>
<td>(1) These BAT-AEELs do not apply to units operated < 1 500 h/yr.

(2) Net electrical efficiency BAT-AEELs apply to CHP units whose design is oriented towards power generation, and to units generating only power.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BAT 37

NO_X and CO emissions to air</td>
<td>In order to prevent or reduce NO_X emissions to air from the combustion of gas oil in gas turbines, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th></th><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Water/steam addition</td><td rowspan="3">See description in Section 8.3</td><td>The applicability may be limited due to water availability</td></tr>
<tr><td>b.</td><td>Low-NO_X burners (LNB)</td><td>Only applicable to turbine models for which low-NO_X burners are available on the market</td></tr>
<tr><td>c.</td><td>Selective catalytic reduction (SCR)</td><td>Not applicable to combustion plants operated < 500 h/yr.
There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr.
Retrofitting existing combustion plants may be constrained by the availability of sufficient space</td></tr>
</table>
</td>
<td>Given that Enemalta's plants are being kept as an emergency plant to be operated for a number of hours per year the implementation of these techniques is either not applicable or else not economically feasible to implement</td>
<td>N/A

To be implemented

(Technique b if normal operating conditions)</td>
<td>Noted. Kindly indicate status of implementation/non-applicability. In the event that the plant no longer remains a back-up, which techniques will be employed.</td>
<td>Should the turbines be put in use for normal operation, Enemalta will consider installing abatement aimed at reducing NOx emissions.</td>
</tr>
<tr>
<td>BAT 38

reduce CO emissions</td>
<td>In order to prevent or reduce CO emissions to air from the combustion of gas oil in gas turbines, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th></th><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combustion optimisation</td><td rowspan="2">See description in Section 8.3</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Oxidation catalysts</td><td>Not applicable to combustion plants operated < 500 h/yr.

Retrofitting existing combustion plants may be constrained by the availability of sufficient space</td></tr>
</table>
As an indication, the emission level for NO_X emissions to air from the combustion of gas oil in dual fuel gas turbines for emergency use operated < 500 h/yr will generally be 145–250 mg/Nm^3 as a daily average or average over the sampling period.</td>
<td>Operation of gas turbine is monitored through the quantity of fuel burnt and electricity generated.

Operation of gas turbine is optimised through these parameters ie fuel burnt per unit of electricity generated</td>
<td>Implemented</td>
<td>Noted. Kindly indicate status of implementation/non-applicability. In the event that the plant no longer remains a back-up, which techniques will be employed.</td>
<td>Optimisation of combustion

(fuel/air ratio)</td>
</tr>
<tr>
<td>BAT 39

SO_X and dust emissions to air</td>
<td>In order to prevent or reduce SOX and dust emissions to air from the combustion of gas oil in gas turbines, BAT is to use the technique given below.
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
</table>
</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</table>

<table>
<tr>
<td></td>
<td>
<table>
<tr><td>a.</td><td>Fuel choice</td><td>See description in Section 8.4</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>
</table>

Table 22

BAT-associated emission levels for SO_2 and dust emissions to air from the combustion of gas oil in gas turbines, including dual fuel gas turbines

<table>
<tr><th rowspan="3">Type of combustion plant</th><th colspan="4">BAT-AELs (mg/Nm^3)</th></tr>
<tr><th colspan="2">SO_2</th><th colspan="2">Dust</th></tr>
<tr><th>Yearly average (1)</th><th>Daily average or average over the sampling period (2)</th><th>Yearly average (1)</th><th>Daily average or average over the sampling period (2)</th></tr>
<tr><td>New and existing plants</td><td>35–60</td><td>50–66</td><td>2–5</td><td>2–10</td></tr>
</table>

(1) These BAT-AELs do not apply to existing plants operated < 1 500 h/yr.
(2) For existing plants operated < 500 h/yr, these levels are indicative.
</td>
<td>Gasoil with a low sulphur content (<0.1%) is being used and for every gasoil consignment received a sample is analysed to check the characteristics of the fuel consignment

Emissions are calculated from the quantity of fuel burnt using the calculation method

SO_2 emissions are dependent on the percentage sulphur in fuel and hence fuel with a sulphur content of (<1%) is being utilised for the gas turbines</td>
<td>Ongoing</td>
<td>Noted, Kindly indicate status of implementation/non-applicability. Kindly note that ELVs will be included in permit, kindly indicate attainable limits within the BAT-AEL range.</td>
<td>Past concentration limits recorded by CEMS for gas turbines were as follows:

<u>SO2</u>
Yearly average - 28.2mg/Nm^3
Daily average – 50.5mg/Nm^3

<u>Dust</u>
Yearly average – 2mg/Nm^3
Daily average – 3.12mg/Nm^3</td>
</tr>
</table>

4. BAT CONCLUSIONS FOR THE COMBUSTION OF GASEOUS FUELS – **NOT APPLICABLE TO DPS GAS TURBINES**

4.1. BAT conclusions for the combustion of natural gas

Unless otherwise stated, the BAT conclusions presented in this section are generally applicable to the combustion of natural gas. They apply in addition to the general BAT conclusions given in Section 1. They do not apply to combustion plants on offshore platforms; these are covered by Section. 4.3.

<table>
<tr><th colspan="2">Bat conclusions</th><th>STATUS AT INSTALLATION: [ENTER NAME OF OPERATOR]

DATE: [ENTER DATE OF ASSESSMENT]

Applicability Assessment (describe how the technique applies or not to your installation)</th><th>STATE WHETHER IT IS IN PLACE OR STATE SCHEDULE FOR IMPLEMENTATION</th></tr>
<tr><td>BAT 40

Energy efficiency</td><td>In order to increase the energy efficiency of natural gas combustion, BAT is to use an appropriate combination of the techniques given in BAT 12 and below.

<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combined cycle</td><td>See description in Section 8.2</td><td>Generally applicable to new gas turbines and engines except when operated < 1 500 h/yr.

Applicable to existing gas turbines and engines within the constraints associated with the steam cycle design and the space availability.

Not applicable to existing gas turbines and engines operated < 1 500 h/yr.

Not applicable to mechanical drive gas turbines operated in discontinuous mode with extended load variations and frequent start-ups and shutdowns.

Not applicable to boilers</td></tr>
</table>
</td><td></td><td></td></tr>
</table>

Table 23

BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of natural gas

Type of combustion unit	**BAT-AEELs** (1)(2)				
	Net electrical efficiency (%)		**Net total fuel utilisation (%)** (3)(4)	**Net mechanical energy efficiency (%)** (4)(5)	
	New unit	**Existing unit**		**New unit**	**Existing unit**
Gas engine	39,5–44 (6)	35–44 (6)	56–85 (6)	No BAT-AEEL.	
Gas-fired boiler	39–42,5	38–40	78–95	No BAT-AEEL.	
Open cycle gas turbine, ≥ 50 MWth	36–41,5	33–41,5	No BAT-AEEL	36,5–41	33,5–41
Combined cycle gas turbine (CCGT)					
CCGT, 50–600 MW_{th}	53–58,5	46–54	No BAT-AEEL	No BAT-AEEL	
CCGT, ≥ 600 MW_{th}	57–60,5	50–60	No BAT-AEEL	No BAT-AEEL	
CHP CCGT, 50–600 MW_{th}	53–58,5	46–54	65–95	No BAT-AEEL	
CHP CCGT, ≥ 600 MW_{th}	57–60,5	50–60	65–95	No BAT-AEEL	

1) These BAT-AEELs do not apply to units operated < 1 500 h/yr.

(2) In the case of CHP units, only one of the two BAT-AEELs 'Net electrical efficiency' or 'Net total fuel utilisation' applies, depending on the CHP unit design (i.e. either more oriented towards electricity generation or heat generation).

(3) Net total fuel utilisation BAT-AEELs may not be achievable if the potential heat demand is too low.

(4) These BAT-AEELs do not apply to plants generating only electricity.

(5) These BAT-AEELs apply to units used for mechanical drive applications.

(6) These levels may be difficult to achieve in the case of engines tuned in order to reach NOX levels lower than 190 mg/Nm3.

BAT 41

Reduce NO_X emissions to air

In order to prevent or 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.

	Technique	**Description**	**Applicability**
a.	Air and/or fuel staging	See descriptions in Section 8.3. Air staging is often associated with low-NO_X burners	Generally applicable
b.	Flue-gas recirculation	See description in Section 8.3	
c.	Low-NO_X burners (LNB)		

d.	Advanced control system	See description in Section 8.3. This technique is often used in combination with other techniques or may be used alone for combustion plants operated < 500 h/yr	The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system
e.	Reduction of the combustion air temperature	See description in Section 8.3	Generally applicable within the constraints associated with the process needs
f.	Selective non–catalytic reduction (SNCR)		Not applicable to combustion plants operated < 500 h/yr with highly variable boiler loads. The applicability may be limited in the case of combustion plants operated between 500 h/yr and 1 500 h/yr with highly variable boiler loads
g.	Selective catalytic reduction (SCR)		Not applicable to combustion plants operated < 500 h/yr. Not generally applicable to combustion plants of < 100 MW_{th}. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr

BAT 42

prevent or reduce NO_X emissions to air

In order to prevent or reduce NO_X emissions to air from the combustion of natural gas in gas turbines, BAT is to use one or a combination of the techniques given below.

	Technique	Description	Applicability
a.	Advanced control system	See description in Section 8.3. This technique is often used in combination with other techniques or may be used alone for combustion plants operated < 500 h/yr	The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system
b.	Water/steam addition	See description in Section 8.3	The applicability may be limited due to water availability
c.	Dry low-NO_Xburners (DLN)		The applicability may be limited in the case of turbines where a retrofit package is not available or when

			water/steam addition systems are installed
d.	Low-load design concept	Adaptation of the process control and related equipment to maintain good combustion efficiency when the demand in energy varies, e.g. by improving the inlet airflow control capability or by splitting the combustion process into decoupled combustion stages	The applicability may be limited by the gas turbine design
e.	Low-NO_Xburners (LNB)	See description in Section 8.3	Generally applicable to supplementary firing for heat recovery steam generators (HRSGs) in the case of combined-cycle gas turbine (CCGT) combustion plants
f.	Selective catalytic reduction (SCR)		Not applicable in the case of combustion plants operated < 500 h/yr. Not generally applicable to existing combustion plants of < 100 MW_{th}. Retrofitting existing combustion plants may be constrained by the availability of sufficient space. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr

BAT 43

prevent or reduce NO_X emissions to air

In order to prevent or 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.

	Technique	Description	Applicability
a.	Advanced control system	See description in Section 8.3. This technique is often used in combination with other techniques or may be used alone for combustion plants operated < 500 h/yr	The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system
b.	Lean-burn concept	See description in Section 8.3. Generally used in combination with SCR	Only applicable to new gas-fired engines
c.	Advanced lean-burn concept	See descriptions in Section 8.3	Only applicable to new spark plug ignited engines

d.	Selective catalytic reduction (SCR)		Retrofitting existing combustion plants may be constrained by the availability of sufficient space. Not applicable to combustion plants operated < 500 h/yr. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr

BAT 44

prevent or reduce CO emissions to air

In order to prevent or reduce CO emissions to air from the combustion of natural gas, BAT is to ensure optimised combustion and/or to use oxidation catalysts.

Description

See descriptions in Section 8.3.

Table 24

BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of natural gas in gas turbines

Type of combustion plant	Combustion plant total rated thermal input (MW_{th})	BAT-AELs (mg/Nm^3) (1)(2)	
		Yearly average (3)(4)	Daily average or average over the sampling period
Open-cycle gas turbines (OCGTs) (5)(6)			
New OCGT	≥ 50	15–35	25–50
Existing OCGT (excluding turbines for mechanical drive applications) — All but plants operated < 500 h/yr	≥ 50	15–50	25–55(7)
Combined-cycle gas turbines (CCGTs) (5)(8)			
New CCGT	≥ 50	10–30	15–40
Existing CCGT with a net total fuel utilisation of < 75 %	≥ 600	10–40	18–50
Existing CCGT with a net total fuel utilisation of ≥ 75 %	≥ 600	10–50	18–55(9)
Existing CCGT with a net total fuel utilisation of < 75 %	50–600	10–45	35–55
Existing CCGT with a net total fuel utilisation of ≥ 75 %	50–600	25–50(10)	35–55(11)

Open- and combined-cycle gas turbines			
Gas turbine put into operation no later than 27 November 2003, or existing gas turbine for emergency use and operated < 500 h/yr	≥ 50	No BAT-AEL	0–140[12][13]
Existing gas turbine for mechanical drive applications — All but plants operated < 500 h/yr	≥ 50	15–50[14]	25–55[15]

(1) These BAT-AELs also apply to the combustion of natural gas in dual-fuel-fired turbines.
(2) In the case of a gas turbine equipped with DLN, these BAT-AELs apply only when the DLN operation is effective.
(3) These BAT-AELs do not apply to existing plants operated < 1 500 h/yr.
(4)Optimising the functioning of an existing technique to reduce NOX emissions further may lead to levels of CO emissions at the higher end of the indicative range for CO emissions given after this table.
(5) These BAT-AELs do not apply to existing turbines for mechanical drive applications or to plants operated < 500 h/yr.
(6) For plants with a net electrical efficiency (EE) greater than 39 %, a correction factor may be applied to the higher end of the range, corresponding to [higher end] × EE/39, where EE is the net electrical energy efficiency or net mechanical energy efficiency of the plant determined at ISO baseload conditions.
(7)The higher end of the range is 80 mg/Nm3 in the case of plants which were put into operation no later than 27 November 2003 and are operated between 500 h/yr and 1 500 h/yr.
(8) For plants with a net electrical efficiency (EE) greater than 55 %, a correction factor may be applied to the higher end of the BAT-AEL range, corresponding to [higher end] × EE/55, where EE is the net electrical efficiency of the plant determined at ISO baseload conditions.
(9) For existing plants put into operation no later than 7 January 2014, the higher end of the BAT-AEL range is 65 mg/Nm3.
(10) For existing plants put into operation no later than 7 January 2014, the higher end of the BAT-AEL range is 55 mg/Nm3.
(11) For existing plants put into operation no later than 7 January 2014, the higher end of the BAT-AEL range is 80 mg/Nm3.
(12) The lower end of the BAT-AEL range for NOX can be achieved with DLN burners.
(13) These levels are indicative.
(14) For existing plants put into operation no later than 7 January 2014, the higher end of the BAT-AEL range is 60 mg/Nm3.
(15) For existing plants put into operation no later than 7 January 2014, the higher end of the BAT-AEL range is 65 mg/Nm3.

As an indication, the yearly average CO emission levels for each type of existing combustion plant operated ≥ 1 500 h/yr and for each type of new combustion plant will generally be as follows:

— New OCGT of ≥ 50 MW_{th}: < 5–40 mg/Nm^3. For plants with a net electrical efficiency (EE) greater than 39 %, a correction factor may be applied to the higher end of this range, corresponding to [higher end] × EE/39, where EE is the net electrical energy efficiency or net mechanical energy efficiency of the plant determined at ISO baseload conditions.

— Existing OCGT of ≥ 50 MW_{th} (excluding turbines for mechanical drive applications): < 5–40 mg/Nm^3. The higher end of this range will generally be 80 mg/Nm^3 in the case of existing plants that cannot be fitted with dry techniques for NO_X reduction, or 50 mg/Nm^3 for plants that operate at low load.

— New CCGT of ≥ 50 MW_{th}: < 5–30 mg/Nm^3. For plants with a net electrical efficiency (EE) greater than 55 %, a correction factor may be applied to the higher end of the range, corresponding to [higher end] × EE/55, where EE is the net electrical energy efficiency of the plant determined at ISO baseload conditions.

— Existing CCGT of ≥ 50 MW_{th}: < 5–30 mg/Nm^3. The higher end of this range will generally be 50 mg/Nm^3 for plants that operate at low load.

— Existing gas turbines of ≥ 50 MW_{th} for mechanical drive applications: < 5–40 mg/Nm^3. The higher end of the range will generally be 50 mg/$Nm^3$when plants operate at low load.

In the case of a gas turbine equipped with DLN burners, these indicative levels correspond to when the DLN operation is effective.

Table 25

BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of natural gas in boilers and engines

Type of combustion plant	BAT-AELs (mg/Nm^3)			
	Yearly average (1)		Daily average or average over the sampling period	
	New plant	Existing plant (2)	New plant	Existing plant (3)
Boiler	10–60	50–100	30–85	85–110
Engine	20–75	20–100	55–85	55–110

(1) Optimising the functioning of an existing technique to reduce NOX emissions further may lead to levels of CO emissions at the higher end of the indicative range for CO emissions given after this table.
(2) These BAT-AELs do not apply to plants operated < 1 500 h/yr.
(3) For plants operated < 500 h/yr, these levels are indicative.
(4) These BAT-AELs only apply to spark-ignited and dual-fuel engines. They do not apply to gas-diesel engines. (5) In the case of engines for emergency use operated < 500 h/yr that could not apply the lean-burn concept or use SCR, the higher end of the indicative range is 175 mg/Nm3.

As an indication, the yearly average CO emission levels will generally be:

— < 5–40 mg/Nm^3 for existing boilers operated ≥ 1 500 h/yr,

— < 5–15 mg/Nm^3 for new boilers,

— 30–100 mg/Nm^3 for existing engines operated ≥ 1 500 h/yr and for new engines.

BAT 45

reduce non-methane volatile organic compounds (NMVOC) and methane (CH_4)

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 engines, BAT is to ensure optimised combustion and/or to use oxidation catalysts.

Description

See descriptions in Section 8.3. Oxidation catalysts are not effective at reducing the emissions of saturated hydrocarbons containing less than four carbon atoms.

Table 26

BAT-associated emission levels (BAT-AELs) for formaldehyde and CH_4emissions to air from the combustion of natural gas in a spark-ignited lean-burn gas engine

Combustion plant total rated thermal input (MW_{th})	BAT-AELs (mg/Nm^3)		
	Formaldehyde	CH_4	
	Average over the sampling period		
	New or existing plant	New plant	Existing plant
≥ 50	5–15 (1)	215–500 (2)	215–560 (1)(2)

(1) For existing plants operated < 500 h/yr, these levels are indicative. (2) This BAT-AEL is expressed as C at full load operation.

4.2. BAT conclusions for the combustion of iron and steel process gases – **NOT APPLICABLE TO DPS GAS TURBINES**

Unless otherwise stated, the BAT conclusions presented in this section are generally applicable to the combustion of iron and steel process gases (blast furnace gas, coke oven gas, basic oxygen furnace gas), individually, in combination, or simultaneously with other gaseous and/or liquid fuels. They apply in addition to the general BAT conclusions given in Section 1.

Bat conclusions		**STATUS AT INSTALLATION: [ENTER NAME OF OPERATOR]** **DATE: [ENTER DATE OF ASSESSMENT]** **Applicability Assessment (describe how the technique applies or not to your installation)**	**STATE WHETHER IT IS IN PLACE OR STATE SCHEDULE FOR IMPLEMENTATION**
BAT 46 **Energy efficiency**	In order to increase the energy efficiency of the combustion of iron and steel process gases, BAT is to use an appropriate combination of the techniques given in BAT 12 and below. (see tables below)		

	Technique	Description	Applicability
a.	Process gas management system	See description in Section 8.2	Only applicable to integrated steelworks

Table 27

BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of iron and steel process gases in boilers

Type of combustion unit	**BAT-AEELs** [(1)(2)]	
	Net electrical efficiency (%)	**Net total fuel utilisation (%)** [(3)]
Existing multi-fuel firing gas boiler	30–40	50–84
New multi-fuel firing gas boiler [(4)]	36–42,5	50–84

(1) These BAT-AEELs do not apply in the case of units operated < 1 500 h/yr.

(2) In the case of CHP units, only one of the two BAT-AEELs 'Net electrical efficiency' or 'Net total fuel utilisation' applies, depending on the CHP unit design (i.e. either more oriented towards electricity generation or towards heat generation).
(3) These BAT-AEELs do not apply to plants generating only electricity.
(4) The wide range of energy efficiencies in CHP units is largely dependent on the local demand for electricity and heat.

Table 28

BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of iron and steel process gases in CCGTs

Type of combustion unit	BAT-AEELs (1)(2)		
	Net electrical efficiency (%)		Net total fuel utilisation (%) (3)
	New unit	Existing unit	
CHP CCGT	> 47	40–48	60–82
CCGT	> 47	40–48	No BAT-AEEL

(1) These BAT-AEELs do not apply in the case of units operated < 1 500 h/yr.
(2) In the case of CHP units, only one of the two BAT-AEELs 'Net electrical efficiency' or 'Net total fuel utilisation' applies, depending on the CHP unit design (i.e. either more oriented towards electricity generation or towards heat generation).
(3) These BAT-AEELs do not apply to plants generating only electricity.

BAT 47

NO_X and CO emissions to air

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

	Technique	Description	Applicability
a.	Low-NO_X burners (LNB)	See description in Section 8.3. Specially designed low-NO_X burners in multiple rows per type of fuel or including specific features for multi-fuel firing (e.g. multiple dedicated nozzles for burning different fuels, or including fuels premixing)	Generally applicable
b.	Air staging	See descriptions in Section 8.3	
c.	Fuel staging		
d.	Flue-gas recirculation		
e.	Process gas management system	See description in Section 8.2.	Generally applicable within the constraints associated with the availability of different types of fuel
f.	Advanced control system	See description in Section 8.3. This technique is used in combination with other techniques	The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system
g.	Selective non-catalytic reduction (SNCR)	See descriptions in Section 8.3	Not applicable to combustion plants operated < 500 h/yr
h.	Selective catalytic reduction (SCR)		Not applicable to combustion plants operated < 500 h/yr.

			Not generally applicable to combustion plants of < 100 MW_{th}. Retrofitting existing combustion plants may be constrained by the availability of sufficient space and by the combustion plant configuration	

BAT 48

prevent or reduce NO_X emissions to air

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

	Technique	Description	Applicability
a.	Process gas management system	See description in Section 8.2	Generally applicable within the constraints associated with the availability of different types of fuel
b.	Advanced control system	See description in Section 8.3. This technique is used in combination with other techniques	The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system
c.	Water/steam addition	See description in Section 8.3. In dual fuel gas turbines using DLN for the combustion of iron and steel process gases, water/steam addition is generally used when combusting natural gas	The applicability may be limited due to water availability
d.	Dry low-NO_X burners(DLN)	See description in Section 8.3. DLN that combust iron and steel process gases differ from those that combust natural gas only	Applicable within the constraints associated with the reactiveness of iron and steel process gases such as coke oven gas. The applicability may be limited in the case of turbines where a retrofit package is not available or when water/steam addition systems are installed
e.	Low-NO_X burners (LNB)	See description in Section 8.3	Only applicable to supplementary firing for heat recovery steam generators (HRSGs) of combined-cycle gas turbine (CCGT) combustion plants
f.	Selective catalytic reduction (SCR)		Retrofitting existing combustion plants may be constrained by the availability of sufficient space

BAT 49

prevent or reduce CO emissions to air

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

	Technique	Description	Applicability
a.	Combustion optimisation	See descriptions in Section 8.3	Generally applicable
b.	Oxidation catalysts		Only applicable to CCGTs. The applicability may be limited by lack of space, the load requirements and the sulphur content of the fuel

Table 29

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

Type of combustion plant	O_2 reference level (vol-%)	BAT-AELs (mg/Nm^3) (1)	
		Yearly average	Daily average or average over the sampling period
New boiler	3	15–65	22–100
Existing boiler	3	20–100 (2)(3)	22–110 (2)(4)(5)
New CCGT	15	20–35	30–50
Existing CCGT	15	20–50 (2)(3)	30–55 (5)(6)

(1) Plants combusting a mixture of gases with an equivalent LHV of > 20 MJ/Nm3 are expected to emit at the higher end of the BAT-AEL ranges.

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

(3) For plants operated < 1 500 h/yr, these BAT AELs do not apply.

(4) In the case of plants put into operation no later than 7 January 2014, the higher end of the BAT-AEL range is 160 mg/Nm3. Furthermore, the higher end of the BAT-AEL range may be exceeded when SCR cannot be used and when using a high share of COG (e.g. > 50 %) and/or when combusting COG with a relatively high level of H2. In this case, the higher end of the BAT-AEL range is 220 mg/Nm3.

(5) For plants operated < 500 h/yr, these levels are indicative.

(6) In the case of plants put into operation no later than 7 January 2014, the higher end of the BAT-AEL range is 70 mg/Nm3.

As an indication, the yearly average CO emission levels will generally be:

— < 5–100 mg/Nm^3 for existing boilers operated ≥ 1 500 h/yr,

— < 5–35 mg/Nm^3 for new boilers,

— < 5–20 mg/Nm^3 for existing CCGTs operated ≥ 1 500 h/yr or new CCGTs.

BAT 50

SO_X emissions to air

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

Technique		Description	Applicability
a.	Process gas management system and auxiliary fuel choice	See description in Section 8.2. To the extent allowed by the iron- and steel-works, maximise the use of: — a majority of blast furnace gas with a low sulphur content in the fuel diet, — a combination of fuels with a low averaged sulphur content, e.g. individual process fuels with a very low S content such as: — Blast furnace gas with a sulphur content < 10 mg/Nm³, — coke oven gas with a sulphur content < 300 mg/Nm³, — and auxiliary fuels such as: — natural gas, — liquid fuels with a sulphur content of ≤ 0,4 % (in boilers). Use of a limited amount of fuels with a higher sulphur content	Generally applicable within the constraints associated with the availability of different types of fuel
b.	Coke oven gas pretreatment at the iron- and steel-works	Use of one of the following techniques: — desulphurisation by absorption systems, — wet oxidative desulphurisation	Only applicable to coke oven gas combustion plants

Table 30

BAT-associated emission levels (BAT-AELs) for SO_2 emissions to air from the combustion of 100 % iron and steel process gases

Type of combustion plant	O_2 reference level (%)	BAT-AELs for SO_2 (mg/Nm³)	
		Yearly average (1)	Daily average or average over the sampling period (2)
New or existing boiler	3	25–150	50–200 (3)
New or existing CCGT	15	10–45	20–70

(1) For existing plants operated < 1 500 h/yr, these BAT AELs do not apply.
(2) For existing plants operated < 500 h/yr, these levels are indicative.
(3) The higher end of the BAT-AEL range may be exceeded when using a high share of COG (e.g. > 50 %). In this case, the higher end of the BAT-AEL range is 300 mg/Nm3.

BAT 51

Dust emissions to air

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

Technique		Description	Applicability
a.	Fuel choice/management	Use of a combination of process gases and auxiliary fuels with a low averaged dust or ash content	Generally applicable within the constraints associated with the availability of different types of fuel
b.	Blast furnace gas pretreatment at the iron- and steel-works	Use of one or a combination of dry dedusting devices (e.g. deflectors, dust catchers, cyclones, electrostatic precipitators) and/or subsequent dust abatement (venturi scrubbers, hurdle-type scrubbers, annular gap scrubbers, wet electrostatic precipitators, disintegrators)	Only applicable if blast furnace gas is combusted
c.	Basic oxygen furnace gas pretreatment at the iron- and steel-works	Use of dry (e.g. ESP or bag filter) or wet (e.g. wet ESP or scrubber) dedusting. Further descriptions are given in the Iron and Steel BREF	Only applicable if basic oxygen furnace gas is combusted
d.	Electrostatic precipitator (ESP)	See descriptions in Section 8.5	Only applicable to combustion plants combusting a significant proportion of auxiliary fuels with a high ash content
e.	Bag filter		

Table 31

BAT-associated emission levels (BAT-AELs) for dust emissions to air from the combustion of 100 % iron and steel process gases

Type of combustion plant	BAT-AELs for dust (mg/Nm^3)	
	Yearly average (1)	Daily average or average over the sampling period (2)
New or existing boiler	2–7	2–10
New or existing CCGT	2–5	2–5

(1) For existing plants operated < 1 500 h/yr, these BAT-AELs do not apply.
(2) For existing plants operated < 500 h/yr, these levels are indicative

4.3. BAT conclusions for the combustion of gaseous and/or liquid fuels on offshore platforms – **NOT APPLICABLE TO DPS GAS TURBINES**

Unless otherwise stated, the BAT conclusions presented in this section are generally applicable to the combustion of gaseous and/or liquid fuels on offshore platforms. They apply in addition to the general BAT conclusions given in Section 1.

Bat conclusions		STATUS AT INSTALLATION: [ENTER NAME OF OPERATOR] DATE: [ENTER DATE OF ASSESSMENT] Applicability Assessment (describe how the technique applies or not to your installation)	STATE WHETHER IT IS IN PLACE OR STATE SCHEDULE FOR IMPLEMENTATION
BAT 52 **improve the general environmental performance**	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.		

	Techniques	Description	Applicability
a.	Process optimisation	Optimise the process in order to minimise the mechanical power requirements	Generally applicable
b.	Control pressure losses	Optimise and maintain inlet and exhaust systems in a way that keeps the pressure losses as low as possible	
c.	Load control	Operate multiple generator or compressor sets at load points which minimise emissions	
d.	Minimise the 'spinning reserve'	When running with spinning reserve for operational reliability reasons, the number of additional turbines is minimised, except in exceptional circumstances	
e.	Fuel choice	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, and minimum concentrations of sulphurous compounds to minimise SO_2 formation. For liquid distillate fuels, preference is given to low-sulphur fuels	
f.	Injection timing	Optimise injection timing in engines	

g.	Heat recovery	Utilisation of gas turbine/engine exhaust heat for platform heating purposes	Generally applicable to new combustion plants. In existing combustion plants, the applicability may be restricted by the level of heat demand and the combustion plant layout (space)
h.	Power integration of multiple gas fields/oilfields	Use of a central power source to supply a number of participating platforms located at different gas fields/oilfields	The applicability may be limited depending on the location of the different gas fields/oilfields and on the organisation of the different participating platforms, including alignment of time schedules regarding planning, start-up and cessation of production

BAT 53

prevent or reduce NO_X emissions to air

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

	Technique	Description	Applicability
a.	Advanced control system	See descriptions in Section 8.3	The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system
b.	Dry low-NO_X burners (DLN)		Applicable to new gas turbines (standard equipment) within the constraints associated with fuel quality variations. The applicability may be limited for existing gas turbines by: availability of a retrofit package (for low-load operation), complexity of the platform organisation and space availability
c.	Lean-burn concept		Only applicable to new gas-fired engines
d.	Low-NO_X burners (LNB)		Only applicable to boilers

BAT 54

prevent or reduce CO emissions to air

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

	Technique	Description	Applicability
a.	Combustion optimisation	See descriptions in Section 8.3	Generally applicable
b.	Oxidation catalysts		Not applicable to combustion plants operated < 500 h/yr.

			Retrofitting existing combustion plants may be constrained by the availability of sufficient space and by weight restrictions

Table 32

BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of gaseous fuels in open-cycle gas turbines on offshore platforms

Type of combustion plant	BAT-AELs (mg/Nm^3) *(1)*
	Average over the sampling period
New gas turbine combusting gaseous fuels *(2)*	15–50 *(3)*
Existing gas turbine combusting gaseous fuels *(2)*	< 50–350 *(4)*

(1) These BAT-AELs are based on > 70 % of baseload power available on the day.
(2) This includes single fuel and dual fuel gas turbines.
(3) The higher end of the BAT-AEL range is 250 mg/Nm3 if DLN burners are not applicable.
(4) The lower end of the BAT-AEL range can be achieved with DLN burners.

As an indication, the average CO emission levels over the sampling period will generally be:

— < 100 mg/Nm^3 for existing gas turbines combusting gaseous fuels on offshore platforms operated ≥ 1 500 h/yr,

— < 75 mg/Nm^3 for new gas turbines combusting gaseous fuels on offshore platforms.

5. BAT CONCLUSIONS FOR MULTI-FUEL-FIRED PLANTS – **NOT APPLICABLE TO DPS GAS TURBINES**

5.1. BAT conclusions for the combustion of process fuels from the chemical industry

Unless otherwise stated, the BAT conclusions presented in this section are generally applicable to the combustion of process fuels from the chemical industry, individually, in combination, or simultaneously with other gaseous and/or liquid fuels. They apply in addition to the general BAT conclusions given in Section 1.

<table>
<tr><th colspan="2">Bat conclusions</th><th>STATUS AT INSTALLATION: [ENTER NAME OF OPERATOR]

DATE: [ENTER DATE OF ASSESSMENT]

Applicability Assessment (describe how the technique applies or not to your installation)</th><th>STATE WHETHER IT IS IN PLACE OR STATE SCHEDULE FOR IMPLEMENTATION</th></tr>
<tr><td>BAT 55

General environmental performance</td><td>In order to improve the general environmental performance of the combustion of process fuels from the chemical industry in boilers, BAT is to use an appropriate combination of the techniques given in BAT 6 and below.

<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Pretreatment of process fuel from the chemical industry</td><td>Perform fuel pretreatment on and/or off the site of the combustion plant to improve the environmental performance of fuel combustion</td><td>Applicable within the constraints associated with process fuel characteristics and space availability</td></tr>
</table>

5.1.2. Energy efficiency

Table 33

BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of process fuels from the chemical industry in boilers

<table>
<tr><th rowspan="3">Type of combustion unit</th><th colspan="4">BAT-AEELs (1)(2)</th></tr>
<tr><th colspan="2">Net electrical efficiency (%)</th><th colspan="2">Net total fuel utilisation (%) (3)(4)</th></tr>
<tr><th>New unit</th><th>Existing unit</th><th>New unit</th><th>Existing unit</th></tr>
</table>
</td><td></td><td></td></tr>
</table>

	Boiler using liquid process fuels from the chemical industry, including when mixed with HFO, gas oil and/or other liquid fuels	> 36,4	35,6–37,4	80–96	80–96		
	Boiler using gaseous process fuels from the chemical industry, including when mixed with natural gas and/or other gaseous fuels	39–42,5	38–40	78–95	78–95		

(1) These BAT-AEELs do not apply to units operated < 1 500 h/yr.
(2) In the case of CHP units, only one of the two BAT-AEELs 'Net electrical efficiency' or 'Net total fuel utilisation' applies, depending on the CHP unit design (i.e. either more oriented towards generation electricity or towards heat generation).
(3) These BAT-AEELs may not be achievable if the potential heat demand is too low.
(4) These BAT-AEELs do not apply to plants generating only electricity.

BAT 56

NO_X and CO emissions to air

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

	Technique	Description	Applicability
a.	Low-NO_X burners (LNB)	See descriptions in Section 8.3	Generally applicable
b.	Air staging		
c.	Fuel staging	See description in Section 8.3. Applying fuel staging when using liquid fuel mixtures may require a specific burner design	
d.	Flue-gas recirculation	See descriptions in Section 8.3	Generally applicable to new combustion plants. Applicable to existing combustion plants within the constraints associated with chemical installation safety
e.	Water/steam addition		The applicability may be limited due to water availability
f.	Fuel choice		Applicable within the constraints associated with the availability of different types of fuel and/or an alternative use of the process fuel
g.	Advanced control system		The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system
h.	Selective non-catalytic reduction (SNCR)		Applicable to existing combustion plants within the constraints associated with chemical installation safety. Not applicable to combustion plants operated < 500 h/yr. The applicability may be limited in the case of combustion plants operated between 500 h/yr and

				1 500 h/yr with frequent fuel changes and frequent load variations		
	i.	Selective catalytic reduction (SCR)		Applicable to existing combustion plants within the constraints associated with duct configuration, space availability and chemical installation safety. Not applicable to combustion plants operated < 500 h/yr. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr. Not generally applicable to combustion plants of < 100 MW_{th}		

Table 34

BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of 100 % process fuels from the chemical industry in boilers

Fuel phase used in the combustion plant	BAT-AELs (mg/Nm³)			
	Yearly average		Daily average or average over the sampling period	
	New plant	Existing plant (1)	New plant	Existing plant (2)
Mixture of gases and liquids	30–85	80–290	50–110	100–330 (3)
Gases only	20–80	70–100 (4)	30–100	85–110 (5)

(1) For plants operated < 1 500 h/yr, these BAT AELs do not apply. (2) For plants operated < 500 h/yr, these levels are indicative. (3) For existing plants of ≤ 500 MW_{th} put into operation no later than 27 November 2003 using liquid fuels with a nitrogen content higher than 0,6 wt-%, the higher end of the BAT-AEL range is 380 mg/Nm3. (4) For existing plants put into operation no later than 7 January 2014, the higher end of the BAT-AEL range is 180 mg/Nm3. (5) For existing plants put into operation no later than 7 January 2014, the higher end of the BAT-AEL range is 210 mg/Nm3.

As an indication, the yearly average CO emission levels for existing plants operated ≥ 1 500 h/yr and for new plants will generally be < 5–30 mg/Nm³.

BAT 57

SO_X, HCl and HF emissions to air

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

Technique	Description	Applicability

a.	Fuel choice	See descriptions in Section 8.4	Applicable within the constraints associated with the availability of different types of fuel and/or an alternative use of the process fuel
b.	Boiler sorbent injection (in-furnace or in-bed)		Applicable to existing combustion plants within the constraints associated with duct configuration, space availability and chemical installation safety. Wet FGD and seawater FGD are not applicable to combustion plants operated < 500 h/yr. There may be technical and economic restrictions for applying wet FGD or seawater FGD to combustion plants of < 300 MW_{th}, and for retrofitting combustion plants operated between 500 h/yr and 1 500 h/yr with wet FGD or seawater FGD
c.	Duct sorbent injection (DSI)		
d.	Spray dry absorber (SDA)		
e.	Wet scrubbing	See description in Section 8.4. Wet scrubbing is used to remove HCl and HF when no wet FGD is used to reduce SO_X emissions	
f.	Wet flue-gas desulphurisation (wet FGD)	See descriptions in Section 8.4	
g.	Seawater FGD		

Table 35

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

Type of combustion plant	BAT-AELs (mg/Nm³)	
	Yearly average (1)	Daily average or average over the sampling period (2)
New and existing boilers	10–110	90–200

(1) For existing plants operated < 1 500 h/yr, these BAT-AELs do not apply. (2) For existing plants operated < 500 h/yr, these levels are indicative.

Table 36

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

Combustion plant total rated thermal input (MW_{th})	BAT-AELs (mg/Nm³)	
	HCl	HF
	Average of samples obtained during one year	

	New plant	Existing plant (1)	New plant	Existing plant (1)
< 100	1–7	2–15 (2)	< 1–3	< 1–6 (3)
≥ 100	1–5	1–9 (2)	< 1–2	< 1–3 (3)

(1) For plants operated < 500 h/yr, these levels are indicative. (2) In the case of plants operated < 1 500 h/yr, the higher end of the BAT-AEL range is 20 mg/Nm^3. (3) In the case of plants operated < 1 500 h/yr, the higher end of the BAT-AEL range is 7 mg/Nm^3.

BAT 58

Dust and particulate-bound metal emissions to air

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

	Technique	Description	Applicability
a.	Electrostatic precipitator (ESP)	See descriptions in Section 8.5	Generally applicable
b.	Bag filter		
c.	Fuel choice	See description in Section 8.5. Use of a combination of process fuels from the chemical industry and auxiliary fuels with a low averaged dust or ash content	Applicable within the constraints associated with the availability of different types of fuel and/or an alternative use of the process fuel
d.	Dry or semi-dry FGD system	See descriptions in Section 8.5. The technique is mainly used for SO_X, HCl and/or HF control	See applicability in BAT 57
e.	Wet flue-gas desulphurisation (wet FGD)		

Table 37

BAT-associated emission levels (BAT-AELs) for dust emissions to air from the combustion of mixtures of gases and liquids composed of 100 % process fuels from the chemical industry in boilers

Combustion plant total rated thermal input (MW_{th})	BAT-AELs for dust (mg/Nm^3)			
	Yearly average		Daily average or average over the sampling period	
	New plant	Existing plant (1)	New plant	Existing plant (2)
< 300	2–5	2–15	2–10	2–22 (3)
≥ 300	2–5	2–10 (4)	2–10	2–11 (3)

(1) For plants operated < 1 500 h/yr, these BAT-AELs do not apply. (2) For plants operated < 500 h/yr, these levels are indicative. (3) For plants put into operation no later than 7 January 2014, the higher end of the BAT-AEL range is 25 mg/Nm^3. (4) For plants put into operation no later than 7 January 2014, the higher end of the BAT-AEL range is 15 mg/Nm^3.

BAT 59

Emissions of volatile organic compounds and polychlorinated dibenzo-dioxins and -furans to air

In order to reduce emissions to air of volatile organic compounds and polychlorinated dibenzo-dioxins and -furans from the combustion of process fuels from the chemical industry in boilers, BAT is to use one or a combination of the techniques given in BAT 6 and below.

Technique	Description	Applicability

a.	Activated carbon injection	See description in Section 8.5	Only applicable to combustion plants using fuels derived from chemical processes involving chlorinated substances. For the applicability of SCR and rapid quenching see BAT 56 and BAT 57
b.	Rapid quenching using wet scrubbing/flue-gas condenser	See description of wet scrubbing/flue-gas codenser in Section 8.4	
c.	Selective catalytic reduction (SCR)	See description in Section 8.3. The SCR system is adapted and larger than an SCR system only used for NO_X reduction	

Table 38

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

Pollutant	Unit	BAT-AELs
		Average over the sampling period
PCDD/F (1)	ng I-TEQ/Nm^3	< 0,012–0,036
TVOC	mg/Nm^3	0,6–12

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

6. BAT CONCLUSIONS FOR THE CO-INCINERATION OF WASTE – **NOT APPLICABLE TO DPS GAS TURBINES**

Unless otherwise stated, the BAT conclusions presented in this section are generally applicable to the co-incineration of waste in combustion plants. They apply in addition to the general BAT conclusions given in Section 1.

When waste is co-incinerated, the BAT-AELs in this section apply to the entire flue-gas volume generated.

In addition, when waste is co-incinerated together with the fuels covered by Section 2, the BAT-AELs set out in Section 2 also apply (i) to the entire flue-gas volume generated, and (ii) to the flue-gas volume resulting from the combustion of the fuels covered by that section using the mixing rule formula of Annex VI (part 4) to Directive 2010/75/EU, in which the BAT-AELs for the flue-gas volume resulting from the combustion of waste are to be determined on the basis of BAT 61.

Bat conclusions		STATUS AT INSTALLATION: [ENTER NAME OF OPERATOR] DATE: [ENTER DATE OF ASSESSMENT] Applicability Assessment (describe how the technique applies or not to your installation)	STATE WHETHER IT IS IN PLACE OR STATE SCHEDULE FOR IMPLEMENTATION
BAT 60 **General environmental performance**	In order to improve the general environmental performance of the co-incineration of waste in combustion plants, to ensure stable combustion conditions, and to reduce emissions to air, BAT is to use technique BAT 60 (a) below and a combination of the techniques given in BAT 6 and/or the other techniques below.		

	Technique	Description	Applicability
a.	Waste pre-acceptance and acceptance	Implement a procedure for receiving any waste at the combustion plant according to the corresponding BAT from the Waste Treatment BREF. Acceptance criteria are set for critical parameters such as heating value, and the content of water, ash, chlorine and fluorine, sulphur, nitrogen, PCB, metals (volatile (e.g. Hg, Tl, Pb, Co, Se) and non-volatile (e.g. V, Cu, Cd, Cr, Ni)), phosphorus and alkali (when using animal by-products). Apply quality assurance systems for each waste load to guarantee the characteristics of the wastes co-incinerated and to control the values of defined critical parameters (e.g. EN 15358 for non-hazardous solid recovered fuel)	Generally applicable
b.	Waste selection/limitation	Careful selection of waste type and mass flow, together with limiting the percentage of the most polluted waste that can be co-incinerated. Limit the	Applicable within the constraints associated with the

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<tr><td></td><td></td><td>proportion of ash, sulphur, fluorine, mercury and/or chlorine in the waste entering the combustion plant.
Limitation of the amount of waste to be co-incinerated</td><td>waste management policy of the Member State</td></tr>
<tr><td>c.</td><td>Waste mixing with the main fuel</td><td>Effective mixing of waste and the main fuel, as a heterogeneous or poorly mixed fuel stream or an uneven distribution may influence the ignition and combustion in the boiler and should be prevented</td><td>Mixing is only possible when the grinding behaviour of the main fuel and waste is similar or when the amount of waste is very small compared to the main fuel</td></tr>
<tr><td>d.</td><td>Waste drying</td><td>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>The 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>e.</td><td>Waste pretreatment</td><td>See techniques described in the Waste Treatment and Waste Incineration BREFs, including milling, pyrolysis and gasification</td><td>See applicability in the Waste Treatment BREF and in the Waste incineration BREF</td></tr>
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<tr>
<td>BAT 61

prevent increased emissions from the co-incineration of waste in combustion plants</td>
<td>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 co-incineration are not higher than those resulting from the application of BAT conclusions for the incineration of waste.</td>
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<td>BAT 62

minimise the impact on residues</td>
<td>In order to minimise the impact on residues recycling of the co-incineration of waste in combustion plants, 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, by using one or a combination of the techniques given in BAT 60 and/or by restricting the co-incineration to waste fractions with pollutant concentrations similar to those in other combusted fuels.</td>
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<td>BAT 63

Energy efficiency</td>
<td>In order to increase the energy efficiency of the co-incineration of waste, BAT is to use an appropriate combination of the techniques given in BAT 12 and BAT 19, depending on the main fuel type used and on the plant configuration.

The BAT-associated energy efficiency levels (BAT-AEELs) are given in Table 8 for the co-incineration of waste with biomass and/or peat and in Table 2 for the co-incineration of waste with coal and/or lignite.</td>
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<tr><td>BAT 64

NO_X and CO emissions to air</td><td>In order to prevent or reduce NO_X emissions to air while limiting CO and N_2O emissions from the co-incineration of waste with coal and/or lignite, BAT is to use one or a combination of the techniques given in BAT 20.</td><td></td><td></td></tr>
<tr><td>BAT 65</td><td>In order to prevent or reduce NO_X emissions to air while limiting CO and N_2O emissions from the co-incineration of waste with biomass and/or peat, BAT is to use one or a combination of the techniques given in BAT 24.</td><td></td><td></td></tr>
<tr><td>BAT 66

SO_X, HCl and HF emissions to air</td><td>In order to prevent or reduce SOX, HCl and HF emissions to air from the co-incineration of waste with coal and/or lignite, BAT is to use one or a combination of the techniques given in BAT 21.</td><td></td><td></td></tr>
<tr><td>BAT 67</td><td>In order to prevent or reduce SO_X, HCl and HF emissions to air from the co-incineration of waste with biomass and/or peat, BAT is to use one or a combination of the techniques given in BAT 25.</td><td></td><td></td></tr>
<tr><td>BAT 68

Dust and particulate-bound metal emissions to air</td><td>In order to reduce dust and particulate-bound metal emissions to air from the co-incineration of waste with coal and/or lignite, BAT is to use one or a combination of the techniques given in BAT 22.

Table 39

BAT-associated emission levels (BAT-AELs) for metal emissions to air from the co-incineration of waste with coal and/or lignite

<table>
<tr><th rowspan="2">Combustion plant total rated thermal input (MW_{th})</th><th colspan="2">BAT-AELs</th><th rowspan="2">Averaging period</th></tr>
<tr><th>Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V (mg/Nm^3)</th><th>Cd + Tl (µg/Nm^3)</th></tr>
<tr><td>< 300</td><td>0,005–0,5</td><td>5–12</td><td>Average over the sampling period</td></tr>
<tr><td>≥ 300</td><td>0,005–0,2</td><td>5–6</td><td>Average of samples obtained during one year</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>BAT 69

reduce dust and particulate-bound metal emissions</td><td>In order to reduce dust and particulate-bound metal emissions to air from the co-incineration of waste with biomass and/or peat, BAT is to use one or a combination of the techniques given in BAT 26.

Table 40

BAT-associated emission levels (BAT-AELs) for metal emissions to air from the co-incineration of waste with biomass and/or peat

<table>
<tr><th colspan="2">BAT-AELs
(average of samples obtained during one year)</th></tr>
<tr><td>Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V (mg/Nm^3)</td><td>Cd+Tl (µg/Nm^3)</td></tr>
</table>
</td><td></td><td></td></tr>
</table>

0,075–0,3	< 5

BAT 70

Mercury emissions to air

In order to reduce mercury emissions to air from the co-incineration of waste with biomass, peat, coal and/or lignite, BAT is to use one or a combination of the techniques given in BAT 23 and BAT 27

BAT 71

Emissions of volatile organic compounds and polychlorinated dibenzo-dioxins and -furans to air

In order to reduce emissions of volatile organic compounds and polychlorinated dibenzo-dioxins and -furans to air from the co-incineration of waste with biomass, peat, coal and/or lignite, BAT is to use a combination of the techniques given in BAT 6, BAT 26 and below.

	Technique	Description	Applicability
a.	Activated carbon injection	See description in Section 8.5. This process is based on the adsorption of pollutant molecules by the activated carbon	Generally applicable
b.	Rapid quenching using wet scrubbing/flue-gas condenser	See description of wet scrubbing/flue-gas condenser in Section 8.4	
c.	Selective catalytic reduction (SCR)	See description in Section 8.3. The SCR system is adapted and larger than an SCR system only used for NO_X reduction	See applicability in BAT 20 and in BAT 24

Table 41

BAT-associated emission levels (BAT-AELs) for PCDD/F and TVOC emissions to air from the co-incineration of waste with biomass, peat, coal and/or lignite

Type of combustion plant	BAT-AELs		
	PCDD/F (ng I-TEQ/Nm^3)	TVOC (mg/Nm^3)	
	Average over the sampling period	Yearly average	Daily average
Biomass-, peat-, coal- and/or lignite-fired combustion plant	< 0,01–0,03	< 0,1–5	0,5–10

7. BAT CONCLUSIONS FOR GASIFICATION – NOT APPLICABLE TO DPS GAS TURBINES

Unless otherwise stated, the BAT conclusions presented in this section are generally applicable to all gasification plants directly associated to combustion plants, and to IGCC plants. They apply in addition to the general BAT conclusions given in Section 1.

Bat conclusions		STATUS AT INSTALLATION: [ENTER NAME OF OPERATOR] DATE: [ENTER DATE OF ASSESSMENT] Applicability Assessment (describe how the technique applies or not to your installation)	STATE WHETHER IT IS IN PLACE OR STATE SCHEDULE FOR IMPLEMENTATION
BAT 72 **Energy efficiency**	In order to increase the energy efficiency of IGCC and gasification units, BAT is to use one or a combination of the techniques given in BAT 12 and below.		

	Technique	Description	Applicability
a.	Heat recovery from the gasification process	As the syngas needs to be cooled down to be cleaned further, energy can be recovered for producing additional steam to be added to the steam turbine cycle, enabling additional electrical power to be produced	Only applicable to IGCC units and to gasification units directly associated to boilers with syngas pretreatment that requires cooling down of the syngas
b.	Integration of gasification and combustion processes	The unit can be designed with full integration of the air supply unit (ASU) and the gas turbine, with all the air fed to the ASU being supplied (extracted) from the gas turbine compressor	The applicability is limited to IGCC units by the flexibility needs of the integrated plant to quickly provide the grid with electricity when renewable power plants are not available
c.	Dry feedstock feeding system	Use of a dry system for feeding the fuel to the gasifier, in order to improve the energy efficiency of the gasification process	Only applicable to new units
d.	High-temperature and -pressure gasification	Use of gasification technique with high-temperature and -pressure operating parameters, in order to maximise the efficiency of energy conversion	Only applicable to new units
e.	Design improvements	Design improvements, such as:	Generally applicable to IGCC units

			— modifications of the gasifier refractory and/or cooling system, — installation of an expander to recover energy from the syngas pressure drop before combustion		

Table 42

BAT-associated energy efficiency levels (BAT-AEELs) for gasification and IGCC units

Type of combustion unit configuration	**BAT-AEELs**		
	Net electrical efficiency (%) of an IGCC unit		**Net total fuel utilisation (%) of a new or existing gasification unit**
	New unit	**Existing unit**	
Gasification unit directly associated to a boiler without prior syngas treatment	No BAT-AEEL		> 98
Gasification unit directly associated to a boiler with prior syngas treatment	No BAT-AEEL		> 91
IGCC unit	No BAT-AEEL	34–46	> 91

BAT 73

NO_X and CO emissions to air

In order to prevent and/or reduce NO_X emissions to air 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.	Combustion optimisation	See description in Section 8.3	Generally applicable
b.	Water/steam addition	See description in Section 8.3. Some intermediate-pressure steam from the steam turbine is reused for this purpose	Only applicable to the gas turbine part of the IGCC plant. The applicability may be limited due to water availability
c.	Dry low-NO_X burners (DLN)	See description in Section 8.3	Only applicable to the gas turbine part of the IGCC plant. Generally applicable to new IGCC plants. Applicable on a case-by-case basis for existing IGCC plants, depending on the availability of a retrofit

			package. Not applicable for syngas with a hydrogen content of > 15 %
d.	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 reduce the combustion temperature in the gas turbine, by being premixed with the syngas before combustion	Only applicable when an ASU is used for the gasification process
e.	Selective catalytic reduction (SCR)	See description in Section 8.3	Not applicable to IGCC plants operated < 500 h/yr. Retrofitting existing IGCC plants may be constrained by the availability of sufficient space. There may be technical and economic restrictions for retrofitting existing IGCC plants operated between 500 h/yr and 1 500 h/yr

Table 43

BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from IGCC plants

IGCC plant total rated thermal input (MW_{th})	BAT-AELs (mg/Nm^3)			
	Yearly average		Daily average or average over the sampling period	
	New plant	Existing plant	New plant	Existing plant
≥ 100	10–25	12–45	1–35	1–60

As an indication, the yearly average CO emission levels for existing plants operated ≥ 1 500 h/yr and for new plants will generally be < 5–30 mg/Nm^3.

BAT 74

SO_X emissions to air

In order to reduce SO_X emissions to air from IGCC plants, BAT is to use the technique given below.

Technique		Description	Applicability
a.	Acid gas removal	Sulphur compounds from the feedstock of a gasification process are removed from the syngas via acid gas removal, e.g. including a COS (and HCN) hydrolysis reactor and the absorption of H_2S using a solvent such as methyl diethanolamine. 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	The applicability may be limited in the case of biomass IGCC plants due to the very low sulphur content in biomass

The BAT-associated emission level (BAT-AEL) for SO_2 emissions to air from IGCC plants of ≥ 100 MW_{th} is 3–16 mg/Nm^3, expressed as a yearly average.

BAT 75

Dust, particulate-bound metal, ammonia and halogen emissions to air

In order to prevent or reduce dust, particulate-bound 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	Dedusting using fly ash cyclones, bag filters, ESPs and/or candle filters to remove fly ash and unconverted carbon. Bag filters and ESPs are used in the case of syngas temperatures up to 400 °C	Generally applicable
b.	Syngas tars and ashes recirculation to the gasifier	Tars and ashes with a high carbon content generated in the raw syngas are separated in cyclones and recirculated to the gasifier, in the case of a low syngas temperature at the gasifier outlet (< 1 100 °C)	
c.	Syngas washing	Syngas passes through a water scrubber, downstream of other dedusting technique(s), where chlorides, ammonia, particles and halides are separated	

Table 44

BAT-associated emission levels (BAT-AELs) for dust and particulate-bound metal emissions to air from IGCC plants

IGCC plant total rated thermal input (MW_{th})	BAT-AELs		
	Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V (mg/Nm^3) (Average over the sampling period)	Hg ($\mu g/Nm^3$) (Average over the sampling period)	Dust (mg/Nm^3) (yearly average)
≥ 100	< 0,025	< 1	< 2,5

8. DESCRIPTION OF TECHNIQUES

8.1. General techniques

Technique	Description
Advanced control system	The use of a computer-based automatic system to control the combustion efficiency and support the prevention and/or reduction of emissions. This also includes the use of high-performance monitoring.
Combustion optimisation	Measures taken to maximise the efficiency of energy conversion, e.g. in the furnace/boiler, while minimising emissions (in particular of CO). This is achieved by a combination of techniques including good design of the combustion equipment, optimisation of the temperature (e.g. efficient mixing of the fuel and combustion air) and residence time in the combustion zone, and use of an advanced control system.

8.2. Techniques to increase energy efficiency

Technique	Description
Advanced control system	See Section 8.1
CHP readiness	The measures taken 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 compared to the separate generation of the heat and power produced. This includes identifying and retaining access to specific points in 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 (BoP) systems and control/instrumentation systems are suitable for upgrade. Later connection of back-pressure turbine(s) is also possible.
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).
Combustion optimisation	See Section 8.1
Flue-gas condenser	A heat exchanger where water is preheated by the flue-gas before it is heated in the steam condenser. The vapour content in the flue-gas thus condenses as it is cooled by the heating water. The flue-gas condenser is used both to increase the energy efficiency of the combustion unit and to remove pollutants such as dust, SO_X, HCl, and HF from the flue-gas.
Process gas management system	A system that enables the iron and steel process gases that can be used as fuels (e.g. blast furnace, coke oven, basic oxygen furnace gases) to be directed to the combustion plants, depending on the availability of these fuels and on the type of combustion plants in an integrated steelworks.
Supercritical steam conditions	The use of a steam circuit, including steam reheating systems, in which steam can reach pressures above 220,6 bar and temperatures of > 540 °C.
Ultra-supercritical steam conditions	The use of a steam circuit, including reheat systems, in which steam can reach pressures above 250–300 bar and temperatures above 580–600 °C.
Wet stack	The design of the stack in order to enable water vapour condensation from the saturated flue-gas and thus to avoid using a flue-gas reheater after the wet FGD.

8.3. Techniques to reduce emissions of NO_x and/or CO to air

Technique	Description
Advanced control system	See Section 8.1

Air staging	The creation of several combustion zones in the combustion chamber with different oxygen contents for reducing NO_X emissions and ensuring optimised combustion. The technique involves a primary combustion zone with substoichiometric firing (i.e. with deficiency of air) and a second reburn combustion zone (running with excess air) to improve combustion. Some old, small boilers may require a capacity reduction to allow the space for air staging.
Combined techniques for NO_X and SO_X reduction	The use of complex and integrated abatement techniques for combined reduction of NO_X, SO_X and, often, other pollutants from the flue-gas, e.g. activated carbon and $DeSONO_X$ processes. They can be applied either alone or in combination with other primary techniques in coal-fired PC boilers.
Combustion optimisation	See Section 8.1
Dry low-NO_X burners (DLN)	Gas turbine burners that include the premixing of the air and fuel before entering the combustion zone. By mixing air and fuel before combustion, a homogeneous temperature distribution and a lower flame temperature are achieved, resulting in lower NO_X emissions.
Flue-gas or exhaust-gas recirculation (FGR/EGR)	Recirculation of part of the flue-gas to the combustion chamber to replace part of the fresh combustion air, with the dual effect of cooling the temperature and limiting the O_2 content for nitrogen oxidation, thus limiting the NO_X generation. It implies the supply of flue-gas from the furnace into the flame to reduce the oxygen content and therefore the temperature of the flame. The use of special burners or other provisions 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.
Fuel choice	The use of fuel with a low nitrogen content.
Fuel staging	The technique is based on the reduction of the flame temperature or localised hot spots by the creation of several combustion zones in the combustion chamber with different injection levels of fuel and air. The retrofit may be less efficient in smaller plants than in larger plants.
Lean-burn concept and advanced lean-burn concept	The control of the 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 to air ratio in the zones where NO_X is generated so that the peak flame temperature is less than the stoichiometric adiabatic flame temperature, therefore reducing thermal NO_X formation. The optimisation of this concept is called the 'advanced lean-burn concept'.
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 improve the combustion and increase the heat transfer (increased emissivity of the flame). The air/fuel mixing reduces the availability of oxygen and reduces 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-low-NO_X burners (ULNBs) includes combustion staging (air/fuel) and firebox gases' recirculation (internal flue-gas recirculation). The performance of the technique may be influenced by the boiler design when retrofitting old plants.
Low-NO_X combustion concept in diesel engines	The technique consists of a combination of internal engine modifications, e.g. combustion and fuel injection optimisation (the very late fuel injection timing in combination with early inlet air valve closing), turbocharging or Miller cycle.
Oxidation catalysts	The use of catalysts (that usually contain precious metals such as palladium or platinum) to oxidise carbon monoxide and unburnt hydrocarbons with oxygen to form CO_2 and water vapour.
Reduction of the combustion air temperature	The use of combustion air at ambient temperature. The combustion air is not preheated in a regenerative air preheater.
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. Several layers of catalyst may be applied. A higher NO_X reduction is achieved with the use of several catalyst layers. The technique design can be modular, and special catalysts and/or preheating can be used to cope with low loads or with a wide flue-gas temperature window. 'In-duct' or 'slip' SCR is a technique that combines SNCR with downstream SCR which reduces the ammonia slip from the SNCR unit.

Selective non-catalytic reduction (SNCR)	Selective reduction of nitrogen oxides with ammonia or urea without a 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 800 °C and 1000 °C for optimal reaction.
Water/steam addition	Water or steam is used as a diluent for reducing the combustion temperature in gas turbines, engines or boilers and thus the thermal NO_X formation. It is either premixed with the fuel prior to its combustion (fuel emulsion, humidification or saturation) or directly injected in the combustion chamber (water/steam injection).

8.4. Techniques to reduce emissions of SO_X, HCl and/or HF to air

Technique	Description
Boiler sorbent injection (in-furnace or in-bed)	The direct injection of a dry sorbent into the combustion chamber, or the addition of magnesium- or calcium-based adsorbents to the bed of a fluidised bed boiler. The surface of the sorbent particles reacts with the SO_2 in the flue-gas or in the fluidised bed boiler. It is mostly used in combination with a dust abatement technique.
Circulating fluidised bed (CFB) dry scrubber	Flue-gas from the boiler air preheater enters the CFB absorber at the bottom and flows vertically upwards through a Venturi section where a solid sorbent and water are injected separately into the flue-gas stream. It is mostly used in combination with a dust abatement technique.
Combined techniques for NO_X and SO_X reduction	See Section 8.3
Duct sorbent injection (DSI)	The injection and dispersion of a dry powder sorbent in the flue-gas stream. The sorbent (e.g. sodium carbonate, sodium bicarbonate, hydrated lime) reacts with acid gases (e.g. the gaseous sulphur species and HCl) to form a solid which is removed with dust abatement techniques (bag filter or electrostatic precipitator). DSI is mostly used in combination with a bag filter.
Flue-gas condenser	See Section 8.2
Fuel choice	The use of a fuel with a low sulphur, chlorine and/or fluorine content
Process gas management system	See Section 8.2
Seawater FGD	A specific non-regenerative type of wet scrubbing using the natural alkalinity of the seawater to absorb the acidic compounds in the flue-gas. Generally requires an upstream abatement of dust.
Spray dry absorber (SDA)	A suspension/solution of an alkaline reagent is introduced and dispersed in the flue-gas stream. The material reacts with the gaseous sulphur species to form a solid which is removed with dust abatement techniques (bag filter or electrostatic precipitator). SDA is mostly used in combination with a bag filter.
Wet flue-gas desulphurisation (wet FGD)	Technique or combination of scrubbing techniques by which sulphur oxides are removed from flue-gases through various processes generally involving an alkaline sorbent for capturing gaseous SO_2 and transforming it into solids. 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 separation of the droplets is required before discharging the flue-gases. The liquid resulting from the wet scrubbing is sent to a waste water treatment plant and the insoluble matter is collected by sedimentation or filtration.
Wet scrubbing	Use of a liquid, typically water or an aqueous solution, to capture the acidic compounds from the flue-gas by absorption.

8.5. Techniques to reduce emissions to air of dust, metals including mercury, and/or PCDD/F

Technique	Description
Bag filter	Bag or fabric filters are constructed from porous woven or felted fabric through which gases are passed to remove particles. The use of a bag filter requires the selection of a fabric suitable for the characteristics of the flue-gas and the maximum operating temperature.

Boiler sorbent injection (in-furnace or in-bed)	See general description in Section 8.4. There are co-benefits in the form of dust and metal emissions reduction.
Carbon sorbent (e.g. activated carbon or halogenated activated carbon) injection in the flue-gas	Mercury and/or PCDD/F adsorption by carbon sorbents, such as (halogenated) activated carbon, with or without chemical treatment. The sorbent injection system can be enhanced by the addition of a supplementary bag filter.
Dry or semi-dry FGD system	See general description of each technique (i.e. spray dry absorber (SDA), duct sorbent injection (DSI), circulating fluidised bed (CFB) dry scrubber) in Section 8.4. There are co-benefits in the form of dust and metal emissions reduction.
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 under a wide range of conditions. The abatement efficiency typically depends on the number of fields, the residence time (size), catalyst properties, and upstream particle removal devices. ESPs generally include between two and five fields. The most modern (high-performance) ESPs have up to seven fields.
Fuel choice	The use of a fuel with a low ash or metals (e.g. mercury) content.
Multicyclones	Set of dust control systems, based on centrifugal force, whereby particles are separated from the carrier gas, assembled in one or several enclosures.
Use of halogenated additives in the fuel or injected in the furnace	Addition of halogen compounds (e.g. brominated additives) into the furnace to oxidise elemental mercury into soluble or particulate species, thereby enhancing mercury removal in downstream abatement systems.
Wet flue-gas desulphurisation (wet FGD)	See general description in Section 8.4. There are co-benefits in the form of dust and metals emission reduction.

8.6. Techniques to reduce emissions to water

Technique	Description
Adsorption on activated carbon	The retention of soluble pollutants on the surface of solid, highly porous particles (the adsorbent). Activated carbon is typically used for the adsorption of organic compounds and mercury.
Aerobic biological treatment	The biological oxidation of dissolved organic pollutants with oxygen using the metabolism of microorganisms. In the presence of dissolved oxygen — injected as air or pure oxygen — the organic components are mineralised into carbon dioxide and water or are transformed into other metabolites and biomass. Under certain conditions, aerobic nitrification also takes place whereby microorganisms oxidise ammonium (NH_4^+) to the intermediate nitrite (NO_2^-), which is then further oxidised to nitrate (NO_3^-).
Anoxic/anaerobic biological treatment	The biological reduction of pollutants using the metabolism of microorganisms (e.g. nitrate (NO_3^-) is reduced to elemental gaseous nitrogen, oxidised species of mercury are reduced to elemental mercury). The anoxic/anaerobic treatment of waste water from the use of wet abatement systems is typically carried out in fixed-film bioreactors using activated carbon as a carrier. The anoxic/anaerobic biological treatment for the removal of mercury is applied in combination with other techniques.
Coagulation and flocculation	Coagulation and flocculation are used to separate suspended solids from waste water and are often carried out in successive steps. Coagulation is carried out by adding coagulants with charges opposite to those of the suspended solids. Flocculation is carried out by adding polymers, so that collisions of microfloc particles cause them to bond thereby producing larger flocs.
Crystallisation	The removal of ionic pollutants from waste water by crystallising them on a seed material such as sand or minerals, in a fluidised bed process
Filtration	The separation of solids from waste water by passing it through a porous medium. It includes different types of techniques, e.g. sand filtration, microfiltration and ultrafiltration.

Flotation	The separation of solid or liquid particles from waste water by attaching them to fine gas bubbles, usually air. The buoyant particles accumulate at the water surface and are collected with skimmers.
Ion exchange	The retention of ionic pollutants from waste water and their replacement by more acceptable ions using an ion exchange resin. The pollutants are temporarily retained and afterwards released into a regeneration or backwashing liquid.
Neutralisation	The adjustment of the pH of the waste water to the neutral pH level (approximately 7) by adding chemicals. Sodium hydroxide (NaOH) or calcium hydroxide ($Ca(OH)_2$) is generally used to increase the pH whereas sulphuric acid (H_2SO_4), hydrochloric acid (HCl) or carbon dioxide (CO_2) is generally used to decrease the pH. The precipitation of some pollutants may occur during neutralisation.

9. DEFINITIONS:

For the purposes of these BAT conclusions, the following definitions apply

Term used	Definition
General terms	
Boiler	Any combustion plant with the exception of engines, gas turbines, and process furnaces or heaters
Combined-cycle gas turbine (CCGT)	A CCGT is a combustion plant where two thermodynamic cycles are used (i.e. Brayton and Rankine cycles). In a CCGT, heat from the flue-gas of a gas turbine (operating according to the Brayton cycle to produce electricity) is converted to useful energy in a heat recovery steam generator (HRSG), where it is used to generate steam, which then expands in a steam turbine (operating according to the Rankine cycle to produce additional electricity). For the purpose of these BAT conclusions, a CCGT includes configurations both with and without supplementary firing of the HRSG
Combustion plant	Any technical apparatus in which fuels are oxidised in order to use the heat thus generated. For the purposes of these BAT conclusions, a combination formed ofL — two or more separate combustion plants where the flue-gases are discharged through a common stack, or — separate combustion plants that have been granted a permit for the first time on or after 1 July 1987, or for which the operators have submitted a complete application for a permit on or after that date, which are installed in such a way that, taking tech- nical and economic factors into account, their flue-gases could, in the judgment of the competent authority, be discharged through a common stack is considered as a single combustion plant. For calculating the total rated thermal input of such a combination, the capacities of all individual combustion plants concerned, which have a rated thermal input of at least 15 MW, shall be added together
Combustion unit	Individual combustion plant
Continuous measurement	Measurement using an automated measuring system permanently installed on site
Direct discharge	Discharge (to a receiving water body) at the point where the emission leaves the installa- tion without further downstream treatment
Flue-gas desulphurisation (FGD) system	System composed of one or a combination of abatement technique(s) whose purpose is to reduce the level of SO_X emitted by a combustion plant
Flue-gas desulphurisation (FGD) system — existing	A flue-gas desulphurisation (FGD) system that is not a new FGD system
Flue-gas desulphurisation (FGD) system — new	Either a flue-gas desulphurisation (FGD) system in a new plant or a FGD system that includes at least one abatement technique introduced or completely replaced in an existing plant following the publication of these BAT conclusions
Gas oil	Any petroleum-derived liquid fuel falling within CN code 2710 19 25, 2710 19 29, 2710 19 47, 2710 19 48, 2710 20 17 or 2710 20 19. Or any petroleum-derived liquid fuel of which less than 65 vol-% (including losses) distils at 250 °C and of which at least 85 vol-% (including losses) distils at 350 °C by the ASTM D86 method
Heavy fuel oil (HFO)	Any petroleum-derived liquid fuel falling within CN code 2710 19 51 to 2710 19 68, 2710 20 31, 2710 20 35, 2710 20 39.

	Or any petroleum-derived liquid fuel, other than gas oil, which, by reason of its distillation limits, falls within the category of heavy oils intended for use as fuel and of which less than 65 vol-% (including losses) distils at 250 °C by the ASTM D86 method. If the distillation cannot be determined by the ASTM D86 method, the petroleum product is also categorised as a heavy fuel oil
Net electrical efficiency (combustion unit and IGCC)	Ratio between the net electrical output (electricity produced on the high-voltage side of the main transformer minus the imported energy — e.g. for auxiliary systems' consumption) and the fuel/feedstock energy input (as the fuel/feedstock lower heating value) at the combustion unit boundary over a given period of time
Net mechanical energy efficiency	Ratio between the mechanical power at load coupling and the thermal power supplied by the fuel
Net total fuel utilisation (combustion unit and IGCC)	Ratio between the net produced energy (electricity, hot water, steam, mechanical energy produced minus the imported electrical and/or thermal energy (e.g. for auxiliary systems' consumption)) and the fuel energy input (as the fuel lower heating value) at the combustion unit boundary over a given period of time
Net total fuel utilisation (gasification unit)	Ratio between the net produced energy (electricity, hot water, steam, mechanical energy produced, and syngas (as the syngas lower heating value) minus the imported electrical and/or thermal energy (e.g. for auxiliary systems' consumption)) and the fuel/feedstock energy input (as the fuel/feedstock lower heating value) at the gasification unit boundary over a given period of time
Operated hours	The time, expressed in hours, during which a combustion plant, in whole or in part, is operated and is discharging emissions to air, excluding start-up and shutdown periods
Periodic measurement	Determination of a measurand (a particular quantity subject to measurement) at specified time intervals
Plant — existing	A combustion plant that is not a new plant
Plant — new	A combustion plant first permitted at the installation following the publication of these BAT conclusions or a complete replacement of a combustion plant on the existing foundations following the publication of these BAT conclusions
Post-combustion plant	System designed to purify the flue-gases by combustion which is not operated as an independent combustion plant, such as a thermal oxidiser (i.e. tail gas incinerator), used for the removal of the pollutant(s) (e.g. VOC) content from the flue-gas with or without the recovery of the heat generated therein. Staged combustion techniques, where each combustion stage is confined within a separate chamber, which may have distinct combustion process characteristics (e.g. fuel to air ratio, temperature profile), are considered integrated in the combustion process and are not considered post-combustion plants. Similarly, when gases generated in a process heater/furnace or in another combustion process are subsequently oxidised in a distinct combustion plant to recover their energetic value (with or without the use of auxiliary fuel) to produce electricity, steam, hot water/oil or mechanical energy, the latter plant is not considered a post-combustion plant
Predictive emissions monitoring system (PEMS)	System used to determine the emissions concentration of a pollutant from an emission source on a continuous basis, based on its relationship with a number of characteristic continuously monitored process parameters (e.g. the fuel gas consumption, the air to fuel ratio) and fuel or feed quality data (e.g. the sulphur content)
Process fuels from the chemical industry	Gaseous and/or liquid by-products generated by the (petro-)chemical industry and used as non-commercial fuels in combustion plants

Process furnaces or heaters	Process furnaces or heaters are: — combustion plants whose flue-gases are used for the thermal treatment of objects or feed material through a direct contact heating mechanism (e.g. cement and lime kiln, glass furnace, asphalt kiln, drying process, reactor used in the (petro-)chemical industry, ferrous metal processing furnaces), or — combustion plants whose radiant and/or conductive heat is transferred to objects or feed material through a solid wall without using an intermediary heat transfer fluid (e.g. coke battery furnace, cowper, furnace or reactor heating a process stream used in the (petro-)chemical industry such as a steam cracker furnace, process heater used for the regasification of liquefied natural gas (LNG) in LNG terminals). As a consequence of the application of good energy recovery practices, process heaters/furnaces may have an associated steam/electricity generation system. This is considered to be an integral design feature of the process heater/furnace that cannot be considered in isolation
Refinery fuels	Solid, liquid or gaseous combustible material from the distillation and conversion steps of the refining of crude oil. Examples are refinery fuel gas (RFG), syngas, refinery oils, and pet coke
Residues	Substances or objects generated by the activities covered by the scope of this document, as waste or by-products
Start-up and shut-down period	The time period of plant operation as determined pursuant to the provisions of Commission Implementing Decision 2012/249/EU (*)
Unit — existing	A combustion unit that is not a new unit
Unit- new	A combustion unit first permitted at the combustion plant following the publication of these BAT conclusions or a complete replacement of a combustion unit on the existing foundations of the combustion plant following the publication of these BAT conclusions
Valid (hourly average)	An hourly average is considered valid when there is no maintenance or malfunction of the automated measuring system

(*) Commission Implementing Decision 2012/249/EU of 7 May 2012 concerning the determination of start-up and shut-down periods for the purposes of Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions (OJ L 123, 9.5.2012, p. 44).

DEFINITIONS

For the purposes of these BAT conclusions, the following **definitions** apply:

Term used	Definition
General terms Pollutants/parameters	
As	The sum of arsenic and its compounds, expressed as As.
C_3	Hydrocarbons having a carbon number equal to three

C_4+	Hydrocarbons having a carbon number of four or greater
Cd	The sum of cadmium and its compounds, expressed as Cd.
Cd+Tl	The sum of cadmium, thallium and their compounds, expressed as Cd+Tl.
CH_4	Methane
CO	Carbon monoxide.
COD	Chemical oxygen demand. Amount of oxygen needed for the total oxidation of the organic matter to carbon dioxide
COS	Carbonyl sulphide
Cr	The sum of chromium and its compounds, expressed as Cr.
Cu	The sum of copper and its compounds, expressed as Cu.
Dust	Total particulate matter (in air).
Fluoride	Dissolved fluoride, expressed as F–
H_2S	Hydrogen sulphide
HCl	Hydrogen chloride.
HCN	Hydrogen cyanide
HF	Hydrogen fluoride.
Hg	The sum of mercury and its compounds, expressed as Hg.
N_2O	Dinitrogen monoxide (nitrous oxide).
NH_3	Ammonia.
Ni	The sum of nickel and its compounds, expressed as Ni.
NO_X	The sum of nitrogen monoxide (NO) and nitrogen dioxide (NO_2), expressed as NO_2.
Pb	The sum of lead and its compounds, expressed as Pb.
PCDD/F	Polychlorinated dibenzo-*p*-dioxins and -furans.
RCG	Raw concentration in the flue-gas. Concentration of SO_2 in the raw flue-gas as a yearly average (under the standard conditions given under General considerations) at the inlet of the SO_X abatement system, expressed at a reference oxygen content of 6 vol-% O_2
Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V	The sum of antimony, arsenic, lead, chromium, cobalt, copper, manganese, nickel, vanadium and their compounds, expressed as Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V.

SO_2	Sulphur dioxide.
SO_3	Sulphur trioxide
SO_X	The sum of sulphur dioxide (SO_2) and sulphur trioxide (SO_3), expressed as SO_2
Sulphate (SO_4^{2-})	Dissolved sulphate, expressed as SO_4^{2-}.
Sulphide, easily released	The sum of dissolved sulphide and of those undissolved sulphides that are easily released upon acidification, expressed as S2–
Sulphite	Dissolved sulphite, expressed as SO_3^{2-}
TOC	Total organic carbon, expressed as C (in water);
TSS	Total suspended solids. Mass concentration of all suspended solids (in water), measured via filtration through glass fibre filters and gravimetry.
TVOC	Total volatile organic carbon, expressed as C (in air).
Zn	The sum of zinc and its compounds, expressed as Zn.

Acronyms

For the purposes of these BAT conclusions, the following acronyms apply:

Acronym	Definition
ASU	Air supply unit
CCGT	Combined-cycle gas turbine, with or without supplementary firing
CFB	Circulating fluidised bed
CHP	Combined heat and power
COG	Coke oven gas
COS	Carbonyl sulphide
DLN	Dry low-NO_X burners
DSI	Duct sorbent injection
ESP	Electrostatic precipitator
FBC	Fluidised bed combustion

FGD	Flue-gas desulphurisation
HFO	Heavy fuel oil
HRSG	Heat recovery steam generator
IGCC	Integrated gasification combined cycle
LHV	Lower heating value
LNB	Low-NO_X burners
LNG	Liquefied natural gas
OCGT	Open-cycle gas turbine
OTNOC	Other than normal operating conditions
PC	Pulverised combustion
PEMS	Predictive emissions monitoring system
SCR	Selective catalytic reduction
SDA	Spray dry absorber
SNCR	Selective non-catalytic reduction