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Integrated Pollution Prevention and Control (IPPC)

Executive summary
Reference Document on Best Available Techniques for Large Combustion Plants

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EXECUTIVE SUMMARY

This Executive Summary describes the main findings, the principal BAT conclusions and the associated emission levels. It can be read and understood as a standalone document but as a summary, it does not present all the complexities of the full BREF text (e.g. full detail of the BAT sections). It is, therefore, not intended as a substitute for the full BREF text as a tool in BAT decision-making and it is strongly recommended to read this summary together with the preface and standard introduction to BAT sections. More than 60 experts from Member States, industry and environmental NGOs have participated in this information exchange.

Scope

This BREF covers, in general, combustion installations with a rated thermal input exceeding 50 MW. This includes the power generation industry and those industries where 'conventional' (commercially available and specified) fuels are used and where the combustion units are not covered within another sector BREF. Coal, lignite, biomass, peat, liquid and gaseous fuels (including hydrogen and biogas) are regarded as conventional fuels. Incineration of waste is not covered, but co-combustion of waste and recovered fuel in large combustion plants is addressed. The BREF covers not only the combustion unit, but also upstream and downstream activities that are directly associated to the combustion process. Combustion installations which use process-related residues or by-products as fuel, or fuels that cannot be sold as specified fuels on the market as well as combustion processes which is an integrated part of a specific production process are not covered by this BREF.

Submitted Information

A large number of documents, reports and information from Member States, industry, operators and authorities as well as from suppliers of equipment and environmental NGOs have been used to draft the document. Information was further obtained during site visits to different European Member States and by personal communication on selection of technology and on experiences with the application of reduction techniques.

Structure of the document

Electricity (power) and/or heat generation in Europe is a diverse sector. Energy generation is based on a variety of fuels, which can generally be classified by their aggregate state into solid, liquid or gaseous fuels. This document has, therefore, been written vertically, fuel by fuel, but with common aspects and techniques described together in the three introductory chapters.

The European Energy Industry

In the European Union, all available types of energy sources are used for electric and thermal power generation. National fuel resources such as the local or national availability of coal, lignite, biomass, peat, oil and natural gas, largely influence the choice of fuel used for energy generation in each EU Member State. Since 1990, the amount of electric power generated from fossil fuel energy sources increased by about 16 % and demand increased by about 14 %. The amount of electric power generated from renewable energy sources (including hydropower and biomass) shows an above average increase of approximately 20 %.

Combustion plants are operated according to energy demand and requirement, either as large utility plants or as industrial combustion plants providing power (e.g. in the form of electricity, mechanical power), steam, or heat to industrial production processes.

Technologies used

Power generation in general utilises a variety of combustion technologies. For the combustion of solid fuels, pulverised combustion, fluidised bed combustion as well as grate firing are all considered to be BAT under the conditions described in this document. For liquid and gaseous fuels, boilers, engines and gas turbines are BAT under the conditions described in this document.

The choice of system employed at a facility is based on economic, technical, environmental and local considerations, such as the availability of fuels, the operational requirements, market conditions, network requirements. Electricity is mainly generated by producing steam in a boiler fired by the selected fuel and the steam is used to power a turbine which drives a generator to produce electricity. The steam cycle has an inherent efficiency limited by the need to condense the steam after the turbine.

Some liquid and gas fuels can be directly fired to drive turbines with the combustion gas or they can be used in internal combustion engines which can then drive generators. Each technology offers certain advantages to the operator especially in the ability to be operated according to variable power demand.

Environmental Issues

Most combustion installations use fuel and other raw materials taken from the earth's natural resources, converting them into useful energy. Fossil fuels are the most abundant energy source used today. However, their burning results in a relevant and, at times, significant impact on the environment as a whole. The combustion process leads to the generation of emissions to air, water and soil, of which emissions to the air are considered to be one of the main environmental concerns.

The most important emissions to air from the combustion of fossil fuels are SO_2, NO_X, CO, particulate matter (PM_{10}) and greenhouse gases, such as N_2O and CO_2. Other substances such as heavy metals, halide compounds, and dioxins are emitted in smaller quantities.

Conditions

The BAT associated emission levels are based on daily average, standard conditions and an O_2 level of 6 % / 3 % / 15 % (solid fuels / liquid and gasous fuels / gas turbines) which represents a typical load situation. For peak loads, start up and shut down periods as well as for operational problems of the flue-gas cleaning systems, short-term peak values, which could be higher, have to be considered.

Unloading, storage and handling of fuel and additives

Some BAT for preventing releases from the unloading, storage and handling of fuels, and also for additives such as lime, limestone, ammonia, etc. are summarised in Table 1.

	BAT
Particulate matter	• the use of loading and unloading equipment that minimises the height of fuel drop to the stockpile, to reduce the generation of fugitive dust (solid fuels) • in countries where freezing does not occur, using water spray systems to reduce the formation of fugitive dust from solid fuel storage (solid fuels) • placing transfer conveyors in safe, open areas aboveground so that damage from vehicles and other equipment can be prevented (solid fuels) • using enclosed conveyors with well designed, robust extraction and filtration equipment on conveyor transfer points to prevent the emission of dust (solid fuels) • rationalising transport systems to minimise the generation and transport of dust on site (solid fuels) • the use of good design and construction practices and adequate maintenance (all fuels) • storage of lime or limestone in silos with well designed, robust extraction and filtration equipment (all fuels)
Water contamination	• having storage on sealed surfaces with drainage, drain collection and water treatment for settling out (solid fuels) • the use of liquid fuel storage systems that are contained in impervious bunds that have a capacity capable of containing 75 % of the maximum capacity of all tanks or at least the maximum volume of the largest tank. Tank contents should be displayed and associated alarms used and automatic control systems can be applied to prevent the overfilling of storage tanks (solid fuels) • pipelines placed in safe, open areas aboveground so that leaks can be detected quickly and damage from vehicles and other equipment can be prevented. For non-accessible pipes, double walled type pipes with automatic control of the spacing can be applied (liquid and gaseous fuels) • collecting surface run-off (rainwater) from fuel storage areas that washes fuel away and treating this collected stream (settling out or waste water treatment plant) before discharge (solid fuels)
Fire prevention	• surveying storage areas for solid fuels with automatic systems, to detect fires, caused by self-ignition and to identify risk points (solid fuels)
Fugitive emissions	• using fuel gas leak detection systems and alarms (liquid and gaseous fuels)
Efficient use of natural resources	• using expansion turbines to recover the energy content of the pressurised fuel gases (natural gas delivered via pressure pipelines) (liquid and gaseous fuels) • preheating the fuel gas by using waste heat from the boiler or gas turbine (liquid and gaseous fuels).
Health and safety risk regarding ammonia	• for handling and storage of pure liquified ammonia: pressure reservoirs for pure liquified ammonia >100 m^3 should be constructed as double wall and should be located subterraneously; reservoirs of 100 m^3 and smaller should be manufactured including annealling processes (all fuels) • from a safety point of view, the use of an ammonia-water solution is less risky than the storage and handling of pure liquefied ammonia (all fuels).

Table 1: Some BAT for storage and handling of fuel and additives

Fuel pretreatment

Fuel pretreatment of solid fuel mainly means blending and mixing in order to ensure stable combustion conditions and to reduce peak emissions. To reduce the amount of water in peat and biomass, drying of fuel is also considered to be part of BAT. For liquid fuels, the use of pretreatment devices, such as diesel oil cleaning units used in gas turbines and engines, are BAT. Heavy fuel oil (HFO) treatment comprises devices such as electrical or steam coil type heaters, de-emulsifier dosing systems, etc.

Thermal efficiency

Prudent management of natural resources and the efficient use of energy are two of the major requirements of the IPPC Directive. In this sense, the efficiency with which energy can be generated is an important indicator of the emission of the climate relevant gas CO_2. One way to reduce the emission of CO_2 per unit of energy generated is the optimisation of the energy utilisation and the energy generating process. Increasing the thermal efficiency has implications on load conditions, cooling system, emissions, use of type of fuel and so on.

Cogeneration (CHP) is considered as the most effective option to reduce the overall amount of CO_2 released and is relevant for any new build power plant whenever the local heat demand is high enough to warrant the construction of the more expensive cogeneration plant instead of the simpler heat or electricity only plant. The BAT conclusion to increase efficiency and the BAT associated levels are summarised in Tables 3 to 5. In this sense, it should be noted that HFO fired plants are considered to have similar efficiencies than coal fired plants.

Fuel	Combined technique	Unit thermal efficiency (net) (%)	
		New plants	Existing plants
Coal and lignite	Cogeneration (CHP)	75 – 90	75 – 90
Coal	PC (DBB and WBB)	43 – 47	The achievable improvement of thermal efficiency depends on the specific plant, but as an indication, a level of 36* – 40 % or an incremental improvement of more than 3 % points can be seen as associated with the use of BAT for existing plants
	FBC	>41	
	PFBC	>42	
Lignite	PC (DBB)	42 – 45	
	FBC	>40	
	PFBC	>42	

PC: pulverised combustion **DBB:** dry bottom boiler **WBB:** wet bottom boiler
FBC: fluidised bed combustion **PFBC:** pressurised fluidised bed combustion
* Some split views appeared in this value and are reported in Section 4.5.5 of the main document

Table 2: Levels of thermal efficiency associated with the application of BAT measures for coal and lignite fired combustion plants

Fuel	Combined technique	Unit thermal efficiency (net) (%)	
		Electric efficiency	Fuel utilisation (CHP)
Biomass	Grate-firing	Around 20	75 – 90 Depending on the specific plant application and the heat and electricity demand
	Spreader-stoker	>23	
	FBC (CFBC)	>28 – 30	
Peat	FBC (BFBC and CFBC)	>28 – 30	

FBC: fluidised bed combustion **CFBC:** circulating fluidised bed combustion
BFBC: bubbling fluidised bed combustion **CHP:** Cogeneration

Table 3: Thermal efficiency levels associated with the application of BAT measures for peat and biomass fired combustion plants

No specific thermal efficiency values were concluded when using liquid fuels in boilers and engines. However, some techniques to consider are available in the respective BAT sections.

Plant type	Electrical efficiency (%)		Fuel utilisation(%)
	New plants	Existing plants	New and existing plants
Gas turbine			
Gas turbine	36 – 40	32 – 35	-
Gas engine			
Gas engine	38 – 45		-
Gas engine with HRSG in CHP mode	>38	>35	75 – 85
Gas-fired boiler			
Gas-fired boiler	40 – 42	38 – 40	
CCGT			
Combined cycle with or without supplementary firing (HRSG) for electricity generation only	54 – 58	50 – 54	-
Combined cycle without supplementary firing (HRSG) in CHP mode	<38	<35	75 – 85
Combined cycle with supplementary firing in CHP mode	<40	<35	75 – 85
HRSG: heat recovery steam generator	**CHP**: Congeneration		

Table 4: Efficiency of gas-fired combustion plants associated to the use of BAT

Particulate matter (dust) emissions

Particulate matter (dust) emitted during the combustion of solid or liquid fuels arises almost entirely from their mineral fraction. By combustion of liquid fuels, poor combustion conditions lead to the formation of soot. Combustion of natural gas is not a significant source of dust emissions. The emission levels of dust, in this case, are normally well below 5 mg/Nm^3 without any additional technical measures being applied.

For dedusting off-gases from new and existing combustion plants, BAT is considered to be the use of an electrostatic precipitator (ESP) or a fabric filter (FF), where a fabric filter normally achieves emission levels below 5 mg/Nm^3. Cyclones and mechanical collectors alone are not BAT, but they can be used as a pre-cleaning stage in the flue-gas path.

The BAT conclusion for dedusting and the associated emission levels are summarised in Table 5. For combustion plants over 100 MW_{th}, and especially over 300 MW_{th}, the dust levels are lower because the FGD techniques, which are already a part of the BAT conclusion for desulphurisation, also reduce particulate matter.

Capacity (MW_{th})	Dust emission level (mg/Nm^3)						BAT to reach these levels
	Coal and lignite		Biomass and peat		Liquid fuels for boilers		
	New plants	Existing plants	New plants	Existing plants	New plants	Existing plants	
50 – 100	5 – 20*	5 – 30*	5 – 20	5 – 30	5 – 20*	5 – 30*	ESP or FF
100 – 300	5 – 20*	5 – 25*	5 – 20	5 – 20	5 – 20*	5 – 25*	ESP or FF in combination FGD (wet, sd or dsi) for PC ESP or FF for FBC
>300	5 – 10*	5 – 20*	5 – 20	5 – 20	5 – 10*	5 – 20*	

Notes:
ESP: Electrostatic precipitator) **FF:** Fabric filter **FGD(wet):** Wet flue-gas desulphurisation
FBC: Fluidised bed combustion) **sd:** semi dry **dsi:** dry sorbent injection
* Some split views appeared in these values and are reported in Sections 4.5.6 and 6.5.3.2 of the main document.

Table 5: BAT for the reduction of particulate emissions from some combustion plants

Heavy metals

The emission of heavy metals results from their presence as a natural component in fossil fuels. Most of the heavy metals considered (As, Cd, Cr, Cu, Hg, Ni, Pb, Se, V, Zn) are normally released as compounds (e.g. oxides, chlorides) in association with particulates. Therefore, BAT to reduce the emissions of heavy metals is generally the application of high performance dedusting devices such as ESPs or FFs.

Only Hg and Se are at least partly present in the vapour phase. Mercury has a high vapour pressure at the typical control device operating temperatures, and its collection by particulate matter control devices, is highly variable. For ESPs or FFs operated in combination with FGD techniques, such as wet limestone scrubbers, spray dryer scrubbers or dry sorbent injection, an average removal rate of Hg is 75 % (50 % in ESP and 50 % in FGD) and 90 % in the additional presence of a high dust SCR can be obtained.

SO_2 emissions

Emissions of sulphur oxides mainly result from the presence of sulphur in the fuel. Natural gas is generally considered free from sulphur. This is not the case for certain industrial gases and desulphurisation of the gaseous fuel might then be necessary.

In general, for solid and liquid-fuel-fired combustion plants, the use of low sulphur fuel and/or desulphurisation is considered to be BAT. However, the use of low sulphur fuel for plants over 100 MW_{th} can, in most cases, only be seen as a supplementary measure to reduce SO_2 emissions in combination with other measures.

Besides the use of low sulphur fuel, the techniques that are considered to be BAT are mainly the wet scrubber (reduction rate 92 – 98 %), and the spray dry scrubber desulphurisation (reduction rate 85 – 92 %), which already has a market share of more than 90 %. Dry FGD techniques such as dry sorbent injection are used mainly for plants with a thermal capacity of less than 300 MW_{th}. The wet scrubber has the advantage of also reducing emissions of HCl, HF, dust and heavy metals. Because of the high costs, the wet scrubbing process is not considered as BAT for plants with a capacity of less than 100 MW_{th}.

Capacity (MW_{th})	SO_2 emission level (mg/Nm^3)						BAT to reach these levels
	Coal and lignite		Peat		Liquid fuels for boilers		
	New plants	Existing plants	New plants	Existing plants	New plants	Existing plants	
50 – 100	200 – 400* 150 – 400* (FBC)	200 – 400* 150 – 400* (FBC)	200 – 300	200 – 300	100 – 350*	100 – 350*	Low sulphur fuel or/and FGD (dsi) or FGD (sds) or FGD (wet) (depending on the plant size). Seawater scrubbing. Combined techniques for the reduction of NO_x and SO_2. Limestone injection (FBC).
100 – 300	100 – 200	100 – 250*	200 – 300 150 – 250 (FBC)	200 – 300 150 -300 (FBC)	100 – 200*	100 – 250*	
>300	20 – 150* 100 – 200 (CFBC/ PFBC)	20 – 200* 100 – 200* (CFBC/ PFBC)	50 – 150 50 – 200 (FBC)	50 – 200	50 – 150*	50 – 200*	

Notes:
FBC: Fluidised bed combustion
CFBC: Circulating fluidised bed combustion
PFBC: Pressurised fluidised bed combustion
FGD(wet): Wet flue-gas desulphurisation
FGD(sds): Flue-gas desulphurisation by using a spray dryer
FGD(dsi): Flue-gas desulphurisation by dry sorbent injection
* Some split views appeared in these values and are reported in Sections 4.5.8 and 6.5.3.3 of the main document.

Table 6: BAT for the reduction of SO_2 emissions from some combustion plants

NO_X emissions
The principal oxides of nitrogen emitted during the combustion are nitric oxide (NO) and nitrogen dioxide (NO_2), referred as NO_x.

For pulverised coal combustion plants, the reduction of NO_X emissions by primary and secondary measures, such as SCR, is BAT, where the reduction rate of the SCR system ranges between 80 and 95 %. The use of SCR or SNCR has the disadvantage of a possible emission of unreacted ammonia (‘ammonia slip’). For small solid fuel-fired plants without high load variations and with a stable fuel quality, the SNCR technique is also regarded as BAT in order to reduce NO_X emissions.

For pulverised lignite and peat-fired combustion plants, the combination of different primary measures is considered as BAT. This means, for instance, the use of advanced low NO_x burners in combination with other primary measures such as flue-gas recirculation, staged combustion (air-staging), reburning, etc. The use of primary measures tends to cause incomplete combustion, resulting in a higher level of unburned carbon in the fly ash and some carbon monoxide emissions.

In FBC boilers burning solid fuel, BAT is the reduction of NO_X emissions achieved by air distribution or by flue-gas recirculation. There is a small difference in the NO_X emissions from BFBC and CFBC combustion.

The BAT conclusion for the reduction of NO_X emissions and the associated emission levels for various fuels are summarised in Tables 8, 9 and 10.

Capacity (MW_{th})	**Combustion technique**	**NO_X emission level associated with BAT (mg/Nm^3)**			**BAT options to reach these levels**
		New plants	Existing plants	Fuel	
50 – 100	Grate-firing	200 – 300*	200 – 300*	Coal and lignite	Pm and/or SNCR
	PC	90 – 300*	90 – 300*	Coal	Combination of Pm and SNCR or SCR
	CFBC and PFBC	200 – 300	200 – 300	Coal and lignite	Combination of Pm
	PC	200 – 450	200 – 450*	Lignite	
100 – 300	PC	90* – 200	90 – 200*	Coal	Combination of Pm in combination with SCR or combined techniques
	PC	100 – 200	100 – 200*	Lignite	Combination of Pm
	BFBC, CFBC and PFBC	100 – 200	100 – 200*	Coal and Lignite	Combination of Pm together with SNCR
>300	PC	90 – 150	90 – 200	Coal	Combination of Pm in combination with SCR or combined techniques
	PC	50 – 200*	50 – 200*	Lignite	Combination of Pm
	BFBC,CFBC and PFBC	50 – 150	50 – 200	Coal and Lignite	Combination of Pm

Notes:
PC: Pulverised combustion
BFBC: Bubbling fluidised bed combustion
CFBC: Circulating fluidised bed combustion
PFBC: Pressurised fluidised bed combustion
Pm: Primary measures to reduce NO_x
SCR: Selective catalytic reduction of NO_x
SNCR: Selective non catalytic reduction of NO_x
The use of anthracite hard coal may lead to higher emission levels of NO_X because of the high combustion temperatures
* Some split views appeared in these values and are reported in Section 4.5.9 of the main document.

Table 7: BAT for the reduction of NO_X from coal-and lignite-fired combustion plants

Capacity (MW_{th})	NO_X -emission level (mg/Nm^3)				BAT to reach these levels
	Biomass and Peat		Liquid fuels		
	New plants	Existing plants	New plants	Existing plants	
50 – 100	150 – 250	150 – 300	150 – 300*	150 – 450	Combination of Pm SNCR/ SCR or combined techniques
100 – 300	150 – 200	150 – 250	50 – 150*	50 – 200*	
>300	50 – 150	50 – 200	50 – 100*	50 – 150*	
Notes: **Pm:** Primary measures to reduce NO_x **SCR:** Selective catalytic reduction of NO_x * Some split views appeared in these values and are reported in Section 6.5.3.4 of the main document					

Table 8: BAT for the reduction of NO_X from peat, biomass and liquid fuel-fired combustion plants

For new gas turbines, dry low NO_X premix burners (DLN) are BAT. For existing gas turbines, water and steam injection or conversion to the DLN technique is BAT. For gas-fired stationary engine plants, the lean-burn approach is BAT analogous to the dry low NO_X technique used in gas turbines.

For most gas turbines and gas engines, SCR is also considered to be BAT. Retrofitting of an SCR system to a CCGT is technically feasible but is not economically justified for existing plants. This is because the required space in the HRSG was not foreseen in the project and is, therefore, not available.

Plant type	Emission level associated with BAT (mg/Nm^3)		O_2 level (%)	BAT options to reach these levels
	NO_x	CO		
Gas turbines				
New gas turbines	20 – 50	5 – 100	15	Dry low NO_x premix burners or SCR
DLN for existing gas turbines	20 – 75	5 – 100	15	Dry low NO_x premix burners as retrofitting packages if available
Existing gas turbines	50 – 90*	30 – 100	15	Water and steam injection or SCR
Gas engines				
New gas engines	20 – 75*	30 – 100*	15	Lean-burn concept or SCR and oxidation catalyst for CO
New gas engine with HRSG in CHP mode	20 – 75*	30 – 100*	15	Lean-burn concept or SCR and oxidation catalyst for CO
Existing gas engines	20 – 100*	30 – 100	15	Low NO_x tuned
Gas-fired boilers				
New gas-fired boilers	50 – 100*	30 – 100	3	Low NO_x burners or SCR or SNCR
Existing gas-fired boile	50 – 100*	30 – 100	3	
CCGT				
New CCGT without supplementary firing (HRSG)	20 – 50	5 – 100	15	Dry low NO_x premix burners or SCR
Existing CCGT without supplementary firing (HRSG)	20 – 90*	5 – 100	15	Dry low NO_x premix burners or water and steam injection or SCR
New CCGT with supplementary firing	20 – 50	30 – 100	Plant spec.	Dry low NO_x premix burners and low NO_x burners for the boiler part or SCR or SNCR
Existing CCGT with supplementary firing	20 – 90*	30 – 100	Plant spec.	Dry low NO_x premix burners or water and steam injection and low NO_x burners for the boiler part or SCR or SNCR
SCR: Selective catalytic reduction of NO_x **SNCR**: Selective non catalytic reduction of NO_x **DLN**: dry low NO_X **HRSG:** heat recovery steam generator **CHP:** Cogeneration **CCGT:** combined cycle gas turbine * Some split views appeared on these values and are reported in Section 7.5.4 of the main document..				

Table 9: BAT for the reduction of NO_X and CO emissions from gas-fired combustion plants

CO emissions
Carbon monoxide (CO) always appears as an intermediate product of the combustion process, BAT for the minimisation of CO emissions is complete combustion, which goes along with good furnace design, the use of high performance monitoring and process control techniques, and maintenance of the combustion system. Some emission levels associated to the use of BAT for different fuels are present in the BAT sections, however in this executive summary only the ones from gas-fired combustion plants are reported.

Water contamination
Besides the generation of air pollution, large combustion plants are also a significant source of water discharge (cooling and waste water) into rivers, lakes and the marine environment.

Any surface run-off (rainwater) from the storage areas that washes fuel particles away should be collected and treated (settling out) before being discharged. Small amounts of oil contaminated (washing) water cannot be prevented from occurring occasionally at a power plant. Oil separation wells are BAT to avoid any environmental damage.

The BAT conclusion for wet scrubbing desulphurisation is related to the application of a waste water treatment plant. The waste water treatment plant consists of different chemical treatments to remove heavy metals and to decrease the amount of solid matter from entering the water. The treatment plant includes an adjustment of the pH level, the precipitation of heavy metals and removal of the solid matter. The full document contains some emission levels.

Waste and residues
A lot of attention has already been paid by the sector to the utilisation of combustion residues and by-products, instead of just depositing them in landfills. Utilisation and re-use is, therefore, the best available option and has priority. There are many different utilisation possibilities for different by-products such as ashes. Each different utilisation option has different specific criteria. It has not been possible to cover all these criteria in this BREF. The quality criteria are usually connected to the structural properties of the residue and the content of harmful substances, such as the amount of unburned fuel or the solubility of heavy metals, etc.

The end-product of the wet scrubbing technique is gypsum, which is a commercial product for the plant in most EU countries. It can be sold and used instead of natural gypsum. Practically most of the gypsum produced in power plants is utilised in the plasterboard industry. The purity of gypsum limits the amount of limestone that can be fed into the process.

Co-combustion of waste and recovered fuel

Large combustion plants, designed and operated according to BAT, operate effective techniques and measures for the removal of dust (including partly heavy metals), SO_2 NO_x, HCl, HF and other pollutants as well as techniques to prevent water and soil contamination. In general, these techniques can be seen as sufficient and are, therefore, also considered as BAT for the co-combustion of secondary fuel. The basis for this is that the BAT conclusions and, in particular, the emission levels associated with the use of BAT as defined in the fuel specific chapters. A higher input of pollutants into the firing system can be balanced within certain limits by adaptation of the flue-gas cleaning system or by limitation of the percentage of secondary fuel that can be co-combusted.

Regarding the impact of co-combustion to the quality of the residues, the main BAT issue is maintaining the quality of gypsum, ashes, slag and other residues and by-products at the same level as those occurring without the co-combustion of secondary fuel for the purpose of recycling. If co-combustion leads to significant (extra) disposal volumes of by-products or residues or extra contamination by metals (e.g. Cd, Cr, Pb) or dioxins, additional measures need to be taken to avoid this.

Degree of Consensus
This document as a whole has a lot of support from the TWG Members. However, industry and mainly two Member States did not express their full support for this final draft and stated with so-called 'split views' to some of the conclusions presented in the document, in particular to the BAT associated efficiency and emission levels for coal and lignite, liquid and gaseous fuels, as well as for the use of SCR due to economical reasons. They contested that the ranges given as emission levels associated with the use of BAT are, in general, too low for both new and existing power plants. However, it should be noted that the upper levels of the BAT associated emission levels, in particular for existing plants, are similar to some current ELVs set in some European Member States. Part of industry has expressed a particular view on the extend to which this document reflects the experiences and circumstances of all large combustion plants. This supports the TWG Members view that BAT levels are reasonable and illustrate that the considered BAT levels are already being achieved by a good number of plants in Europe.

The EC is launching and supporting, through its RTD programmes, a series of projects dealing with clean technologies, emerging effluent treatment and recycling technologies and management strategies. Potentially these projects could provide a useful contribution to future BREF reviews. Readers are, therefore, invited to inform the EIPPCB of any research results which are relevant to the scope of this document (see also the preface of this document).