**Factsheet & checklist**

**Sector: Large Combustion Plants**

*Project MK-10-IB-EN-01*

*Activity no: 1.2*

Prepared by:

Cees Braams

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**List of Acronyms**

|  |  |
| --- | --- |
| BATs | Best Available Techniques |
| BAT-AELs | BAT Associated Emission Levels |
| BREFs  | Best Available Techniques Reference Document |
| CCGT | Combined Cycle Gas Turbine |
| CHP | Combined Heat and Power |
| DBB | Dry Bottom Boiler |
| EC  | European Commission  |
| HFO | Heavy Fuel Oil |
| IED | Industrial Emissions Directive 2010/75/EU |
| IGCC | Integral Gasification Combined Cycle |
| IPPC  | Integrated Pollution Prevention and Control  |
| LCP | Large Combustion Plant |
| LFO | Light Fuel Oil |
| PCDD/F | Polychlorinated dibenzo dioxins |
| VOC | Volatile organic Carbon |
| SCR | Selective Catalytic Reduction |
| SNCR | Selective Non-Catalytic Reduction |
| TOC  | Total Organic Carbon |

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# Introduction

This factsheet for large combustion plants contains a short description of this sector as it exists and operates in the Republic of Macedonia. It will be necessary to update this document if the situation in the sector evolves substantially.

To prepare and execute well the environmental inspection of facilities within this sector, this document provides information for inspectors about how this industry works, what are its main environmental impact and pollution abatement measures, and what are the key points for the inspection of these facilities, complemented by a practical inspection checklist. The goal is to facilitate the work of inspectors, ensuring a more uniform inspection approach and quality, and a level playing field for the operators.

Detailed information about production processes and Best Available Techniques (BATs) relevant for this sector can be found in the reference links and documents in Annex 2. This document provides a first introduction and is intended to be a practical tool for inspectors, and for that sake is kept brief.

# What are large combustion installations/plants?

1.
2.

## Production process

Combustion installations/plants for the production of heat and, in many cases electricity by the combustion of gaseous, liquid or solid fuels, exist in many types and are distinguished by the fuel used, the combustion technology, the size of the installation and the purpose of the plant or installation. The largest combustion plants for fossil fuels (and renewables) have still a very important role in the electricity production in most countries. For Macedonia lignite- and gas fired combustion installations are the most important. Approximately 75 % of the electicity generation is from lignite fired powerplants, 15% is from natural gas and 10 % from hydropower.

The most used combustion technology in power plants is pulverised, atomised or direct firing of the fuel in the combustion chamber of a boiler. In all combustion systems fuel energy, (net caloric value), is converted close to 100% to heat. In most applications this released net fuel heat is transferred to and applied in steam processes or mechanical drives. Other important combustion techniques are fluïdised bed combustion (solid fuels, different types), grate firing of solid fuels, combustion engines (reciprocating engines that use diesel, heavy fuel oil and/or gas as fuel) and gas turbines that operate with liquid fuel or gas. Gas turbines are installed in different types of combustion plants such as combined cycle units (CCGT), cogeneration plants (CHP) and integrated gasification combined cycle units (IGCC).

### **Lignite fired combustion**

Fuel preparation: lignite is transferred from the storage yard with belt conveyers (normally under a roof) to the crusher house where its size is reduced by hammer mills and crushers to pieces of 40-80 mm or less. Then the crushed lignite is transported to the boiler bunkers. The lignite moisture is 30-70 % so there is no big risk of dust emission in this stage. At transfer points dust emission may be possible and dedusting installations like air suction and cleaning should be present to guarantee a good working atmosphere inside.

The pulverised fuel is transported to the boiler and burnt in the combustion chamber of the boiler where the thermal energy is used for the generation of steam. The steam is used for heating purposes or, after being processed to superheated steam, it is used for the production of electricity via different stages of steam turbines and generators.

 The combination of the fuel with oxygen requires a temperature high enough for ignition of the constituents, good mixing or turbulence and sufficient time for complete combustion. Unburnt carbon in ash and the formation of carbon monoxide and VOCs account for the losses of fuel energy during the combustion process resulting in a lower effiency. Dry bottom ash furnace / dry bottom boilers (DBB) where the temperature is far below the melting point of the ash is the most common type of boiler for the burning of coal/lignite. The fuel/gas mixture is forced through nozzles in the combustion chamber and burnt with additional combustion air. Separate ignition/pilot burners are used during start-up and for shutdown. These burners are mostly oil- or gas fired. There are different coal-burner configurations for coal and lignite boilers (wall fired, tangentially (corner) fired, vertically fired).

Besides the above described combustion of coal/lignite, also other combustion techniques are appliedlike iffernt types of fluidized bed combustion (mostly in smaller units) and grate firing. The combustion process in grate firing is not as well controlled as in pulverised fuel burners.Grate firing is still an applied technology for smaller coal fire boilers, mainly applied in industrial and local district heating plants

### Gas and liquid (oil) fired combustion

Boilers designed for burning liquid or gaseous fuels are very similar to coal fired boilers. Gaseous fuel is directly combusted with air, while liquid fuels are sprayed into the furnace via nozzles generating very small droplets atomised by high pressure steam and producing a high amount of volatiles. (vapourized hydrocarbons)

Gas turbines are used for the transformation of chemically bound fuel energy into mechanical energy. They are applied for the production of electrical energy and to drive pumps and compressors. Gas turbines are increasingly used for electricity production in base and intermediate loads and for emergency and peak demands in large grids. In isolated areas gas turbines operate with liquid fuel, mainly diesel or heavy fuel oil. Gas turbines are used within a wide range of thermal capacities from 100 kWel until 300 MWel. Usually fueled by natural gas, gas turbines may also use other gases such as low calorific gases from biomass or coal gasification. Heavy duty gas turbines can burn a variety of liquid fuels, however this requires comprehensive off-gas treatment systems.

Gas turbines are often used in cogeneration and combined cycle plants (CCGT). Gas and steam turbine, combined heat and power).

Combustion or reciprocating engines have one or more cylinders in which fuel combustion occurs. The chemical energy of the fuel is converted into mechanical energy in the same way as in automobile motors (Otto or Diesel). Spark ignited Otto engines often work with the lean burn concept which means that there is more air present in the cylinder than needed for the combustion. Dual fuel engines can run on different fuels and operate at full load in both fuel modes.

## Production schemes



Figure 1: Scheme of a coal/lignite fired power plant (boiler type)



Figure 2: Emissions and possible monitoring parameters



Figure 3: Scheme of a CCGT

# Sector description in the Republic of Macedonia

1.

## Power plants and electricity generation

In the Republic of Macedonia electricity is produced in different types of power plants, such as:

* thermo power plants,
* hydroelectric power plants,
* cogeneration or combined heat and power (CHP),
* wind power plants and
* photovoltaic power plants

The total installed capacity for electricity production of facilities in Macedonia is 2.011,25 MW.

The largest electricity producer in Macedonia AD ELEM Skopje.

The total installed capacity of thermo power plants is 1.010 MW, i.e 50.22% of total installed capacity. Two thermo power plants are owned by AD ELEM Skopje (TE REK Bitola and Oslomej) and one thermo power station is owned by AD TEC Negotino (TPP Negotino).

*Thermo power plants in Republic of Macedonia*

|  |  |  |  |
| --- | --- | --- | --- |
| **Title** | **Installed capacity (MW)** | **Estimated annual production (GWh)** | **Location** |
| TE REK Bitola | 675  | 4.600  | Bitola  |
| TE Oslomej | 125  | 700  | Kicevo  |
| TE Negotino | 210  | reserve | Dubrovo  |
| **Total**  | **1.010**  | **5.300**  |  |

The total installed capacity of large hydroelectric power plants with installed capacity exceeding 10 MW is 603,2 MW, i.e. 29.99% of the total installed capacity in the country, of which:

* 8 hydropower plants with a total installed capacity of 571,4 MW are owned by AD ELEM Skopje.
* 2 hydropower plants HPP Kalimanci and HPP Matka with total installed capacity of 23,8 MW are owned by EVN Macedonia AD Skopje.

*Hydropower plants in Republic of Macedonia*

|  |  |  |  |
| --- | --- | --- | --- |
| **Title** | **Installed capacity (MW)** | **Estimated annual production (GWh)** | **Location** |
| HPP Kozjak  | 88  | 150  | Treska River |
| HPP Globocica  | 42  | 191  | Crn Drim River, Struga  |
| HPP Spilje  | 84  | 300  | Crn Drim River, Debar  |
| HPP Tikves  | 116  | 184  | Crna Reka River, Kavadarci  |
| HPP Vrutok  | 213  | 217  | Mavrovo |
| HPP Vrben  |
| HPP Raven  |
| HPP Sv. Petka  | 36,4  | 66  | Treska River  |
| HPP Kalimanci  | 13,8  | 17  | Bregalnica River  |
| HPP Matka  | 10  | 40  | Tresak River  |
| Total  | 603,2  | 1.165  |  |

The total installed capacity for electricity generation from cogeneration plants for electricity and thermal energy is 287 MW, i.e. 14.27% of the total installed capacity in the country. A cogeneration plant ELEM Energy is owned by AD ELEM Skopje, while the other two (Thermo power and heat плант, ТЕ-ТО Balkan Energy Group and KOGEL) are privately owned.

*Cogeneration or combined heat and power (CHP)*

|  |  |  |  |
| --- | --- | --- | --- |
| **Title** | **Installed capacity (MW)** | **Estimated annual production (GWh)** | **Location** |
| ElEM Energy  | 30 | 500 | Skopje |
| TE-TO  | 227 | 1.900 | Skopje |
| KOGEL  | 30 | 600 | Skopje |
| **Total**  | **287** | **3.000** |  |

The energy sector, i.e. electricity production of is one of the sectors that have the greatest impact on the environment as a result of the combustion of poor quality coal-fired power plants. One of the goals of the Strategy for Energy Development in Macedonia is environmental protection and reduce of greenhouse gas emissions. This goal is a part of an action within the Third National Communication on Climate Changes through the Plan to reduce greenhouse gas emissions from the energy sector.

## Applicable legislation

On the ‘Legislation’ section of the website of the State Environmental Inspection (SEI) (<http://www.sei.gov.mk/page_en.asp?ID=2>) there is relevant legislation available.

The relevant legislation includes the following main laws:

* Law on Environment
* Law on Inspection Supervision
* Law on Waters
* Law on Nature Protection
* Law on Protection from Environmental Noise
* Law on Ambient Air Quality
* Law on Waste Management
* Law on Management of Batteries and Accumulators and Waste Batteries and Accumulators
* Law on Management of Packaging and Packaging Waste
* Law on Management of Electrical and Electronic Equipment and Waste Electrical and Electronic Equipment
* Law on Genetically Modified Organisms
* Law on Control of Emissions of Volatile Organic Compounds Resulting from Use of Petrol
* Law on Administrative Procedure
* Law on Misdemeanor
* Criminal Code Law on Criminal Procedure
* Law establishing a State Commission for decisions in the second instance in the area of the inspection supervision and misdemeanor procedures

Additionally, on the website of the Ministry of Environment and Physical Planning (<http://www.moepp.gov.mk>) there are also links to relevant primary and secondary legislation provided. Information about secondary legislation like Rulebooks is available on the website of the Official Gazette ([www.slvesnik.com.mk](http://www.slvesnik.com.mk)).

# Key environmental issues of the sector

## Preliminary information about LCP BREF & applicable BATs

***First important point: the update of the LCP BREF is still under construction and the text and data that are shown in this chapter are not yet definitive (most probably they will be established by the EU only in 2016). The existing BREF dates from 2006; most BATs inside are no longer up to date.***

### Scope of LCP BREF & BAT Conclusions

The scope of the BAT conclusions for LCPs is described in the introduction on chapter 10 of the LCP BREF. The BAT conclusions for LCPs concern combustion of fuels in installations with a total rated thermal input of 50 MWth or more, including plants composed of aggregated units of 15 MWth or more. The fuels considered in the BAT conclusions are any solid, liquid or gaseous combustible material, including:

* Primary solid fuels (hard coal, brown coal, lignite, peat).
* Biomass (e.g. wood, sawdust, bark, straw), and wood waste not contaminated by halogenated organic compounds or metals.
* Primary liquid fuels (heavy and light fuel oil).
* Gaseous fuels (natural gas, hydrogen containing gas and syngas).
* Other industry-specific fuels (production residues and by-products from the chemical and the iron and steel industries).
* Waste, excluding unsorted municipal waste.

A number of activities is not addressed in this BREF (see introduction of chapter 10 for the full list), and so no BAT are established for them in this document. E.g. combustion in process furnaces or heaters, flares, coke battery ovens and post-combustion plants are not under the scope of the LCP BREF.

### 4.1.2. LCP BAT Conclusions

**The general BAT conclusions** describe the Environmental Management System (chapter 10.1.1, BAT 1) with a special point of attention for large combustion plants, concerning the identification of risk points for fuels subject to self-ignition, to set up a survey accordingly to the fuel storage areas.

Chapter 10.1.2 gives the general monitoring BAT. BAT 2 gives a link to the specific monitoring obligations for each different BAT and BAT 3 describes the process parameters that must be monitored in order to ensure a good environmental and combustion performance.

Inaddition chapter 10.1.3 prescribes BAT for a good general environmental and combustion performance (BAT 4, 5 and 6 about fuel treatment, choice and firing, quality control and the shortening of start-up and shutdown periods).

In chapter 10.1.5, BAT 7, a number of techniques is described in order to increase the energy efficiency of combustion plants. Amongst other things these are the use of ultra supercritical and supercritical steam conditions, optimization of the steam cycle, heat recovery during cogeneration, preheating of combustion air, etc.

Chapter 10.1.5 describes BAT for the prevention of diffuse emissions from unloading, storage and handling of fuel and additives (BAT 8 sealing roofs, use of closed-loop systems) and BAT 9 (capture of emissions).

In chapter 10.1.6 the BAT for the reduction of water use and the emission of pollutants in waste water are described. (BAT 10 and 11). This is about water emissions from combustion installations that are fitted with wet abatement techniques for the reduction of pollutants to the air. Table 10.1 contains the BAT-AEL’s for emissions to water from combustion plants that are fitted with wet abatement techniques.

For a **complete list of BATs in LCP BAT Conclusions see reference in Annex 1**.

1.
2.
3.
4. 1.

## Air

### Pollutant substances: SOx, NOx, CO, NH3, HCl, HF, dust, particulate-bound metals and mercury emissions to air

The most important emissions to air from the combustion of solid and liquid fossil fuels are SOx, NOx, CO, CO2 and particulate matter. Heavy metals can be bound to particulate matter and fly ash, with the exception of mercury, that is mostly emitted as a gas. Substances such as hydrogenchloride, hydrogenfluoride, unburnt hydrocarbons, non-methane volatile organic substances and persistant organic pollutants like polycyclic aromatic hydrocarbons and dioxines are also emitted in smaller quatities but if not abated they may have a significant effect on the environment due to their toxicity. Gas fired combustion plants only give emissions of NOx, CO, CO2 and some unburnt methane. Other gases, like blast furnace and coke ovengas may contain sulfur which lead to additional SOx emission.

Large combustion plants are often responsible for a great part of the national emissions due to their size that leads to high use of fuels. The influence on the air quality can be important, however abatement techniques like desulfurization and denitrification of flue gas and the use of electrofilters to abate dust and metal emissions, in combination with high stacks, can considerably limit this influence. The BAT conclusions from the EU BREF document on LCP describe the latest accepted abatement techniques .

***BAT conclusions for the combustion of coal and lignite: (chapter 10.2.1)***

In addition to the BAT for general environmental performance and energy efficiency (BAT 4 and 7) BAT 17 about an integrated combustion process with a higher boiler efficiency and BAT 18 about lignite pre-drying are established. Table 10.2 gives the BAT associated environmental performance levels for the energy efficiency of coal and lignite combustion.

BAT 19 gives the best available techniques to prevent or reduce NOx emissions while limiting CO and NH3 (if SCR or SNCR techniques are used) emissions to air from the combustion of coal and lignite for the different size classes of the combustion installations. (<100 MWth, 100-300 MWth and >300 MWth) .The BAT asssociated emission levels are given in table 10.3.

BAT 21 gives the best available techniques to prevent and reduce the emissions of SOx, HCl and HF from the combustion of coal and lignite for the different size classes of the combustion installations. The BAT-AELs are given in the tables 10.5 and 10.6.

BAT 22 gives the best available techniques to reduce dust and metal emissions from the combustion of coal and lignite with the BAT-AELs in table 10.7.

BAT 23 gives a comprehensive number of techniques in order to reduce the emission of mercury from the combustion of coal and lignite and the tables 10.8 and 10.9 give the BAT-AELs for the different types of fuel and sizes of the installations (for lignite table 10.9).

***BAT conclusions for the combustion of solid biomass and peat (section 10.2.2)***

In addition to the BATs for general environmental performance and energy efficiency (BAT 4 and 7), BAT 24 about fuel classification based on size and quality and BAT 25 to reduce the moisture content of the fuel are established. The BAT associated environmental performance levels are given in table 10.10.

BAT 26 gives the best available techniques to prevent or reduce NOx emissions while limiting CO and NH3 (if SCR or SNCR techniques are used) emissions to air from the combustion of solid biomass and peat for the different size classes of the combustion installations (<100 MWth, 100-300 MWth and >300 ). The BAT asssociated emission levels are given in table 10.11.

BAT 28 gives the best available techniques to prevent and reduce the emissions of SOx, HCl and HF from the combustion of solid biomass and/or peat. The BAT-AELs are given in table 10.12.

BAT 29 gives the best available techniques to reduce dust and metal emissions from the combustion of solid biomass and peat with the BAT-AELs in table 10.13.

BAT 30 gives a number of techniques in order to reduce the emission of mercury from the combustion of solid biomass and/or peat and table 10.14 gives the BAT-AEL.

***BAT conclusions for the combustion of liquid fuels***

In addition to the BAT for energy efficiency (BAT 7), BAT 31 is established in order to increase the energy efficiency of HFO and LFO combustion in burners. The BAT associated energy efficiency levels are given in table 10.15.

BAT 32 gives the best available techniques to prevent or reduce NOx , NH3 and CO emissions to air from HFO and LFO fired boilers.The BAT-AELs for the different sizes of installations (< 100 MWth and > 100 MWth) are given in table 10.16.

BAT 33 gives the best available techniques to prevent and reduce the emissions of SOx, HCl and HF from the combustion in HFO and LFO fired boilers. The BAT-AELs for the SOx emissions are given in table 10.17.

BAT 34 gives the best available techniques to reduce dust and particulate bound metal emissions from the combustion of LFO and HFO in boilers with the BAT-AELs for dust emissions in table 10.18.

For HFO fired reciprocing engines separate BAT and BAT-AELs have been established (BAT 35-39, tables 10.19-10.22) and this is also the case for LFO fired gas turbines (BAT 40-43); tables 10.23-10.25).

***BAT conclusions for the combustion of gaseous fuels***

In addition to the BAT for energy efficiency (BAT 7), BAT 44 is established in order to increase the energy efficiency of natural gas combustion in burners. There is well BAT 45, that describes the use of expansion turbines to recover the energy content of the pressurised supplied fuel gases. The BAT associated environmental performance levels for the energy efficiency of natural gas fired combustion plants are given in table 10.26 (gas fired boilers, open- and combined cycle gas turbines (CCGT)).

In chapter 10.4.1.2 the BAT to reduce the NOx emissions to air from the combustion of natural gas in boilers is described (BAT 46), and also the BAT for the reduction of NOx emissions to air from the combustion of natural gas in gas turbines, while limiting the NH3 slip in the case of SCR use (BAT 47) and the reduction of NOx emissions to air from the combustion of natural gas in engines (BAT 48).

BAT 49 gives the best available techniques in order to reduce CO emissions to air from the combustion of natural gas. The BAT associated emission levels for CO and NOx emissions to air from the combustion of natural gas are given in table 10.27 (gas turbines) and 10.28 (boilers and engines).

BAT 50 describes the best available techniques to reduce non-methane volatile organic compounds (NM-VOC) and methane emissions to air from the combustion of natural gas in spark ignited lean burn gas (SG) and dual fuel (DF) engines. BAT is to ensure complete and stable combustion conditions and/or to apply oxidation catalysts. Table 10.29 gives the BAT associated emission limit values for NMVOC and CH4 emissions to air from the combustion of natural gas in SG or DF engines.

In chapter 10.4.2 the BAT conclusions and BAT associated emission levels for the combustion of iron- and steel process gases are given (BAT 51-58, tables 10.30-10.36, not for EAF).

***BAT conclusions for the combustion of industrial process fuels produced by the chemical industry***

In chapter 10.5.1 the BAT conclusions and the BAT associated emission levels for the combustion of gaseous and liquid fuels that emerge in processes of the chemical industry, including their mixture with commercial fuels are established (BAT 61-69, tables 10.38-10.45). In this chapter BAT–AELs are given for NOx, NH3, CO, SOx, HCl, HF, dust, particulate bound metals, mercury, dioxins and furans and total organic carbon. (TOC).

***BAT conclusions for waste co-incineration***

Chapter 10.6.1 describes the BAT and BAT-AELs for the emissions to air of combustion installations firing waste as part of the combusted feedstock (BAT 70-81, tables 10.46-10.54). In this chapter BAT-AELs are given for NOx, CO, NH3, SOx, HCl, HF, dust, particulate bound metals, mercury, PCDD/F (dioxin) and TOC. Difference is made in some BAT-AELs between co-incineration in coal and lignite fired combustion plants and biomass and peat fired combustion plants.

***BAT conclusions for gasification and Integral Gasification Combined Cycle (IGCC) plants***

(Chapter 10.7, BAT 82-85, BAT-AEL tables 10.55-10.57). These installations are not present in Macedonia.

### Odour

Odour emissions may occur due to storage and handling of liquid fuels and/or biomass. Chapter 10.1.5 describes the BATs to reduce VOC emissions to air from the storage of liquid fuels (BAT 8). The BAT in the „BREF Emissions from Storage” must also be applied in these cases.

BAT 9 describes the best available techniques to reduce diffuse emissions to air , including odorous substances, from the unloading, storage and handling of fuels, waste and additives. BAT 71 about the storage of handling and waste to be co-incinerated is also applicable.

### Greenhouse gases

The emission of greenhouse gases is not regulated in BREFs but in other relevant European policy instruments like the Emission Trading System (ETS). However, the general chapter 10.1.4, BAT 7 (Energy efficiency) is applicable for combustion plants and installations.

In different BATs in the LCP BREF additional best available techniques for the improvement of the energy efficiency are given (BAT 18, 25, 31, 35, 40, 44, 51, 64, 73, 82).

## Noise and vibrations

Noise and vibration are common issues arising from the use of LCPs. The most significant sources are the transport and handling of fuels, residues and by products, the use of large pumps and fans, safety valves, cooling techniques and the steam and gasturbines. The impact of the noise of a LCP is limited to a relatively close area around the installation.

In chapter 10.1.8 of the LCP BREF the BATs to reduce noise emissions from relevant sources in combustion plants (e.g. boiler soot-blowers, cutting-straw hammer-mills, fuel pneumatic transport to the burner) are given (BAT 14).

Strategic planning of the location, a noise reduction programme, low-noise equipment, operational and management techniques, noise reducers, vibration insulation, enclosure of noisy equipment, soundproof buildings and noise abatement are the most important elements of the BAT.

## Waste water

LCPs are also a significant source of water pollution (waste water and cooling water). Depending on the type of fuel used, the cooling technique, the abatement techniques, the amount of water used and the reagents that are added for chemical and biological treatment and for maintenance purposes, water quality problems may occur. Due to the thermal efficiency of the combustion cycle always a significant portion of the energy is dissipated as energy loss in the surrounding water. Many LCPs consume large amounts of cooling water. In permits often limits are set for discharging water in order to prevent too high temperatures in the receiving waters. The relevant polluting parameters are given in the description in the LCP BREF (chapter 1.3.3) and can differ for specific installation

In chapter 10.1.6 the BATs for the reduction of water consumption and the volume of contaminated water are described (BAT 10). BAT 11 gives the best available techniques to reduce the emission of pollutants to the receiving water (mechanical treatment, physico-chemical treatment, zero-liquid discharge). In table 10.1 BAT-AELs for emissions to water from combustion plants fitted with wet abatement techniques are given.

## Soil and groundwater

Techniques for the prevention of emissions to soil and groundwater are described in section 3.3.7. of the BREF. In particular measures to prevent leaching of metals and chemicals from open storages and transport equipment must be abated by the use of sealed surfaces with drainage systems and eventually treatment in settling ponds,

The BAT for prevention of soil and groundater contamination is described in chapter 10.1.9. BAT 15 describes the measures to prevent soil and groundwater contamination from the unloading, storage and handling of solid fuels and additives (storing fuels on sealed surfaces with drainage, collecting and treating before discharge of leakages and run-off rainwater from fuel storage).

##  Waste

The combustion of fossil fuels (solid and liquid) generates a variety of by products and residues. The most important are slag, fly- and bottom ash and gypsum from desulphurisation units. Most of these residues and by products can be reused, as raw material for building and construction activities.

Chapter 10.1.7 deals with waste, by-products and residues management. BAT 12 prescribes a waste management plan that ensures that waste is avoided, reused, recycled, recovered or safely disposed of. BAT 13 gives best available techniques to reduce the quantities of wastes from the combustion process and abatement techniques sent for disposal and to organise operations on the site to maximise the proportion of residues which arise as by-products, waste reuse acording to the specific requested quality criteria, waste recycling and other recovery by implementing technical measures (described in BAT 13).

## Safety

In the IED no conditions and prescriptions about safety aspects like storage of hazardous substances are given, so in the BREF documents BAT for these and other safety aspect will not be found. The Seveso-III Directive (2012/18/EU) about the prevention of major accidents involving dangerous substances is applicable in this case. The Directive covers establishments where dangerous substances may be present (e.g. during processes or in storage) in quantities above a certain treshold. The Directive describes the main obligations for member state authorities and operators. In the Republic of Macedonia until now only the Seveso-II Directive is transposed as a Chapter within the Law on Environment.

## Administrative organisation / Internal control

### Environmental management system

BAT 1 (in the section „General BAT Conclusions”) describes all elements of the environmental management system for the sector. The BREF „Reference Document on the General Principles of Monitoring” (see Annex 1) must also be taken into account. The scope (e.g. level of details) and nature of the EMS (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.

For the Large Combustion Plants sector it is important to consider to identify risk points for fuels subject to self-ignition and to survey the fuel storage areas accordingly.

### Self-monitoring and reporting

Chapter 10.1.2 describes the monitoring obligations in general (BAT 2 and BAT 3).

BAT 2 states that application of best available techniques requires that emissions to air after all the flue gas treatment steps and before mixing with other flue gases and releasing, should be monitored (water at the point of discharge) for the pollutants given in each BAT-AEL table of the BAT conclusions with at least the frequency indicated in the same table and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.

In order to ensure general good environmental and combustion performance BAT 3 demands the additional monitoring of process and environmental parameters, like energy output, waste generation, waste water flow, noise level and particulate bound metals and N2O in specific cases.

## Other environmental issues

### Energy consumption and efficiency

In chapter 10.1.5, BAT 7, a number of techniques is described in order to increase the energy efficiency of combustion plants. Amongst other things these are the use of ultra supercritical and supercritical steam conditions, optimization of the steam cycle, heat recovery during cogeneration, preheating of combustion air etc.

In different BATs in the LCP- BREF additional best available techniques for the improvement of the energy efficiency are given (BAT 18, 25, 31, 35, 40, 44, 51, 64, 73, 82).

### Natural resources management

BAT 1 ( Environmental management system), BAT 5 (fuel characterisation), BAT 6 (start-up and shut down periods) and (BAT 16 about plant decommissioning) of the BAT conclusions document of the LCP BREF are applicable and describe obligations in order to improve the natural resources management of the combustion plants and instllations.

# The inspection

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## Preparation before inspection

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### Decide on type/duration of inspection

The inspection team shall decide on the type of inspection and on the resources, including staff and equipment, which will be assigned to the task. Examples of inspection types can be routine inspection of all production processes or targeted inspection of problematic areas on the basis of complaints or in case that there are indications that critical emission limit values (ELV) cannot be met.

The following aspects should be taken into account:

* Complexity and duration of the installation - the more complex it is the more inspectors that may be needed
* Time of inspection - for safety reasons it is recommended that at night two inspectors should conduct inspection;
* For non-routine inspection, especially conducted upon a complaint and problematic situation, it is advisable to direct two inspectors to it;
* Weather condition as well as the time of a year - some additional equipment might be needed (e.g. torches, protective clothes, etc.).
* The resources needed (man-power/equipment, safety precautions)
* In relation to the previous point, it is recommended to have a check-list of the equipment needed (including safety gear, sampling equipment in case sample taking is required, laptop if available and convenient…).

### Desk study

The collection and evaluation of existing information about the installation is critical for the success of the inspection since it allows the easier formulation of targeted questions for the interview of the operator and the concrete investigation of those unit operations which show the highest potential for not complying with the conditions set in the decision on the EIA or surpassing the set ELV in the environmental permit. **Examples of** **information to be collected** are listed below:

1. Reports of previous inspections of the site
2. Maps
3. Environmental Impact Assessment (decision, study, monitoring plan, monitoring reports)
4. Application for the permit
5. Environmental permit/s
6. Environmental reports submitted by operators, including monitoring reports
7. Complaints received about the installation
8. BREF for Large Combustion Plants: 1st Draft second BREF (June 2013), chapter 10 on BAT conclusions (<http://eippcb.jrc.ec.europa.eu/reference/BREF/LCP_D1_June_online.pdf> ).
9. PRTR and other registers such as register of polluting substances into air, register of waste producers and managers
10. Information on installation to be inspected received from other competent authorities
11. Information available on the website of the operator

On the basis of the evaluation of the collected information **the following has to be prepared**:

* A comprehensive questionnaire which will be used for the operator’s interview
* A **check list** to facilitate the inspection (see next subsection).
* An outline of the “critical” ELV (i.e. those parameters which significantly contribute to the pollution load coming out of the installation)
* The list of BATs (according to the issued permit) which the operator should have installed and operated
* The list of documentation to be provided by the operator (e.g. self-monitoring records, annual reports submitted to the authorities)
* The inspection minutes and report templates (tailor-made for the installation) to be filled in at the end of the inspection
* **Agenda of the inspection** (see next subsection).

### Templates for agenda of the inspection and checklist

**You can use** as starting, **partially completed, checklist template** the one **in Annex 4**, which is **tailored to this sector**.

A **short agenda** can be a **very useful** tool that will help to conduct an inspection. Providing an operator with it in advance may result in more smooth coordination of the inspection from his/her side, simply because the operator will be aware of how many resources and people they will have to allocate to the inspection. Preparing such a document before an inspection is not time-consuming, you can **use the template of inspection agenda in Annex 2**.

### Prior operator notification

* Routine inspections. The operator shall be previously notified of routine inspections as provided in the Law on Inspection Supervision.
* Non-routine inspections. There is not an obligation to notify operators of non-routine inspections. Therefore, in case of inspections carried out to verify if the operator is in line with environmental regulations, as a consequence of complaints by citizens or for other reasons, it is not recommended to notify operators previously.

## On site inspection

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### General considerations to take into account

The aim of the inspection will be to **check compliance** of the operator **with** the operating/environmental conditions set in the issued **permit**.

1. Identify yourself. Clearly introduce yourself and show your identification card at the beginning of each inspection.
2. Explain purpose of visit
3. The operating/environmental conditions set in the issued **permit will be the „guidance”** throughout the inspection.
4. If necessary take **samples**, and/or define the samples that should be taken by a certified laboratory
5. **Always record your inspection with photographs and/or videos**, they are fundamental as a proof in Court

#### Best Available Techniques (BATs)

It must be checked that all BATs that are prescribed in the permit are present and that the corresponding Emission Limit Values are met. For installations falling under the scope of the IED, if a necessary BAT-Associated Emission Level (BAT-AEL) is not in the permit it must be checked if there is an explanation as prescribed by the article 15.4 in the IED[[1]](#footnote-1). If there is no (good) explanation, feedback to the permit writer and the operator must be given. If a BAT prescribed in the permit is present, works properly but the ELV is not met, possible alternatives can be discussed with the permit writer and the operator.

### Main questions for inspection

The major points of interest for inspection for the Large combustion Plants sector (lignite or natural gas fired power plants, boiler or CHP technology) are the following:

#### Air emissions

 **Pollutant substances to air from coal or lignite fired power plants or installations**

* Check whether BAT 4, 7, 17 and 18, the BATs to achieve complete combustion, to increase the energy efficiency, to improve the general environmental performance, and about lignite pre-drying have been drawn up in the permit. Check when they are not in the permit, if there is an explanation in the permit according to the derogation article in the IED (15.4). Check if these BATs eventually are installed and work properly.
* Check whether BAT 19, 21, 22 and 23 have been installed and properly operated and the respective ELV are met. These BATs concern the abatement of the emissions to air of NOx, SO2, HCl, HF, dust, particulate bound heavy metals and mercury.

**Pollutant substances to air from combustion of solid biomass and peat**

* Check whether BAT 4,7, 24 and 25 are applicable, have been taken into the permit and eventually are installed. These BATs concern the complete combustion, increase of energy efficiency, the general environmental performance and the reduction of the moisture content in the fuel.
* Check whether BAT 26,28, 29 and 30 have been installed and properly operated and whether the respective ELV’s are met. These BATs concern the abatement of the emissions to air of NOx, NH3, CO, SO2, HCl ,HF, dust and particulate bound heavy metals

**Pollutant substances to air from combustion of liquid fuels**

* Check whether BAT 7 and 31 are applicable, have been taken into the permit and eventually installed. These BATs concern the complete combustion and the increase of the energy efficiency.
* Check whether BAT 32, 33 and 34 have been installed and properly operated and whether the respective ELV’s are met. These BATs concern the abatement of the emissions to air of NOx, NH3, CO, SO2, HCL, HF, dust and particulate bound heavy metals.
* For reciprocating engines the same applies, if applicable for the BATs 35-39 and for LFO gas turbines if applicable the BAT 40-43. The BATs 35 to 39 concern increase of the energy efficiency and the abatement of the emissions to air of NOx, NH3, CO, TOC, SO2, HCl, HF, dust and particulate bound heavy metals and the BATs 40-43 concern increase of energy efficiency and the abatement of the emissions to air of NOx, NH3, CO SO2 and dust.

**Pollutant substances to air from the combustion of gaseous fuels**

* Check whether BAT 7, BAT 44 and BAT 45 are applicable, have been taken into the permit and eventually installed. These BATs concern increase of the energy efficiency and the use of expansion turbines.
* Check whether BATs 46, 47, 48, 49 and 50 have been installed and properly operated and whether the respective ELV’s are met. The BATs concern the reduction of the emissions to air of NOx, CO, NMVOC and methane in boilers, gas turbines and engines.

#### Odour

* If applicable check whether BAT 8 and 9 are taken into the permit and properly operated. These BATs concern the reduction of VOC emissions and diffuse emissions including odorous emissions to air.

#### Greenhouse gases

* Check if requirements for energy efficiency are applicable, taken into the permit and implemented (one of these BATs: 18, 25, 31, 40, 44, 51, 64, 73, 82 depending on the type of combustion installation and fuel used). These BATs concern different techniques for the increase of energy efficiency.

#### Noise – vibrations (see 4.2)

* Check whether BAT 14 is applicable and implemented. This BAT contains a number of technical measures that can be used independent or in combination and also contains measures in the field of spatial planning.

#### Wastewater (see 4.3)

* Check whether BAT 10 and 11 are applicable and implemented. These BATs concern measures for reduction of water use and a number of techniques that must be used in combination to abate the emissions to surface water.

#### Soil and groundwater (see 4.4)

* Check whether BAT 15 is applicable and implemented. This BAT contains a number of prevention measures to protect soil and groundwater to be applied for storage and handling.

#### Waste (see 4.5)

* Examine to which extent waste minimisation techniques are applied (BAT 12). This BAT prescribes the establishment of a waste management plan.

#### Safety (see 4.7)

* Safety aspects are outside the scope of the BREF; the obligations of the Seveso Directive (III) must be implemented and applied for the establisment.

#### Environmental management system (see 4.8)

* Check the necessary elements of the EMS for the combustion plant or installation according to the elements described in BAT 1. This BAT contains a number of criteria (10) that have to be checked (see also Annex 2 of the Inspection Manual).

#### Self monitoring and reporting

* Check whether the monitoring obligations as described in BAT 2 and 3 are implemented in the permit and are applied in practice, according to the frequency and standards that are prescribed in the relevant BATs.

#### Energy consumption and efficiency

* Check if techniques described in BAT 7 if applicable are implemented. (Improvement of energy efficiency
* Check if requirements for energy efficiency are applicable, taken into the permit and implemented (one of these BATs: 18, 25, 31, 40, 44, 51, 64, 73, 82 depending on the type of combustion installation and fuel used). See also 5.2.1.3

### Obstruction by the operator

It may happen sometimes that an operator does not want to have an inspector in his/her factory and closes the door for him/her. If this is the case you are entitled to call a state administration body for assistance/police.

But this is not the only way an operator can obstruct your job. Other ways may include such things as:

* Not providing information explaining at the same time that all is confidential
* Trying to ask you for giving them a few additional days for preparation of information that is needed
* Trying to discourage inspectors from visiting "difficult" places such as for example areas where waste is improperly stored.

It must be kept in mind that an obstruction by an operator is considered to be a misdemeanor.

## After the inspection

### Inspection reporting

After the inspection, according to EU best practices, the inspector has to draft a final inspection report. A template for such report has been delivered within this Twinning project and is available at SEI’s website (see Annex 1 for more information). The main contents of such a report are the following:

1. Baseline of the inspection
* Inspection basis (permit, legal regulations)
* Competent inspection authority, cooperating inspection authorities
* Kind of installation (e. g. slaughterhouse, meat processing)
* Operator (Name of the company)
* Address
* Date of inspection
* Length of inspection time
* Scope of the inspection (e. g. integrated inspection, media that were inspected, parts of the installation that were inspected)
* Kind of inspection (regular, extraordinary, control)
1. Inspection’s results
* No or only minor non-compliances
* Significant or relevant non-compliances
* Serious or important non-compliances
1. Recommended corrective measures
* Minor corrective measures
* Significant or major corrective measures
* Serious or important corrective measures

### Inspection recording

The inspection report and any other additional material used for the preparation of the inspection should be stored and made accessible to any relevant authorities for their information.

1.

# Annex 1: Useful references & links

|  |  |
| --- | --- |
| **Document / information** | **Link** |
| Website of the State Environmental Inspectorate, with useful materials, including inspection manual, factsheets and checklists | [www.sei.gov.mk](http://www.sei.gov.mk) |
| Best Available Techniques Reference Document for the Large Combustion PlantsJoint Research Centre Sevilla, Draft 1, June 2013 | <http://eippcb.jrc.ec.europa.eu/reference/>  |
| Reference Document on Best Available Techniques for Energy Efficiency, February 2009 | <http://eippcb.jrc.ec.europa.eu/reference/>  |
| Reference Document on Best Available Techniques on Storage, July 2006 | <http://eippcb.jrc.ec.europa.eu/reference/> |
| Reference Document on Best Available technique for the Waste Treatments Industry, August 2006 | <http://eippcb.jrc.ec.europa.eu/reference/>  |
| Reference Document on Economics and Cross-Media Effects, July 2006 | <http://eippcb.jrc.ec.europa.eu/reference/>  |
| JRC Reference Report on Monitoring of Emissions from IED-installationsIndustrial Emissions Directive 2010/75/EU Joint Research Centre, Final Draft October 2013  | <http://eippcb.jrc.ec.europa.eu/reference/>  |

# Annex 2: Template for an inspection agenda

**AGENDA FOR THE INSPECTION**

*Name of the company*

*Data of the inspection*

*n. of IPPC A/B permit*

This Agenda for the inspection defines and plans the in situ activities; it defines the type of investigations to be performed (identification of key environmental issues) and how to investigate the defined topics (administrative or technical check by means of direct inspection on the plant). The Agenda is delivered to members of the inspection team and the operator during the preliminary meeting .

***Composition of Inspection Group***

The Inspection Group (IG) is composed of the following technical officials :

*Name – Administration* (Leader of the IG)

*Name – Administration*

xxx

xxx

**Timing and execution of the inspection**

The inspection will be conducted according to the following program:

***Day/month/year***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Subject** | **Activities** | **Time** | **Who / Staff needed** |
| Step 1 | Opening meeting | Presentation of the Agenda and the inspection teamPresentation and current status of the plant (production capacity and planimetry to check differences with the authorized layout) by the Operator | 9.00 | IG LeaderLegal responsible of the plantRepresentative of the plant in charge of environmental issues |
| Step 2 | Administrative inspection | *xxxxx*  | 11.00 | *xxx* |
| Step 3 | Site visit  | Check BAT Application | 12.00 | Representative of the plant in charge of environmental issues |
| Lunch 13.30 -14.30 |
| Step 4 | Site visit  | Waste storage | 14.30 | Representative of the plant in charge of environmental issues |
| Step 5 | Site visit  | Water treatment plant | 15.00 | Representative of the plant in charge of environmental issues |
| *Step xxx* | *xxx* | *xxx* | *xxx* | *xxx* |
| Step xx | Minutes of the inspection  | Drafting and projecting the minutes of the inspection.  | 16.00 | Legal responsible of the plant |
| Step xx | Conclusive meeting | Conclusions | 17.30 | Legal responsible of the plantRepresentative of the plant in charge of environmental issues |

***Documents to be prepared by the operator***

* Updated planimetry of the plant, indicating:
* Water discharge points
* Air emissions points
* Waste storage areas
* *xxxxxx;*
* Environmental Management System certificate.
* Analysis certificate provided by certified laboratory of last monitoring analysis.
* Communication to Competent Authority related to Incidents.
* *xxxxx.*

# Annex 3: Sector terminology

A Supercritical steam generator is a type of boiler that operates at supercritical pressure, frequently used in the production of electric power. A supercritical steam generator operates at temperatures above the critical pressure 22 MPa in which bubbles can form. Instead liquid water immediately becomes steam. Water passes below the critical point as it does work in a high pressure turbine and enters the generators condenser, resulting in slightly less fuel use and less CO2 emission. In an ultra supercritical steam generator even higher temperatures and pressures are reached which mean higher efficiency and less emission of greenhouse gases.

# Annex 4: Inspection checklist for large combustion plants

1. Art.15.4 of the IED states the following:

The competent authority may, in specific cases, set less strict emission limit values than BAT-AELs. Such a derogation may apply only where an assessment shows that the achievement of emission levels associated with the BATs as described in BAT conclusions would lead to disproportionately higher costs compared to the environmental benefits due to:

(a) the geographical location or the local environmental conditions of the installation concerned; or

(b) the technical characteristics of the installation concerned.

The competent authority shall document in an annex to the permit conditions the reasons for the application of the derogation including the result of the assessment and the justification for the conditions imposed.

The ELVs set in accordance with the derogation shall, however, not exceed the ELVs set out in the Annexes to the IED, where applicable.

The competent authority shall in any case ensure that no significant pollution is caused and that a high level of protection of the environment as a whole is achieved.

The competent authority shall re-assess the application of the derogation as part of each reconsideration of the permit conditions pursuant to Article 21 of the IED. [↑](#footnote-ref-1)