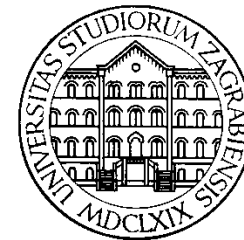




FKITMCMXIX

Faculty of Chemical Engineering and Technology
University of Zagreb



BAT in Chemical Industry

Prof. dr. sc. Ante Jukić



Industrial Emissions

Prevention and control of industrial emissions

Industrial activities play an important role in the economic well-being of Europe contributing to sustainable growth but can also have a significant impact on the environment.

The largest industrial installations account for a considerable share of total emissions of key atmospheric pollutants and also have other important environmental impacts, including emissions to water and soil, generation of waste and the use of energy.

Environmental impacts of industrial installations have therefore been subject to EU-wide legislation for some time. The following main pieces of legislation currently apply:

- **Directive 2010/75/EU on industrial emissions (IED)**: This establishes the main principles for permitting and control of large industrial installations based on an **integrated approach and the application of best available techniques (BAT)**. **BAT is the most effective techniques to achieve a high level of environmental protection, taking into account the costs and benefits.**

- **Directive (EU) 2015/2193 on medium combustion plants (MCPD)**:

The MCPD regulates emissions of sulphur dioxide, nitrogen oxides and dust from the combustion of fuels in plants with a rated thermal input between 1 and 50 MW thermal.

- **Directive 1994/63/EC** and **Directive 2009/126/EC** on **petrol storage & distribution**:

These related directives reduce volatile organic compound emissions to the atmosphere by imposing measures on storage and distribution of petrol.

- **Regulation 166/2006** on the **European Pollutant Release and Transfer Register**:

This register gives public access to detailed information on the emissions and the off-site transfers of pollutants and waste from around 30 000 industrial facilities.

IED scope – environmental issues

emissions
to air

emissions
to water

emissions
to land

prevention
and control
of accidents

waste prevention
and recovery

energy &
water use

noise

vibration

heat

odour

Successes in reducing industrial emissions

Specific case studies provide evidence of progress towards cleaner industry and improved environmental quality.

BEST AVAILABLE TECHNIQUES (BAT) FOR PREVENTING AND CONTROLLING INDUSTRIAL POLLUTION



Activity 1:
Policies on BAT or similar
concepts Across the World



BEST AVAILABLE TECHNIQUES (BAT) FOR PREVENTING AND CONTROLLING INDUSTRIAL POLLUTION



Activity 2:
Approaches to Establishing
BAT Around the World



BREFs and BAT conclusions

Best Available Techniques (BAT) are identified through an exchange of information with experts from Member States, industry and environmental organisations.

This process results in **BAT Reference documents (BREFs)**.

BREFs contain BAT conclusions which are adopted by the Commission as Implementing Decisions.

All finalised BREFs and adopted BAT conclusions can be found at this link: [BREFs and BAT conclusions](#)



European Commission > EIPPCB > Reference Documents

European IPPC Bureau

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Reference Documents

The table below presents, in alphabetical order, the list of reference documents that have been drawn (or are planned to be drawn) as part of the [exchange of information](#) carried out in the framework of Article 13(1) of the [Industrial Emissions Directive \(IED, 2010/75/EU\)](#).

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Name	Code	Adopted/Published Document	Formal draft	Kick off meeting report	Status
Ceramic Manufacturing Industry	CER	BREF (08.2007)			Review started
Common Waste Gas Treatment in the Chemical Sector	WGC		D1 (11.2019)	MR (09.2017 and 03.2018)	Review started

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Ceramic Manufacturing Industry	CER	BREF (08.2007)			Review started
Common Waste Gas Treatment in the Chemical Sector	WGC		D1 (11.2019)	MR (09.2017 and 03.2018)	Review started
Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector	CWW	BREF BATC (06.2016)			Published
Economics and Cross-media Effects	ECM	REF (07.2006)			Document formally adopted
Emissions from Storage	EFS	BREF (07.2006)			Document formally adopted
Energy Efficiency	ENE	BREF (02.2009)			Document formally adopted
Ferrous Metals Processing Industry	FMP	BREF (12.2001)	D1 (03.2019)	MR (11.2016)	Document formally adopted
Food, Drink and Milk Industries	FDM	BREF BATC (12.2019)			Published
Industrial Cooling Systems	ICS	BREF (12.2001)			Document formally adopted
Intensive Rearing of Poultry or Pigs	IRPP	BREF BATC (02.2017)			Published
Iron and Steel Production	IS	BREF BATC (03.2012)			Published
Large Combustion Plants	LCP	BREF BATC (07.2017)			Published
Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilisers	LVIC-AAF	BREF (08.2007)			Document formally adopted

JRC SCIENCE AND POLICY REPORTS

Best Available Techniques (BAT) Reference Document for the Refining of Mineral Oil and Gas

*Industrial Emissions Directive
2010/75/EU
(Integrated Pollution
Prevention and Control)*

Pascal Barthe, Michel Chaugny, Serge Roudier,
Luis Delgado Sancho

2015



Best Available Techniques Reference Document for the Refining of Mineral Oil and Gas

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❖ Relevant IED Definitions

- Art. 3(11) IED: "**BAT reference document**" (**BREF**)= document resulting from the exchange of information under Art. 13 (for defined activities)
 - Art. 3(12) IED: "**BAT conclusions**" = document containing the parts of BREF laying down the conclusions on BAT, their description, information to assess their applicability, the emission levels associated with the BAT, associated monitoring, associated consumption levels and, where appropriate, relevant site remediation measures
 - Art. 3(13) IED: "**Emission levels associated with the best available techniques**" (**BAT-AEL**) = *range* of emission levels obtained under normal operating conditions using a BAT or a combination of BAT, as described in BAT conclusions, expressed as an average over a given period of time, under specified reference conditions
-
- ❖ "**Environmental performance levels associated with the best available techniques**"
 - BAT-AELs
 - Non-emission BAT-AEPLs, including consumption levels (e.g. water), efficiency levels (e.g. energy use) and narrative environmental performance (e.g. waste management with priority to re-use)

Definition of Best Available Techniques (BAT): Art. 3(10) IED

Best

most effective in achieving a **high general level of protection** of the environment as a whole

Available

developed on a scale to be implemented in the relevant industrial sector, **under economically and technically viable conditions**, advantages balanced against costs

Techniques

the **technology** used *and* the way the installation is **designed, built, maintained, operated and decommissioned**

(2bis) BAT defined on the basis of 12 criteria listed in Annex III IED

1. the use of low-waste technology;
2. the use of less hazardous substances;
3. the furthering of recovery & recycling of substances generated/used in the process and of waste,
4. comparable processes/facilities/methods of operation that tried successfully on industrial scale;
5. technological advances and changes in scientific knowledge and understanding;
6. the nature, effects and volume of the emissions concerned;
7. the commissioning dates for new or existing installations;
8. the length of time needed to introduce the best available technique;
9. the consumption/nature of raw materials (incl. water) used in the process and energy efficiency;
10. need to prevent/reduce to a minimum overall impact of emissions upon envir. and the risks to it;
11. need to prevent accidents and to minimise the consequences for the environment;
12. information published by public international organisations.

(3(i)) Role of the BAT Conclusions in setting permit conditions – Typical content of BAT Conclusions

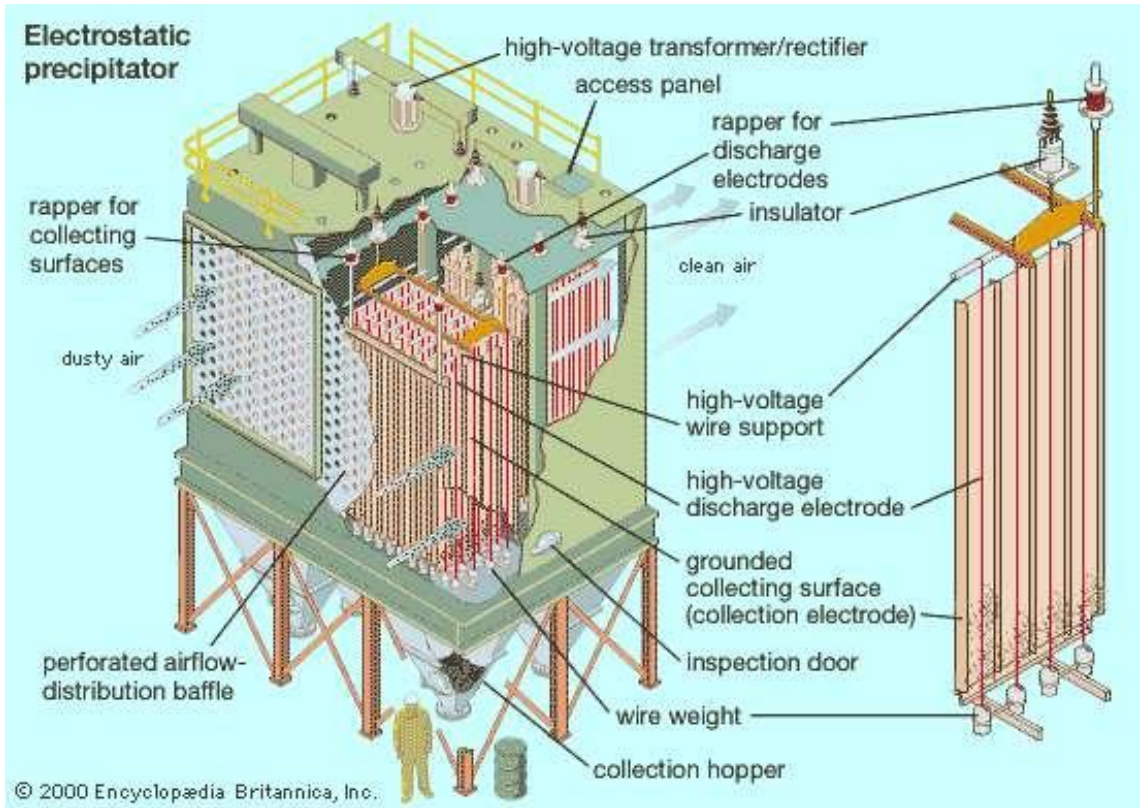
- **Typically between 15 and 70 Conclusions, including description of techniques as possible BAT and on the basis of which BAT-AEPLs have been set**
- **Topics covered (depends on sector) could include:**
 - Environmental management systems
 - Noise
 - Emissions to soil and groundwater
 - Energy management and efficiency
 - Odour
 - Management of waste and residues and reuse
 - Monitoring
 - Emissions to air
 - Emissions to water
 - Water use

Air pollution control, the techniques employed to reduce or eliminate the emission into the [atmosphere](#) of substances that can harm the [environment](#) or human health. The control of [air pollution](#) is one of the principal areas of [pollution control](#), along with [wastewater treatment](#), [solid-waste management](#), and [hazardous-waste management](#).

Control of particulates - Airborne particles can be removed from a polluted airstream by a variety of physical processes. Common types of equipment for collecting fine particulates include cyclones, scrubbers, electrostatic precipitators, and baghouse filters. Once collected, particulates adhere to each other, forming agglomerates that can readily be removed from the equipment and disposed of, usually in a [landfill](#).



cyclone collector, for removing relatively coarse particulates from the air. Small cyclone devices are often installed to control pollution from mobile sources.



electrostatic precipitator, a common particle-collection device at fossil-fuel power-generating stations.

Example of BAT defined in BAT Conclusions on large combustion plants (Section 8 *Description of techniques*)

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

Technique

Description

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 DeSONOX processes.** They can be applied either alone or in combination with other primary techniques in coal-fired PC boilers.

Example of BAT defined in BAT Conclusions on production of pulp paper and board (Section 1.7 *Description of techniques*)

1.7.1.2 Techniques for the prevention and control of NO_x emissions to air

Technique	Description
Reduction of air/fuel ratio	The technique is mainly based on the following features:
—	careful control of air used for combustion (low excess oxygen),
—	minimisation of air leakages into the furnace,
—	modified design of the furnace combustion chamber.
Optimised combustion and combustion control	Based on permanent monitoring of appropriate combustion parameters (e.g. O ₂ , CO content, fuel/air ratio, un-burnt components), this technique uses control technology for achieving the best combustion conditions. NO _x formation and emissions can be decreased by adjusting the running parameters, the air distribution, excess oxygen, flame shaping and the temperature profile.



Training package on Industrial Emissions Directive



In this section you can download training tools that have been developed by the European Commission as a support to all training structures and trainers with a special interest in the Industrial Emissions Directive. They can be used in a European, national or local training context, and be adapted to specific needs and target groups.

What can be found in the training package on the Industrial Emissions Directive?

The present training package aims at facilitating the design and development of training workshops on EU Environmental Assessment Law with special focus on Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) Directives including the following topics:

- Introduction to the EU Industrial Emissions Directive (IED)
- Best Available Techniques (BAT) conclusions
- Implementation of the IED – most important legal issues
- Large combustion plants and their specific situation
- Enforcement of EU and national law on industrial emissions with a focus on inspections and penalties
- Public participation in the Framework of the EU Industrial Emissions Directive
- Preliminary reference procedure invoking non-compliance with the EU Industrial Emissions Directive

Material of the training package:

- [Documentation on the Topic \(collected legislation, CJEU case law, policy documents and reports, Implementation Guidelines and Fact Sheets\)](#)
- [User's and Trainer's Manual](#)
- Presentations on the aforementioned topics (ppt and trainer's notes)
 - [David Grimeaud – Introduction to the Industrial Emissions Directive \(IED\) 2010/75/EU](#)
 - [David Grimeaud – Best available technique \(BAT\) conclusions](#)
 - [Peter Vajda – Implementation of the IED – most important legal issues](#)
 - [Peter Vajda – Large combustion plants and their specific situation](#)
 - [Vojtech Vomáčka – Enforcement of EU and national law on industrial emissions with a focus on inspections and penalties](#)
 - [Magdalena Bar – Public participation and access to justice in the IED](#)
 - [Matthias Keller – Preliminary reference procedure in context: Invoking non-compliance with the IED](#)
- Case Studies and their solutions on the aforementioned topics
 - [Peter Vajda – Case study on the legal issues with regard to the implementation of the IED](#)
 - [Peter Vajda – Case study on the legal issues with regard to the implementation of the IED - Solution](#)
 - [Magdalena Bar – Case study on public participation in environmental matters with a focus on the IED](#)
 - [Magdalena Bar – Case study on public participation in environmental matters with a focus on the IED - Solution](#)
 - [Matthias Keller – Case study on the role of a judge when dealing with files on the IED – preliminary ruling](#)
 - [Matthias Keller – Case study on the role of a judge when dealing with files on the IED – preliminary ruling - Solution](#)
- E-Learning on EU Law on Industrial Emissions

Data on industrial emissions

Information is published annually on emissions from large industrial facilities.

This Europe-wide register provides easily accessible environmental data on industrial facilities in European Union Member States as well as Iceland, Liechtenstein and Norway. For each facility information is provided on the pollutant releases to air, water and land as well as off-site transfers of waste for the year 2007 onwards.

Some information on releases from diffuse sources is also available.

To access this information go to the [European Pollutant Release and Transfer Register \(E-PRTR\)](#).

BEST AVAILABLE TECHNIQUES (BAT) FOR PREVENTING AND CONTROLLING INDUSTRIAL POLLUTION



Activity 3:
Measuring the Effectiveness
of BAT Policies

HOW DO COUNTRIES DETERMINE BEST AVAILABLE TECHNIQUES (BAT) AND PERMIT CONDITIONS FOR PREVENTING AND CONTROLLING INDUSTRIAL POLLUTION?

Relevant industries are selected for BAT-based environmental permitting.

Multi-stakeholder groups are set up to determine BAT, representing government, industry and NGOs.

1 INFORMATION COLLECTION

Information is collected on pollution prevention and control techniques, emission and consumption levels, and important contextual information.



2 EVALUATION OF TECHNIQUES AND DATA

The data on techniques and other relevant elements are evaluated, considering technical, environmental and economic criteria.



3 BAT REFERENCE DOCUMENTS

BAT and associated environmental performance levels (BAT-AEPLs), including emission levels, are established and presented in BAT Reference Documents (BREFs).



4 ENVIRONMENTAL PERMITS

Permit authorities translate the BAT-AEPLs into environmental permit conditions, including emission limit values.



HOW CAN COUNTRIES STRENGTHEN THEIR MEASURES TO TACKLE INDUSTRIAL POLLUTION?



➔ By measuring the effectiveness of their Best Available Techniques (BAT) policies - comparing emission trends before and after their introduction using:



Emission data from Pollutant Release and Transfer Registers (PRTRs) or other emissions monitoring systems



Data on industrial production and/or consumption volumes



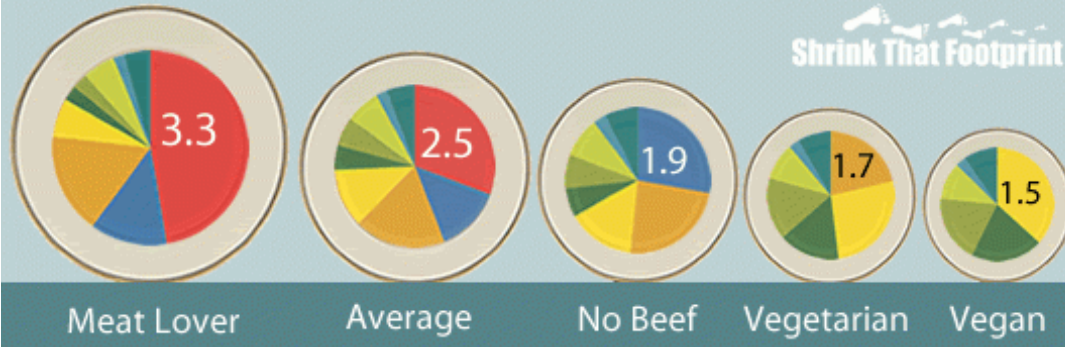
Information on the environmental permit conditions of industrial installations



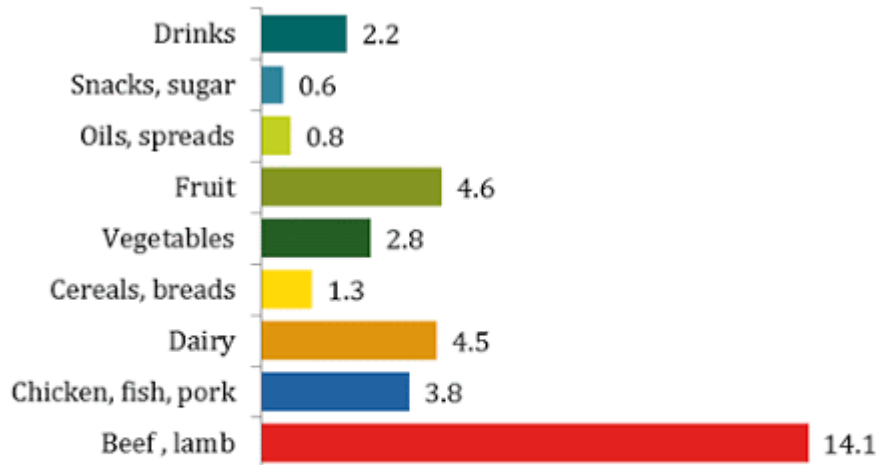
Information on installed pollution prevention and control techniques

Comparing Carbon Footprints (t CO₂e)

Shrink That Footprint



Carbon Intensity of Eating: g CO₂e/kcal



Note: Figures are grams of carbon dioxide equivalents per kilocalorie of food eaten (g CO₂e/kcal). Intensities include emissions for total food supplied to provide each kilocalorie consumed. This accounts for emissions from food eaten as well as consumer waste and supply chain losses. All figures are based on typical food production in the USA. Estimates are emissions from cradle to point of sale, they do not include personal transport, home storage or cooking, or include any land use change emissions

Sources: ERS/USDA, LCA data, IO-LCA data, Weber & Matthews 