



**Use of wastes as fuels and/or raw materials
in cement kilns**

**Reference Document on
Best Available Techniques
in the Cement,
Lime and Magnesium Oxide Manufacturing
Industries**

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EU Legislation

Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control (IPPC Directive)

- **Section 3.1 of Annex I to Directive 2008/1/EC:**
‘3.1. Installations for the production of cement clinker in rotary kilns with a production capacity exceeding 500 tonnes per day or lime in rotary kilns with a production capacity exceeding 50 tonnes per day or in other furnaces with a production capacity exceeding 50 tonnes per day.’
- **Integrated permit**
- **Information exchange regarding best available techniques (BAT)**
- **Reference Documents on Best Available Techniques (BREFs)**

Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste (WID)



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May 2010

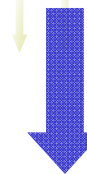


[EC, CLM BREF, May 2010]

<http://eippcb.jrc.ec.europa.eu/reference/>



Covers the processes involved in the production of cement, the use of wastes as raw materials and/or fuels and associated activities which could have an effect on emissions or pollution



(inter alia)



Applied processes and techniques



Use of waste

- General aspects for the use of waste
- Use of waste as raw materials and/or fuels
- Types of waste fuels (solid, liquid)
- Quality requirements of waste and input control
- Storage and handling of waste

Cement manufacturing [EC, CLM BREF, May 2010]

Energy-intensive firing processes by:

- using different types of kilns
- high temperatures of around 2000 °C
- using various fossil and/or waste fuels to provide the thermal energy demand required for the process
 - recovering of a substantial amount of waste-derived fuels, which replace fossil fuels up to a level of more than 80 % in some plants [EC, CLM BREF, May 2010]



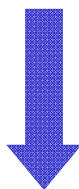
Consideration for the use of types of waste [EC, CLM BREF, May 2010]

- **Appropriate selection of waste materials**
- **Extensive analysing procedure of wastes and pretreatment:**
 - energy efficiency, energy consumption;
 - sufficient or adequate calorific value;
 - pollutants;
 - keep quality standards of the clinker.
- **Considerations and decisions have to be based on:**
 - the clinker production process and the operation conditions;
 - the raw materials and fuel compositions;
 - volumes and categories;
 - physico-chemical composition and characteristics;
 - the feeding points;
 - the flue-gas cleaning technique used;
 - the given waste management problems;
 - the requirements of existing European and national regulations.

Types of waste fuels [EC, CLM BREF, May 2010]

Different types of solid and liquid wastes are used, e.g.:

- non-hazardous waste as listed in the table, group number 1 – 10;
- hazardous waste listed in the table, group number 11 – 13.



Added value to the cement kiln:

- calorific value from waste material;
- material value from waste material.

Group Nr. ¹⁾	Types of waste fuels (hazardous and non-hazardous)
1	Wood, paper, cardboard
2	Textiles
3	Plastics
4	Processed fractions (e.g. RDF)
5	Rubber/tyres
6	Industrial sludge
7	Municipal sewage sludge
8	Animal meal, fats
9	Coal/carbon waste
10	Agricultural waste
11	Solid waste (impregnated sawdust)
12	Solvents and related waste
13	Oil and oily waste
14	Others

¹⁾ Each grouping spans several EWC listings, see Table 4.1 in Section 4.2.1



Quality requirements [EC, CLM BREF, May 2010]

- **Constant waste quality is essential**
- **A quality assurance system is required to guarantee the characteristics of the waste fuel:**
 - **this includes provisions for the sampling, the sample preparation, the analysis and the external monitoring.**
- **Important characteristics and parameters for waste fuels are:**
 - **calorific value along with a content of water, ash, sulphur, chlorine and heavy metals (especially mercury, cadmium and thallium);**
 - chlorine may have a negative impact on the production process;
 - **the suitability for the burners.**
- **Waste with adequate calorific value can replace primary fuel in cement kilns**
 - **It has to be noted that the calorific values of these wastes vary widely.**

Examples of calorific values [EC, CLM BREF, May 2010]

Examples of types of waste fuels (hazardous and non-hazardous)	Examples of calorific values (MJ/kg)	Examples of types of waste fuels (hazardous and non-hazardous)	Examples of calorific values (MJ/kg)
Wood	Approx. 16	Agricultural waste	12 – 16
Paper, cardboard	3 – 16	Solid waste (impregnated sawdust)	14 – 28
Textiles	up to 40	Solvents and related waste	20 – 36
Plastics	17 – 40	Oil and oily waste	25 – 36
Processed fractions (RDF)	14 – 25	Oil-shale based fuel mix (85 – 90 % oil-shale)	9.5
Rubber/tyres	approx. 26	Sewage sludge (moisture content >10 %)	3 – 8
Industrial sludge	8 – 14	Sewage sludge (moisture content <10 to 0 %)	8 – 13
Municipal sewage sludge	12 – 16		
Animal meal, fats	14 – 18, 27 – 32		
Animal meal (carcase meal)	14 – 21.5		
Coal/carbon waste	20 – 30		



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(inter alia)



Best Available Techniques (BAT)

- !! Energy consumption (BAT 6d, e)
- !! Waste quality control (BAT 10 a – c)
- !! Waste feeding into the kiln (BAT 11 a – f)
- !! Safety management for the use of hazardous waste materials (BAT 12)

BAT for energy consumption and the use of waste [EC, CLM BREF, May 2010]

Cement BAT 6 d), e)		Energy consumption ... reduce/minimise thermal energy consumption use fuels which have positive influence on thermal energy consumption use optimised and suitable cement kiln systems ...
Cement BAT 10 a) – c)		Waste quality control ... quality assurance system control amount of relevant parameters ...
Cement BAT 11 a) – f)		Waste feeding into the kiln ... feed points ..., ...temperatures ..., ...continuous and constant feeding, ...stop feeding for start-ups and/or shutdowns
Cement BAT 12		Safety management for the use of hazardous waste materials



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Best Available Techniques (BAT)

- !! Dust emissions (BAT13 – 16)
- !! NOx emissions (BAT 17, 18)
- !! SOx emissions (BAT 19)
- !! CO emissions
- !! Reduction of CO trips
- !! TOC emissions
- !! HCl and HF, PCDD/F emissions
- !! Metal emissions
- !! Process losses/waste and noise



**Thank you
for your attention!**

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