Specifications for Waste-derived Fuels

October 4th, 2022

ENVIROMANAGEMENT 2022

Štrbské Pleso, High Tatras, Slovakia

„Continuous Improvement in the Waste and Recycling Industry"

UVP
Environmental Management and Engineering

Helga Stoiber

UVP Environmental Management and Engineering (1)

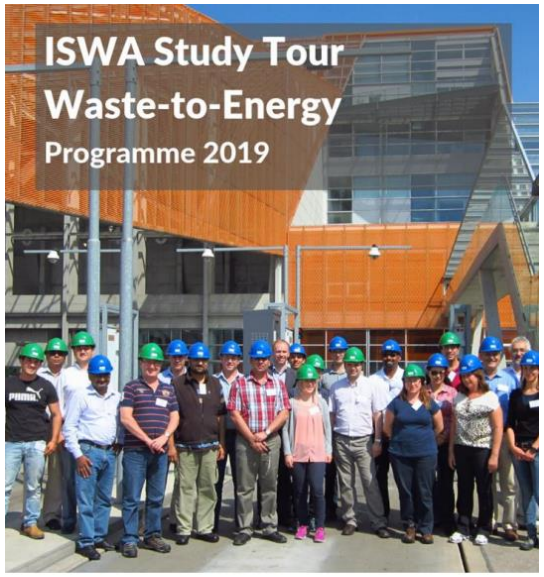
We are a **leading Austrian consulting and engineering company** in the field of waste management, with offices in Vienna, Linz, and Carinthia.

Since the 1990s, we have made the development and analysis of **sustainable waste management options** our responsibility.

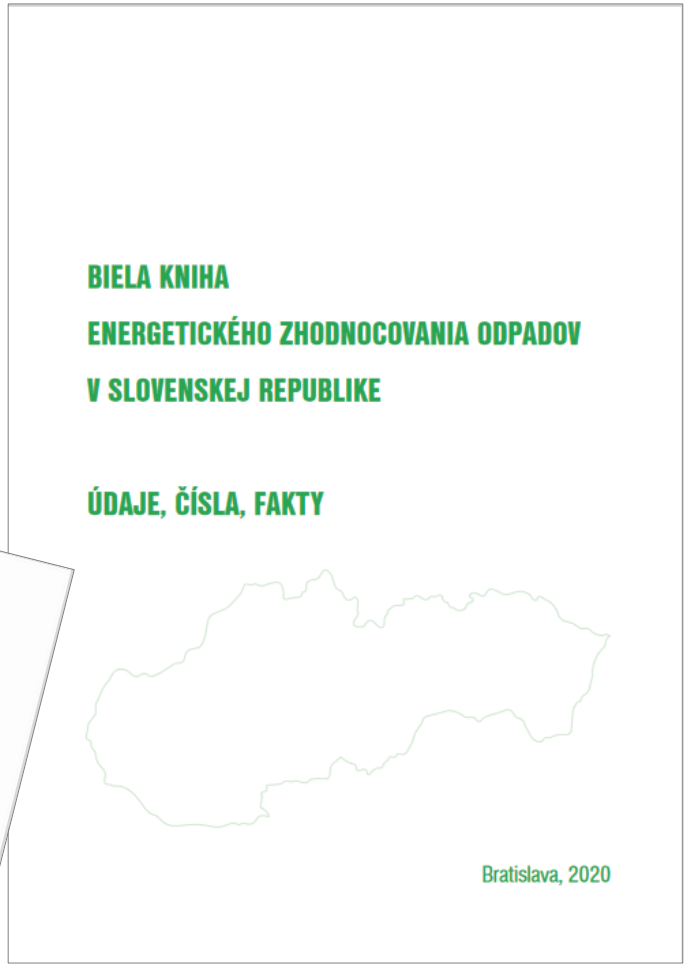
Our company provides consulting and engineering services for **waste treatment, recycling and recovery, waste-to-energy and biomass-to-energy, energy efficiency, air pollution abatement, monitoring and remediation of landfills and contaminated industrial sites** etc.

UVP Environmental Management and Engineering (2)

Trainings, Capacity Building & White Book WtE



ISWA Austria International Solid Waste Association — Think Globally · Work Locally — ISWA



https://www.ewia.sk/wp-content/uploads/2021/03/biela-kniha.pdf

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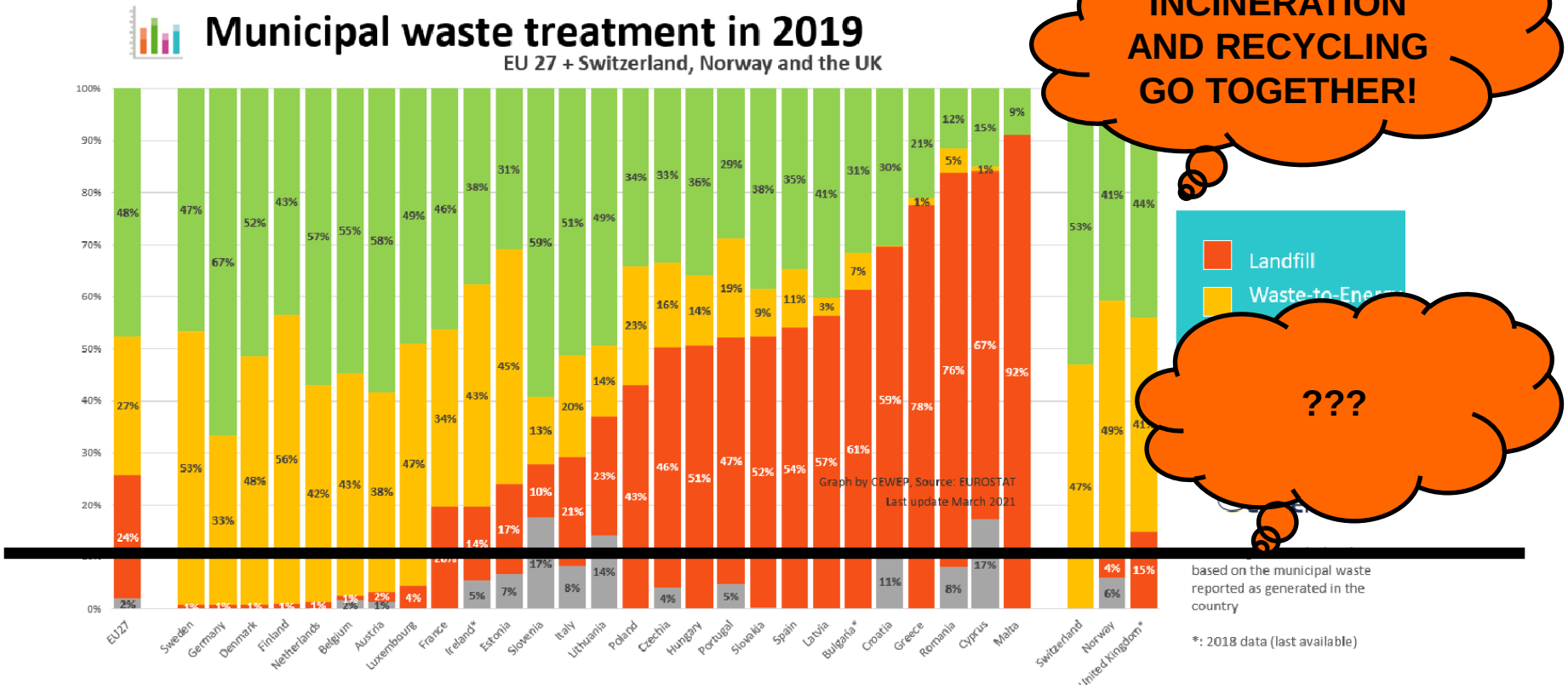
Diverting Waste from Landfill - A Legally Binding Goal for EU Member States

EU Landfill Directive 1999/31/EC, as amended by Directive (EU) 2018/850:

Member States must reduce the amount of municipal waste sent to landfill to 10% or less of the total amount of municipal waste generated by 2035.

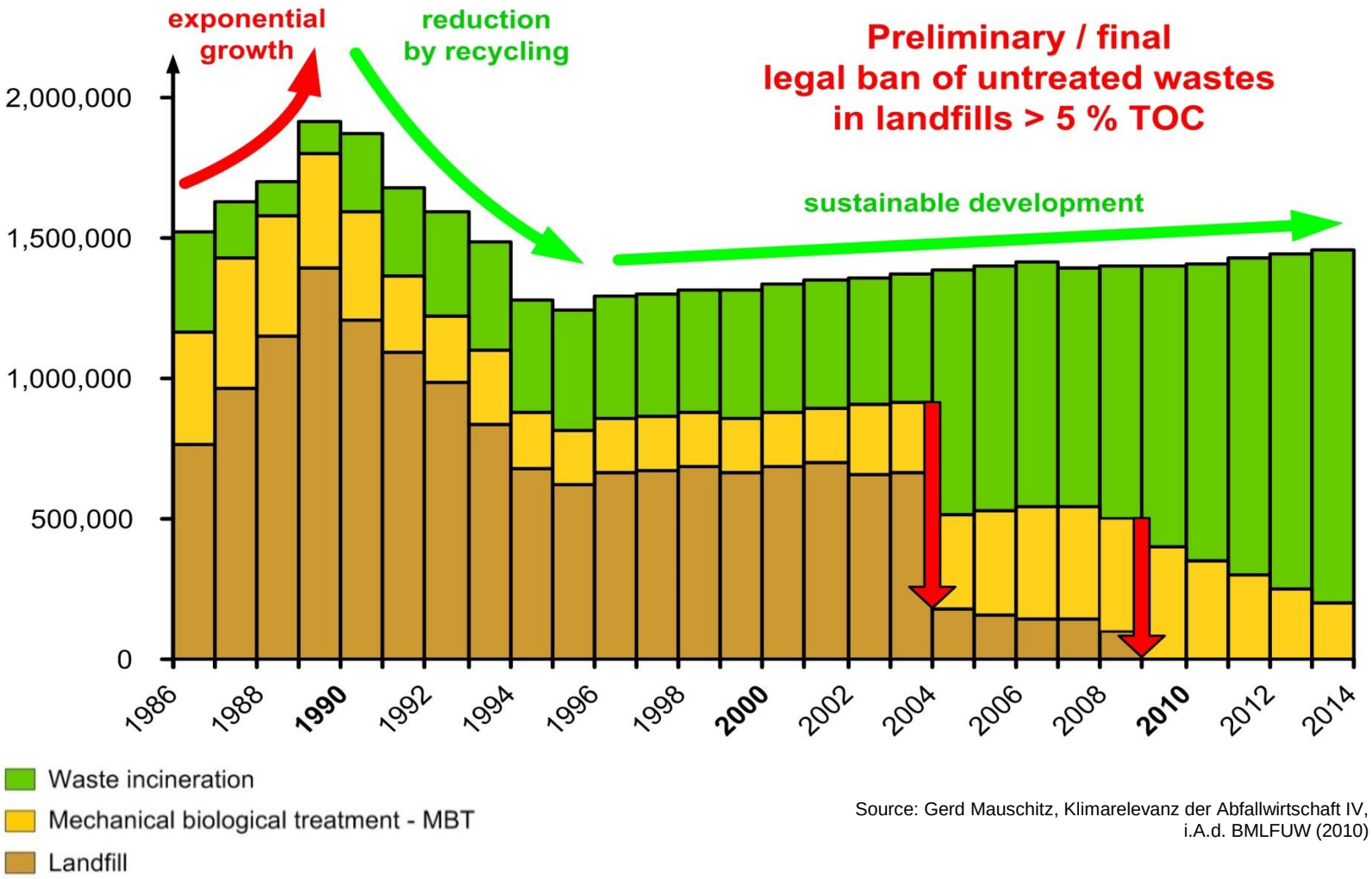


INCINERATION AND RECYCLING GO TOGETHER!

???

Diverting Waste from Landfill - Example from Austria (1)

Residual Municipal Solid Waste collected in Austria
Figures in tons per year

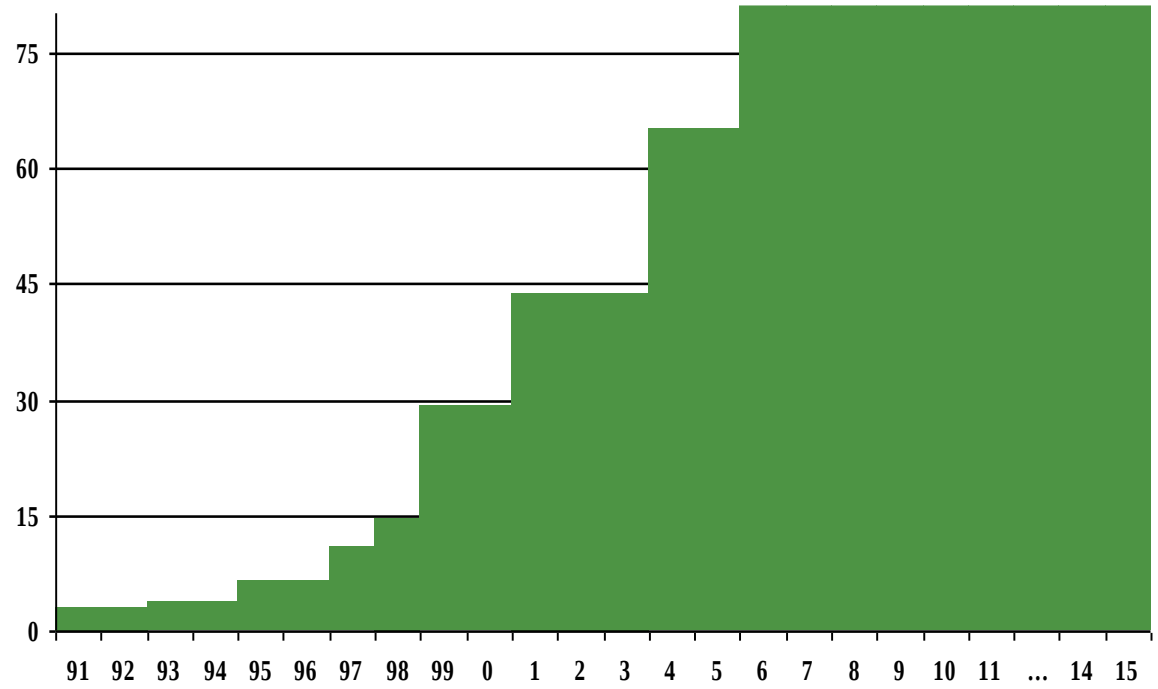


Source: Gerd Mauschitz, Klimarelevanz der Abfallwirtschaft IV, i.A.d. BMLFUW (2010)

Diverting Waste from Landfill - Example from Austria (2)

- Legal **Landfill Ban** as of **01.01.2004** (incl. some exemptions)
- Special **Landfill Tax** (ALSAG)

Landfill tax in € / ton of waste (e.g. MSW)



3 Criteria:

- **Foreseeable for 20 years (at least 10 years)**
- **Environmental standard of the landfill**
- **Quality of waste to be landfilled**

Specifications for Waste-derived Fuel (WDF)

Dr. Helga Stoiber

Terminology of WDF, a Babylonian Confusion ...

Different abbreviations are used in different countries.
The most commonly used terms are nowadays:

- **RDF - Refuse Derived Fuel**
  RDF is used for any combustible waste, which has undergone some sort of treatment, such as MT or MBT.
  There are **no specific quality criteria** for RDF.

- **SRF - Secondary Recovered Fuel**
  SRF is defined in ISO EN 21460.
  SRF can be **classified** and **specified** according to this standard, but there are **no specific quality criteria or limit values** given for SRF in this standard.

There are other terms in use as well, as e.g. **CDR** (IT, PT), **CSR** (FR), **CSS** (IT), in the past we also had **BRAM** and **BRAP** (DE, AT), and there is still **BPG** (DE) and others.
Some of these are rather RDF, others are rather SRF.

International Standards – ISO EN 21640:2021 (1)

The scope of ISO EN 21640:2021 covers the **production, trade, and storage of SRF**.

SRF is only produced from **non-hazardous waste**, such as non-hazardous industrial waste, construction and demolition waste, waste from waste management facilities, waste from material recycling facilities, municipal solid waste and similar non-hazardous commercial waste, and others.

ISO EN 21640:2021 defines parameters for

1) **Classification (Categorizing) of SRF:**
   - 3 parameters - NHV, chlorine, mercury.
2) **Specification (Characterization) of SRF:**
   - Properties obligatory to specify (Annex A);
   - Properties non-obligatory to specify.

International Standards – ISO EN 21640:2021 (2)

1) <u>Key properties for CLASSIFICATION (Categorizing) of SRF:</u>

- **NCV (ar)** as a mean value (arithmetic);
- **Cl (d)** as a mean value (arithmetic);
- **Hg (ar)** as a median and an 80th percentile,

with NCV being called the “economic criterion”, Cl the “technical criterion”, and Hg the “environmental criterion”.

The classification itself is not enough for an intending user or other stakeholders.

Table 2 — Classification for solid recovered fuels

Classification characteristic	Statistical measure	Unit	Classes				
			1	2	3	4	5
Net calorific value (NCV)	Mean	MJ/kg (ar)	≥ 25	≥ 20	≥ 15	≥ 10	≥ 3
Chlorine (Cl)	Mean	% in mass (d)	≤ 0,2	≤ 0,6	≤ 1,0	≤ 1,5	≤ 3
Mercury (Hg)	Median 80th percentile	mg/MJ (ar) mg/MJ (ar)	≤ 0,02 ≤ 0,04	≤ 0,03 ≤ 0,06	≤ 0,05 ≤ 0,10	≤ 0,10 ≤ 0,20	≤ 0,15 ≤ 0,30

International Standards – ISO EN 21640:2021 (3)

2) SPECIFICATION (Characterization) of SRF

No limit values, only information on properties / characterization.

Obligatory:

- **Class code –** NHV, Cl, Hg.
- **Origin –** Waste input.
- **Traded form** – Pellets, bales, briquettes, chips, flakes, fluff, powder.
- **Particle diameter d_x**
- **Ash content (A)**
- **Moisture content (M)**
- **Net calorific value (NCV)** – as received (ar) and dried (d).
- **Chemical properties** – Cl, Sb, As, Cd, Cr, Co, Cu, Pb, Mn, Hg, Ni, Tl, Sn, V.

Non-obligatory:

- Biomass content, composition of waste fractions, fuel preparation, physical properties, further chemical properties (e.g. C, H, N, S, halogens, trace elements).

Waste Incineration vs. Waste Co-Incineration

The EU legal framework distinguishes between Waste Incineration and Waste Co-Incineration – cf. IED Art. 3:

(41) **'waste co-incineration plant'** means any stationary or mobile technical unit whose **main purpose is the generation of energy or production of material products** and which uses waste as a regular or additional fuel or in which waste is thermally treated for the purpose of disposal through the incineration by oxidation of waste as well as other thermal treatment processes, such as pyrolysis, gasification or plasma process, if the substances resulting from the treatment are subsequently incinerated;
*(Remark: 3 types → **cement kilns, LCP, other co-incineration plants**)*

(40) **'waste incineration plant'** means any stationary or mobile technical unit and equipment **dedicated to the thermal treatment of waste, with or without recovery of the combustion heat generated**, through the incineration by oxidation of waste as well as other thermal treatment processes, such as pyrolysis, gasification or plasma process, if the substances resulting from the treatment are subsequently incinerated;
*(Remark: → typical **MSWI**)*

Specification by Legal Regulations – WDF Austria (1)

Annex 8 of the Austrian Waste Incineration Ordinance sets out
INPUT QUALITY CRITERIA for WDF that is CO-INCINERATED:

a) **Limit Values for WDF when incinerated in Cement Kilns**

b) **Limit Values for WDF when incinerated in Large Combustion Plants (LCPs)**

c) **Limit Values for WDF when incinerated in Other Co-Incineration Plants**

d) **Limit Values for Waste which is not WDF and is being co-incinerated**

e) **Additional Requirements for Waste Oil and Waste Solvents**

f) **Cd and Hg Limit Values for Sewage Sludges and Paper Fibre Residues**

The Ordinance uses the German expression **„Ersatzbrennstoff“,** which can be translated as „substitute fuel“ or as „WDF“.

„Ersatzbrennstoff“ is defined as waste-derived fuel that meets the requirements set out in Annex 8 of the Waste Incineration Ordinance.

Specification by Legal Regulations – WDF Austria (2)

Example: Limit Values for WDF when co-incinerated in LCPs

1.2 Grenzwerte für Ersatzbrennstoffe beim Einsatz in Kraftwerksanlagen

Die Grenzwerte gelten für Kessel, die überwiegend Steinkohle oder Braunkohle einsetzen und die zur Strom- und Fernwärmeerzeugung dienen. Der Anteil der Brennstoffwärmeleistung aus der Verbrennung von Abfällen an der Gesamtbrennstoffwärmeleistung ist mit maximal 15% begrenzt.

Parameter	Grenzwerte [mg/MJ]			
	Anteil der BWL [1]) ≤ 10%		Anteil der BWL [1]) ≤ 15%	
	Median	80-er Perzentil	Median	80-er Perzentil
Sb	7	10	7	10
As	2	3	2	3
Pb	23	41	15	27
Cd	0,27	0,54	0,17	0,34
Cr	31	46	19	28
Co	1,4	2,5	0,9	1,6
Ni	11	19	7	12
Hg	0,075	0,15	0,075	0,15

[1]) Prozentualer Anteil der Brennstoffwärmeleistung aus der Verbrennung von Abfällen an der Gesamtbrennstoffwärmeleistung.

End-of-waste Status

According to **Art. 6 (1) of the EU Waste Framework Directive (2008/98/EC)**

"Certain specified waste **shall cease to be waste** within the meaning of point (1) of Article 3 when it **has undergone a recovery, including recycling, operation** and **complies with specific criteria** to be developed in accordance with the following conditions:

a) the substance or object is **commonly used** for specific purposes;

b) a **market or demand exists** for such a substance or object;

c) the substance or object **fulfils the technical requirements** for the specific purposes and **meets the existing legislation and standards** applicable to **products**; and

d) the use of the substance or object **will not lead to overall adverse environmental or human health impacts**.

The criteria shall include **limit values for pollutants where necessary** and shall take into account any possible adverse environmental effects of the substance or object."

Specification by Legal Regulations – WDF Products
End-of-waste for WDF in Austria (1)

End-of-waste status has been established by the EU for:

- **Iron / Steel / Aluminium scrap** - EU Regulation No. 333/2011,
- **Glass cullet** - EU Regulation No. 1179/2012,
- **Copper scrap** - EU Regulation No. 715/2013,

but **not for waste-derived fuels.**

Annex 9 of the Austrian Waste Incineration Ordinance sets out **End-of-waste criteria for waste-derived-fuels.**

The Ordinance uses the German expression **„Ersatzbrennstoffprodukt“,** which can be translated as „WDF product“.

The Ordinance sets out „**Limit Values for WDF products and use according to regulations“** for:

a) WDF products made from wood waste

b) WDF products made from other waste

Specification by Legal Regulations – WDF Products
End-of-waste for WDF in Austria (2)

a) Limit values for WDF products made from wood waste

1.1 Grenzwerte für Ersatzbrennstoffprodukte aus Holzabfällen

Holzabfälle sind Abfälle der Schlüssel-Nummergruppe 17 gemäß Abfallverzeichnisverordnung BGBl. II Nr. 570/2003, in der geltenden Fassung. Ersatzbrennstoffe aus Holzabfällen müssen für das Vorliegen des Abfallendes folgende Grenzwerte einhalten.

Parameter	Grenzwerte [mg/kg TM]	
	Median	80-er Perzentil
As	1,2	1,8
Pb	10	15
Cd	0,8	1,2
Cr	10	15
Hg	0,05	0,075
Zn	140	210
Cl	250	300
F	15	20
Summe PAK (EPA)	2	3

Specification by Legal Regulations – WDF Products
End-of-waste for WDF in Austria (3)

b) Limit values for WDF products made from other waste

1.2 Grenzwerte für sonstige Ersatzbrennstoffprodukte

Sonstige Ersatzbrennstoffe müssen für das Vorliegen des Abfallendes folgende Grenzwerte einhalten.

Parameter	Grenzwert [mg/MJ]	
	Median	80-er Perzentil
Sb	0,5	0,75
As	0,8	1,2
Pb	4	6
Cd	0,05	0,075
Cr	1,4	2,1
Co	0,7	1,05
Ni	1,6	2,4
Hg	0,02	0,03
S	200	300
Cl	100	150

Specification by Operators for Acceptance of Waste-derived Fuels

WDF Specification for Co-Incineration in the Cement Industry – Examples from two Austrian Cement Factories

Requirements as defined by Austrian Waste Incineration Ordinance, Annex 8

Parameter	Grenzwerte [mg/MJ]	
	Median	80-er Perzentil
Sb	7	10
As	2	3
Pb	20	36
Cd	0,23 [1])	0,46 [1])
Cr	25	37
Co	1,5	2,7
Ni	10	18
Hg	0,075	0,15

[1]) Für qualitätsgesicherte Ersatzbrennstoffe (Schlüssel-Nummer 91108 gemäß Abfallverzeichnisverordnung, BGBl. II Nr. 570/2003, in der geltenden Fassung) gilt für den Median ein Grenzwert von 0,45 mg/MJ und für das 80-er Perzentil ein Grenzwert von 0,7 mg/MJ.

Additional Requirements specified by two Austrian Cement Producers

Parameter	Unit	Operator 1	Operator 2
Cl	% (d)	**1.0**	**0.9**
Cl	% (ar)		**0.8**
NCV	MJ/kg (ar)	**15**	**16 - 18**
H_2O	% (ar)	**30**	
Particle size	mm	**80**	**80**

Thank you for your Attention!

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