Standardization as a help to facilitate SRF acceptance and use
Experience of the European Cement Industry

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HeidelbergCement in a glance

- Global top 4 in cement, ready-mix and aggregates
- Building on People, Planet and Profit
- Recover globally 5,5 million tons Waste Materials
- We see “Waste as a Resource”
Position of cement industry in Waste Management

- **Reduce** – lowering the amount of waste produced
- **Reuse** – using materials repeatedly
- **Recycle** – using materials to produce new products
- **Recovery** – Recovering energy and minerals from waste
- **Incineration/WtE** – Recovering energy from waste
- **Landfill** – safe disposal of waste to landfill

3R economically not possible, co-processing best next option
Quantity of WtE versus WtC in European countries

Waste to Energy in Europe (kg/cap)  Waste to Cement in Europe (estimation 2013)

Waste to Energy and Waste to Cement co-exist in Europe
RDF / SRF flows in Europe

- Export from UK is most dominant, but there are a lot of other cross border flows as well.
Co-processing of RDF/SRF in cement kiln environmental friendly

- Long residence time at high temperature: Complete destruction organics, no PCDD/DF formation
- Combustion rich in oxygen and active lime: Neutralisation of acid gases, SOx and hydrogen chloride
- High clinker mass stream: Heavy metals stable embedded
- Ashes of fuel in clinker replacing raw material: Zero waste solution

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Temperature and time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature at main burner</td>
<td>&gt;1450°C: material</td>
</tr>
<tr>
<td></td>
<td>&gt;1800°C: flame temperature</td>
</tr>
<tr>
<td>Residence time at main burner</td>
<td>&gt;12-15 sec and &gt;1200°C</td>
</tr>
<tr>
<td></td>
<td>&gt;5-6 sec and &gt;1800°C</td>
</tr>
<tr>
<td>Temperature at precalciner</td>
<td>&gt;850°C: material</td>
</tr>
<tr>
<td></td>
<td>&gt;1000°C: flame temperature</td>
</tr>
<tr>
<td>Residence time at precalciner</td>
<td>&gt;2-6 sec and &gt;800°C</td>
</tr>
</tbody>
</table>
SRF potential benefits versus RDF

1. Quality control more explicit executed at the SRF-supplier → cement industry as user can limit control efforts
2. Supplier A and supplier B better exchangeable
3. Network of several suppliers and several off-takers is easier to build when standards are applied
4. Cross border flows will become less complicated:
   a. Reduce paper work load
   b. Shorten timeframe between application and approval
5. Stakeholder – acceptance by cement plant is easier realized when EU-standardization is applied on waste fuels
Best practice example: Poland

- Cement Industry in Poland already in 2004 replaced 10% of coal by SRF/RDF
- Landfill diversion only 2% and very low landfilling costs
- Imports from Germany were the driving force for the early development

Cross border flows SRF® are essential for market development!
Best practice example: Poland – Quality Control

- HC-plant in Gorazdze:
  - receives > 50 trucks per day
  - > 15 suppliers
  - LHV ranging from 15 to 22 GJ/t
  - Cl- ranging from 0.6 to 0.9 %
  - Each truck is sampled + analysed
  - > 10,000 samples per year!

- SRF classification will reduce the huge effort on quality control at this plant
SRF classification system is “only” 1 element

### Table 1 — Classification system for solid recovered fuels

<table>
<thead>
<tr>
<th>Classification characteristic</th>
<th>Statistical measure</th>
<th>Unit</th>
<th>Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net caloric value (NCV)</td>
<td>Mean</td>
<td>MJ/kg (ar)</td>
<td>≥ 25</td>
</tr>
<tr>
<td>Chlorine (Cl)</td>
<td>Mean</td>
<td>% (w)</td>
<td>≤ 0.2</td>
</tr>
</tbody>
</table>

**Calculation example**

- **Class**: NCV 3, Cl 3, NCV 3, Cl 3
- **Analysis**: 18 GJ/t; 0.7% Cl-
- **Feed to kiln**: 60% (thermal)
- **Cl- input**: 100 units, 130 units

A cement kiln operating 24 hours on 30% more Cl- than expected will block completely!!

**Constant /predictable quality remains key also in classified SRF!**
Value SRF classification in stakeholders acceptance

- WID, BAT for cement, IED, permits etc:
  - Waste co-processing limits cement kilns = incinerator
  - (Online) monitoring has become fully mature
  - Development on input-side ongoing:
    - end-of-waste;
    - mixing ban; BREF waste treatment;
    - LCA, sustainable supply chain

- Added value for acceptance co-processing at cement kilns if suppliers comply with:
  - Classification standards according to CEN/TC 343
  - ISO-standards + OHSAS-standards

Standardization requires professionalism in QA-QC and supports to respond on concerns of stakeholders!
Best practice example: Poland – Future

- Poland 2012: 8 mio ton to landfill
- Capacity: cement plants 1,5 mio tons + 6 incinerators 2015: 1,2 mio tons
- 2016 ban on landfill of MSW > 6 GJ/t

Classification SRF important for export out of Poland!
Poland – market value RDF / SRF

- Actual market price of coal limited influence – long term trends do
- Regulation is influencing market price significantly
- SRF will follow same path as RDF, probably with some premium

Classification results in price premium, but impact less than other price drivers!
1. The use of SRF / RDF is widely adopted in the European Cement Industry

2. SRF classification has a major importance for
   - Reducing complexity and crucial lead time in approving cross border flows
   - Minimizing the required quality control efforts at cement sites that are managed on lean as possible operations
   - Stakeholder acceptance of co-processing waste derived materials from solid organized suppliers working with approved and standardized methods

3. SRF classification will give a price premium compared to RDF of similar specification although other drivers are more dominant in pricing

4. SRF classification will support faster development of RDF co-processing in cement kilns in upcoming waste markets in- and around Europe

Concluding remarks