Co-processing Initiatives for environmentally sound management of wastes

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About Geocycle

For a zero-waste future

Geocycle is a provider of waste management solutions that solves waste challenges for customers

- Brand was created in 2007 as the dedicated identity used to brand waste management solutions in the Holcim
- We apply the highest health, environment and safety standards in all our operation complying to relevant regulation
Geocycle’s Global Presence
What is Co-processing?

- Co-processing is...
  - ...based on the principles of industrial ecology and stands for the **usage** of waste material (as raw materials, as a source of energy or both) in resource intensive industries to...
  - ...replace natural mineral resources (material recycling) and fossil fuels such as coal, petroleum and gas (energy recovery)
  - .... Recognised by Basel Convention and other conventions as appropriate technology for management of wastes

*In short, co-processing is an environmentally-friendly *alternative business* **model** for waste management*
Benefits of Co-processing?

• to the industry & community are……..
  ▶ Provides a permanent solution to waste management problems
  ▶ Reduces emissions and greenhouse gases
  ▶ Lessens reliance on fossil fuels
  ▶ Preserves natural resources

• to the cement industry are…….
  Service charges towards co-processing / Tipping fees
  Reduces cost of Fuel and Raw material
Waste Co-Processing in the Cement Kiln

Higher in waste management hierarchy over land fill and incineration
What happens to waste in the cement kiln?

- High temperature and long residence time condition of the Kiln ensures complete destruction of waste
  - Organic constituents are completely destroyed
  - Inorganic constituents, including heavy metals, react with raw materials in the kiln and are embedded in the crystalline structure of clinker.
- Acid gases from S and Cl are absorbed and neutralized by freshly formed lime and other alkaline materials within the kiln.
- The use of waste makes no difference to the construction and environmental properties of cement and concrete.
- Waste co-processing helps in reduction of GHG emission helping to build a green future
- It helps to absorb the heat and mineral content of the waste thus conserving resources for future generation
Incineration v/s Co-processing

- The higher temperature in co-processing results in efficient thermal destruction
- Residence time is 2 times higher in co-processing which helps in complete destruction of the waste
- Turbulence when induced in cement kiln helps in complete combustion
- The Alkaline environment in kiln acts as natural gas cleaning
- Co-processing leaves no residue to be land-filled

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Incineration</th>
<th>Co-processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>850°C – 1200°C</td>
<td>1400°C – 2000°C</td>
</tr>
<tr>
<td>Residence Time</td>
<td>&gt; 2 sec @ &gt;1200°C</td>
<td>4-6 sec @ &gt;1800°C</td>
</tr>
<tr>
<td>Turbulence</td>
<td>Induced in SCC</td>
<td>Induced in kiln</td>
</tr>
<tr>
<td>Gas cleaning</td>
<td>Alkaline scrubbing</td>
<td>Alkaline Environment in kiln</td>
</tr>
<tr>
<td>Residues</td>
<td>Ash / fly ash</td>
<td>In clinker product</td>
</tr>
</tbody>
</table>
Reduction of Green House Gases

Co-processing and Incineration
Reduction in GHG Emissions

Co-processing and Landfill
Prevention of Methane* Emissions

* Methane has 21 times more global warming potential than CO2

The same argument is valid for all other emissions too.
Wastes suitable for Pre-processing and Co-processing

“Banned wastes" will not be processed
- Radioactive waste
- Asbestos-containing waste
- Explosives and ammunition / weapons
- Anatomical medical waste

“Banned wastes" will not be co-processed
- Electronic fraction of electrical and electronic waste (e-waste)
- Whole batteries as a targeted material stream
- Waste of unknown or unpredictable composition, including unsorted municipal waste

- These wastes however can be co-processed after pre-processing to remove the banned portion of the waste
Co-processing supports Sustainability

• In a world of diverse industries, a wide range of waste materials get produced in the process of manufacturing goods and services. Landfill & incineration are considered as necessary disposal options for these wastes but are less preferred due to their large environmental foot print.

• Cement kiln co-processing recovers energy & material present in the waste without influencing environment and product quality and conserves natural resources. It reduces the GHG emissions and hence represents a sustainable solution for many waste streams which otherwise get land filled or incinerated.

• Co-processing is thus a preferred solution for the management of both incinerable and also land fill able wastes.
Wastes & Alternative Fuels and Raw materials (AFRs)
Pre-Processing of Wastes into AFRs for co-processing
Geocycle initiatives for demonstrating superiority of cement kiln co-processing for wastes in India

- **Volumes of waste for co-processing increased from about 10,000 TPY (2006) to about 700,000 TPY (2014).** Waste streams co-processed included LD slag, Red mud, Marble slurry, Mill scale, Iron slag, Dolachar, Carbon black, Agro-wastes, approved Hazardous wastes from Automobile, Chemical, Petrochemical, Refinery, Sugar and other sectors.

- **More than 50 demonstration trials implemented successfully with the involvement of SPCBs and CPCB.** Wastes consisted of Solids, Liquids, Sludge and Gases having varying chemical characteristics. Hazard nature varied from simple expired FMCG products to complex POPs.

- **Implemented “model” MSW management system in collaboration with Jabalpur Municipality & MPPCB.** Successfully duplicated the model at various other ULBs in the country.

- **Implemented six world class waste handling and pre-processing facilities and 14 co-processing facilities in the country with an investment of about Rs. 400 Crores**
Co-processing in cement kilns helps ensure “Zero Waste” getting into the environment.

Co-processing in cement kilns provides appropriate waste management solution for smart cities.
Why wastes need to be managed sustainably?

• Environmental damage is getting out of control.
• Climate change is impacting us all.
• Communities are implementation of landfills and incineration facilities for waste management.
• Landfill is building liabilities for the business.
• Industries are shifting to Green procurement processes.
• Importing countries are demanding compliance to sustainable waste management practices.
Is co-processing in cement kilns the right choice?

- Energy value and material value gets fully utilized as AFRs.
- AFRs conserve natural resources for future.
- Co-processing stimulates circular economy.
- Co-processing is higher in waste management hierarchy
What are the benefits of co-processing technology?

• There is no subsequent waste - hence zero waste future.
• It helps mitigate global warming.
• It lessens the use of fossil fuels and raw materials.
• It reduces pollution and negative health impacts.
• It reduces cost of production of cement
• It generates additional employment and opportunity for sustainable livelihood.
Wastes can cause obnoxious or toxic emissions? Co-processing is not a proven technology in India?

- Wastes do not impact the cement kiln emissions
- Co-processing evaluated for more than 40 years globally.
- Emission testing from >75 trials in India confirmed the same.
- Simple waste streams to complex ODS materials
- Waste materials had large variation in the characteristics.
- Trials were conducted in cement kilns spread across country
- Globally, some cement kilns operate at TSR levels of >90%
- It is an approved technology by Basel convention for disposal of HWs
- Co-processing is recommended for the destruction of POPs and ODS by Stockholm convention.
Why India’s TSR is very low?

TSR (%) achieved in cement kilns by countries
Which wastes can be co-processed?

- All kinds of acceptable waste materials can be co-processed in the cement kilns.
- Co-processing capacity depends upon available infrastructure, kiln capacity and raw material and fuel chemistry.
- Globally >20,000 waste streams are co-processed
- A few wastes identified as banned wastes can not be co-processed
Is co-processing a viable business model in India?

- Co-processing business model is operating for the past 10 years.
- Volumes are increasing year on year
- Waste generators desire to grow sustainably
- The considerations involved in the costing of disposal through co-processing and landfill / incineration options are different.
- National Task Force on co-processing has evaluated the co-processing business model for Hazardous and other wastes as well as for RDF.
Wastes can not be transported over large distances for pre & co-processing !!!!!

Volumes of the Industrial waste transported over large distances

(Source :Database – Geocycle India)
Only wastes having similar characteristics can be approved for co-processing?

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>MIN</th>
<th>MAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture (%)</td>
<td>0.60</td>
<td>67.4</td>
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<tr>
<td>Ash (%)</td>
<td>0.96</td>
<td>98.70</td>
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<tr>
<td>VM (%)</td>
<td>0.3</td>
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<tr>
<td>FC (%)</td>
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<td>45.7</td>
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<tr>
<td>Carbon</td>
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<tr>
<td>Hydrogen</td>
<td>0.2</td>
<td>9.1</td>
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<tr>
<td>Nitrogen</td>
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</tr>
<tr>
<td>Sulphur</td>
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<tr>
<td>Oxygen</td>
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<tr>
<td>GCV (Kcal/Kg)</td>
<td>80</td>
<td>7960</td>
</tr>
<tr>
<td>NCV (Kcal/Kg)</td>
<td>114.8</td>
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<tr>
<td>Mineral matter</td>
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<td>Chloride as Cl (mg/kg)</td>
<td>0</td>
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<tr>
<td>Fluoride as F (mg/kg)</td>
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<tr>
<td>VOC (mg/kg)</td>
<td>4.20</td>
<td>207.0</td>
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<tr>
<td>SVOC (mg/kg)</td>
<td>BDL</td>
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</tr>
<tr>
<td>PCB (mg/kg)</td>
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<td>0.5</td>
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</table>

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>MIN</th>
<th>MAX</th>
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</thead>
<tbody>
<tr>
<td>Cadmium (mg/kg)</td>
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<tr>
<td>Chromium (mg/kg)</td>
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<td>Nickel (mg/kg)</td>
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<td>Lead (mg/kg)</td>
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<td>Zinc (mg/Kg)</td>
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<tr>
<td>Arsenic (mg/kg)</td>
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<tr>
<td>Mercury (mg/kg)</td>
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<td>3.8</td>
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<tr>
<td>Selenium (mg/kg)</td>
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<tr>
<td>Antimony (mg/kg)</td>
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<tr>
<td>Vanadium (mg/kg)</td>
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<td>Thallium (mg/kg)</td>
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<tr>
<td>Tin (mg/kg)</td>
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<tr>
<td>VOC (mg/kg)</td>
<td>BDL</td>
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</tr>
<tr>
<td>SVOC (mg/kg)</td>
<td>BDL</td>
<td>0.2</td>
</tr>
<tr>
<td>PCB (mg/kg)</td>
<td>BDL</td>
<td>66.0</td>
</tr>
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</table>
Trial is must for permitting co-processing!!!!

- There is huge variation in the characteristics of wastes on day to day and batch by batch basis.
- Waste streams are required to be mixed in different proportions to prepare uniform AFRs. Hence, individual characteristics of the wastes bear no relevance to that of the waste mix.
- It took 10 years to conduct trials of about 100 waste streams. When we will complete trials for all the waste streams co-processed globally on regular basis?
- Although co-processing is higher in waste management hierarchy, trial is not required to exercise incineration or landfill option.
What are we striving for??????

• The permitting process needs to be aligned with global practice.
• The cement plant facility needs be approved for receiving, storing and pre-processing hazardous and other wastes based on the availability of infrastructure to handle them safely.
• Co-processing in cement plant to be authorised based on the compliance to prescribed emission standards.
Recommendations submitted to MoEFCC

- Recommendations to include co-processing in the new HWM Rules / SWM Rules / Plastic Rules submitted to MoEFCC.
- SPCBs to grant authorisation to cement plants for implementing pre and co-processing based on availability of required infrastructure and compliance to prescribed emission standards.
- MoEFCC has agreed to include co-processing in the respective rules.
- Wastes to be moved across states for co-processing with letter of intimation.