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For a zero-waste future

Pre-processing for Effective Co-processing

Geocycle Wadi Pre-processing Facility

Agenda

- What is Pre-processing?
- Pre-processing at Geocycle
- Co-processing – A challenge
- Effects in a Kiln System
- The Salesman – A game for you to play!

What is Pre-processing?

- “Pre-processing “means the treatment of waste to make it suitable for co-processing or recycling or for any further processing

- “Co-processing” means the use of waste materials in manufacturing processes for the purpose of energy or resource recovery or both, and resultant reduction in use of conventional fuels or raw materials or both, through substitution

Source: HW(MH&T)R, 2016

- AFR – Alternative Fuel and Raw material

Waste → ***Pre-processing*** → **AFR**

Pre-processing is a lot like cooking

Falling objects

Slips/ Trips/ Falls

Manual handling

Contact with hot material

Contact with sharp objects

Risk of fire/ explosion

Electrocution

Entrapment

Allergies

Risks associated with Pre-processing are to be properly understood and controlled
Pre-processing is best left to the experts!

Unreasonable expectations

Compliance

- All of Geocycle's pre-processing facilities are ISO certified –
  - ISO 9001 : 2015
  - ISO 14001 : 2015
  - OHSAS 18001 : 2007
- Waste Profile Form (WPF): Multidisciplinary team signs off on acceptance of a particular waste from OH&S, Quality and Operations perspective
- Formal Agreement/ MoU signed with all customers
- Complete adherence to requirements of HWR
- Complete adherence to co-processing timelines with all industries given a specific "Certificate of Destruction" for their waste streams
- Continuous emission monitoring systems (CEMS) installed at all pre- and co-processing kilns
- Open door policy to all stakeholders across any pre-processing facility

Fire Safety

- State of the art fire detection, alarm and suppression system
- NFPA (US) and FM Approved design
- Auto detection – UV-IR (building) IIIR (line), LHS cables(belts) and QBD(roof level), smoke detectors (Office)
- Auto Supression – ESFR sprinklers (roof level), MVWS systems (line), MEFS (shredder and pits)
- Alarm – AV alarm, Siren
- Interlocks – Pre-processing line interlocked with hydrant line pressure and fire pump ready mode condition
- Manual FF – Water hydrants, hose reels, portable fire extinguishers
- CCTV camera – Still and PTZ
- Manual Call Points (MCP)

Compatibility and Quality

- Full fledged Waste and AFR testing laboratory onsite
- Robust Quality Control Plan (QCP) for incoming waste and pre-processed AFR
- Compatibility testing of all incoming waste streams to ascertain storage location
- Trained and experienced lab Analysts
- Traditional fuel, Clinker and Cement testing onsite
- Daily waste mix design for co-processing
- Continuous data recording and accessibility through cloud based service. LIMS 2017
- State of the art equipment including ICP, Gas Chromatograph, CHNS analyser, proximate analyser, KF moisture analyser, radiation survey meter, flash point analyser, cutting mill, etc
- Gas detection and alarm system

Environmental Contamination

- Sealed concrete flooring with geo-membrane (leachate protection technology) throughout the floor area of the pre-processing building
- Concrete roads
- Spill control and response kits available throughout the facility
- Rain water collection drains
- Epoxy coated fire water collection drains connect to retention basin where water it let out to storm water only subsequent to testing and analysis
- Leachate collection sumps. Leachate is impregnated and re-utilised.
- Zero discharge facility. Complete material balance
- Odour suppression system – Internal and external
- Green belt development

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Logistics Safety

- No waste truck is allowed to enter the facility without all authorised documentation – Waste Label (form 8),TREM Card (form 9), Manifest (form 10)
- Only SPCB authorised transporters
- Mandatory 13 point checklist is followed for all vehicles. This included vehicle condition, driver training, PPE, etc
- All Geocycle pre-processing facilities are unidirectional travel (one-way) only
- Segregation of pedestrians and vehicles/ heavy equipment
- Spark arrestor for all incoming vehicles
- Light-on engine-on including flashing light for all heavy equipment
- Mandatory defensive driver training requirement
- SARATHI – Logistic safety project – IVMS, In-cabin training, E-Passport, journey management plan, etc

Sarathi

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Other OH&S practices

- Mandatory PPE’s and dedicated uniforms
- BLS and FA training to all personnel
- Segregated inbound and outbound area with firewall
- Quarantine area
- First aid room
- Drivers washrooms and rest areas withTV and games facility
- Staff welfare facilities like washrooms and pantry
- De-tarping and sampling station with fall prevention systems
- ATEX (Zone 22) certified equipment
- Stockpile temperature, illumination, noise and radiation monitoring
- Safety showers and eye wash stations
- Traffic management system (lights and proximity sensors)
- Flame proof/ LED lighting
- Autosampler (2 sites)
- Access control systems for MCC room ....etc

Community Engagement

- Open door policy at all facilities
- Monthly meetings with community leaders, influencers, women groups, SHG's, etc.
- Support to schools and gram panchayat on key sustainability areas such as climate change, resource conservation, waste management.
- Facilitate and support SWM by communities and villages
- Involve and encourage community to aggregate biomass for co-processing in cement plant
- Farmers engagement through improved seeding and advanced aricultural techniques

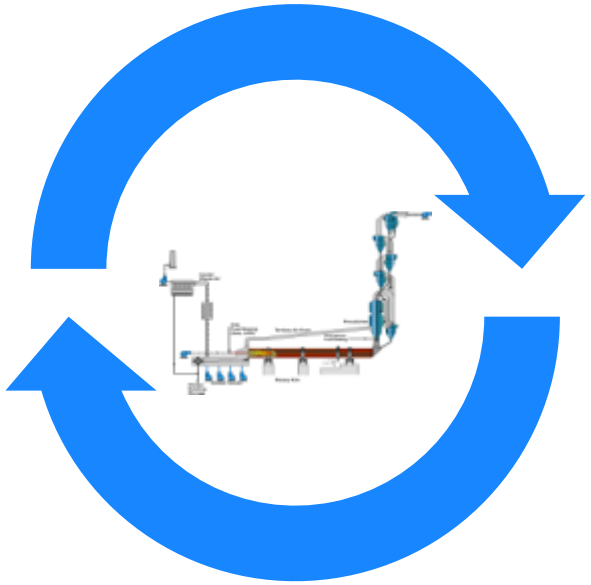
AFR doesn’t make life easier, but certainly more interesting

Challenges

More difficult
Fuel Properties

Kiln Process (Co-Processing)

Increased Heat Consumption



Higher Exhaust Gas Volume
Higher Input of Chlorine

Consequence

Solutions to avoid impacts on OEE,
Quality and Emissions

Reduced Kiln OEE
Deterioration of Quality
Higher Emissions

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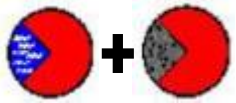
Critical Alternative Fuel Properties (typical, compared to traditional fuel)

- Coarser Granulometry

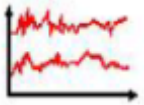
- Higher moisture / water content

- Higher ash content

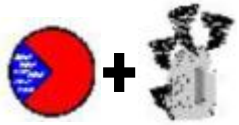


- Lower Calorific Value (high moisture and high ash)

- Higher Chl entration
  (sulfur typ due as concentration typically ≤ traditional fuels)



- Lower omogeneity (e.g. standard deviation of NCV, H2O, ash,…)



- Lower dosing accuracy and more difficult material handling
  (consequence of coarser granulometry and higher moisture)

Which property is most critical?

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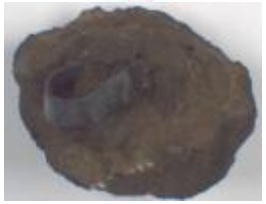
Effects in kiln system and possible remedies

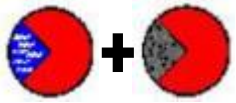
- Granulometry
  - Too coarse fuel for feed-point. Exceeding TSR per feedpoint.
  - CO, VOC emissions, lower NOx. Sulfur cycle / build-up formation.
    → higher pressure drop, more cleaning effort, cyclone blockage (availability)
  - Better fuel preparation (sorting, shredding) or negotiations (e.g. fluff fineness).

- Moisture / water content
  - Very high water content and/or feed rates.
  - Flame cooling (lower heat transfer in kiln). Incomplete combustion (CO). Higher exhaust gas quantity and increased heat consumption. Lower NOx emissions.
  - Drying. Negotiations of max. water content.



Source: VDZ

- Ash
  - Becomes relevant at ash input changes > 0.01 t ash/t clinker (depends also on ash content/composition of traditional fuel).
  - Raw mix needs to be adjusted. Sudden ash input changes (e.g. failure of feed system) can lead to off-spec clinker (no quick correction possible).
  - AF blending. Maintaining fuel mix stable (ash input).



- Calorific value
  - At CV's below 10 GJ/t the effective fuel substitution in kiln should be checked.

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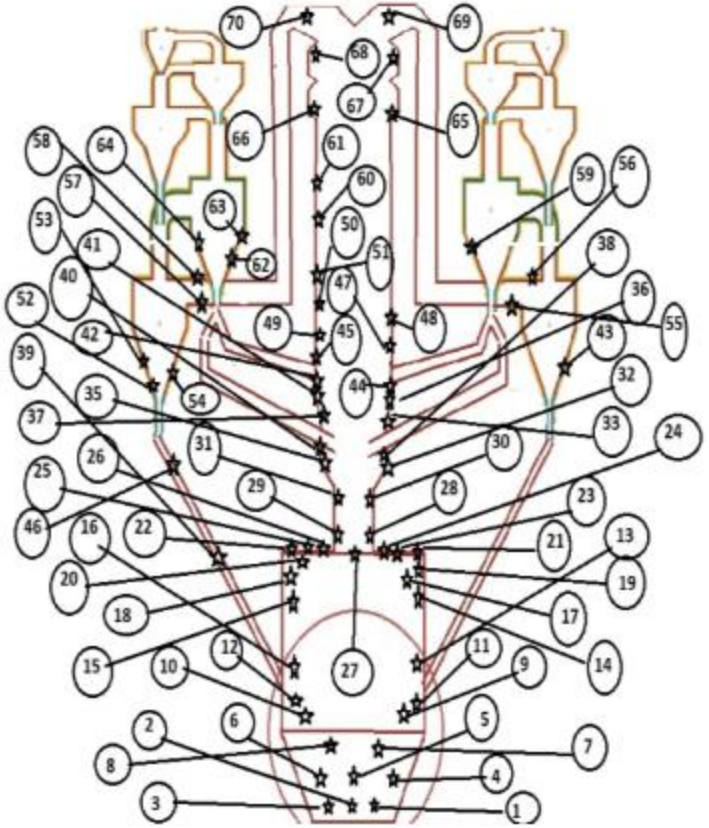
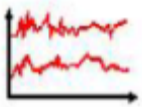
Chlorine – has it's limits and costs

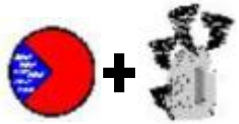


- Preheater kilns are limited to 300 g Cl/t clinker input (sustainably).
  50-150 g Cl/t cli typical input already from raw materials.
- Cl is highly volatile and leads to fast formation of build-ups.
- Installations of additional air blasters required!
- To accept higher Cl inputs, high CAPEX is required:
  - Gas bypass: 800-1200 g Cl/t cli
  - Hot meal extraction: 400-600 g/t cli of kiln dust
  - Kiln dust extraction: up to 400 g/t cli
- Input limits need to be respected: Feed rates and Cl concentration
- Max. Cl concentration to be agreed with customer and/or cost tag to Cl concentration

Effects in kiln system and possible remedies



- NCV fluctuations
  - Cannot be measured real time. Quick effect in calciner (°C) observable → correction of feed rate possible. Effect of NCV fluctuation cannot be corrected as it is detected too late.
  - Cooling / overheating of kiln → process/quality (freelime) issue. CO peaks. Higher average heat consumption.
  - Better blending. Agreements. Actual NCV communicated to kiln CCR.



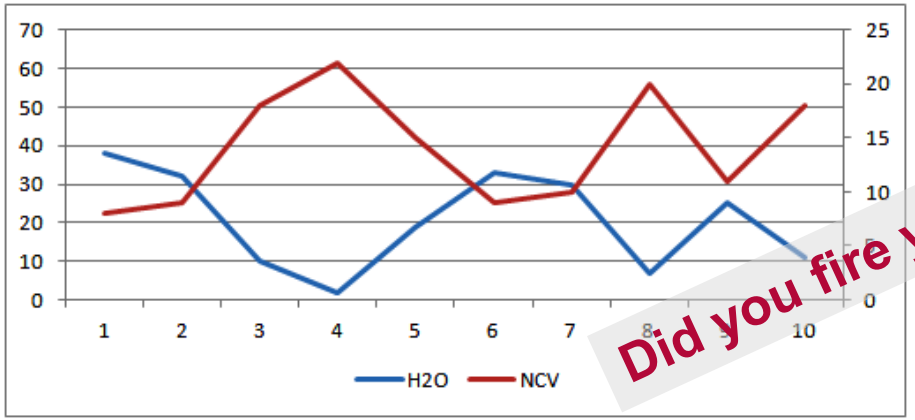
- Dosing fluctuations
  - High accuracy for fine solids / liquids (within seconds) required. For coarse solid feed rate accuracy required over a minute.
  - Cooling / overheating of kiln → process/quality (freelime) issue. CO peaks. Higher average heat consumption.
  - Maintenance. Tuning of feed rate controller. Upgrade of weighing system. New feed system

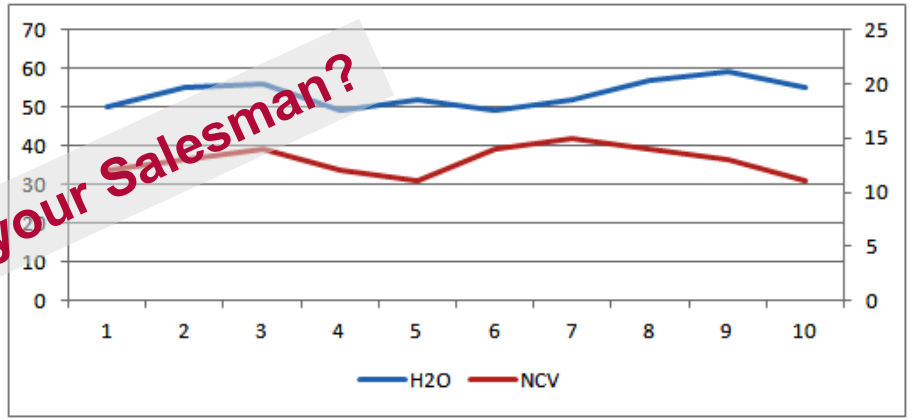
The Salesman – A game for you all

Only the best waste for you Sir!
- Multinational Company
- Highest environmental honours
- Less than 40% moisture content
- More than 20Mj/T Calorific Value
- As much as you can take
- Price (-) 12000/T

Only the best waste for you Sir!
- Indian company from Bhainsa, TS
- Applied for environmental honours
- Between 45-60% moisture content
- Range of NCV only 10-14Mj/T
- 500T stock and 100TPM generation
- Price (-) 6000/T

What is your preference?





Did you fire your Salesman?

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What I would like you to retain

- ✓ Pre-processing is like cooking
- ✓ Pre-processing is best left to the experts
- ✓ Pre-processing of waste requires a high level of skill, able infrastructure and effective health and safety measures

- ✓ Co-processing is a lot more challenging than it looks
- ✓ Higher the waste volumes co-processed, greater the challenges
- ✓ Critical properties and their potential impacts must be studied and alleviated
- ✓ Its not about price. Its about Consistency and Sustainability


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