

Waste Co-processing in Cement Kilns: Concepts and Benefits

- Concepts and benefits of co-processing
 - Geocycle India- waste management service provider
 - The challenge during co-processing
 - Holcim Co-processing policy
 - Experience on co-processing
 - Waste disposal facilities with Geocycle India
 - Safety: Value not priority for Geocycle Business
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Waste Management Hierarchy

3R+C



Figure 1: Waste management hierarchy

1. Reduce

2. Reuse

3. Recycle - Re-processing

- ▶ When prevention / reuse is not feasible
- ▶ Recycling of end-of life cementitious products
- ▶ Wastes as MIC and/or AR

4. Resources Co-processing in existing EII's

- ▶ When re-processing is not feasible
- ▶ Process specific guidelines
- ▶ Pre-processing is key

5. Wastes disposal activities

- ▶ When co-processing is not applicable
- ▶ For organics: Incineration
 - Wastes – to – energy programs
 - Energy efficiency is key
- ▶ For minerals: Land filling

■ Co-processing

- › Upgrades waste management within the waste hierarchy
- › Reduces global environmental impacts
- › Decreases (largely) the costs of waste management
- › Regional job creation in waste collection and pretreatment etc.
- › Zero-emission technology

Characteristics	Temperature and time
Temperature at main burner	>1450°C: material >1800°C: flame temperature.
Residence time at main burner	>12-15 sec and >1200°C >5-6 sec and >1800°C
Temperature at precalciner	>850°C: material >1000°C: flame temperature
Residence time at precalciner	>2 - 6 sec and >800°C

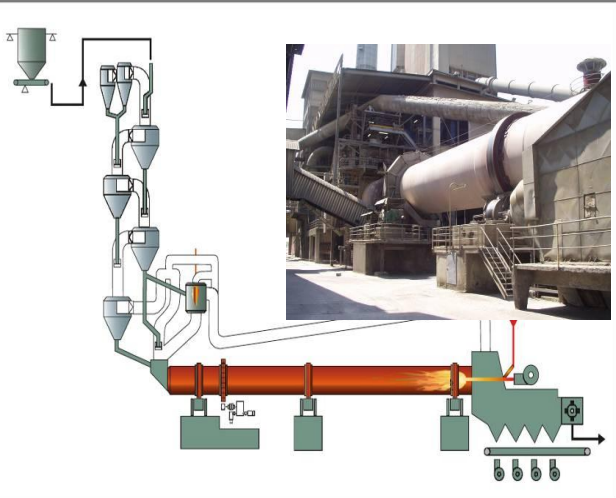


Table 2: Temperature and residence time during cement production



The clinker process: Main characteristics for waste co-processing



High temperatures and long residence time

In all cases more than 3" > 1100 °C



Self cleaning process

Lime represent > 60% in mass



Double valorization: organic and minerals

Organic totally destroyed

Ash incorporated in the final product



Reduction of global emissions

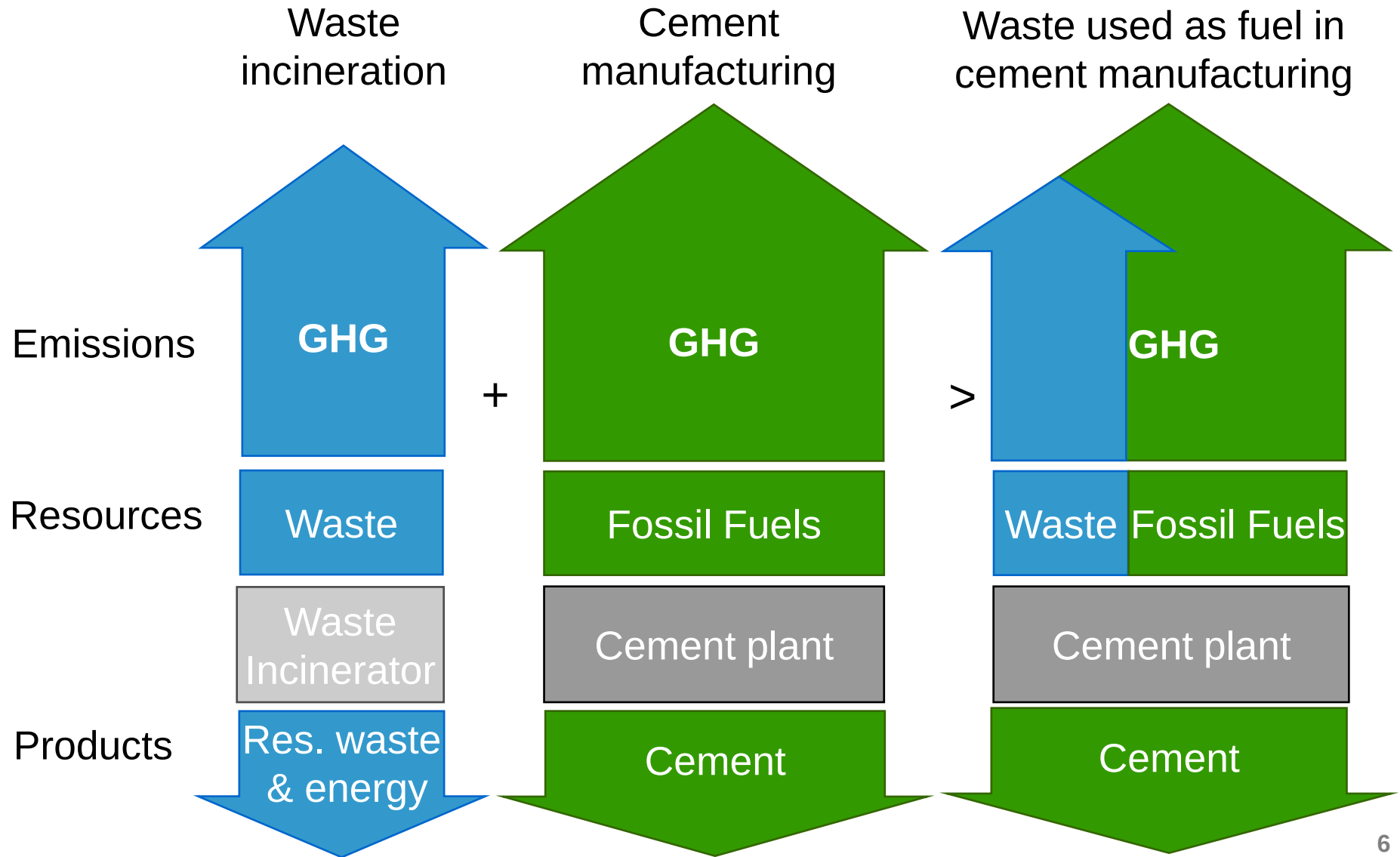
No more emission if waste is used - Global CO2 is reduced



Existing, local industry

Traditional industry located close to limestone areas

Reduction of GHGs



Co-processing vs. Incineration

Aspect	HW Incinerator	Cement Kiln
Temperature	850oC – 1200oC	1400oC – 2000oC
Residence Time	> 2 sec @ >1200oC	4-6 sec @ >1800oC
Gas cleaning	Alkaline scrubbing	Alkaline Env. in kiln
Residues	Ash / fly ash	In clinker product
Fuel	Fossil fuel used	Disposed within the cement process
DRE	99.9999 %	99.9999 %*

DRE: "Destruction and Removal Efficiency"

* Reported for PCBs in Norway and Sweden performance generally > 99.999%

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F
M
C
G



Colgate



Hindustan Unilever Limited

NIVEA

Godrej



SaraLee



Toys



IndianOil

Petroleum



DR. REDDY'S

Johnson & Johnson

RANBAXY
LABORATORIES LIMITED

SARVOTHAM
CARE LIMITED

Orchid Chemicals
& Pharmaceuticals Ltd.
Shaping A Dream

HUNTSMAN
Enriching lives through innovation

Coca-Cola



Cadbury

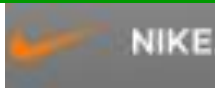


Narmada Gelatines Limited

Food
products

Pharmaceutical

Foot ware



Automobile



Construction



Tagros



Chemical

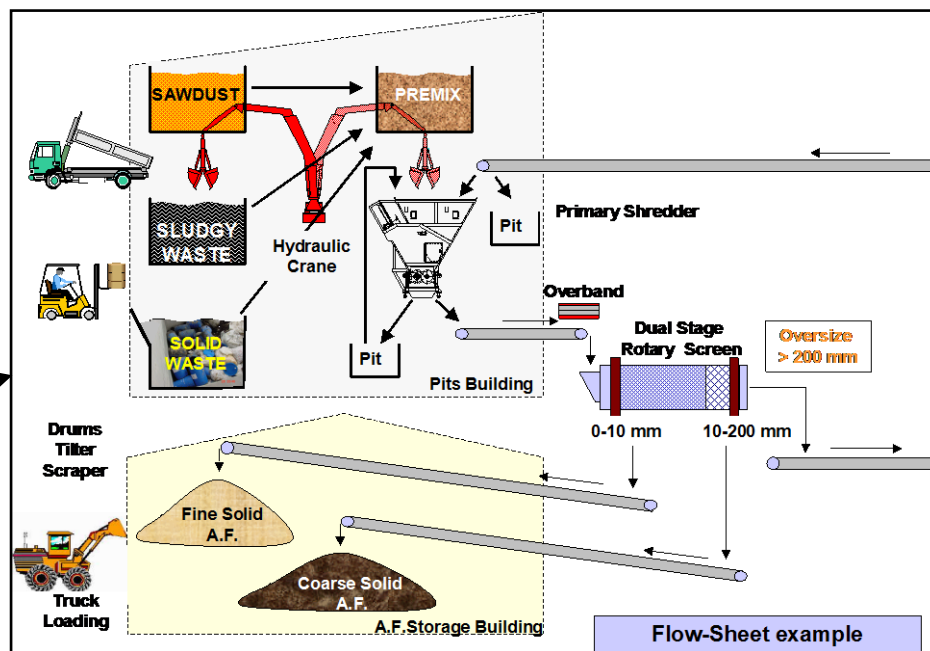
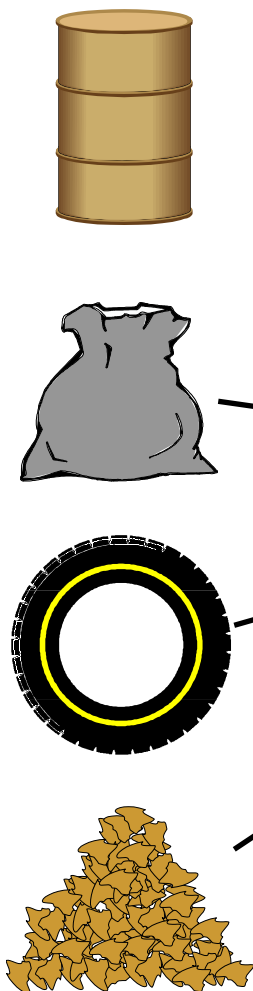


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Waste Pre-processing Activities

Diffrent Waste Markets



Diffrent Kiln Systems

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Co-processing Policy

Holcim has defined a policy that will govern the Group companies' behaviour and operations when co-processing

Holcim and GTZ strategic alliance



The 9 principles of our co-processing policy

Elements of sustainability

- I. Act as a partner to society by offering waste management solutions
- II. Keep our environment safe
- III. Add value to our core business

What we will do

- IV. Ensure occupational **health & safety**
- V. Refuse the listed "banned wastes"
- VI. Guarantee the quality of our products

How we will do it

- VII. Comply with the **relevant regulations** and promote best practices
- VIII. **Monitor and control the inputs, process, products and emissions**
- IX. Communicate transparently

Waste Co-Processing Principles

Refuse the listed "banned wastes"

- ✘ Anatomical Hospital Wastes
- ✘ Asbestos-containing Wastes
- ✘ Bio-hazardous Wastes
- ✘ Electronic Scrap
- ✘ Entire Batteries
- ✘ Explosives
- ✘ High-concentration Cyanide Wastes
- ✘ Mineral Acids
- ✘ Radioactive Wastes
- ✘ Unsorted Municipal Garbage

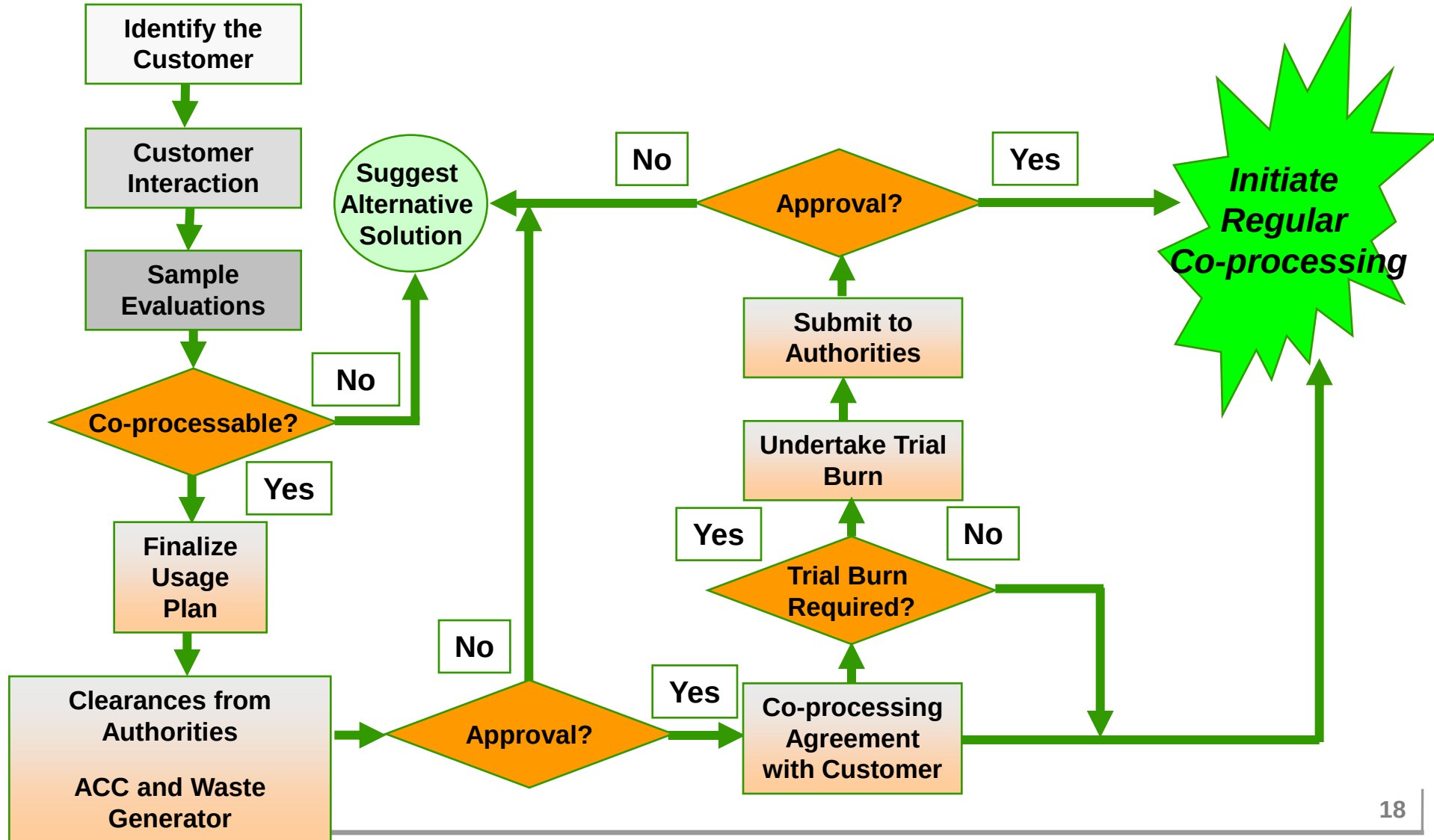
ACC will refuse the aforementioned wastes for one or more of the following reasons: health & safety issues; to promote adherence to the waste management hierarchy; other treatment options or processes must be used.

Sources of Material for Co-processing

Identified 26 Industries that are sources of Co-processing Material Worldwide

- | | |
|---|---|
| 1. Agricultural Production - Crops | 14. Paper and Allied Products |
| 2. Agricultural Production - Livestock | 15. Chemicals and Allied Products |
| 3. Agricultural Services | 16. Petroleum Refining and Related Industries |
| 4. Metal Mining | 17. Rubber and Miscellaneous Plastic Products |
| 5. Coal Mining | 18. Leather and Leather Products |
| 6. Oil and Gas Extraction | 19. Glass Products |
| 7. Mining and Quarrying of Nonmetallic Minerals | 20. Primary Metal Industries |
| 8. General Building Contractors | 21. Fabricated Metal Products |
| 9. Heavy Construction Contractors | 22. Indus. and Comm. Machinery and Computers |
| 10. Special Trade Contractors | 23. Electronic & Electrical Equipment |
| 11. Food and Kindred Products | 24. Transportation Equipment |
| 12. Lumber and Wood Products, Except Furniture | 25. Photographic Equipment and Supplies |
| 13. Furniture and Fixtures | 26. Electric, gas, and sanitary services |

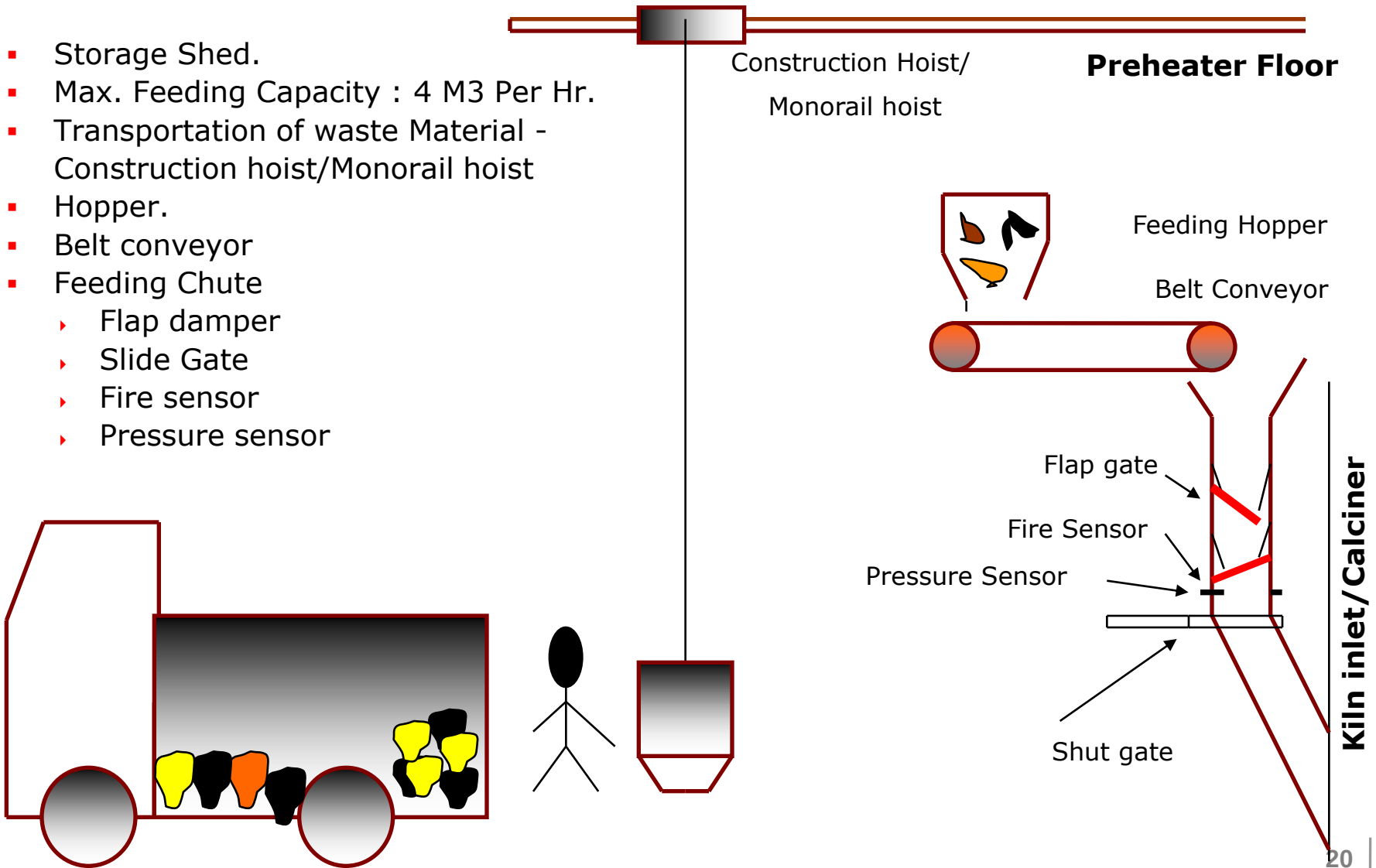
Frame Work Of Operation



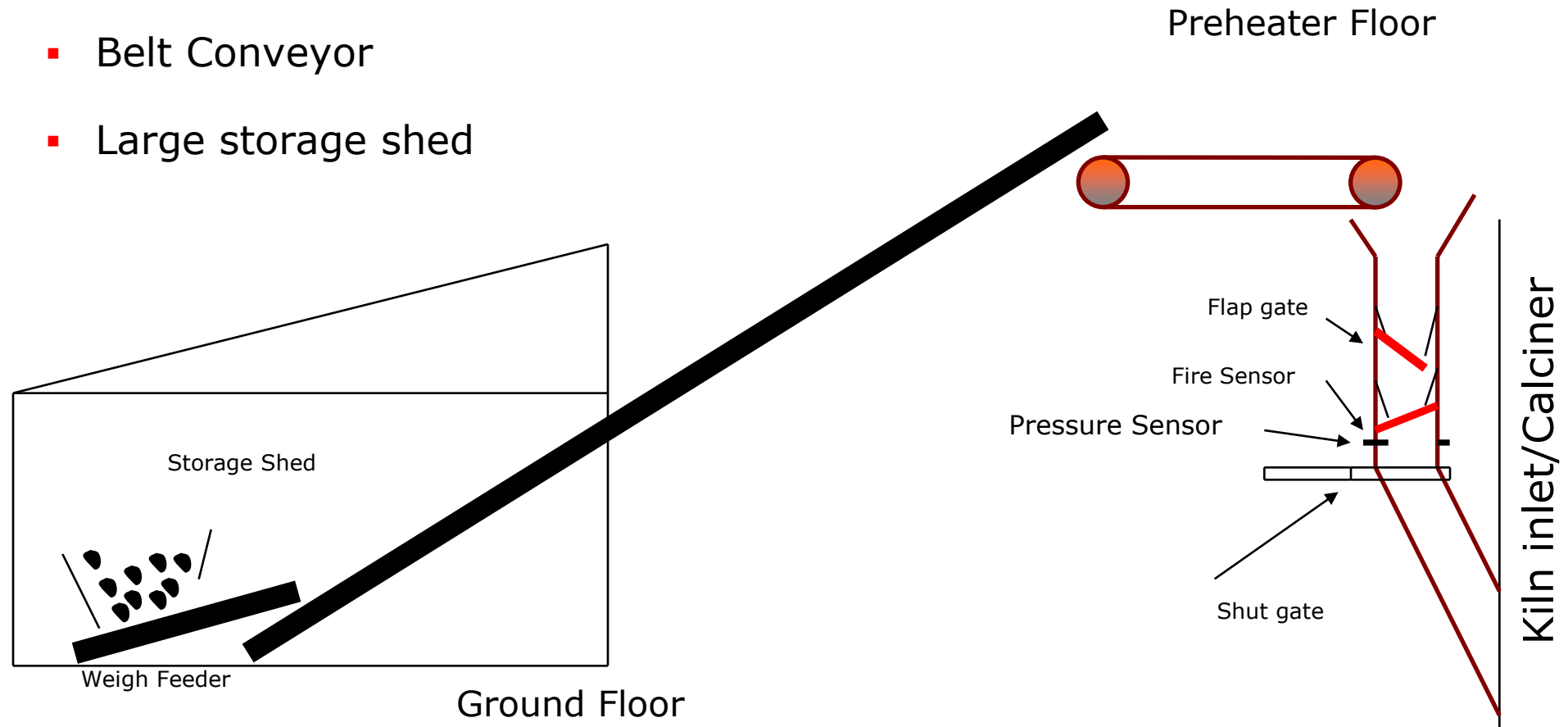
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AFR Feeding System - Starter Kit

- Storage Shed.
- Max. Feeding Capacity : 4 M3 Per Hr.
- Transportation of waste Material - Construction hoist/Monorail hoist
- Hopper.
- Belt conveyor
- Feeding Chute
 - Flap damper
 - Slide Gate
 - Fire sensor
 - Pressure sensor

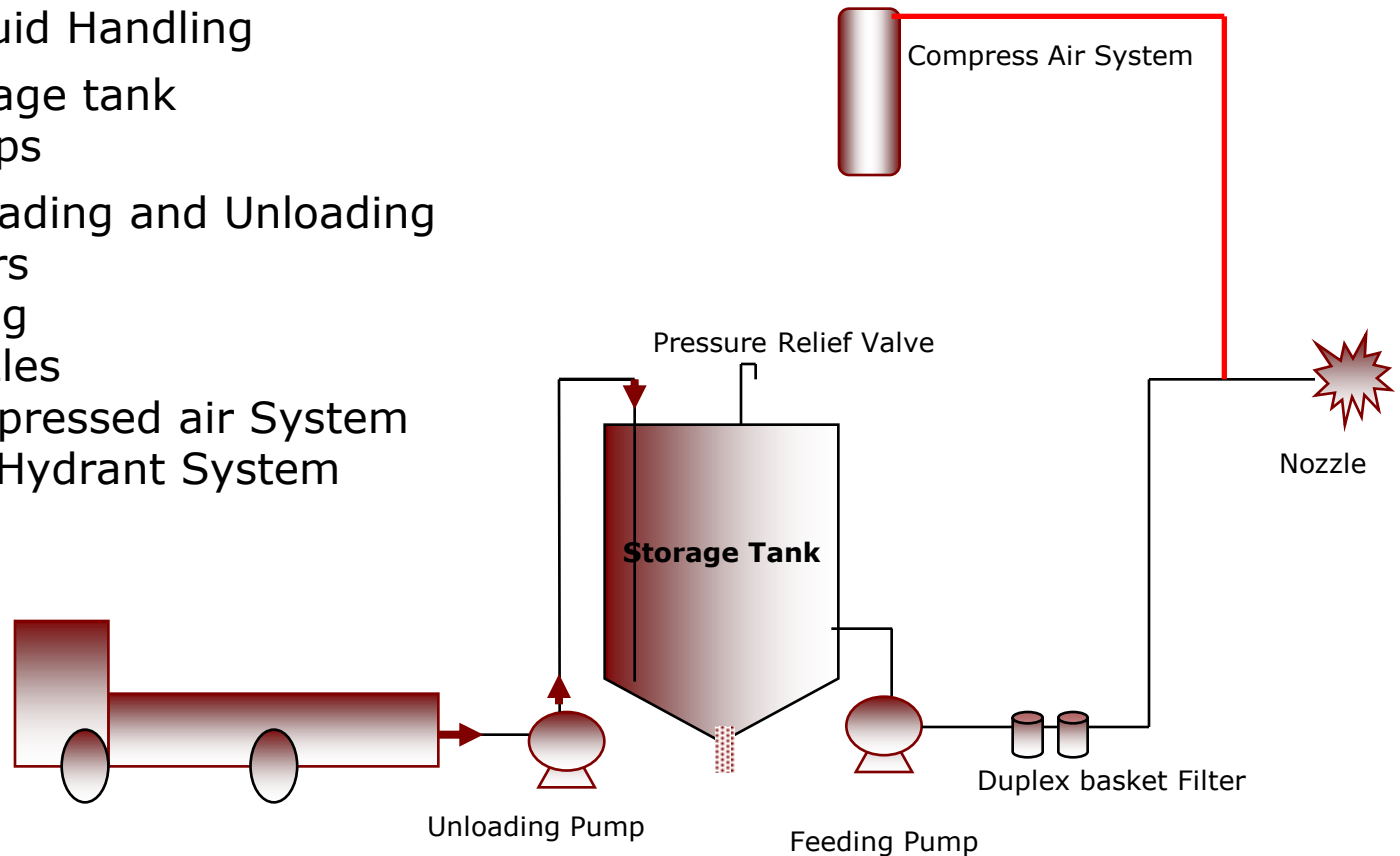


- Belt Conveyor
- Large storage shed



AFR Feeding System – Liquid Handling

- For Liquid Handling
 - Storage tank
 - Pumps
 - Loading and Unloading
 - Filters
 - Piping
 - Nozzles
 - Compressed air System
 - Fire Hydrant System



State of the art Laboratories for waste analysis



Establishment of
Laboratories & facilities for
assessing co process ability
and acceptability of wastes



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- **Trial burns are being carried out to generate large amount of data base on co processing.**
 - to demonstrate the environmentally sound co processing capability of the cement kiln
 - as a statutory measure under the guidance of State Pollution Control Board
 - as a voluntarily jointly by the Industry and ACC
- **Trial burn is conducted at conditions satisfying following criteria**
 - Waste generation rate at the Industry end.
 - Co processing capability of the kiln without adversely impacting the process operation or quality of clinker.
 - OH&S considerations of the plant related to People & Process

Methodology for Co-processing Trial Burn

- **During the trial burn of the waste materials,**
 - the kiln process parameters are closely monitored by ACC process experts and the possible operational impacts are averted.
 - Parameters related to following are closely monitored & recorded through SPCB & CPCB approved third party.
 - Quality of Waste Material
 - Stack Emissions
 - Coal and Raw Meal
 - Clinker
 - The stack emission monitoring is carried out in 3 phases (i.e. **Pre Co-processing, During Co-Processing & Post Co-processing**)

During Co-processing trial Emission Monitoring is conducted by CPCB and ISO 17025 certified 3rd Party Monitoring agency

Stack Emission Monitoring Plan

Parameters	USEPA Method No
Particulate	17
CO ₂ , CO, O ₂ , Moisture	3B
NO _x	7E
NH ₃	6 A/B
HCL	26
HF	26
Heavy Metals (Sb, As, Cd, Cr, Co, Cu, Pb, Mn, Ni, Tl, V)	29
SO ₂	6B
Benzene	NIOSH 1501
Mercury	29/10 1 A
Dioxins (PCDD)/ Furans (PCDF)	23 A
TOC	25 A

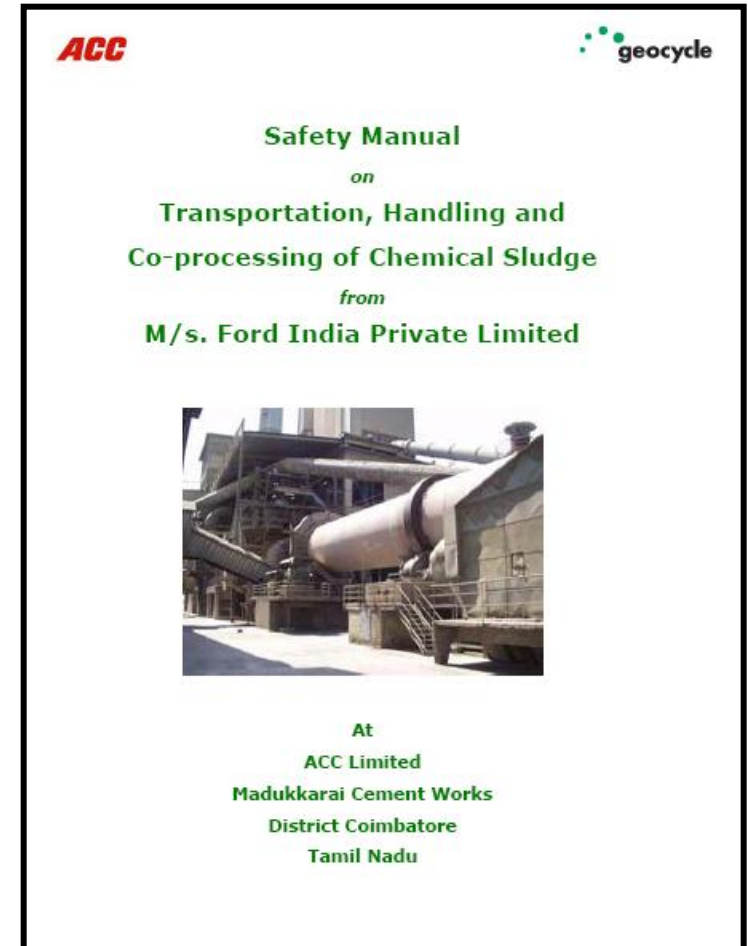
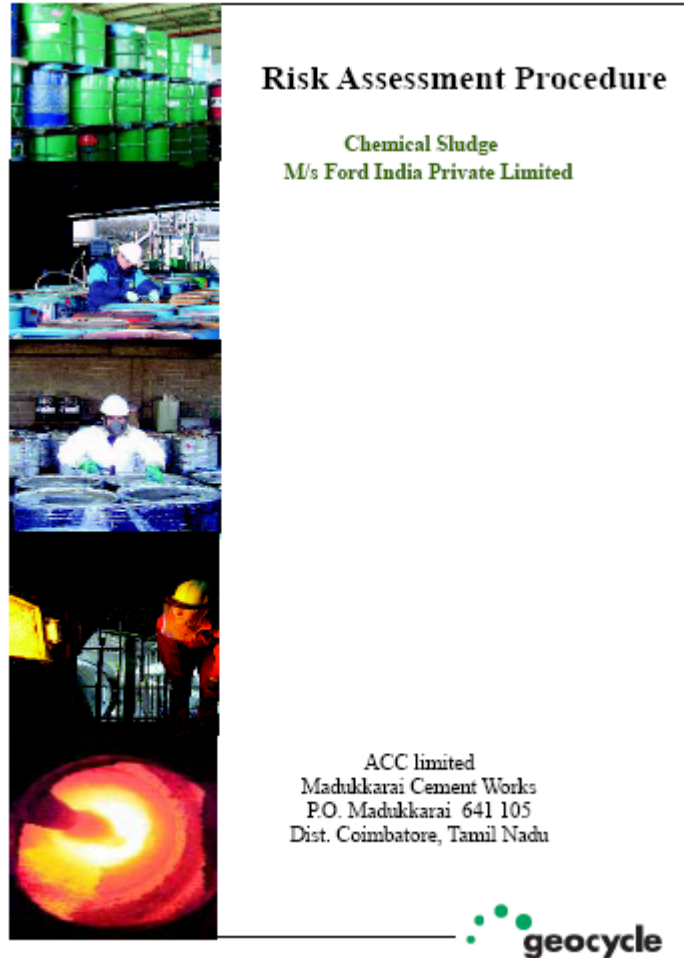
Other Parameters Evaluated

- Waste Material - Total Petroleum Hydrocarbon, Organo Chlorine Compounds, VOCs & Semi VOCs, Poly Chloro Phenols (PCP), Calorific Value, Proximate and Ultimate Analysis, Heavy Metals [Antimony (Sb), Arsenic (As), Cadmium (Cd), Chromium (Cr), Cobalt (Co), Copper (Cu), Lead (Pb), Manganese (Mn), Thallium (Tl), Vanadium (V), Zinc (Zn), Tin (Sn), Selenium (Se)].
- Coal and Raw Meal - Heavy Metals: [Antimony (Sb), Arsenic (As), Cadmium (Cd), Chromium (Cr), Cobalt (Co), Copper (Cu), Lead (Pb), Manganese (Mn), Thallium (Tl), Vanadium (V), Zinc (Zn), Tin (Sn), Selenium (Se)].
- **Clinker** –Heavy Metals: [Antimony (Sb), Arsenic (As), Cadmium (Cd), Chromium (Cr), Cobalt (Co), Copper (Cu), Lead (Pb), Manganese (Mn), Thallium (Tl), Vanadium (V), Zinc (Zn), Tin (Sn), Selenium (Se)].
- **Leaching test of the clinker for heavy metals**

Trials conducted in ACC Works

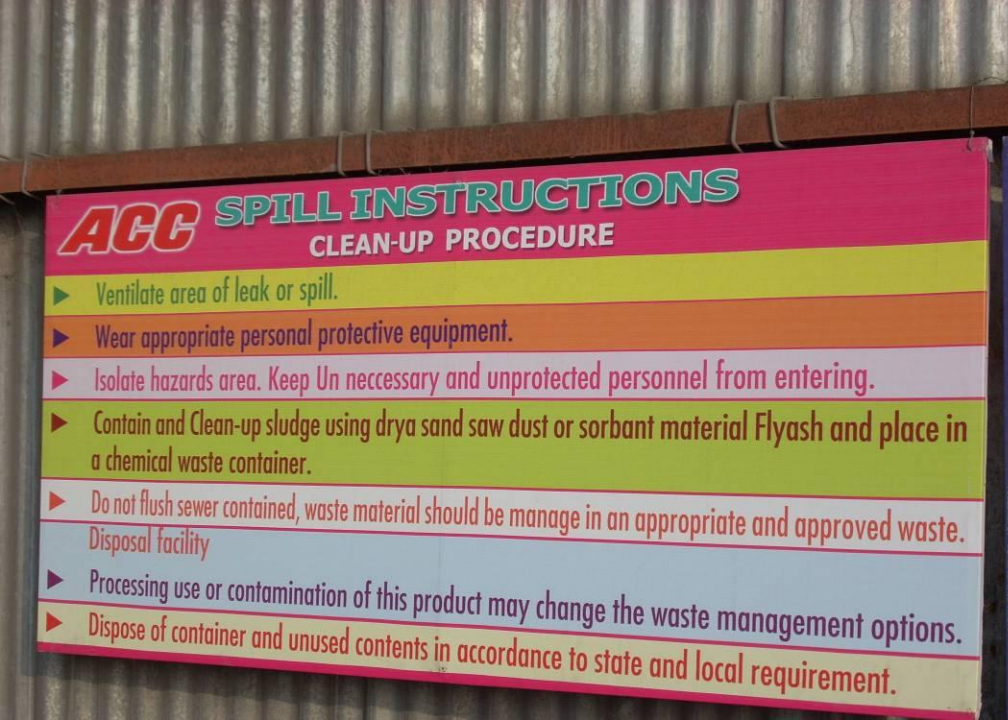
		<u>Industry / Source (Plant)</u>	<u>Waste material</u>
Kymore		HUL	Expired products
		SRF Ltd.	Polyresidue (3 times)
		ICPE	Plastic waste
WADI		Toyota	Paint sludge
			Phosphate sludge
		Coca Cola	Spent Carbon
			ETP Sludge
			WTP Sludge
		Jubilient Organics	N Butanol Residue SEP Sludge
		SKF India Ltd.	Grinding Muck
		Kirloskar Toyoda	Grinding Muck
		Kumar Organics	Benzo Furan
		Suzlon	Green Mesh Resin
Madu kkarai		Ford India Ltd	Chemical sludge
			Phosphate sludge
			Chemical ETP sludge Oily rags
Chanda		Nivea ACC Limited	Expired products

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- Safety precautions are ensured during transportation of waste materials from Waste generation site to designated ACC Works
- Safety training is imparted to concerned personnel
- All necessary PPEs (safety shoes, helmets, hand gloves, vapor mask) are provided



- Boards displaying precautionary measures, safety signs, work procedures while handling waste material etc. are displayed at various locations
- Fire extinguishers are made available in the storage shed

Example of Workplace Label

N - BUTANOL RESIDUE Waste Generator: M/s Jubilant Organosys Ltd. Nanjangud, Karnataka.				
				
D A N G E R				
Hazard Statement				
* COMBUSTIBLE, Catches fire at high temperature * CORROSIVE * Health hazards: Eye contact : causes eye irritation Skin contact: May cause skin irritation Inhalation : Irritating to mucous membrans and upper respiratory track. Ingestion: May be harmful. * Decomposition products: Carbon monoxide & carbon dioxide * Incompatibility: Strong oxidising agents				
Precautionary Statement				
* Storage: Keep tightly closed. Store in covered, cool dry place. * Fire Fighting Measures: Water spray, CO2, DCP or Foam type * First-aid Measures Eye contact : Immediately flush eyes (with eyelids open) with water for atleast 15 min. Skin contact: Gently flush affected areas with soap and water. Remove contaminated clothing. Inhalation : If inhaled, remove to freash air. If not breathing give artificial respiration. Ingestion : If swallowed, wash out mouth with water provided person is conscious. Call a physician. * Spill Release Procedure: Wear appropriate personal protective equipment. Collect the spilled the material and store it in labelled container and use for co-process. * Personal Protection: Nitril rubber hand gloves Organic vapour respirator Chemical safety goggle PVC apron				

- Waste Specific Workplace Label is prepared for each waste material
- These labels are displayed in both English & Local language



Golden Peacock Awards

*World Environment Foundation (WEF) has recognized the efforts made by ACC Limited in providing waste management services and the prestigious **Golden Peacock Award 2008 for Eco-Innovation** was awarded this year to **ACC AFR Department for "Disposal of Industrial Wastes through Co-processing them in cement kiln"**.*

GreenTech Environment Excellence Award



Thank You