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For a zero-waste future

Lafarge Richmond Kiln: Integral to BC and the Lower Mainland Waste Diversion

Rustam Punja
Geocycle Canada
778-833-1968

Geocycle – Facts and Figures

- Subsidiary of LafargeHolcim since the 1970's
- 2000 employees
- 50 countries on all continents
- 180 cement plants (co-processing) facilities
- 80 pre-treatment facilities
- 14M tonnes of waste treated by Geocycle every year leaving no residues
  - North America – 3M tonnes
- 16M tonnes of C02 emissions prevented through recovery of energy from processed waste

Cement vs Concrete – There is a difference!

Cement → Water + Rocks +Sand → **Concrete**

Step 1. Creating a raw mix

- Raw materials are combined in exact proportions to create a chemically correct raw mix
  - Silica (sand, clay, shale) (foundry sand, sandblast…)
  - Alumina (clay, shale, bauxite) (catalysts, coal ash, WTR…)
  - Iron (mill scale, smelter slag)
  - Lime (limestone)
- Raw mix is pulverized in a mill

Creating a Raw Mix (1.6M mt/year)

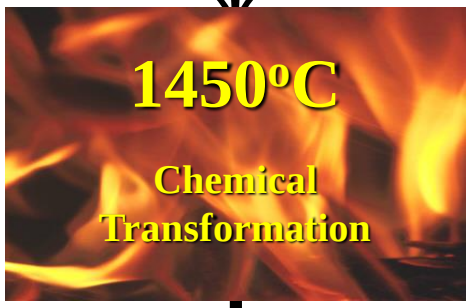
Limestone: Quarry

Silica: Sand , contaminatedf soils, blasting media,

Alumina: Coal Ash, Catalysts

Iron: Steel slag, millscales

Burning the raw mix

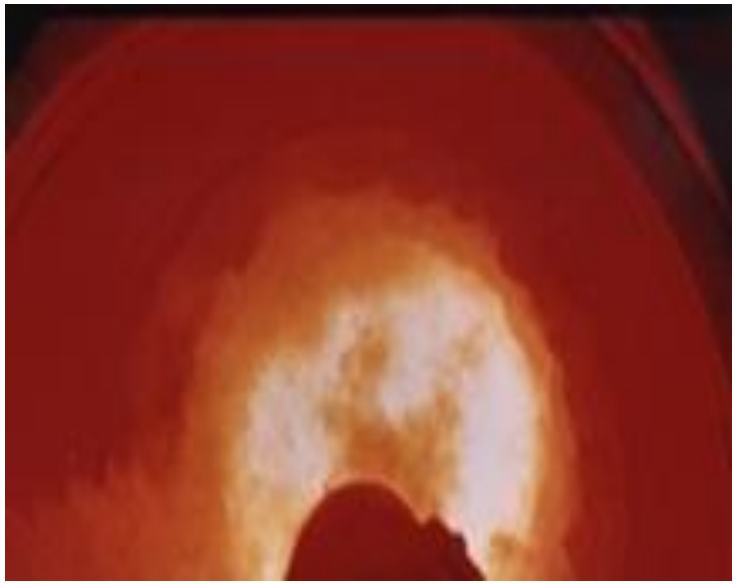


Pulverizing Clinker to Cement w/Gypsum

Cement

Step 2. Burning the raw mix in a kiln

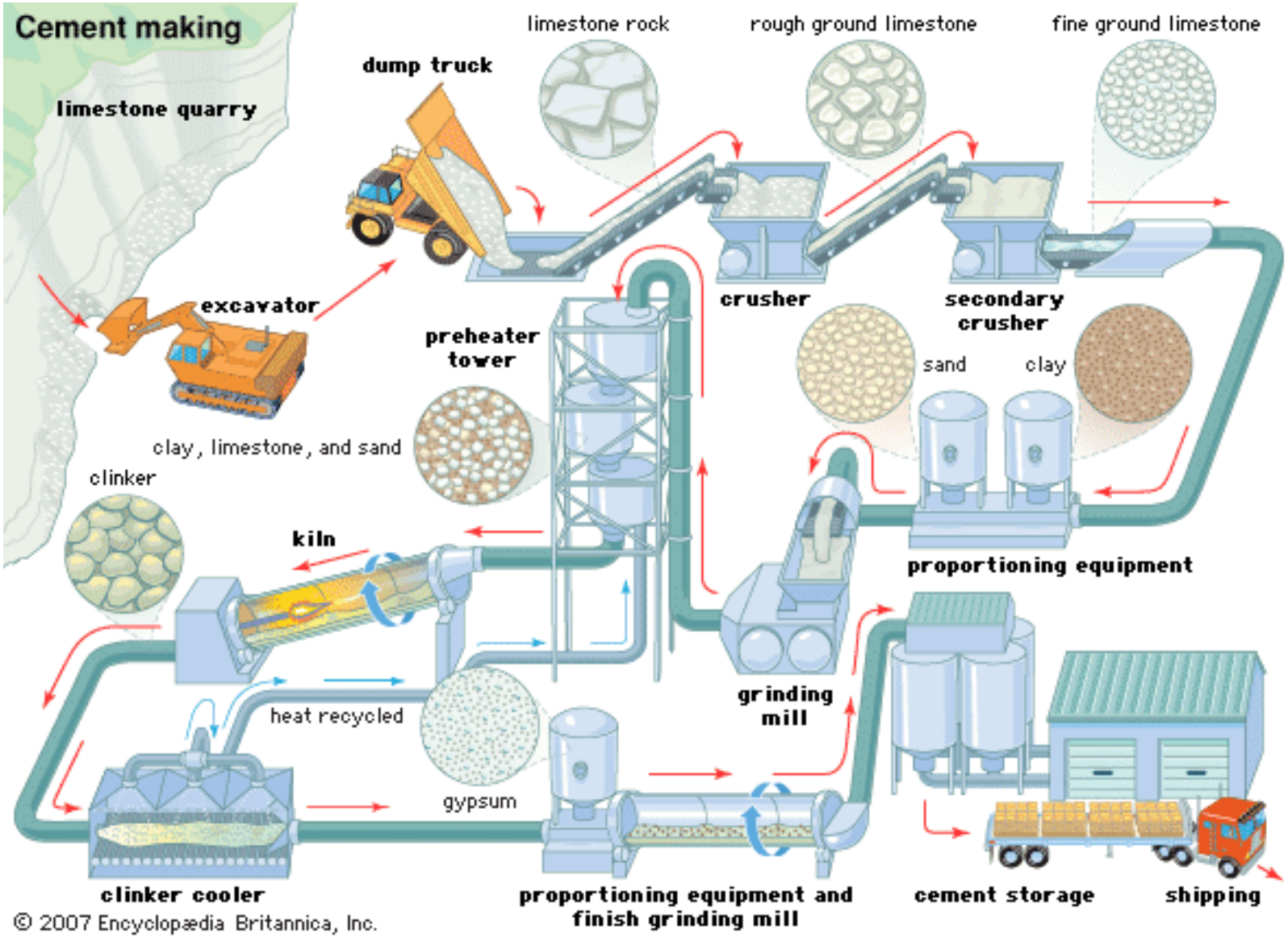
- Raw mix is burned in a kiln
- Material temperatures >1450 ^{0} C
- End product is cooled to form pellet size material “Clinker”
- Alternate fuels are introduced here



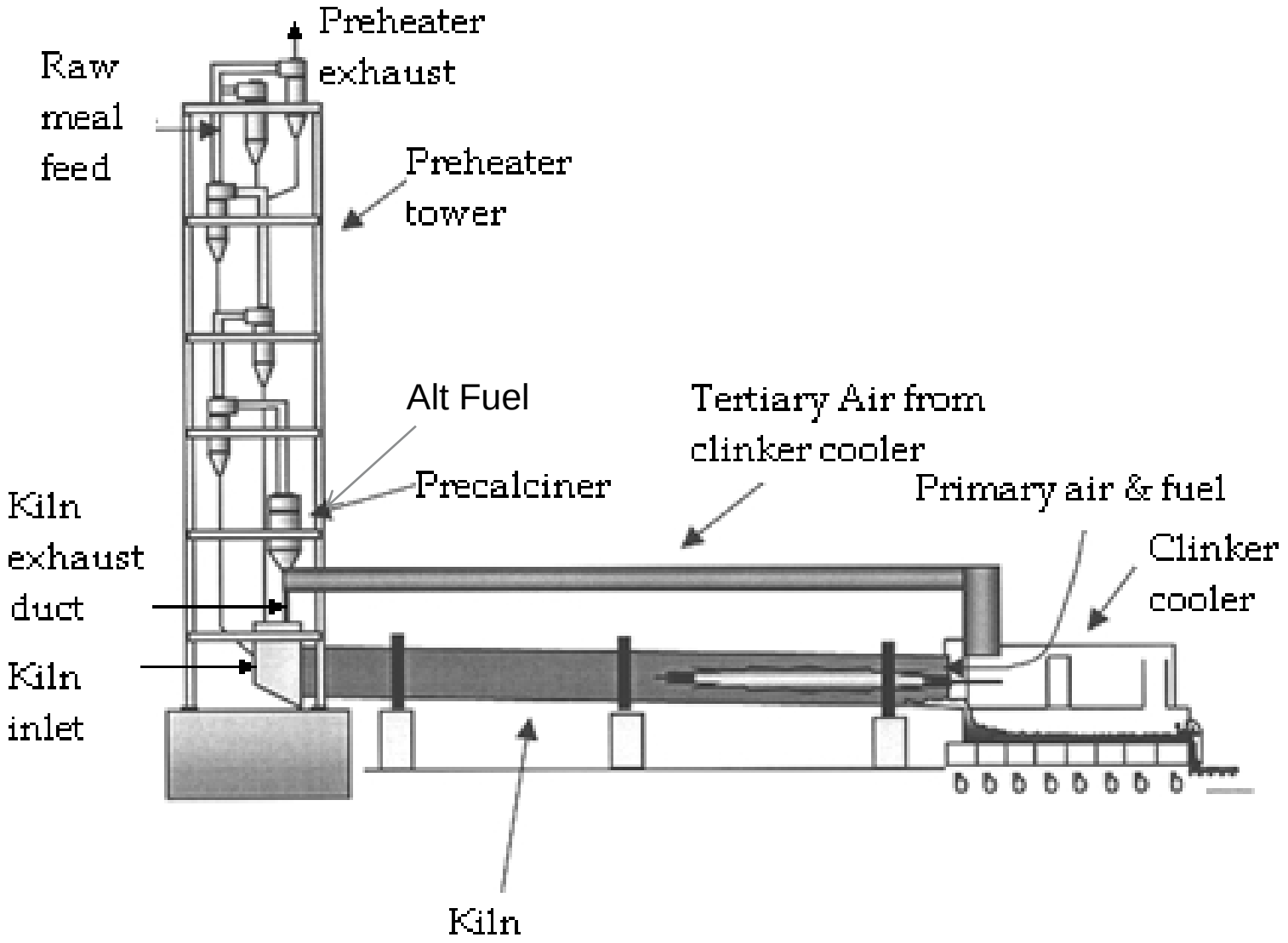
Step 3. Pulverizing the Clinker

- Clinker is combined with a small percentage of gypsum and ground in a mill to produce the powder know as cement (Gypsum wallboard can be included)

Cement Manufacturing Process



Cement Kiln – Heating and Burning Zones

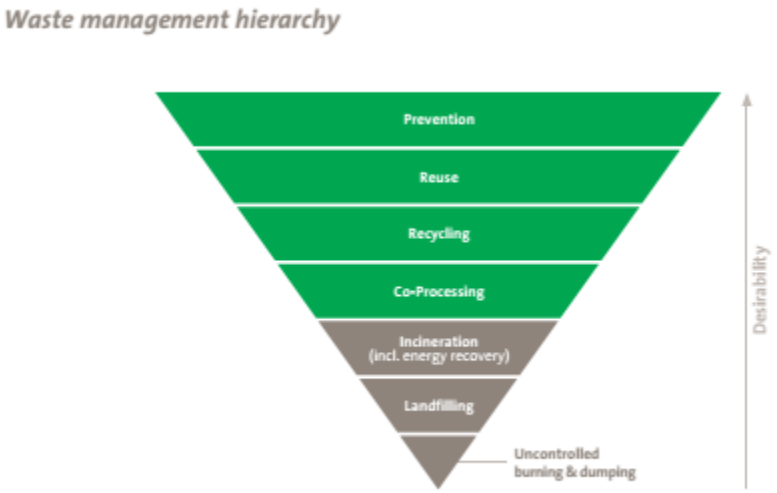


What is Co-Processing?

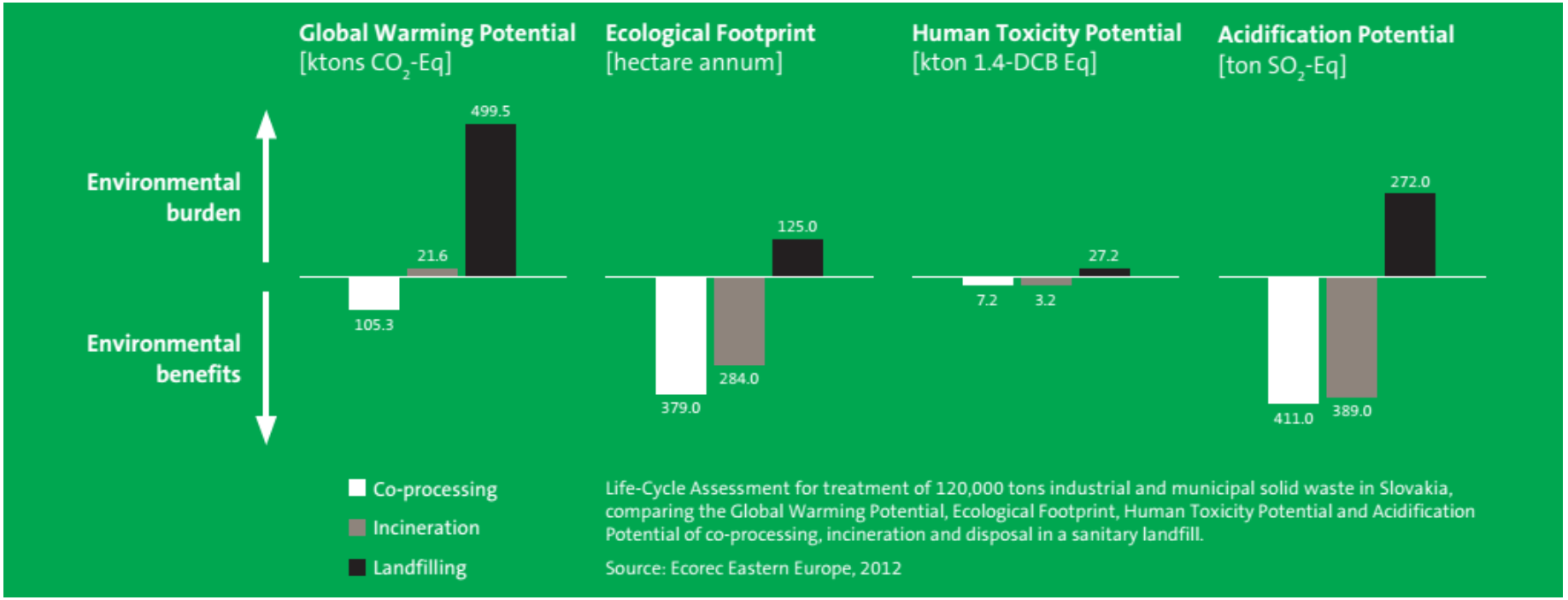
- Simultaneous recovery and recycling process
  - Combustible Waste = Energy
  - Mineral Waste = Raw Material
  - Developed in the late 1970's
- Unique waste management solution
  - Main objective is substitution of primary fossil fuels and raw materials in one single industrial process. The production of clinker and cement.
  - No ash residues
  - Main objective of incineration is disposal of waste. Ash residue left behind.
- Regulated process

Advantages of Co-Processing

- LCA demonstrates co-processing offers superior environmental performance to landfilling and incineration
  - Completely destroys waste material due to high temperature (1450C) and long residence time
  - Avoids formation of dioxin and furan due to temperature profile
  - Leaves no ash that needs to be landfilled
  - Reduced GHG emissions as waste is used to replace fuel
  - Preserves non renewalbe materials (fossil fuels and minerals)



Co-Processing Reduced GHG Emissions



Various Alternative Raw Materials

- Aluminum catalysts
- Fluid cracking catalysts
- Boiler ash
- Silica Desiccant
- Contaminated soils (metal impacted)
- Steel slags, copper slags, millscales
- Refractory bricks
- Spent blast abrasives
- Spent foundry sands
- Flyash/Bottom Ash
- Incinerator Ash
- Lime Sludge
- Alumina Sludges
- Filter Cakes
- And many more…

Various Alternative Fuels

- Wood waste
- Construction waste
- Non Recyclable Plastics
- Non Recycle Paper
- Coated paper
- Biomass such as seeds and shells, rice husks, coffee chaff
- Animal Meal
- Treated Wood
- Muncipal Solid Waste
- Roofing tear-off
- Tires – whole or shred
- Carpet and Textiles
- Waste oils and solvent
- Rubber Waste
- Shredded tires
- Used oil
- Glycerin
- Hazardous Wastes

Alternative Fuel Criteria

- Chemically compatibility
- Physical characteristics, handling and process introduction
- Environmental considerations
- Health and safety factors
- Financial considerations
- Guidelines:
  - Moisture < 25% (can go to 40% but adds considerable cost, lower is better)
  - Chlorine < 0.4% (lower is better)
  - Calorific Value (as received) > 12 Gj/T (higher is better)

Alternative Fuel Opportunities: C&D

- Construction and demolition debris, industrial solid waste, and other waste are ground for use as an alternative fuel/ coal replacement.
- Richmond, BC Plant

Alternative Fuel Opportunities: Wood residues

- Cedar shavings
- Mill planings
- Mill wastes
- Secondary manufacturing
  - Wood working (cabinetry etc)
- Green wood (hog) typically not suitable due to high moisture

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New AF System (1/2)

- **$22M investment** in co-processing system
- > **100,000 tonnes/year**
- Goal is to substitute **>50%** of traditional (fossil) fuel
- Currently in Commissioning
- Highlights of system
  - **Large storage hall –** unique in this industry and one of the largest we have in the world. This is a market differentiator
  - Completely **enclosed** system
  - **Belt conveyor** feeds to Pre-Calciner System. Much more robust than current pneumatic system. More forgiving for oversized contamination (no plugging)
  - Weigh feeder dosing system
  - Police screening – the last line of defense before AF goes up the belt (star screens and magnets)

New AF System (2/2)

- Safety - world class design in line with Geocycle ACERT procedures
  - Truckers drive through (no backing up) and offload quickly
  - World class fire suppression and explosion protection system
    - Limited horizontal surfaces built into design
  - Fireproof materials and waste segregation standards
  - Rigorous qualification standards
- Environmental protection
  - Includes fire water capture, rain water
  - Enclosed – fugitive dust and windblow, noise reduction, aesthetics and dry storage
  - Alternative fuels subject to strict quality management system including lab testing

Cement Kiln Beneficial Recovery

- Cement kilns can provide complete and safe destruction for a variety of byproducts while recovering their inherent value.
- Beneficial recovery is aligned with the concept of sustainable development through the replacement of fossil fuels and conventional materials with byproducts.
- Proven safe use of byproducts at many cement plants worldwide.

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