Beneficial Recovery of Metal Contaminated Soils in a Cement Kiln

- Cement manufacturing process
- Lafarge’s Beneficial Resource Recovery Program – use of Metal Contaminated Soils
- Summary and Questions
Subsidiary of Lafarge (since 1986)
Works with Cementos Argos to continue supplying alternative fuel for two cement plants that were purchased from Lafarge in 2011 - Harleyville, SC and Calera, AL
Works with Eagle Materials Inc. which purchased the Tulsa, OK and Sugar Creek, MO facilities from Lafarge in 2012.

Lafarge SA had over $19 billion in sales in 2011 and is:
- a global Fortune 500 company
- the world’s largest cement and construction materials manufacturer
- a world-wide user of waste by-products
- on most recent list of: “Global 100 Most Sustainable Corporations in the World”

Cementos Argos
- has facilities in Columbia, the U.S. and the Caribbean
- had $2.0 billion in sales in 2011

Eagle Materials, Inc.
- has six cement plants, all based in the United States (also has other construction materials divisions)
- had revenue of $495 million in 2012.
Systech’s Coverage Area
and other cement partner locations

- w/Systech (haz/nonhaz FQW)
- w/Systech (nonhaz byproduct/fuels)
+ Ecuador and Honduras
- Lafarge Cement plant

- w/Systech (nonhaz byproduct fuels)
- w/Systech (haz/nonhaz FQW)
- Eagle Mat’l Cement plant
- Cementos Argos (nonhaz fuels)
Cement Manufacturing Process
Cement vs Concrete – There is a difference!

Cement: Water + Rocks + Sand

Concrete: Water + Rocks + Sand
Cement Manufacturing Process

Step 1. Create a raw mix
Step 2. Burn the raw mix in a kiln to produce “clinker”
Step 3. Pulverize the clinker to make the powder known as cement
Step 1. Creating a raw mix

• Raw materials are combined in exact proportions to create a chemically correct raw mix
  – Silica (sand, clay, shale)
  – Alumina (clay, shale, low grade bauxite)
  – Iron (mill scale, smelter slag)
  – Lime (limestone)

• Raw mix is pulverized in a mill
Step 2. Burning the raw mix in a kiln

- Raw mix is burned in a kiln
- Material temperatures >1450 °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 known as cement.
Richmond Cement Kiln
Richmond Cement Kiln
How Cement is Manufactured – 3 Step Process

1. Creating a raw mix
   - Lime: Limestone
   - Alumina: Ash, Shale
   - Silica: Sand, soil
   - Iron: Steel slag

2. Burning the raw mix
   - 1450°C
   - Chemical Transformation

3. Final Grind
   - Clinker

   - Cement
Lafarge’s Beneficial Resource Recovery Program
Resource Recovery Opportunities at Cement Plants

1) Replacement of conventional raw materials with byproduct streams originating primarily from industrial and commercial sources.

2) Replacement of conventional fuels with by-product streams originating from industrial, commercial, institutional and residential sources.
Beneficial Recovery of Metal Contaminated Soil Materials

- Cement plants consume large quantities of conventional raw materials such as sand, shale and limestone.
- Industrial by-products can off-set usage of natural raw materials
- A large number of cement kilns around the world consume a wide variety of by-products containing silica, alumina, iron and/or lime.
Contaminated Soil Utilization Criteria

- Non hazardous soils only
- Chemically compatibility
- Physical characteristics, handling and process introduction
- Environmental considerations and impact on emissions
- Health and safety factors
- Financial considerations
Typical Alternative Raw Materials

- Aluminum catalysts
- Fluid cracking catalysts
- Boiler ash
- Silica Desiccant
- Metal impacted soils
- Spent abrasives
- Spent foundry sands
- Flyash
- Lime Sludge
- Alumina Sludges
Lafarge Cement Kiln Beneficial Recovery

• Lafarge cement kilns can provide complete and safe destruction for a variety of byproducts including contaminated soil 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 use of byproducts at many of Lafarge’s plants worldwide.
Cement Kiln Beneficial Recovery Differs from Incineration

- Conventional raw materials are replaced by the by-products
- Conventional fuels are replaced by the by-products for energy use
- No residual materials to landfill – NO ASH
  - Ash is incorporated into final product