MANAGING RESOURCES of USA: Opportunities for Resources of the Future

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Reduce, reuse, and recycle for sustainable developments. Minimize use of manufactured materials.
Basic Approach

WASTE is wasted if you waste it, otherwise it is a resource.

Recycle. Recycle as is.

Recycle without additional processing, (i.e., without adding any cost to it).
Introduction

• Over 5 billion tonnes of non-hazardous by-product materials are produced each year in USA (2000). At an average cost of $30. per ton, it would cost B$150. to throw it all away.

• They consist of by-products from agricultural sources, domestic/post-consumer sources, industrial sources, and materials processing sources.
Coal Ash

Fly ash & Bottom ash

Cyclone boiler slag, Cenospheres

FGD Materials (dry or sludge)

AFBC & PFBC Materials

Clean-coal ash

Co-generation ash (coal, wood, petroleum coke, etc.)
Coal Ash (CCPs)

- Over 100 million tons of non-hazardous coal combustion products (CCPs) are produced each year in USA (2003). At an average disposal cost of $30 per ton, it would cost three billion USD to throw it all away.

- CCPs are produced by coal-burning power plants to generate electricity and other industrial plants/boilers to generate steam/energy.

- These by-products generally can be used as a partial substitution of cement and many other everyday construction needs.
Coal Combustion Products (CCPs)

- Develop recycling technology for high-volume applications of coal combustion products (CCPs) generated by using both conventional and clean-coal technologies.

- Fly ash (Class F, since 1930s, and Class C, since early 1980s), bottom ash, cyclone-boiler slag, and clean-coal ash (since late 1980s, ash derived from SOx control technologies, including FBC and AFBC or PFBC boilers, as well as dry- or wet-FGD materials from SOx/NOx control technologies).
Blast furnace slag, Scrap-iron slag, Electric-arc Furnace slag.
Foundry By-Products

• About 15 million tons of non-hazardous by-product materials are produced each year in USA (2003) by the cast-metals industry (foundries). At an average cost of $30. per ton, it would cost 450 million USD to throw it all away.

• They consist of by-products from sand molds (used foundry sand - UFS), broken or rejected core butts, slag, furnace-refractory, dust-collector fines, floor-sweepings, abrasives, materials processing sources, and other similar materials.
Foundry By-Products

(steel, iron, brass, aluminum)

- Used Foundry Sand

- Core butts, abrasives, etc.

- Cupola Slag

- Bauxite processing and aluminum & brass foundries by-products
Foundry Slag

In Wisconsin, the most prominent scrap or new metal melting method is Cupola at 73% and 25% is induction furnace. The other category is Electric Arc Resistance furnace.
Pulp and Paper Mills and Paper-recycling Facilities Residual Solids (i.e., sludge)
Introduction

• Forest products industries are pulp and paper mills, lumber mills, wood products manufacturers (e.g., furniture, windows & doors, pallets, etc.), paper recycling plants, and others.

• According to estimates, over 10 million wet-tons of non-hazardous primary & secondary clarifier residuals are produced each year in USA (2002). These and all other by-products from such industries totals over 20 million wet-tons per year. At an average disposal cost of $30 per ton, it would cost 600 million USD to throw it all away.
Recycled-Paper Primary Sludge Solids
Residual Fiber Reinforcing a Micro-crack in Concrete
Wood ash
Introduction

• Forest products industries are pulp and paper mills, lumber mills, wood products manufacturers (e.g., furniture, windows & doors, pallets, etc.), paper recycling plants, and others.

• Over five million wet-tons of wood ash is produced. These and all other by-products from such industries totals over 20 million wet-tons of per year. At an average disposal cost of $30 per ton, it would cost 600 million USD to throw it all away.
Wood Fly Ash & Bottom Ash

Generated by burning a combination of wood products (bark & chips), saw-dust & wood from saw mills, wood products industry, scrap-paper pellets, coal, coke, or oil.
Wisconsin alone generates approximately one million tons of wood ash each year.
CKD and LKD
Mining tailings, spoilage, and dust.
Dredged Materials
Brown Fields Soils

In-situ brown field remediation, excavated soils re-use, engineered fills & structural embankments with high-volume industrial by-products.
Textiles and carpet fibers
Post-Consumer Glass – for SCM and/or pozzolanic aggregates
Post-Consumer Plastics

Hard plastics & Styrofoam
Wood waste from (forest products industry)sawmills, pulp mills, wood processing industries, etc. to pins, chips, and bundled fibers.
New construction and CDW scrap woods to pins, chips, and bundled fibers.
CDW painted and treated woods to pins, chips, and bundled fibers.
CDW – clay bricks to SCM, and concrete blocks and other concrete to SCM and pozzolanic aggregates.
Scrap wallboards (gypsum drywalls) from new construction and CDW.
MSW for Cement

Residues from incineration facilities, with or without sewage sludge.
Biodegradable-MSW for Composting with vermicomposting

Anaerobic decomposition followed by wastewater sludge, wood ash, coal ash, and/or cement- or lime-kiln dust.
• To obtain compost efficiently and faster: anaerobic digester followed by vermicomposting, co-composting of BSW (biodegradable solid wastes) with sewage sludge and wood ash and/or coal fly ash and/or cement- or lime-kiln dust.

➢ Advantages:
  ✓ Generates a finished compost instead of soil conditioner;
  ✓ Generates liquid fertilizer;
  ✓ Generates biogas (which can be used to provide energy and steam to the plant);
  ✓ Allows marketing of worms; and,
  ✓ Reduces total processing time.
Construction and demolition waste represents a significant proportion of total waste generation. It contains useful products, such as metals, wood products and sawn lumber, bricks and other masonry, plasters and concrete, clay, soil, and other recyclable materials. Use of such materials as a secondary aggregates and/or rip-rap for flood banks protection is one of the best practices. Be careful for painted and/or treated wood, asbestos, roofing shingles and other tar-based products, contaminated soils, painted wall boards, and other similar materials.
Saving of Resources by Recycling (per ton):

- Paper – 17 Grown trees, 26,000 Lts. water, and 4,100 kw of electricity;
- Plastics – Petroleum, natural gas, 40,000 Lts, water, and 5,040 kw of electricity;
- Aluminum – 4 tons of bauxite and 91,200 Lts. of water;
- Glass - 1.2 tons of silica sand, 50% less water, and 2,400 kw of electricity.
Time for Degradation in Landfills at ambient condition (years):

- Periodicals – one; Paint cans – 13;
- Plastic bags – 100;
- Steel cans – 100; Aluminum cans – 200 to 500;
- Plastic bottles – 450; and,
- Glass – more than one million.
Spaceship Earth – La Bella Terra

Center for By-Products Utilization
Thank you very much for your interest.
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