

## *Reuse Options for Industrial By-products*

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### **Solid Waste Regulations**

- Part 115, Solid Waste Management, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended
- Michigan's Solid Waste Management Act Administrative Rules
- Subtitle D of the federal Resource Conservation and Recovery Act of 1976, as amended

### **Waste Utilization**

- Using waste, site or source separated materials, or other approved material for beneficial purposes
  - reuse
  - recycling
  - composting
  - energy recovery
  - gasification
  - anaerobic digestion

### **Why Recycle?**

- Good for economy
- Creates jobs
- Reduces waste
- Good for environment
- Saves energy
- Preserves landfill space
- Prevents global warming
- Reduces water pollution
- Protects wildlife
- Creates new demand

### **Materials defined as Beneficial Use By-Products**

- Cement Kiln Dust/Lime Kiln Dust: Particulate matter collected in air emission control devices serving Portland cement kilns and lime kilns.
- Coal Bottom or Wood Ash: Ash particles from combustion of coal or any type of ash or slag resulting from wood burning.
- Coal or Wood Ash: Material recovered from an air pollution control system or non-combusted residue from combustion of coal, wood, or both (although only cementitious ash is suitable for use as fill).
- Dewatered Grinding Sludge: from public transportation agency road projects.
- Flue Gas Desulfurization Material: Material recovered from air pollution control systems that capture sulfur dioxide during wood, coal, or fossil fuel combustion including synthetic gypsum.
- Foundry Sand: Silica sand used in metal casting process from ferrous or nonferrous foundries.
- Lime Softening Residuals: from treatment and conditioning of water for domestic use or community water supply.
- Mixed Wood Ash: Material recovered from air pollution control systems or non-combusted residue from combustion of wood, scrap wood, railroad ties, and tires.
- Pulp and Paper Mill Ash: Non-combusted residue remaining after combustion of coal, wood, pulp and paper mill material, wood or biomass pellets, rail road ties, tires, and scrap wood.
- Pulp and Paper Mill Material: Materials generated at pulp and paper mills including wastewater treatment sludge; rejects from screens, cleaners, and mills; bark, wood fiber, and chips; scrap paper and causticizing residues.
- Soils Washed or Removed from Sugar Beets.
- Spent Media from sandblasting: with uncontaminated soil, newly manufactured, and unpainted steel.
- Stamp Sands: Sand remaining after stamping and processing copper bearing ores.

### **Specific Beneficial Uses for By-Products**

- Beneficial Use 1: Means use as aggregate, road material, or building material if it will be bonded or encapsulated by cement, limes, or asphalt.
- Beneficial Use 2: Means use as construction fill, road base, soil stabilizer, or road shoulder material.
- Beneficial Use 3: Means application of material as a fertilizer, a soil conditioner under Part 85, or a liming material under 1955 PA 162.
- Beneficial Use 4: Means use to stabilize, neutralize solid, or treat waste; to treat wastewater or sludge; to stabilize hazardous substances; or to serve as landfill construction material.
- Beneficial Use 5: Means soil mixtures using foundry sand and organic material to manufacture soil.

#### **Paper Mill Residuals Program Vision**

- Reclamation of Rock Stockpile Benches and Slopes Utilizing Paper Mill Residuals At Cleveland-Cliffs Michigan Operations
- Collaborative research program to successfully pioneer technical development of paper mill residuals to accomplish vegetation of waste rock stockpile benches and slopes meeting final reclamation requirements without soil cover or other amendments under Part 631, Reclamation of Mining Lands, of the Michigan Natural Resources & Environmental Protection Act 1994 PA 451
- 2003 - 05 Participants
  - Cleveland – Cliffs Michigan Operations
  - International Paper Quinnesec Mill
  - NewPage Paper Escanaba Mill
  - Manistique Papers Manistique Mill
  - Michigan Department of Environmental Quality
- The solid material removed from the waste water treatment system is referred to as paper mill residuals or “paper sludge”

#### **Residuals Primary Constituents**

- Water
- Clay Particles - Kaolin
- Coating – Fine Grained Calcium Carbonate
- Whiteners – Titanium Dioxide
- Inorganic Nitrogen from Wastewater Treatment Plant
  - Added to promote biodegradation and immediately available to plants
- Organic Nitrogen from Process
  - Slowly converted to Plant Available Nitrogen
- Macronutrients – N, P, K, Ca, Mg, S
- Micronutrients – Mn, Fe, Zn, Al, Cu, Na, B

#### **Residuals Beneficial Use**

- Paper mill residuals act as a nitrogen sink during the early stages of organic matter decomposition, due to the high C/N ratio, which results in nitrogen immobilization. This occurs when the nitrogen concentration of the residuals is insufficient to meet the demands of the soil microbial community and results in reduced growth.
- Note different coloration of residuals from same mill
- Cleveland Cliffs uses three practices to overcome nitrogen immobilization:
  - Applying and spreading residuals 6-12 months in advance of planting
  - Using a nitrogen supplement at planting to satisfy microbial demand
  - Planting grass mixes with legumes to reduce initial nitrogen demand

#### **Reuse Options for Other Materials**

- Composting
- Tires

2017 Michigan Industrial By-Products Reused (tons)<sup>1</sup>

Material	Recycled	Disposed	Percent Recycled	Percent Volume Change from 2016	2009 Volumes	Percent Volume Change from 2009
<b>Pulp/Paper/Wood Sludge<sup>2</sup></b>	115,241	117,161	50%	+1%	39,889	+189%
<b>Shingles</b>	29,014			+42%	19,650	+48%
<b>Scrap Wood<sup>3</sup></b>	102,267			-7%	26,432	+287%
<b>Cement Kiln Dust</b>	25,007	359,746	6%	+0%	29,081	-14%
<b>Lime Kiln Dust</b>	49,507		NA	+4%	NA	NA
<b>Foundry Sand<sup>4</sup></b>	111,866	253,298	31%	+32%	66,870	+67%
<b>Food Processing</b>	20,568			-3%	16,073	+28%
<b>Coal Ash<sup>5</sup></b>	111,522	1,208,560	15%	-44%	174,900	-36%
<b>Drywall</b>	8,609			+1,200%	1,048	+560%
<b>Flue Gas Desulfurization Sludge</b>	374,715			+1,207%	32,328	+1,060%
<b>Wood Ash<sup>6</sup></b>	3,563	93,373	4%	+42%	5,592	-37%
<b>Totals</b>	<b>951,878</b>			<b>+39%</b>	<b>411,863</b>	<b>+131%</b>

<sup>1</sup> Did not count any of the listed materials that were used for alternate daily cover or waste stabilization as being reused

<sup>2</sup> 3 wet tons per dry ton

<sup>3</sup> 6 cubic yards per ton. With low natural gas prices, less scrap wood is being burned at power plants

<sup>4</sup> 1 cubic yard per ton

<sup>5</sup> Coal ash is exempted by statute. Obtained recycling numbers by contacting Headwaters Resources

<sup>6</sup> Wood ash from clean wood is exempted by statute with no reporting requirements