

METHOD OF RECYCLING HAZARDOUS WASTE

BENEFITS

- Conserves the energy required to concentrate and melt ores
- Eliminates transportation costs and energy for shipment of ores
- Recycles hazardous materials that would otherwise be sent to special hazardous waste landfills
- Lowers cost of process for recovering metallic values and producing mineral wool insulation fiber
- Offers significant cost savings while recycling materials
- Creates no additional pollution because no liquid or solid waste discharges are produced

APPLICATIONS

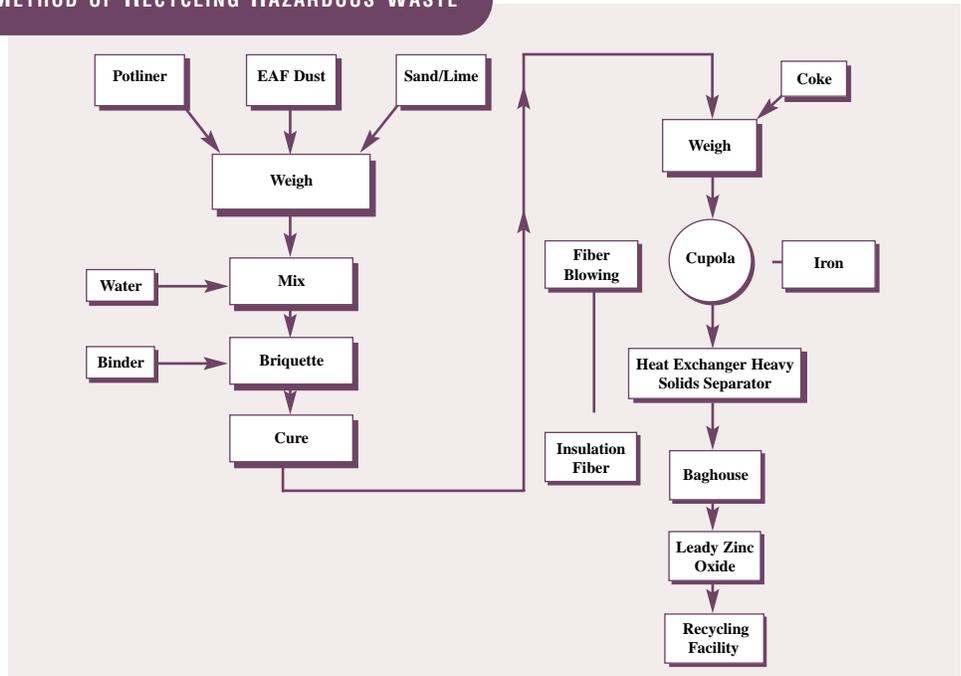
This technology utilizes wastes from the steel, aluminum, and metal finishing industries and eliminates the cost of disposing of hazardous wastes in special landfills.

A NEW COST-EFFECTIVE PROCESS RECYCLES HAZARDOUS WASTE WITHOUT ENVIRONMENTAL IMPACT

The production of primary metal from ores has long been a necessary, but environmentally devastating process. Over the past 20 years, in an effort to lessen environmental impacts, the metal processing industry has developed methods for recovering metal values from certain hazardous wastes. However, these processes leave residual molten slag that requires disposal in hazardous waste landfills.

A new process recovers valuable metals, metal alloys, and metal oxides from hazardous wastes, such as electric arc furnace (EAF) dust from steel mills, mill scale, spent aluminum pot liners, and wastewater treatment sludge from electroplating. At the same time, the process does not create residual waste for disposal. This new method uses all wastes from metal production processes. These hazardous materials are converted to three valuable products – mineral wool, zinc oxide, and high-grade pig iron.

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By recycling hazardous metallic wastes, this new process creates insulation fiber, high-grade pig iron, and pure zinc oxide for tire production.



Project Description

Goal: The goals of the project were to construct a preproduction unit and to work to refine the process to operate at a commercial size. Another goal was to optimize the process for manufacturing materials that will meet market specifications using both pyrometallurgical and hydrometallurgical processes.

Hazardous wastes generated from metal production operations contain valuable metals in oxide form. To make these metals useful, the oxygen must be removed from the metal using carbon to create carbon monoxide or carbon dioxide. The carbon and waste material is then mixed and formed into briquettes that are heated to create 98% pure liquid iron metal, leady zinc oxide, and a by-product of molten slag. Iron oxide is reduced to high-grade pig iron. The leady zinc oxide collected in the bag house can be refined into pure zinc oxide for tire production or into Western Prime Grade zinc metal. The molten slag, which is cooled into solid aggregate and sent to landfills for disposal in traditional metal production operations, is brought to the desired viscosity and spun into mineral wool insulation fiber.

The invention eliminates the need to send millions of tons of hazardous waste created in steel mini-mills, the primary aluminum industry, and the metal finishing industry to landfills.

Enviroscience developed this new technology with the help of a grant funded by the Inventions and Innovation Program through the Department of Energy's Office of Industrial Technologies.

Progress and Milestones

- First working facility handling the entire process opened in September 1999 in Longview, Texas, at Alpha Omega Recycling, Inc.
- Invention is in the "Commercial Validation and Production Preparation" stage as defined by the National Institute of Standards and Technology's Engineering Stages of Development.
- Protected by three U.S. patents: 5,198,190; 5,496,392; and 5,364,447.

Economics and Commercial Potential

Compared with currently used processes, this new process could have significant economic and commercial potential. The invention could have a direct production advantage of around \$60-\$100 per ton over conventional processes. It is likely that the use of membrane-generated oxygen will provide additional cost reductions.

By using waste materials, the process creates 98% pure iron from wastes produced in mini-mills. With the number of mini-mills rapidly increasing, there appears to be unlimited potential to recycle wastes produced there while eliminating the need to tap into additional natural resources.



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and conduct early development. Ideas that have significant energy savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

PROJECT PARTNERS

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