Case study of a successful metals recovery project

As we continue to invent, manufacture, and consume countless numbers and types of consumer goods, we need an increasing study supply of raw materials, especially metals. Although the earth's metal resources are finite, we continue to mine metal ores worldwide while we simultaneously dispose of highly refined metals in solid waste landfills.

Each year we generate an estimated 1.2-1.9 billion metric tons of solid waste worldwide with landfills being the dominant disposal method. While the amount of metal that has been disposed is unknown, in the US for example, the mean metal concentration in solid waste is 4.89%. According to the U.S. Environmental Protection Agency, between 1960 and 2012, more than 589 million metric tons of metals were disposed of in US landfills and we continue to landfill valuable metals. Given the increasing demand for metals and the fact that we throw away perfectly good metals coupled with the significant environmental and geopolitical concerns with mining ores, the question has to be asked, why aren't we mining landfills for valuable resources?

Mining landfills for metals has been elusive due primarily to the high cost of trying to extract metals from landfilled waste. Metals in waste can be contaminated and usually bound within other products such as, for example, furniture, tires, and electronics. In addition, we have limited knowledge of what was disposed of in landfills, which can increase the cost. Thus, as long as the cost of mining raw ore and producing new metal remains lower, there is little economic sense in mining landfills, but this is changing.

One of the first economically successful landfill mining projects recently concluded in the US state of Maine. This four-year project involved the mining of an ashfill, which is a landfill dedicated to the disposal of ash remaining from the incineration of solid waste. Incinerating the waste first enabled important barriers to mining landfills to be overcome. In short, it reduces the cost of mining to make it profitable. In typical landfills, the wet organics, such as food wastes were eliminated with incineration. In addition, metals that were bound in products, such as mattresses, were liberated. The act of incineration dries, liberates, and concentrates the metals, which makes them much

easier, and thus cheaper to remove. An important aspect of this particular project is that the ash and metal were extracted using standard construction equipment, which included front loaders, screens, conveyor belts, magnets, and eddy currents.

During the project, approximately 27,350 Mt of metals were extracted and sent offsite for smelting. The metals included steel, iron, stainless steel, aluminum, brass, and copper in such products as aluminum beverage cans, electric motors, bed springs, nails and screws, coins, flatware, and automobile parts.
The conservative estimated value of the recovered metal at this mine site was US$7.42 million. There is an added benefit to remove the metal. . The estimated per-Mt cost for the extraction of metal was $158—meaning that the mining was profitable. The removal of metals and the act of mining decreased airspace in the landfill by 10,194 m^3 thereby extending the life of the ashfill with an estimated economic value of US$267,000. The economic and political costs of constructing a new landfill are important considerations
This project demonstrated that landfills can be profitably mined for metals without financial support from government. Although there are comparatively few ashfills, the results and experience obtained from this project has demonstrated the financial viability of thermally treating waste followed by metals extractions and prodive new directions for further research.

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