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Processes for Treatment of Heavy Metals in Ash from Municipal Solid Waste Incinerators

Matthew A. Eaton

County Sanitation Districts of Los Angeles County
Commerce Refuse-to-Energy Facility
5926 Sheila St.
Commerce, CA 90040
(213) 721-1278
Fax (213) 888-9560
E-mail: meaton@lacsdsd.org

ABSTRACT

Modern municipal waste combustors (MWC's) process approximately 100 million tons of refuse each year in the United States, Europe and Japan, producing 30 million tons of ash. The incineration process has the effect of concentrating the toxic heavy metals normally present in municipal refuse. As a result, the ash may require treatment to reduce the quantity or the mobility of heavy metals within the ash. Four treatment categories are discussed: stabilization, extraction, vitrification and solidification. Within each category a variety of treatment processes are reviewed. Numerous methods have been shown to be successful in laboratory-scale tests and full-scale trials. Several processes have been in continuous, full-scale use for several years including: stabilization using cement; stabilization using phosphate; stabilization by lime addition; and vitrification processes.

INTRODUCTION

Waste-to-energy is an environmentally sound method for reducing the mass and volume of non-recyclable refuse that would otherwise require landfilling. Combustion typically reduces the volume of the refuse by 90% and reduces the solid mass by 70-80%. The resulting ash, while largely inert, can contain concentrations of heavy metals that require treatment in order to comply with regulations, meet standards for producing a usable product, and to provide for long-term stability of the metals when the ash is exposed in the environment. Heavy metals such as lead and cadmium can be toxic to biological systems when present in high enough concentrations.

In the United States, Europe and Japan approximately 100 million tons of refuse are combusted each year (Sawyers, 1996; Nilsson, 1997; Sandbongi, 1997). As a result, about 30 million tons of ash are produced in these regions. Proper management of the ash is an important component of municipal waste combustor operations.

Ash management, processing and treatment can consist of a variety of methods. On the most basic level, ash can be permanently stored in landfills or monofills. Additional processing can be employed to create a usable product (such as aggregate). In any case, heavy metals will be present in the ash. Any management method should include, at a minimum, analysis of the ash to determine the potential hazard of the heavy metals in the ash. If required, a variety of treatment processes may be employed to reduce the quantity and/or mobility of heavy metals present in the ash in order to meet applicable regulations and to ensure the safety of the ash when present in the environment.