Bull. Environ. Contam. Toxicol. (1988) 41:844–846

Bulletin of Environmental Contamination and Toxicology

Analysis of Municipal Refuse Incinerator Ashes for Asbestos

Kusum J. Patel-Mandlik,[1] Charles G. Manos,[1] and Donald J. Lisk[2]

[1]Environmental Science and Engineering, Inc., Gainesville, Florida 32602-3053 and [2]Toxic Chemicals Laboratory, New York State College of Agriculture and Life Sciences, Cornell University, Ithaca, New York 14853-7401

Municipal solid waste (MSW) landfills can reduce nearby property values and result in groundwater pollution. Incineration of such refuse is therefore underway or being planned by many communities. A wide variety of material types comprise the combustible portion of MSW including paper, cardboard, wood, plastics, leather, rubber and textiles as well as food and yard wastes. Other classes of noncombustible refuse include glass, ceramics, ferrous and nonferrous metals, ash, soil and stones. Specialized incinerators may also be used to burn animal carcasses, organs and organic wastes from hospitals, laboratories or pounds. Most existing incinerators in the United States are of the mass burn type, i.e. the refuse is burned as received without prior removal of noncombustible material. The resulting heat may or may not be used to generate steam and/or electricity, i.e. refuse-derived fuel (RDF) plants.

The ash which results from incineration includes bottom ash (slag) and fly ash, the latter being trapped in electrostatic precipitators or fabric filtration systems (baghouses, etc.). These ashes are collected separately or mixed and usually disposed in secure landfills with or without prior recovery of reusable metals. Whereas many published surveys have dealt with the concentrations of heavy metals and toxic organics in such ashes, very little has been reported on the possible presence of asbestos in them. In the work reported here, an analytical survey was conducted of the possible presence of asbestos in 20 such ashes from 18 incinerators in the United States.

MATERIALS AND METHODS

About 20 kg of ash was obtained from each of 18 incinerators throughout the United States in 1987. The ashes were either bottom ash, fly ash or a mixture of the two depending on the particular ash disposal method of the facility. The total quantity of ash received was air-dried at room temperature. Fly ashes were mixed by tumbling and subsampled for analysis. Samples containing bottom ash were sieved (4 mm opening) to remove stones and large glass, metal or ceramic objects. The material passing through was reduced to a fine powdery consistency in a hammermill, mixed and subsampled. Each sample was thoroughly examined under a

Send reprint requests to Donald J. Lisk at the above address.

stereo binocular microscope and the fibrous material was removed and mounted for polarized light microscopy (EPA 1982).

RESULTS AND DISCUSSION

The results of analysis of the ashes for asbestos are given in Table 1. Asbestos fibers were found only in ashes coded A, S and T. The absence of asbestos fibers in most of the refuse ash samples is not unexpected. MSW incinerators operate at temperatures in the range of 1000°C and temperatures of 550°C or higher dehydroxylate the asbestos lattice resulting in alteration or even destruction of the mineral (EPA 1982). Properties such as refractive index or other key parameters used to identify asbestos minerals are therefore changed above 550°C. The high organic

Table 1. Results of analysis of the refuse ashes for asbestos fibers.

	Ash		Asbestos	Asbestos	
Code[a]	Type	Color	Present	Type	Volume %
A	BA[b]	grey	positive	chrysotile	about 1%
B	FA[c]	grey	negative		
C	FA	grey	negative		
D	BA-FA[d]	black	negative		
E	FA	dark tan	negative		
F	BA	black	negative		
G	BA-FA	black	negative		
H	BA-FA	black	negative		
I	BA	black	negative		
J	FA	black	negative		
K	BA	black	negative		
L	BA	black	negative		
M	BA-FA	dark grey	negative		
N	FA	grey	negative		
O	BA-FA	black	negative		
P	BA	black	negative		
Q	BA-FA	grey	negative		
R	BA-FA	grey	negative		
S	BA	dark tan	positive	chrysotile	trace
T	BA-FA	dark grey	positive	amosite	trace

[a]Each of the ashes derived from "mass burn" type incinerators except those coded A,B,C,N,O and R.
[b]Bottom ash
[c]Fly ash
[d]Bottom ash-fly ash mixture

matter content of refuse may also contribute to the destruction of silicate minerals. Reducing reactions, brought about by carbon particles formed during coal combustion, have been reported (France et al. 1984). Carbon radicals formed during MSW incineration may abstract oxygen from the asbestos structure, thus altering it. Mozzon et al. (1987) also report the absence of

asbestos in precipitator/boiler ash and transfer station baghouse fines resulting from refuse incineration. The composition of MSW is highly variable with time and the absence of asbestos in refuse ash may simply reflect its absence in the original refuse.

Asbestos was found in ashes A, S and T. Glass fibers were found in 14 and cellulose was found in 16 of the 20 ashes examined. Glass fibers and cellusose were both detected in the ashes containing asbestos (A, S and T). Wood chips were detected only in ashes K, M and O. This may indicate that the temperature of combustion was insufficiently high to destroy asbestos. Low temperatures might be most prevalent at specific times when incinerators are first starting up or shutting down. Whether or not asbestos not destroyed by heat would be more apt to be found in the resulting bottom ash or carried by flue gases into the fly ash is speculative but it is interesting that ashes A, S and T each contained bottom ash.

The sources of asbestos in MSW will reflect its many uses including the manufacture of floor tile, shingles, gaskets, packings, friction products, coatings, reinforced plastics, cement pipe and sheet, textiles and paper materials. It is presently being removed from many buildings nationwide but legally should be disposed in secure landfills rather than discarded with refuse.

REFERENCES

Environmental Protection Agency (1982) Interim method for the determination of asbestos in bulk insulation samples. EPA-600/M4-82-020, Environmental Monitoring Systems Laboratory, Research Triangle Park, NC 27711

France JE, Grimm U, Anderson RJ, Kovack JJ (1984) Deposition and corrosion in gas turbines utilizing coal or coal-derived fuel. US Department of Energy Publication, DOE/METC/84-17, Morgantown, WV

Mozzon, D, Brown DA, Smith JW (1987) Occupational exposure to airborne dust, respirable quartz and metals arising from refuse handling, burning and landfilling. Am Ind Hyg Assoc J 48:111-116

Received April 16, 1988; accepted May 24, 1988.