



Lead in Paint on Pencils

A. F. SCHAPLOWSKY

Mr. Schaplowsky is director of the Division of Planning and Standards, Bureau of Community Environmental Management, Health Services and Mental Health Administration. Tearsheet requests to A. F. Schaplowsky, Room 8004, Federal Office Building, 550 Main Street, Cincinnati, Ohio 45202.

Concern over the content of lead in paint on pencils and its potential hazard as a source of lead poisoning for children has been expressed recently. The percentage of lead in the paint is not, per se, a satisfactory criterion; the health hazard for a child ingesting a paint chip is related to the amount (specifically, the weight) of the lead he ingests. The maximum amount of lead generally regarded as safe in paint is 1 percent; however, some persons now contend that this

concentration may be too high (1).

A limited number of analyses were performed for the Bureau of Community Environmental Management, Health Services and Mental Health Administration, by the Environmental Sciences Associates, Inc., of Cambridge, Mass., to determine the quantities of lead available from paint on pencil surfaces. The analyses were for the purpose of orientation only and no generalizations can be made with respect to pencils as a potentially hazardous source of lead for children.

Meaningful measurements include the total amounts of paint per pencil, the percentage lead content of the paint, the total weight of elemental lead, the surface area of the pencil, and the weight of lead per unit area. The analyses were made on nine pencils—two each of three brands and three on a fourth brand.

Method

The weights of the painted pencils were determined. Twenty to forty milligrams of paint were scraped off the pencils and weighed into 50-milliliter volumetric flasks; 10 milliliters of concentrated nitric acid were added, and the solution was heated to dryness. Five milliliters of concentrated perchloric acid were added and refluxed for 30 minutes. The flasks were filled to volume with distilled water. Fifty microliters were taken for analysis by anodic stripping voltammetry (ASV).

The analyses were performed in 2 molal sodium acetate at -1.1 volt for 30 minutes, with nitrogen pressure (N_2) 6 pounds per square inch and a sweep rate of 55 millivolts per second. Cadmium, lead, and copper were recorded. Since ASV is a nondestructive method of analysis, the samples were saved with their

lead content.

Finally, paint was stripped totally from the pencils by soaking them in dilute 1.5 nitric acid and scraping them with a scalpel. The pencils were then reweighed to determine the total weight of paint.

Results

The results of the analyses are shown in the table. The amount of lead in the painted surface coverings of three brands of pencils ranged from 0.1146 to 1.037 micrograms per pencil. The fourth brand tested contained more than 47 micrograms lead in each of the three pencils tested. There were differences in the weight of paint in two pencils of the same brand as well as differences in percentage of lead content. The total weight of paint on all brands ranged from 0.350 to 0.436 gram. The percentage of lead content for the three brands varied from 0.03 to 0.24; the paint from the fourth brand had a lead content of approximately 12 percent. For the sake of completeness, analyses were performed on the graphite composite cores ("lead"), and these were found to be essentially lead free.

The quantity of lead per pencil on brands A and B is great enough to result in continuing ac-

cumulation of lead in the body and increased blood lead levels for a child who is a habitual pencil chewer and who chips paint off relatively large areas each day (1). Accumulation of body lead would be expected to begin and to increase progressively if the paint on more than one-fifth of the area of pencil A is ingested per day. Accumulation of lead in the body and a marked rise in blood lead could be expected within about a month if the child ingested paint from approximately one-tenth the area of brand D per day. Kehoe (2) reported two cases of severe lead poisoning in young adults who had ingested from 5 to 10 milligrams of lead per day for 30 days—equivalent to the amount of lead in paint covering 10 to 20 percent of the area of the brand D pencil.

Discussion

Because lead chromates (as used in pencil paints) are insoluble in water, a relatively widespread view is held that no hazard exists. However, when lead salts and elemental lead are ingested they are in an acid medium at 37° C. in which they are soluble.

An unanswered question is the extent to which children strip

paint off pencils. An effort should be made to investigate this problem to assist in developing appropriate control measures. Such measures include educational programs emphasizing the necessity of supervision in schools and in homes to control the pencil-chewing habit and reduction in the amount of lead available in the surface covering of pencils.

In regard to reduction of lead in pencil paint, the Pencil Makers Association, representing 90 percent of the U.S. producers, announced in late June 1971 the establishment of a formal certification program for evaluation of every member company's pencil paint to insure that the lead content of the paint is not more than 1 percent. Thus, paint containing the high concentrations of lead that have been found recently in some brands of pencils probably will not be used in the future in this country.

REFERENCES

- (1) King, B. G.: Maximum intake of lead without accumulation of excessive body lead burden in children. *J Child Dis*. In press.
- (2) Kehoe, R. A.: The Harben lectures, 1960. The metabolism of lead in man in health and disease. *J R Inst Public Health Hyg* 24: 81-97, 101-120, 129-143, 177-203 (1961).

Analyses of surface covering of four brands of pencils

Brand and sample No.	Mg. paint per pencil	Percent lead	Mg. lead per pencil ¹	Mg. lead per cm ²	Lead, ppm
A, 1.....	398	0.24	0.955	0.0255	2,400
A, 2.....	432	.24	1.037	.0277	2,400
B, 1.....	350	.07	.2450	.0066	700
B, 2.....	390	.14	.5460	.0146	1,400
C, 1.....	382	.03	.1146	.0031	300
C, 2.....	374	.06	.2244	.0060	600
D, 1.....	402	11.8	47.436	1.2683	118,000
D, 2.....	392	12.5	49.000	1.3102	125,000
D, 3.....	436	12.5	54.500	1.4572	125,000

¹ Calculated from weights of paint and percent lead. Environmental Sciences Associates, Inc., determination of lead by ASV analysis, using 20 to 40 mg. samples of paint.

² Total surface area of pencil 37.4 cm ² (17×2.2 cm).