AMERICAN ACADEMY OF PEDIATRICS
COMMITTEE ON ENVIRONMENTAL HAZARDS

LEAD CONTENT OF PAINT APPLIED TO SURFACES ACCESSIBLE TO YOUNG CHILDREN

The Committee on Environmental Hazards has recommended that the American National Standards Institute (ANSI) revise that portion of the American Standard Z86.1/64 pertaining to the lead content of paint downward from the present 1% to "minimum traces" or <0.06% of the total weight of the contained solid, including pigment, film solids, and driers. This recommendation is based on a study of recently published materials which appeared after the 1% voluntary standard for lead was originally established in 1955 by ANSI.

At the same time, in response to the notice in the Federal Register of November 2, 1971 (21 CFR Part 191), the Committee recommended that Federal standards for lead content of paint used on surfaces accessible to young children be reduced to "minimum traces" or <0.06%, and that paints containing more than this amount of lead be banned as hazardous substances.

On review and evaluation of available data in children and adults, an ad hoc committee (B. C. King, Chairman) recently concluded that, for children, the maximum daily permissible intake (DPI) of lead from all sources should not exceed 300 μg Pb/day. If average daily intake is maintained below this level, blood lead concentrations are unlikely to exceed 40 μg Pb/100 gm whole blood. At this level of intake, it is estimated that the amount assimilated by 1- to 3-year-old children could probably be excreted so no net increment in total body lead burden would be anticipated. It is estimated that approximately one half of this 300 μg Pb/day intake would be derived from usual food, water, and air, so intake from all other sources, on the average, should not exceed 150 μg Pb/day. In particular, average daily intakes below this DPI would not be associated with any significant increment in soft tissue lead content. It is this portion of the total body lead burden which appears to be responsible for the known toxic effects of lead.

Available data indicate that increments in total lead intake above the DPI increase assimilation2 and raise blood levels above...
40 μg Pb/100 gm whole blood. Such increments may be associated with increases in the soft tissue component of the total body lead burden. At blood lead concentrations of 40 to 50 μg Pb/100 gm whole blood, some individuals may show minimal adverse metabolic response in the form of increased delta-aminolevulinic acid (ALA) excretion in urine. Increased ALA excretion in urine is the metabolic response most specifically associated with rising concentrations of lead in the soft tissues. Increments in total assimilation of lead to levels fivefold to tenfold above that assimilated from usual dietary intake, if continued for several weeks or months, clearly can bring such persons into the range of adverse metabolic effects and can be statistically correlated with blood lead concentrations in the range of 60 to 80 μg Pb/100 gm whole blood. In some instances, persons with blood lead concentrations in this range may show nonspecific symptoms compatible with, but not diagnostic of, clinical plumbism. At blood lead concentrations of 60 μg Pb/100 gm whole blood or higher, x-ray evidence of abnormal skeletal mineralization at the ends of growing long bones occurs in some children when excessive intake persists for several weeks or months or longer. Such undesirable effects should be avoided in young, growing children.

To preserve health, prevent adverse metabolic effects attributable to increased soft tissue lead content in growing children, and minimize the risk of serious poisoning, the total daily intake of lead should be limited to < 300 μg Pb/day. A policy statement recently approved by the Surgeon General of the U. S. Public Health Service similarly concluded that blood lead concentrations > 40 μg Pb/100 gm whole blood be considered indicative of undue exposure to lead and that children with blood lead concentrations in the 50 to 80 μg Pb/100 gm whole blood range be considered as possible cases of lead intoxication and that such children require further medical evaluation. In view of the prevalence of pica in 1- to 3-year-old children, the permissible content of lead in paint should be considered with the foregoing in mind.

The content of lead in paint calculated as elemental lead and expressed as a percent of the total weight of the paint may be a good criterion by industry for the content of lead in paint per se. However, this is not a good criterion for evaluating the health hazard present in chips of paint from surface coverings of the walls, windows, doors, furniture, and other objects to which children may be exposed. It is the weight of lead in the chips that determines the health hazard. Recent studies indicate that the weight of multilayer paint chips can be related to the number of layers of paint applied to a surface. In this way, the amount of lead in single and multiple layers of paint can be calculated from the percentage of lead contained in the paint. Such calculations are shown in Table I. For ex-

<table>
<thead>
<tr>
<th>Number of Layers</th>
<th>Painted Surface Coverings</th>
<th>Calculated Lead Content of Paint Chip with 1 cm² of Exposed Surface (μg Pb)</th>
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</thead>
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<tr>
<td></td>
<td>Paint Content in Paint, 1.0% by Weight</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>6.5</td>
<td>65</td>
</tr>
<tr>
<td>6</td>
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<td>10</td>
<td>65.0</td>
<td>650</td>
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<td></td>
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<tr>
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<td>Paint Content in Paint, 0.05% by Weight</td>
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<td>32.0</td>
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</tbody>
</table>

* Same area, e.g., 1 sq cm of 1, 6, and 10 layers of paint.
ample, studies at the U.S. Public Health Service Injury Control Laboratory, Providence, Rhode Island, indicate that 1 sq cm of one layer of interior paint may weigh 5.2 to 8.0 mg (average, 6.5 mg) and that six layers of paint may weigh 37.0 to 40.6 mg (average, 38.8). Sixty-nine samples of multilayer paint chips obtained from old dwellings in Philadelphia were found to weigh 89 ± 33 mg per square centimeter of exposed surface. (The term “square centimeter of exposed surface” is used here because of the difficulty in sampling a precise and reproducible volume of paint under field conditions.) Forty milligrams of interior paint (six layers) containing 1% of lead in the final dried solids would contain 400 μg Pb. Using the same calculation, a 10-layered paint surface containing 1% lead might contain 650 μg Pb/sq cm of exposed surface. The calculated dose in either instance is in excess of the calculated DPI (daily permissible intake). One square centimeter of six layers of paint on a surface containing 0.1% of lead would contain 40 μg Pb; whereas, at 0.05% lead, 1 sq cm of a six-layered surface would contain 20 μg Pb. In this last instance, ingestion of a paint chip with 1 sq cm (6.25 cm²) of exposed surface per day on the average can be calculated to provide a dose of 125 μg Pb. Thus, 125 μg of lead from paint, together with an allowance of 150 μg of lead from the usual lead content of food, water, and air approaches the DPI of 300 μg Pb from all sources but would make little allowance for other nondietary sources the child may encounter.

Not only should the present ANSI standard be reduced to <0.06%, but a similar Federal standard for lead is also needed to minimize lead as a health hazard to future generations of children. At the present time, lead poisoning as seen in children is related to old, deteriorated housing, so a Federal standard is unlikely to have a significant impact on plumbism as now seen. However, as this old housing is replaced or rehabilitated, safe surface covering should be used to minimize hazards to the health of future children. Because pica has been a well-recognized habit among humans for many centuries, it appears unlikely that this behavioral pattern will quickly change.

The American Academy of Pediatrics therefore endorses the principle contained in the petition filed with the Commissioner of the Food and Drug Administration that paints containing more than minute traces of lead be declared as banned, hazardous substances. It appears that cautionary labeling will not adequately protect the public’s health and safety.

It should also be noted that therapy is not effective in reversing or preventing permanent brain damage associated with severe forms of acute lead poisoning such as acute encephalopathy. It is currently estimated that 40% or more of survivors of encephalopathy sustain permanent brain damage. To provide a margin of safety against such occurrences, which are not reversible by current methods of chelation therapy, it is essential that the level of exposure be reduced. Promulgation of a Federal standard with respect to lead to minimum traces, and certainly to <0.06% Pb, probably would provide a safety factor of five with respect to doses unequivocally associated with demonstrable adverse metabolic responses in virtually all individuals and clinical toxicity in some. Except in instances of voracious pica for paint, it may provide a safety factor of at least 20 with respect to the average daily intake, which is probably necessary to cause encephalopathy and fatalities in children. Such a safety
factor appears to be a minimum requirement.

ADDENDUM

On March 10, 1972, regulations were published by the Food and Drug Administration which would ban as hazardous substances the shipment in interstate commerce of paints and similar surface coating materials which contain more than 0.06% levels of lead. The regulation will become effective December 31, 1973. As an interim measure, the regulation bans as hazardous substances the shipment in interstate commerce of all paints containing more than 0.5% levels of lead beginning December 31, 1972.

The regulation also will apply to paint or similar surface coating materials of articles intended for use by children, including toys.

Committee on Environmental Hazards

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Pediatrics 1972;49;918

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Pediatrics 1972;49:918

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