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SUBJECT: POSITION PAPER ON OCCUPATIONAL HEALTH PRACTICES FOR THE LEAD INDUSTRY

TO THE OFFICIAL MEMBERS OF THE LEAD INDUSTRIES ASSOCIATION, INC.

Attached is a document prepared by the ILZRO/LIA Environmental Health Department with the guidance of the Environmental Health Committee and industry specialists to clarify and formulate our position with respect to occupational health practices for lead and its compounds.

It is our belief that a biological standard based on blood lead determinations is the best means for protecting workers in the lead industry as well as for compliance with OSHA. Until a new lead standard is developed by the Department of Labor's Occupational Safety and Health Administration, however, air lead is the only basis for determining compliance. Nevertheless, we strongly recommend that member companies adopt biological testing.

Sincerely,

Jerome F. Smith

Jerome F. Smith
Secretary & Manager

JFS:ln
Attachment

INDUSTRIAL INORGANIC LEAD POISONING —

A PROGRAM FOR PREVENTION

Recommended Occupational Health Practices for
Industries Producing or Using Lead
and Its Inorganic Compounds

A Position Paper

by

Lead Industries Association, Inc.

November, 1972

INTRODUCTION

This paper was prepared as the lead industry's recommended occupational health practices for industries producing or using lead and its inorganic compounds. The paper represents the consensus of the Lead Industries Association Environmental Health Committee at a meeting held in South Slocan, B.C.,on July 18-19, 1972. This meeting was held specifically for the purpose of developing recommendations which reflect the lead industry's position on occupational lead exposures and the prevention of occupational lead poisoning.

It is the position of the Lead Industries Association that a biological standard based on blood lead determinations provides the best means of protecting the worker and determining compliance under the Occupational Safety and Health Act of 1970. Biochemical indices provide much more accurate assessment of possible hazard to lead exposure than do air concentrations. It is recommended that air sampling be used only to indicate the necessity to institute biological monitoring and to evaluate engineering controls.

I. Biologic Monitoring

The adoption of biologic action levels to provide employee protection and as compliance standards under the Occupational Safety and Health Act is strongly endorsed. Biological indices of exposure to lead provide much more accurate estimates of lead absorption and possible hazard than do air concentrations.

A review of a few of the important publications which describe biochemical tests for estimating the degree of lead absorption and the values likely to be found for varying levels of effects indicate general agreement[1,2,3]. These are described in Appendices I-1, I-2 and I-3.

Elkins[4] and more recently Williams, et al.[5] have reported on the correlation of airborne concentrations of lead with biochemical levels. Elkins concluded that a urinary lead concentration of 0.20 mg/liter would, on the average, correspond to an air lead concentration of 0.20 mg/m^3. Williams reported correlation coefficients for lead in air and various biochemical tests as follows: blood lead (0.90), urinary lead (0.82), urinary coproporphyrins (0.82), urinary dALA (delta-amino-levulinic acid) (0.68). Williams also reported on the correlations of all possible pairs of biochemical results, which indicated that blood lead and urinary lead were highly correlated (0.90), dALA and blood lead (0.68), etc. However, the important consideration is not how well various parameters (biochemical tests) correlate with air lead levels or with each other, but what parameters correlate best with the prevention of lead poisoning. All of the problems and inadequacies of air sampling, which are discussed in the next section, are also present in any correlation of biochemical parameters with air levels.

An important consideration is whether multiple biochemical tests provide assessment of lead absorption or whether more frequent samples for one specific biochemical test would provide the most efficient assessment of lead absorption. For example, assume that the results as reported by Williams on the correlations are accurate. Therefore, the use of blood lead and urinary lead results, which are highly correlated (0.90), would most likely not result in an increase in the ability to evaluate lead absorption, and more frequent sampling by one or the other may be more meaningful. It is believed that lead in blood provides the most reliable practical index of lead absorption and the use of lead in blood determinations is recommended as the primary biological action level.

The interpretation of blood lead concentrations should take into consideration several factors not related to lead exposure which may affect the actual value obtained[3]. These factors are described in Appendix I-4.

Recommendations

A. The frequency of obtaining blood specimens from employees for lead analysis depends on the severity of exposure. Blood samples must be taken for lead analysis at least quarterly for employees exposed to lead

in air levels near 200 ug/m^3. The use of air measurements to determine frequency of blood lead determinations may be supplanted by the use of equivalent screening methods if sufficient evidence becomes available demonstrating their reliability. Blood lead determinations must be made not less often than every six months for any worker exposed to lead.

B. All blood lead determinations must be corrected for the mass of circulating red cells. Such a correction may be regarded as an additional safety factor for workers who have a deficient number of red cells. Hematocrit or hemoglobin determinations provide a good basis for the correction providing the blood sample is fresh, and in the case of hematocrit, unclotted.

Corrections may be made as follows:

Hematocrit:

$$\text{Corrected Blood Lead} = \frac{\text{observed blood lead}}{\text{observed hematocrit}} \times \text{hematocrit normal for age, sex, and location.}$$

Hemoglobin:

$$\text{Corrected Blood Lead} = \frac{\text{observed blood lead}}{\text{observed hemoglobin(\%)}} \times \text{100\% hemoglobin for age, sex, and location}$$

C. A corrected blood lead concentration of 80 µg/100G should be recognized as the Biological Limit Value for compliance purposes.

D. The following actions should be taken depending on the corrected blood lead concentration found. These actions recognize that there may be a normal analytical error of ± 10 ug/100G in blood lead determinations in these ranges.

Corrected Blood Pb Level	Action
70 µg/100G	(1) Repeated analysis of Pb in blood. (2) Investigation of employee's work habits to determine cause of excessive absorption.
80 µg/100G	All the above plus (3) Reduction of employee exposure. (4) Medical review.
100 µg/100G	All the above plus (5) Immediate reduction of exposure by administrative means until corrected blood lead concentration is reduced to below 70 µg/100G or until physician authorizes a higher value.

E. Because it has been shown that blood lead determinations are subject to gross errors, these determinations should be performed only by experienced laboratories with proven ability.

F. Urinary dALA may have value as an additional biological monitoring parameter. A finding of 2.5 mg/100 ml in a fresh morning specimen with a specific gravity greater than 1.010 would indicate the necessity of making a blood lead determination. There is some indication that lead workers exhibiting a urinary dALA of 3 mg/100 ml may develop some minor symptoms compatible with lead poisoning. Such workers should be referred to a physician.

II. Airborne Levels

The American National Standards Institute (ANSI) Standard 2.23.11-1969, "Standard for Acceptable Concentrations of Lead and Its Organic Compounds," recommends an acceptable time-weighted average concentration for lead of 200 $\mu g/m^3$. The Threshold Limit Value (TLV) for lead, which the American Conference of Governmental Industrial Hygienists (ACGIH) had adopted is 200 $\mu g/m^3$. However, lead was placed on the intended change list in 1971. If after two years on the intended change list, no evidence comes to light that questions its appropriateness, a value of 150 $\mu g/m^3$ will be adopted. The basis of this reduction is strongly questioned and is discussed in Appendix II-I.

An air level of 200 $\mu g/m^3$ is adequate to protect the health of the worker if air is the only source of unusual exposure to lead. However, an air lead level should be used only to determine whether biological sampling is required and not as a compliance standard. There are many weaknesses in relying strictly on an air value as a fixed requirement such as:

(A) A standard for lead in air alone does not take into consideration the potential exposure from ingestion. Variation in personal hygiene habits of employees may lead to large variations in lead absorption which cannot be detected by air sampling. In a controlled human exposure experiment, Kehoe found that exposure to lead in air at a concentration of 150 $\mu g/m^3$ (8hrs/day, 5 days/week for 22 months) produced a blood-lead concentration considerably less than predicted by Williams et al.[7,5]. During this exposure period the mean stable blood lead concentration was 42 µg/100G with a single peak mean concentration (during the 17th month) of 56 µg/100G. It is possible that this subject did not exhibit a higher blood lead level because ingestion, common in plant environments, was not a factor in the controlled laboratory inhalation chamber.

(B) Air samples do not represent the amount of lead actually absorbed into the body because of differences in particle sizes and solubilities. Air samples currently used by OSHA for compliance purposes do not take into account the significant effect of particle size on lung deposition nor do they take into consideration the effect of chemical composition and solubility of lead on the absorption of lead from either the lung or the alimentary tract.

(C) Air samples represent only a small sample or an aliquot of the total volume of air inhaled by an individual. There are many difficulties in obtaining a sample which represents an individual's time-weighted average exposure and a sample of 3 to 4 hours is not indicative of an individual's overall exposure. There are wide fluctuations in airborne concentrations of lead in the workplace and a sample of short duration will most likely not be representative of an individual's exposure. Roach has held that fluctuations in airborne concentrations of a pollutant on a time scale of less than 1/10 of the biological half-life of that pollutant are unimportant for practical purposes[8]. Short sampling periods measure fluctuations in airborne concentrations, which may be on the high or low side of the actual exposure, but these high and low fluctuations are unimportant for compounds like lead, which has a long biological half-life. Roach, using a biological half-life of six months for lead, recommended a sampling time of ten work shifts.

(D) Short term air sampling with low flow rates, as is the case with personal-type air samplers, is subject to rather large errors. Contamination of a small sample is much more serious than in a large one since that contamination will be multiplied several times to arrive at the final concentration figure. Further, the position of the sampling head of the personal-type air sampler is critical. Chatterjee, et al., found a 22% difference in the lead in air concentration measured simultaneously 5 inches apart vertically on chests of exposed lead workers[9]. In the particular case cited, the mean concentration found in the upper position was 181 $\mu g/m^3$ while the mean concentration found at the lower position was 225 $\mu g/m^3$. If this test were being used as the basis for a citation it is obvious that, depending on the position of the air sampler, the plant environment would both be in compliance and in violation of a standard of 200 $\mu g/m^3$.

For the above reasons it is obvious that air samples, and particularly air samples obtained through the use of personal-type air samplers, should not be used for compliance purposes. Because of the ingestion factor a lead-in-air standard can fail to protect a worker. On the contrary, biological monitoring provides an index of exposure to all sources of lead.

Recommendations

A. Air sampling should be used only for these purposes:
   (a) to indicate the necessity to institute biological monitoring.
   (b) to indicate areas in which engineering controls should be instituted and to evaluate the effectiveness of these procedures.

B. If, despite the inadequacies of air standards for compliance purposes, an air lead standard is adopted, no citation should be issued for exceeding this standard unless the blood lead concentrations exceed the biological limit value (80 µg/100G).

C. Attention should be directed to the use of size selective sampling for lead in air and to the various compounds of lead so as to provide a more reasonable estimate of the "absorbable" portion of airborne lead.

III. Recommended Industrial Practice

A. Controls

(1) Feasible Engineering Controls

Engineering controls may include isolation, enclosure, local exhaust ventilation and shall be the primary means of reducing lead exposure.

(2) Specifications Under Which Personal Protection Devices Should Be Required

The use of personal protection equipment shall be required in the following circumstances:

(a) During the time period necessary to install the engineering controls and to institute the work practices required to reduce exposure when necessary.

(b) In work situations in which engineering control methods and work practices are either technically not feasible or feasible to an extent insufficient to reduce the exposure to or below required limits. Respirators used shall be approved by the US Bureau of Mines for "dusts and fumes not significantly more toxic than lead" and used in accordance with the procedures outlined in the Respiratory Protective Devices Manual [10].

(3) Work Practices and Procedures

(a) Adequate washing facilities must be provided.

(b) Street clothes and soiled work clothes must not be stored in the same locker.

(c) Lunchroom facilities must be separate from lead processing areas.

(d) Shower facilities must be separate from lead processing areas.

(e) Dust suppression compounds or water should be used in dusty areas to minimize airborne dust.

(f) Dry sweeping should be avoided by the use of vacuum sweeping when feasible.

(g) Clothing control is an integral part of exposure control.

1. Steps must be taken to prevent contamination

of workers' homes and families by contaminated clothing.
2. Protective over-clothing should be provided for use in jobs where clothing contamination by lead is a significant factor.

(h) Smoking, eating and drinking in lead processing plants shall be prohibited except in specified "clean" areas. Smoking materials and foodstuffs shall not be brought into lead processing areas.

(i) Employees must practice careful personal hygiene. Careful washing of hands and fingernails prior to eating and showering after the work shift are important components of exposure reduction.

B. Medical Aspects

(1) Medical Examinations

(a) Pre-employment - All prospective employees who will be exposed to lead shall have a pre-employment medical examination. Special tests shall include a blood lead determination, a urinary dALA determination, and hemacrit or hemoglobin.

(b) Periodic - All employees exposed to lead shall have a medical review at least annually. The content of the medical review shall be at the discretion of the physician but should include a review of blood lead and urinary dALA records, medical records and, if indicated, a personal interview. Detailed physical examinations should be undertaken if warranted by the medical review.

(2) Treatment

Medical treatment for lead poisoning should not be necessary if the practices outlined in this document are followed. However, the following recommendations regarding treatment are made:

(a) No specific medical treatment should be undertaken, unless specific symptoms of lead poisoning are present.

(b) Intravenous EDTA is the recommended means of therapy when treatment is indicated. However, oral EDTA treatment has been shown to be of benefit[11].

(c) The prophylactic use of oral EDTA, sometimes called "preventive medicine" is strongly discouraged on the grounds that prolonged used of EDTA may have adverse consequences and such use masks the need for or discourages proper in-plant preventive corrective measures.

Accurate medical and biological monitoring records of employees exposed to lead shall be maintained by the employer. These records should be retained by the employer at least 20 years or for the working life of the employee.

D. Warning Labels

Caution labels shall be affixed to raw materials and products containing lead compounds when the material changes ownership and when inhalation or ingestion of fumes, dust or powders could result in dangerous absorption during use. The labels should state:

CAUTION
CONTAINS LEAD
AVOID INGESTING AND BREATHING FUMES AND DUST
FOR PROLONGED PERIODS

If a description of symptoms resulting from overexposure to lead is required, it is recommended that the following wording be used:

Effect of Overexposure: Prolonged excessive absorption of inorganic lead by ingestion or inhalation of dust and fume may cause abdominal pain or what is sometimes referred to as "lead colic", metallic taste in mouth, loss of weight, pains in the muscles, muscular weakness, constipation and nausea. The similarity of these symptoms with those of other illnesses requires that excessive absorption of lead be verified by medical examination and analyses of biological specimens.

Skin or Eye Contact: For inorganic lead compounds, absorption through the skin is of no practical importance.

Emergency First Aid Procedures: Unimportant for lead.

Appendix I-1

Ranges Of Lead In Blood And Lead In Urine Reported By Kehoe[1].

(1) Lead in Blood
Normal (or usual) - 0.01 through 0.04 mg/100gm.
Abnormal but safe - 0.05 through 0.07 mg/100gm.
Potentially dangerous minimum - 0.08 mg/100gm.

(2) Lead in Urine
Normal - 0.02 to 0.10 through 0.15 mg/liter.
Dangerous - 0.20 + mg/liter.

Appendix I-2

Ranges Of Lead In Blood And Urine, Urinary ALA, And Urinary Coproporphyrin Reported By The Following List Of Signatories:[2]

Ronald E. Lane, University of Manchester. Donald Hunter, Guy's Hospital. D. Malcolm, C.E.G. Co. and University of Manchester. M.K. Williams, London School of Hygiene. University of London. T.G.F. Hudson, Imperial Smoking Co., and University of Bristol. R.C. Browne, University of Newcastle upon Tyne. R.I. McCallum, University of Newcastle. A.R. Thompson, Vauxhall Ltd. A.J. de Kreeser, Vauxhall Ltd. R.I. Zielhuis, University of Amsterdam. K. Cramer, University of Goteborg. P.A.I. Barry, Associated Octel Co. A. Goldberg, University of Glasgow. T. Bertic, University of Zagreb. E.C. Vigliani, University of Milan. R. Truhaut, University of Paris. R.A. Kehoe, University of Cincinatti, U.S.A.. E. King, University of Manchester.

Categories of Lead Absorption. (The Values Given Below Will Not Necessarily Apply In Cases Where There is a Lowered Haemoglogin Concentration, or Where Chelating Agents, for Example EDTA, Have Been Used)

Test	A Normal	B Acceptable	C Excessive	D Dangerous
Blood lead ..	<40 ug. / 100 ml.	40-80 ug. / 100 ml.	80-120 ug. / 100 ml.	>120 ug. / 100 ml.
Urinary lead	<80 ug. /l.	80-150 ug. /l.	150-250 ug. /l.	>250 ug. /l.
Urinary coproporphyrin	<150 ug. /l.	150-500 ug. /l.	500-1,500 ug. /l.	>1,500 ug. /l
Urinary d-aminolevulinic acid	<0.6 mg. / 100 ml.	0.6-2mg. / 100 ml.	2-4mg. / 100 ml.	>4 mg. / 100 ml.

Blood and urinary lead determinations can be relied on only when carried out in laboratories experienced in the techniques. Even so, errors of ± 10% may be expected.

Urinary samples of specific gravity less than 1.010 are unreliable and should be rejected: 24-hour samples or repeated spot samples are desirable.

A measurement of haemoglogin is important additional evidence: a lowered haemoglobin concentration is commonly found in lead poisoning and may be associated with category C or D.

Punctate basophil counts, though still used, are less reliable than the tests shown in the Table, and are not advised.

The four arbitrary categories are

(A) Absorption found in the "normal" population where there has been no occupational or abnormal exposure.

(B) Increased absorption resulting from occupational or abnormal exposure which is occupationally acceptable. At these levels of lead absorption the mild symptoms listed below, which are common to a number of minor complaints, are not attributable to lead.

(C) Increased absorption from excessive occupational or other exposure which may be associated with mild symptoms or signs (see below), or, rarely, with severe symptoms or signs. Even in the absence of symptoms and signs these levels of absorption are unacceptable because of the possibility of toxic episodes and long-term sequelae.

(D) Dangerous absorption from occupational or other exposure in which mild, and severe, symptoms and also long-term sequelae are increasingly probable.

Levels Of Lead Absorption Related To Effects As Reported In Table 4-11, Of The Document, "Airborne Lead In Perspective", By National Academy Of Sciences[3].

Level and Types of Effects of Inorganic Lead Salts as Related to Estimates of Various Levels of Absorption - Recent and Remote[a]

Type of Effects	Level I: No Demonstrable or Minimal Effect	Level II: Minimal Subclinical Metabolic Effect	Level III: Compensatory Biologic Mechanisms Involved	Level IV: Acute Lead Poisoning — Mild	Level IV: Acute Lead Poisoning — Severe	Level V: Late Effects of Chronic or Long-past Acute Lead Poisoning
Metabolic (accumulation and excretion of lead, permanent)	Changing ALAD[b]	Slight increase in urinary ALA may be present	ALA, UCP, FEP progressively increased	ALA, UCP, FEP increased 5- to 100 fold		Increased if excessive exposure arrest, but may not be increased if excessive exposure remote
Functional injury: Hematopoietic	None	None known	Shortened red-cell life-span, reticulocytosis (+) (reversible)	Shortened red-cell life-span and reticulocytosis with or without anemia (reversible)		Anemia (+) (reversible)
Kidney (renal tubular function)	None	None known	?	Amino-aciduria, glycosuria (+) (reversible) ?	Fanconi syndrome (permanent)	Chronic nephropathy[b] (permanent)
Central nervous system	None	None known	?	Mild injury (*** reversible)	Severe injury (permanent)	Severe injury[b] (permanent)
Peripheral nerves	None	None known	?	Rare	Rare	Impaired conduction (wrist, foot drop usually improve slowly, but may be permanent)
Clinical effects	None	None known	Nonspecific mild symptoms (ma) be due in part to coexisting diseases)	Colic, constipation, vomiting	Ataxia, stupor, coma, convulsions	Mental deficiency (may be profound), seizure disorder, renal insufficiency (poor) (permanent)
Index of level of current or current absorption:						
Blood lead, µg/100 g of whole blood	<40	40-60	50-100+	>80 With anemia, intercurrent illness 50-100+	>80	May be normal
Urine lead (adults only), µg/liter	-	<80	<130	>130 (May be less in severe illness)	>130	Spontaneous excretion may be normal

[a] See p. 106 for discussion of changing levels of ALAD.
[b] CaEDTA mobilization test on chronic nephropathy is positive, may or may not be positive in permanent central nervous system injury

Appendix I-4

Interpretation Of Blood Lead Concentrations[3].

The following factors must be taken into account in interpreting a given blood lead concentration: Proper collection of whole blood sample and reliability of laboratory performing the analysis, hematocrit value, current or recent administration of chelating agents that temporarily decrease blood lead content, presence of hemolytic anemia, and period since termination of undue exposure. Long-term continuous administration of a chelating agent, such as D-penicillamine, suppresses blood lead content to the normal range during the diuresis of lead, and intermittent chelation therapy is associated with fluctuating blood lead content.

Marked changes in the mass of circulating red blood cells may influence wholeblood lead content, in that 90% or more of the lead in blood is attached to the red cells. In persons with moderate to severe anemia, clinical evaluation of the significance of a given blood lead content may be facilitated by correcting the observed concentration to the approximate value that would be expected if the patient's packed red cell volume (hematocrit) were within the normal range. The relevance of such corrections must, however, be assessed further through the use of other indices of lead absorption and adverse effects (e.g., response to chelating agents and dALA excretion). Subjects whose high-level exposure has terminated several months to several years previously may still have evidence of increased body burden, as measured by the CaEDTA mobilization test and blood lead concentrations that are minimally to moderately increased.

Appendix II-1

Discussion Of The Proposed Reduction Of The TLV From 200 $\mu g/m^3$ To 150 $\mu g/m^3$

The reduction in the TLV by the ACGIH has resulted primarily from the work of Williams, et al.[5]. The Documentation for the TLV for Lead states:

> In an extremely thorough study of atmospheric lead exposures and biochemical criteria, Williams et al. found among 39 workers in England high correlation coefficients between air concentrations and blood lead (r=0.9); urinary lead (r=0.82); urinary coproporphyrins (r=0.82) and urinary dALA (r=0.68). Lower correlations were found for punctate (atrippled) basophilic count (r=0.45) and percent hemoglobin (r=0.09). Furthermore, they observed that in every case the upper 95% confidence limit considerably exceeded the safe limits, when the air limit is 0.2 mg/m^3, but approximates it when the air limit is 0.15 mg/m^3.
>
> In view of these more recent data using improved biochemical indicators of response to lead exposure, although originating in Great Britain, but clearly showing that the TLV of 0.2 mg/m^3 has little or no safety factor for some workers, a TLV of 0.15 mg/m^3 as lead is recommended as a standard for exposure to inorganic lead dusts and fume[6].

The study by Williams and coworkers represents a significant contribution to the area of occupational exposure to lead. However, it is our opinion that the data and statistical treatment have not been adequately evaluated and the appropriateness of reducing the TLV for lead on this basis is questioned. The blood lead concentration predicted from air lead concentrations of 150 $\mu g/m^3$ and 200 $\mu g/m^3$ were calculated from a regression equation utilizing 39 pairs of air lead and blood lead values. The blood lead concentration predicted from the regression equation describing the regression of blood lead on air lead for an air lead of 200 $\mu g/m^3$ was 70 $\mu g/100ml$ with 95% confidence limits (expressed for single determinations) of 48 and 92 $\mu g/100ml$. The blood lead concentration predicted for an air lead of 150 $\mu g/m^3$ was 60 $\mu g/100ml$ with 95% confidence limits of 38 and 82 $\mu g/100ml$.

The basis for the suggested reduction in the TLV form 200 $\mu g/m^3$ to 150 $\mu g/m^3$ is that the upper 95% confidence limits for blood lead and other biochemical parameters at an air lead of 150 $\mu g/m^3$ do not exceed the "safe limits" for the biochemical tests while the upper 95% confidence limits at an air lead of 200 $\mu g/m^3$ do exceed the "safe limits".

The data do not justify a reduction for a number of reasons:

(1) Confidence limits are dependent on the degree of scatter of the data points so that a large amount of scatter results in a wide confidence band.

Appendix II-1 Continued

(2) Confidence limits are dependent on the number of samples taken. An experiment involving a small number of samples will provide a wider confidence band than an experiment which includes a large number of samples.

(3) Confidence limits vary (increase) with magnitude from the mean value (of x). The narrowest confidence band is at the mean value of air lead which appears from the plot of the data to be much less than 0.20 mg/m^3. Therefore, the confidence limits at 0.20 mg/m^3 are much wider than at the mean air lead value which was approximately 0.10 to 0.12 mg/m^3. In the article, the values in Table 5 listed as means are actually predicted values, not mean values.

(4) The confidence limits are for a single determination rather than for the regression line. The confidence band is much wider for a single determination than for the regression line.

(5) The results are heavily influenced by plastic department employees where the lead in air concentrations were 9 and 12 $\mu g/m^3$. If this clump of low points is omitted it is doubtful that the regression of blood lead on air lead is significant.

Further, examination of the data points shows that there were no cases in which the blood lead was higher than 80 $\mu g/100G$ when the air lead was less than 200 $\mu g/m^3$. It is apparent, then, that these data do not justify a reduction in the TLV. If anything, they support the 200 $\mu g/m^3$ figure.

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