California Environmental Protection Agency

Air Resources Board

Draft Report for Review and Comment - Do Not Cite or Quote

Proposed Identification of Inorganic Lead as a Toxic Air Contaminant

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Staff Report/Executive Summary

Stationary Source Division

March 1993

DRAFT FOR REVIEW AND COMMENT

STAFF REPORT/EXECUTIVE SUMMARY

PROPOSED IDENTIFICATION OF INORGANIC LEAD AS A TOXIC AIR CONTAMINANT

Prepared by the Staffs of
Air Resources Board and
the Office of Environmental Health Hazard Assessment

March 1993

In accordance with California Health and Safety Code Sections 39660-39662, the California Environmental Protection Agency's Air Resources Board will consider the identification of inorganic lead as a toxic air contaminant in 1993. The draft report was written for the purpose of a public workshop which will be conducted before the document is reviewed by the Scientific Review Panel. Identification of inorganic lead as a toxic air contaminant and proposal of control measures will not occur at this workshop. In preparing this report, staff reviewed pertinent literature through April 1992.

The ARB also recently adopted an air toxic control measure that reduces emissions from non-ferrous metal melting facilities. The control measure was written specifically to address emissions of arsenic, cadmium, and nickel which have previously been identified as toxic air contaminants in California. As a side benefit, emissions of lead from these facilities will be reduced by 45 percent when the rule is implemented.

Further, in 1992, the South Coast Air Quality Management District adopted Rule 1420 to ensure that facilities do not discharge emissions which cause ambient concentrations of lead to exceed the state ambient lead standard beyond the property line of the facility. This rule is discussed in greater detail on page 9.

Is There Still a Concern for Exposure to Inorganic Lead in California?

Yes. Based on the information presented in this report, even though California is in attainment for the ambient air quality standard for lead, ambient and near source exposure still present a potential public health concern. This report contains the technical information which is the basis for consideration of inorganic lead as a toxic air contaminant (TAC) under state law.

Also, the ARB staff are involved with a group called the Lead Interagency Workgroup. This group includes participants from health, air, waste, toxics, and housing agencies at local, state, and federal levels. The Lead Interagency Workgroup was formed in late 1991 to address multimedia concerns regarding lead in the environment.

What is the California Air Toxics Identification and Control Program?

The California toxic air contaminant program for the identification and control of toxic substances is administered by the Air Resources Board. This program is based on California statute established in 1983 (California Health and Safety Code Sections 39660-39662). This statute created a comprehensive program to address adverse public health impacts from emissions of toxic substances to ambient air.

The program provides for a two-phase process which separates risk assessment (identification) from risk management (control). During the identification phase a report is developed which considers whether there are adverse health effects from substances and the quantity of their emissions in California. During this phase, the Board determines, with the assistance of the Office of Environmental Health Hazard Assessment (OEHHA) and the Scientific Review Panel (SRP), whether a substance should be formally identified as a TAC. If identified, the substance enters the risk management phase.

During the identification phase, pollutant exposure data are obtained by monitoring ambient air at various locations throughout California (27 for inorganic lead), compiling an emissions inventory, modeling hot spots, and analyzing indoor air concentrations. Information is also derived from focused ARB research projects and reports. The ARB and the OEHHA also work with scientists from universities, institutions, and industry.

With the adoption of the AB 2728 legislation (signed by the Governor in September 1992 and effective in January 1993), the procedure for identifying substances already classified by the U.S. Environmental Protection Agency (U.S. EPA) as federal hazardous air pollutants (HAPs) as TACs was changed. Pursuant to the new legislation, the state board shall identify as a TAC any substance that is listed as a federal HAP through a simplified process. Lead compounds (includes organic and inorganic lead) are listed as HAPs and therefore, will be identified as a TAC under the new process. The Federal HAPs list does not include elemental lead in the definition of lead compounds. However, inorganic lead, which is the subject of this report, includes elemental lead and will be considered for identification under the state's identification process.

What is Contained in This Report?

The report consists of a Staff Report/Executive Summary which summarizes the scientific basis for the proposed regulation and Parts A and B of the Technical Support Document. Part A, prepared by the ARB staff, is an evaluation of emissions of inorganic lead, ambient and indoor concentrations, statewide population exposure, and atmospheric persistence and fate. Part B, prepared by the OEHHA staff, assesses the health effects of inorganic lead. Part C (which will become part of the Technical Support Document) consists of the ARB/OEHHA staff responses to public comments on draft versions of the report.

What are the Requirements of the Health and Safety Code Sections 39660-39662?

The Health and Safety Code requires using the following criteria to prioritize compounds for evaluation as possible TACs as defined in the Health and Safety Code Section 39660(f): 1) risk of harm to public health, 2) amount or potential amount of emissions, 3) manner of usage, 4) persistence in the atmosphere, and 5) ambient concentrations.

Once a substance is selected to enter the TAC identification process, the ARB requests relevant information from the public and a written evaluation of available health effects information (Part B of the Technical Support Document) from the OEHHA. The OEHHA staff's evaluation is required to contain an estimate of the threshold exposure level above which the substance causes, or contributes to, adverse health effects. In the case where no threshold for significant, adverse health effects can be determined, the OEHHA is required to state the range of risk to humans resulting from current or anticipated exposure.

Simultaneously with the preparation of the OEHHA health evaluation, the ARB staff prepares an exposure assessment (Part A of the Technical Support

Document) that includes information on the substance's usage, emissions or potential emissions, environmental persistence, and available ambient and indoor exposure levels.

Following a public comment period, which includes a public workshop attended by members of the SRP, the Staff Report/Executive Summary and Parts A, B, and C of the Technical Support Document are formally reviewed by the SRP at a public meeting. Upon reviewing the data, assessments, and conclusions of the report and ascertaining that appropriate scientific methods were used to gather and analyze the data presented, the SRP submits written findings to the ARB. At a public hearing, the Board decides whether or not the evidence in the Technical Support Document supports the identification of the substance as a TAC and, if so, whether there is evidence of a threshold exposure below which adverse effects are not expected to occur. Once a substance is identified as a TAC and listed in Title 17 of the California Code of Regulations Section 93000, the ARB staff prepares a report on the need and appropriate degree of regulation pursuant to Health and Safety Code Sections 39665-39668.

What is a Toxic Air Contaminant (TAC)?

According to Section 39655 of the California Health and Safety Code, a TAC is "an air pollutant which may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health". In addition, "substances which have been identified as hazardous air pollutants pursuant to Section 7412 of Title 42 of the United States Code shall be identified by the state board as toxic air contaminants".

Does the ARB Staff Recommend Inorganic Lead be Identified as a TAC by the Board?

Yes. Furthermore, the OEHHA staff conclude that there is not sufficient scientific evidence at this time to support the identification of an exposure level below which no significant adverse health impacts are anticipated. The OEHHA staff recommended that inorganic lead be treated as having no identified threshold below which adverse health effects would not be expected to occur.

Why Does the Staff Recommend Inorganic Lead be Identified as a TAC?

The staff of the ARB and the OEHHA have reviewed the available scientific evidence on the presence of inorganic lead in the atmosphere of California and its potential adverse effect on public health. Staff have found that lead is emitted from a variety of sources, is found throughout California in ambient air, is persistent in the environment, and may be re-entrained in the atmosphere. Inorganic lead has been associated with many different health effects which include neurodevelopmental effects in children and hypertension and related cardiovascular conditions in adults. Furthermore, the OEHHA staff, the United States Environmental Protection Agency (US EPA), and the International Agency for Research on Cancer (IARC) have determined that, based on animal studies, inorganic lead is a carcinogen. In addition, the OEHHA staff have found no evidence for a threshold level for lead-induced cancer. The OEHHA staff have found that, based on neurotoxicity, hypertension and related cardiovascular effects, and carcinogenicity, ambient lead is an air pollutant that may cause or contribute to an increase in mortality or an increase in serious illness, or that may pose a present or potential hazard to human health. Therefore, the OEHHA staff and the ARB staff conclude that inorganic lead meets the definition of a TAC supported by the findings of neurotoxicity, hypertension and related cardiovascular effects, carcinogenicity, and exposure.

What are the Sources of Inorganic Lead Emissions?

The major identified sources of outdoor emissions in California include: industrial metal melting, stationary point and area source fuel combustion, aircraft fuel combustion, auto body refinishing, cement manufacturing, and incineration. Also, airborne lead emissions may deposit and accumulate in soil for many years. These particles can be resuspended from wind and agricultural activities.

How Much Inorganic Lead is Released into California's Air?

Based on information from local air districts and surveys conducted by the ARB staff, an estimated 360 to 480 tons of lead are directly emitted to California's atmosphere annually. Major sources include aircraft operation and non-ferrous metal melting facilities. Emissions of lead particles may deposit on soil and other surfaces and accumulate for many years. These particles may be re-entrained in the atmosphere as windblown dust and are estimated to contribute approximately 390 tons of lead per year to California's atmosphere. Most of the lead emitted into ambient air is expected to be associated with small particles, less than 10 micrometers in size, which are of health concern because of their ability to bypass the body's natural defense systems and their potential for long residence time in the lung.

Are Emissions of Inorganic Lead Expected to Change in the State?

There is not enough information to determine whether overall emissions in California will increase or decrease. Emissions from non-ferrous metal melting will decrease due to an air toxic control measure (ATCM) proposed by the ARB staff. Emissions from soil dust are expected to decrease because of the removal of lead from fuel. Emissions from cement manufacturing may increase because manufacturers may use tires as a new source of fuel for cement kilns. In January 1992, remaining lead additives used in fuels were banned for use in on-road vehicles in California and emissions of lead from this source category will be virtually eliminated. Nationally the Federal Clean Air Act (FCAA) also will prohibit the use of leaded fuel in on-road vehicles after December 31, 1995. However, both in California and nationally, leaded fuel may still be used in aircraft. In addition, offroad vehicles such as pleasure-craft and farm implements may also use leaded fuel however, these vehicles are expected to obtain unleaded fuel from the same fuel distribution system as on-road vehicles.

What are the Ambient Outdoor Air Concentrations of Inorganic Lead?

The ambient outdoor concentrations of inorganic lead are based on data collected in 1990-91 from the ARB's criteria pollutant monitoring network. Mean annual concentrations ranged from a minimum of 0.02 micrograms per cubic meter at Bethel Island to 0.12 micrograms per cubic meter at Richmond. The statewide population-weighted exposure is estimated to be 0.06 micrograms per cubic meter.

Is There Evidence of Indoor Air Exposure to Inorganic Lead?

Yes, however, indoor concentrations of airborne lead are typically lower than outdoor concentrations. Most of the lead present in the indoor air of non-occupational environments appears to result from the entry of lead particles from outdoor air. However, certain activities that disturb lead-based paint, such as remodeling or paint removal, can release large amounts of lead-bearing particles into the air. Lead has been banned for use in residential paint, but may still be used in industrial, military, and marine applications. Other potential sources of lead in indoor air are resuspension of lead-bearing dusts, and certain hobbies that use melted lead or lead glazes.

Are There Near Source Exposures to Inorganic Lead in California?

Yes. The most significant exposures to atmospheric lead are expected to occur in populations near emission sources. Recent measurements of ambient air concentrations of lead near two secondary lead smelters were used to represent the potential impact of emissions on nearby populated areas in the South Coast region. Ambient air measurements less than one kilometer from two secondary lead smelters in the South Coast Air Basin showed averaged monthly ambient lead concentrations as much as 52-fold higher at the fence-line than the South Coast Air Basin mean annual ambient lead concentration of 0.07 micrograms per cubic meter. As a result, actions have been taken by the smelters to reduce emissions.

Also, using a conservative modeling approach, the South Coast Air Quality Management District estimated that a facility which emits 0.5 pounds per day of inorganic lead has the potential to exceed the state's ambient air lead standard of 1.5 micrograms per cubic meter for a thirty day period. Therefore, in 1992 the District adopted a rule to reduce emissions of lead from stationary sources; Rule 1420 - Emission Standards for Lead. Rule 1420 requires facilities that use or process more than two tons of lead per year and have maximum daily lead emissions of 0.5 pounds per day or more to install or upgrade emission controls on equipment and processes to certain specifications. The District estimated that approximately 125 facilities have emissions at this rate or greater and it requires these facilities to also conduct modeling or monitoring to assure that the remaining emissions do not cause exceedances of the ambient air quality standard. The rule also requires facilities to practice good housekeeping to minimize lead emissions from fugitive dust sources.

Are There Other Routes of Exposure to Inorganic Lead?

Yes. Inhalation is not the only pathway by which people are exposed to atmospheric lead. People may be exposed to particulate lead emissions when emissions settle onto water, soil, vegetation, and other surfaces which are ingested or by dermal absorption.

The greatest source of waterborne human exposure is drinking water contaminated by lead leached from plumbing. Currently, the maximum lead concentration allowed in drinking water is 50 parts per billion and public water systems nationwide are required to evaluate households with tapwater concentrations exceeding 15 micrograms per liter lead for repair. Lead may also be consumed in plants that take up lead from the soil. The U.S. EPA reports that the typical soil lead concentration is about 15 micrograms per gram; however, soils near emissions sources may have concentrations 100-fold higher or more. The U.S. EPA has also reported studies of livestock forage located 25 meters from roads with high-traffic density that have shown lead concentrations ranging from 20 to 950 micrograms per gram. Lead solder in food containers is another source of lead. However, only approximately one percent of canned goods currently have lead solder.

The ingestion of paint and soil containing high concentrations of lead is the source of most cases of acute lead poisoning in children. The greatest opportunity for lead-based paint exposure occurs when painted surfaces are refinished or remodeled. Approximately 2.5 million homes in California are likely to contain lead-based paint. The federal Department of Housing and Urban Development (HUD) initiates lead abatement in public housing where lead concentrations are above 5,000 micrograms per gram in the paint. In a study of about 1,000 homes in Oakland, Sacramento, and Los Angeles, approximately 25 percent of the households had lead concentrations of 5,000 micrograms per gram or above in the paint. Homes built prior to 1950 may contain paint with lead concentrations as high as 500,000 micrograms per gram (50 percent).

What is the Persistence of Inorganic Lead in the Atmosphere?

As mentioned previously, inorganic lead is emitted and atmospherically transported in the form of small particulate matter (less than 10 micrometers in diameter). The primary mechanisms for removal of inorganic lead particulate matter from the atmosphere are wet and dry deposition. After removal from the atmosphere and being deposited on the ground and soil, inorganic lead may be reentrained in the atmosphere. Many factors, such as physical characteristics and meteorological conditions, affect the lifetime of lead in the atmosphere. Particles which contain inorganic lead are expected to have an atmospheric lifetime of up to 30 days.

What are the Health Effects of Inorganic Lead Exposure?

Inorganic lead is unique in that non-cancer effects pose a more significant health effect than cancer at environmental airborne concentrations. For all previously identified TACs, cancer has posed the most significant risk at environmental levels for areas that are not located near sources. The OEHHA staff's report focuses on three adverse health effects resulting from exposure to inorganic lead. These effects are neurodevelopmental effects in children, elevated blood pressure and associated cardiovascular effects in male adults, and cancer.

As more health information has become available showing the serious adverse effects of lead on humans, the blood lead levels recommended by health administrators to protect public health have decreased. These effects of inorganic lead exposure have been reviewed and evaluated to determine whether inorganic lead meets the definition of a TAC. The following text summarizes the OEHHA staff findings regarding the health effects of inorganic lead exposure.

Neurodevelopmental Effects in Children

Neurodevelopmental effects related to lead exposure at relatively low blood lead levels of less than 10 micrograms per deciliter include decreased intelligence, short term memory loss, reading and spelling underachievement, impairment of visual motor functioning, poor perception integration, disruptive classroom behavior, and impaired reaction time. Recently, the relationship of blood lead level to neurodevelopmental effects related to lead exposure in children has been examined in five prospective studies. Taken together, these studies indicate an association between general measures of intelligence and either pre- or post-natal blood lead concentrations. The studies show health effects at 10 to 15 micrograms per deciliter and in one study as low as six to seven micrograms per deciliter. Based on these findings, the OEHHA staff has identified six to seven micrograms per deciliter as the lowest observed adverse health effects (LOAEL) and has not identified a no observed adverse effect level (NOAEL). Therefore, a threshold for adverse effects cannot be identified.

Hypertension and Related Cardiovascular Conditions in Adults

Lead in the environment has also been correlated with increased blood pressure (hypertension) and related cardiovascular effects in adults. There are several large population-based studies that examine the relationship of blood lead levels and hypertension with related cardiovascular effects. The relationship between blood lead levels and blood pressure appears to exist for a wide range of blood lead levels, possibly as low as seven micrograms per deciliter for middle aged white men. This relationship may apply to other adults as well.

Carcinogenic and Potentially Carcinogenic Effects

The IARC has placed lead in class 2B, possibly carcinogenic to humans, due to sufficient evidence of carcinogenicity in animals and inadequate evidence of carcinogenicity in humans. The US EPA has placed lead in group B2, probably carcinogenic to humans. The US EPA has defined group B2 as those substances in which there is sufficient evidence of carcinogenicity in animals and inadequate or no data from epidemiological studies.

Studies show that in mammalian cells lead causes gene mutation and cell transformation and can interfere with DNA synthesis. Studies in which lead compounds were fed to rodents show increased occurrences of kidney tumors. Epidemiological studies indicate that occupational exposure to lead may cause cancer. However, lead was not the only carcinogen present in these studies.

What is the Risk Assessment for Exposure to Inorganic Lead?

To perform a risk assessment for exposure to inorganic lead, it was important to estimate the relationship between ambient lead levels and blood lead levels. The OEHHA staff used an aggregate model and human studies to estimate this relationship. Current evidence suggests that a one microgram per cubic meter decrease in ambient air lead is associated with approximately a two microgram per deciliter decrease in blood lead in adults and a four microgram per deciliter decrease in children.

Using the above estimate, risk assessments were performed for three different health effects: neurodevelopmental effects in children, cardiovascular effects in adults, and cancer.

The OEHHA staff estimate that, if ambient lead concentrations to the exposed population decrease by one microgram per cubic meter, it will result in a mean increase of 0.96 intelligence quotient (IQ)[1] points. While this change in IQ may appear insignificant at the individual level, the change will result in a shift in the distribution of IQ points for the entire exposed community. This may result in a significant shift in the number of children below a given IQ level. In addition, the same decrease in ambient lead concentrations would result in between 260 and 1200 children per million experiencing a decline in their blood lead level to less than 10 micrograms per deciliter.

Since ambient air directly effects the level of lead in blood, a decrease of 0.06 micrograms per cubic meter of lead, which is equivalent to the 1990-1991 average statewide population weighted-exposure, may result in a mean increase of approximately 0.06 IQ points.

The OEHHA staff also estimates that for a one microgram per cubic meter decrease in ambient lead concentration there will be approximately 48,000 fewer cases of hypertension and related cardiovascular effects for one million males aged between 20 and 70 years. The same decrease in lead concentrations would result in 196 fewer heart attacks per year for the next 10 years and 196 fewer deaths per year for the next 12 years for one million males between the ages of 40 to 59.

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1. Intelligence Quotient (IQ): The ratio of tested mental age to chronological age, usually expressed as a quotient multiplied by 100.

The use of OEHHA staffs' estimate for hypertension and related cardiovascular effects and a reduction of inorganic lead of 0.06 micrograms per cubic meter could result in approximately 2,900 fewer cases of hypertension and related cardiovascular effects per million people. This decrease of 0.06 micrograms per cubic meter is equivalent to the 1990-1991 average statewide population-weighted exposure. Based on a population of 30 million, it is estimated that there may be approximately 86,000 fewer cases of hypertension and related cardiovascular effects due to a reduction in the ambient exposure statewide. Based on the same reduction in lead from ambient air, we estimate that 12 heart attacks per million people per year and 350 heart attacks statewide per year could be avoided. In addition, a different study found for the same reduction in lead there would be an average of 12 fewer deaths from heart attacks per million people and 350 fewer deaths from heart attacks statewide.

A quantitative estimate of unit cancer risk from inorganic lead was performed by the OEHHA staff. This estimate of unit cancer risk was based on rodent data because there is inadequate data in humans. By extrapolation of rodent data, the OEHHA staff determined a range of unit cancer risk for humans and also a best value of unit cancer risk. From the available studies on inorganic lead, the range of unit cancer risk is 1.2×10^{-5} to 6.5×10^{-5} for a lifetime exposure to one microgram per cubic meter lead. The best value is based on the largest data set available for quantitative risk assessment and is 1.2×10^{-5} per microgram per cubic meter.

Using the OEHHA staff's range of risk numbers and the 1990-1991 average statewide population-weighted exposure of 0.06 micrograms per cubic meter, exposure to this level of inorganic lead could result in 0.7 to 4 potential cancer cases per million people exposed for a 70 year lifetime. Based on a population of 30 million, it is estimated that the cancer burden for California residents would be approximately 22 to 117 potential excess cancer cases statewide. Using the OEHHA staff's best value, exposure to inorganic lead could result in 0.7 potential cancer cases per million with a cancer burden of 22 among the 30 million residents of California. This estimate represents the upper range of plausible excess cancer risk and the potential number may be significantly lower. Table 1 shows a comparison of the inorganic lead cancer potency with other compounds the Board has identified as TACs in unit risk per micrograms per cubic meter (664s³l;1 ~1;0;160;3 unit risk per part per billion volume (ppbv).

The quantitative cancer risk assessment is subject to several sources of uncertainty including statistical uncertainty (due to the number of animals in the experiment to which the model was applied), extent of absorption of lead by various routes, variability of response to lead in different species, the choice of the animal-to-human scaling factors, the choice of the extrapolation model, and the large range of extrapolation (five orders of magnitude) from the lead concentrations used in the animal experiments to current ambient levels.

What is the Potential for Acute or Chronic Non-carcinogenic Health Effects from Exposure to Ambient Concentrations of Inorganic Lead?

For all other TACs identified so far, cancer has posed the only significant risk at environmental concentrations. At the current background airborne level of lead, there may be greater concern for public health over noncancer health effects including adverse neurodevelopment effects in children, and hypertension and related cardiovascular effects in adults.

Is There a Threshold Level for Inorganic Lead?

No. Based on information available, the OEHHA staff recommend inorganic lead be identified as a toxic air contaminant with no identifiable threshold for neurotoxicity, hypertension, or carcinogenicity.

What are the Findings of the Scientific Review Panel?

(To be added, following review by the Scientific Review Panel)

TABLE 1

COMPOUNDS APPROVED BY THE SCIENTIFIC REVIEW PANEL FROM 1984 TO 1992

(in order of cancer potency)

Compound	Unit Risk $(\mu g/m^3)^{-1}$	Unit Risk $(ppbv)^{-1}$
Dioxins	$3.8x10^{1}$	Particulate Matter
Chromium VI	$1.4x10^{-1}$	Particulate Matter
Cadmium	$4.2x10^{-3}$	Particulate Matter
Inorganic Arsenic	$3.3x10^{-3}$	Particulate Matter
Nickel	$2.6x10^{-4}$	Particulate Matter
1,3-Butadiene	$1.7x10^{-4}$	$3.7x10^{-4}$
Ethylene Oxide	$8.8x10^{-5}$	$1.6x10^{-4}$
Vinyl Chloride	$7.8x10^{-5}$	$2.0x10^{-4}$
Ethylene Dibromide	$7.1x10^{-5}$	$5.5x10^{-4}$
Carbon Tetrachloride	$4.2x10^{-5}$	$2.6x10^{-4}$
Benzene	$2.9x10^{-5}$	$9.3x10^{-5}$
Ethylene Dichloride	$2.2x10^{-5}$	$8.9x10^{-5}$
Inorganic Lead	$\mathbf{1.2x10^{-5}}$	**Particulate Matter**
Perchloroethylene	$5.9x10^{-6}$	$4.0x10^{-5}$
Formaldehyde	$6.0x10^{-6}$	$7.0x10^{-6}$
Chloroform	$5.3x10^{-6}$	$2.6x10^{-5}$
Trichloroethylene	$2.0x10^{-6}$	$1.1x10^{-5}$
Methylene Chloride	$1.0x10^{-6}$	$3.5x10^{-6}$
Asbestos	$1.9x10^{-4}$ per 100 fiber/m^3	

$\mu g/m^3$: microgram per cubic meter

ppbv : part per billion volume

March 9, 1993

Addendum

6. Development of Reference Exposure Levels (RELs)

6.1. Development of a REL for Chronic Exposure

In order to develop a reference exposure level for chronic exposure, a change of 1 $\mu g/m^3$ air lead was assumed to result in a change of 4 $\mu g/dl$ blood lead level in children (see Section 4.1.). Preliminary data from NHANES III indicate that the mean blood lead level in children is 4 to 6 $\mu g/dl$ (Dr. Sue Binder, CDC, personal communication). An increase of air lead by 0.75 $\mu g/m^3$ would increase blood lead levels by 3 $\mu g/dl$ thereby raising a current blood lead level of 6 $\mu g/dl$ to 9 $\mu g/dl$. This would leave a small 1 $\mu g/dl$ margin of safety below the 10 $\mu g/dl$ level of concern. Therefore, the proposed chronic REL is 0.75 $\mu g/m^3$ averaged over 30 days.

6.2. Development of a REL for Acute Exposure

Developing a REL for acute exposure is problematic for several reasons. First, research on long term effects of acute exposures, which would entail measurements of blood lead levels and health endpoints taken before and after the acute exposure, has not been done in animals or humans. Secondly, since lead is so prevalent in the environment, we are all exposed chronically. Therefore the importance of acute low-level exposure is unclear relative to total body burden. In addition, toxicokinetic data following acute exposure, useful for estimating impacts of short-term relatively high level exposures on blood lead levels, are not available. However, since some facilities do emit high concentrations of lead over short periods, which would not be captured by using a monthly or quarterly average, it is important to estimate a REL for acute exposure. At this time, the data necessary for the development of such a REL are not available.

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