EXPOSURE TO AIRBORNE LEAD FROM STATIONARY SOURCES: AN EVALUATION OF PROPOSED NATIONAL AMBIENT AIR QUALITY STANDARDS FOR LEAD

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EXECUTIVE SUMMARY

At the request of Lead Industries Association, Inc., TRC Environmental Consultants (TRC) has reviewed an EPA staff estimate of the number of children less than seven years old living near stationary sources of lead who might benefit from a reduction of the National Ambient Air Quality Standard for Lead from the present 1.5 ug/m^3 to 0.5 ug/m^3.

EPA's Staff has estimated that a total of 233,000 such children live in areas impacted by stationary source lead emissions. However, the staff has not estimated the actual number who would benefit from a standard reduction, i.e., those whose blood lead levels exceed 20 ug/dl, the new upper limit deemed safe by EPA's staff and who would presumably benefit from lowering the lead standard.

TRC is persuaded that because of such factors as an error in the estimate of the number of lead smelters and battery plants in operation and the use of a model rather than on-site estimates of the number of children living near these facilities, EPA's staff has greatly overestimated the number of children who would be affected by a standard reduction. TRC estimates that the number of children living in affected areas is only 8291 and only 1244 of those might acquire blood lead levels exceeding 20 ug/dl and therefore might benefit from a standard reduction following the staff's view of health benefits.

Applying the benefit factor ($3,500 per child) used by EPA in the recent gasoline lead phasedown proceeding, TRC has estimated that the benefits of meeting the 0.5 μg/m^3 standard would be only $4.4 million. TRC's estimate the costs of meeting an 0.5 ug/m^3 lead standard is $218 million, many times the estimated benefits.

The adjustments made by TRC to the EPA staff estimate are as follows:

1. EPA's staff used an outdated survey of the number of stationary sources of lead emissions. Since the date of the survey, a large number of lead sources have shut down. Only 138 are still in

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operation--not 199 as EPA has assumed--and this does not account for additional secondary lead smelter closures that are likely to occur in the near future.

2. Actual on-site estimates of the number of children less than seven years old living near stationary lead sources are much lower than EPA's census modeling approach would suggest.

3. EPA's staff has assumed that ambient lead concentrations will exceed 0.25 ug/m^3 within 5 kilometers of primary smelters, 2 kilometers of secondaries and 1 kilometer of battery plants. Monitored data and modeling results show that the exposure distances are much less than EPA's staff has assumed.

4. Not all children within the exposed areas would have elevated blood lead concentrations. Based on actual blood lead concentration data near existing sources, TRC estimates that the total number of children in the exposure area who would have elevated blood lead concentration above 20 ug/dl would be only 1244 and only that number of children would benefit from a standard reduction if EPA's health assumptions are accepted.

These adjustments are explained in detail in the sections below.

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1.0 OBJECTIVES

This study seeks to define the number of young children in the United States with elevated blood lead concentrations living near stationary sources of lead emissions for purposes of determining the benefits of a reduction in the National Ambient Air Quality Standard for lead. The study is limited to stationary sources because automotive sources of lead emissions are already subject to a phased control plan, and only stationary sources will be affected by a change in the lead standard. Stationary sources included in the study are primary and secondary lead smelters, a primary lead refinery, battery plants and the only remaining tetraethyl lead production plant.

The study focuses on several aspects of the exposure determination:

- Defining the distance from a stationary source at which a specified air concentration might be exceeded.
- Defining the population; children aged less than 7 years old who live within that distance of stationary sources,
- Defining the number of such children with elevated blood lead concentrations.

Given the estimates of the number of such children, the study proceeds to its second objective. The second objective is the calculation of expected benefit costs derived from reducing the National Ambient Air Quality Standard for lead to 1.0 or 0.5 $\mu g/m^3$.

2.0 INTRODUCTION

The United States Environmental Protection Agency has published its second draft of the Ambient Air Standard Criteria Document for Lead[1]. The Criteria Document sets out the basic health studies and findings which could be used to develop a revised standard. The Clean Air Scientific Advisory Committee is in the process of reviewing the Criteria Document along with the accompanying Office of Air Quality Planning and Standards (OAQPS) Staff Paper[2]. The Staff Paper seeks to translate the Criteria Document into proposed policy options for review. The Staff Paper evaluates possible reductions of the existing 1.5 $\mu g/m^3$ standard on a calendar quarter average basis. It suggests the possibility of reductions to standards of 1.0 $\mu g/m^3$ or 0.5 $\mu g/m^3$ and reducing the length of the averaging time to monthly.

The Lead Industries Association has requested TRC Environmental Consultants, Inc. to study the costs and benefits of a more stringent NAAQS for lead. One of the factors which LIA wished to address was the exposure assessment, i.e., the number of individuals exposed to airborne lead concentrations above the proposed alternative standards. Preliminary estimates performed for EPA[3] suggest that as many as 233,000 children less than age 7 are exposed to concentrations greater than 0.25 $\mu g/m^3$ near stationary sources of lead. Several factors lead to a preliminary hypothesis that the number of children is much smaller and those with elevated blood lead concentrations are much smaller still. These factors include:

- The number of lead stationary source facilities in operation has decreased substantially since the 1981 survey which was used by EPA staff in the estimate of children exposed,
- The EPA staff estimate was based on a computerized method of determining the location of population. Given the nature of industrial sites such as smelters, and the tendency over the years for people to move away from such areas, it was felt that the computerized method was overestimating populations exposed, and

- Due to the strong tendency for EPA air quality diffusion models to overestimate actual concentrations, it was felt that the distances used by EPA staff to measure exposed population were too large.

In order to test the above hypotheses and gather other useful information, the industry has utilized a questionnaire (Appendix A) to its members. Each responding site has evaluated its condition with regard to ambient lead and population exposure. The results of the questionnaire responses are presented in this report.

Beyond the question of population exposed, it was deemed desirable to calculate the benefits which might be gained by the further reduction of ambient lead concentrations. In order to provide this analysis it is necessary to assess how many exposed children acquire elevated blood lead concentrations. Rather than use the various hypotheses for this relationship proposed in the Staff Paper, it was decided that a review of studies of blood lead concentrations of children actually living near lead emission stationary sources was more appropriate. Once the number of individuals with elevated blood lead was estimated, the avoided costs, i.e. benefits, of a revised standard was to be calculated. Because the EPA recently completed the assessment[4] of benefits from the phase down of lead in automotive gasoline, it was convenient and consistent to use those analyses for the present evaluation.

3.0 INDUSTRY STATUS

Table 3-1 lists the number of stationary sources of lead taken from a 1981 survey by the International Lead Zinc Research Organization[5] published in 1982. The EPA Staff's estimate[3] of population near stationary sources was based on the numbers listed in the second column. EPA's staff estimate deleted tetraethyl lead production presumably on the assumption that these facilities are expected to close, it increased secondary lead smelters for an unidentified reason, and it added lead-acid battery plants.

LIA, in cooperation with the Secondary Lead Smelters Association and the Battery Council International, has resurveyed the existing and open lead facilities. The current numbers are presented in the third column of Table 3-1. The total number of facilities is significatnly lower than the number used by EPA's staff, reflecting the fact that industry has been generally hard hit over the intervening years. Lead commodity prices are low continuously, at or near production cost. Some lead continues to be produced primarily for the value of the associated zinc and silver.

Among the primary smelters, the Bunker Hill smelter is permanently closed, while the El Paso smelter has been indefinitely shutdown since last Fall. The one stand-alone primary refinery (3 primary smelters refine on-site) is cut back to half production because half of its volume came from El Paso. The secondary industry, which has been hardest hit in the intervening years, has suffered a reduction from 56 smelters in 1981 to 23 at present. There are only 108 battery plants today compared to the 132 estimated by EPA's staff.

TABLE 3-1

NUMBER OF LEAD INDUSTRY POINT SOURCES

Category	ILZRO (1982) Used In EPA[2]	EPA[3]	Present Study
Primary Smelters	6	6	5*
Primary Refinery	1	1	1*
Secondary Smelters	56	60	23
Tetraethyl Lead	4	0	1
Battery Plants	N/A	132	108**
		199	138

* The ASARCO-El Paso lead smelter is shut-down indefinitely but has been included. Half of the production at the Asarco-Omaha refinery was based on El Paso production.

** Ten of these are at secondary smelters and are not counted as stand alone battery plants.

There is reason to believe that the trend toward lowered lead production in the U.S. will continue. Lead prices have been low for several years and there is no sign that they are about to rise. Meanwhile, costs are rising, particularly as additional environmental requirements are imposed, and there are likely to be additional closures in the future. The one relatively bright spot in the lead industry is battery manufacturing, which has benefited as the demand for new automobiles has rebounded. However, no new battery plants have been built and some closed when demand was down.

4.0 ESTIMATING THE EXPOSURE AREA

The EPA staff memo defined the exposure areas for purposes of tabulating the number of young children affected by a standard reduction by employing modeling techniques. In essence, these techniques were used to define for each type of facility the area in which ambient concentration of lead would exceed 0.25 ug/m^3. Ultimately, EPA concluded that the exposure area was 5 kilometers for primary smelters, 2 kilometers for secondaries, and 1 kilometer for battery plants.

TRC questions the use of the model to define the exposure area and is persuaded that EPA's modeling techniques greatly overestimate the size of the area. The EPA memo also chose a concentration of 0.25 ug/m^3 to define the outer boundary of impact in order to estimate the effect of going to a monthly average standard.

4.1 Modeling Evidence

As for modeling, the details of the method employed by the EPA staff are not available at this writing, but it is clear that they do not square with the analyses done for lead emission facilities in connection with the State Implementation Plan (SIP) process and are excessively conservative. An example will help elucidate the problem. The original modeling performed by EPA at one stationary source site, in connection with the (SIP) process, projected concentrations of 19.8 ug/m^3 within one hundred meters of the fenceline of a lead refinery. A year's worth of monitoring at that location measured a maximum quarterly average concentration of 2.84 μg/m^3. If appropriate changes in the model were made for a more accurate emissions estimate, the model only projected 5.6 μg/m^3. The rest of the overestimate is due to the over-conservatism of the air dispersion model. What is even more significant is that the model also overpredicts concentrations at larger distances from the refinery. This overprediction occurs universally. At a secondary smelter site where the model[6] overpredicted fenceline measured concentrations by a average factor of 2.5.

Figure 4-1 shows the change in concentration as a function of downwind distance at the refinery using the EPA model with the correct emissions but still including the overestimates of air dispersion. The most striking feature of the figure is that concentrations decrease rapidly with downwind distance. In fact, it can be seen that even with the conservative model, the refinery, after controls to meet the present 1.5 $\mu g/m^3$ standard at the fenceline, is down to a 0.5 $\mu g/m^3$ concentration at 300 meters from the fenceline and will drop below 0.25 $\mu g/m^3$ before 500 meters downwind.

In addition, the analysis represented in Figure 5-1 is for the worst-case direction. In other directions, concentrations are lower at the fenceline and the distances to 0.5 $\mu g/m^3$ are therefore much less. This is a major reason that uniform radius tabulations of children will substantially overstate the exposure.

Nor is the example of the refinery atypical. At the primary and secondary smelters which have been subjected to extensive modeling, concentrations at residences after controls to meet 1.5 $\mu g/m^3$ at the fenceline are well below 0.5 $\mu g/m^3$.

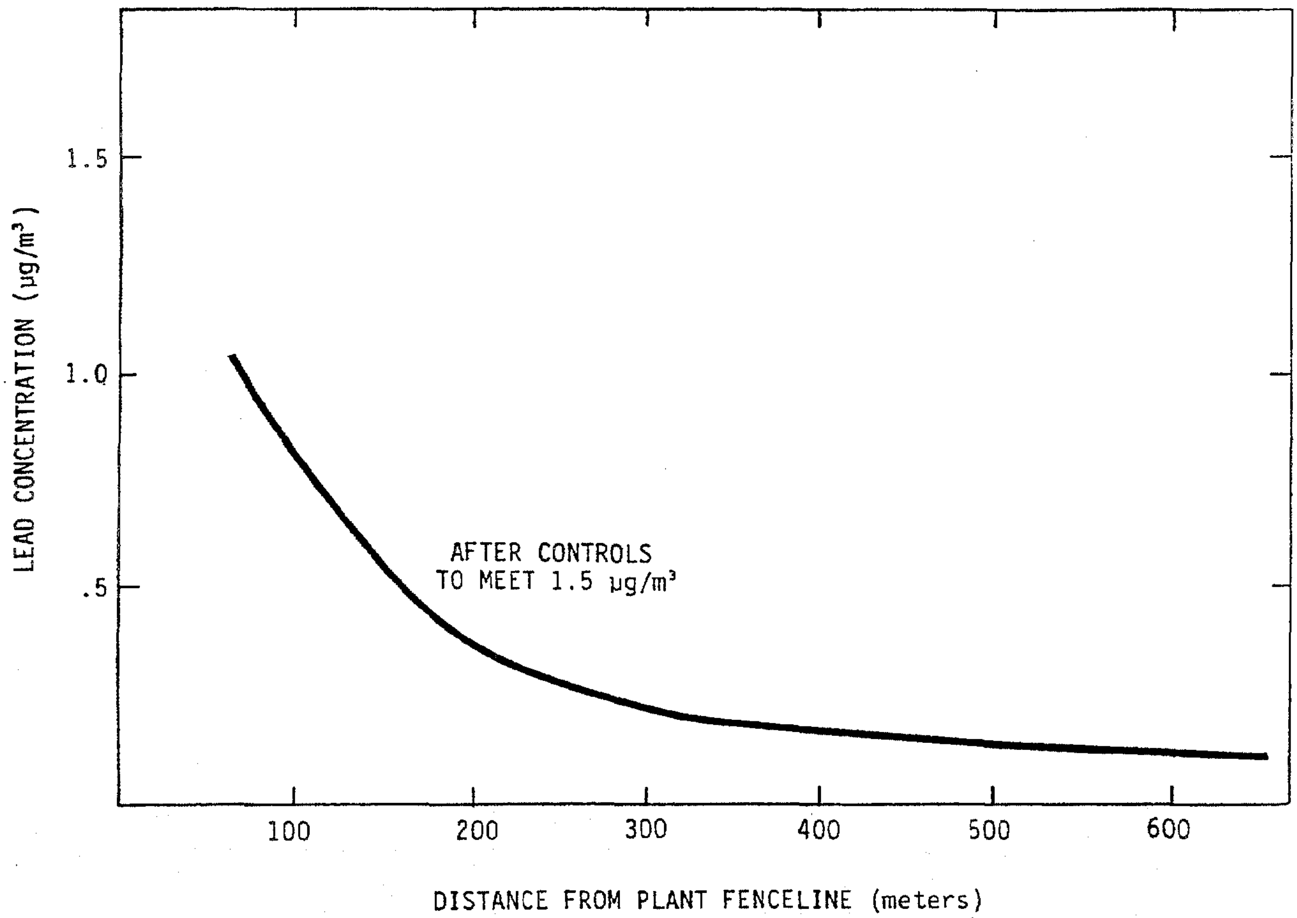

Figure 4-1 Lead Concentrations versus Downwind Distance (results using EPA Model).

4.2 Monitoring Evidence

The monitoring data collected through the questionnaire also confirms the results of the modeling analysis above. Except for monitors placed at or near the fenceline, most monitors around stationary sources show concentrations at or near 0.5 $\mu g/m^3$. For instance, at the refinery, concentrations at microscale monitors surrounding the facility are presently below 0.5 $\mu g/m^3$ except for the worst-case quarter. Subtraction of the background due to present automotive emissions, 0.19 to 0.27 $\mu g/m^3$, would bring these all to less than 0.5 $\mu g/m^3$. The proposed controls installed to meet 1.5 $\mu g/m^3$ at the fenceline monitoring location would guarantee that these monitors, which are set at the edge of residential areas and areas of general public access, would be below 0.5 $\mu g/m^3$ and closer to 0.25 $\mu g/m^3$.

The primary smelters experience the same situations. Fenceline monitors are over 1.5 $\mu g/m^3$ prior to controls, yet monitors set at residential areas are already less than 0.5 $\mu g/m^3$ except where there are automotive influences. SIP's which seek to control facility fenceline concentrations to 1.5 $\mu g/m^3$ ensure that exposures at residences are well below 0.5 $\mu g/m^3$, and a 2.0 kilometer limit of exposure is, therefore, still overprotective.

At the tetraethyl lead facility the highest quarterly average concentration over the last two years is 0.9 $\mu g/m^3$ and is expected to fall below 0.5 $\mu g/m^3$ once SIP mandated controls to meet 1.5 $\mu g/m^3$ at the fenceline are in place.

At a secondary smelter with associated battery manufacture there are fenceline monitors which are expected to decrease to less than 1.5 $\mu g/m^3$ after SIP controls. There are no monitors beyond the fenceline but the modeling[6] projects concentrations less than 0.5 $\mu g/m^3$ within 1 kilometer. This represents a worst-case situation since a majority of the secondary smelters report fenceline concentrations less than 1.5 $\mu g/m^3$ now and expect far lower results after controls.

The few battery plants which have monitoring perform it at the fenceline. For some with SIP requirements, concentrations are above 1.5 $\mu g/m^3$ only in one direction. For many, concentrations at the fenceline are less than 1.0 $\mu g/m^3$ and for some they are already less than 0.5 $\mu g/m^3$.

In summary, the EPA requirements to achieve 1.5 $\mu g/m^3$ at the fenceline using rigorous and conservative modeling techniques has assured relatively small distances to expected concentrations of 0.5 $\mu g/m^3$. It can be reasonably argued that the distances should be two kilometers for primary and refinery sources, one kilometer for secondary facilities and 0.5 kilometers for battery plants. These distances are actually in excess of, perhaps double, the expected results when SIP controls to meet 1.5 $\mu g/m^3$ are in place. In addition, if 1.0$\mu g/m^3$ were a sufficient air concentration to protect against elevated blood lead concentrations in young children, distances half again could be used; i.e., primary and refinery, 1 kilometer; secondary and tetra ethyl lead, 0.5 kilometer and battery plants, 0.25 kilometer.

5.0 POPULATION NEAR STATIONARY SOURCES

The questionnaire requested that each source identify the total population and the children less than 7 years of age. The data was requested at four radial distances: 0-0.5, 0.5-1.0, 1.0-2.0 and 2.0-5.0 kilometers. These distances were chosen to be consistent with the EPA[3] distances so that a direct comparison could be made and so that the shorter distances TRC believes are more appropriate could be evaluated.

The facilities used such sources as census data, and data produced by economic development agencies and boards of education. To determine the reliability of the estimates, a check was made using USGS maps of residence locations around a few facilities. This check indicates a reasonable degree of confidence in the population estimates.

Although all of the operating facilities have not reported, a reasonable percentage of each category has done so. The results of the survey for children less than 7 years of age are presented in Table 5-1. This table shows that, for the reporting facilities, 32,670 children less than age 7 live within the distances specified by the EPA staff analysis distances (see Section 4).

As one can tell by comparing the results for the five primary smelters and the one refinery, there are vast differences in the population living around individual facilities. ASARCO-EL PASO, for instance, accounts for 4/5ths of the children in the primary smelter group. However, the number of reporting facilities is sufficient that an extrapolation from the reporting facilities to the total number of open facilities seems reasonable. This extrapolation has been done in Table 5-2 and a comparison made to the EPA staff[3] estimates of children exposed. As can be easily seen from the table, the estimate derived from actual on-site counts of children differs substantially from the EPA estimate. This is due in part to the lower number of operating

TABlE 5-1

FACILITY ESTIMATES OF CHILDREN LESS THAN 7 YEARS OLD
LIVING NEAR STATIONARY SOURCES OF LEAD

Category	Facilities Reporting	Children < 7 as a Function of Distance (kilometers)				Total at maximum distance
		0-.5	.5-1	1-2	2-5	
Primary Smelters	5	184	430	1,330	4,208	6,152
Primary Refinery	1	0	7	546	8,408	8,961
Secondary Smelters	11	141	996	8,303		9,440
Tetraethyl Lead	1	37	85	243		365
Battery Plants	48	1,613	6,139			7,752
					Total	32,670

TABlE 5-2

EXTRAPOLATION OF FACILITY ESTIMATES OF CHILDREN LIVING NEAR STATIONARY SOURCES OF LEAD

Category	Facilities Open	Extrapolation at TRC Specified Distances* 1.0 μg/m³	0.5 μg/m³	Extrapolation at EPA Staff Distances*	EPA Staff Estimate
Primary Smelters	5	616	1,946	6,154	21,000
Primary Refinery	1	7	553	8,961	
Secondary Smelter	23	141	2,377	19,738	187,000
Tetraethyl Lead	1	37	122	365	N/A
Battery Plants	98	1,647	3,293	15,827	25,000
Totals		2,448	8,291	51,045	233,000

* Distances are specified as those with concentrations greater than the column heading when 1.5 $\mu g/m^3$ is attained at the fenceline; for 1.0$\mu g/m^3$ this is 1 kilometer for primary facilities, 0.5 kilometers for secondary and tetraethyl lead and 0.25 kilometers for battery plants; for 0.5$\mu g/m^3$ the distances are 2,1 and 0.5 kilometers respectively; the EPA staff distances are 5,2 and 1 kilometers respectively.

facilities. If the questionnaire responses were extrapolated to the EPA Staff[3] list of open facilities rather than presently open facilities there would have been 89,519 children. Therefore, the EPA Staff method using the census modeling approach overestimates the number of children by a factor of 2.6 compared to the estimates derived from the questionnaires. (Additional comparisons are found in Appendix C).

Also shown on Table 5-2 are the estimates of actual numbers of children living within distances specified in Section 4. For protection against ambient concentration greater than 1.0 $\mu g/m^3$. These distances are 1 km for primaries and the refinery, 0.5 km for secondaries and tetraethyl lead plant and 0.25 km for battery plants (children within 0.5 km divided by two). Similarly, if meeting the 1.5 $\mu g/m^3$ at the fenceline; children exposed to greater than 0.5 $\mu g/m^3$ are within distances of 2 km for primaries and the refinery, 1 km for secondaries and the tetraethyl lead plant and 0.5 km for battery plants. These still represent overestimates of the distance since they are evaluated in the worst-case direction. Children living in non-predominant wind directions would be exposed to far lower concentrations.

6.0 ELEVATED BLOOD LEAD CONCENTRATION DUE TO AIRBORNE LEAD EXPOSURE

Not all children exposed to airborne lead concentrations (PbA) are measured to have elevated lead concentration in their blood (PbB). For this analysis, an estimate must be made of the percentage of children exposed who may experience elevated blood lead concentrations. The OAQPS staff paper[2] derives this relationship of PbA to PbB using three separate model methods. TRC has grave misgivings about the model methods and would prefer to use more direct sources of data to develop the needed relationship.

Two recent studies in the vicinity of primary smelters have a direct leaning on the issue. During 1983, children living within 1 mile of the East Helena smelter were tested[7] for PbB. Ten percent of the children had PbB's greater than 20 μg/dl and 13 percent of the children had greater than 15 μg/dl. During 1984, children living within one mile of the Herculaneum smelter were also tested[8] for PbB. Fifteen percent of the children had PbB's greater than 20 μg/dl and 26 percent had PbB's greater than 15 μg/dl. PbB of 15-20μg/dl is being used by the EPA Staff[2] to evaluate the basis for a standard, although the Centers for Disease Control uses a 25 μg/dl threshold. In both cases, the primary smelters are on compliance plans to control airborne emissions but have not yet succeeded in meeting the 1.5$\mu g/m^3$ on a regular basis. Concentrations at East Helena were greater than 5$\mu g/m^3$ and concentrations at the nearest monitor to the Herculaneum smelter were greater than 2.4 $\mu g/m^3$. These blood lead tests, therefore, do not provide a true evaluation of PbB once the present standard is met at the fenceline.

Blood lead surveys around secondary smelters show even smaller percentages of children with elevated blood lead concentrations. In two years of testing within 1/2 mile of the two smelters in Dallas 4.1% of the children tested had PbB's greater than 25μg/dl. The largest percentage was 8% in the four tests. In Granite City, the tests within 1/2 mile of a secondary smelter revealed no children with pbB greater than 30 µg/dl despite relatively high ambient concentrations.

The data from Herculaneum illustrate another important point. The "control" group lives about 5 kilometers south of the smelter in a relatively low frequency wind direction. Their test results are an average PbB of 8 µg/dl, and only one child (1% of sample) had a PbB over 20 µg/dl (23). In the non-predominate wind direction, exposure and resultant PbB's are much less. The estimates of children exposed, even at the reduced distances specified in this study, significantly overestimate blood lead concentrations.

Given the above results it seems reasonable and still a significant overestimate to adopt 15% as the number of children which, if exposed, would develop PbB's above 20 µg/dl. Some significant support for this value comes from the Argonne risk assessment[10]. That risk assessment calculates that a maximum of 15% of the total children aged 0-6 years around various smelters belong in the 84 month cohort. That is 15% of the population were exposed over the entire 7 years of their early childhood. It is possible to conclude the 15% of the children have this extended opportunity for elevated blood lead concentrations and assume the 15% is a reasonable upper estimate of those children who will. Therefore, 15% has been used as an estimate in the remainder of this analysis of the percentage of young children whose blood lead concentration may size above 20µg/dl.

Even if the lower end of EPA's range of PbB were considered, i.e., 15 µg/dl, the percentage of children would be 26 using the above methodology.

7.0 BENEFITS/AVOIDED COSTS OF A REDUCED STANDARD

Given the number of children estimated to be exposed to concentrations of airborne lead greater than 1.0 or 0.5 μg/m³ and given that as many 15% of those children would have elevated blood lead concentrations, the benefits of avoiding elevated blood lead concentrations can estimated. The Final Regulatory Impact Analysis[4] for reducing lead in gasoline provides a cost for treating elevated blood lead concentrations in children less than seven years old. That cost is $3500 per child made up of $900 for medical care and $2600 for compensatory education. Since this is a recent EPA cost estimate and was applied to lead in gasoline, its use here would be consistent.

Table 7-1 shows the estimation of costs to be avoided by a 1.0 or 0.5 μg/m³ quarterly average standard. In addition, the evaluation at the distances to 0.25 μg/m³ in the EPA Staff[3] memo, are presented. As can be seen from the Table, there is an order of magnitude difference between the two values. As can also be seen, a comparison to the $358 million per year cost avoided by the lead in gasoline decision can also be made.

Even if 15 μg/dl were used as a threshold for exposure, 26 percent of the children might benefit. This would increase the benefit costs to 2.2 million for the 1.0 μg/m³ standard and $7.5 million for the 0.5 μg/m³ standard.

TABLE 7-1

AVOIDED COSTS OF 1.0 or 0.5 $\mu g/m^3$
ALTERNATIVE LEAD STANDARDS

Estimated Children with Elevated PbB (15% of exposed)	TRC Specified Distances		At EPA Staff Distances
	1.0 $\mu g/m^3$	0.5 $\mu g/m^3$	
Primary Smelters	92	292	923
Refinery	1	83	1,344
Secondary	21	357	2,961
Tetraethyl Lead	6	18	55
Battery	247	494	2,374
Totals	367	1,244	7,657
Avoided Costs ($3,500/child)	$1,284,500	$4,354,000	$26,799,500

REFERENCES

1. EPA, "Air Quality Criteria for Lead" Second Review Draft EPA-600/8-83-028B, September 1984.

2. EPA, "Review of the National Ambient Air Quality Standards for Lead: Assessment of Scientific and Technical Information" OAQPS Staff Paper, February 1986.

3. Battye, W.: "Estimated Numbers of Children Residing Near Lead Point Sources", GCA letter to EPA/ASB dated April 8, 1985.

4. EPA "Costs and Benefits of Reducing Lead in Gasoline: Final Regulatory Impact Analysis" OPPE, February 1985.

5. International Lead Zinc Research Organization, "Locations of Major Lead Operations in the United States" (Map), 1982

6. Balentine, H.W.: "Ambient Lead Concentrations at East Penn Manufacturing Company Inc." Report to EPA Region III. January 1984.

7. Center for Disease Control, "1983 East Helena Montana Blood Lead Study" Preliminary Results

8. Missouri Department of Public Health," 1984 Herculaneum Blood Lead Study", Preliminary Results.

9. City of Dallas Department of Health, "Blood Lead Screening Program: East Oak Cliff and West Dallas," Final Reports, Fall 1985.

10. Wallsten and Whitfield; "Estimating the Risks of Lead-Induced Health Effects," Argonne National Laboratory, January 1986 Draft.

APPENDIX A

LEAD INDUSTRIES ASSOCIATION
QUESTIONNAIRE

Questionnaire
Lead Industries Association
September 1985

Company Name ____________________

Location of Plant

City/Town ____________________

County ____________________

State ____________________

Longitude/Latitude or UTM Coordinates

____________________ ____________________

Name of USGS Topographic Map where plant is located

____

Please attach plot plan showing showing Plant Boundary.

Person Responding ____________________

Title ____________________

Phone ____________________

Mailing Address ____________________

____

Type of Lead Production Facility(s) at Site/Size of Facility

______	Mine	______	(tons of ore/year)
______	Primary Smelting	______	(tons of lead/year)
______	Secondary Smelting	______	(tons of lead/year)
______	Refining	______	(tons of lead/year)
______	Battery Manufacture	______	(numbers of batteries/ year)

Other ____________________(annual basis)______

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1. Was facility subject to a State Implementation Plan (SIP) for the existing lead NAAQS?

   Yes _____ No_____

2. Has an air quality modeling study been performed for lead for the facility?

   Yes _____ No_____

   If yes please attach copy if available, or give references.

   ____

3. Have controls been required to meet the SIP or other regulatory requirements?

   Yes_______ No_______

4. Please provide the following information for emission controls at your facility whether resulting from SIP requirements or for other reasons.

Type of Control	Initial Capital Cost	Annual Operational Cost	Control Efficiency
Stack (baghouse, Electrostatic Precipitator [ESP] or other)	_______	_______	______
Baghouse/ESP unloading operations	_______	_______	_______
Increase in process ventilation (secondary hooding, air flow rate changes)	_______	_______	_______
	_______	_______	_______
Building enclosure and ventilation (structural changes, air circulation modification)	_______	_______	_______
	_______	_______	_______
	_______	_______	_______
Plant area cleanings/paving (control of dust from plant property other than material handling)	_______	_______	_______
	_______	_______	_______
	_______	_______	_______
	_______	_______	_______

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Material handling controls (raw materials and wastes, including disposal)	______	______	______
	______	______	______
	______	______	______
	______	______	______
Other controls	______	______	______
	______	______	______
	______	______	______

5. Please identify additional control measures that would be required to reduce plant emissions to meet a 1.0 μg/m^3 standard.

Control Type	Efficiency or Increase in Efficiency	Initial Capital Cost	Annual Operational Cost
______	______	______	______
______	______	______	______
______	______	______	______
______	______	______	______

6. Please identify additional control measures that would be required (beyond those in question 6) to reduce plant emissions to meet a 0.5 μg/m^3 standard.

Control Type	Efficiency	Initial Capital Cost	Annual Operational Cost
______	______	______	______
______	______	______	______
______	______	______	______
______	______	______	______

7. What ambient air quality data is available around the facility including special purpose monitors?

Monitor Site	Distance from Fenceline	Direction from Plant	Highest Quarterly Average Lead in last two years	Expected Quarterly Average after SIP Required Controls
______	______	______	______	______
______	______	______	______	______
______	______	______	______	______
______	______	______	______	______

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8. Please indicate the number of residences and how many children live within the following distances from the facility.

Distance from Fenceline	Number of Residence	Number of Children
1/2 Kilometer	__________	__________
1 Kilometer	__________	__________
2 Kilometers	__________	__________
5 Kilometers	__________	__________

9. Have blood-lead studies been performed in the community around the facility?

Yes______ No______

If yes, please attach copy or give reference.

Date of Study	Conducted By	Results Published In	Date Published
______	__________	__________	______
______	__________	__________	______
______	__________	__________	______

10. Please provide other pertinent facts about the facility that would help in evaluating the exposure or cost of controls.

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Instructions for Respondents
to
Lead Industries Association Questionnaire

General Information

At the beginning of the questionnaire you are asked to provide general information about your facility. Most of the information requested is self explanatory and should be readily available. Notes on completing some specific items are as follows:.

- Latitude/Longitude or Universal Transverse Mercator (UTM) Coordinates - This information is best determined from U.S. Geological Survey 7-1/2 or 15 minute topographic quadrangle maps of the plant area. Latitude/longitude should be given to the nearest minute. If you elect to provide UTM coordinates, please give these to the nearest 100 meters. Both latitude/longitude and UTM coordinates are shown by black or blue tick marks, respectively, along the map borders. Select some definitive landmark, such as the main stack, for the coordinate location.

- Plot Plan - A distinct plot plan at a scale of approximately 1/24,000, or other large scale, that enables the property line to be accurately determined on a 7-1/2 minute quadrangle map is desired.

- Size of Facility - Please provide annual production figures for your most recent company reporting year (annual .. fiscal). If the annual production is expected to be much greater than this in future years, i.e. increase by 25 percent or more, please make note of this on the questionnaire.

Specific Questions:

Question 1 - Coverage by SIP means your facility was required to take specific action under the SIP such as adding emission controls, being placed under emission limitations in order to meet the NAAQS for lead. Answer negatively if your facility was "grandfathered" or otherwise not included in the SIP.

Question 2 - Please provide a copy of any ambient air quality dispersion modeling studies done for lead within the last 5 years.

Question 3 - Other requirements include new source performance standards, local air pollution regulations, etc.

Question 4 - Initial capital cost should include purchase price, installations and testing of unit. Annual operational cost should cover your most recent company reporting year (to coincide with annual production rates).

Questions 5 & 6 - These questions assume your facility is now meeting or will meet only the 1.5 $\mu g/m^3$ standard. Please comment if your facility is already meeting a stricter standard. If new control equipment needed, state its efficiency. If additional efficiency to be added to existing control equipment state increase in efficiency.

Question 7 - Any monitoring data less than 5 years old is desired from any source, company, local agency or federal agency.

Question 8 - This information is extremely important to an accurate evaluation of exposure in the lead standard setting process. You will probably need to contact several groups to obtain adequate information. These might include: local real estate agent, local/county planning/zoning board, local/county education bord or housing commission, local/county clerk or voter registrar, local/county office of vital statistics. The information required for question 8 can best be obtained in a step wise fashion as follows:

- Identify areas neighboring the plant at radial distances of 1/2, 1, 2 and 5 kilometers from the plant fenceline specified on suitable map.
- Determine residences in each neighborhood area through contact with realtors, local/county education board or housing commission, local/county zoning board. Aerial photos may be useful in some areas if available. Actual street counts for limited, representative areas may be the only means of estimating residences for some facilities.
- After residential counts are obtained most recent census data can be obtained from local/county planning office or clerks office to estimate populations and children age 5 or under for number of residences neighboring plant.

Question 9 - Recent studies within last ten years are of interest for community at large as well as neighboring plant. Blood lead screening programs that have not been published are of particular interest.

*Question 10 - After considering the problem, please provide any other comments or assistance.

For additional information or other questions not answered above, please contact:

Walt Klinger
TRC Environmental Consultants, Inc.
East Hartford, CT 06108

Telephone: (203) 289-8631

during regular business hours - eastern time.

APPENDIX B

APPENDIX B CONTROL COSTS FOR MEETING ALTERNATIVE LEAD STANDARDS

B-1 Introduction

Alternative NAAQS for lead would require that stationary sources be re-evaluated for compliance with a new standard. In addition, State Implementation Plans would need to be revised and new controls placed upon existing stationary sources. While the course of that process can hardly be anticipated, a preliminary view of the costs can be attempted. The questionnaire asks for data on control costs to meet the existing standard of 1.5 $\mu g/m^3$ and two alternatives, 1.0 and 0.5 $\mu g/m^3$. It was assumed that the quarterly averaging time would be retained for the standard. This assumption makes for easier engineering judgements of how much control would be required to reduce emissions by 1/3 or 2/3. To the extent that EPA chooses a monthly average standard or increased sampling frequency, these projected decreases in emissions are underestimated. A whole host of other variables introduced by modeling uncertainties, regulatory uncertainties and local and public pressure also cannot be reflected on these evaluations but also would cause these projected costs to be underestimated. That means that a 1/3 emission reduction will, in all likelyhood, be insufficient to obtain an acceptable SIP to insure attaining a 1.0 $\mu g/m^3$ at the plant fenceline.

The costs of control presented here represent a single focus view of the cost, i.e. what the plant-level engineer expects the costs would be to achieve the stated emissions reductions. In many cases although not generally for battery plants, the plant-level engineer has a reasonable idea of the expected costs because of the recent completion or near completion of the SIP's for attainment of the 1.5 $\mu g/m^3$ standard. What is not generally reflected is the impact on that specific plant site, or the corporation, or the lead industry as a whole of these increased control costs. In a few cases the plant-level engineer decided that reaching a 0.5 $\mu g/m^3$ standard would be "technologically infeasible". In a few more cases the plant-level engineer offered that the plant would be closed before incuring the significant costs to reduce emissions. In most cases the viability of the plant site was not actively considered in developing a control cost. In no case was the viability of the corporation considered, and the macroeconomic impact on the lead industry has not been considered at all.

Given that preface to the control costs, the results of the survey are presented in Table B-1. Costs are presented in thousands of dollars for three scenarios. The first is the costs basically to achieve the present 1.5 $\mu g/m^3$ ambient standard and the latter two columns present the incremental increase in control costs to achieve the alternative standards. These costs are divided by industrial sector as in the body of this study. In addition, they have been extrapolated to the entire industry using the number of facilities existing in each sector (The first line in each sector is reported costs with number of facilities in parentheses while total industry values are on the second line).

B-2 Present Costs

The column listed "present costs" reflects the air pollution control equipment placed in service in the last few years or to be placed in service to meet present regulatory objectives. The primary objective intended is meeting the 1.5 $\mu g/m^3$ NAAQS as reflected in the SIP requirements. Some facilities, most notably battery plants (12 out of 49 responding) do meet that standard at the plant fenceline without having added controls. On the other hand, some of the expenses recorded will result in overachieving the 1.5 $\mu g/m^3$ standard. This occurs where public pressure has forced tighter controls, e.g. Dallas, Texas. It also occurs where uncertainties in modeling or emissions determinations have been overcompensated for in SIP's. In all likelihood, the measured fenceline concentrations are now or will be less

TABLE B-1

LEAD INDUSTRY CONTROL COSTS
(Thousands of Dollars)

Industrial Sector		Present Costs		Costs to Meet 1.0		Costs to Meet 0.5	
		Capital	O&M	Capital	O&M	Capital	O&M
Primary	(3)	19,825	3,207	14,203	900	30,766	1,725
	(5)	33,042	5,345	23,672	1,500	51,277+	2,875+
Refinery	(1)	7,416	717	2,250	110	4750	140
Tetraethyl	(1)	7,000	3,000	*	*	3,000	500
Secondary	(11)	24,889	5,414	8,611**	696**	17,502***	1,499***
	(23)	52,691	11,320	18,084	2,034	36,755	3,079
Battery	(49)	26,659****	4,903	359*****	1,600	14,335******	3,402
	(98)	53,318	9,806	718	3,200	28,670	6,804
Total Reporting Industry		85,789	17,241	25,423	3,579	70,353	7,266
		153,467	30,188	44,724	6,844	124,452	13,398

* Believes the plant could meet this standard
** 3 facilities believe they could meet this standard
*** 3 facilities believe they would be forced to close
**** 12 meet without controls
***** 18 could meet, 0 would close
****** 3 could meet, 2 more would close
\+ The Bureau of Mines preliminary estimate is $68 million in capital cost and $9 million per year in O+M costs. This does not include El Paso, which is idled.

than 1.5 μg/m^3 when the SIP controls are in place. The other reason that some of the control costs exceed those strictly required to meet the standard is costs associated with control of airborne lead to meet OSHA, RCRA or Clean Water Act standards. While many such costs serve multiple purposes and are reflected in the SIP's, some are not.

The timing of the costs cited under "present costs" varies substantially for the facilities. Since some of the capital costs were incurred as long ago as 1980 and some of the capital costs are not to be incurred until 1988, the cost basid varies. The operations and maintenance (O+M) costs more likely reflect current dollars.

The resulting total costs to the industry to meet the 1.5 μg/m^3 standard or other airborne lead requirements are on the order of $150 million in capital costs spread over eight years and $30 million per year in operations and maintenance costs.

B-3 <u>Meeting a 1.0 μg/m^3 Standard</u>

Projected incremental costs to meet a 1.0 μg/m^3 standard are presented on Table B-1 in the second column. These totals for the industry are about $45 million in capital costs and $7 million per year in operation and maintenance costs. It can be assumed that these costs represent 1986 dollars. These costs are lower than otherwise might be expected because a substantial number of facilities felt that they could meet the standard with present or proposed controls listed under "present costs". This reflects, in part, the amount of overcontrol in meeting 1.5 μg/m^3. A total of 22 reporting facilities felt they could meet 1.0 μg/m^3 without further controls. This feeling came from either measured fenceline data after installation of controls reflected in "present costs" or model projections that after "present cost" controls the 1.0 μg/m^3 would be achieved. Six battery plants are apparently marginal enough that they would be forced to close of 1.0 μg/m^3 needed to be met.

In extrapolating to the totals for each industrial sector, the percent of facilities which presently feel they could meet the standard or would close was counted. For example, out of 49 battery plants reporting, 24 would not incur costs so the ratio $\frac{49-24}{49}$ was applied to the 98 plants in the total industry, i.e., multiply costs by two.

The costs of a 1.0 μg/m^3 standard would apparently fall most heavily on the primary and secondary industries. But since the actual SIP process is far more rigorous, especially if a monthly average standard is adopted, these costs are grossly under estimated and the entire industry would bear much larger costs.

B-4 Meeting a 0.5 μg/m^3 Standard

Projected incremental costs to meet a 0.5 μg/m^3 quarterly average standard are presented in the third column of Table B-1. These totals for the industry are 125 million in capital costs and $14 million per year in operation and maintenance costs. This does reflect costs of going from 1.5 to 0.5 μg/m^3 rather than just 1.0 to 0.5 μg/m^3. The plant-level engineering approach reports that at least 3 secondary and 8 battery plants would be forced to close with a 0.5 μg/m^3 standard. As mentioned before, this evaluation of closing does not truly reflect plant margins, corporate decisions or lead market reasons to close plants. In addition it does not consider non-air control costs which may force closure. Only 3 battery plants out of all the facilities in the industry feel that they could meet a 0.5 standard without additional controls.

These projected costs are seriously underestimated because of the proximity of 0.5 μg/m^3 to background or non-stationary source concentrations.

TABLE B-2

COST BENEFIT COMPARISON
(7 YEAR BASIS) THOUSANDS OF 1986 DOLLARS

Industrial Sector	1.0 $\mu g/m^3$ Standard		0.5 $\mu g/m^3$ Standard	
	Cost	Benefits	Cost	Benefits
Primary	34,172	322	71,400*	1,022
Refinery	3,020	4	5,730	291
Tetraethyl	0	21	6,500	63
Secondary	32,322	74	58,308	1,250
Battery	23,118	865	73,298	1,729
Total Industry	92,632	1,286	218,236	4,355
Costs/Benefit ratio	72:1		50:1	

* The Bureau of Mines perliminary results would lead to costs of $131 million for the primary smelters.

In calculating the control costs it was necessary to evaluate operation and maintanence costs over a period of years. Since the cohort of children who might obtain elevated blood lead concentrations is the same percentage (15%) as that used to derive benefit costs, it can realistically be assumed that 7 years is appropriate for O&M costs. The number of years, however, hardly matters since total capital costs are $45 and $125 million to meet 1.0 and 0.5 $\mu g/m^3$ respectively. The capital costs alone are well over an order of magnitude greater than the benefits.

At the bottom of Table B-2 there is a calculation of the control costs per child. This is a guide to how expensive it is to attempt to manage blood lead concentrations in children through the mechanism of the lead NAAQS. Substantially more cost-effective health maintenance of children around stationary sources of lead can be obtained through direct programs. Such programs are already widespread and can lead to significant reductions in numbers of children with elevated blood lead concentrations. This is true because airborne lead is a minor part of the total exposure of a child to lead and because awareness of the health impacts of lead leads to substantial reduction in the other sources of exposure.

The results presented in Table B-2 still represent an underestimation of the cost/benefit ratio. For the reasons cited above, the costs are underestimated. On the other hand, the benefits continue to be overestimated. It is clear, however, that reducing the NAAQS is not a cost effective method of reducing lead exposures from stationary sources of lead emissions.

APPENDIX C

POPULATION ESTIMATES AROUND
SPECIFIC SOURCES

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APPENDIX C POPULATION ESTIMATES AROUND SPECIFIC SOURCES

The EPA staff's and this studies' facilities questionnaire estimates of children living in the vicinity of stationary sources are substantially different. A direct comparison can be made using data supplied in Table 5-1 of the Argonne risk assessment[10]. That Table lists five stationary sources and total children aged 0-6 years for each individual source. TRC has obtained from EPA Staff[c-1] the facility identification and distances used to develop Table 5-1. The precedent of not revealing the specific source names will be continued.

Table C-1 shows the comparison for these 5 facilities. It is self evident that the model method used by EPA staff to estimate exposed children creates serious overestimation difficulties. Even if these EPA staff listed values were in error, i.e., population or residences rather than children 0-6 years of age, the estimates would still be substantially greater than the actual values reported by on-site investigations. Using census areas of 2,500-8,000 population simply does not place locations of children accurately enough geographically. There is a strong tendency for housing to avoid the areas in close proximity to industry and that tendency just is not accounted for in the model methods used by EPA staff. At 20 kilometers, the census based model does substantially better as would be expected due to the much larger area.

Since the two secondary and two battery plants are located in the same city, other overestimates in tabulating children have emerged as follows:

- One of the battery plants was permanently closed in May 1985. This is evidence of the continual erosion of the industry that can be expected to continue. The number of children exposed will continually decrease.

- One of the battery plants is co-located with a secondary plant and owned by the same company. The children exposed out to two kilometers from the battery plant are thus double counted. The presence of battery manufacture at a secondary smelter site does not double the exposure of children. This type of co-location is specifically avoided in this study.

TABLE C-1

COMPARISON OF ESTIMATES OF
CHILDREN 0-6 YEARS OF AGE LIVING
NEAR STATIONARY SOURCES

Point Source	Facility Type	EPA Staff[8] Estimate of Chilren	EPA Staff Specified Distance Kilometers	Facility Estimate of Children
1	Secondary	15,835	5	*
2	Secondary	4,614	5	200
3	Battery	23,422	2	158**
4	Battery	12,956	2	58***
5	Primary	12,576	20	11,980

*   Facility not reporting
** Closed permanently in May 1985.
*** Based on residences out to 1 km only.

- The two secondary plants are about 3.3 kilometers from each other. Since each site used a 5 kilometer radius, the children are double counted (it is recognized the Argonne's[10] subsequent modeling may have accounted for this fact, but in counting exposed children it is ignored). This study has not been able to explictly account for such double counting. While nearby facilities may increase ambient concentrations, doubling of exposure does not occur because of wind direction considerations.

C-1 Haines J,: Personnel Communication with Gale F. Hoffnagle, February 21, 1986

APPENDIX D

MONTHLY AVERAGE CONCENTRATIONS

APPENDIX D SELECTING A STANDARD

D-1 Concept of a Monthly Standard

Given that the relationship between PbB and PbA has been developed based upon quarterly average measured concentrations of ambient lead (a weak relationship at best), derivation of a monthly average standard is untenable. If the quarterly average target value is 0.5 $\mu g/m^3$, then the monthly concentration value should be higher, not lower. The presentation of monthly-to-quarterly ratios (Table 7-1 of the Staff Paper[2]) is in error for two reasons:

1. Since samples are collected every sixth day, monthly averages are made up of 4 or 5 and an occasional six samples. As recent study with daily lead samples yields monthly averages ranging from 45% to 335% of the sixth day samples. Monthly to quarterly average ratios based on sixth day sampling cannot be relied upon. Even quarterly average values produced on an every sixth day basis ranged from 81% to 190% of daily values.

2. The high-volume samples used to measure ambient concentration of lead is unreliable. The mass collected is dependant upon wind speed, wind direction, atmospheric stability, and settling of particles. These variablilities in actual airborne concentrations hinders both the establishment of correlation of PbA to PbB and development of reliable State Implementation Plans.

D-2 Monthly Average Concentrations at Fenceline Monitors

Since stationary source facilities are judged for compliance on the basis of fenceline monitors, it is important to review those monitors in order to judge the effect of alternative averaging times and sampling periods. Daily sampling has been performed at only a few locations. One facility has performed daily sampling for a 10-month period at 100 meters from the fenceline in the worst-case wind direction in order to establish correct parameters for devising a 1.5 $\mu g/m^3$ SIP. The results of that sampling in forming monthly averages is presented in Table D-1. It shows that, on the average, monthly concentrations formed by daily values are 70% higher than those formed by every sixth day averages. Because every sixth day sampling is a hit-or-miss proposition for stationary source, the ratio to more accurate daily sampling fluctuates wildly. The highest monthly average for every sixth day sampling is twice the actual value. The lowest monthly average for every sixth day sampling is 1/3 the actual value. The conclusion is that every sixth day sampling is an entirely inappropriate way to form monthly averages near stationary sources and is unreliable in determining the effect of alternate standards. Secondly, there is a real effect of going to daily samples, i.e., an increase in expected concentrations. The use of daily samples would, however, avoid abberant monthly averages such as the 5.07 $\mu g/m^3$ in May shown on Table D-1. Since the PbA/PbB relationships are based on every sixth day sampling averaged over a quarter, going to daily sampling results in an unintended and uncorrelated to health effects tightening of the standard.

Comparisons of monthly to quarterly averages show different results using daily as opposed to every sixth day sampling. Table D-2 presents monthly to quarterly ratios at four sites in the vicinity of a stationary source of lead emissions. Using the every sixth day sampling, the Table shows that concentrations at the fenceline show substantially higher monthly to quarterly ratios than the 1.40 mean ratio presented in the OAQPS staff paper. While more distant monitors show generally lower ratios, as might be expected, the second quarter values are higher. Comparing the ratios formed with daily samples to the ratios formed with every sixth day samples, shows that daily sampling produces lower ratios. The highest ratio, 1.34, is below the mean ratio of 1.4 presented by the Staff paper and more like the results for non-stationary source monitors. The implication is that the reason stationary

TABLE D-1

DAILY VERSUS EVERY SIXTH DAY
MONITORING FOR LEAD
(SITE 100 METERS FROM FENCELINE)

Month/Quarter	Average Based on Daily Samples (μg/m³)	Average Based on Every Sixth Day (μg/m³)	Ratio Daily/Sixth day
March	.25	.56	.45
April	2.25	.68	3.34
May	2.44	5.07	.48
June	3.01	3.79	.79
2nd Quarter	2.57	3.18	.81
July	3.64	.83	3.18
August	2.11	.65	3.25
September	3.86	3.05	1.27
3rd Quarter	2.87	1.51	1.90
October	2.42	1.50	1.61
November	2.34	2.96	.79
December	1.39	.80	1.73
4th Quarter	2.05	1.75	1.17
10 Month Average	2.27	1.99	1.69

TABLE D-2

MONTHLY TO QUARTERLY RATIOS
FOR A SINGLE FACILITY

	Daily Sampling		Monitor Sites Distance to the Facility Fence line (meters) Every Sixth Day Sampling							
	100		100		450		760		800	
Quarter	Q Ave	Ratio	Q Ave	Ratio	Q Ave	Ratio	Q Ave	Ratio	Q Ave	Ratio
1st			1.26	1.36	.33	1.09	.39	1.00	.72	1.63
2nd	2.57	1.17	3.18	1.59	.60	1.12	.70	2.40	.79	2.15
3rd	2.87	1.34	1.51	2.02	.72	1.54	.36	1.14	.20	1.10
4th	2.05	1.18	1.75	1.69	.60	1.43	.36	1.47	.54	1.19

* QAve = Quarterly average concentration in $\mu g/m^3$

** Ratio = Ratio of highest monthly average concentration in the quarter to the quarterly average.

source monitors show higher ratios is the every sixth day sampling rather than something instintically different in source type.

As a summary, a quarterly average of 1.5 µg/m^3 can be attained, on the average, by a monthly average of 1.86 µg/m^3 with daily sampling. A 1.75 µg/m^3 monthly average would protect against exceeding the 1.5 µg/m^3 quarterly average in the worst-case. Using every sixth day sampling, a 3.0 µg/m^3 monthly standard would, on the average, protect against exceeding 1.5 µg/m^3 on a quarterly basis. A 2.0 µg/m^3 standard would provide that protection in the worst-case.

D-3 Sampling Method

TRC presented[D-1] in the CASAC hearings on the particulate standards, all of the reasons why the high-volume sampler was an anachronistic and unreliable method of determining compliance with the standard. Each of those reasons continue to apply. Figure D-1 is taken from that presentation a shows that the high volume sampler collection efficiency is much too variable for reliability. One of the reasons PbA/PbB correlationd are difficult to attain is the use of the high-volume sampler. One of the reasons reliable SIP's are difficult to demonstrate is the high-volume sampler. If the high-volume sampler is not to be used for the particulate standard, why should we continue its use for lead? The most cost-effective sampling method would be PM_{10} but it is unknown what the appropriate particle size cut off for lead should be. It is known that the high volume sampler, especially 100 meters from the fenceline of a stationary source, measures particles substantially larger than 50 microns and some larger than 100 microns with highly variable collection efficiencies. These large particles tend to dominate the mass being measured

HI-VOL SAMPLER EFFICIENCY AND RELATIVE SIZE RANGES OF PARTICLES THAT DOMINATE SOILING AND PARTICLES THAT DOMINATE SETTLED DUST MASS

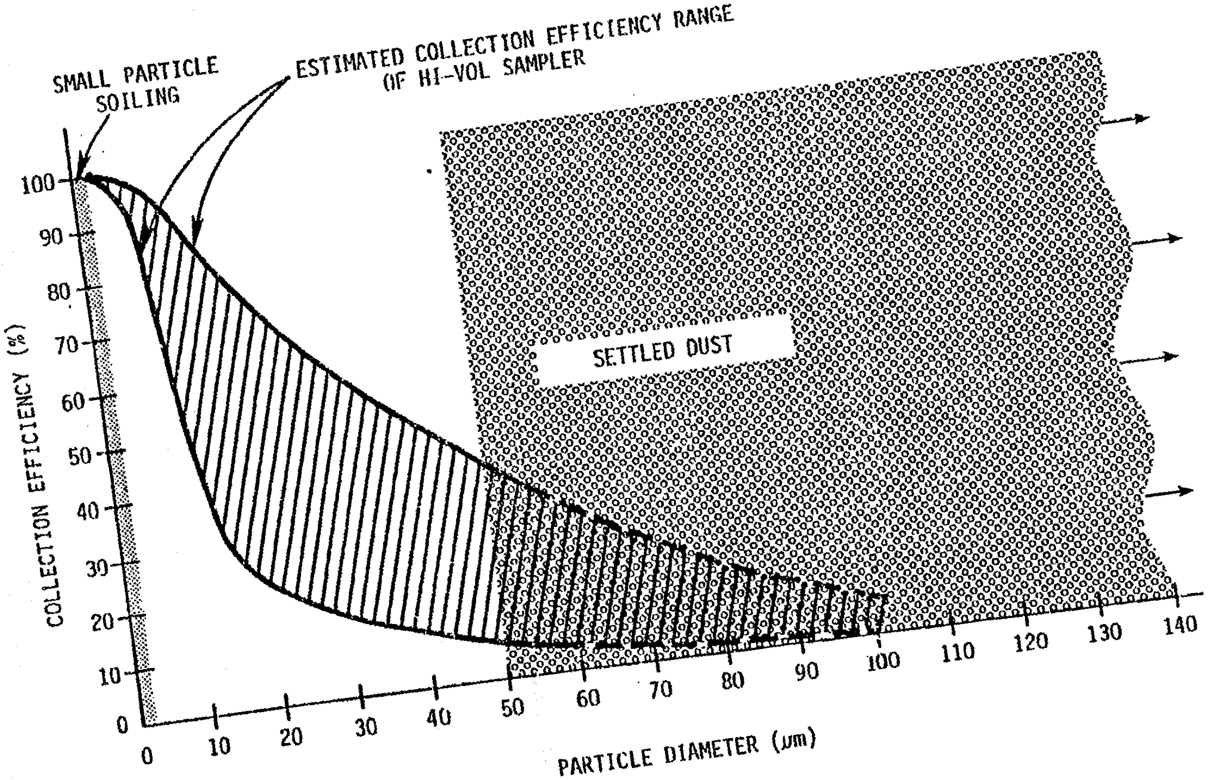

FIGURE D-1

and the subsequently reported concentrations. EPA should find and promote a more reliable, more accurate way of measuring airborne lead concentration and one that is more consistent with human health effects.

D-1 Hoffnagle, G.F.: Testimony before the Clean Air Scientific Advisory Committee on the Particulate Standard, December 10, 1985.

GCA[9] has estimated that by the year 1995 concentrations of lead due to automotive sources would average 0.02 but could go as high as 0.13 $\mu g/m^3$. In addition, reentrainment of soil dust lead accounts for some reasonable fraction of measured lead concentrations. Practical experience with comparisons of modeled versus measured concentrations suggests that reentrainment accounts for 10-20% of maximum measured concentrations at stationary source locations. These other sources of lead suggest strongly that the emissions from stationary sources will have to be reduced substantially more than dividing by 3 to demonstrate attainment of a 0.5 $\mu g/m^3$ standard. If the averaging time is monthly rather than quarterly, it will be infeasible to meet the standard short of shutting down the facility. Ambient concentrations at Bunker Hill exceed monthly averages of 0.5 $\mu g/m^3$ even though the smelter has been shut-down since 1981. The cost impact on the industry are certainly not reflected in these results.

B-5 <u>Industry Sector Differences</u>

The results reflected in Table B-1 should not be compared directly to other analyses of costs to the industry. For instance, the Bureau of Mines is preparing costs to the <u>primary</u> industry for controlling to meet the 1.0 or 0.5 $\mu g/m^3$ standard. Their preliminary results are $68 million capital costs and $9 million per year O+M costs. The basis upon which this analysis is performed differs from the basis of responses to this questionnaire. The results, therefore, could not be expected to be equivalent.

B-6 <u>Costs Versus Benefits</u>

Given the control cost estimates presented in this Appendix and the benefit costs from Section 8, a comparison can now be made. That comparison is provided in Table B-2. It demonstrates emphatically that the control costs exceed the benefit costs by substanially more than an order of magnitude.