May 20, 2008

MEMORANDUM

SUBJECT: Analysis of Socio-Demographic Factors for Populations Living Near Pb TSP Monitors and Larger Pb Point Sources

FROM: Zachary Pekar, OAQPS/HEID/ASG
Erika Sasser, OAQPS/HEID
Jackie Ashley, OAQPS/HEID

TO: Lead NAAQS Review Docket (EPA-HQ-OAR-2006-0735)

This memo describes a limited screening-level analysis of the socio-demographic characteristics of populations living near ambient air lead monitors and stationary sources of lead emissions completed as part of the current Pb NAAQS review. The memo describes the technical approach used in the analysis, discusses uncertainties and limitations associated with the analysis, and presents preliminary results.

1.0 Introduction

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 FR 7629; Feb. 16, 1994), directs federal agencies, to the greatest extent practicable and permitted by law, to make environmental justice (EJ) part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations in the United States. Accordingly, the Environmental Protection Agency's (EPA) Office of Air Quality Planning and Standards (OAQPS) has conducted a limited analysis of population demographics in some areas that may be affected by the proposed revisions to the national ambient air quality standards (NAAQS) for lead (Pb).

On May 1, 2008, EPA Administrator Stephen L. Johnson signed a proposed rule to revise the NAAQS for lead from the current level of 1.5 micrograms per cubic meter of air ($\mu g/m^3$) to within the range of 0.10 to 0.30 $\mu g/m^3$, while also soliciting comment on levels up to 0.5 $\mu g/m^3$ and levels below 0.10 $\mu g/m^3$. This proposed rule will establish uniform national standards for lead in ambient air. The proposed revisions would improve public health protection for at-risk groups, especially children. Therefore, as stated in the preamble to the proposed rule, EPA has determined that this proposed rule will not have disproportionately high and adverse human health or environmental effects on minority or low-income populations because it increases the level of environmental protection for all affected populations without having any disproportionately high and adverse human health or environmental effects on any population, including any minority or low-income population.

EPA recognizes, however, that recent data from the Centers for Disease Control and Prevention, which has been monitoring blood Pb levels nationally through the National Health and Nutrition Examination Survey (NHANES) since 1976, indicate notably higher blood Pb levels in children in poverty and in black, non-Hispanic children compared to those for more economically well-off children and white children, in general. Though the median blood Pb level for U.S. children under age 5 declined from 15 micrograms per deciliter (μg/dL) in 1976-1980 to 1.6 μg/dL in 2003-2004,[1] EPA's Pb Criteria Document (U.S. EPA, 2006, henceforth "CD") points out that "blood-Pb levels have been declining at differential rates for various general subpopulations, as a function of income, race, and certain other demographic indicators such as age of housing" (CD, p. 8-21). For example, the geometric mean blood Pb level for children (aged one to five) living in poverty in the 2003-2004 survey period is 2.4 μg/dL. For black, non-Hispanic children, the geometric mean is 2.7 μg/dL, and for the subset of this group that is living in poverty, the geometric mean is 3.1 μg/dL (Axelrad, 2008).

These statistics suggest that the overall burden of lead exposure, as reflected in elevated blood Pb levels, falls most heavily on minority and low-income children, and EPA's Office of Environmental Justice (OEJ) has identified lead as a pollutant of concern. It is therefore appropriate to consider EJ concerns in the context of Pb regulations. Although as previously indicated EPA believes that the proposed Pb NAAQS will not have any adverse impacts on any population group, including low-income and minority populations, the Agency has elected to conduct a limited analysis of key socio-demographic characteristics of populations living in census block groups within certain distances of ambient air lead monitors and stationary sources of lead emissions.

However, because of limitations in the available data, this analysis does not constitute a robust or complete assessment of any potential EJ issues associated with lead pollution. Most importantly, *it does not allow us to draw conclusions with regard to whether the current ambient air concentrations of lead as measured by fixed-site monitors or proximity to stationary sources of lead are associated with elevated exposure or increased risk for any socio-demographic group*. The limitations on this analysis are discussed in detail below, but include significant uncertainties in the lead emissions inventory and limited air quality data given the current monitoring network. For this analysis, EPA has not performed any air quality dispersion modeling of emissions around major stationary sources or conducted any exposure analyses, which would be necessary to develop estimates of exposure and risk.[2] There are additional uncertainties introduced because of the spatial resolution of the available census data. For this reason, the conclusions that can be drawn from the results of this analysis are extremely limited and the approach described below should not be considered a template for future EJ analysis.

[1] http://www.epa.gov/envirohealth/children/body_burdens/b1-table.htm.

[2] EPA did conduct quantitative risk assessments for a number of case studies as part of the Pb NAAQS review (see Section II.C of the NPR). These case studies included residential areas surrounding a primary Pb smelter, as well as several larger residential areas in specific cities. These assessments included consideration of sensitive populations by modeling exposure and risk for children under 7 years of age, but did not explicitly examine effects in poor or minority children.

In this memo, we outline the methodological approach and design of the assessment, and present the limited quantitative results. EPA believes that some commenters may find this information relevant to assessing EJ concerns associated with the proposed Pb NAAQS. Because of the significant uncertainties and limitations in the analysis, EPA does not believe that the information presented here can be used to definitively determine whether there are or are not EJ concerns associated with current air lead concentrations. EPA requests comment on the characterization of the results presented below, and on other relevant aspects of this analysis. As part of the rulemaking effort, EPA is also requesting comment more generally on EJ issues related to the proposed revision of the standards.

2.0 Design of Analysis

As noted above, this analysis focused on characterizing the socio-demographic attributes of residential populations located in areas (a) within 1 and 2 km of ambient monitors with Pb measurements in the range of the proposed Pb NAAQS levels and (b) areas within 1 and 2 km of intermediate to larger point sources of Pb emissions. The characterization of these residential populations focused on socio-demographic attributes of potential relevance to EJ analysis in the context of Pb exposure, including: race, ethnicity, age (focusing on the presence of children), median income, poverty status (specifically presence of children in households above and below the poverty line), and educational level. In addition to these socio-demographic factors, information on housing vintage (age) was also included to reflect the fact that older housing may be associated with increased risk of Pb exposure in children (CD, p. 4-21). This may be due to the presence of indoor Pb paint and/or lead solder in water pipes which can be important non-air sources of lead exposure and may contribute to total blood lead levels (BLLs).

The socio-demographic attributes of residential populations located relatively close to monitors and point sources (as represented by the 1 km and 2 km rings mentioned above) are contrasted to patterns of these same socio-demographic attributes for the broader regional areas where these monitors and point sources are located. Two spatial units have been selected as the basis for the regional comparison in this analysis: (a) a 10 km ring surrounding the point source or monitor and (b) the county within which the point source or monitor is located. It is likely that there will be spatial gradients in ambient air Pb levels around both point sources and monitors. In the case of point sources, generally, ambient air Pb levels will be higher near the point source and then decrease with distance away from the point source. In the case of monitors, levels will be closest to the measured value near the monitor, but may be higher or lower than the measured value at distances farther from the monitor.

As described in greater detail below (Section 2.3) the demographic component of this analysis relied on block-group-level data from the U.S. Census Bureau. Thus, the design of the analysis was shaped by both the spatial resolution of Census data and the socio-demographic variables available from that source. There are some important limitations related to the use of U.S. Census block group-level data which should be highlighted before presenting more detail regarding the demographic variables included in the analysis and the analytical approach used for each assessment.

The U.S. Census Bureau collects information on the variables described in the previous paragraph for individuals and households, and reports data on these characteristics at the census block group level. Census block groups are the smallest geographical unit for which the Bureau publishes sample data. They generally contain between 600 and 3,000 people, with an optimum size of 1,500 people, and can vary significantly in terms of geographical size depending on population density. In general, census block groups in urban areas will be smaller (often significantly so because of greater population density) than census block groups in rural areas. Furthermore, populations may not be distributed evenly throughout the geographic area of the block group. Rural block groups, for example, may consist of small pockets or clusters of dwellings surrounded by significant uninhabited space. However, because we lacked information regarding how populations were distributed in individual block groups, for purposes of this analysis, populations were assumed to be evenly distributed within the block group. Because this is unlikely to be true in most instances (particularly in rural areas where block group density is low and block group size is large) this introduces potentially significant uncertainty into the analysis.

2.1 Description of Specific Assessments Conducted

Specific assessments completed for this analysis are described below, followed by a more detailed description of the technical approach followed in each assessment.

- **Characterization of populations within specified distances of ambient air Pb monitoring sites with Pb measurements exceeding levels within the proposed range for the revised Pb NAAQS (*Pb-TSP monitor-based demographic analysis*)**: socio-demographic attributes and housing vintage for residential populations living within 1 km and 2 km of a subset of Pb-TSP monitors, were compared to 10 km ring, county-level and national statistics. The subset of monitors included those with maximum quarterly or second maximum monthly measurements greater than 0.10 $\mu g/m^3$ (the lower end of the range of standard levels proposed in the NPR), 0.20 $\mu g/m^3$ and 0.30 $\mu g/m^3$ (the higher end of the range of standard levels proposed in the NPR).[3] For this analysis, the county comparisons are based on the set of counties within which the Pb-TSP monitors > 0.10 $\mu g/m^3$, > 0.20 $\mu g/m^3$ or > 0.30 $\mu g/m^3$ are located. This assessment provides information relevant to determining if populations residing within 1 km or 2 km of Pb-TSP monitors measuring Pb levels in the proposed NAAQS standard range differ from populations living further from monitors (10 km ring), populations within the broader counties, and/or the national population with regard to socio-demographic attributes that are potentially EJ-relevant.[4]

[3] The averaging time and form of the standard define the air quality statistics that are compared to the level of the standards to determine whether an area attains the standard. The range of ambient air Pb levels proposed is from 0.10 to 0.30 $\mu g/m^3$ with averaging times and forms including maximum quarterly average and second maximum monthly average. The Pb-TSP-related assessments completed for this analysis focused on these combinations of level, form and averaging time, as calculated for each site using 2004-2006 data from EPA's Air Quality System (AQS). See http://www.epa.gov/air/lead/pdfs/20080501_tech1.pdf and http://www.epa.gov/air/lead/pdfs/20080501_tech2.pdf, and also the full dataset available at: http://www.epa.gov/ttn/naaqs/standards/pb/s_pb_cr_td.html.

[4] In addition to looking across the full set of monitors, we also stratified the set of Pb-TSP monitors into rural versus urban monitors and completed separate sub-analyses for these two categories. Note, however that as described in

- **Calculation of population-weighted average Pb-TSP values based on populations within specified distances of Pb-TSP monitors (*population-weighted monitor-based analysis*)**: To provide a broader perspective on the relative ambient air concentrations affecting different socio-demographic groups, we also conducted an analysis looking at the full set of 144 non-co-located Pb-TSP monitors, rather than just those measuring > 0.10 μg/m^3.[5] Pb-TSP measurements were generated for two of the distance rings (1 km and 2 km) by weighting individual monitor Pb-TSP levels by the number of residents within each of these rings.[6] For example, in calculating a population-weighted estimate for the 1 km distance ring, each monitor's value would receive a weight equal to the total population (or population subgroup) within 1 km of that particular monitor divided by the total population (or population subgroup) within 1 km of the full set of Pb-TSP monitors included in this analysis. Population-weighted Pb-TSP estimates were generated based on both maximum quarterly values and second maximum monthly values at each Pb-TSP monitor, reflecting the form and averaging time associated with the Pb NAAQS proposal. The results of this assessment provide information regarding whether different demographic groups within 1 km and 2 km of a fixed site monitor experience different average ambient concentrations of Pb-TSP. Again it is important to note that because we did not complete quantitative exposure assessments for any of these locations, the potential health significance of these different population-weighted Pb-TSP values cannot be assessed. In addition, the ambient air Pb concentration measured at each monitor is assumed to pertain equally to all of the individuals living within a particular distance ring (i.e., there is no spatial "gradient" assumed in assigning TSP-based ambient air Pb levels to residents within rings).[7]

- **Characterization of populations within specified distances of point sources with annual Pb emissions of one ton or more (*Pb point source-based demographic analysis*)**: This analysis characterizes the demographic attributes of populations living within 1 km, 2 km or 10 km of Pb industrial point sources. The analysis was completed both for all point sources with at least 1 ton of annual Pb emissions and for the subset of those sources with at least 5 tons of annual Pb emissions, as described in Pace (2008).[8] This assessment compares the

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Section 3, the significant uncertainties associated with evaluating socio-demographic attributes for the rural subset of TSP monitors (together with other technical limitations) leads us to conclude that it is inappropriate to focus on these results. Consequently, results differentiated for rural versus urban areas are not presented or discussed in this memo (although they have been included in the Pb NAAQS docket).

[5] http://www.epa.gov/ttn/naaqs/standards/pb/s_pb_cr_td.html.

[6] Population-weighted average TSP values were not generated for the 10km ring because of the high degree of uncertainty in associating populations out to that distance with the associated TSP monitors. Note, that there is also considerable uncertainty in relating populations out to 1km and 2km with associated TSP monitors and as noted previously, in the absence of a quantitative exposure analysis, actual exposure levels for resident populations can not be characterized and may differ considerably from ambient measurements taken at TSP monitors within 1 to 2 km of those populations.

[7] One implication of assuming that ambient air Pb levels remain constant within each distance ring (i.e., that there is no spatial gradient), is that population-weighted average ambient air Pb levels can be seen to increase with increasing distance to the monitor, since a given monitor value may be "up-weighted" due to the inclusion of more residents (which result in that monitor receiving a higher weight in generating the population-weighted average relative to other monitors).

[8] While this subset of facilities does represent relatively larger sources of Pb emission within the US, it is important to emphasize that the significance of any particular emissions rate in terms of ambient air Pb levels near that facility and resulting health impacts, is highly site-specific, reflecting a number of factors including: (a) whether there are significant fugitive emissions (which can have higher near-facility impacts), (b) the effective stack height for the

percentage of residents in specific socio-demographic categories to the percentage at the associated county and national level. Generally, the results of this assessment provide information regarding whether populations residing within 1 and 2 km of intermediate to larger Pb point sources differ from 10 km ring, county and national populations with regard to socio-demographic attributes that are potentially EJ-relevant.

2.2 Demographic Variables Included in Analysis

Before presenting a stepwise description of the technical approaches used in completing the three assessments described above, we wanted to first briefly describe the socio-demographic variables included in the analysis (these variables reflect specific fields from the 2000 U.S. Census, block-group-level data files):

- **Race/Ethnicity:** The U.S. Census tracks race and ethnicity separately. The U.S. Census breaks out the results separately and in combination because people who identify themselves as Hispanic can be of any race. Specific categories for this field include:
    - Race: White alone, Black or African American alone, American Indian and Alaska Native alone, Asian alone, Native Hawaiian and Other Pacific Islander alone, Some other race alone, Two or more races
    - Ethnicity: Not Hispanic, Hispanic
    - Race and Ethnicity: Breaks out each race category by Hispanic and Not Hispanic. For example, the sum of Non Hispanic White alone and Hispanic White alone would equal the total White alone.
- **Age:** Children were the focus of the Pb NAAQS evidence calculations and risk assessment included in the proposal, reflecting their status as a sensitive population. Consequently, emphasis was placed in this limited EJ analysis on considering the numbers of children in the vicinity of point sources and Pb-TSP monitors. The U.S. Census provides enumeration for the following age ranges: 0-7, 8-18, 19-64, 65 and over.
- **Median Income:** The U.S. Census collects information on income ranges based on $5,000 increments. We have included these more differentiated income ranges in this analysis as well as the single parameter *median income*.
- **Poverty Status:** This provides counts of families with children (less than 5 years of age and less than 18 years of age) that fall above and below the calculated poverty threshold.

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facility (which influences the degree of dispersion of stack emissions), (c) the meteorology and topographic of the area (which also influences dispersion of Pb released from the facility) and (d) the spatial distribution and behavior of residential populations in relation to the pattern of air Pb dispersion associated with the facility (this influences the degree of population exposure and risk). Because quantitative risk assessments were not completed for each facility, the health significance of any particular annual emissions rate can not be quantified and remains highly uncertain.

The threshold depends on the number of adults and children in each family. In 2000, the poverty threshold for a family of three with one child was $13,861.[9]

- **Education:** The U.S. Census includes several categories of educational attainment which were included in this analysis, including: Less Than High School, High School Graduation, Some College, Completed College, and Higher Degree.

- **Housing Vintage:** This provides the year of construction for a structure. This variable is of interest to this assessment because lead paint was banned in 1978, with houses constructed prior to that date having increased potential for indoor Pb paint hazards, which could contribute to total BLLs in children.

2.3 Methodological Approach for Each Assessment

We now present a step-wise description of the approach used to complete each of the three assessments described at the beginning of this section. The technical approach used in completing the first of these assessments (the Pb-TSP monitor-based demographic analysis) involved the following steps:

1. *Identify subsets of the Pb-TSP monitoring sites, each corresponding to a particular level, form and averaging time combination included in the Pb NAAQS proposal.* As noted above, EPA relied on AQS data from 2004-2006. The set of six combinations identified for this assessment are presented below:

Pb-TSP Monitoring Site Subgroup	Total number of sites
Max quarterly lead average > 0.10 $\mu g/m^3$	46
Max quarterly lead average > 0.20 $\mu g/m^3$	30
Max quarterly lead average > 0.30 $\mu g/m^3$	21
Second highest monthly lead average > 0.10 $\mu g/m^3$	51
Second highest monthly lead average > 0.20 $\mu g/m^3$	37
Second highest monthly lead average > 0.30 $\mu g/m^3$	24

2. *Create 1 km, 2 km and 10 km buffer zones (rings) around each monitor using GIS.* Note, if two monitors were close enough for their rings to overlap, then a Thiessen polygon approach was used, wherein the rings were extended to the point where they were equidistant between the two monitors and that point of intersection formed the boundary between the two polygons. See Figure 1 for an example of how this technique is applied.

[9] A table of poverty thresholds used by the U.S. Census is available at http://www.census.gov/hhes/www/poverty/threshld.html. Note that these data are different than the income data because they are given at the family level. Income data are given at the household level, and in some instances household composition may differ from family composition (e.g., some households consist of multiple family units).

3. *Overlay 1 km, 2 km and 10 km rings with U.S. Census block-group-level socio-demographic data*. The demographics for each block group were assumed to be equally distributed across that block group. As noted above, this introduces significant uncertainty into the analysis. The demographic counts for the portions of block group(s) within each distance ring were apportioned to that particular ring (e.g., if a ring intersects 25% of the surface area of a block group with 100 Whites, then 25 Whites would be attributed to that ring from that block group).

4. *Identify demographic counts for relevant socio-demographic variables for the counties within which the Pb-TSP monitoring sites are located*. This information was used to compare the populations within the rings around the Pb-TSP monitoring sites to a broader county pattern. The populations within the rings were also compared to total demographic counts for the US.

5. *Translate demographic counts for rings (1 km, 2 km and 10 km) and county and national categories to associated percentages to facilitate comparison*. These percentages were generated by dividing the total count for a particular demographic group by the total person count for each category.

The technical approach used in completing the second of these assessments (the population-weighted monitor-based analysis) involved the following steps:

1. *Identify set of 144 non-co-located Pb-TSP monitoring sites* (from http://www.epa.gov/ttn/naaqs/standards/pb/s_pb_cr_td.html).

2. *Using the same demographic variable-differentiated population counts for the 1 km and 2 km rings described above (in bullets 2 and 3 of the first assessment), generate population-weighted average Pb-TSP values for both max quarterly and second max monthly metrics*. The ambient air Pb level for a particular Pb-TSP monitor (either max quarterly or second max monthly) is weighted by the relevant demographic count associated with the ring around that monitor (compared to the total demographic count for rings of that size around all monitors). So, if a monitor had a max quarterly value of 0.20 $\mu g/m^3$ and it had 1,000 Whites in its 1 km ring (compared to 100,000 total Whites in the 1 km rings around all monitors), then that monitor value of 0.20 was assigned a weight of 1,000/1000,000 (or 1/1000th) in calculating the population-weighted average for all monitors (for that 1 km ring size).

The technical approach used in completing the third of these assessments (the Pb point source-based demographic analysis) involved an approach very similar to that used for the first assessment involving Pb-TSP monitors. The set of point source locations identified for this analysis included those sources (from the EPA's 2002 v3 National Emissions Inventory (NEI) database with modifications documented in Pace, 2008) with total annual Pb emissions greater than or equal to 1 ton. EPA has identified 124 such sources excluding airports. A separate sub-analysis based on these data was completed for the group of 12 sources with greater than or equal to 5 tons of annual Pb emissions. With the exception of how the point locations were identified (as noted here and contrasted with the Pb-TSP monitors described in the first

assessment), the rest of the procedure for developing SES-differentiated numerical counts for rings around these point sources and associated counties, is identical to that described in steps 2-5 in assessment one above.

3.0 Considerations in Evaluating and Interpreting Results

As noted above, EPA has determined that the proposed rule would strengthen the uniform national standards for Pb in ambient air and that this proposed rule will not have disproportionately high and adverse human health or environmental effects on minority or low-income populations because it increases the level of environmental protection for all affected populations without having any disproportionately high and adverse human health or environmental effects on any population, including any minority or low-income population.

As also noted earlier, this analysis characterizes the socio-demographic attributes of populations located in areas potentially near air monitoring sites measuring values above the proposed range included in the NPR, and emissions sources of Pb greater than 1 ton. Therefore, the results of this analysis can only be used to inform whether there are differences in the composition of populations residing near (within 1 and 2 km) of known Pb emissions sources or areas with monitored Pb levels near the current NAAQS, as compared to populations living within 10 km, the relevant counties, or the nation. However, because this analysis does not include a quantitative assessment of exposure and/or risk for specific populations of potential interest from an EJ-perspective, it cannot be used to draw any conclusions regarding potential disparities in exposure or risk across populations of interest from an EJ perspective.

The analytical design did include a stratification for urban vs. rural locations of monitors and point sources. However, after conducting the analysis, EPA concluded that the uncertainty inherent in the results of the analysis stratified by rural versus urban locations precluded any reliance on these comparisons. First, stratification of both sets (the Pb-TSP monitors and point sources) resulted in reduced sample sizes, further increasing the likelihood that socio-demographic attributes for an atypical location (with higher relative population density) could disproportionately impact the overall analysis. In addition, the lower population density in rural areas increases the chance that bias is introduced into the analysis through the assumption of uniform population density across U.S. Census block groups. Because of the greater uncertainty associated with the stratified analysis, the rural/urban differentiated results are not included in this memo, although these results are included in the full dataset which has been submitted to the Pb NAAQS docket.

There are additional sources of uncertainty related to limitations of the design of this analysis that need to be considered in reviewing and interpreting the results presented in Section 4. These sources of uncertainty fall into several categories:

<u>Limitations related to the design of the analysis</u>

- *The significance of the 1 km, 2 km and 10 km rings in terms of exposure and risk magnitude is highly uncertain:* Because we did not have information on the spatial distribution of ambient air Pb levels in the vicinity of the Pb-TSP monitors, and dispersion rates and patterns

near Pb point sources, we do not know how relevant the distance rings used in this analysis are to Pb exposure and risk. In order to clearly identify disparities in risk between populations of interest, we would need to conduct rigorous site-specific population-level exposure and risk assessments. While the 1 km distance ring does focus on areas relatively close to the point sources and Pb-TSP monitors, actual patterns of ambient air Pb dispersion (for a particular location) could mean that this ring is either two small to capture populations with significant exposure, or too large and consequently includes populations likely to experience low levels of exposure.

- *Lack of statistical tests of significance in comparing distance ring estimates to county and national statistics limits the conclusions that can be drawn*: The analysis compared residential populations within 1 and 2 km of point sources and Pb-TSP monitors to populations living within 10 km, the broader counties, and the nation, but did not evaluate whether any observed differences were statistically significant. Consequently, any conclusions drawn as to the significance of differences in the percentages, either across socio-demographic categories, or between rings and county or national statistics (for the same socio-demographic category), are subjective and therefore, highly uncertain.

- *Small sample sizes for some of the sub-assessments included in the analysis increase overall uncertainty associated with these sub-assessments*: Both the Pb-TSP based assessments and the point source-based assessment utilize stratified analyses that focus on a subset of Pb-TSP monitors and Pb points sources, respectively. Specifically, the Pb-TSP assessments include sub-analyses with smaller sample sizes focusing on monitors with > 0.20 $\mu g/m^3$ and > 0.30 $\mu g/m^3$ (max quarterly or second max monthly) levels, while the Pb point source-based assessment includes a sub-analysis focusing on point sources with > 5 tons per year (TPY) of Pb emissions. In both cases, the smaller sample size means that the bias associated with any individual location has a greater potential to influence the results of the sub-analysis. In addition, in the case of the Pb-TSP assessments, of 8 of the 24 monitors > 0.30 $\mu g/m^3$ are within 2 km of the primary Pb smelter at Herculaneum. Therefore, there is the potential for the demographics associated with this location to dominate the results relative to any other individual location.

- *Because we did not complete a quantitative risk assessment as part of this analysis, we did not consider short-term mobility (daily patterns of travel linked for example to school or work) or long-term mobility (families moving into or out of specific block groups) in conducting this analysis.*

<u>Limitation related to the Pb-TSP monitoring network used in the Pb-TSP-based assessment</u>

- *The existing lead monitoring network has uneven coverage which significantly limits the representativeness of the assessments focusing on Pb-TSP monitors*. The current network includes fewer than 200 lead monitoring sites (of which 144 are reflected in the non-collocated set used in this analysis). States are only required to operate two lead monitors in any area that has exceeded the existing standard (1.5 $\mu g/m^3$) in the past two years. The number of Pb-TSP monitors has declined over time as ambient lead concentrations have fallen well below the standard in most areas. This decline in the number of Pb-TSP sites is

attributable to the dramatic decrease in lead concentrations observed since the 1980s and the need to fund new monitoring objectives (e.g., PM2.5 and ozone monitoring). The limitations on the monitoring network for Pb increase the potential for any analysis based on the current monitoring network to exclude some areas with elevated Pb levels in the range of standard levels included in the proposal.

Limitations related to the national emissions inventory data used in the point source-assessment

- *Lack of precision in specifying the location of point sources (and specific emissions sources) increases uncertainty related to buffer zone-based assessments, particularly the 1 km and 2 km analyses.* OAQPS recently endeavored to verify the emissions information in the 2002 National Emissions Inventory for facilities that emit more than 1 TPY of lead and lead compounds (these are the point sources used in the third assessment described in Section 2). Details about the revisions were submitted to the docket as a technical memo on May 1, 2008 (Pace, 2008). The verification process included quality assurance of the geographic coordinates for stationary sources included in the NEI. EPA believes the coordinates are generally accurate to within at least 1 mile (1.6 km) of the reported stationary source location. We also note that some facilities are very large and the coordinates do not necessarily reflect the exact point of emissions at a particular facility. These limitations introduce some uncertainty into the results generated, particularly for the 1 km and 2 km distance rings, since these rely on levels of precision that, in some cases, may be greater than that associated with identifying source locations in the NEI.

- *The number of facilities with emissions of between 1 and 5 tons of Pb per year may be under-estimated.* Another limitation in the NEI is that only sources that emit more than 5 tons of lead per year are required to report emissions data to States, which in turn report the data to EPA. Other sources included in the NEI report lead emissions data voluntarily.

- *The relationship between proximity to an emissions source and actual exposures depends on the precise form and location of emissions, facility design, meteorology, and other factors.* In this analysis, the lack of dispersion modeling greatly increases uncertainty about how emissions from a given facility might affect local populations. Furthermore, the facility-by-facility approach does not consider the combined impacts of multiple sources that may affect air quality in some areas. Given the lack of information about the actual location and direction of emissions points, the resulting air quality impacts, and related patterns of exposure among the population, the results of the point-source-based assessment should be interpreted with caution.

- *Emissions-based analyses do not allow for consideration of aggregate impacts on residential populations from multiple Pb point sources located close to each other:* There is the potential for facilities located in close proximity to have emissions levels (and associated ambient air Pb levels) that meet specified health target levels when considered in isolation, but to have aggregate (combined) impacts on nearby residential populations that exceed these same target levels. This issue of aggregate exposure and risk can be of particular interest in the EJ context, since one concern often raised is the potential for residential populations to be located close to industrial areas with multiple sources of lead exposure. An analysis based on

annual emissions levels (as was completed here) can not consider this issue of aggregate exposure and risk.

- **4.0 Presentation of Results and Key Observations**

This section presents tables of key results for the three assessments completed for this analysis, and a limited set of observations that are illustrative of the types of comparisons that might be drawn from the data.

Tables 1-5 focus on the demographic variables that were included in this analysis because they are relevant to EJ considerations and/or have the potential to be associated with elevated BLLs.[10]

- Tables 1-3: provide results of the first assessment (Pb-TSP monitor-based demographic analysis). Table 1 presents results for Pb-TSP monitors with levels > 0.10 $\mu g/m^3$; Table 2 presents results for Pb-TSP monitors with levels > 0.20 $\mu g/m^3$ and Table 3 presents results for Pb-TSP monitors with levels > 0.30 $\mu g/m^3$. Note that each of these tables presents results for both maximum quarterly and second maximum monthly averaging times.

- Table 4: provides results for the second assessment (population-weighted monitor-based analysis).

- Table 5: provides results for the third assessment (Pb point source-based demographic analysis).

To facilitate critical evaluation of these results, we have identified some potential observations that may be of interest to commenters. These observations are organized by assessment, and are derived from comparisons across the rows and columns presented in the Tables 1-5. It is important to note, however, that the observations may not hold across all subsets of the data—that is, some of the apparent socio-demographic differences that might be observed in one set of results are not observed in other sets of results. Furthermore, because statistical significance tests were not included in comparing results across socio-demographic categories or across rings (and subsequently against county and national statistics), none of the conclusions drawn are known to reflect actual (i.e., statistically significant) differences, and therefore the meaningfulness of these results is highly uncertain. Most importantly, as noted repeatedly above, because quantitative exposure and risk assessments were not conducted for

[10] It should also be noted that while the results reported in these tables reflect key variables (including race, ethnicity, age, median income, poverty status, education, and housing vintage), the full analysis contained additional variables that may also be of interest to commenters. The full set of results has been included as an attachment to this memo in the Pb NAAQS docket. Parameters not included in the summary tables presented here include: a) total population counts for each category and each variable within the category (only percentages are reported here); b) results for the combination of race and ethnicity (each of these are presented separately here); c) results for rural vs. urban locations (due to greater uncertainties associated with these results as noted in Section 3); and d) results associated with more detailed income breakouts (only median income is reported here).

this analysis, none of the observed differences necessarily reflect any significant public health or EJ impacts

Finally, it is critical to recognize that the observations noted below are limited and do not represent a complete set of the potential observations that commenters may find relevant and useful. EPA invites commenters to provide additional observations drawn from the results of this analysis that they believe it may be useful to consider.

Observations regarding the Pb-TSP monitor-based demographic analysis:

- There were no notable differences in terms of race, ethnicity, or age among the populations living within 1, 2, or 10 km of these monitors as compared to the county or national population.

- Median income results suggest that median income for households within 1 km and 2 km of the Pb-TSP monitors may be lower than the county or national averages. For example, results for the 1 km and 2 km rings for the > 0.20 μg/m3 2nd max monthly (Table 2) are $31,610 and $34,511, respectively, while the county and national values are $47,052 and $41,994, respectively.

- The percentage of families with children younger than 5 years of age that have income below the poverty level appears to be slightly elevated within the 1 km and 2 km rings compared with the county and national statistics. For example, results for the 1 km and 2 km rings for the > 0.20 $\mu g/m^3$ 2nd max monthly (Table 2) are 6% and 5%, respectively, while the county and national values are 2% and 3%, respectively. These results suggest that children from families below the poverty level, in counties containing these high Pb-TSP monitors, may be concentrated to some extent closer to those monitors.

- Educational attainment may be lower among populations living within 1 km or 2 km of a high monitor. Specifically, the percentage of the adult population that did not complete high school appears to be higher for the 1 km and 2 km rings, compared with the county and national statistics. For example, the percentage that did not complete high school within the 1 km and 2 km rings for the monitors > 0.20 $\mu g/m^3$ 2nd max monthly (Table 2) are 27% and 25%, respectively, while the county and national values are 20% and 17%, respectively

- Housing vintage results suggest that housing within 1 to 2 km of the Pb-TSP monitors may be older relative to housing in the associated counties and the nation. For example, within the 1 km and 2 km rings around the monitors > 0.10 $\mu g/m^3$ 2nd max monthly (Table 1), 31% of the housing was built before 1940, while only 20% of the housing in the associated counties is of that vintage and the national statistic is only 13%. To the extent that housing within the rings is older, there might be greater potential for a subset of the children in these rings to have higher levels of non-air Pb exposure associated with deteriorating indoor Pb paint. Though this is a non-air-related pathway, it would be relevant to total blood lead levels among these children. EPA's recent Lead Renovation, Repair and Painting Rule is designed to address, in part, the threat to children's health associated with this pathway. (73 FR 21692)

Observations regarding the population-weighted monitor-based analysis:

- Little difference was noted in the population-weighted ambient air Pb levels associated with different subgroups based on race, poverty or education. In comparing the values in Table 4, we see that the population-weighted averages for different subgroups within the 1 km and 2 km rings range from 0.01 $\mu g/m^3$ to 0.08 $\mu g/m^3$, but all of these concentrations fall below the levels of the proposed revised Pb NAAQS. In addition, some of the lowest population-weighted ambient concentrations are associated with racial groups comprising only a few individuals in the associated census block groups (e.g. Native Hawaiian/other Pacific Islanders). There is greater uncertainty associated with relating these smaller populations to concentrations measured at fixed-site ambient monitors.

Observations regarding the Pb point source-based demographic analysis:

- There were no notable differences in the distance ring results as compared to county or national statistics for the race, ethnicity, age, or education attributes.

- Median income results suggest that median income for households within 1 km and 2 km of all Pb emissions sources $\geq$ 1 TPY may be lower than the county or national averages; however, the opposite appears to be true for households within 1 km and 2 km of the 12 point sources with emissions of at least 5 TPY. Specifically, Table 5 indicates that median household income within the 1 km and 2 km rings for sources $\geq$ 1 TPY is $32,454 and $33,932, respectively, while the county and national values are $42,243 and $41,944, respectively. However, median household income within the 1 km and 2 km rings for sources $\geq$ 5 TPY is $42,563 and $38,769, respectively, compared to respective county and national values of $39,722 and $41,994.

- The percentage of the families with children younger than 5 years of age that have income below the poverty level appears to be slightly higher within the 1 km and 2 km rings around all stationary sources emitting at least 1 TPY as compared with the county and national statistics. For example, results for the 1 km and 2 km rings around sources emitting $\geq$ 1 TPY (Table 5) are 6% and 5%, respectively, while the county and national values are both 3%. The results are similar for the percentage of families in poverty with children in other age groups living near sources as compared to county or national averages as well. This suggests that children from families below the poverty level may be concentrated to some extent closer to Pb stationary sources. However, if we restrict the dataset to those 12 sources emitting $\geq$ 5 TPY, we see that the percentage of families with children (of any age) with income below the poverty level appears to be similar to the county and national percentages. Thus children living in poverty may not be concentrated close to the very largest sources of lead emissions in the United States.

- Housing vintage results suggest that housing within 1 to 2 km of the point sources may be older relative to housing in the associated counties and the nation. For example, 29% and 28% of the housing within the 1 km and 2 km rings, respectively, around sources emitting $\geq$

1 TPY (Table 5) was built before 1940. This compares to 21% of housing with this vintage in the associated counties and 16% in the nation overall. This increases the potential for a subset of the children in these buffer rings to have higher levels of non-air-related exposure associated with indoor Pb paint. As noted above, EPA's recent Lead Renovation, Repair and Painting Rule is designed to address some of the issues associated with indoor Pb paint exposure. (73 FR 21692).

References

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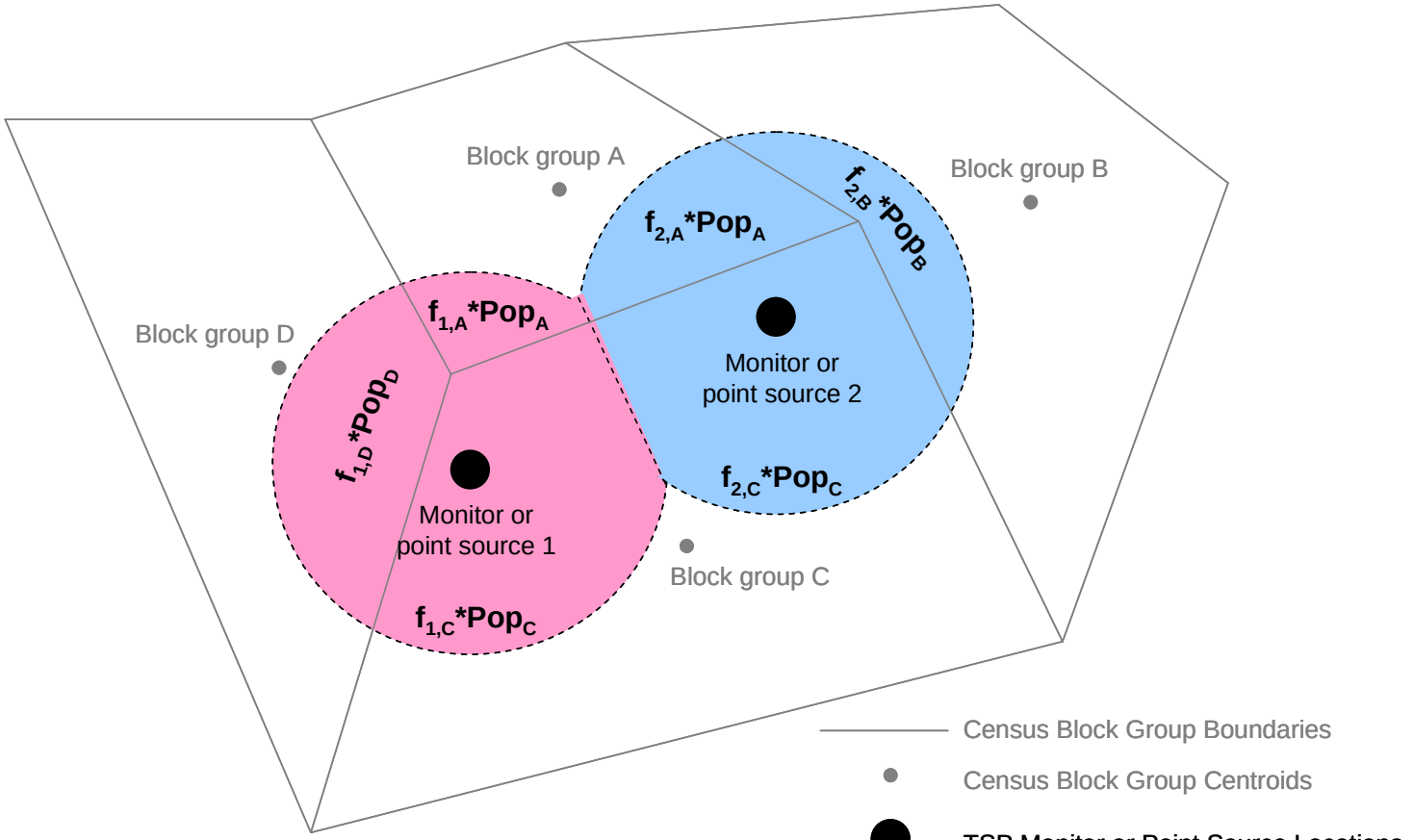
U.S. Environmental Protection Agency. 2006. *Air Quality Criteria for Lead*. Washington, D.C., EPA/600/R–5/144aF. Available online at: www.epa.gov/ncea/.

Figure 1. GIS-based approach used to apportion block group population counts to distance rings around monitors and point sources



Total Population at Monitor or Point Source:

$$N = \Sigma f_{N,M} * Pop_M$$

Table 1. Demographics of Populations within Specified Distances of Pb-TSP Monitors Exceeding 0.10 μg/m^3

Percent of Total in Each Category

Demographic Variable		51 Monitors > 0.10 μg/m3 2nd Max Monthly				46 Monitors > 0.10 μg/m3 Max Quarterly				US Total
		1 km Ring	2 km Ring	10 km Ring	Counties	1 km Ring	2 km Ring	10 km Ring	Counties	
Race	White alone	67%	64%	62%	68%	69%	66%	64%	76%	75%
	Black or African American alone	20%	20%	22%	10%	18%	18%	23%	15%	12%
	American Indian and Alaska Native alone	1%	1%	1%	1%	1%	1%	1%	0%	1%
	Asian alone	4%	4%	5%	6%	1%	2%	3%	3%	4%
	Native Hawaiian and Other Pacific Islander alone	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Some other race alone	6%	7%	8%	12%	9%	10%	6%	4%	5%
	Two or more races	3%	3%	3%	3%	3%	3%	3%	2%	3%
Ethnicity	Not Hispanic	88%	86%	84%	77%	83%	80%	86%	91%	87%
	Hispanic	12%	14%	16%	23%	17%	20%	14%	9%	13%
Age	0-7	11%	11%	12%	12%	12%	12%	11%	12%	11%
	8-18	15%	15%	16%	16%	15%	15%	15%	16%	16%
	19-64	60%	62%	61%	61%	61%	62%	62%	61%	61%
	65 and over	13%	12%	11%	10%	12%	11%	11%	11%	12%
Median Income	(in $)	$36,661	$38,402	$43,893	$45,884	$33,483	$35,777	$44,221	$47,384	$ 41,994
Poverty Status	Above Poverty Level, Families with Children < 5	16%	18%	17%	17%	16%	17%	17%	18%	16%
	Above Poverty Level, Families with Children < 5 and 5 to 17	16%	16%	17%	18%	16%	16%	16%	17%	16%
	Above Poverty Level, Families with Children 5 to 17 only	49%	49%	50%	52%	47%	48%	51%	54%	54%
	Below Poverty Level, Families with Children < 5	5%	4%	3%	3%	5%	5%	3%	2%	3%
	Below Poverty Level, Families with Children < 5 and 5 to 17	6%	5%	5%	5%	7%	6%	5%	3%	4%
	Below Poverty Level, Families with Children 5 to 17 only	8%	8%	8%	7%	8%	8%	7%	5%	7%
Education	Less Than High School	23%	23%	21%	22%	28%	27%	21%	18%	20%
	High School Graduation	31%	29%	28%	25%	33%	32%	29%	29%	29%
	Some College	20%	21%	21%	21%	18%	18%	20%	21%	21%
	Completed College	19%	20%	22%	23%	16%	17%	21%	23%	22%
	Higher Degree	7%	7%	8%	9%	5%	5%	9%	8%	9%
Housing Vintage	< 1940	31%	31%	20%	13%	34%	33%	21%	13%	15%
	1940-1949	10%	12%	9%	8%	11%	11%	9%	8%	7%
	1950-1959	13%	13%	16%	16%	13%	14%	17%	14%	13%
	1960-1979	11%	12%	15%	15%	10%	11%	14%	13%	14%
	> 1979	35%	33%	39%	49%	32%	31%	39%	51%	51%

Table 2. Demographics of Populations within Specified Distances of Pb-TSP Monitors Exceeding 0.20 μg/m^3

Percent of Total in Each Category

Demographic Variable		37 Monitors > 0.20 μg/m3 2nd Max Monthly				30 Monitors > 0.20 μg/m3 Max Quarterly				US Total
		1 km Ring	2 km Ring	10 km Ring	Counties	1 km Ring	2 km Ring	10 km Ring	Counties	
Race	White alone	78%	76%	72%	82%	84%	80%	77%	85%	75%
	Black or African American alone	12%	13%	16%	9%	8%	9%	12%	7%	12%
	American Indian and Alaska Native alone	1%	1%	1%	0%	0%	0%	1%	0%	1%
	Asian alone	1%	1%	2%	2%	1%	1%	3%	3%	4%
	Native Hawaiian and Other Pacific Islander alone	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Some other race alone	6%	7%	7%	4%	5%	6%	6%	3%	5%
	Two or more races	3%	3%	3%	2%	2%	2%	3%	2%	3%
Ethnicity	Not Hispanic	88%	86%	84%	90%	90%	87%	86%	90%	87%
	Hispanic	12%	14%	16%	10%	10%	13%	14%	10%	13%
Age	0-7	10%	10%	11%	11%	12%	12%	12%	12%	11%
	8-18	14%	14%	15%	16%	16%	16%	16%	16%	16%
	19-64	62%	63%	62%	61%	59%	60%	61%	62%	61%
	65 and over	14%	12%	12%	11%	13%	12%	11%	10%	12%
Median Income	(in $)	$31,610	$34,511	$42,264	$47,052	$37,917	$41,043	$46,105	$50,410	$41,994
Poverty Status	Above Poverty Level, Families with Children < 5	16%	17%	18%	18%	16%	18%	18%	19%	16%
	Above Poverty Level, Families with Children < 5 and 5 to 17	15%	15%	16%	17%	17%	16%	17%	17%	16%
	Above Poverty Level, Families with Children 5 to 17 only	48%	48%	50%	55%	52%	52%	52%	56%	54%
	Below Poverty Level, Families with Children < 5	6%	5%	3%	2%	4%	4%	3%	2%	3%
	Below Poverty Level, Families with Children < 5 and 5 to 17	6%	6%	5%	3%	5%	4%	4%	3%	4%
	Below Poverty Level, Families with Children 5 to 17 only	9%	9%	8%	5%	5%	6%	7%	4%	7%
Education	Less Than High School	27%	25%	21%	18%	26%	23%	20%	17%	20%
	High School Graduation	33%	31%	29%	29%	38%	37%	31%	28%	29%
	Some College	17%	18%	20%	21%	16%	17%	20%	22%	21%
	Completed College	17%	19%	22%	23%	15%	17%	22%	25%	22%
	Higher Degree	6%	6%	9%	9%	5%	5%	8%	9%	9%
Housing Vintage	< 1940	39%	39%	24%	14%	27%	23%	17%	8%	15%
	1940-1949	10%	10%	10%	6%	9%	8%	7%	4%	7%
	1950-1959	10%	11%	16%	12%	13%	12%	13%	9%	13%
	1960-1979	8%	9%	13%	12%	10%	11%	13%	11%	14%
	> 1979	33%	31%	37%	56%	41%	45%	51%	68%	51%

Table 3. Demographics of Populations within Specified Distances of Pb-TSP Monitors Exceeding 0.30 μg/m^3

Percent of Total in Each Category

Demographic Variable		24 Monitors > 0.30 μg/m3 2nd Max Monthly				21 Monitors > 0.30 μg/m3 Max Quarterly				US Total
		1 km Ring	2 km Ring	10 km Ring	Counties	1 km Ring	2 km Ring	10 km Ring	Counties	
Race	White alone	84%	79%	76%	85%	80%	78%	77%	86%	75%
	Black or African American alone	8%	10%	12%	7%	9%	9%	10%	6%	12%
	American Indian and Alaska Native alone	0%	0%	1%	0%	0%	0%	1%	0%	1%
	Asian alone	1%	1%	3%	3%	1%	1%	3%	2%	4%
	Native Hawaiian and Other Pacific Islander alone	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Some other race alone	5%	7%	6%	3%	7%	8%	7%	3%	5%
	Two or more races	2%	2%	3%	2%	2%	2%	3%	2%	3%
Ethnicity	Not Hispanic	89%	86%	86%	90%	88%	85%	85%	91%	87%
	Hispanic	11%	14%	14%	10%	12%	15%	15%	9%	13%
Age	0-7	12%	12%	12%	12%	11%	11%	12%	12%	11%
	8-18	16%	16%	16%	16%	17%	16%	16%	17%	16%
	19-64	59%	60%	61%	62%	59%	60%	61%	62%	61%
	65 and over	14%	12%	11%	10%	13%	12%	11%	9%	12%
Median Income	(in $)	$37,559	$39,934	$45,992	$50,422	$38,828	$39,944	$47,747	$51,249	$41,994
Poverty Status	Above Poverty Level, Families with Children < 5	16%	18%	18%	19%	17%	18%	18%	19%	16%
	Above Poverty Level, Families with Children < 5 and 5 to 17	17%	15%	17%	17%	17%	16%	17%	17%	16%
	Above Poverty Level, Families with Children 5 to 17 only	52%	52%	52%	56%	51%	52%	51%	56%	54%
	Below Poverty Level, Families with Children < 5	5%	3%	3%	2%	5%	4%	3%	2%	3%
	Below Poverty Level, Families with Children < 5 and 5 to 17	5%	4%	4%	3%	5%	4%	4%	2%	4%
	Below Poverty Level, Families with Children 5 to 17 only	5%	7%	7%	4%	5%	6%	6%	4%	7%
Education	Less Than High School	27%	25%	20%	17%	27%	25%	20%	17%	20%
	High School Graduation	37%	36%	30%	28%	35%	35%	30%	28%	29%
	Some College	16%	18%	20%	22%	17%	17%	20%	22%	21%
	Completed College	15%	17%	22%	25%	16%	17%	23%	25%	22%
	Higher Degree	5%	5%	8%	8%	5%	5%	8%	8%	9%
Housing Vintage	< 1940	27%	23%	16%	7%	19%	22%	17%	7%	15%
	1940-1949	9%	8%	7%	4%	8%	9%	7%	4%	7%
	1950-1959	13%	12%	13%	8%	13%	13%	13%	9%	13%
	1960-1979	10%	11%	13%	11%	12%	11%	13%	11%	14%
	> 1979	41%	45%	51%	70%	48%	46%	49%	69%	51%

Table 4. Population-Weighted Average Ambient Pb Concentrations within Specified Distances of 144 Existing Pb-TSP Monitors

Population-Weighted Average Concentrations in μg/m3

Demographic Variable		1 km Ring		2 km Ring	
		Max Quarterly	2nd Max Monthly	Max Quarterly	2nd Max Monthly
Total	**Total Population**	0.05	0.06	0.05	0.06
Race	**Total Race/Ethnicity**	0.05	0.06	0.05	0.06
	White alone	0.06	0.07	0.06	0.08
	Black or African American alone	0.04	0.05	0.04	0.05
	American Indian and Alaska Native alone	0.03	0.03	0.04	0.05
	Asian alone	0.02	0.03	0.03	0.04
	Native Hawaiian and Other Pacific Islander alone	0.01	0.02	0.01	0.03
	Some other race alone	0.04	0.04	0.04	0.05
	Two or more races	0.04	0.05	0.04	0.05
Ethnicity	Not Hispanic	0.05	0.07	0.06	0.07
	Hispanic	0.04	0.05	0.04	0.05
Age	**Total Age**	0.05	0.06	0.05	0.06
	0-7	0.05	0.06	0.05	0.06
	8-18	0.05	0.06	0.05	0.06
	19-64	0.05	0.06	0.05	0.07
	65 and over	0.05	0.07	0.05	0.07
Median Income	**Total Income**	0.05	0.06	0.06	0.07
	Less than $10,000	0.05	0.06	0.05	0.06
	$10,000 to $14,999	0.05	0.06	0.06	0.07
	$15,000 to $19,999	0.05	0.06	0.06	0.07
	$20,000 to $24,999	0.05	0.06	0.05	0.06
	$25,000 to $29,999	0.05	0.06	0.06	0.07
	$30,000 to $34,999	0.05	0.07	0.06	0.07
	$35,000 to $39,999	0.05	0.06	0.06	0.07
	$40,000 to $44,999	0.05	0.07	0.06	0.07
	$45,000 to $49,999	0.05	0.06	0.06	0.07
	$50,000 to $59,999	0.05	0.07	0.06	0.07
	$60,000 to $74,999	0.05	0.06	0.06	0.07
	$75,000 to $99,999	0.05	0.06	0.06	0.07
	$100,000 to $124,999	0.05	0.07	0.05	0.07
	$125,000 to $149,999	0.06	0.08	0.06	0.07
	$150,000 to $199,999	0.05	0.07	0.05	0.07
	$200,000 or more	0.06	0.07	0.05	0.06
Poverty Status	**Total Poverty Status**	0.05	0.06	0.05	0.07
	Above Poverty Level, Families with Children < 5	0.05	0.07	0.06	0.07
	Above Poverty Level, Families with Children < 5 and 5 to 17	0.05	0.06	0.05	0.06
	Above Poverty Level, Families with Children 5 to 17 only	0.05	0.07	0.06	0.07
	Below Poverty Level, Families with Children < 5	0.05	0.06	0.05	0.06
	Below Poverty Level, Families with Children < 5 and 5 to 17	0.05	0.05	0.04	0.05
	Below Poverty Level, Families with Children 5 to 17 only	0.04	0.05	0.04	0.05
Education	**Total Education**	0.05	0.06	0.05	0.07
	Less Than High School	0.05	0.06	0.05	0.06
	High School Graduation	0.06	0.07	0.06	0.07
	Some College	0.05	0.06	0.05	0.06
	Completed College	0.05	0.06	0.05	0.07
	Higher Degree	0.05	0.06	0.05	0.06
Housing Vintage	**Total Housing Vintage**	0.05	0.06	0.06	0.07
	< 1940	0.05	0.07	0.06	0.07
	1940-1949	0.05	0.06	0.05	0.06
	1950-1959	0.05	0.06	0.05	0.06
	1960-1979	0.05	0.06	0.05	0.06
	> 1979	0.06	0.07	0.07	0.08

Table 5. Demographics of Populations within Specified Distances of Stationary Sources with Emissions ≥ 1 TPY or > 5 TPY

Percent of Total in Each Category

Demographic Variable		124 Sources with Emissions ≥ 1 TPY				12 Sources with Emissions ≥ 5 TPY				US Total
		1 km Ring	2 km Ring	10 km Ring	Counties	1 km Ring	2 km Ring	10 km Ring	Counties	
Race	White alone	69%	69%	67%	64%	84%	82%	71%	78%	75%
	Black or African American alone	20%	17%	17%	15%	9%	13%	19%	15%	12%
	American Indian and Alaska Native alone	0%	1%	0%	1%	1%	0%	0%	1%	1%
	Asian alone	1%	1%	3%	6%	1%	1%	1%	1%	4%
	Native Hawaiian and Other Pacific Islander alone	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Some other race alone	7%	10%	10%	12%	4%	3%	7%	4%	5%
	Two or more races	2%	2%	3%	3%	1%	1%	2%	2%	3%
Ethnicity	Not Hispanic	85%	79%	77%	76%	95%	96%	87%	92%	87%
	Hispanic	15%	21%	23%	24%	5%	4%	13%	8%	13%
Age	0-7	13%	12%	12%	12%	9%	10%	12%	11%	11%
	8-18	17%	17%	16%	16%	18%	17%	16%	16%	16%
	19-64	57%	58%	59%	60%	59%	56%	59%	60%	61%
	65 and over	13%	13%	13%	12%	14%	16%	13%	13%	12%
Median Income	(in $)	$32,454	$33,932	$39,800	$42,243	$42,563	$38,769	$37,471	$39,722	$41,994
Poverty Status	Above Poverty Level, Families with Children < 5	15%	15%	15%	16%	11%	12%	16%	16%	16%
	Above Poverty Level, Families with Children < 5 and 5 to 17	15%	15%	16%	17%	16%	14%	16%	16%	16%
	Above Poverty Level, Families with Children 5 to 17 only	44%	46%	49%	51%	59%	53%	51%	54%	54%
	Below Poverty Level, Families with Children < 5	6%	5%	4%	3%	3%	5%	4%	3%	3%
	Below Poverty Level, Families with Children < 5 and 5 to 17	8%	7%	6%	5%	3%	5%	5%	4%	4%
	Below Poverty Level, Families with Children 5 to 17 only	13%	11%	9%	8%	8%	11%	8%	7%	7%
Education	Less Than High School	30%	30%	27%	24%	20%	23%	23%	21%	20%
	High School Graduation	35%	33%	29%	25%	35%	35%	35%	36%	29%
	Some College	17%	18%	19%	20%	19%	19%	22%	22%	21%
	Completed College	15%	15%	18%	22%	18%	16%	16%	16%	22%
	Higher Degree	4%	5%	7%	9%	8%	7%	5%	5%	9%
Housing Vintage	< 1940	29%	28%	21%	16%	15%	15%	20%	14%	15%
	1940-1949	12%	13%	12%	10%	7%	8%	11%	10%	7%
	1950-1959	18%	18%	19%	18%	15%	15%	18%	17%	13%
	1960-1979	14%	14%	15%	16%	21%	19%	16%	16%	14%
	> 1979	27%	28%	34%	40%	43%	43%	35%	43%	51%