Blood Lead Study
and
Environmental Sampling Report
Reading, Pennsylvania

Prepared for
Exide Corporation
645 Penn Street
Reading, PA 19601

Prepared by
Gradient Corporation
238 Main Street
Cambridge, MA 02142

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Table of Contents

1 Introduction

1.1 Site Description and History

Exide operates a secondary lead smelter and battery manufacturing/distribution facility (Facility) in Berks County, Pennsylvania. Since 1991, several studies have been performed on soil, sediment and groundwater in areas adjacent to and in the vicinity of the Facility to investigate the occurrence of lead that may be attributable to past Facility operations. The areas included as part of the investigations are herein referred to as the "Study Area." The Study Area covers approximately a one-square mile area centered around the Facility (see Plates 1A and 1B). The Study Area includes portions of Laureldale Borough and Muhlenburg Township, Berks County, Pennsylvania, and is situated less than one mile north of the City of Reading.

Several investigations conducted to date suggest that historic Facility air emissions, prior to the promulgation of standards under the Federal Clean Air Act and installation of air emission control devices, may be responsible, in part, for elevated levels of lead in soil in portions of the Study Area.

1.2 Background

Exide Technologies (Exide) has entered into an Administrative Order on Consent (Order) (USEPA Docket No. RCRA-III-3-2000-002TH) with the United States Environmental Protection Agency (USEPA) concerning areas in the vicinity of its facility in Muhlenberg Township and Laureldale Borough, Berks County, Pennsylvania. The work to be performed under the Order includes refinement of the Study Area, investigation and assessment using exposure models, and remediation, as necessary. A Step 2 Work Plan was prepared in July, 2002, by Advanced Geoservices Corp. (AGC). The tasks to be performed under Step 2 include:

- Blood Lead Study;
- Risk Assessment Sampling (*i.e.*, dust and tap water sampling and paint screening); and
- Site-Specific Risk Assessment.

This report discusses the results of the risk assessment sampling and the blood lead study that were conducted in August and September, 2002.

2 Study Objectives and Overview

2.1 Objectives

The Step 2 study was performed to evaluate children's lead exposure within the Study Area, and to determine current risks to children from ongoing exposures to lead. If a child has chronic exposure to sources of lead, blood lead measurements provide a useful indication of lead exposure over the preceding months.

The blood lead study involved obtaining blood lead measurements from children in the community, and the risk assessment sampling (*i.e.*, the environmental sampling) involved collecting dust and residential tap water samples and screening for lead in paint. Residential soil samples were collected during previous investigations (Step 1); therefore, the Step 2 environmental sampling did not include residential soil sampling. The objectives of the Step 2 study were as follows:

- Determine whether children living in the Muhlenberg Township and Laureldale Borough, Pennsylvania area currently exhibit elevated blood lead levels (> 10 µg/dL).
- Identify and quantify sources of lead in residential environments where young children are present, with emphasis on those where the children have blood lead levels greater than 10 µg/dL.
- Estimate the relative direct and indirect impact of each source on blood lead levels.
- Use the blood lead and environmental lead data obtained during the study to aid in developing site-specific inputs to the IEUBK model, following EPA guidance documents.

A site-specific risk assessment will be performed following completion of the blood lead study, according the Risk Assessment Work Plan provided in Appendix A of the Step 2 Work Plan (AGC, July, 2002).

2.2 Study Overview

A voluntary blood lead sampling program was conducted to collect blood lead samples from children between 6 and 84 months of age who either resided in, or frequently visited, the Study Area. A key objective of the blood lead sampling program was to obtain a high participation rate from the

resident children. The first step involved contacting all residences within the Study Area to determine whether any children in the age range 6 to 84 months reside there, and then recruiting those children to participate in the blood lead sampling program. Financial incentives (a U.S. Savings Bond) were offered to encourage participation in both the demographic survey and the blood lead sampling program.

The blood lead study also included environmental sampling to collect dust and residential tap water samples and screen for lead in paint from residences within the Study Area. Residential soil samples were collected during previous investigations; therefore, the blood lead study did not include residential soil sampling.

2.3 Project Team

The project team members consisted of staff from Advanced Geoservices Corp. (AGC), Gradient Corporation, and phlebotomists from Omega Laboratories who staffed the blood lead clinic. An organizational chart is included in Figure 1.

3 Study Methodology

3.1 Study Area Census

A telephone census was performed in June and July, 2002, to determine the number of children who reside within the Study Area, or visit the Study Area on a regular basis, and their interest or willingness to participate in the blood lead study. The census inquired whether there were any children under the age of 7 years living or visiting the household more than 10 hours per week. The census was conducted verbally by phone, and also by door-to-door survey when phone contact was not possible. Residents that could not be reached either by phone or in-person received a census form at their door or by mail. It was determined that there were 470 households within the Study Area boundary. A total of 408 responses were received from the 470 households within the Study Area boundary. Out of the 408 responding households, there were a total of 73 children under the age of 7 years who either resided in the Study Area, or visited the Study Area on a regular basis (Table 1).

Table 1
Census Results as of July 29, 2002

Number of households within Study Area boundary	470 households
Number of responses	408 households
Number of potential participants (number of children under age 7 years)	73 children (51 households)

3.2 Recruitment for the Sampling Program

Resident and visitor children identified by the census were recruited to participate in the blood lead sampling program. Recruitment was accomplished first by phone, and then by door-to-door survey, for residents that could not be reached by phone. Appointments were made for blood lead testing and environmental sampling at the time of recruitment. To further encourage participation, the impending blood lead study was also presented and discussed at a community meeting held on August 8, 2002. Parents were invited to have their other children tested even if they were outside the age range. Pregnant women and mothers nursing young infants were also invited to participate in the blood lead sampling program. The final participation rates are presented in Table 2.

Table 2
Participation Rates

	Resident	Visitor	Total Participants	Total Population	Participation Rate
Children Age 6-84 months	36	12	48	73	66%
Adults and Children >84 months	26	8	34	NA	NA

3.3 Exposure Survey at Blood Lead Sampling

An exposure questionnaire was conducted with the blood lead study participant's parent or guardian when they arrived at the clinic for blood sample collection. Appendix B presents the Exposure Survey form that was used. The exposure survey covered the following general topics:

- Time of residence at current address
- Time spent indoors, outdoors, at day care centers, or secondary residences.
- Time spent at community playgrounds.
- Frequency of childhood habits such as mouthing behavior and pica.
- The type of playing surface at the residence, *i.e.*, presence of grass, dirt, swing set, sandbox, or driveway.

Exposure surveys were completed for all children ages 6-84 months who had their blood lead tested.

3.4 Blood Lead Sampling

The Exide Blood Lead Study Clinic was held at the Exide Conference and Visitor Center. A description of the study was provided to participants, and all study participants signed an Informed Consent form indicating their agreement to participate (see Consent Form - Appendix B).

3.4.1 Blood Sample Collection

Whole blood samples were collected by trained pediatric phlebotomists from Omega Laboratories. For these analyses, a maximum of 2 mL of blood was obtained by using venipuncture

blood collection techniques. A person was designated to oversee the collection and record keeping of these samples, make the necessary preparations for analyses, and be sample custodian. Venipuncture samples were drawn using a 23 gauge butterfly apparatus attached to a 6 mL disposable syringe. Blood was immediately dispensed into a K_3EDTA-containing pediatric vacutainer tube by insertion of the needle through the top of the tube. The tube itself was then inverted several times to mix the blood with the anticoagulant. The sample tube was labeled with the sample ID number, date, time and initials of the collector, and an initialed and dated custody seal. All samples were listed on a chain of custody that accompanied the samples to the laboratory. The sample tube was placed in a shipping container, along with the chain-of-custody form, for sample shipment. Samples were preserved with ice at 4°C during shipment to the laboratory.

3.4.2 Blood Lead Sample Analysis

All samples were analyzed for lead in duplicate using anodic stripping voltammetry (ASV). Analyses were conducted by Omega Laboratory in Wyomissing, PA. For quality control purposes, a blood lead standard purchased from BioMed was analyzed with all analytical runs. These samples consisted of human blood samples with lead content determined by isotope dilution-mass spectrometry, the definitive lead method. Almost all (98%) of the samples had duplicate lead values that differed by 1 µg/dL or less.

Ten percent (10%) of the sample population was used for quality assurance (QA), and two types of QA were employed; blind duplicate QA and split sample QA. For the blind duplicate QA samples, two vials were collected from a participant and sent to Omega Laboratory, one as the primary sample and one as a blind duplicate (*i.e.*, given a new sample designation [Eli Jones]) to evaluate the laboratory's reproducibility. For the split samples, two vials were collected from a participant. One vial was sent to Omega Laboratories as the primary sample and the second vial was sent to Reading Hospital (a Pennsylvania Department of Health approved blood lead laboratory) to evaluate the Omega Laboratory's accuracy. The blind duplicate and split samples were not performed on the same participant as this would have required collecting 3 vials from a participant, which may have been difficult considering the participant's body size and general reluctance for blood collection .

3.5 Environmental Survey

An environmental survey was conducted with the property owner or tenant at the time that environmental samples were collected from participants' homes. Appendix B presents the Environmental Survey form that was used. The environmental survey covered the following general topics:

- Parental occupation and education.
- Lead-related hobbies or occupations.
- The presence of smokers or pets in the house.
- Recent major renovation at current or prior address (if during last twelve months).
- Awareness of home in the Study Area.

An environmental survey was completed for all houses where environmental sampling was conducted. There were a total of six houses (House codes 4, 12, 14, 17, 23, 36) where children participated in the blood lead study, but environmental sampling was not conducted due to lack of permission or failure of the owner to schedule an appointment; this affects seven children ages 6 to 84 months.

3.6 Environmental Sampling

Properties identified during the residential census as being within the Study Area and occupied by children under the age of 84 months, or pregnant or nursing women, were the subject of the environmental sampling activities intended to aid in developing site-specific input parameters for the IEUBK model. The media sampled included tap water, interior and exterior paint screening, and household interior surface dust. Residential soil samples were collected during the Step 1 characterization soil sampling, which was intended to identify the average soil lead concentration on each property (or exposure area) within the Study Area. Therefore, the environmental sampling did not include residential soil sampling.

3.6.1 Dust Sampling for Risk Assessment

3.6.1.1 Dust Sample Locations

One composite dust sample was collected from each residence to assess children's exposure to lead in interior dust. The interior housedust sample was composited by collecting from a minimum of four floor regions within a house. The areas sampled were selected to represent areas frequented by children. Examples of these areas included:

- A floor area directly inside of the main entry to the residence.
- A floor area in the most frequently occupied room (usually living room).
- A floor area in the kitchen near the main sink.
- A floor area in the child's bedroom.

One field duplicate dust sample was collected at every tenth house as a QA sample. The field duplicate consisted of a co-located sample (*i.e.*, adjacent to all the original housedust sample locations that comprised the composite sample). The house selected for QA dust sampling was the same as that for the paint screening and tap water sampling.

3.6.1.2 Dust Sampling Procedures

The interior housedust collection apparatus involved vacuum-assisted dry sampling using a personal monitor pump (*e.g.*, Mine Safety Appliances Company). The apparatus consisted of plastic tubing with the sampling (free) end cut at a 45° angle. Samples were collected in Millipore Matched Weight Aerosol Cartridges (37mm) with a mixed cellulose esters membrane filter for lead analysis.

Each composite subsample was collected within an approximately 625 cm^2 (0.0625 m^2) grid area, as demarcated by a 25 cm by 25 cm wooden frame (template), which was placed on the designated sampling area. The area inside the template (grid area) was sampled by passing the vacuum over the area a total of three times. For each pass, the plastic collection apparatus was held at an approximate 60° angle to the surface while covering the grid area in 45 seconds. This step was repeated for each of the subsample areas as follows:

- The sampling apparatus was assembled using clean (new) plastic tubing on the personal sampling pump;
- The personal pump was calibrated with a rotameter prior to each composite sample collected at a flow rate 2.5 to 3.0 liters per minute; and
- Following collection of the composite dust sample, the sampling apparatus was disassembled, and the plastic inlet tubing was decontaminated for reuse. The filter and the collected sample were removed from the monitoring pump, and the filter holder (sampling cartridge) was secured with the provided plugs.

The sampling cartridge was placed in a sealed zip-lock plastic bag with a sample label (listing the sample ID number, date, time, and the initials of the collector) and an initialed custody seal. The sealed cartridges were placed in a container along with a chain-of-custody form for storage and shipment. Sampling information was recorded on a sample data sheet in accordance with the Quality Assurance Project Plan (QAPP) (see Appendix B of Step 2 Work Plan). All dust samples were analyzed by Martel Laboratories in Baltimore, Maryland.

3.6.2 Lead-Based Paint Screening

Non-destructive lead-based paint screening was performed at residences with children ages 6 to 84 months, or pregnant or nursing women. The screening was performed in general accordance with HUD's "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing" (HUD, 1995). Both interior and exterior painted surfaces of structures were scanned for the presence of lead using an XRF lead paint analyzer.

Prior to paint screening, the XRF instrument calibration was checked with a known standard. The calibration of the XRF instrument was performed prior to and after the screening activities at each residence. The calibration checks were done using standards provided with the instrument.

The screening locations included at least one wall and one trim in each of the primary living areas (entry room, living room, child's room). The types of surfaces screened with the XRF included the trim and walls of the child's bedroom; entryway; kitchen; most utilized room; and play room. Three readings per surface were obtained, and the average calculated. The XRF unit was relocated on the same surface for each of the three individual readings. Readings were also obtained from surfaces that

appeared to be covered with multiple layers of paint, or from paint of different colors within a room. Three exterior surfaces were also screened. Thus, nine surfaces in and around each residence were evaluated. A duplicate repeat XRF survey was made at every tenth house as a QA procedure. Unpainted surfaces were not screened, including paneling, wallpapered surfaces, unpainted brick, unpainted sidings, and woodwork with non-paint finishes. In addition to the XRF readings, the condition of the painted surface was rated as either tight, loose, or peeling.

3.6.3 Residential Tap Water Sampling

A water sample was collected from the primary water faucet, most often the kitchen sink. The water was allowed to run for three minutes and then shut off. The sample was collected after the water was allowed to sit for thirty minutes after the faucet was closed. The water sample consisted of 100 mL (equivalent to water contained in 1.3 meters of pipe) taken immediately upon turning on the faucet, without wasting any water. Each sample was labeled with the time, date, and house identification number. Samples were acidified with nitric acid within eight hours of collection. Field duplicates were collected at every tenth house as a QA sample. Sampling information was recorded on a sample data sheet in accordance with the QAPP.

4 Study Results

4.1 Blood Lead Data Reporting to Study Participants

All blood lead results were sent to the participant child's parent or guardian by mail.

The parent or guardian of any child with a lead level in excess of 10 µg/dL was contacted promptly *via* telephone to inform them of the result and discuss the need for a repeat blood test to confirm the value as recommended by the Centers for Disease Control (CDC). The results were then also sent to the participant child's parent or guardian by mail. Follow-up guidelines from the CDC were included with the results to assist in their interpretation.

Two children had blood lead levels above 10 µg/dL. One child (Person Code 91) was an 8 year old male resident with a blood lead level of 17 µg/dL. He and his family have lived at the residence within the Study Area (House Code 41) for 18 months. According to the child's parent, the child has a history of elevated blood lead levels and has his blood lead tested regularly. According to the mother, he had a blood lead level of 83 µg/dL when he was 10 months old, and had to be hospitalized. According to the mother, at that time the child was living in a dwelling with high lead-paint levels. The mother is aware that the child's blood lead levels are still high but said they have been decreasing with time. This child's two younger siblings have blood lead levels of 4 µg/dL (Age 6) and 6 µg/dL (Age 3).

The second child (Person Code 46) was a 2 year old visitor to the Study Area with a blood lead level of 14 µg/dL. The child visits his grandmother's house at House Code 17. The grandmother has lived in this house for 4 months. The mother is aware of the child's elevated blood lead level and, according to the mother, prior to the study the child had a blood lead level of 20 µg/dL. The child has lived in an apartment outside of the Study Area for about 3 years. This apartment was tested (prior to this study) and found to contain lead-based paint. The landlord was requested to abate the lead-paint situation in the apartment but did not. The child's brother (Person Code 44) is a 5 year old with a blood lead of 7 µg/dL; according to the mother he had a blood lead of 12 µg/dL at age 2. The mother (Person Code 43) was tested and has a blood lead of 3 µg/dL.

4.2 Blood Lead Results

4.2.1 Blood Lead QA/QC Results

The results of the QA evaluation for the blood lead data indicated that all blood lead data were valid and useable. A total of eight (8) blind duplicates were sent to Omega Laboratory. All of the blind duplicates agreed within 1 µg/dL of their primary sample (Table 3).

Table 3
Blind Duplicate Results

House Code	Primary (Person Code)	Duplicate (Person Code)	Primary PbB (µg/dL)	Duplicate PbB (µg/dL)
34	79	78	2	2
1	2	3	2.5	2.5
14	37	36	3	3
12	32	33	3	2
15	41	42	0.75	0.5
17	44	45	7	6.5
20	52	51	1.5	1.5
6	16	17	1	1

PbB: blood lead level

A total of six (6) split samples were sent to Reading Hospital. All of the split samples agreed within 1-2 µg/dL of their primary sample (Table 4).

Table 4
Split Sample Results

House Code	Person Code	Primary Sample PbB (µg/dL)	Split Sample PbB (µg/dL)
9	24	3	3
33	76	3	1
4	11	2	1
26	61	3	1
31	69	3	2
32	73	1	0.5

4.2.2 Blood Lead Results Summary

Blood lead samples were analyzed in duplicate by the laboratory, and the laboratory reported both results. For averaging purposes, a value of 0.5 µg/dL was substituted for results reported as <1 µg/dL (*i.e.*, non-detects). The average of the two duplicates was calculated and used as the reported blood lead level for each individual. In this report, the calculated average is reported to two decimal places, thus it is possible to have a blood lead level of 0.75 µg/dL or 1.25 µg/dL, *etc.*, even though the laboratory data were reported only to the nearest whole number.

Blood lead results for each participant are presented in Appendix A. Blood lead summary statistics are presented in Table 5 by age group and resident/visitor status. For visitor children, the time estimated by parents that the child visited a house within the Study Area ranged from 15 to 75 percent of their time. No field duplicates or split samples were included in the summary statistics.

A total of 48 children in the age range 6 to 84 months participated in the blood lead study; 36 were residents and 12 were visitors. The geometric mean (GM) for visitor children is slightly higher than that for resident children, most likely due to the one visitor child with a blood lead of 14 µg/dL.

A total of 21 individuals in the ages 7 to <18 years participated in the blood lead study; 15 residents and 6 visitors. The geometric mean (GM) for visitors is slightly higher than that for residents.

A total of 11 adults over the age of 18 years participated in the blood lead study; 9 residents and 2 visitors. The geometric mean (GM) for visitors is slightly higher than that for residents.

Table 5
Blood Lead Summary Statistics (µg/dL)

Age 6-84 months

Type	N	Min	Max	Mean	GM	GSD
R	36	0.5	7	2.8	2.4	1.7
V	12	0.75	14	4.0	3.1	2.1
Total	48					

Age 7 to <18 years

Type	N	Min	Max	Mean	GM	GSD
R	15	0.5	17	2.9	1.9	2.2
V	6	0.75	4	2.4	2.1	1.8
Total	**21**					

Adults Age ≥18 years

Type	N	Min	Max	Mean	GM	GSD
R	9	0.75	3	1.5	1.4	1.6
V	2	1	3	2.0	1.7	2.2
Total	**11**					

Notes:
Type: R: Resident V: Visitor
No field duplicates are included in the summary statistics.
Statistics used a value of 0.5 µg/dL for results reported as <1 µg/dL.
Arbitrary Age of 30 yrs was assigned to adults whose age is not known.

4.3 Dust Lead Results

One composite dust sample was collected from each residence to assess children's exposure to lead in interior dust. A total of 37 dust samples were collected; dust lead concentrations ranged from 120 mg/kg to 8,100 mg/kg, with an average of 1,480 mg/kg. Dust lead results are presented in Appendix A and summarized in Table 6 by property remediation status.

Table 6
Summary of Dust Lead Data

Remediation Status	No. Properties	Dust Lead Min (mg/kg)	Dust Lead Max (mg/kg)	Dust Lead Avg (mg/kg)
Cleanup (1)	4	370	1800	1243
Retained for Future (2)	18	250	5000	1493
No Further Action (3)	15	120	8100	1533
Total	37			

Notes:

(1) Properties that were remediated during the 2002 IRM soil removal activities. These properties underwent environmental sampling prior to soil removal.

(2) Based on Step 1 soil sampling results, USEPA has determined that these properties did not require immediate cleanup but should be retained for further investigation in Step 2.

(3) Based on Step 1 soil sampling results, USEPA has determined that these properties did not require cleanup or further investigation.

4.4 Paint Screening Results

The interior and exterior painted surfaces of dwellings were screened for the presence of lead-based paint using an XRF lead paint analyzer, at a total of 37 dwellings. Three readings were taken from each surface, and the average of the three readings was used as the reported result for that surface. Results are reported in mg of lead per square centimeter of surface (mg/cm^2).

Each average result was assigned to one of three groups: <1 mg/cm^2, 1-10 mg/cm^2, and >10 mg/cm^2. The U.S. Department of Housing and Urban Development (HUD) defines paint with lead concentrations of 0.1 to 1 mg/cm^2 as "lead-containing" paint, and paint with lead concentrations of greater than 1 mg/cm^2 as "lead-based" paint (HUD, 1995). The detailed XRF paint screening data for each dwelling tested are presented in Appendix A. Summary statistics for the paint screening data by room/location are presented in Table 7. Lead was detected in both interior and exterior paint at many of the houses screened. A total of 11 houses have maximum XRF readings for interior paint greater than 10 mg/cm^2. The maximum interior paint reading of 23.9 mg/cm^2 was from an entryway trim. A total of 11 houses have maximum XRF readings for exterior paint greater than 10 mg/cm^2. The maximum exterior paint reading was 30.8 mg/cm^2.

Table 7
Summary of Paint Screening Results

Interior Paint Group (mg/cm^2)	N	Min XRF	Max XRF
<1	16	0.017	0.7
1-10	10	0.04	7.9
>10	11	0.04	23.9
Exterior Paint Group (mg/cm^2)	**N**	**Min XRF**	**Max XRF**
<1	11	0.1	0.6
1-10	14	0.1	9
>10	11	0.3	30.8

Note: One exterior paint was not collected, therefore the total number of exterior paint samples is one less than the number of interior paint sample.

4.5 Tap Water Results

Tap water samples were collected from a total of 37 residences to assess children's exposure to lead in tap water. Tap water lead results are presented for each house in Appendix A and summarized in Table 8. Only one house had a tap water lead concentration that exceeded the maximum contaminant level (MCL) of 0.015 mg/L. House Code 10 had a tap water lead concentration of 0.025 mg/L.

Table 8
Summary of Residential Tap Water Data
(Lead Concentration in mg/L)

N	Min	Max	Mean	Std Dev
37	0.0005	0.025	0.0017	0.0040

4.6 Soil Lead Results

Residential soil samples were collected during the Step 1 characterization soil sampling, to determine the average soil lead concentration on each property. A total of 229 soil samples were collected from the 37 residential properties included in the blood lead study; 171 samples from depths of 0-3 inches (surface soil) and 58 samples from 3-10 inches. A total of 3 to 8 surface soil samples were collected on most properties; however, two properties with large yards had 19 and 24 surface soil samples. The majority of the soil samples were analyzed for lead by XRF. Approximately 10% (27 out of 229) of the samples were split and analyzed by a fixed-base laboratory. A correlation was developed between the XRF and laboratory results, and was used to correct the XRF results. The soil lead data

reported in the database are thus corrected XRF results. The average surface soil lead concentration on each property is presented in Appendix A. Table 9 summarizes the soil lead data by remediation status of the property.

Table 9
Summary of Soil Lead Data (mg/kg)

Remediation Status	No. Properties	Avg Soil Lead Min	Avg Soil Lead Max	Avg Soil Lead Avg
Cleanup	4	1058	1671	1358
Retained for Future	19	124	1023	649
No Further Action	14	60	498	245

Note: The number of properties in each category is different from that in the dust summary table because the 37 houses with soil data differ slightly from the 37 houses with dust data.

4.7 Blood Lead *vs.* Factors from Exposure Survey

Blood lead results were evaluated with respect to two factors from the Exposure Survey: the total percent of time the child spends away from home (at daycare, neighbors, or playground, excluding school), and the occurrence of recent remodeling in the home.

4.7.1 Time Away from Home

Table 10 presents blood lead summary statistics for resident children, age 6 to 84 months, with respect to whether the child spends more or less than 25% of his time away from his home within the Study Area. The GM blood lead level (PbB) for children who spend more than 25% of their time away from home is slightly lower than those who do not. In general, the amount of time the child spends away from home does not appear to have a strong influence on blood lead levels in this community.

Table 10
Blood Lead Levels (µg/dL) *vs.* Time Away from Home

Status	Away from home >25% of time	N	Min	Max	Mean	GM	GSD
R	Yes	9	1.5	3	2.39	2.28	1.4
R	No	26	0.5	7	2.85	2.41	1.86

4.7.2 Recent Remodeling

Table 11 presents blood lead summary statistics for children age 6 to 84 months, with respect to the occurrence of recent remodeling in the home. For those who answered this question on the exposure survey, the GM PbB for resident children who live in a home with recent remodeling was slightly lower than for those who lived in a home with no recent remodeling. The GM PbB for visitor children who live in a home with recent remodeling is slightly higher than for those who do not. However, the dataset is quite small for visitor children (8 children). Overall, blood lead levels do not appear to be correlated with the occurrence of recent remodeling for this community.

Table 11
Blood Lead *vs.* Recent Remodeling

Status	Recent Remodeling	N	Min	Max	Mean	GM	GSD
R	Yes	16	1	7	2.72	2.36	1.73
R	No	17	0.5	6	2.82	2.42	1.86
R	NA	3	2	3	2.67	2.62	1.26
V	Yes	3	2	4	3.17	3.04	1.44
V	No	5	0.75	3	2.25	1.98	1.86
V	NA	4	2	14	6.75	5.29	2.29

4.7.3 Other Factors

Other exposure information was collected from study participants, however, several exposure factors could not be evaluated quantitatively due to a lack of adequate data. A total of four children (including three children ages 6-84 months) have parents who have occupational exposure to lead (Child ID nos. 28, 24, 61, and 94). The blood lead levels for these four children were 2, 3, 3, and 3.5 µg/dL, respectively. Parental occupational exposure to lead does not appear to influence the child blood lead in these four cases. No children had parents with hobbies that exposed them to lead. All children have lived at their current residence for more than three months.

4.8 Blood Lead *vs.* Paint Lead Screening Results

Blood lead data were evaluated with respect to the XRF paint screening results. The maximum XRF reading (Table 12A) or the average XRF reading (Table 12B) for each house was assigned to one of three paint groups: <1 mg/cm^2, 1-10 mg/cm^2, and >10 mg/cm^2. Blood lead summary statistics are

presented by paint group, for interior and exterior paint, in Tables 12A and 12B. In Table 12A for interior paint, the GM PbB decreased as the paint category increased. In Table 12A for exterior paint, the GM PbB for visitors decreased as the paint category increased; for residents, the GM PbB was slightly higher only in the >10 mg/cm^2 paint group. In Table 12B for interior paint, the GM PbB decreased as the paint category increased. In Table 12B for exterior paint, the GM PbB for visitors decreased as the paint category increased; for residents, the GM PbB was slightly higher only in the >10 mg/cm^2 paint group. Blood lead levels thus do not appear to be well correlated with the presence of lead based paint in this community.

Table 12A
Blood Lead Summary Statistics (µg/dL) by Paint Lead Concentration
(Paint Groups Based on Maximum XRF Reading)

Interior Paint

Status	Paint group (mg/cm^2)	N	Min	Max	Mean	GM	GSD
R	<1	12	1	6	3.1	2.8	1.6
R	1-10	11	1	6	2.6	2.3	1.7
R	>10	11	0.5	7	2.5	2.0	2.0
V	<1	3	3	3.5	3.2	3.2	1.1
V	1-10	2	2	2	2.0	2.0	1.0
V	>10	3	0.75	4	2.1	1.7	2.3
	Total	42					

Exterior Paint

Status	Paint group (mg/cm^2)	N	Min	Max	Mean	GM	GSD
R	<1	10	1	4	2.5	2.3	1.5
R	1-10	12	1.5	4.5	2.4	2.2	1.5
R	>10	11	0.5	7	3.5	2.8	2.2
V	<1	3	3	3.5	3.2	3.2	1.1
V	1-10	2	2	2	2.0	2.0	1.0
V	>10	3	0.75	4	2.1	1.7	2.3
	Total	41					

Table 12B
Blood Lead Summary Statistics (µg/dL) by Paint Lead Concentration
(Paint Groups Based on Average XRF Reading)

Interior Paint

Status	Paint group (mg/cm^2)	N	Min	Max	Mean	GM	GSD
R	<1	15	1	6	2.8	2.5	1.7
R	1-10	19	0.5	7	2.7	2.3	1.9
V	<1	3	3	3.5	3.2	3.2	1.1
V	1-10	5	0.75	4	2.1	1.8	1.8

Exterior Paint

Status	Paint group (mg/cm^2)	N	Min	Max	Mean	GM	GSD
R	<1	10	1	4	2.5	2.3	1.5
R	1-10	12	1.5	4.5	2.4	2.2	1.5
R	>10	11	0.5	7	3.5	2.8	2.2
V	<1	3	3	3.5	3.2	3.2	1.1
V	1-10	2	2	2	2.0	2.0	1.0
V	>10	3	0.75	4	2.1	1.7	2.3

4.9 Blood Lead *vs.* Dust Lead

The blood lead data were evaluated with respect to dust lead concentrations. Dust lead concentrations were divided into two categories, greater than and less than 1,000 mg/kg. Table 13 presents the blood lead summary statistics by dust lead category. For both resident and visitor children, the GM blood lead level was lower for children in dwellings with dust lead concentrations greater than 1,000 mg/kg than for children in dwellings with dust lead concentrations less than 1000 mg/kg. Figure 2 plots blood lead levels *vs.* dust lead concentrations. The linear regression of this plot has a negative slope close to zero, and a correlation coefficient (r^2) of 0.0009. Therefore, blood lead levels do not appear to be correlated with interior dust lead concentrations in this community.

Table 13
Blood Lead Summary Statistics (µg/dL) *vs.* Dust Lead Category

Status	Dust Lead Category	N	Min	Max	Mean	GM	GSD
R	<1000 mg/kg	19	1	7	2.97	2.57	1.74
R	>1000 mg/kg	15	0.5	4.5	2.47	2.15	1.81
V	<1000 mg/kg	3	3	3.5	3.17	3.16	1.09
V	>1000 mg/kg	6	0.75	4	2.21	1.94	1.79

Notes: Children 6 to 84 months; No duplicates

4.10 Blood Lead *vs.* Soil Lead

The blood lead data were evaluated with respect to soil lead concentrations. The soil remediation status of the property was used as a surrogate for soil lead concentration (see Table 9 – Summary of Soil Lead Data). Table 14 presents the blood lead summary statistics by soil remediation status, for resident and visitor children combined. The GM blood lead levels for the categories of Cleanup and Retained for Future (2.7 µg/dL and 2.6 µg/dL) are slightly higher than the GM for the No Further Action category (2.5 µg/dL). Figure 3 plots blood lead levels *vs.* average soil lead concentrations for each property. The linear regression of this plot has a slope of 0.001 (close to zero), and a low correlation coefficient (r^2) of 0.06. Therefore, blood lead levels do not appear to be well correlated with soil lead concentrations in this community.

Table 14
Blood Lead Summary Statistics (µg/dL)
***vs.* Soil Remediation Status**

Soil Remediation Status	N	Min	Max	Mean	GM	GSD
Cleanup	5	1.5	6.0	3.1	2.7	1.8
Retained for Future	28	0.5	14.0	3.2	2.6	2.0
No Further Action	15	1.0	4.5	2.8	2.5	1.6

Notes: Children 6 to 84 months; No duplicates, Residents and Visitors Combined

4.11 Environmental Data Correlations

The following sections discuss the correlations among dust lead, soil lead, and paint lead, and the degree to these types of environmental data are related.

4.11.1 Dust Lead *vs.* Soil Lead

Dust lead data were evaluated with respect to the average soil lead concentrations on each property. Figure 4 plots dust lead concentrations *vs.* average soil lead concentrations for each property where both types of data were collected (N = 32). The linear regression of this plot has a slope of 0.27 and a low correlation coefficient (r^2) of 0.004. Therefore, dust lead concentrations appear to be poorly correlated with soil lead concentrations in this community.

4.11.2 Dust Lead *vs.* Interior Paint Lead

Dust lead concentrations were evaluated with respect to both the average and the maximum interior paint XRF readings for each property. Figure 5 plots dust lead concentrations *vs.* the average and maximum XRF readings for each property where both types of data were collected (N = 36). The linear regressions have correlation coefficients (r^2) ranging from 0.034 (for average XRF) to 0.065 (for maximum XRF). Therefore, dust lead concentrations do not appear to be well correlated with interior paint lead concentrations in this community. However, it is noted that out of the 17 dust lead concentrations greater than or equal to 1,000 mg/kg, 6 were found in dwellings with maximum XRF readings greater than 10 mg/cm^2, and 8 were found in dwellings with maximum XRF readings in the range of 1-10 mg/cm^2. Thus, the empirical data show evidence that elevated dust lead concentrations may be related to the presence of lead-based paint in some houses.

4.11.3 Soil Lead *vs.* Exterior Paint Lead

Soil lead concentrations were evaluated with respect to the average and maximum exterior paint XRF readings for each property. Figure 6 plots soil lead concentrations *vs.* the average and maximum XRF readings for each property where both types of data were collected (N = 30). The linear regressions have correlation coefficients (r^2) ranging from 0.01 (for average XRF) to 0.19 (for maximum XRF). Therefore, soil lead concentrations appear to be poorly correlated with exterior paint lead concentrations in this community.

5 Summary and Conclusions

5.1 Results Summary

A total of 48 children in the age range of 6 to 84 months participated in the blood lead study; 36 were residents and 12 were visitors. A total of 73 children in this age range live in or visit the Study Area; thus the participation rate was 66%. The geometric mean (GM) PbB was 2.4 μg/dL for resident children and 3.1 μg/dL for visitor children. By way of comparison, in NHANES-III (Phase 2, 1991-1994), the GM PbB is 2.62 μg/dL for non-hispanic white children ages 6 to 84 months in the northeast region of the U.S. (U.S. Public Health Service, 1997). A total of 21 individuals in the ages 7 to <18 years participated in the blood lead study; 15 were residents and 6 were visitors. The GM PbB for visitors (2.1 μg/dL) was slightly higher than that for residents (1.9 μg/dL). A total of 11 adults over the age of 18 years participated in the blood lead study; 9 were residents and 2 were visitors. The GM PbB for visitors (1.7 μg/dL) is slightly higher than that for residents (1.4 μg/dL).

Two children had blood lead levels above 10 μg/dL. One 8 year old resident child had a blood lead level of 17 μg/dL; and one 2 year old visitor child had a blood lead of 14 μg/dL. Both of these children have a history of elevated blood lead levels that are mainly related to their former (in the case of the resident) or primary (in the case of the visitor) residence, and that appear to be unrelated to the environmental lead levels associated with their residence within the Study Area.

Interior dust samples were collected from a total of 37 dwellings. Dust lead concentrations ranged from 120 mg/kg to 8100 mg/kg, with an average of 1480 mg/kg.

Interior and exterior paint was screened for the presence of lead-based paint at a total of 37 residences. A total of 11 houses had maximum XRF readings for interior paint greater than 10 mg/cm^2, with a maximum interior paint reading of 23.9 mg/cm^2 from an entryway trim. A total of 11 houses had maximum XRF readings for exterior paint greater than 10 mg/cm^2, with the maximum exterior paint reading of 30.8 mg/cm^2.

Tap water samples were collected from a total of 37 residences. All dwellings had tap water lead concentrations less than the MCL of 0.015 mg/L, with the exception of one house (House Code 10) that had a tap water lead concentration of 0.025 mg/L.

A total of 171 surface soil samples were collected from the 37 residential properties included in the blood lead study. Average soil lead concentrations ranged from 60 mg/kg (on a No Further Action property) to 1,671 mg/kg (on a property that was subsequently remediated).

5.2 Blood Lead Level Determinants

Geomean blood lead levels for children ages 6 to 84 months were examined with respect to several factors from the Exposure Survey, including the amount of time the child spends away from home; the presence of recent remodeling in the home; and parental occupational exposure to lead. In general, blood lead levels do not appear to be correlated with, or strongly influenced by, the occurrence of recent home remodeling, the amount of time the child spends away from home, or parental occupational exposure to lead.

Geomean blood lead levels for children ages 6 to 84 months were examined with respect to the maximum interior paint lead reading in the home; the interior dust lead concentration; and the average soil lead concentration on the property. In general for this community, blood lead levels do not appear to be correlated with either interior paint lead levels, interior dust lead concentrations, or average soil lead concentrations.

5.3 Conclusions

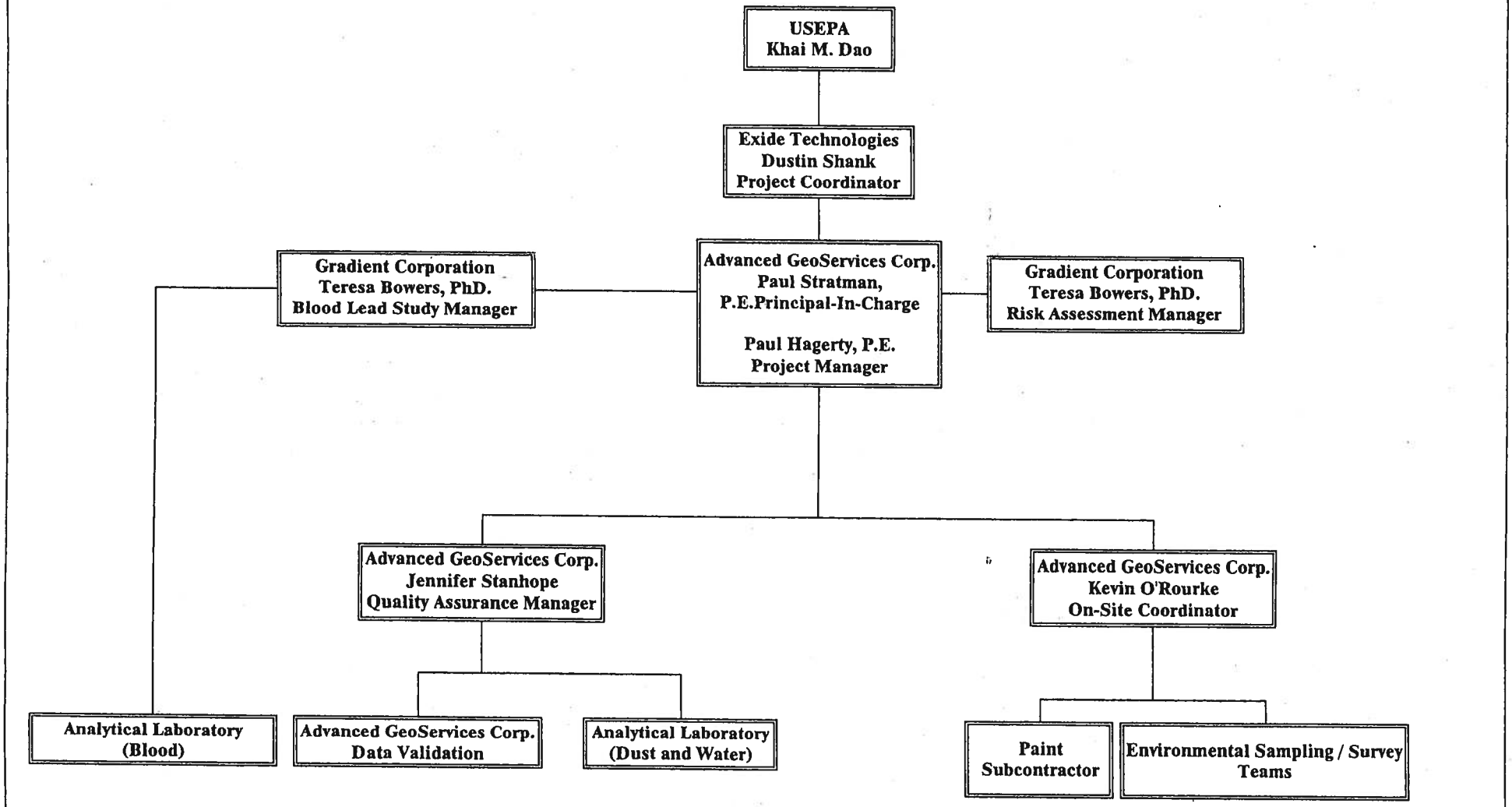
The results of the blood lead study indicate that child blood lead levels in the Study Area surrounding the Exide facility are generally not elevated and do not present a community-wide problem. Child blood lead levels in this community are not well correlated with environmental lead levels, including dust and soil concentrations, and interior paint lead readings. The results of this study indicate that there are adequate data to proceed with the IEUBK Parameter Feasibility Study and the Lead Risk Assessment, based on the fact that data are available for 48 children in the age range of 6 to 84 months, and the participation rate was 66%.

6 References

Advanced Geoservices Corp. (AGC). 2002. "Step 2: Environmental and Human Health Sampling Work Plan, Reading, Pennsylvania." Prepared for Exide Technologies, Reading, PA. Submitted to US EPA Region III, July 31, 2002.

U.S. Dept. of Housing and Urban Development (HUD). 1995. "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing." June.

U.S. Public Health Service. 1997. National Center for Health Statistics, Div. of Health Examination Statistics (Hyattsville, MD). The Third National Health and Nutrition Examination Survey (NHANES III), 1988-94 on CD-ROM. October.



EXIDE TECHNOLOGIES

READING, PENNSYLVANIA

Scale: N.T.S.	STEP 2 PROJECT ORGANIZATION
Originated By: P.A.H.	
Drawn By: P.S.G.	
Checked By: P.A.H.	
Project Mgr: P.A.H.	
Dwg No. 2002-977-01-02	

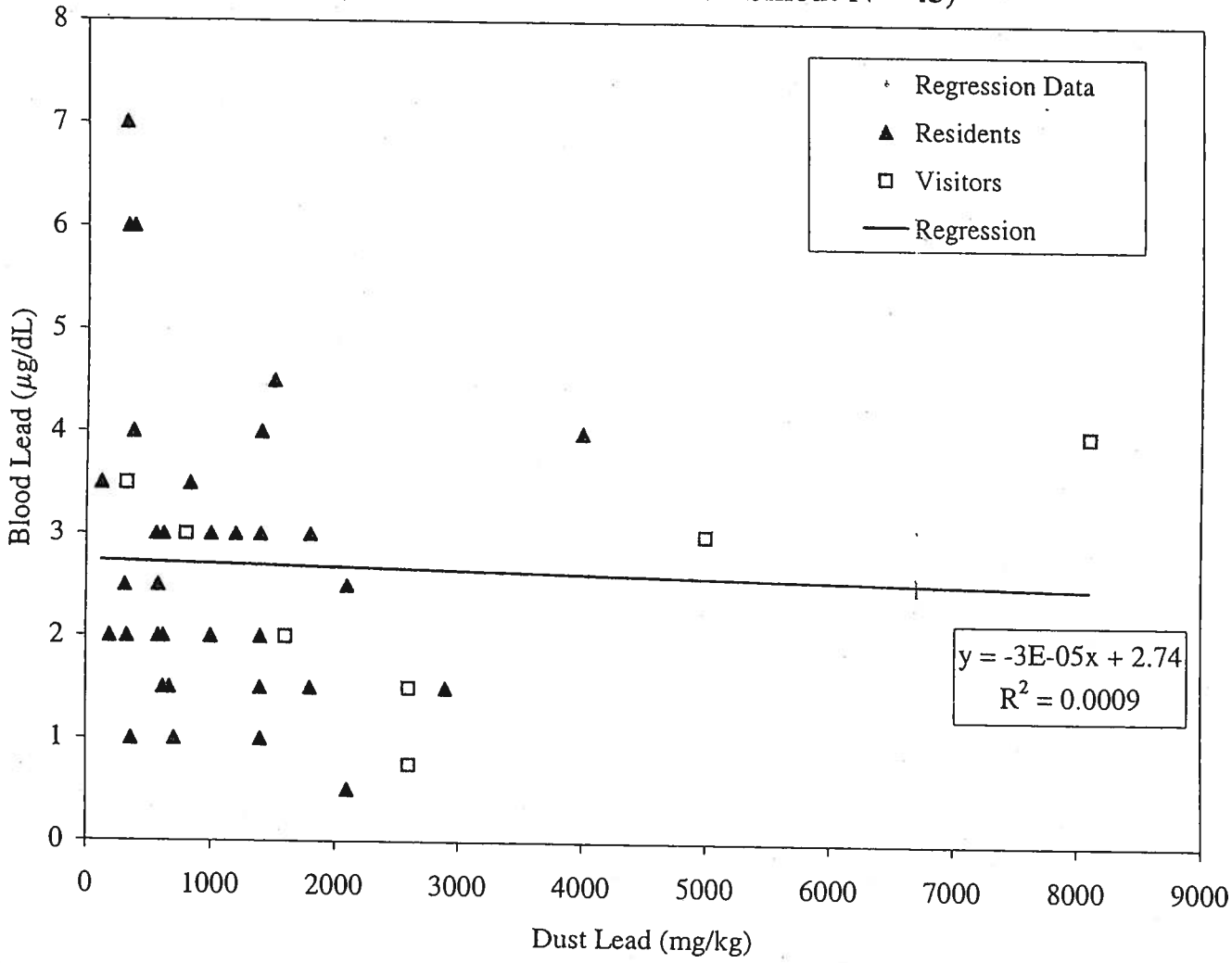
Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

Project No. 2002-977-01

FIGURE: 1

J:\EXIDE\DRAWINGS\2002-977-01\2002-977-01-02

Figure 2
Blood Lead vs. Dust Lead for Children 6-84 months
(Resident and Visitors Combined: N = 43)



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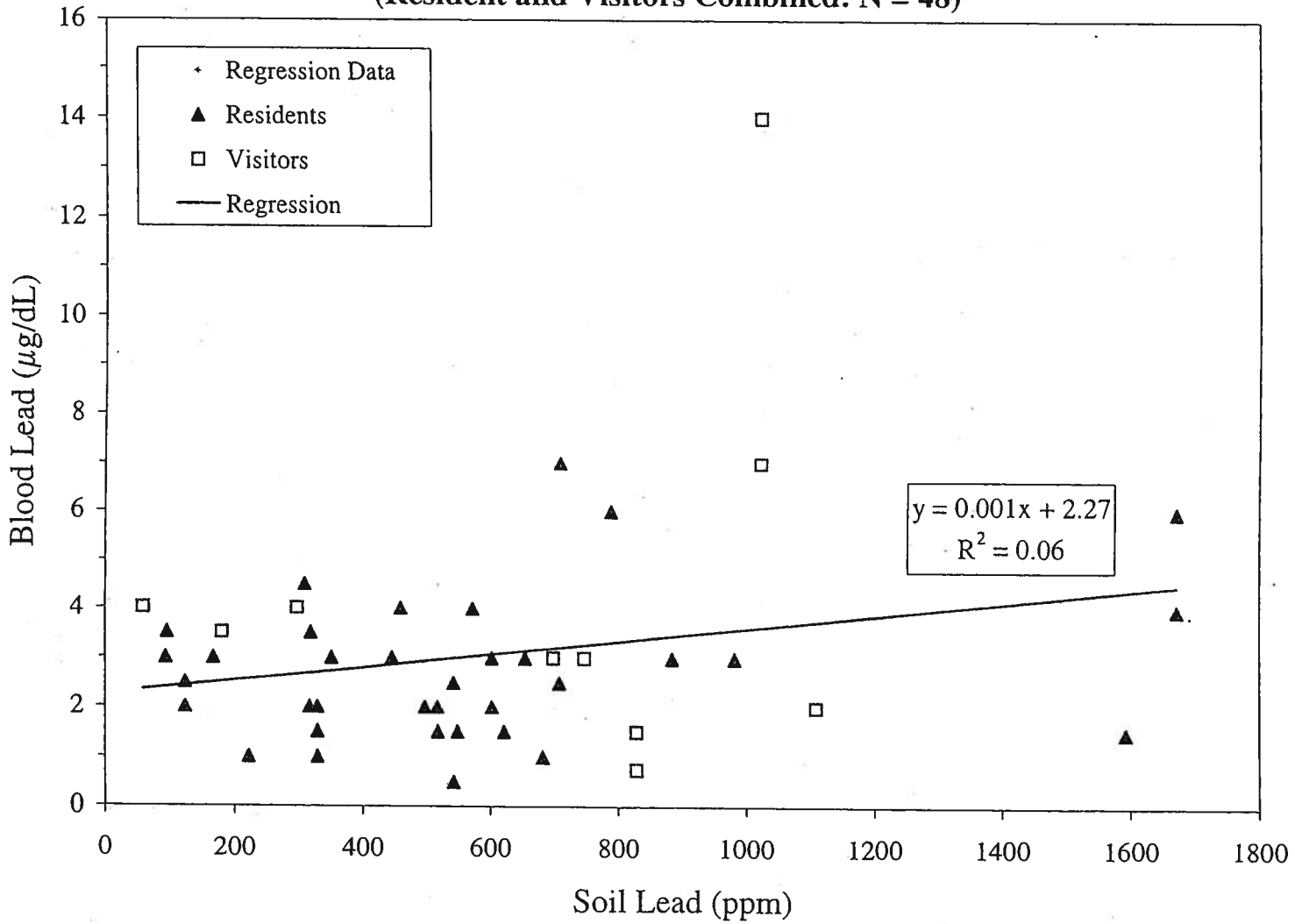
1/7/2003

Figure 3
Blood Lead vs Soil Lead for Children 6-84 months
(Resident and Visitors Combined: N = 48)



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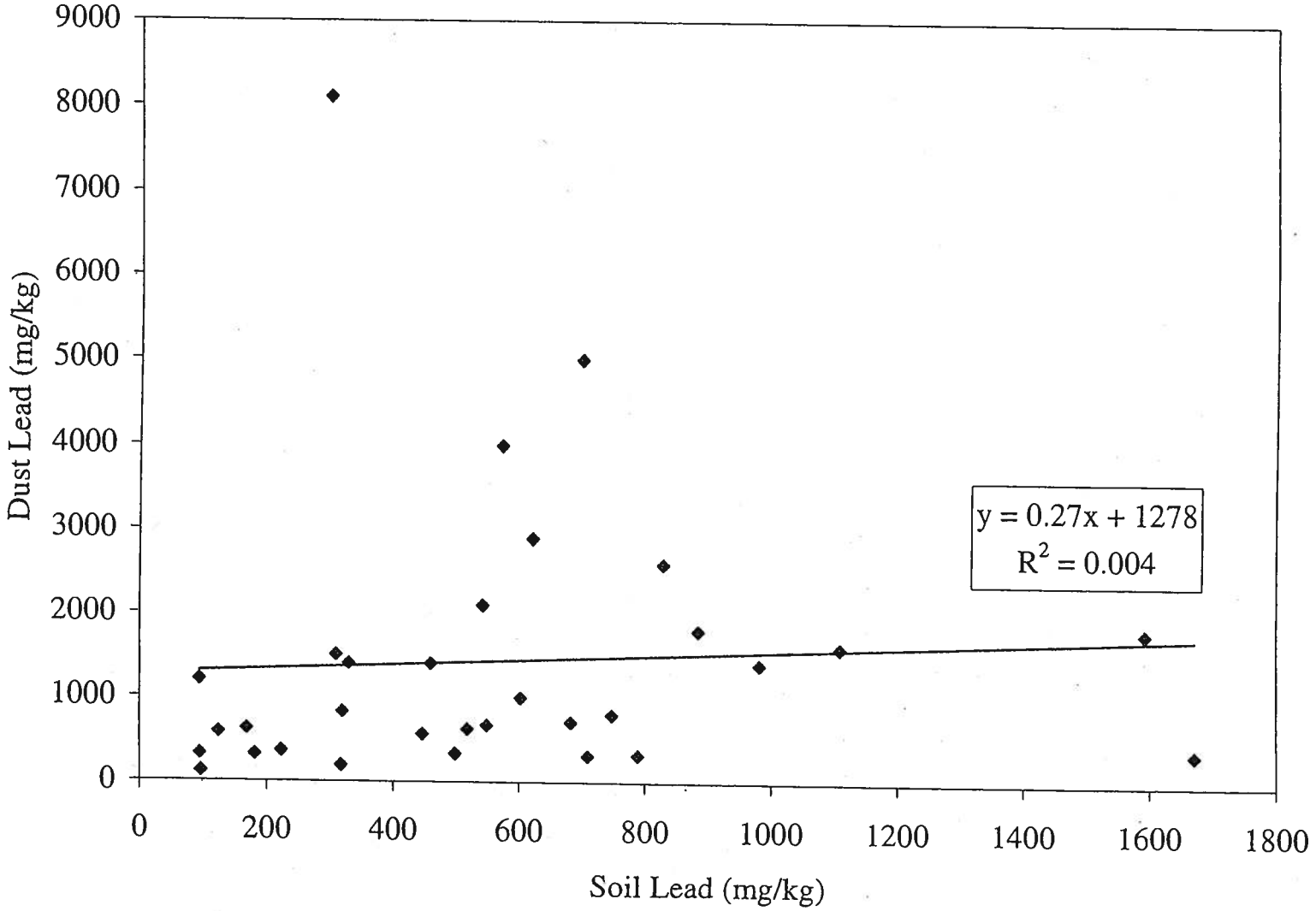
1/7/2003

Figure 4
Dust Lead vs. Soil Lead



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1/7/2003

Figure 5
Dust Lead vs. Interior Paint Lead

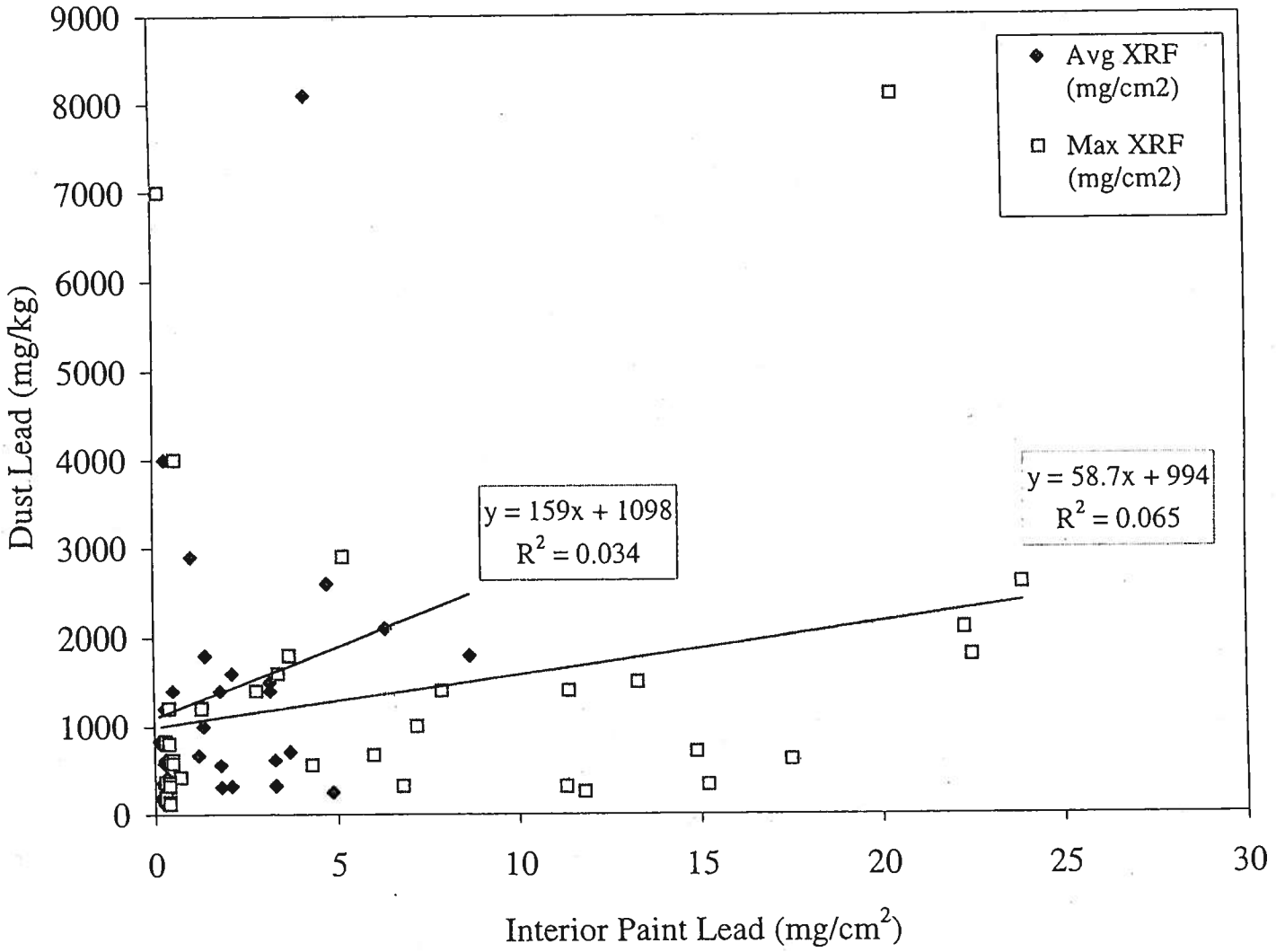
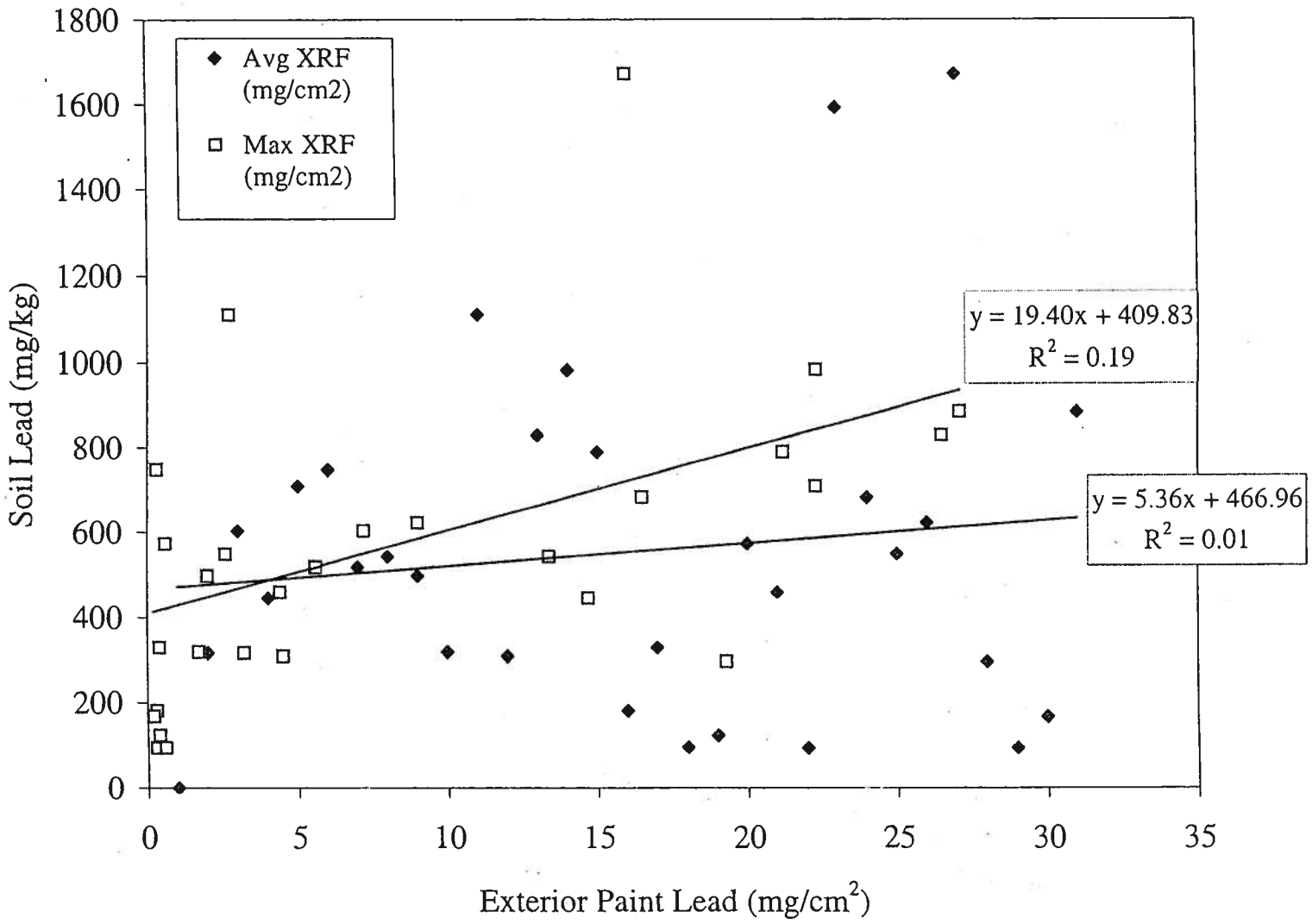


Figure 6
Soil Lead vs. Exterior Paint Lead



Appendix A

Blood Lead and Environmental Data

Appendix A

House Code	Person Code	Type	Avg PbB (µg/dL)	Age (yr)	Age (mo)	Avg Soil Pb (mg/kg)	Dust Pb (mg/kg)	Water Pb (mg/L)	Exterior Paint Max (mg/cm²)	Exterior Paint Avg (mg/cm²)	Interior Paint Max (mg/cm²)	Interior Paint Avg (mg/cm²)	Remediation Status
1	1	R	0.5	4	55	542	2100	0.001	13.4	8.4	22.3	6.4	Retained for Future
1	2	R	2.5	2	26	542	2100	0.001	13.4	8.4	22.3	6.4	Retained for Future
1	4	R	1	30	360	542	2100	0.001	13.4	8.4	22.3	6.4	Retained for Future
2	5	R	3.5	4	49	96	120	0.002	0.4	0.4	0.4	0.3	No Further Action
3	6	V	4	5	72	298	8100		19.3	12.1	20.4	4.3	No Further Action
3	7	V	2	8	96	298	8100		19.3	12.1	20.4	4.3	No Further Action
4	8	R	1.5	5	71	518	620	0.001	5.6	2.0	17.5	3.3	Retained for Future
4	10	R	1	30	360	518	620	0.001	5.6	2.0	17.5	3.3	Retained for Future
4	11	R	2	4	54	518	620	0.001	5.6	2.0	17.5	3.3	Retained for Future
5	12	R	1.5	3	46	1593	1800		3.8	2.3	22.5	8.7	Cleanup
5	13	R	2	30	360	1593	1800		3.8	2.3	22.5	8.7	Cleanup
5	14	R	1	30	360	1593	1800		3.8	2.3	22.5	8.7	Cleanup
6	15	R	0.5	9	118	682	710	0.002	16.5	11.5	14.9	3.7	Retained for Future
6	16	R	1	6	78	682	710	0.002	16.5	11.5	14.9	3.7	Retained for Future
7	18	R	1	9	116	549	670	0.001	2.6	1.0	6	1.2	Retained for Future
7	19	R	1.25	7	89	549	670	0.001	2.6	1.0	6	1.2	Retained for Future
7	20	R	1.5	5	66	549	670	0.001	2.6	1.0	6	1.2	Retained for Future
8	21	R	2	8	106	622	2900		9	6.4	5.2	1.0	Retained for Future
8	22	R	1.5	6	82	622	2900		9	6.4	5.2	1.0	Retained for Future
9	23	R	2	10	128	446	560		14.7	9.3	4.3	1.8	No Further Action
9	24	R	3	5	71	446	560		14.7	9.3	4.3	1.8	No Further Action
10	26	R	3	8	105	498	330	0.025	2	1.2	15.2	3.3	No Further Action
10	27	R	2	5	71	498	330	0.025	2	1.2	15.2	3.3	No Further Action
11	28	R	2	7	90	95	320		0.6	0.4	0.4	0.4	No Further Action
11	29	R	2	12	144	95	320		0.6	0.4	0.4	0.4	No Further Action
12	30	R	2	14	170	351							Retained for Future
12	31	R	2	10	131	351							Retained for Future
12	32	R	3	6	76	351							Retained for Future
13	34	R	0.75	34	409	309	1500	0.004	4.5	1.8	13.3	3.2	No Further Action
13	35	R	4.5	4	51	309	1500	0.004	4.5	1.8	13.3	3.2	No Further Action
14	37	R	3	2	32	655							Retained for Future
15	38	V	1	42	512	829	2600	0.002	26.5	13.7	23.9	4.8	Retained for Future
15	39	V	0.75	11	134	829	2600	0.002	26.5	13.7	23.9	4.8	Retained for Future
15	40	V	1.5	5	66	829	2600	0.002	26.5	13.7	23.9	4.8	Retained for Future
15	41	V	0.75	3	45	829	2600	0.002	26.5	13.7	23.9	4.8	Retained for Future
17	43	V	3	23	281	1023							Retained for Future
17	44	V	7	5	61	1023							Retained for Future
17	46	V	14	2	29	1023							Retained for Future
18	47	R	3	5	60	982	1400		22.3	18.2	11.4	3.2	Retained for Future
18	48	R	1	11	132	982	1400		22.3	18.2	11.4	3.2	Retained for Future
19	49	R	6	2	25	789	320		21.2	13.9	6.8	2.1	Retained for Future
20	50	R	1	4	53	329	1400		0.4	0.3	2.8	0.5	No Further Action

Appendix A

House Code	Person Code	Type	Avg PbB (µg/dL)	Age (yr)	Age (mo)	Avg Soil Pb (mg/kg)	Dust Pb (mg/kg)	Water Pb (mg/L)	Exterior Paint Max (mg/cm²)	Exterior Paint Avg (mg/cm²)	Interior Paint Max (mg/cm²)	Interior Paint Avg (mg/cm²)	Remediation Status
20	52	R	1.5	2	35	329	1400		0.4	0.3	2.8	0.5	No Further Action
20	53	R	2	1.33	11	329	1400		0.4	0.3	2.8	0.5	No Further Action
21	54	R	3	30	360		7000	0.001	0.2	0.2	0.2	0.2	No Further Action
23	55	V	2.5	14	169	60							No Further Action
23	56	V	4	4	59	60							No Further Action
24	57	V	2.5	12	154	181	320		0.3	0.2	0.4	0.3	No Further Action
24	58	V	2.5	11	137	181	320		0.3	0.2	0.4	0.3	No Further Action
24	59	V	3.5	4	59	181	320		0.3	0.2	0.4	0.3	No Further Action
25	60	R	2	3	41	317	190		3.2	1.3	0.3	0.2	No Further Action
26	61	V	3	6	83	699	5000		5.3	3.5	0.4	0.3	Retained for Future
27	63	R	2	5	70	124	580	0.001	0.4	0.4	0.5	0.3	Retained for Future
27	64	R	2.5	2	34	124	580	0.001	0.4	0.4	0.5	0.3	Retained for Future
27	65	R	2.5	2	34	124	580	0.001	0.4	0.4	0.5	0.3	Retained for Future
29	66	R	3	2	34	94	1200		0.3	0.3	0.4	0.3	No Further Action
29	67	R	1	30	360	94	1200		0.3	0.3	0.4	0.3	No Further Action
29	68	R	2	30	360	94	1200		0.3	0.3	0.4	0.3	No Further Action
31	69	R	3	1	19	168	620	0.001	0.2	0.2	0.5	0.3	No Further Action
32	71	R	1.5	12	151	223	360	0.001			0.4	0.2	No Further Action
32	72	R	1	7	92	223	360	0.001			0.4	0.2	No Further Action
32	73	R	1	4	58	223	360	0.001			0.4	0.2	No Further Action
33	75	V	3	5	64	747	800		0.3	0.3	0.4	0.2	Retained for Future
33	76	V	3	3	40	747	800		0.3	0.3	0.4	0.2	Retained for Future
34	79	R	2	4	55	602	1000	0.001	7.2	5.7	7.2	1.3	Retained for Future
34	80	R	3	2	34	602	1000	0.001	7.2	5.7	7.2	1.3	Retained for Future
35	81	R	2.5	6	74	709	310		22.3	12.8	11.3	1.8	Retained for Future
35	82	R	7	2	34	709	310		22.3	12.8	11.3	1.8	Retained for Future
36	83	V	2	3	70	1110	1600		2.7	1.8	3.4	2.1	Cleanup
36	84	V	2	5	46	1110	1600		2.7	1.8	3.4	2.1	Cleanup
37	85	V	4	8	98	1058							Cleanup
38	86	R	3	5	68	885	1800		27.1	19.1	3.7	1.4	Retained for Future
39	87	R	4	3	36	572	4000	0.002	0.6	0.3	0.6	0.3	Retained for Future
40	88	R	2	28	338	460	1400	0.002	4.4	2.7	7.9	1.8	Retained for Future
40	89	R	4.5	7	96	460	1400	0.002	4.4	2.7	7.9	1.8	Retained for Future
40	90	R	4	6	84	460	1400	0.002	4.4	2.7	7.9	1.8	Retained for Future
41	91	R	17	8	97	1671	370	0.001	16	7.5	0.3	0.3	Cleanup
41	92	R	6	3	47	1671	370	0.001	16	7.5	0.3	0.3	Cleanup
41	93	R	4	6	72	1671	370	0.001	16	7.5	0.3	0.3	Cleanup
42	94	R	3.5	4	54	319	830	0.001	1.7	1.2	0.3	0.1	No Further Action
Notes: Missing person codes are from duplicate or split samples not listed here.													
Blanks indicate that no data were collected.													

Appendix B

Environmental Survey Form
Exposure Survey Form
Consent Form

Environmental Survey Form

1.0 Environmental Sample Label:	Mark Visitor (V) or Resident (R)

Instructions: Introduce yourself, date form and initial, and verify that informed consent has been signed.

1.2 Collection Date: _____

1.3 Interviewer Initials: _____

1.4 Informed Consent: Y N DO NOT PROCEED WITHOUT CONSENT

PART A: ADULT INFORMATION

What is your name? (Parent or Legal Guardian providing information)

A1: LAST: _____

A2: FIRST: _____

A3: **What is your relationship to the child?**: Mother Father Other :_____

A4: **Do you live with the child?** Y N

A5: **What is the current address where the child lives?**

Child's Current Address: _____

Instructions: All the following questions are related to the home where the child lives.

PART C: HOUSEHOLD INFORMATION

C1 **What are the occupations of the adults who live with the child?**

C1.1 Person: _____ Occupation: _____

C1.2 Person: _____ Occupation: _____

C1.3 Person: _____ Occupation: _____

C2: **Do these occupations bring any adults into contact with lead?** Y N Unknown

C2.1 If yes, can you please describe?

Page 2: CHILD: _____

C3 **Do any of the adults who live with the child engage in hobbies that would bring them into contact with lead, such as working with stained glass, lead glazes for pottery, lead casting for fishing sinkers or bullets, metal and/or pipe soldering?** Y N Unknown

C3.1 If yes, can you please describe?

C4: **Are there smokers in the house where the child lives?** Y N

If YES, many in each category?

C4.1 Number of light smokers (less than 1 pack per week) _____

C4.2 Number of moderate smokers (less than 1 pack per day) _____

C4.3 Number of heavy smokers (more than 1 pack per day) _____

C5: **Do you have any pets that go in and out of the house where the child lives?** Y N

C5.1 If yes, how many: Dogs _____ Cats_____

Other (type and how many)?_____

C6: **Has there been any remodeling in the house where the child lives recently?** Y N

C6.1 What part of the house:_____

C6.2: When was this:_____

C6.3 Did this involve scraping or sanding existing painted surfaces? Y N Unknown

C7: **Have you seen or heard any suggestions for how to reduce your exposure to lead?** Y N

Comments:

C8: **Do you presently take any active steps to reduce exposure of your children to lead?** Y N

Comments

C9: **Were you aware prior to entering this study that your house is within the Study Area surrounding the facility?** Y N

C10: Other comments or notes

Exposure Survey Form

1.0 Blood Lead Sample Label:	Mark Visitor (V) or Resident (R)

Instructions: Introduce yourself, date form and initial, and verify that informed consent has been signed.

1.2 Collection Date: _____

1.3 Interviewer Initials: _____

1.4 Informed Consent: Y N DO NOT PROCEED WITHOUT CONSENT

PART A: ADULT INFORMATION

What is your name? (Parent or Legal Guardian providing information)

A1: LAST: _____

A2: FIRST: _____

A3: **What is your relationship to the child?**: Mother Father Other :_____

A4: **Do you live with the child?** Y N

A5: **What is the current address where the child lives?**

Child's Current Address: _____

Instructions: All the following questions are related to the home where the child lives.

PART B: CHILD INFORMATION

What is the child's name?

B1: LAST: _____

B2: FIRST: _____

B3: **What is the child's birthday**?: (mm/dd/yyyy) _____

B4: **Is the child a BOY or a GIRL?** (circle)

B5: **What is the child's ethnic background?** (circle all that apply)

Non-Hispanic white Hispanic Black Asian Native American

B6: **How long has the child lived at the current address?**: _____yrs _____mos

B6.1 Is this less than 3 months? Y N

B6.2 If YES, **where did the child live previously**?:

Page 2: CHILD: _____

B7: **Over the past three months, can you please estimate the percentage of times during a typical week that the child has spent in the following locations:**

B7.1 At home, indoors: _____%

B7.2 At home, outdoors: _____%

B7.3 At daycare/babysitter: _____% Location: _____

B7.4 At local playground: _____% Location: _____

B7.5 At neighbor's house: _____% Location: _____

B7.6 Other: _____% Location: _____

B7.7 Other: _____% Location: _____

B8: **When your child is outdoors at home, what do they like to do?**

B8.1 Play on grass Y N

B8.2 Play on dirt Y N

B8.3 Play in sand box Y N

B8.4 Play in driveway Y N

B8.5 Play on swing set Y N

B8.6 Other: _____

B9: **Does your child tend to put things (thumb, fingers, hand, toys, misc. objects, *etc.*) in his/her mouth? (circle)** Very often Often Once in a while Almost never

B10: Who is your child's pediatrician and where are they located? (Please also include a phone number).

COMMENTS:

_____

_____

CONSENT FOR PARTICIPATION IN BLOOD LEAD STUDY

I understand that the purpose of this study is to investigate the potential of childhood lead exposure in Muhlenberg Township, Laureldale Borough. My participation will involve answering a questionnaire and allowing my child to provide blood for laboratory analysis. Both the questionnaire answers and blood results will be confidential and any reporting of the results will be done in such a way as to keep your identity completely confidential. The participation is a one-time event, and should involve a limited amount of time. I understand that the risks for my child are minor discomfort for the blood drawing and potential bruising in the area of the needle stick. I understand that if the discomforts or complications do occur, medical attention will be provided.

I understand that the information collected will be evaluated by Gradient, and may be reviewed by other state and federal agencies.

I understand that the possible benefits of my child's participation is research is that, if elevated blood lead levels are determined, my child will be referred for further follow-up environmental assessment by an appropriate health agency.

I understand that my child's participation is voluntary and that refusal to participate will involve no penalty to me or my child. I understand that I may withdraw my child's participation in the study at any time without penalty or prejudice. Specifically, I understand that I need not answer any questions asked by AGC if I do not wish to, and that I can stop my child's participation at any point, without needing to give a reason. Since participation is voluntary, I understand that neither my child or I will be charged for any part of this project or for the services provided, and that an alternative to this study is not to participate.

I have read the above statement and have been able to ask questions and express concerns, which have been satisfactorily answered by AGC and/or the USEPA. I believe I understand the purpose of the study, as well as the potential risks and benefits that are involved. I hereby give my informed and free consent for my and my child's participation in this study.

Date _____ _____
month/day/year Child's Name

Parent/Guardian Signature _____

Witness Signature _____

Witness Name (Printed) _____

LANDOWNER CONSENT FORM

We hereby consent to the entry upon our premises by representatives, or contractors of Exide Technologies (Exide) and Advanced Geoservices Corp. (AGC) for the purpose of conducting a blood lead study. We understand that sample collection will require indoor dust, tap water, and paint sampling.

The indoor dust sampling will be conducted from floor areas in the interior of my home. Tap water will be collected by running the kitchen faucet for 3 minutes, shutting off the water, waiting one hour (with no use of the water in any part of the house), then collecting a water sample from my kitchen faucet. The paint sampling will consist of screening interior and exterior painted surfaces. No surfaces will be impacted (cutting, scraping, *etc.*) by the screening technique. Painted surfaces in the entry way, main living area, and your children's bedroom(s) will be screened as interior paint and three exterior painted house surfaces will be screened as exterior paint. All costs associated with the sampling will be paid by Exide. A copy of the results will be provided to the landowner.

_____
Property Address

_____
Owner/Signature

_____
Renter Signature

_____
PLEASE PRINT NAME

_____
PLEASE PRINT NAME

_____
Date

_____
Date

_____
Phone Number

_____
Phone Number