BIOAVAILABILITY OF LEAD IN SOIL SAMPLES FROM THE NEW JERSEY ZINC NPL SITE PALMERTON, PENNSYLVANIA

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EXECUTIVE SUMMARY

A study using young swine as test animals was performed to measure the gastrointestinal absorption of lead from two soil samples from the New Jersey Zinc Superfund site located in Palmerton, Pennsylvania. Young swine were selected for use in the study primarily because the gastrointestinal physiology and overall size of young swine are similar to that of young children, who are the population of prime concern for exposure to soil lead.

The two test soils were composites from different areas of the site. The first sample contained 3,230 ppm lead, and was referred to as the "Location 2" sample. The second sample contained 2,150 ppm lead, and was referred to as the "Location 4" sample. Groups of 5 swine were given average oral doses of 7.7, 23.2, or 69.7 mg/kg-d of Location 2 soil or 11.6, 34.9, or 104.7 mg/kg-d of Location 4 soil for 15 days. This corresponded to target average doses of 25, 75, or 225 ug/kg/day of lead. Other groups of animals were given a standard lead reference material (lead acetate) either orally at doses of 0, 25, or 75 ug Pb/kg-day, or intravenously at a dose of 100 ug Pb/kg-day. The amount of lead absorbed by each animal was evaluated by measuring the amount of lead in the blood (measured on days -4, 0, 1, 2, 3, 5, 7, 9, 12, and 15), and the amount of lead in liver, kidney and bone (measured on day 15 at study termination). The amount of lead present in blood or tissues of animals exposed to test soils was compared to that for animals exposed to lead acetate, and the results were expressed as relative bioavailability (RBA). For example, a relative bioavailability of 50% means that 50% of the lead in soil was absorbed equally as well as lead from lead acetate, and 50% behaved as if it were not available for absorption. Thus, if lead acetate were 40% absorbed, the test material would be 20% absorbed.

The RBA results for the two samples from the Palmerton site are summarized below:

Measurement Endpoint	Test Material	
	Location 2	Location 4
Blood Lead AUC	0.74	0.58
Liver Lead	0.50	0.54
Kidney Lead	0.42	0.34
Bone Lead	0.47	0.39

Because the estimates of RBA based on blood, liver, kidney, and bone do not agree in all cases, judgment must be used in interpreting the data. In general, we recommend greatest emphasis be placed on the RBA estimates derived from the blood lead data. This is because blood lead data are more robust and less susceptible to random errors than the tissue lead data, so there is greater confidence in RBA estimates based on blood lead. In addition, absorption into the central compartment is an early indicator of lead exposure, is the most relevant index of central nervous system exposure, and is the standard measurement endpoint in investigations of this sort. However, data from the tissue endpoints (liver, kidney, bone) also provide valuable information. We consider the plausible range to extend from the RBA based on blood AUC to the mean of the other three tissues (liver, kidney, bone). The preferred range is the interval from the RBA based on blood to the mean of the blood RBA and the tissue mean RBA. Our suggested point estimate is the mid-point of the preferred range. These values are presented below:

Relative Bioavailability of Lead	Test Material	
	Location 2	Location 4
Plausible Range	0.74-0.46	0.58-0.42
Preferred Range	0.74-0.60	0.58-0.50
Suggested Point Estimate	0.67	0.54

These RBA estimates may be used to help assess lead risk at this site by refining the estimate of absolute bioavailability (ABA) of lead in soil, as follows:

$$ABA_{soil} = ABA_{soluble} \cdot RBA_{soil}$$

Available data indicate that fully soluble forms of lead are about 50% absorbed by a child. Thus, the estimated absolute bioavailability of lead in the HL Smelter, LL Yard, and HL Mill soils are as follows:

Absolute Bioavailability of Lead	Test Material	
	Location 2	Location 4
Plausible Range	37%-23%	29%-21%
Preferred Range	37%-30%	29%-25%
Suggested Point Estimate	34%	27%

These absolute bioavailability estimates are appropriate for use in EPA's IEUBK model for this site, although it is clear that there is both natural variability and uncertainty associated with these estimates. This variability and uncertainty arises from several sources, including : 1) the inherent variability in the responses of different individual animals to lead exposure, 2) uncertainty in the relative accuracy and applicability of the different measurement endpoints, 3) the extrapolation of measured RBA values in swine to young children, and 4) the potential effect of food in the stomach on lead absorption. Thus, the values reported above are judged to be reasonable estimates of typical lead absorption by children at this site, but should be interpreted with the understanding that the values are not certain.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

BIOAVAILABILITY OF LEAD IN SOIL SAMPLES FROM NEW JERSEY ZINC SITE PALMERTON, PENNSYLVANIA

1.0 INTRODUCTION

Absolute and Relative Bioavailability

Bioavailability is a concept that relates to the absorption of chemicals and how absorption depends upon the physical-chemical properties of the chemical and its medium (e.g., dust, soil, rock, food, water, etc.) and the physiology of the exposed receptor. Bioavailability is normally described as the fraction (or percentage) of a chemical which enters into the blood following an exposure of some specified amount, duration and route (usually oral). In some cases, bioavailability may be measured using chemical levels in peripheral tissues such as liver, kidney, and bone, rather than blood. The fraction or percentage absorbed may be expressed either in absolute terms (absolute bioavailability, ABA) or in relative terms (relative bioavailability, RBA). **Absolute bioavailability** is measured by comparing the amount of chemical entering the blood (or other tissue) following oral exposure to test material with the amount entering the blood (or other tissue) following intravenous exposure to an equal amount of some dissolved form of the chemical. Similarly, **relative bioavailability** is measured by comparing oral absorption of test material to oral absorption of some fully soluble form of the chemical (e.g., either the chemical dissolved in water, or a solid form that is expected to fully dissolve in the stomach). For example, if 100 ug of dissolved lead were administered in drinking water and a total of 50 ug entered the blood, the ABA would be 0.50 (50%). Likewise, if 100 ug of lead in soil were administered and 30 ug entered the blood, the ABA for soil would be 0.30 (30%). If the lead dissolved in water were used as the reference substance for describing the relative amount of lead absorbed from soil, the RBA would be 0.30/0.50 = 0.60 (60%). These values (50% absolute bioavailability of dissolved lead and 30% absolute absorption of lead in soil) are the values currently employed as defaults in EPA's IEUBK model.

It is important to recognize that simple solubility of a test material in water or some other fluid (e.g., a weak acid intended to mimic the gastric contents of a child) may not be a reliable estimator of bioavailability due to the non-equilibrium nature of the dissolution and transport processes that occur in the gastrointestinal tract (Mushak 1991). For example, fluid volume and pH are likely to be changing as a function of time, and transport of lead across the gut will prevent an approach to equilibrium concentrations, especially for poorly soluble lead compounds. However, information on the solubility of lead in different materials is useful in interpreting the importance of solubility as a determinant of bioavailability. To avoid confusion, the term "bioaccessability" is used to refer to the relative amount of lead that dissolves under a specified set of test conditions.

For additional discussion about the concept and application of bioavailability see Goodman et al. (1990), Klaassen et al. (1996), and/or Gibaldi and Perrier (1982).

Using Bioavailability Data to Improve Exposure Calculations for Lead

Data on bioavailability are important for evaluating exposure and potential health effects for a variety of different types of chemicals. This investigation focused mainly on evaluating the bioavailability of lead in various samples of soil or other solid materials from mining, milling or smelting sites. This is because lead may exist, at least in part, as poorly water soluble minerals (e.g., galena), and may also exist inside particles of inert matrix such as rock or slag of variable size, shape and association. These chemical and physical properties may tend to influence (usually decrease) the solubility (bioaccessability) and the absorption (bioavailability) of lead when ingested.

When data are available on the bioavailability of lead in soil, dust, or other soil-like waste material at a site, this information can often be used to improve the accuracy of exposure and risk calculations at that site. The basic equation for estimating the site-specific RBA of a test soil is as follows:

$$ABA_{soil} = ABA_{soluble} \cdot RBA_{soil}$$

where:

ABA_{soil}	=	Absolute bioavailability of lead in soil ingested by a child
$ABA_{soluble}$	=	Absolute bioavailability in children of some dissolved or fully soluble form of lead
RBA_{soil}	=	RBA for soil measured in swine

Based on available information on lead absorption in humans and animals, the EPA estimates that the absolute bioavailability of lead from water and other fully soluble forms of lead is usually about 50% in children. Thus, when a reliable site-specific RBA value for soil is available, it may be used to estimate a site-specific absolute bioavailability as follows:

$$ABA_{soil} = 50\% \cdot RBA_{soil}$$

In the absence of site-specific data, the absolute absorption of lead from soil, dust and other similar media is estimated by EPA to be about 30%. Thus, the default RBA used by EPA for lead in soil and dust compared to lead in water is 30%/50% = 60%. When the measured RBA in soil or dust at a site is found to be less than 60% compared to some fully soluble form of lead, it may be concluded that exposures to and risks from lead in these media at that site are probably lower than typical default assumptions. If the measured RBA is higher than 60%, absorption of and risk from lead in these media may be higher than usually assumed.

2.0 STUDY DESIGN

A standardized study protocol for measuring absolute and relative bioavailability of lead was developed based upon previous study designs and investigations that characterized the young pig model (Weis et al. 1995). The study was performed as nearly as possible within the spirit and guidelines of Good Laboratory Practices (GLP: 40 CFR 792). Standard Operating Procedures (SOPs) that included detailed methods for all aspects of the study were prepared, approved, and distributed to all study members prior to the study. The generalized study design, quality assurance project plan and all standard operating procedures are documented in a project notebook that is available through the administrative record.

2.1 Test Materials

Soil samples were collected from four different locations at the Palmerton site. Each sample was a composite of four subsamples collected from four 1-foot square areas covering a 2-foot by 2-foot area at each sampling location. The depth of the soil collected was 1 to 2 inches. All samples consisted of dry, dusty leaf debris and organic soil. After initial screening, USEPA Region III selected two of the four samples for analysis in the swine bioavailability assay. These were referred to as "Location 2" and "Location 4". Both samples were sieved, and only the fine fraction (particles less than about 250 um in diameter) derived from each sample were evaluated. This is because it is believed that soil particles less than about 250 um are most likely to adhere to the hands and be ingested by hand-to-mouth contact, especially in young children.

Table 2-1 lists the metal content of these samples measured using standard EPA Contract Laboratory program (CLP) methods. Inspection of the data in this table reveals that although the two test materials are similar in some regards, they do differ in the content of some important constituents (e.g., barium, calcium, lead, sodium, and zinc). These data suggest that these two samples are distinct, but it is beyond the scope of this project to attempt to identify the sources of lead and other metals in the soil samples.

Each soil was well mixed and samples were analyzed by electron microprobe in order to identify a) how frequently particles of various lead minerals were observed, b) how frequently different types of mineral particles occur entirely inside particles of rock or slag ("included") and how often they occur partially or entirely outside rock or slag particles ("liberated"), c) the size distribution of particles of each mineral class, and d) approximately how much of the total amount of lead in the sample occurs in each mineral type. This is referred to as "relative lead mass". The results are summarized in Figure 2-1 and in Table 2-2.

As seen in Figure 2-1, the most common form of lead in each soil sample, both in terms of particle frequency and relative lead mass, is manganese lead oxide. Most of the lead-bearing particles are small, with mean lengths of different mineral classes typically ranging from about 5-30 um (Table 2-2). The distribution of particles sizes for each sample is presented graphically in Figure 2.2. As noted above, small particles are often assumed to be more likely to adhere to the hands and be ingested and/or be transported into the house. Further, small

TABLE 2-1 METAL ANALYSIS OF TEST MATERIALS

Chemical	Concentration (ppm)	
	Location 2	Location 4
Aluminum	7750	7850
Antimony	6.0	7.4
Arsenic	110	134
Barium	6850	1090
Beryllium	1.4	2.0
Cadmium	195	319
Calcium	1160	2480
Chromium	30.2	26.6
Cobalt	18.8	17.4
Copper	462	350
Iron	25900	26700
Lead	**3230**	**2150**
Magnesium	725	684
Manganese	6320	9230
Mercury	1.7	1.1
Nickel	15.0	26.8
Potassium	515	512
Selenium	11.8	6.9
Silver	9.5	5.1
Sodium	667	2100
Thallium	1.9	0.85
Vanadium	53.1	49.8
Zinc	6500	19100

FIGURE 2-1 LEAD MINERALS OBSERVED IN SITE SOILS

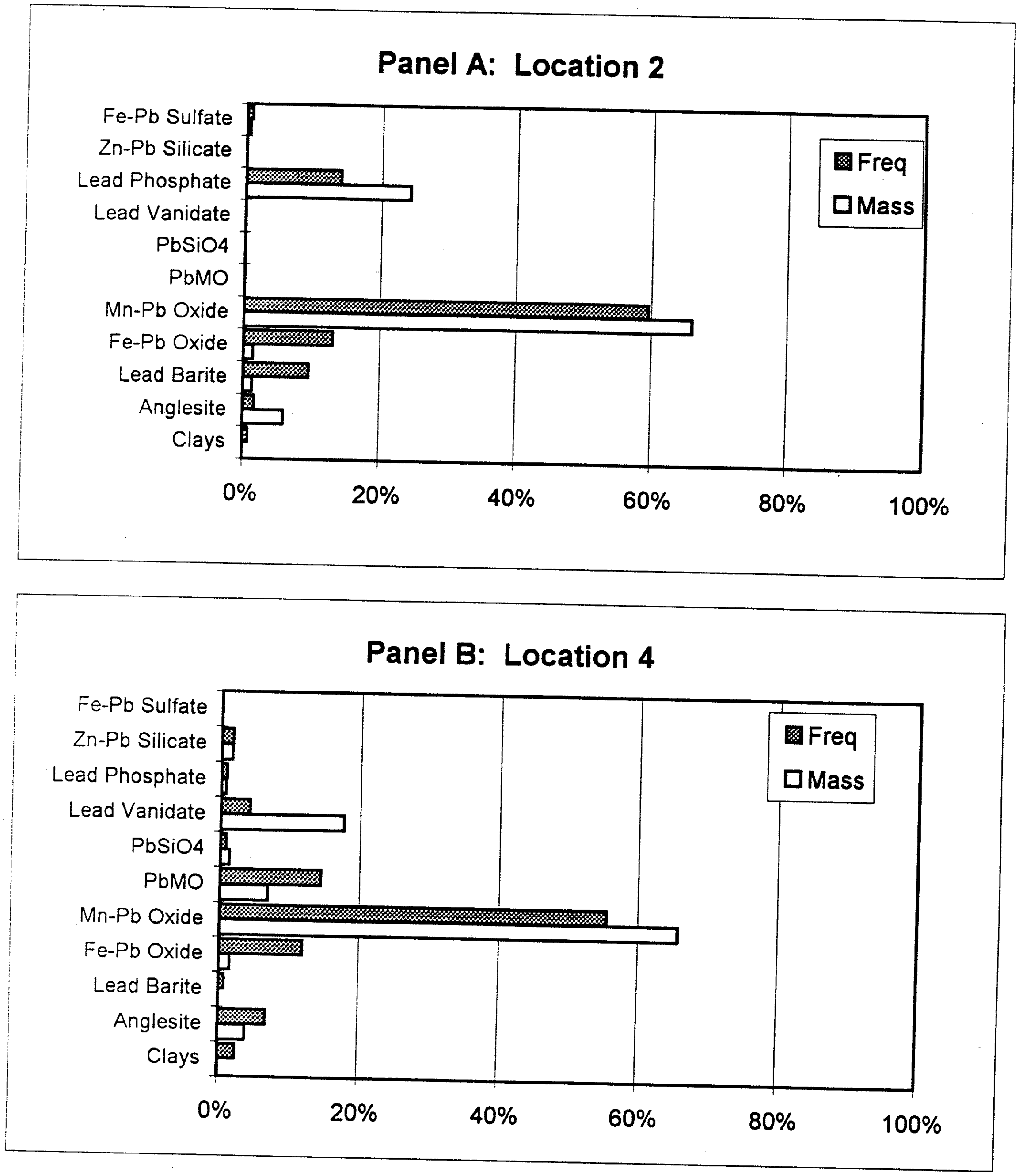
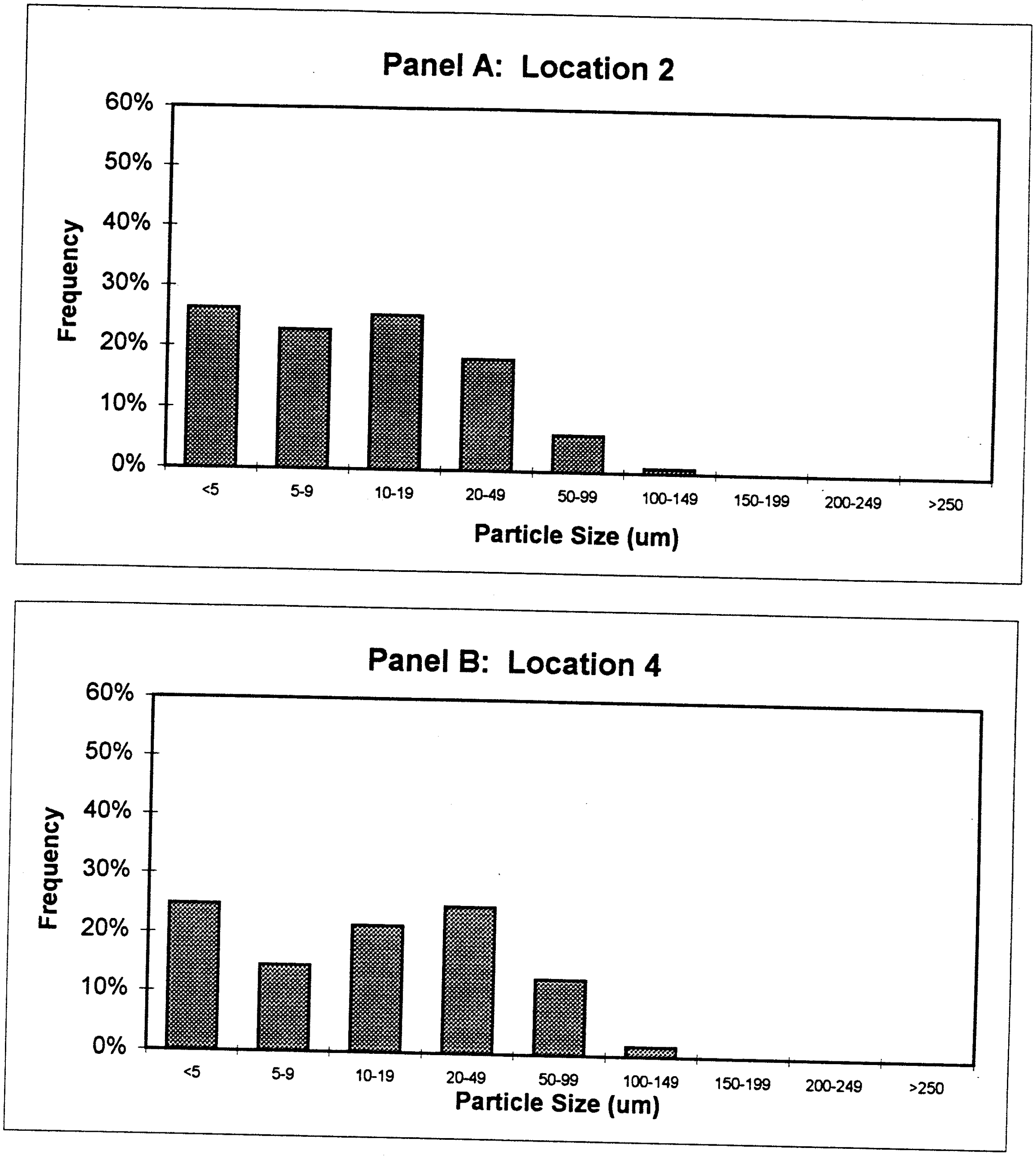


TABLE 2-2 GEOCHEMICAL CHARACTERISTICS OF TEST MATERIALS[a]

Mineral Form	Location 2						Location 4					
	Particle Freq.(%)		Particle Size[d] (um)			Relative Lead Mass[e] (%)	Particle Freq. (%)		Particle size (um)			Relative Lead Mass (%)
	Count-Based[b]	Length-Weighted[c]	min	max	mean		Count-Based	Length-Weighted	min	max	mean	
Clays	0.9%	0.6%	10	10	10	0.03%	2.6%	2.9%	8	45	24	0.1%
Anglesite ($PbSO_4$)	1.8%	0.4%	3	4	4	6.0%	6.8%	0.3%	1	1	1	4.0%
Lead barite	9.6%	5.0%	1	41	8	1.4%	0.9%	0.5%	12	12	12	0.1%
Fe-Pb Oxide	13.2%	7.4%	3	20	8	1.5%	12.0%	9.0%	8	40	16	1.6%
Mn-Pb Oxide	59.6%	68.8%	2	100	17	66.1%	55.6%	80.8%	4	110	31	65.8%
Pb-Metal Oxide	--	--	--	--	--	ND	14.5%	0.7%	1	1	1	7.0%
Pb-Silicate	--	--	--	--	--	ND	0.9%	0.2%	4	4	4	1.4%
Lead Vanidate	--	--	--	--	--	ND	4.3%	3.0%	5	35	15	17.7%
Lead Phosphate	14.0%	17.4%	1	45	19	24.4%	0.9%	0.6%	15	15	15	0.7%
Zn-Pb Silicate	--	--	--	--	--	ND	1.7%	2.1%	12	40	26	1.6%
Fe-Pb Sulfate	0.9%	0.5%	8	8	8	0.6%	--	--	--	--	--	ND

[a] Samples were analyzed using an electron microprobe (JEOL 8600) to identify the number of particles of each lead species present in each sample and the particle size (largest dimension) of each particle.
[b] Percentage of all lead-bearing particles of the mineral form shown
[c] Percentage of total length of all lead particles consisting of mineral form shown
[d] Based on longest dimension of each particle
[e] Rough estimate of the percent of the total mass of lead present in each mineral form

FIGURE 2-2 PARTICLE SIZE DISTRIBUTION



particles have larger surface area-to-volume ratios than larger particles, and so may tend to dissolve more rapidly in the acidic contents of the stomach than larger particles. Thus, small particles (e.g., less than 25-50 um) are thought to be of greater potential concern to humans than larger particles (e.g., 100-250 um or larger).

All of the lead-bearing particles in the sample from Location 2 and most (about 79%) of the particles from Location 4 are "liberated" (i.e., they have some or all of their surface exposed to the outside). This is of potential importance because liberated grains are thought to be more likely to be solubilized by acidic fluids in the stomach that are grains that are entirely confined within a glassy or rocky matrix.

2.2 Experimental Animals

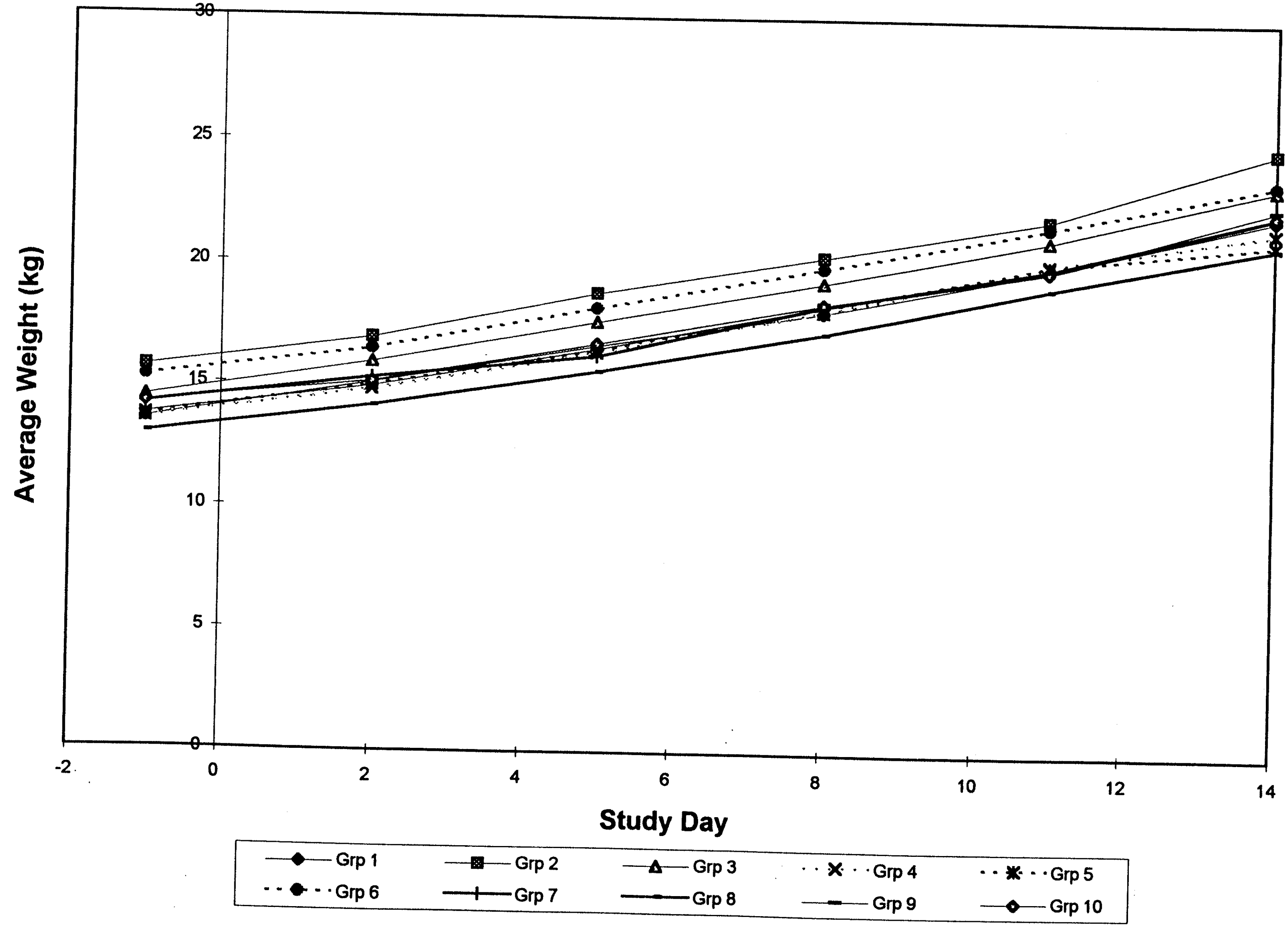
Young swine were selected for use in these studies because they are considered to be a good physiological model for gastrointestinal absorption in children (Weis and LaVelle 1991). The animals were intact males of the Pig Improvement Corporation (PIC) genetically defined Line 26, and were purchased from Chinn Farms, Clarence, MO. The animals were held under quarantine to observe their health for one week before beginning exposure to test materials. To minimize weight variations between animals and groups, the number of animals purchased from the supplier was six more than needed for the study, and the six animals most different in body weight on day -4 (either heavier or lighter) were excluded from further study. The remaining animals were assigned to dose groups at random. When exposure began (day zero), the animals were about 5-6 weeks old (juveniles, weaned at 3 weeks) and weighed an average of about 14.6 kg. Animals were weighed every three days during the course of the study. The group mean body weights over the course of the study are shown in Figure 2-3. On average, animals gained about 0.6 kg/day, and the rate of weight gain was comparable in all groups.

All animals were housed in individual lead-free stainless steel cages. Each animal was examined by a certified veterinary clinician (swine specialist) prior to being placed on study, and all animals were examined daily by an attending veterinarian while on study. Blood samples were collected for clinical chemistry and hematological analysis on days -4, 7, and 15 to assist in clinical health assessments. In this study, there were no animals that were judged by the principal investigator and the veterinary clinician to be seriously ill, and no animals were removed from the study due to concerns over poor health.

2.3 Diet

Animals provided by the supplier were weaned onto standard pig chow purchased from MFA Inc., Columbia, MO. In order to minimize lead exposure from the diet, the animals were gradually transitioned from the MFA feed to a special low-lead feed (guaranteed less than 0.2 ppm lead, purchased from Zeigler Brothers, Inc., Gardners, PA) over the time interval from day -7 to day -3, and this feed was then maintained for the duration of the study. The feed was nutritionally complete and met all requirements of the National Institutes of Health-National Research Council. The typical nutritional components and chemical analysis of the feed is

FIGURE 2-3 BODY WEIGHTS OF TEST ANIMALS



presented in Table 2-3. Typically, the feed contained approximately 5.7% moisture, 1.7% fiber, and provided about 3.4 kcal of metabolizable energy per gram. Periodic analysis of feed samples during this program indicated the mean lead level (treating non-detects at one-half the quantitation limit of 0.05 ppm) was less than 0.05 ppm.

Each day every animal was given an amount of feed equal to 5% of the mean body weight of all animals on study. Feed was administered in two equal portions of 2.5% of the mean body weight at each feeding. Feed was provided at 11:00 AM and 5:00 PM daily. Drinking water was provided ad libitum via self-activated watering nozzles within each cage. Periodic analysis of samples from randomly selected drinking water nozzles indicated the mean lead concentration (treating non-detects at one-half the quantitation limit) was less than 2 ug/L.

2.4 Dosing

The protocol for exposing animals to lead is shown in Table 2-4. The dose levels for lead acetate were based on experience from previous investigations that showed that doses of 25-75 ug Pb/kg/day gave clear and measurable increases in lead levels in all endpoints measured (blood, liver, kidney, bone). The doses of test materials were set at the same level as lead acetate, with one higher dose (225 ug Pb/kg-day) included in case the test materials were found to yield very low responses.

Animals were exposed to lead acetate or test material for 15 days, with the dose for each day being administered in two equal portions given at 9:00 AM and 3:00 PM (two hours before feeding). Doses were based on measured group mean body weights, and were adjusted every three days to account for animal growth. For animals exposed by the oral route, dose material was placed in the center of a small portion (about 5 grams) of moistened feed, and this was administered to the animals by hand. Most animals consumed the dose promptly, but occasionally some animals delayed ingestion of the dose for up to two hours (the time the daily feed portion was provided). These delays are noted in the data provided in Appendix A, but are not considered to be a significant source of error. Occasionally, some animals did not consume some or all of the dose (usually because the dose dropped from their mouth while chewing). All missed doses were recorded and the time-weighted average dose calculation for each animal was adjusted downward accordingly.

For animals exposed by intravenous injection, doses were given via a vascular access port (VAP) attached to an indwelling venous catheter that had been surgically implanted according to standard operating procedures by a board-certified veterinary surgeon through the external jugular vein to the cranial vena cava about 3 to 5 days before exposure began.

Actual mean doses, calculated from the administered doses and the measured body weights, are also shown in Table 2-4.

TABLE 2-3 TYPICAL FEED COMPOSITION[a]

Nutrient Name	Amount	Nutrient Name	Amount
Protein	20.1021%	Chlorine	0.1911%
Arginine	1.2070%	Magnesium	0.0533%
Lysine	1.4690%	Sulfur	0.0339%
Methionine	0.8370%	Manganese	20.4719 ppm
Met+Cys	0.5876%	Zinc	118.0608 ppm
Tryptophan	0.2770%	Iron	135.3710 ppm
Histidine	0.5580%	Copper	8.1062 ppm
Leucine	1.8160%	Cobalt	0.0110 ppm
Isoleucine	1.1310%	Iodine	0.2075 ppm
Phenylalanine	1.1050%	Selenium	0.3196 ppm
Phe+Tyr	2.0500%	Nitrogen Free Extract	60.2340%
Threonine	0.8200%	Vitamin A	5.1892 kIU/kg
Valine	1.1910%	Vitamin D3	0.6486 kIU/kg
Fat	4.4440%	Vitamin E	87.2080 IU/kg
Saturated Fat	0.5590%	Vitamin K	0.9089 ppm
Unsaturated Fat	3.7410%	Thiamine	9.1681 ppm
Linoleic 18:2:6	1.9350%	Riboflavin	10.2290 ppm
Linoleic 18:3:3	0.0430%	Niacin	30.1147 ppm
Crude Fiber	3.8035%	Pantothenic Acid	19.1250 ppm
Ash	4.3347%	Choline	1019.8600 ppm
Calcium	0.8675%	Pyridoxine	8.2302 ppm
Phos Total	0.7736%	Folacin	2.0476 ppm
Available Phosphorous	0.7005%	Biotin	0.2038 ppm
Sodium	0.2448%	Vitamin B12	23.4416 ppm
Potassium	0.3733%		

[a] Nutritional values provided by Zeigler Bros., Inc.

TABLE 2-4 DOSING PROTOCOL

Group	Number of Animals	Dose Material Administered	Exposure Route	Lead Dose (ug Pb/kg-d)	
				Target	Actual[a]
1	7	Lead Acetate	Intravenous	100	106
2	5	None	Oral	0	0
3	5	Lead Acetate	Oral	25	24.9
4	5	Lead Acetate	Oral	75	74.7
5	5	Location 2 soil	Oral	25	25.1
6	5	Location 2 soil	Oral	75	74.9
7	5	Location 2 soil	Oral	225	226
8	5	Location 4 soil	Oral	25	25.2
9	5	Location 4 soil	Oral	75	74.9
10	5	Location 4 soil	Oral	225	224

Doses were administered in two equal portions given at 9:00 AM and 3:00 PM each day. Doses were based on the mean weight of the animals in each group, and were adjusted every three days to account for weight gain.

[a] Calculated as the administered daily dose divided by the measured or extrapolated daily body weight, averaged over days 0-14 for each animal and each group.

2.5 Collection of Biological Samples

Blood

Samples of blood were collected from each animal four days before exposure began (day -4), on the first day of exposure (day 0), and on days 1, 2, 3, 5, 7, 9, 12, and 15 following the start of exposure. All blood samples were collected by vena-puncture of the anterior vena cava, and samples were immediately placed in purple-top Vacutainer® tubes containing EDTA as anticoagulant. Blood samples were collected each sampling day beginning at 8:00 AM, approximately one hour before the first of the two daily exposures to lead on the sampling day and 17 hours after the last lead exposure the previous day. This blood collection time was selected because the rate of change in blood lead resulting from the preceding exposures is expected to be relatively small after this interval (LaVelle et al. 1991, Weis et al. 1993), so the exact timing of sample collection relative to last dosing is not likely to be critical.

Following collection of the final blood sample at 8:00 AM on day 15, all animals were humanely euthanized and samples of liver, kidney and bone (the right femur) were removed and stored in lead-free plastic bags for lead analysis. Samples of all biological samples collected were archived in order to allow for reanalysis and verification of lead levels, if needed, and possibly for future analysis for other metals (arsenic, cadmium, etc.). All animals were also subjected to detailed examination at necropsy by a certified veterinary pathologist in order to assess overall animal health.

2.6 Preparation of Biological Samples for Analysis

Blood

One mL of whole blood was removed from the purple-top Vacutainer and added to 9.0 mL of "matrix modifier", a solution recommended by the Centers for Disease Control and Prevention (CDCP) for analysis of blood samples for lead. The composition of matrix modifier is 0.2% (v/v) ultrapure nitric acid, 0.5% (v/v) Triton X-100, and 0.2% (w/v) dibasic ammonium phosphate in deionized and ultrafiltered water. Samples of the matrix modifier were routinely analyzed for lead to ensure the absence of lead contamination.

Liver and Kidney

One gram of soft tissue (liver or kidney) was placed in a lead-free screw-cap teflon container with 2 mL of concentrated (70%) nitric acid and heated in an oven to 90°C overnight. After cooling, the digestate was transferred to a clean lead-free 10 mL volumetric flask and diluted to volume with deionized and ultrafiltered water.

Bone

The right femur of each animal was removed and defleshed, and dried at 100°C overnight. The dried bones were then placed in a muffle furnace and dry-ashed at 450°C for 48 hours. Following dry ashing, the bone was ground to a fine powder using a lead-free mortar and pestle, and 200 mg was removed and dissolved in 10.0 mL of 1:1 (v:v) concentrated nitric acid/water. After the powdered bone was dissolved and mixed, 1.0 mL of the acid solution was removed and diluted to 10.0 mL by addition of 0.1% (w/v) lanthanum oxide (La_2O_3) in deionized and ultrafiltered water.

2.7 Lead Analysis

Samples of biological tissue (blood, liver, kidney, bone) and other materials (food, water, reagents and solutions, etc.) were arranged in a random sequence and provided to EPA's analytical laboratory in a blind fashion (identified to the laboratory only by a chain of custody tag number). Each sample was analyzed for lead using a Perkin Elmer Model 5100 graphite furnace atomic absorption spectrophotometer. Internal quality assurance samples were run every tenth sample, and the instrument was recalibrated every 15th sample. A blank, duplicate and spiked sample were run every 20th sample.

All results from the analytical laboratory were reported in units of ug Pb/L of prepared sample. The quantitation limit was defined as three-times the standard deviation of a set of seven replicates of a low-lead sample (typically about 2-5 ug/L). The standard deviation was usually about 0.3 ug/L, so the quantitation limit was usually about 0.9-1.0 ug/L (ppb). For prepared blood samples (diluted 1/10), this corresponds to a quantitation limit of 10 ug/L (1 ug/dL). For soft tissues (liver and kidney, diluted 1/10), this corresponds to a quantitation limit of 10 ug/kg (ppb) wet weight, and for bone (final dilution = 1/500) the corresponding quantitation limit is 0.5 ug/g (ppm) ashed weight.

3.0 DATA ANALYSIS

3.1 Overview

Studies on the absorption of lead are often complicated because some biological responses to lead exposure may be non-linear functions of dose (i.e., tending to flatten out or plateau as dose increases). The cause of this non-linearity is uncertain but might be due either to non-linear **absorption kinetics** and/or to non-linear **biological response** per unit dose absorbed. When the dose-response curve for either the reference material (lead acetate) and/or the test material is non-linear, RBA is equal to the ratio of doses that produce equal responses (not the ratio of responses at equal doses). This is based on the simple but biologically plausible assumption that equal absorbed doses yield equal biological responses. Applying this assumption leads to the following general methods for calculating RBA from a set of non-linear experimental data:

1. Plot the biological responses of individual animals exposed to a series of oral doses of soluble lead (e.g., lead acetate). Fit an equation which gives a smooth line through the observed data points.

2. Plot the biological responses of individual animals exposed to a series of doses of test material. Fit an equation which gives a smooth line through the observed data.

3. Using the best fit equations for reference material and test material, calculate RBA as the ratios of doses of test material and reference material which yield equal biological responses. Depending on the relative shape of the best-fit lines through the lead acetate and test material dose response curves, RBA may either be constant (dose-independent) or variable (dose-dependent).

The principal advantage of this approach is that it is not necessary to understand the basis for a non-linear dose response curve (non-linear absorption and/or non-linear biological response) in order to derive valid RBA estimates. Also, it is important to realize that this method is very general, as it will yield correct results even if one or both of the dose-response curves are linear. In the case where both curves are linear, RBA is dose-independent and is simply equal to the ratio of the slopes of the best-fit linear equations.

3.2 Fitting the Curves

There are a number of different mathematical equations which can yield reasonable fits with the dose-response data sets obtained in this study. Conceptually, any equation which gives a smooth fit would be acceptable, since the main purpose is to allow for interpolation of responses between test doses. In selecting which equations to employ, the following principles were applied: 1) mathematically simple equations were preferred over mathematically complex equations, 2) the shape of the curves had to be smooth and biologically realistic, without inflection points, maxima or minima, and 3) the general form of the equations had to be able to fit data not only from this one study, but from all the studies that are part of this project. After testing a wide variety of different equations, it was found that all data sets could be well fitted using one of the following three forms:

Linear (LIN): Response $= a + b \cdot \text{Dose}$

Exponential (EXP): Response $= a + c \cdot (1\text{-}\exp(\text{-}d \cdot \text{Dose}))$

Combination (LIN+EXP): Response $= a + b \cdot \text{Dose} + c \cdot (1\text{-}\exp(\text{-}d \cdot \text{Dose}))$

Although underlying mechanism was not considered in selecting these equations, the linear equation allows fitting data that do not show evidence of saturation in either uptake or response, while the exponential and mixed equations allow evaluation of data that appear to reflect some degree of saturation in uptake and/or response.

Each dose-response data set was fit to each of the equations above. If one equation yielded a fit that was clearly superior (as judged by the value of the adjusted correlation coefficient R^2) to the others, that equation was selected. If two or more models fit the data approximately equally well, then the simplest model (that with the fewest parameters) was selected. In the process of finding the best-fits of these equations to the data, the values of the parameters (a, b, c, and d) were subjected to some constraints, and some data points (those that were outside the 95% prediction limits of the fit) were excluded. These constraints and outlier exclusion steps are detailed in Appendix A (Section 3). In general, most blood lead AUC dose-response curves were best fit by the exponential equation, and most dose-response curves for liver, kidney and bone were best fit by linear equations.

3.3 Responses Below Quantitation Limit

In some cases, most or all of the responses in a group of animals were below the quantitation limit for the endpoint being measured. For example, this was normally the case for blood lead values in unexposed animals (both on day -4 and day 0, and in control animals), and also occurred during the early days in the study for animals given test materials with low bioavailability. In these cases, all animals which yielded responses below the quantitation limit were evaluated as if they had responded at one-half the quantitation limit.

3.4 Quality Assurance

A number of steps were taken throughout this study and the other studies in this project to ensure the quality of the results. These steps are summarized below.

Duplicates

A randomly selected set of about 5% of all samples generated during the study were submitted to the laboratory in a blind fashion for duplicate analysis. The raw data are presented in Appendix A, and Figure 3-1 plots the results for blood (Panel A, upper) and for bone, liver and kidney (Panel B, lower). As seen, there was good intra-laboratory reproducibility between duplicate samples for both blood and tissues, with linear regression lines having a slope near 1.0, an intercept near zero, and an R^2 value near 1.0.

Standards

The Centers for Disease Control and Prevention (CDCP) provides a variety of blood lead "check samples" for use in quality assurance programs for blood lead studies. Each time a group of blood samples was prepared and sent to the laboratory for analysis, several CDCP check samples of different concentrations were included in random order and in a blind fashion.

The results for the samples submitted during this study are presented in Appendix A, and the values are plotted in Figure 3-2 (Panel A, upper). As seen, the analytical results obtained for the check samples tended to be low for the "low" and "medium" standards employed (nominal concentrations = 1.7 ug/dL and 4.8 ug/dL). Although there was some scatter in the results for the "high" check sample, the mean of all results (14.5 ug/dL) is close to the nominal value of this standard (14.9 ug/dL).

Interlaboratory Comparison

An interlaboratory comparison of blood lead analytical results was performed by sending a set of 20 randomly selected whole blood samples from this study to CDCP for blind independent preparation and analysis. The results are presented in Appendix A, and the values are plotted in Figure 3-2 (Panel B, lower). As seen, the values obtained by EPA tended to be slightly lower (about 15%) than the values reported by CDCP. The reason for this apparent discrepancy between the EPA laboratory and the CDCP laboratory is not clear, but might be related to differences in sample preparation techniques. Regardless of the reason, the differences are sufficiently small that they are likely to have no significant effect on calculated RBA values. In particular, it is important to realize that if both the lead acetate and test soils dose-response curves are biased by the same factor, then the biases cancel in the calculation of the ratio.

Data Audits and Spreadsheet Validation

All analytical data generated by EPA's analytical laboratory were validated prior to being released in the form of a database file. These electronic data files were "decoded" (linking the sample tag to the correct animal and day) using Microsoft's database system ACCESS® (Version 5 for Windows). To ensure that no errors occurred in this process, original electronic files were printed out and compared to printouts of the tag assignments and the decoded data.

FIGURE 3-1 COMPARISION OF DUPLICATE ANALYSES PALMERTON

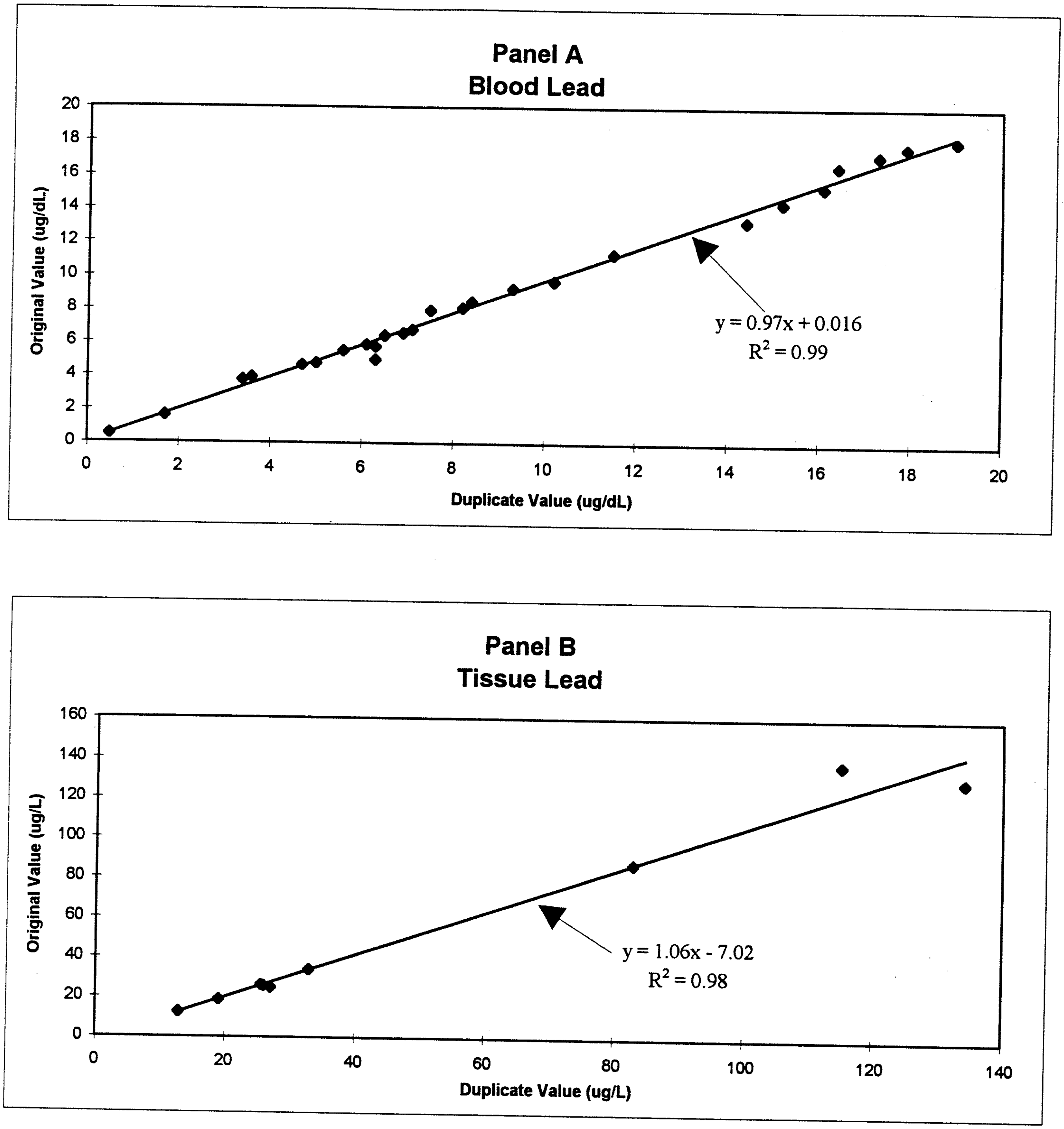
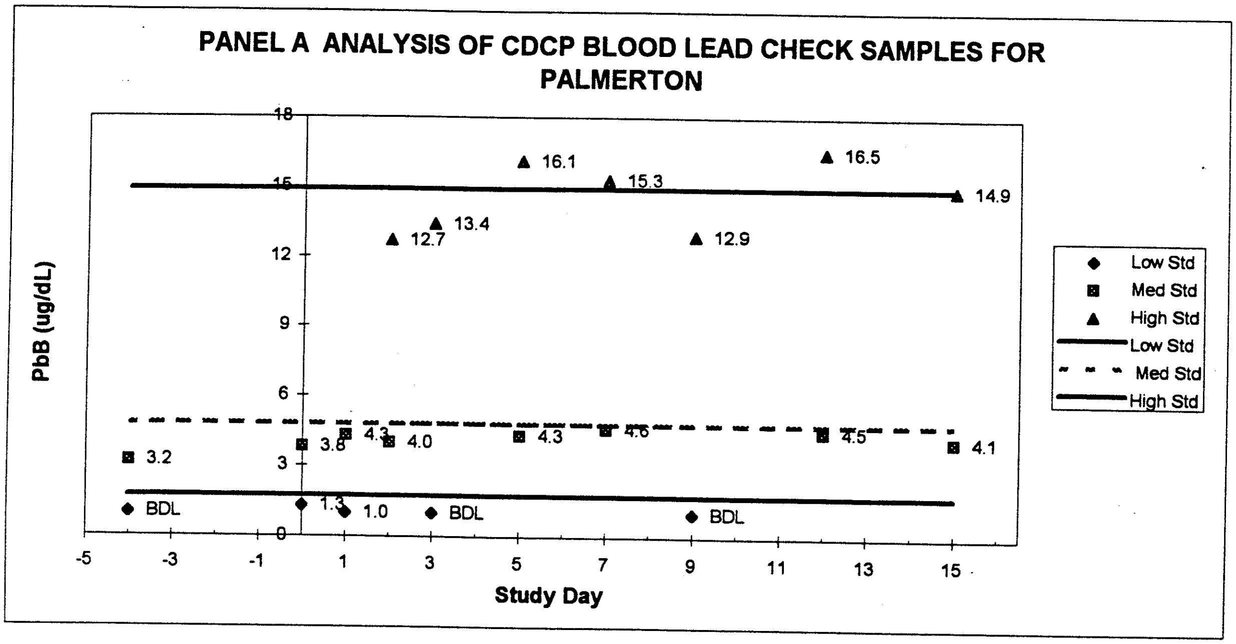
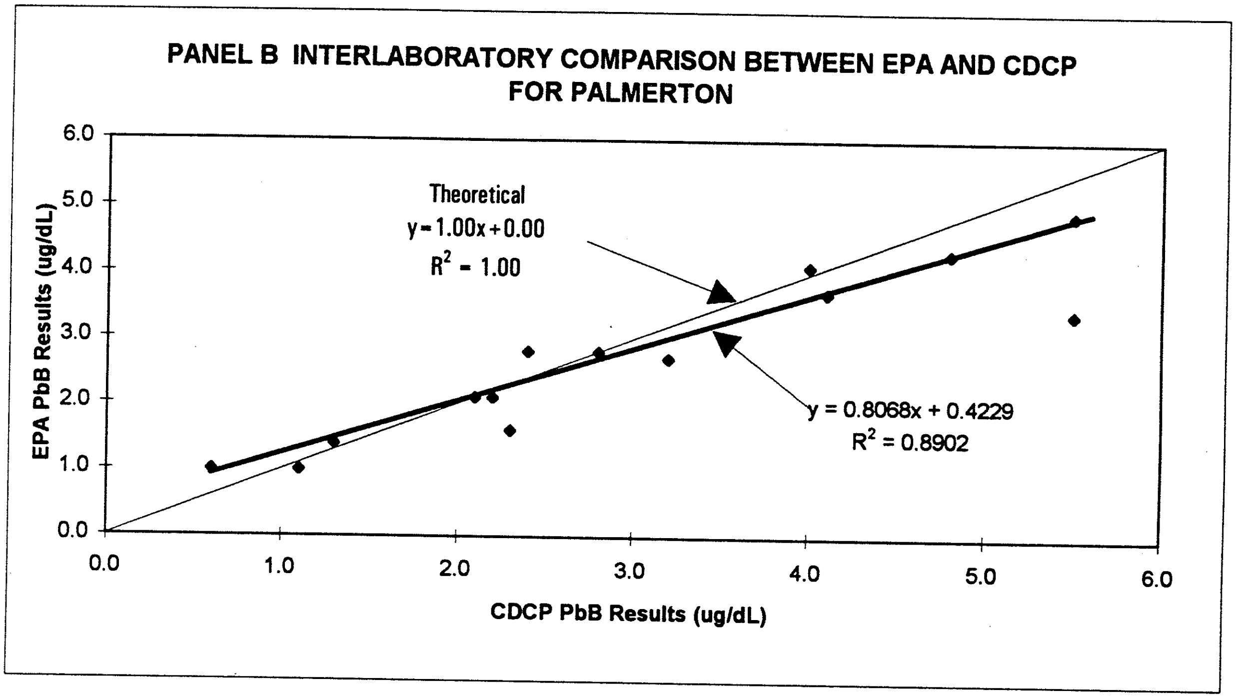


FIGURE 3-2 CDCP CHECK SAMPLES FOR PALMERTON NPL SITE





All spreadsheets used to manipulate the data and to perform calculations (see Appendix A) were validated by hand-checking random cells for accuracy.

4.0 RESULTS

The following sections provide results based on the group means for each dose group investigated in this study. Appendix A provides detailed data for each individual animal. Results from this study will be compared and contrasted with the results from other studies in a subsequent report.

4.1 Blood Lead vs Time

Figure 4-1 shows the group mean blood lead values as a function of time during the study. As seen, blood lead values began at or below quantitation limits (about 1 ug/dL) in all groups, and remained at or below quantitation limits in control animals (Group 2). In animals given repeated oral doses of lead acetate (Groups 3 and 4), Location 2 soil (Groups 5-7, upper panel), or Location 4 soil (Groups 8-10, lower panel), blood levels began to rise within 1-2 days, and tended to plateau by the end of the study (day 15). A similar pattern was observed in animals exposed to lead acetate by intravenous injection (Group 1).

4.2 Dose-Response Patterns

<u>Blood Lead</u>

The measurement endpoint used to quantify the blood lead response was the area under the curve (AUC) for blood lead vs time (days 0-15). AUC was selected because it is the standard pharmacokinetic index of chemical uptake into the blood compartment, and is relatively insensitive to small variations in blood lead level by day. The AUC was calculated using the trapezoidal rule to estimate the AUC between each time point that a blood lead value was measured (days 0, 1, 2, 3, 5, 7, 9, 12, and 15), and summing the areas across all time intervals in the study. The detailed data and calculations are presented in Appendix A, and the results are shown graphically in Figure 4-2. Each data point reflects the group mean exposure and group mean response, with the variability in dose and response shown by standard error bars. The figure also shows the best-fit equation through each data set.

As seen, the dose response pattern is non-linear for both the soluble reference material (lead acetate, abbreviated "PbAc"), and for each of the two test soils. Dose response curves for soil from both Location 2 and Location 4 are lower than those seen for lead acetate, with Location 4 being the lowest.

<u>Tissue Lead</u>

The dose-response data for lead levels in bone, liver and kidney (measured at sacrifice on day 15) are detailed in Appendix A, and are shown graphically in Figures 4-3 through 4-5, respectively.

FIGURE 4-1 GROUP MEAN BLOOD LEAD BY DAY FOR NEW JERSEY ZINC NPL SITE, PALMERTON, PA

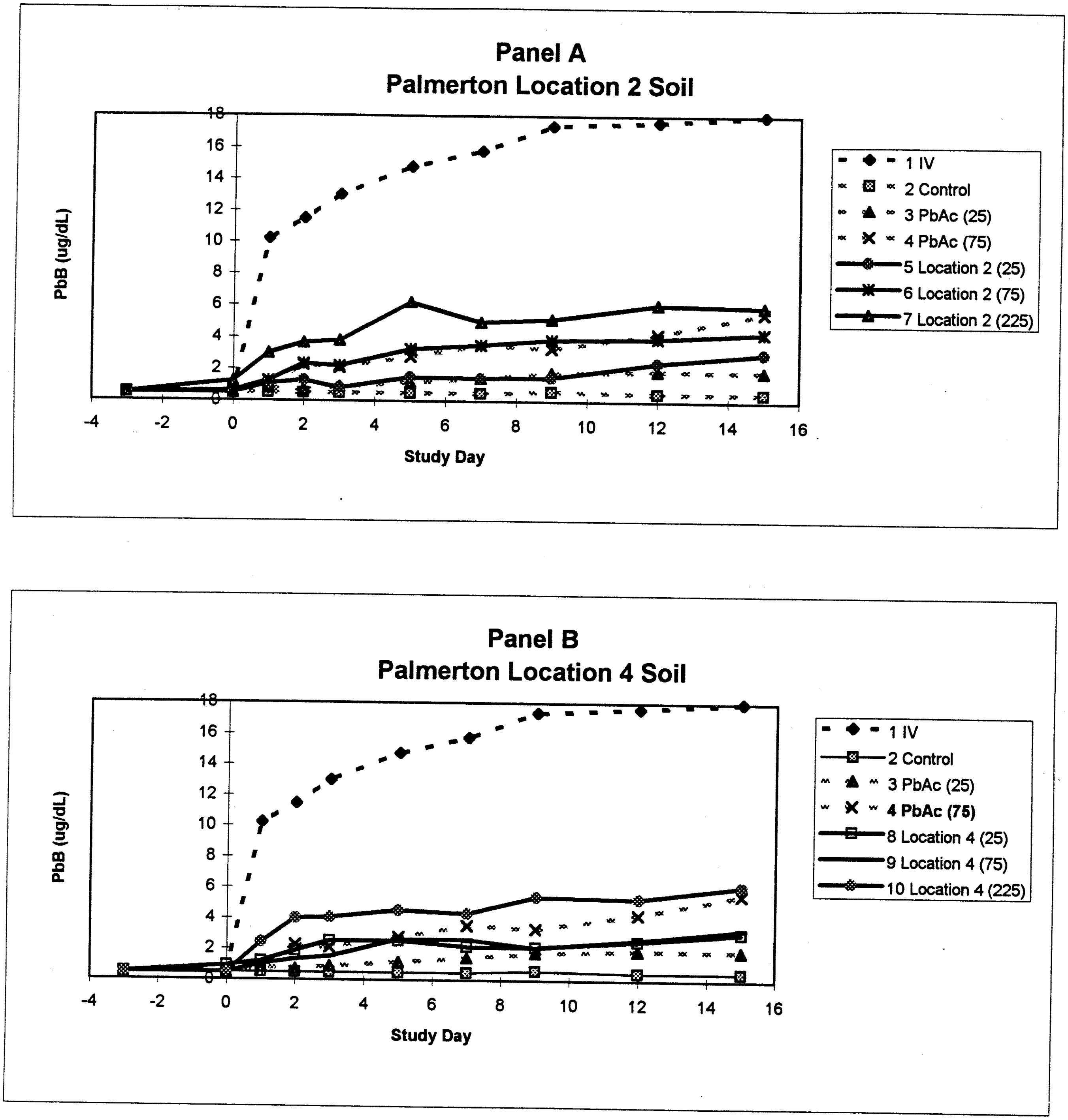


FIGURE 4-2 BLOOD LEAD DOSE-RESPONSE, GROUP MEANS ± SEMS FOR NEW JERSEY ZINC NPL SITE, PALMERTON, PA

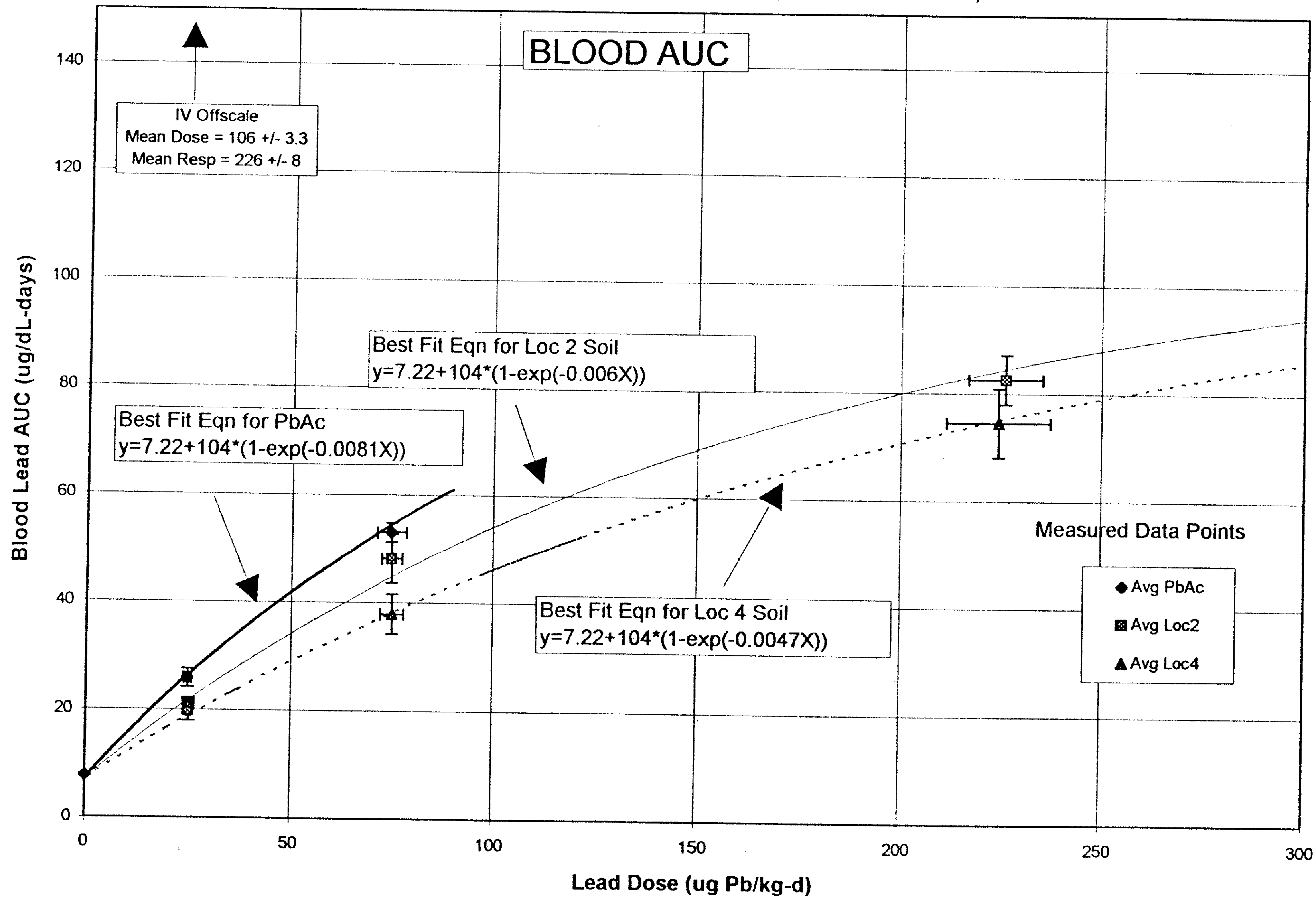


FIGURE 4-3 BONE LEAD DOSE-RESPONSE, GROUP MEANS ± SEMS FOR NEW JERSEY ZINC NPL SITE, PALMERTON, PA

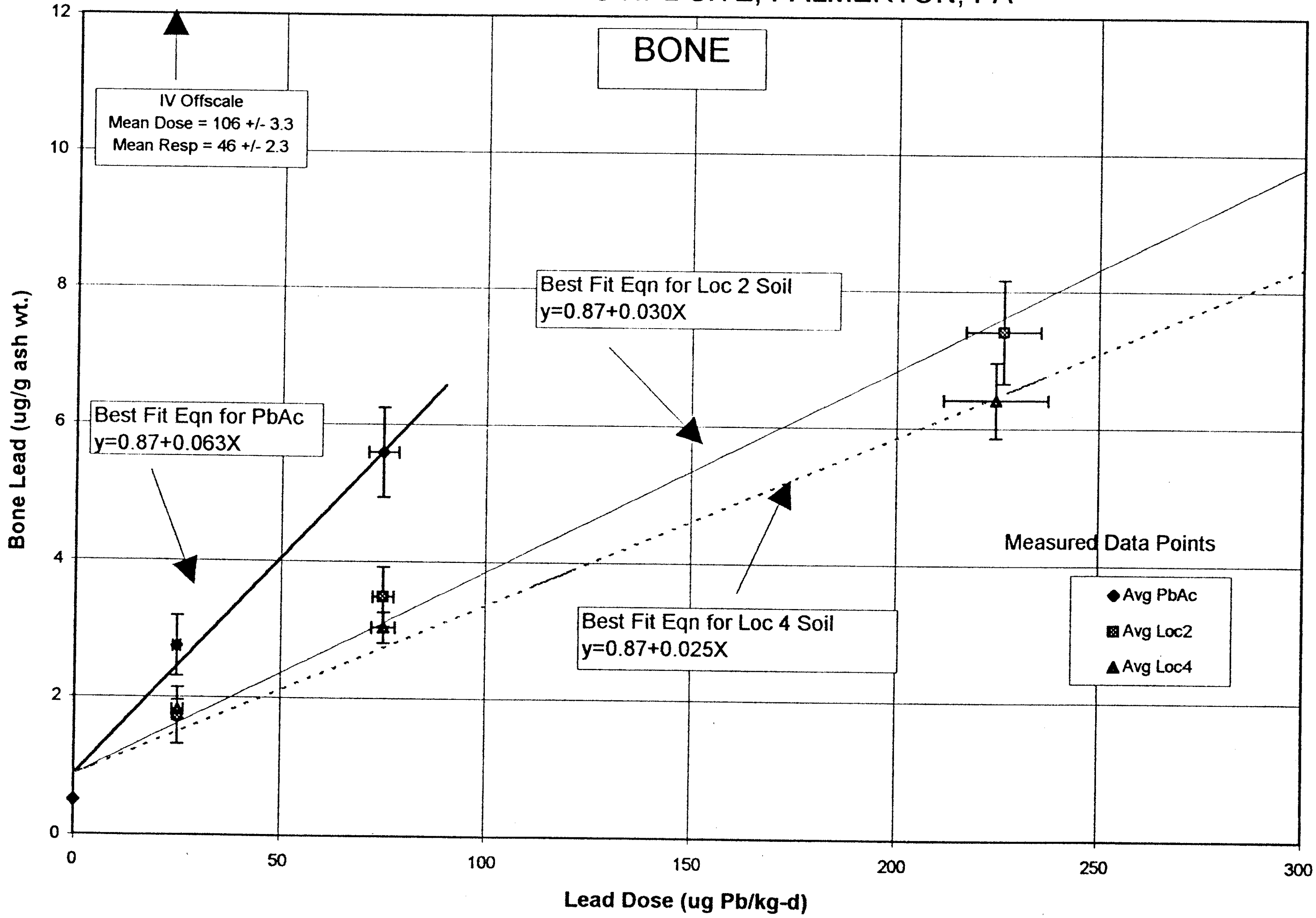


FIGURE 4-4 LIVER LEAD DOSE-RESPONSE, GROUP MEANS ± SEMS FOR NEW JERSEY ZINC NPL SITE, PALMERTON, PA

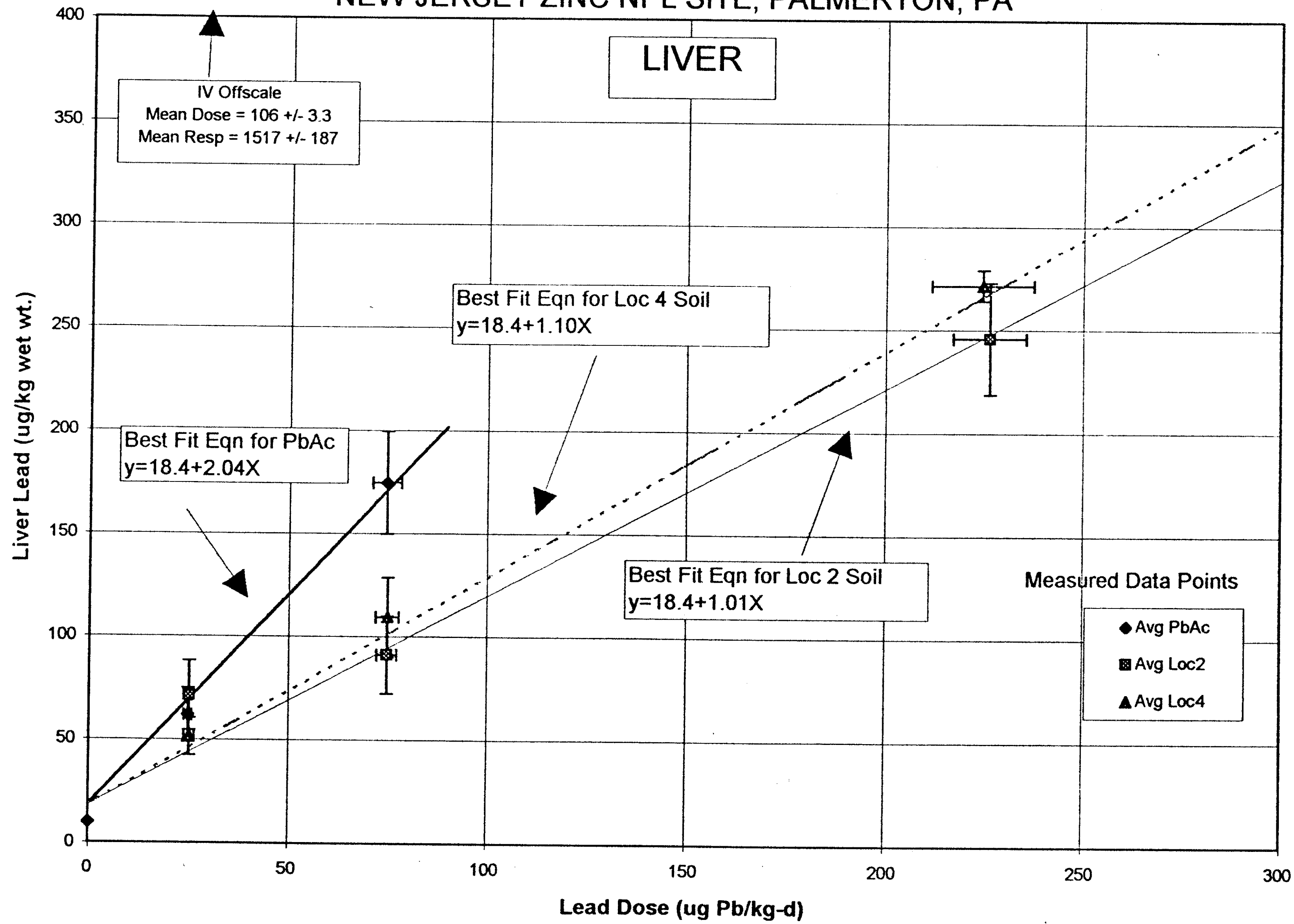
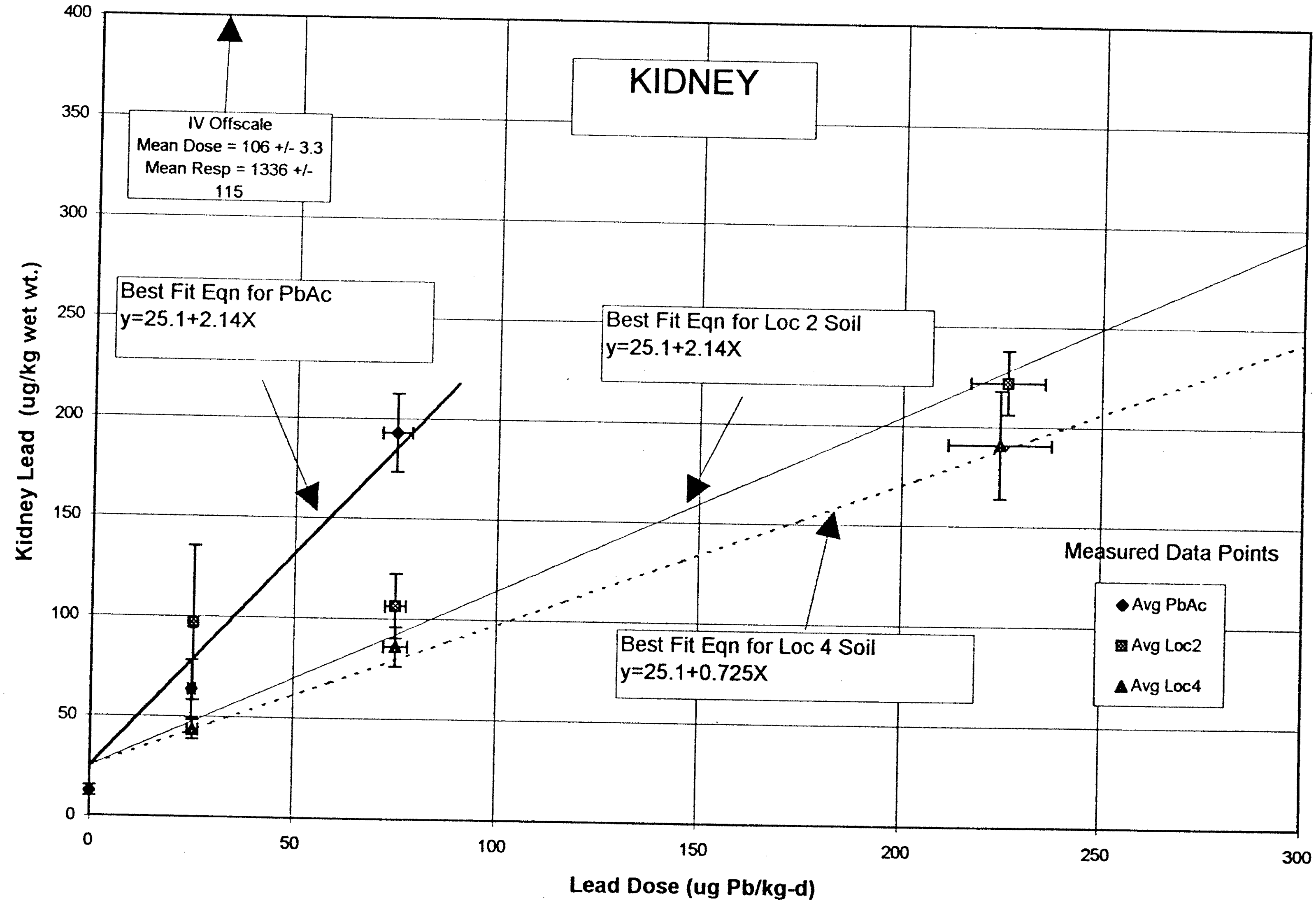


FIGURE 4-5 KIDNEY LEAD DOSE-RESPONSE, GROUP MEANS ± SEMS FOR NEW JERSEY ZINC NPL SITE, PALMERTON, PA



As seen, all of these dose response curves for tissues are fit by linear equations. The responses of the two test soils tend to be generally similar to each other, and the responses for each of the three tissues (liver, bone and kidney) all appear to be lower than for lead acetate.

4.3 Calculated RBA Values

Relative bioavailability values were calculated for each test material for each measurement endpoint (blood, bone, liver, kidney) using the method described in Section 3.0. The results are shown below:

Measurement Endpoint	Test material	
	Location 2	Location 4
Blood Lead AUC	0.74	0.58
Liver Lead	0.50	0.39
Kidney Lead	0.42	0.54
Bone Lead	0.47	0.34

Recommended RBA Values

As shown above, for each test material, there are four independent estimates of RBA (based on blood, liver, kidney, and bone), and the values do not agree in all cases. In general, we recommend greatest emphasis be placed on the RBA estimates derived from the blood lead data. There are several reasons for this recommendation, including the following:

1) Blood lead calculations are based on multiple measurements over time, and so are statistically more robust than the single measurements available for tissue concentrations. Further, blood is a homogeneous medium, and is easier to sample than complex tissues such as liver, kidney and bone. Consequently, the AUC endpoint is less susceptible to random measurement errors, and RBA values calculated from AUC data are less uncertain.

2. Blood is the central compartment and one of the first compartments to be affected by absorbed lead. In contrast, uptake of lead into peripheral compartments (liver, kidney, bone) depend on transfer from blood to the tissue, and may be subject to a variety of toxicokinetic factors that could make bioavailability determinations more complicated.

3. The dose-response curve for blood lead is non-linear, similar to the non-linear dose-response curve observed in children (e.g., see Sherlock and Quinn 1986). Thus, the response of this endpoint is known to behave similarly in swine as in children, and it is not known if the same is true for the tissue endpoints.

4. Blood lead is the classical measurement endpoint for evaluating exposure and health effects in humans, and the health effects of lead are believed to be proportional to blood lead levels.

However, data from the tissue endpoints (liver, kidney, bone) also provide valuable information. We consider the plausible range to extend from the RBA based on blood AUC to the mean of the other three tissues (liver, kidney, bone). The preferred range is the interval from the RBA based on blood to the mean of the blood RBA and the tissue mean RBA. Our suggested point estimate is the mid-point of the preferred range. These values are presented below:

Relative Bioavailability of Lead	Test Material	
	Location 2	Location 4
Plausible Range	0.74-0.46	0.58-0.42
Preferred Range	0.74-0.60	0.58-0.50
Suggested Point Estimate	0.67	0.54

4.4 Estimated Absolute Bioavailability in Children

These RBA estimates may be used to help assess lead risk at this site by refining the estimate of absolute bioavailability (ABA) of lead in soil, as follows:

$$ABA_{soil} = ABA_{soluble} \cdot RBA_{soil}$$

Available data indicate that fully soluble forms of lead are about 50% absorbed by a child (USEPA 1991, 1994). Thus, the estimated absolute bioavailability of lead in site soils are calculated as follows:

$$ABA_{Location\ 2} = 50\% \cdot RBA_{Location\ 2}$$

$$ABA_{Location\ 4} = 50\% \cdot RBA_{Location\ 4}$$

Based on the RBA values shown above, the estimated absolute bioavailabilities in children are as follows:

Absolute Bioavailability of Lead	Test Material	
	Location 2	Location 4
Plausible Range	37%-23%	29%-21%
Preferred Range	37%-30%	29%-25%
Suggested Point Estimate	34%	27%

4.5 Uncertainty

These absolute bioavailability estimates are appropriate for use in EPA's IEUBK model for this site, although it is clear that there is both variability and uncertainty associated with these estimates. This variability and uncertainty arises from several sources. First, differences in physiological and pharmacokinetic parameters between individual animals leads to variability in response even when exposure is the same. Because of this inter-animal variability in the responses of different animals to lead exposure, there is mathematical uncertainty in the best fit dose-response curves for both lead acetate and test material. This in turn leads to uncertainty in the calculated values of RBA, because these are derived from the two best-fit equations. Second, there is uncertainty in how to weight the RBA values based on the different endpoints, and how to select a point estimate for RBA that is applicable to typical site-specific exposure levels. Third, there is uncertainty in the extrapolation of measured RBA values in swine to young children. Even though the immature swine is believed to be a useful and meaningful animal model for gastrointestinal absorption in children, it is possible that differences in stomach pH, stomach emptying time, and other physiological parameters may exist and that RBA values in swine may not be precisely equal to values in children. Finally, studies in humans reveal that lead absorption is not constant even within an individual, but varies as a function of many factors (mineral intake, health status, etc.). One factor that may be of special importance is time after the last meal, with the presence of food tending to reduce lead absorption. The values of RBA measured in this study are intended to estimate the maximum uptake that occurs when lead is ingested in the absence of food. Thus, these values may be somewhat conservative for children who ingest lead along with food. The magnitude of this bias is not known, although preliminary studies in swine suggest the factor may be relatively minor.

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APPENDIX A

DETAILED DATA AND CALCULATIONS FOR USEPA SWINE BIOAVAILABILITY STUDY PHASE II, EXPERIMENT 9

NEW JERSEY ZINC NPL SITE PALMERTON, PA

APPENDIX A

DETAILED DATA SUMMARY

1.0 OVERVIEW

Performance of this study involved collection and reduction of a large number of data items. All of these data items and all of the data reduction steps are contained in a Microsoft Excel spreadsheet named "PALMERTN.XLS" that is available upon request from the administrative record. This file is intended to allow detailed review and evaluation by outside parties of all aspects of the study.

The following sections of this Appendix present printouts of selected tables and graphs from the XLS file. These tables and graphs provide a more detailed documentation of the individual animal data and the data reduction steps performed in this study than was presented in the main text. Any additional details of interest to a reader can be found in the XLS spreadsheet.

2.0 RAW DATA AND DATA REDUCTION STEPS

2.1 Body Weights and Dose Calculations

Animals were weighed on day -1 (one day before exposure) and every three days thereafter during the course of the study. Doses of lead for the three days following each weighing were based on the group mean body weight, adjusted by addition of 1 kg to account for the expected weight gain over the interval. After completion of the experiment, body weights were estimated by interpolation for those days when measurements were not collected, and the actual administered doses (ug Pb/kg) were calculated for each day and then averaged across all days. If an animal missed a dose or was given an incorrect dose, the calculation of average dose corrected for these factors. These data and data reduction steps are shown in Tables A-1 and A-2. Doses which required adjustment are shown by a heavy black box outlining the value in Table A-1.

2.2 Blood Lead vs Time

Blood lead values were measured in each animal on days -4, 0, 1, 2, 3, 5, 7, 9, 12, and 15. The raw laboratory data (reported as ug/L of diluted blood) are shown in Table A-3. These data were adjusted as follows: a) non-detects were evaluated by assuming a value equal to one-half the quantitation limit, and b) the concentrations in diluted blood were converted to units of ug/dL in whole blood by dividing by a factor of 1 dL of blood per L of diluted sample. The results are shown in the right-hand column of Table A-3. Figures A-1 to A-3 plot the results for individual animals organized by group and by day. Figure A-4 plots the mean for each dosing group by day.

After adjustment as above, values that were more than a factor of 1.5 above or below the group mean for any given day were "flagged" by computer as potential outliers. These values are shown in Table A-4 by cells that are shaded gray. Each data point identified in this way was reviewed and professional judgment was used to decide if the value should be retained or excluded. In order to avoid inappropriate biases, blood lead outlier designations were restricted to values that were clearly aberrant from a time-course and/or dose-response perspective. In this study, none of the flagged values were excluded (Table A-5).

2.3 Blood Lead AUC

The area under the blood lead vs time curve for each animal was calculated by finding the area under the curve for each time step using the trapezoidal rule:

$$AUC(d_i \text{ to } d_j) = 0.5*(r_i+r_j)*(d_j-d_i)$$

where:

d = day number
r = response (blood lead value) on day i (r_i) or day j (r_j)

The areas were then summed for each of the time intervals to yield the final AUC for each animal. These calculations are shown in Table A-6. If a blood lead value was missing (either because of problems with sample preparation, or because the measured value was excluded as an outlier), the blood lead value for that day was estimated by linear interpolation.

2.4 Liver, Kidney and Bone Lead Data

At sacrifice (day 15), samples of liver, kidney and bone (femur) were removed and analyzed for lead. The raw data (expressed as ug Pb/L of prepared sample) are summarized in Table A-7. These data were adjusted as follows: a) non-detects were evaluated by assuming a value equal to one-half the quantitation limit, and b) the concentrations in prepared sample were converted to units of concentration in the original biological sample by dividing by the following factors:

Liver:	0.1 kg wet weight/L prepared sample
Kidney:	0.1 kg wet weight/L prepared sample
Bone:	2 gm ashed weight/L prepared sample

The resulting values are shown in the right-hand column of Table A-7.

3.0 CURVE FITTING

Basic Equations

A commercial curve-fitting program (Table Curve-2D™ Version 2.0 for Windows, available from Jandel Scientific) was used to derive best fit equations for each of the individual dose-response data sets derived above. A least squares regression method was used for both linear and non-linear equations. As discussed in the text, three different user-defined equations were fit to each data set:

Linear (LIN):	$\text{Response} = a + b \cdot \text{Dose}$
Exponential (EXP):	$\text{Response} = a + c \cdot (1\text{-exp}(\text{-}d \cdot \text{Dose}))$
Combination (LIN+EXP):	$\text{Response} = a + b \cdot \text{Dose} + c \cdot (1\text{-exp}(\text{-}d \cdot \text{Dose}))$

Constraints

In the process of finding the best-fits of these equations to the data, the values of the parameters (a, b, c, and d) were constrained as follows:

- Parameter "a" (the intercept, equal to the baseline or control value of the measurement endpoint) was constrained to be non-negative and was forced in all cases to be the same for the reference material (lead acetate) and the test materials. This is because, by definition, all dose-response curves for groups of animals exposed to different materials must arise from the same value at zero dose. In addition, for blood lead data, "a" was constrained to be equal to the mean of the control group ± 20% (typically 7.5 ± 1.5 AUC units).

- Parameter "b" (the slope of the linear dose-response line) was constrained to non-negative values, since all of the measurement endpoints evaluated are observed to increase, not decrease, as a function of lead exposure.

- Parameter "c" (the plateau value of the exponential curve) was constrained to be non-negative, and was forced to be the same for the reference material (lead acetate) and the test material. This is because: 1) it is expected on theoretical grounds that the plateau (saturation level) should be the same regardless of the source of lead, and 2) curve-fitting of individual curves tended to yield values of "c" that were close to each other and were not statistically different.

- Parameter "d" (which determines where the "bend" in the exponential equation occurs) was constrained to be greater than 0.0045 for the lead acetate blood lead (AUC) dose-response curve. This constraint was judged to be necessary because the weight of evidence from all studies clearly showed the lead acetate blood lead dose response curve was non-linear and was best fit by an exponential equation, but in some studies there were only two low doses of lead acetate used to define the dose-response curve, and this narrow range data set could sometimes be fit nearly as well by a linear as an exponential curve. The choice of the constraint on "d" was selected to be slightly lower than the observed best-fit value of "d" (0.006) when data from all lead acetate AUC dose-response curves from all of the different studies in this program were used. This approach may tend to underestimate relative bioavailability slightly in some studies (especially at low dose), but use of the information gained from all studies is judged to be more robust than basing fits solely on the data from one study.

In general, one of these models (the linear, the exponential, or the combination) usually yielded a fit (as judged by the value of the adjusted correlation coefficient R^2 and by visual inspection of the fit of the line through the measured data points) that was clearly superior to the others. If two or more models fit the data approximately equally well, then the simplest model (that with the fewest parameters) was selected.

Outlier Identification

During the dose-response curve fitting process, all data were carefully reviewed to identify any anomalous values. Typically, the process used to identify outliers was as follows:

Step 1 — Any data points judged to be outliers based on information derived from analysis of data across multiple studies (as opposed to conclusions drawn from within the study) were excluded.

Step 2 — The remaining raw data points were fit to the equation judged to be the most likely to be the best fit (linear, exponential, or mixed). Table Curve 2-D was then used to plot the 95% prediction limits around the best fit line. All data points that fell outside the 95% prediction limits were considered to be outliers and were excluded.

Step 3 — After excluding these points (if any), a new best-fit was obtained. In some cases, data points originally inside the 95% prediction limits were now outside the limits. However, further iterative cycles of data point exclusion were not performed, and the fit was considered final.

It should be noted that professional judgment can be imposed during any stage of the above outlier identification process. In this study, one additional data point was determined to be an outlier and excluded from analysis.

Curve Fit Results

Table A-8 lists the data used to fit these curves, indicating which endpoints were excluded as outliers and why. Table A-9 shows the type of equation selected to fit each data set, and the best fit parameters. The resulting best-fit equations for the data sets are shown in Figures A-5 to A-16. Values excluded as outliers are represented in the figures by the symbol "+".

4.0 RESULTS -- CALCULATED RBA VALUES

The value of RBA for a test substance was calculated for a series of doses using the following procedure:

1. For each dose, calculate the expected response to test material, using the best fit equation through the dose-response data for that material.

2. For each expected response to test material, calculate the dose of lead acetate that is expected to yield an equivalent response. This is done by "inverting" the dose-response curve for lead acetate, solving for the dose that corresponds to a specified response.

3. Calculate RBA at that dose as the ratio of the dose of lead acetate to the dose of test material. For the situation where both curves are linear, the value of RBA is the ratio of the slopes (the "b" parameters). In the case where both curves are exponential and where both curves have the same values for parameters "a" and "c", the value of RBA is equal to the ratio of the "d" parameters.

The results are summarized in Table A-10.

5.0 QUALITY ASSURANCE DATA

A number of steps were taken throughout this study and the other studies in this project to ensure the quality of the results, including 5% duplicates, 5% standards, a program of interlaboratory comparison. These steps are detailed below.

Duplicates

Duplicate samples were prepared and analyzed for about 5% of all samples generated during the study. Table A-11 lists the first and second values for blood, liver, kidney, and bone. The results are shown in Figure 3-1 in the main text.

Standards

The Centers for Disease Control and Prevention (CDCP) provides a variety of blood lead "check samples" for use in quality assurance programs for blood lead studies. Each time a group of blood samples was prepared and sent to the laboratory for analysis, several CDCP check samples of different concentrations were included. Table A-12 lists the concentrations reported by the laboratory compared to the nominal concentrations indicated by CDCP for the samples submitted during this study, and the results are plotted in Figure 3-2 in the main text.

Interlaboratory Comparison

An interlaboratory comparison of blood lead analytical results was performed by sending a set of 15 randomly selected whole blood samples from this study to CDCP for independent analysis. The data are presented in Table A-13, and the results are plotted in Figure 3-3 in the main text.

TABLE A-1 BODY WEIGHTS AND ADMINISTERED DOSES, BY DAY

Body weights were measured on days -1, 2, 5, 8, 11, 14. Weights for other days are estimated, based on linear interpolation between measured values.

Group	ID #	Day -1		Day 0		Day 1		Day 2		Day 3		Day 4		Day 5		Day 6	
		BW (kg)	ug Pb/day	BW (kg)	ug Pb/day	BW (kg)	ug Pb/day	BW (kg)	ug Pb/day	BW (kg)	ug Pb/day	BW (kg)	ug Pb/day	BW (kg)	ug Pb/day	BW (kg)	ug Pb/day
1	907	11.56	0.0	12.1	1449.7	12.6	1449.7	13.12	1449.7	13.7	1604.3	14.3	1604.3	14.84	1604.3	15.3	1904.3
1	912	14.8	0.0	15.3	1449.7	15.7	1449.7	16.22	1449.7	16.8	1604.3	17.4	1604.3	17.94	1604.3	18.3	1904.3
1	919	12.82	0.0	13.3	1449.7	13.7	1449.7	14.2	1449.7	14.6	1604.3	14.9	1604.3	15.32	1604.3	15.7	1904.3
1	930	12.52	0.0	13.1	1449.7	13.6	1449.7	14.12	1449.7	14.6	1604.3	15.1	1604.3	15.62	1604.3	16.2	1904.3
1	942	14.06	0.0	14.5	1449.7	15.0	1449.7	15.46	1449.7	16.1	1604.3	16.8	1604.3	17.4	1604.3	17.8	1904.3
1	943	15.14	0.0	15.7	1449.7	16.2	1449.7	16.76	1449.7	17.3	1604.3	17.8	1604.3	18.26	1604.3	18.9	1904.3
1	953	13.58	0.0	14.2	1449.7	14.8	1449.7	15.42	1449.7	15.9	1604.3	16.3	1604.3	16.8	1604.3	17.4	1904.3
2	901	15.08	0.0	15.3	0.0	15.6	0.0	15.86	0.0	16.7	0.0	17.5	0.0	18.34	0.0	18.9	0.0
2	902	16.26	0.0	16.6	0.0	17.0	0.0	17.42	0.0	18.3	0.0	19.1	0.0	19.96	0.0	20.6	0.0
2	920	15.92	0.0	16.5	0.0	17.0	0.0	17.52	0.0	18.3	0.0	19.1	0.0	19.86	0.0	20.1	0.0
2	925	16.9	0.0	17.4	0.0	17.8	0.0	18.32	0.0	18.7	0.0	19.1	0.0	19.5	0.0	20.1	0.0
2	928	14.1	0.0	14.5	0.0	14.9	0.0	15.32	0.0	15.6	0.0	15.8	0.0	16.1	0.0	16.8	0.0
3	905	16.78	0.0	17.3	385.4	17.9	385.4	18.46	385.4	18.9	422.3	19.3	422.3	19.76	422.3	20.3	464.3
3	909	14.72	0.0	15.2	289.1	15.7	385.4	16.22	385.4	16.7	422.3	17.3	422.3	17.78	422.3	18.5	464.3
3	927	14.48	0.0	15.0	385.4	15.5	385.4	16.02	385.4	16.5	422.3	17.1	422.3	17.6	422.3	18.2	464.3
3	931	12.76	0.0	13.2	385.4	13.7	385.4	14.2	385.4	15.0	422.3	15.9	422.3	16.7	422.3	17.1	464.3
3	940	13.34	0.0	13.7	385.4	14.2	385.4	14.56	385.4	15.0	422.3	15.5	422.3	16.02	422.3	16.5	464.3
4	923	11.14	0.0	11.4	1087.8	11.6	1087.8	11.8	1087.8	12.3	1181.4	12.9	1181.4	13.4	1181.4	14.1	1298.7
4	933	14.16	0.0	14.6	1087.8	15.1	1087.8	15.58	1087.8	16.2	1181.4	16.9	1181.4	17.56	1181.4	18.0	974.0
4	948	14.4	0.0	14.9	1087.8	15.4	1087.8	15.94	1087.8	16.3	1181.4	16.6	1181.4	16.96	1181.4	17.5	1298.7
4	950	14.56	0.0	15.1	1087.8	15.7	1087.8	16.3	1087.8	16.8	1181.4	17.3	1181.4	17.82	1181.4	18.4	1298.7
4	956	13.26	0.0	13.6	1087.8	13.8	1087.8	14.14	1087.8	14.7	1181.4	15.3	1181.4	15.84	1181.4	16.5	1298.7
5	911	12.56	0.0	13.0	366.1	13.3	366.1	13.74	366.1	14.2	398.3	14.8	398.3	15.26	398.3	15.7	435.8
5	929	12.28	0.0	12.9	366.1	13.5	366.1	14.04	366.1	14.5	398.3	15.1	398.3	15.56	398.3	16.2	435.8
5	934	15.38	0.0	15.7	366.1	16.1	366.1	16.4	366.1	16.7	398.3	17.0	398.3	17.26	398.3	17.8	435.8
5	947	14.24	0.0	14.7	366.1	15.2	366.1	15.62	366.1	16.3	398.3	17.0	398.3	17.7	398.3	18.4	435.8
5	954	13.76	0.0	14.1	366.1	14.5	366.1	14.86	366.1	15.4	398.3	15.9	398.3	16.38	398.3	17.1	435.8
6	903	16.3	0.0	16.8	1218.0	17.3	1218.0	17.78	1218.0	18.3	1307.4	18.8	1307.4	19.38	1307.4	20.1	1435.2
6	910	15.9	0.0	16.3	1218.0	16.7	1218.0	17.06	1218.0	17.8	1307.4	18.6	1307.4	19.36	1307.4	19.9	1435.2
6	938	14.34	0.0	14.5	1218.0	14.7	1218.0	14.82	1218.0	15.4	1307.4	15.9	1307.4	16.48	1307.4	16.8	1435.2
6	951	14.52	0.0	14.9	1218.0	15.2	1218.0	15.56	1218.0	16.0	1307.4	16.4	1307.4	16.86	980.6	17.4	1435.2
6	955	15.14	0.0	15.7	1218.0	16.3	1218.0	16.94	1218.0	17.5	1307.4	18.0	1307.4	18.6	1307.4	19.3	1435.2
7	906	15.46	0.0	15.9	3400.2	16.4	3400.2	16.86	3400.2	17.2	3651.3	17.5	3651.3	17.84	3651.3	18.5	3862.8
7	908	13.52	0.0	13.7	3400.2	13.9	3400.2	14.12	3400.2	14.3	3651.3	14.5	3651.3	14.66	3651.3	15.5	3862.8
7	916	12.84	0.0	13.3	3400.2	13.7	3400.2	14.18	3400.2	14.5	3651.3	14.8	3651.3	15.08	3651.3	15.7	3862.8
7	918	13.22	0.0	13.5	3400.2	13.8	3400.2	14.16	3400.2	14.5	3651.3	14.9	3651.3	15.24	3651.3	15.9	3862.8
7	922	15.52	0.0	16.0	3400.2	16.4	3400.2	16.82	3400.2	17.2	3651.3	17.6	3651.3	18.02	3651.3	18.8	3862.8
8	913	11.32	0.0	11.4	347.5	11.5	347.5	11.58	347.5	11.9	377.2	12.2	377.2	12.5	377.2	13.1	413.3
8	914	12.6	0.0	13.1	347.5	13.5	347.5	14.02	347.5	14.5	377.2	15.0	377.2	15.56	377.2	16.0	413.3
8	932	14.6	0.0	14.9	347.5	15.1	347.5	15.42	347.5	16.1	377.2	16.8	377.2	17.52	377.2	18.2	413.3
8	937	14.04	0.0	14.6	347.5	15.2	347.5	15.8	347.5	16.3	377.2	16.7	377.2	17.16	377.2	17.7	413.3
8	946	11.94	0.0	12.5	347.5	13.1	347.5	13.62	347.5	14.1	377.2	14.5	377.2	14.92	377.2	15.5	413.3
9	924	13.68	0.0	14.2	1100.4	14.7	1100.4	15.28	1100.4	15.9	1192.2	16.4	1192.2	17.02	1192.2	17.7	1310.1
9	926	11.7	0.0	12.2	1100.4	12.6	1100.4	13.08	1100.4	13.6	1192.2	14.2	1192.2	14.72	1192.2	15.1	1310.1
9	944	14.78	0.0	15.5	1100.4	16.1	1100.4	16.82	1100.4	17.2	1192.2	17.7	1192.2	18.1	1192.2	18.9	1310.1
9	949	14.3	0.0	14.4	1100.4	14.5	1100.4	14.62	1100.4	15.2	1192.2	15.8	1192.2	16.32	1192.2	16.8	1310.1
9	957	13.9	0.0	14.2	1100.4	14.4	1100.4	14.68	1100.4	15.2	1192.2	15.7	1192.2	16.18	1192.2	16.9	1310.1
10	917	12.16	0.0	12.4	3411.0	12.7	3411.0	12.92	3411.0	13.3	3619.8	13.7	3619.8	14.02	3619.8	14.5	3978.9
10	921	14.86	0.0	14.8	1705.5	14.8	3411.0	14.7	3411.0	15.3	3619.8	15.9	3619.8	16.48	3619.8	17.0	3978.9
10	939	16.36	0.0	16.8	3411.0	17.3	3411.0	17.72	3411.0	18.2	3619.8	18.7	3619.8	19.12	3619.8	19.9	3978.9
10	941	14.7	0.0	15.1	3411.0	15.6	3411.0	16.02	3411.0	16.8	3619.8	17.5	3619.8	18.24	3619.8	18.8	3978.9
10	945	12.72	0.0	13.2	3411.0	13.6	3411.0	14.08	3411.0	14.6	3619.8	15.1	3619.8	15.56	3619.8	16.0	3978.9

Shaded boxes show days in which adminstered doses were ingested late

Days which required adjustment for missed or partially missed doses

Day 0

Pig 909 - Dropped most of one doughball. Daily dose adjusted to 75%
Pig 921 - Did not eat one doughball. Daily dose adjusted to 50%

Day 5

Pig 951 - Ate 1/2 of one doughball, dropped the rest through cage bottom. Daily dose adjusted to 75%.

Day 6

Pig 933 - Vomit found after one dosing. Daily dose adjusted to 75%

Day 8

Pig 933 - Vomitted AM doughball. Dose was treated as missed. Daily dose adjusted to 50%
Pig 946 - Possibly vomitted one dose. Daily dose adjusted to 75%

Day 9

Pig 941 - Portion of one dose fell on floor. Daily dose adjusted to 75%
Pig 945 - Portion of one dose fell on floor. Daily dose adjusted to 75%

TABLE A-1 (cont.)

Day 7		Day 8		Day 9		Day 10		Day 11		Day 12		Day 13		Day 14		Day 15	
BW (kg)	ug Pb/day	BW (kg)	ug Pb/day	BW (kg)	ug Pb/day	BW (kg)	ug Pb/day	BW (kg)	ug Pb/day	BW (kg)	ug Pb/day	BW (kg)	ug Pb/day	BW (kg)	ug Pb/day	BW (kg)	ug Pb/day
15.7	1904.3	16.18	1904.3	16.5	2084.6	16.8	2084.6	17.18	2084.6	17.8	2305.1	18.5	2305.1	19.12	2305.1	19.8	0.0
18.6	1904.3	19	1904.3	19.6	2084.6	20.2	2084.6	20.82	2084.6	21.3	2305.1	21.8	2305.1	22.3	2305.1	22.8	0.0
16.0	1904.3	16.38	1904.3	17.0	2084.6	17.6	2084.6	18.14	2084.6	18.9	2305.1	19.6	2305.1	20.34	2305.1	21.1	0.0
16.7	1904.3	17.28	1904.3	18.1	2084.6	19.0	2084.6	19.82	2084.6	20.7	2305.1	21.5	2305.1	22.32	2305.1	23.2	0.0
18.3	1904.3	18.72	1904.3	19.3	2084.6	19.9	2084.6	20.46	2084.6	21.1	2305.1	21.8	2305.1	22.5	2305.1	23.2	0.0
19.5	1904.3	20.16	1904.3	20.9	2084.6	21.5	2084.6	22.24	2084.6	23.0	2305.1	23.8	2305.1	24.52	2305.1	25.3	0.0
18.0	1904.3	18.58	1904.3	19.1	2084.6	19.7	2084.6	20.26	2084.6	21.3	2305.1	22.3	2305.1	23.26	2305.1	24.3	0.0
19.4	0.0	19.96	0.0	20.3	0.0	20.6	0.0	20.92	0.0	22.1	0.0	23.3	0.0	24.52	0.0	25.7	0.0
21.2	0.0	21.76	0.0	22.4	0.0	23.1	0.0	23.78	0.0	24.6	0.0	25.5	0.0	26.3	0.0	27.1	0.0
20.2	0.0	20.44	0.0	21.0	0.0	21.5	0.0	22.1	0.0	23.0	0.0	23.9	0.0	24.8	0.0	25.7	0.0
20.7	0.0	21.24	0.0	21.9	0.0	22.7	0.0	23.36	0.0	24.2	0.0	25.0	0.0	25.88	0.0	26.7	0.0
17.5	0.0	18.18	0.0	18.5	0.0	18.9	0.0	19.28	0.0	20.3	0.0	21.3	0.0	22.3	0.0	23.3	0.0
20.8	464.3	21.26	464.3	21.8	506.3	22.4	506.3	22.92	506.3	23.8	551.4	24.7	551.4	25.64	551.4	26.5	0.0
19.3	464.3	20.04	464.3	20.6	506.3	21.1	506.3	21.62	506.3	22.4	551.4	23.1	551.4	23.82	551.4	24.6	0.0
18.9	464.3	19.5	464.3	20.2	506.3	20.8	506.3	21.46	506.3	22.2	551.4	23.0	551.4	23.76	551.4	24.5	0.0
17.5	464.3	17.88	464.3	18.6	506.3	19.3	506.3	19.98	506.3	20.8	551.4	21.6	551.4	22.36	551.4	23.2	0.0
17.1	464.3	17.58	464.3	18.2	506.3	18.7	506.3	19.3	506.3	19.8	551.4	20.3	551.4	20.8	551.4	21.3	0.0
14.8	1298.7	15.44	1298.7	16.2	1430.1	16.9	1430.1	17.64	1430.1	18.2	1581.3	18.8	1581.3	19.32	1581.3	19.9	0.0
18.5	1298.7	18.98	649.4	19.4	1430.1	19.9	1430.1	20.32	1430.1	20.6	1581.3	21.0	1581.3	21.3	1581.3	21.6	0.0
18.0	1298.7	18.58	1298.7	19.1	1430.1	19.6	1430.1	20.1	1430.1	20.7	1581.3	21.3	1581.3	21.92	1581.3	22.5	0.0
19.0	1298.7	19.62	1298.7	20.3	1430.1	21.1	1430.1	21.78	1430.1	22.3	1581.3	22.8	1581.3	23.24	1581.3	23.7	0.0
17.1	1298.7	17.72	1298.7	18.7	1430.1	19.6	1430.1	20.58	1430.1	21.0	1581.3	21.4	1581.3	21.76	1581.3	22.2	0.0
16.2	435.8	16.62	435.8	17.3	481.5	18.0	481.5	18.7	481.5	18.7	526.0	18.8	526.0	18.82	526.0	18.9	0.0
16.9	435.8	17.54	435.8	18.4	481.5	19.3	481.5	20.16	481.5	20.4	526.0	20.7	526.0	20.98	526.0	21.3	0.0
18.3	435.8	18.82	435.8	19.1	481.5	19.4	481.5	19.66	481.5	19.9	526.0	20.2	526.0	20.42	526.0	20.7	0.0
19.1	435.8	19.82	435.8	20.3	481.5	20.8	481.5	21.32	481.5	21.7	526.0	22.1	526.0	22.42	526.0	22.8	0.0
17.8	435.8	18.5	435.8	19.1	481.5	19.7	481.5	20.36	481.5	21.1	526.0	21.8	526.0	22.5	526.0	23.2	0.0
20.9	1435.2	21.66	1435.2	22.2	1563.6	22.7	1563.6	23.16	1563.6	23.9	1693.8	24.6	1693.8	25.26	1693.8	26.0	0.0
20.4	1435.2	20.92	1435.2	21.6	1563.6	22.3	1563.6	23.06	1563.6	23.6	1693.8	24.1	1693.8	24.62	1693.8	25.1	0.0
17.2	1435.2	17.54	1435.2	18.1	1563.6	18.7	1563.6	19.3	1563.6	20.0	1693.8	20.6	1693.8	21.28	1693.8	21.9	0.0
17.9	1435.2	18.44	1435.2	19.0	1563.6	19.5	1563.6	20.08	1563.6	20.6	1693.8	21.2	1693.8	21.76	1693.8	22.3	0.0
20.0	1435.2	20.68	1435.2	21.2	1563.6	21.8	1563.6	22.32	1563.6	23.0	1693.8	23.6	1693.8	24.3	1693.8	25.0	0.0
19.2	3862.8	19.86	3862.8	20.3	4339.8	20.7	4339.8	21.06	4339.8	22.1	4701.6	23.0	4701.6	24.04	4701.6	25.0	0.0
16.2	3862.8	17.04	3862.8	17.5	4339.8	18.0	4339.8	18.48	4339.8	19.3	4701.6	20.0	4701.6	20.8	4701.6	21.6	0.0
16.3	3862.8	16.94	3862.8	17.6	4339.8	18.3	4339.8	19.02	4339.8	19.7	4701.6	20.4	4701.6	21.04	4701.6	21.7	0.0
16.5	3862.8	17.18	3862.8	17.6	4339.8	17.9	4339.8	18.32	4339.8	18.8	4701.6	19.3	4701.6	19.8	4701.6	20.3	0.0
19.6	3862.8	20.42	3862.8	21.1	4339.8	21.9	4339.8	22.6	4339.8	23.5	4701.6	24.3	4701.6	25.16	4701.6	26.0	0.0
13.7	413.3	14.24	413.3	15.0	454.0	15.8	454.0	16.58	454.0	17.1	502.1	17.6	502.1	18.08	502.1	18.6	0.0
16.4	413.3	16.84	413.3	17.3	454.0	17.7	454.0	18.16	454.0	18.8	502.1	19.5	502.1	20.16	502.1	20.8	0.0
18.8	413.3	19.5	413.3	20.2	454.0	21.0	454.0	21.74	454.0	22.3	502.1	22.8	502.1	23.32	502.1	23.8	0.0
18.2	413.3	18.66	413.3	19.3	454.0	19.9	454.0	20.52	454.0	21.1	502.1	21.7	502.1	22.22	502.1	22.8	0.0
16.0	413.3	16.56	310.0	17.2	454.0	17.8	454.0	18.42	454.0	19.2	502.1	19.9	502.1	20.62	502.1	21.4	0.0
18.4	1310.1	19.02	1310.1	19.5	1447.2	20.0	1447.2	20.54	1447.2	21.3	1558.8	22.0	1558.8	22.8	1558.8	23.6	0.0
15.4	1310.1	15.72	1310.1	16.2	1447.2	16.7	1447.2	17.14	1447.2	18.2	1558.8	19.3	1558.8	20.38	1558.8	21.5	0.0
19.7	1310.1	20.46	1310.1	21.0	1447.2	21.6	1447.2	22.2	1447.2	23.2	1558.8	24.2	1558.8	25.26	1558.8	26.3	0.0
17.3	1310.1	17.82	1310.1	18.3	1447.2	18.8	1447.2	19.24	1447.2	20.1	1558.8	20.9	1558.8	21.78	1558.8	22.6	0.0
17.7	1310.1	18.46	1310.1	18.9	1447.2	19.4	1447.2	19.8	1447.2	20.6	1558.8	21.3	1558.8	22.08	1558.8	22.8	0.0
15.1	3978.9	15.6	3978.9	15.9	4362.3	16.1	4362.3	16.36	4362.3	17.2	4680.0	18.1	4680.0	18.9	4680.0	19.7	0.0
17.5	3978.9	17.98	3978.9	18.5	4362.3	18.9	4362.3	19.4	4362.3	20.2	4680.0	21.0	4680.0	21.76	4680.0	22.5	0.0
20.7	3978.9	21.56	3978.9	22.1	4362.3	22.7	4362.3	23.2	4362.3	24.1	4680.0	25.1	4680.0	26.04	4680.0	27.0	0.0
19.4	3978.9	19.96	3978.9	20.6	3271.7	21.1	4362.3	21.74	4362.3	22.5	4680.0	23.2	4680.0	23.92	4680.0	24.6	0.0
16.4	3978.9	16.84	3978.9	17.3	3271.7	17.8	4362.3	18.3	4362.3	19.0	4680.0	19.7	4680.0	20.42	4680.0	21.1	0.0

TABLE A-2
Body Weight Adjusted Doses
(Dose for Day/BW for Day)

Group	ID #	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Avg Dose	Target Dose	% Target	Avg %
1	907	120.009	115.057	110.497	117.158	112.450	108.106	124.572	121.035	117.694	126.236	123.738	121.337	129.309	124.782	120.562	119.50	100	120	
1	912	94.918	92.065	89.378	95.531	92.377	89.425	104.097	102.125	100.226	106.320	103.129	100.124	108.155	105.708	103.370	99.13	100	99	
1	919	109.165	105.511	102.093	110.084	107.334	104.718	121.498	118.820	116.257	122.863	118.756	114.916	122.138	117.569	113.331	113.67	100	114	
1	930	111.061	106.701	102.671	109.732	106.104	102.707	117.742	113.847	110.202	115.000	109.868	105.175	111.611	107.282	103.277	108.87	100	109	
1	942	99.797	96.691	93.772	99.604	95.759	92.200	106.742	104.173	101.725	108.009	104.858	101.885	109.042	105.644	102.451	101.49	100	101	
1	943	92.456	89.378	86.498	92.948	90.331	87.858	100.791	97.522	94.459	99.963	96.747	93.731	100.224	97.018	94.011	94.26	100	94	
1	953	102.141	97.910	94.015	101.026	98.182	95.493	109.484	105.872	102.491	108.912	105.816	102.891	108.426	103.555	99.103	102.35	100	102	106
2	901	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0		
2	902	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0		
2	920	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0		
2	925	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0		
2	928	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0		
3	905	22.226	21.531	20.878	22.352	21.851	21.371	22.917	22.365	21.839	23.211	22.636	22.090	23.142	22.294	21.505	22.15	25	89	
3	909	18.991	24.517	23.761	25.227	24.467	23.751	25.052	24.074	23.169	24.618	24.003	23.418	24.667	23.884	23.149	23.78	25	95	
3	927	25.705	24.854	24.057	25.522	24.734	23.994	25.464	24.610	23.810	25.122	24.334	23.593	24.808	23.981	23.207	24.52	25	98	
3	931	29.109	28.090	27.141	28.091	26.616	25.287	27.163	26.552	25.968	27.250	26.260	25.340	26.544	25.567	24.660	26.64	25	107	
3	940	28.036	27.230	26.470	28.066	27.187	26.361	28.071	27.216	26.411	27.890	27.036	26.233	27.848	27.163	26.510	27.18	25	109	99
4	923	95.757	93.938	92.186	95.789	91.819	88.164	92.237	87.988	84.113	88.423	84.588	81.071	86.885	84.291	81.848	88.61	75	118	
4	933	74.337	72.008	69.820	72.746	69.905	67.278	54.012	70.175	34.212	73.615	71.961	70.379	76.589	75.396	74.239	68.44	75	91	
4	948	72.941	70.514	68.243	72.568	71.083	69.658	74.211	71.990	69.898	74.927	72.989	71.149	76.367	74.193	72.140	72.19	75	96	
4	950	71.849	69.198	66.736	70.294	68.236	66.296	70.505	68.281	66.193	70.310	67.906	65.661	71.016	69.498	68.042	68.67	75	92	
4	956	80.261	78.560	76.931	80.331	77.351	74.583	78.868	75.977	73.290	76.585	72.865	69.490	75.396	74.008	72.670	75.81	75	101	100
5	911	28.263	27.430	26.645	27.957	26.997	26.101	27.734	26.957	26.221	27.811	26.740	25.749	28.068	28.009	27.949	27.24	25	109	
5	929	28.453	27.213	26.075	27.381	26.459	25.598	26.868	25.818	24.846	26.150	24.965	23.884	25.742	25.402	25.071	26.00	25	104	
5	934	23.289	22.796	22.323	23.869	23.466	23.076	24.511	23.814	23.156	25.209	24.845	24.491	26.414	26.083	25.759	24.21	25	97	
5	947	24.905	24.149	23.438	24.416	23.420	22.503	23.676	22.801	21.988	23.696	23.127	22.584	24.255	23.851	23.461	23.48	25	94	
5	954	25.916	25.260	24.637	25.920	25.092	24.316	25.505	24.492	23.557	25.183	24.392	23.649	24.960	24.143	23.378	24.69	25	99	100
6	903	72.529	70.459	68.504	71.391	69.370	67.461	71.261	68.670	66.260	70.560	69.003	67.513	70.989	68.966	67.055	69.33	75	92	
6	910	74.785	73.051	71.395	73.340	70.316	67.531	72.193	70.353	68.604	72.277	69.970	67.806	71.832	70.282	68.798	70.84	75	94	
6	938	84.000	83.083	82.186	85.043	82.089	79.333	85.259	83.507	81.824	86.260	83.555	81.016	84.860	82.144	79.596	82.92	75	111	
6	951	81.928	80.061	78.278	81.747	79.590	58.158	82.546	80.119	77.831	82.353	80.048	77.869	82.064	79.896	77.840	78.69	75	105	
6	955	77.382	74.541	71.901	74.737	72.446	70.290	74.388	71.808	69.400	73.662	71.813	70.054	73.708	71.650	69.704	72.50	75	97	100
7	906	213.491	207.414	201.673	212.450	208.487	204.669	208.650	201.327	194.502	214.205	210.058	206.068	213.192	204.003	195.574	206.38	225	92	
7	908	247.828	244.267	240.807	255.336	252.162	249.065	249.965	237.760	226.690	247.705	241.100	234.838	244.197	234.767	226.038	242.17	225	108	
7	916	255.911	247.587	239.788	252.162	247.043	242.129	246.038	236.691	228.028	246.113	236.802	228.170	238.741	230.848	223.460	239.97	225	107	
7	918	251.246	245.561	240.127	251.467	245.383	239.587	243.147	233.637	224.843	247.141	241.906	236.889	249.908	243.522	237.455	242.12	225	108	
7	922	213.134	207.498	202.152	212.038	207.225	202.625	205.250	196.881	189.167	205.224	198.406	192.027	200.466	193.428	186.868	200.83	225	89	101
8	913	30.465	30.235	30.009	31.733	30.935	30.176	31.598	30.256	29.024	30.226	28.734	27.382	29.397	28.561	27.771	29.77	25	119	
8	914	26.581	25.652	24.786	25.954	25.069	24.242	25.853	25.181	24.543	26.273	25.621	25.000	26.670	25.758	24.906	25.47	25	102	
8	932	23.364	22.942	22.536	23.400	22.426	21.530	22.734	21.937	21.195	22.423	21.626	20.883	22.549	22.028	21.531	22.21	25	89	
8	937	23.758	22.842	21.994	23.208	22.578	21.981	23.403	22.759	22.149	23.548	22.814	22.125	23.811	23.188	22.597	22.85	25	91	
8	946	27.800	26.608	25.514	26.841	26.038	25.282	26.722	25.810	18.718	26.426	25.506	24.647	26.215	25.248	24.350	25.45	25	102	101
9	924	77.420	74.620	72.016	75.170	72.518	70.047	74.073	71.382	68.880	74.114	72.240	70.458	73.206	70.705	68.368	72.35	75	96	
9	926	90.493	87.195	84.128	87.490	84.116	80.992	87.031	85.145	83.340	89.370	86.832	84.434	85.554	80.767	76.487	84.89	75	113	
9	944	71.177	68.178	65.422	69.126	67.458	65.867	69.366	66.593	64.032	68.783	66.938	65.189	67.132	64.307	61.710	66.75	75	89	
9	949	76.381	75.820	75.267	78.503	75.679	73.051	77.889	75.641	73.519	79.111	77.115	75.218	77.604	74.465	71.570	75.79	75	101	
9	957	77.712	76.311	74.959	78.538	76.033	73.684	77.338	74.017	70.970	76.544	74.778	73.091	75.817	73.114	70.598	74.90	75	100	100
10	917	274.785	269.289	264.009	272.439	265.122	258.188	273.527	263.969	255.058	275.166	270.838	266.644	271.988	259.232	247.619	265.86	225	118	
10	921	115.185	231.202	232.041	236.691	227.851	219.648	234.329	227.626	221.296	236.396	230.484	224.861	231.836	223.140	215.074	220.51	225	98	
10	939	202.875	197.548	192.494	199.036	194.056	189.320	199.610	191.785	184.550	197.330	192.568	188.030	193.816	186.504	179.724	192.62	225	86	
10	941	225.297	218.935	212.921	215.979	206.846	198.454	211.494	205.239	199.344	159.182	206.288	200.658	208.309	201.782	195.652	204.43	225	91	
10	945	258.932	250.318	242.259	248.385	240.252	232.635	248.889	242.419	236.277	188.826	244.890	238.377	246.229	237.403	229.187	239.02	225	106	100

TABLE A - 3 RAW AND ADJUSTED BLOOD LEAD DATA

pig number	sample	group	material administered	dosage	qualifier	lab result (ug/L)	day	source file	MATRIX	Adjusted Value (ug/dL)[a]
907	8-990162	1	IV	100	<	1	-4	T951206	BLOOD	0.5
912	8-990165	1	IV	100	<	1	-4	T951206	BLOOD	0.5
919	8-990173	1	IV	100	<	1	-4	T951206	BLOOD	0.5
930	8-990125	1	IV	100	<	1	-4	T951206	BLOOD	0.5
942	8-990142	1	IV	100	<	1	-4	T951206	BLOOD	0.5
943	8-990176	1	IV	100	<	1	-4	T951206	BLOOD	0.5
953	8-990170	1	IV	100	<	1	-4	T951206	BLOOD	0.5
901	8-990143	2	Control	0	<	1	-4	T951206	BLOOD	0.5
902	8-990157	2	Control	0	<	1	-4	T951206	BLOOD	0.5
920	8-990140	2	Control	0	<	1	-4	T951206	BLOOD	0.5
925	8-990155	2	Control	0	<	1	-4	T951206	BLOOD	0.5
928	8-990137	2	Control	0	<	1	-4	T951206	BLOOD	0.5
905	8-990121	3	PbAc	25	<	1	-4	T951206	BLOOD	0.5
909	8-990131	3	PbAc	25	<	1	-4	T951206	BLOOD	0.5
927	8-990150	3	PbAc	25	<	1	-4	T951206	BLOOD	0.5
931	8-990136	3	PbAc	25	<	1	-4	T951206	BLOOD	0.5
940	8-990135	3	PbAc	25	<	1	-4	T951206	BLOOD	0.5
923	8-990156	4	PbAc	75	<	1	-4	T951206	BLOOD	0.5
933	8-990172	4	PbAc	75	<	1	-4	T951206	BLOOD	0.5
948	8-990132	4	PbAc	75	<	1	-4	T951206	BLOOD	0.5
950	8-990158	4	PbAc	75	<	1	-4	T951206	BLOOD	0.5
956	8-990153	4	PbAc	75	<	1	-4	T951206	BLOOD	0.5
911	8-990144	5	Palmerton Loc 2	25	<	1	-4	T951206	BLOOD	0.5
929	8-990126	5	Palmerton Loc 2	25	<	1	-4	T951206	BLOOD	0.5
934	8-990159	5	Palmerton Loc 2	25	<	1	-4	T951206	BLOOD	0.5
947	8-990128	5	Palmerton Loc 2	25	<	1	-4	T951206	BLOOD	0.5
954	8-990169	5	Palmerton Loc 2	25	<	1	-4	T951206	BLOOD	0.5
903	8-990164	6	Palmerton Loc 2	75	<	1	-4	T951206	BLOOD	0.5
910	8-990154	6	Palmerton Loc 2	75	<	1	-4	T951206	BLOOD	0.5
938	8-990168	6	Palmerton Loc 2	75	<	1	-4	T951206	BLOOD	0.5
951	8-990134	6	Palmerton Loc 2	75	<	1	-4	T951206	BLOOD	0.5
955	8-990123	6	Palmerton Loc 2	75	<	1	-4	T951206	BLOOD	0.5
906	8-990167	7	Palmerton Loc 2	225	<	1	-4	T951206	BLOOD	0.5
908	8-990163	7	Palmerton Loc 2	225	<	1	-4	T951206	BLOOD	0.5
916	8-990127	7	Palmerton Loc 2	225	<	1	-4	T951206	BLOOD	0.5
918	8-990129	7	Palmerton Loc 2	225	<	1	-4	T951206	BLOOD	0.5
922	8-990161	7	Palmerton Loc 2	225	<	1	-4	T951206	BLOOD	0.5
913	8-990124	8	Palmerton Loc 4	25	<	1	-4	T951206	BLOOD	0.5
914	8-990133	8	Palmerton Loc 4	25	<	1	-4	T951206	BLOOD	0.5
932	8-990146	8	Palmerton Loc 4	25	<	1	-4	T951206	BLOOD	0.5
937	8-990166	8	Palmerton Loc 4	25	<	1	-4	T951206	BLOOD	0.5
946	8-990122	8	Palmerton Loc 4	25	<	1	-4	T951206	BLOOD	0.5
924	8-990120	9	Palmerton Loc 4	75	<	1	-4	T951206	BLOOD	0.5
926	8-990152	9	Palmerton Loc 4	75	<	1	-4	T951206	BLOOD	0.5
944	8-990148	9	Palmerton Loc 4	75	<	1	-4	T951206	BLOOD	0.5
949	8-990149	9	Palmerton Loc 4	75	<	1	-4	T951206	BLOOD	0.5
957	8-990130	9	Palmerton Loc 4	75	<	1	-4	T951206	BLOOD	0.5
917	8-990141	10	Palmerton Loc 4	225	<	1	-4	T951206	BLOOD	0.5
921	8-990147	10	Palmerton Loc 4	225	<	1	-4	T951206	BLOOD	0.5
939	8-990175	10	Palmerton Loc 4	225	<	1	-4	T951206	BLOOD	0.5
941	8-990171	10	Palmerton Loc 4	225	<	1	-4	T951206	BLOOD	0.5
945	8-990138	10	Palmerton Loc 4	225	<	1	-4	T951206	BLOOD	0.5
907	8-990226	1	IV	100	<	1	0	T951206	BLOOD	0.5
912	8-990189	1	IV	100	<	1	0	T951206	BLOOD	0.5
919	8-990183	1	IV	100	<	1	0	T951206	BLOOD	0.5
930	8-990204	1	IV	100	<	1	0	T951206	BLOOD	0.5
942	8-990177	1	IV	100	<	1	0	T951206	BLOOD	0.5
943	8-990211	1	IV	100		1.3	0	T951206	BLOOD	1.3
953	8-990230	1	IV	100	<	1	0	T951206	BLOOD	0.5
901	8-990197	2	Control	0	<	1	0	T951206	BLOOD	0.5
902	8-990180	2	Control	0	<	1	0	T951206	BLOOD	0.5
920	8-990220	2	Control	0	<	1	0	T951206	BLOOD	0.5
925	8-990229	2	Control	0	<	1	0	T951206	BLOOD	0.5
928	8-990178	2	Control	0	<	1	0	T951206	BLOOD	0.5
905	8-990184	3	PbAc	25	<	1	0	T951206	BLOOD	0.5
909	8-990203	3	PbAc	25	<	1	0	T951206	BLOOD	0.5
927	8-990196	3	PbAc	25	<	1	0	T951206	BLOOD	0.5
931	8-990200	3	PbAc	25	<	1	0	T951206	BLOOD	0.5
940	8-990201	3	PbAc	25	<	1	0	T951206	BLOOD	0.5
923	8-990221	4	PbAc	75	<	1	0	T951206	BLOOD	0.5
933	8-990224	4	PbAc	75	<	1	0	T951206	BLOOD	0.5
948	8-990210	4	PbAc	75	<	1	0	T951206	BLOOD	0.5
950	8-990195	4	PbAc	75	<	1	0	T951206	BLOOD	0.5
956	8-990205	4	PbAc	75	<	1	0	T951206	BLOOD	0.5
911	8-990232	5	Palmerton Loc 2	25	<	1	0	T951206	BLOOD	0.5
929	8-990222	5	Palmerton Loc 2	25	<	1	0	T951206	BLOOD	0.5
934	8-990212	5	Palmerton Loc 2	25	<	1	0	T951206	BLOOD	0.5
947	8-990186	5	Palmerton Loc 2	25	<	1	0	T951206	BLOOD	0.5
954	8-990209	5	Palmerton Loc 2	25	<	1	0	T951206	BLOOD	0.5
903	8-990225	6	Palmerton Loc 2	75	<	1	0	T951206	BLOOD	0.5
910	8-990228	6	Palmerton Loc 2	75		1.2	0	T951206	BLOOD	1.2
938	8-990199	6	Palmerton Loc 2	75	<	1	0	T951206	BLOOD	0.5
951	8-990193	6	Palmerton Loc 2	75	<	1	0	T951206	BLOOD	0.5
955	8-990215	6	Palmerton Loc 2	75	<	1	0	T951206	BLOOD	0.5
906	8-990219	7	Palmerton Loc 2	225		1.3	0	T951206	BLOOD	1.3

pig number	sample	group	material administered	dosage	qualifier	lab result (ug/L)	day	source file	MATRIX	Adjusted Value (ug/dL)[a]
908	8-990213	7	Palmerton Loc 2	225		1.8	0	T951206	BLOOD	1.8
916	8-990191	7	Palmerton Loc 2	225		1.5	0	T951206	BLOOD	1.5
918	8-990185	7	Palmerton Loc 2	225		1.1	0	T951206	BLOOD	1.1
922	8-990208	7	Palmerton Loc 2	225		1.3	0	T951206	BLOOD	1.3
913	8-990192	8	Palmerton Loc 4	25	<	1	0	T951206	BLOOD	0.5
914	8-990227	8	Palmerton Loc 4	25		1	0	T951206	BLOOD	1
932	8-990214	8	Palmerton Loc 4	25	<	1	0	T951206	BLOOD	0.5
937	8-990216	8	Palmerton Loc 4	25		1.2	0	T951206	BLOOD	1.2
946	8-990202	8	Palmerton Loc 4	25	<	1	0	T951206	BLOOD	0.5
924	8-990179	9	Palmerton Loc 4	75	<	1	0	T951206	BLOOD	0.5
926	8-990188	9	Palmerton Loc 4	75	<	1	0	T951206	BLOOD	0.5
944	8-990182	9	Palmerton Loc 4	75	<	1	0	T951206	BLOOD	0.5
949	8-990181	9	Palmerton Loc 4	75	<	1	0	T951206	BLOOD	0.5
957	8-990231	9	Palmerton Loc 4	75	<	1	0	T951206	BLOOD	0.5
917	8-990218	10	Palmerton Loc 4	225	<	1	0	T951206	BLOOD	0.5
921	8-990217	10	Palmerton Loc 4	225	<	1	0	T951206	BLOOD	0.5
939	8-990190	10	Palmerton Loc 4	225	<	1	0	T951206	BLOOD	0.5
941	8-990207	10	Palmerton Loc 4	225	<	1	0	T951206	BLOOD	0.5
945	8-990198	10	Palmerton Loc 4	225	<	1	0	T951206	BLOOD	0.5
907	8-990262	1	IV	100		12	1	T951206	BLOOD	12
912	8-990279	1	IV	100		10.7	1	T951206	BLOOD	10.7
919	8-990246	1	IV	100		9.7	1	T951206	BLOOD	9.7
930	8-990236	1	IV	100		11.1	1	T951206	BLOOD	11.1
942	8-990289	1	IV	100		9.2	1	T951206	BLOOD	9.2
943	8-990247	1	IV	100		9.3	1	T951206	BLOOD	9.3
953	8-990241	1	IV	100		9.7	1	T951206	BLOOD	9.7
901	8-990265	2	Control	0	<	1	1	T951206	BLOOD	0.5
902	8-990275	2	Control	0	<	1	1	T951206	BLOOD	0.5
920	8-990258	2	Control	0	<	1	1	T951206	BLOOD	0.5
925	8-990271	2	Control	0	<	1	1	T951206	BLOOD	0.5
928	8-990235	2	Control	0	<	1	1	T951206	BLOOD	0.5
905	8-990276	3	PbAc	25	<	1	1	T951206	BLOOD	0.5
909	8-990277	3	PbAc	25	<	1	1	T951206	BLOOD	0.5
927	8-990244	3	PbAc	25		1.2	1	T951206	BLOOD	1.2
931	8-990255	3	PbAc	25		1.4	1	T951206	BLOOD	1.4
940	8-990240	3	PbAc	25	<	1	1	T951206	BLOOD	0.5
923	8-990284	4	PbAc	75	<	1	1	T951206	BLOOD	0.5
933	8-990287	4	PbAc	75		1.7	1	T951206	BLOOD	1.7
948	8-990285	4	PbAc	75		1.7	1	T951206	BLOOD	1.7
950	8-990290	4	PbAc	75	<	1	1	T951206	BLOOD	0.5
956	8-990252	4	PbAc	75		1.9	1	T951206	BLOOD	1.9
911	8-990260	5	Palmerton Loc 2	25		1.3	1	T951206	BLOOD	1.3
929	8-990257	5	Palmerton Loc 2	25	<	1	1	T951206	BLOOD	0.5
934	8-990270	5	Palmerton Loc 2	25	<	1	1	T951206	BLOOD	0.5
947	8-990239	5	Palmerton Loc 2	25		1.2	1	T951206	BLOOD	1.2
954	8-990281	5	Palmerton Loc 2	25	<	1	1	T951206	BLOOD	0.5
903	8-990269	6	Palmerton Loc 2	75	<	1	1	T951206	BLOOD	0.5
910	8-990238	6	Palmerton Loc 2	75		1.7	1	T951206	BLOOD	1.7
938	8-990251	6	Palmerton Loc 2	75	<	1	1	T951206	BLOOD	0.5
951	8-990256	6	Palmerton Loc 2	75		3.1	1	T951206	BLOOD	3.1
955	8-990243	6	Palmerton Loc 2	75		2	1	T951206	BLOOD	2
906	8-990248	7	Palmerton Loc 2	225		2.2	1	T951206	BLOOD	2.2
908	8-990254	7	Palmerton Loc 2	225		4.4	1	T951206	BLOOD	4.4
916	8-990266	7	Palmerton Loc 2	225		4.2	1	T951206	BLOOD	4.2
918	8-990261	7	Palmerton Loc 2	225		2.2	1	T951206	BLOOD	2.2
922	8-990250	7	Palmerton Loc 2	225		4	1	T951206	BLOOD	4
913	8-990267	8	Palmerton Loc 4	25	<	1	1	T951206	BLOOD	0.5
914	8-990274	8	Palmerton Loc 4	25	<	1	1	T951206	BLOOD	0.5
932	8-990263	8	Palmerton Loc 4	25	<	1	1	T951206	BLOOD	0.5
937	8-990234	8	Palmerton Loc 4	25	<	1	1	T951206	BLOOD	0.5
946	8-990283	8	Palmerton Loc 4	25	<	1	1	T951206	BLOOD	0.5
924	8-990288	9	Palmerton Loc 4	75		1.2	1	T951206	BLOOD	1.2
926	8-990242	9	Palmerton Loc 4	75		1.2	1	T951206	BLOOD	1.2
944	8-990264	9	Palmerton Loc 4	75		1	1	T951206	BLOOD	1
949	8-990273	9	Palmerton Loc 4	75		1.1	1	T951206	BLOOD	1.1
957	8-990268	9	Palmerton Loc 4	75	<	1	1	T951206	BLOOD	0.5
917	8-990280	10	Palmerton Loc 4	225		4.1	1	T951206	BLOOD	4.1
921	8-990249	10	Palmerton Loc 4	225		3.9	1	T951206	BLOOD	3.9
939	8-990282	10	Palmerton Loc 4	225		2.3	1	T951206	BLOOD	2.3
941	8-990286	10	Palmerton Loc 4	225		1.4	1	T951206	BLOOD	1.4
945	8-990259	10	Palmerton Loc 4	225		2.6	1	T951206	BLOOD	2.6
907	8-990326	1	IV	100		13.3	2	T951206	BLOOD	13.3
912	8-990294	1	IV	100		10.9	2	T951206	BLOOD	10.9
919	8-990344	1	IV	100		12	2	T951206	BLOOD	12
930	8-990329	1	IV	100		12.1	2	T951206	BLOOD	12.1
942	8-990305	1	IV	100		10.4	2	T951206	BLOOD	10.4
943	8-990306	1	IV	100		9.2	2	T951206	BLOOD	9.2
953	8-990318	1	IV	100		12.4	2	T951206	BLOOD	12.4
901	8-990299	2	Control	0	<	1	2	T951206	BLOOD	0.5
902	8-990331	2	Control	0	<	1	2	T951206	BLOOD	0.5
920	8-990298	2	Control	0	<	1	2	T951206	BLOOD	0.5
925	8-990315	2	Control	0	<	1	2	T951206	BLOOD	0.5
928	8-990314	2	Control	0	<	1	2	T951206	BLOOD	0.5
905	8-990335	3	PbAc	25	<	1	2	T951206	BLOOD	0.5
909	8-990301	3	PbAc	25		1	2	T951206	BLOOD	1
927	8-990333	3	PbAc	25	<	1	2	T951206	BLOOD	0.5
931	8-990317	3	PbAc	25		1.1	2	T951206	BLOOD	1.1
940	8-990296	3	PbAc	25		1.6	2	T951206	BLOOD	1.6

pig number	sample	group	material administered	dosage	qualifier	lab result (ug/L)	day	source file	MATRIX	Adjusted Value (ug/dL)[a]
923	8-990321	4	PbAc	75		2.1	2	T951206	BLOOD	2.1
933	8-990312	4	PbAc	75		2.2	2	T951206	BLOOD	2.2
948	8-990308	4	PbAc	75		3.2	2	T951206	BLOOD	3.2
950	8-990337	4	PbAc	75		2.2	2	T951206	BLOOD	2.2
956	8-990302	4	PbAc	75		3.6	2	T951206	BLOOD	3.6
911	8-990343	5	Palmerton Loc 2	25		1.3	2	T951206	BLOOD	1.3
929	8-990339	5	Palmerton Loc 2	25	<	1	2	T951206	BLOOD	0.5
934	8-990319	5	Palmerton Loc 2	25	<	1	2	T951206	BLOOD	0.5
947	8-990293	5	Palmerton Loc 2	25	<	1	2	T951206	BLOOD	0.5
954	8-990300	5	Palmerton Loc 2	25		1.1	2	T951206	BLOOD	1.1
903	8-990322	6	Palmerton Loc 2	75		2.1	2	T951206	BLOOD	2.1
910	8-990340	6	Palmerton Loc 2	75		2.6	2	T951206	BLOOD	2.6
938	8-990341	6	Palmerton Loc 2	75		2	2	T951206	BLOOD	2
951	8-990310	6	Palmerton Loc 2	75		3.8	2	T951206	BLOOD	3.8
955	8-990307	6	Palmerton Loc 2	75		2.3	2	T951206	BLOOD	2.3
906	8-990332	7	Palmerton Loc 2	225		3.7	2	T951206	BLOOD	3.7
908	8-990342	7	Palmerton Loc 2	225		5.1	2	T951206	BLOOD	5.1
916	8-990334	7	Palmerton Loc 2	225		4.6	2	T951206	BLOOD	4.6
918	8-990292	7	Palmerton Loc 2	225		2.6	2	T951206	BLOOD	2.6
922	8-990311	7	Palmerton Loc 2	225		4.9	2	T951206	BLOOD	4.9
913	8-990295	8	Palmerton Loc 4	25		1.6	2	T951206	BLOOD	1.6
914	8-990328	8	Palmerton Loc 4	25	<	1	2	T951206	BLOOD	0.5
932	8-990325	8	Palmerton Loc 4	25		1.3	2	T951206	BLOOD	1.3
937	8-990309	8	Palmerton Loc 4	25		1.2	2	T951206	BLOOD	1.2
946	8-990297	8	Palmerton Loc 4	25	<	1	2	T951206	BLOOD	0.5
924	8-990347	9	Palmerton Loc 4	75		1.7	2	T951206	BLOOD	1.7
926	8-990303	9	Palmerton Loc 4	75		1.4	2	T951206	BLOOD	1.4
944	8-990323	9	Palmerton Loc 4	75		1.4	2	T951206	BLOOD	1.4
949	8-990338	9	Palmerton Loc 4	75		1.7	2	T951206	BLOOD	1.7
957	8-990330	9	Palmerton Loc 4	75		1.8	2	T951206	BLOOD	1.8
917	8-990324	10	Palmerton Loc 4	225		5.4	2	T951206	BLOOD	5.4
921	8-990346	10	Palmerton Loc 4	225		4.9	2	T951206	BLOOD	4.9
939	8-990304	10	Palmerton Loc 4	225		4.7	2	T951206	BLOOD	4.7
941	8-990316	10	Palmerton Loc 4	225		3.2	2	T951206	BLOOD	3.2
945	8-990320	10	Palmerton Loc 4	225		3.5	2	T951206	BLOOD	3.5
907	8-990352	1	IV	100		14.2	3	T951206	BLOOD	14.2
912	8-990399	1	IV	100		12.6	3	T951206	BLOOD	12.6
919	8-990401	1	IV	100		11.9	3	T951206	BLOOD	11.9
930	8-990370	1	IV	100		13.5	3	T951206	BLOOD	13.5
942	8-990351	1	IV	100		12.9	3	T951206	BLOOD	12.9
943	8-990360	1	IV	100		10.8	3	T951206	BLOOD	10.8
953	8-990393	1	IV	100		15.1	3	T951206	BLOOD	15.1
901	8-990377	2	Control	0	<	1	3	T951206	BLOOD	0.5
902	8-990368	2	Control	0	<	1	3	T951206	BLOOD	0.5
920	8-990371	2	Control	0	<	1	3	T951206	BLOOD	0.5
925	8-990384	2	Control	0	<	1	3	T951206	BLOOD	0.5
928	8-990349	2	Control	0	<	1	3	T951206	BLOOD	0.5
905	8-990396	3	PbAc	25		1.8	3	T951206	BLOOD	1.8
909	8-990369	3	PbAc	25	<	1	3	T951206	BLOOD	0.5
927	8-990383	3	PbAc	25	<	1	3	T951206	BLOOD	0.5
931	8-990388	3	PbAc	25		1.3	3	T951206	BLOOD	1.3
940	8-990363	3	PbAc	25		1.4	3	T951206	BLOOD	1.4
923	8-990380	4	PbAc	75		1.3	3	T951206	BLOOD	1.3
933	8-990382	4	PbAc	75		1.6	3	T951206	BLOOD	1.6
948	8-990356	4	PbAc	75		4	3	T951206	BLOOD	4
950	8-990381	4	PbAc	75		2.3	3	T951206	BLOOD	2.3
956	8-990385	4	PbAc	75		1.5	3	T951206	BLOOD	1.5
911	8-990362	5	Palmerton Loc 2	25	<	1	3	T951206	BLOOD	0.5
929	8-990359	5	Palmerton Loc 2	25		1.1	3	T951206	BLOOD	1.1
934	8-990395	5	Palmerton Loc 2	25	<	1	3	T951206	BLOOD	0.5
947	8-990386	5	Palmerton Loc 2	25	<	1	3	T951206	BLOOD	0.5
954	8-990397	5	Palmerton Loc 2	25		1.5	3	T951206	BLOOD	1.5
903	8-990403	6	Palmerton Loc 2	75		3.6	3	T951206	BLOOD	3.6
910	8-990389	6	Palmerton Loc 2	75		2	3	T951206	BLOOD	2
938	8-990376	6	Palmerton Loc 2	75	<	1	3	T951206	BLOOD	0.5
951	8-990364	6	Palmerton Loc 2	75		3.4	3	T951206	BLOOD	3.4
955	8-990373	6	Palmerton Loc 2	75		1.5	3	T951206	BLOOD	1.5
906	8-990398	7	Palmerton Loc 2	225		5.5	3	T951206	BLOOD	5.5
908	8-990379	7	Palmerton Loc 2	225		3.8	3	T951206	BLOOD	3.8
916	8-990367	7	Palmerton Loc 2	225		4.5	3	T951206	BLOOD	4.5
918	8-990392	7	Palmerton Loc 2	225		3.7	3	T951206	BLOOD	3.7
922	8-990350	7	Palmerton Loc 2	225		8.1	3	T951206	BLOOD	8.1
913	8-990404	8	Palmerton Loc 4	25		2.2	3	T951206	BLOOD	2.2
914	8-990387	8	Palmerton Loc 4	25	<	1	3	T951206	BLOOD	0.5
932	8-990361	8	Palmerton Loc 4	25	<	1	3	T951206	BLOOD	0.5
937	8-990353	8	Palmerton Loc 4	25		1.4	3	T951206	BLOOD	1.4
946	8-990355	8	Palmerton Loc 4	25		1.3	3	T951206	BLOOD	1.3
924	8-990402	9	Palmerton Loc 4	75		3.9	3	T951206	BLOOD	3.9
926	8-990375	9	Palmerton Loc 4	75	<	1	3	T951206	BLOOD	0.5
944	8-990366	9	Palmerton Loc 4	75	<	1	3	T951206	BLOOD	0.5
949	8-990374	9	Palmerton Loc 4	75		1.4	3	T951206	BLOOD	1.4
957	8-990354	9	Palmerton Loc 4	75		3.1	3	T951206	BLOOD	3.1
917	8-990372	10	Palmerton Loc 4	225		3.6	3	T951206	BLOOD	3.6
921	8-990391	10	Palmerton Loc 4	225		5.9	3	T951206	BLOOD	5.9
939	8-990348	10	Palmerton Loc 4	225		3.9	3	T951206	BLOOD	3.9
941	8-990394	10	Palmerton Loc 4	225		3.8	3	T951206	BLOOD	3.8
945	8-990378	10	Palmerton Loc 4	225		2.2	3	T951206	BLOOD	2.2
907	8-990434	1	IV	100		16.3	5	T960105	BLOOD	16.3

pig number	sample	group	material administered	dosage	qualifier	lab result (ug/L)	day	source file	MATRIX	Adjusted Value (ug/dL)[a]
912	8-990408	1	IV	100		13.7	5	T960105	BLOOD	13.7
919	8-990457	1	IV	100		15.1	5	T960105	BLOOD	15.1
930	8-990449	1	IV	100		14.5	5	T960105	BLOOD	14.5
942	8-990406	1	IV	100		15.2	5	T960105	BLOOD	15.2
943	8-990435	1	IV	100		13.5	5	T960105	BLOOD	13.5
953	8-990422	1	IV	100		15	5	T960105	BLOOD	15
901	8-990416	2	Control	0	<	1	5	T960105	BLOOD	0.5
902	8-990461	2	Control	0	<	1	5	T960105	BLOOD	0.5
920	8-990429	2	Control	0	<	1	5	T960105	BLOOD	0.5
925	8-990413	2	Control	0		0.5	5	T960105	BLOOD	0.5
928	8-990444	2	Control	0	<	1	5	T960105	BLOOD	0.5
905	8-990420	3	PbAc	25		1.2	5	T960105	BLOOD	1.2
909	8-990445	3	PbAc	25		1.7	5	T960105	BLOOD	1.7
927	8-990455	3	PbAc	25		1.4	5	T960105	BLOOD	1.4
931	8-990437	3	PbAc	25		1.1	5	T960105	BLOOD	1.1
940	8-990448	3	PbAc	25		1.8	5	T960105	BLOOD	1.8
923	8-990412	4	PbAc	75		2.2	5	T960105	BLOOD	2.2
933	8-990456	4	PbAc	75		2.9	5	T960105	BLOOD	2.9
948	8-990458	4	PbAc	75		4.1	5	T960105	BLOOD	4.1
950	8-990432	4	PbAc	75		3	5	T960105	BLOOD	3
956	8-990426	4	PbAc	75		3.5	5	T960105	BLOOD	3.5
911	8-990428	5	Palmerton Loc 2	25		1.7	5	T960105	BLOOD	1.7
929	8-990460	5	Palmerton Loc 2	25	<	1	5	T960105	BLOOD	0.5
934	8-990454	5	Palmerton Loc 2	25	<	1	5	T960105	BLOOD	0.5
947	8-990452	5	Palmerton Loc 2	25		1.4	5	T960105	BLOOD	1.4
954	8-990431	5	Palmerton Loc 2	25		1.6	5	T960105	BLOOD	1.6
903	8-990427	6	Palmerton Loc 2	75		3	5	T960105	BLOOD	3
910	8-990453	6	Palmerton Loc 2	75		3.4	5	T960105	BLOOD	3.4
938	8-990451	6	Palmerton Loc 2	75		2.2	5	T960105	BLOOD	2.2
951	8-990415	6	Palmerton Loc 2	75		6.2	5	T960105	BLOOD	6.2
955	8-990436	6	Palmerton Loc 2	75		3.2	5	T960105	BLOOD	3.2
906	8-990447	7	Palmerton Loc 2	225		6	5	T960105	BLOOD	6
908	8-990405	7	Palmerton Loc 2	225		6.8	5	T960105	BLOOD	6.8
916	8-990446	7	Palmerton Loc 2	225		9.1	5	T960105	BLOOD	9.1
918	8-990439	7	Palmerton Loc 2	225		5.9	5	T960105	BLOOD	5.9
922	8-990424	7	Palmerton Loc 2	225		8.2	5	T960105	BLOOD	8.2
913	8-990411	8	Palmerton Loc 4	25		1.5	5	T960105	BLOOD	1.5
914	8-990440	8	Palmerton Loc 4	25	<	1	5	T960105	BLOOD	0.5
932	8-990409	8	Palmerton Loc 4	25		1.4	5	T960105	BLOOD	1.4
937	8-990442	8	Palmerton Loc 4	25		1.1	5	T960105	BLOOD	1.1
946	8-990418	8	Palmerton Loc 4	25		1.5	5	T960105	BLOOD	1.5
924	8-990407	9	Palmerton Loc 4	75		3.2	5	T960105	BLOOD	3.2
926	8-990423	9	Palmerton Loc 4	75		3	5	T960105	BLOOD	3
944	8-990419	9	Palmerton Loc 4	75		2.6	5	T960105	BLOOD	2.6
949	8-990430	9	Palmerton Loc 4	75		2.8	5	T960105	BLOOD	2.8
957	8-990443	9	Palmerton Loc 4	75		3.1	5	T960105	BLOOD	3.1
917	8-990450	10	Palmerton Loc 4	225		5.2	5	T960105	BLOOD	5.2
921	8-990421	10	Palmerton Loc 4	225		4.8	5	T960105	BLOOD	4.8
939	8-990438	10	Palmerton Loc 4	225		5.8	5	T960105	BLOOD	5.8
941	8-990441	10	Palmerton Loc 4	225		3.6	5	T960105	BLOOD	3.6
945	8-990459	10	Palmerton Loc 4	225		4.2	5	T960105	BLOOD	4.2
907	8-990473	1	IV	100		17.4	7	T960105	BLOOD	17.4
912	8-990510	1	IV	100		13.5	7	T960105	BLOOD	13.5
919	8-990503	1	IV	100		17.5	7	T960105	BLOOD	17.5
930	8-990469	1	IV	100		16.7	7	T960105	BLOOD	16.7
942	8-990507	1	IV	100		15	7	T960105	BLOOD	15
943	8-990481	1	IV	100		13.7	7	T960105	BLOOD	13.7
953	8-990505	1	IV	100		16.6	7	T960105	BLOOD	16.6
901	8-990482	2	Control	0	<	1	7	T960105	BLOOD	0.5
902	8-990480	2	Control	0	<	1	7	T960105	BLOOD	0.5
920	8-990500	2	Control	0	<	1	7	T960105	BLOOD	0.5
925	8-990504	2	Control	0	<	1	7	T960105	BLOOD	0.5
928	8-990491	2	Control	0	<	1	7	T960105	BLOOD	0.5
905	8-990471	3	PbAc	25		1.5	7	T960105	BLOOD	1.5
909	8-990499	3	PbAc	25		1.1	7	T960105	BLOOD	1.1
927	8-990485	3	PbAc	25		2.1	7	T960105	BLOOD	2.1
931	8-990475	3	PbAc	25		2.1	7	T960105	BLOOD	2.1
940	8-990494	3	PbAc	25		1.9	7	T960105	BLOOD	1.9
923	8-990496	4	PbAc	75		2.1	7	T960105	BLOOD	2.1
933	8-990472	4	PbAc	75		4.3	7	T960105	BLOOD	4.3
948	8-990462	4	PbAc	75		4.5	7	T960105	BLOOD	4.5
950	8-990492	4	PbAc	75		4.9	7	T960105	BLOOD	4.9
956	8-990493	4	PbAc	75		3	7	T960105	BLOOD	3
911	8-990516	5	Palmerton Loc 2	25		1.4	7	T960105	BLOOD	1.4
929	8-990508	5	Palmerton Loc 2	25		1.1	7	T960105	BLOOD	1.1
934	8-990497	5	Palmerton Loc 2	25	<	1	7	T960105	BLOOD	0.5
947	8-990478	5	Palmerton Loc 2	25		1.3	7	T960105	BLOOD	1.3
954	8-990513	5	Palmerton Loc 2	25		1.7	7	T960105	BLOOD	1.7
903	8-990512	6	Palmerton Loc 2	75		2.2	7	T960105	BLOOD	2.2
910	8-990466	6	Palmerton Loc 2	75		3.5	7	T960105	BLOOD	3.5
938	8-990477	6	Palmerton Loc 2	75		3.9	7	T960105	BLOOD	3.9
951	8-990474	6	Palmerton Loc 2	75		6.4	7	T960105	BLOOD	6.4
955	8-990486	6	Palmerton Loc 2	75		3.3	7	T960105	BLOOD	3.3
906	8-990514	7	Palmerton Loc 2	225		5.5	7	T960105	BLOOD	5.5
908	8-990517	7	Palmerton Loc 2	225		4.3	7	T960105	BLOOD	4.3
916	8-990463	7	Palmerton Loc 2	225		6.2	7	T960105	BLOOD	6.2
918	8-990488	7	Palmerton Loc 2	225		5.5	7	T960105	BLOOD	5.5
922	8-990511	7	Palmerton Loc 2	225		5.4	7	T960105	BLOOD	5.4

pig number	sample	group	material administered	dosage	qualifier	lab result (ug/L)	day	source file	MATRIX	Adjusted Value (ug/dL)[a]
913	8-990509	8	Palmerton Loc 4	25		1	7	T960105	BLOOD	1
914	8-990467	8	Palmerton Loc 4	25		1.3	7	T960105	BLOOD	1.3
932	8-990465	8	Palmerton Loc 4	25		1.8	7	T960105	BLOOD	1.8
937	8-990502	8	Palmerton Loc 4	25		1.4	7	T960105	BLOOD	1.4
946	8-990484	8	Palmerton Loc 4	25		1.4	7	T960105	BLOOD	1.4
924	8-990498	9	Palmerton Loc 4	75		3.1	7	T960105	BLOOD	3.1
926	8-990464	9	Palmerton Loc 4	75		2.4	7	T960105	BLOOD	2.4
944	8-990489	9	Palmerton Loc 4	75		2.9	7	T960105	BLOOD	2.9
949	8-990476	9	Palmerton Loc 4	75		3.4	7	T960105	BLOOD	3.4
957	8-990495	9	Palmerton Loc 4	75		2.7	7	T960105	BLOOD	2.7
917	8-990490	10	Palmerton Loc 4	225		5.6	7	T960105	BLOOD	5.6
921	8-990487	10	Palmerton Loc 4	225		5	7	T960105	BLOOD	5
939	8-990501	10	Palmerton Loc 4	225		4.6	7	T960105	BLOOD	4.6
941	8-990470	10	Palmerton Loc 4	225		3.7	7	T960105	BLOOD	3.7
945	8-990518	10	Palmerton Loc 4	225		5.9	7	T960105	BLOOD	5.9
907	8-990524	1	IV	100		20.4	9	T960105	BLOOD	20.4
912	8-990562	1	IV	100		16.8	9	T960105	BLOOD	16.8
919	8-990553	1	IV	100		17.7	9	T960105	BLOOD	17.7
930	8-990557	1	IV	100		17.1	9	T960105	BLOOD	17.1
942	8-990566	1	IV	100		16.9	9	T960105	BLOOD	16.9
943	8-990575	1	IV	100		15.5	9	T960105	BLOOD	15.5
953	8-990520	1	IV	100		17.3	9	T960105	BLOOD	17.3
901	8-990556	2	Control	0	<	1	9	T960105	BLOOD	0.5
902	8-990535	2	Control	0	<	1	9	T960105	BLOOD	0.5
920	8-990572	2	Control	0	<	1	9	T960105	BLOOD	0.5
925	8-990555	2	Control	0	<>	1	9	T960105	BLOOD	1
928	8-990560	2	Control	0	<	1	9	T960105	BLOOD	0.5
905	8-990546	3	PbAc	25		1.8	9	T960105	BLOOD	1.8
909	8-990565	3	PbAc	25		2.3	9	T960105	BLOOD	2.3
927	8-990540	3	PbAc	25		1.7	9	T960105	BLOOD	1.7
931	8-990538	3	PbAc	25		2.7	9	T960105	BLOOD	2.7
940	8-990545	3	PbAc	25		2	9	T960105	BLOOD	2
923	8-990530	4	PbAc	75		2.2	9	T960105	BLOOD	2.2
933	8-990569	4	PbAc	75		3.8	9	T960105	BLOOD	3.8
948	8-990573	4	PbAc	75		5.7	9	T960105	BLOOD	5.7
950	8-990532	4	PbAc	75		3	9	T960105	BLOOD	3
956	8-990554	4	PbAc	75		3.8	9	T960105	BLOOD	3.8
911	8-990567	5	Palmerton Loc 2	25		1.2	9	T960105	BLOOD	1.2
929	8-990528	5	Palmerton Loc 2	25		1	9	T960105	BLOOD	1
934	8-990529	5	Palmerton Loc 2	25	<	1	9	T960105	BLOOD	0.5
947	8-990542	5	Palmerton Loc 2	25		1.1	9	T960105	BLOOD	1.1
954	8-990522	5	Palmerton Loc 2	25		2.2	9	T960105	BLOOD	2.2
903	8-990539	6	Palmerton Loc 2	75		2.8	9	T960105	BLOOD	2.8
910	8-990574	6	Palmerton Loc 2	75		3.8	9	T960105	BLOOD	3.8
938	8-990544	6	Palmerton Loc 2	75		3.9	9	T960105	BLOOD	3.9
951	8-990543	6	Palmerton Loc 2	75		6.7	9	T960105	BLOOD	6.7
955	8-990552	6	Palmerton Loc 2	75		3.6	9	T960105	BLOOD	3.6
906	8-990561	7	Palmerton Loc 2	225		6.4	9	T960105	BLOOD	6.4
908	8-990521	7	Palmerton Loc 2	225		4.7	9	T960105	BLOOD	4.7
916	8-990531	7	Palmerton Loc 2	225		6.3	9	T960105	BLOOD	6.3
918	8-990534	7	Palmerton Loc 2	225		4.8	9	T960105	BLOOD	4.8
922	8-990547	7	Palmerton Loc 2	225		5.8	9	T960105	BLOOD	5.8
913	8-990551	8	Palmerton Loc 4	25		1.6	9	T960105	BLOOD	1.6
914	8-990558	8	Palmerton Loc 4	25		1.9	9	T960105	BLOOD	1.9
932	8-990533	8	Palmerton Loc 4	25		1	9	T960105	BLOOD	1
937	8-990526	8	Palmerton Loc 4	25	<	1	9	T960105	BLOOD	0.5
946	8-990537	8	Palmerton Loc 4	25		1.2	9	T960105	BLOOD	1.2
924	8-990568	9	Palmerton Loc 4	75		2.9	9	T960105	BLOOD	2.9
926	8-990550	9	Palmerton Loc 4	75		1.8	9	T960105	BLOOD	1.8
944	8-990559	9	Palmerton Loc 4	75		2	9	T960105	BLOOD	2
949	8-990549	9	Palmerton Loc 4	75		2.6	9	T960105	BLOOD	2.6
957	8-990519	9	Palmerton Loc 4	75		4.2	9	T960105	BLOOD	4.2
917	8-990563	10	Palmerton Loc 4	225		8.3	9	T960105	BLOOD	8.3
921	8-990525	10	Palmerton Loc 4	225		4.2	9	T960105	BLOOD	4.2
939	8-990536	10	Palmerton Loc 4	225		6	9	T960105	BLOOD	6
941	8-990523	10	Palmerton Loc 4	225		4.5	9	T960105	BLOOD	4.5
945	8-990548	10	Palmerton Loc 4	225		5.4	9	T960105	BLOOD	5.4
907	8-990623	1	IV	100		21.9	12	T960105	BLOOD	21.9
912	8-990630	1	IV	100		16	12	T960105	BLOOD	16
919	8-990624	1	IV	100		16.7	12	T960105	BLOOD	16.7
930	8-990618	1	IV	100		17.2	12	T960105	BLOOD	17.2
942	8-990601	1	IV	100		18.7	12	T960105	BLOOD	18.7
943	8-990584	1	IV	100		14.9	12	T960105	BLOOD	14.9
953	8-990616	1	IV	100		18	12	T960105	BLOOD	18
901	8-990598	2	Control	0	<	1	12	T960105	BLOOD	0.5
902	8-990606	2	Control	0	<	1	12	T960105	BLOOD	0.5
920	8-990577	2	Control	0	<	1	12	T960105	BLOOD	0.5
925	8-990629	2	Control	0	<	1	12	T960105	BLOOD	0.5
928	8-990605	2	Control	0	<	1	12	T960105	BLOOD	0.5
905	8-990621	3	PbAc	25		1.4	12	T960105	BLOOD	1.4
909	8-990578	3	PbAc	25		3.6	12	T960105	BLOOD	3.6
927	8-990604	3	PbAc	25		1.5	12	T960105	BLOOD	1.5
931	8-990589	3	PbAc	25		2.6	12	T960105	BLOOD	2.6
940	8-990602	3	PbAc	25		2.4	12	T960105	BLOOD	2.4
923	8-990591	4	PbAc	75		2.7	12	T960105	BLOOD	2.7
933	8-990595	4	PbAc	75		5.1	12	T960105	BLOOD	5.1
948	8-990607	4	PbAc	75		6.8	12	T960105	BLOOD	6.8
950	8-990587	4	PbAc	75		4.3	12	T960105	BLOOD	4.3

pig number	sample	group	material administered	dosage	qualifier	lab result (ug/L)	day	source file	MATRIX	Adjusted Value (ug/dL)[a]
956	8-990596	4	PbAc	75		4.7	12	T960105	BLOOD	4.7
911	8-990620	5	Palmerton Loc 2	25		2.6	12	T960105	BLOOD	2.6
929	8-990611	5	Palmerton Loc 2	25		1.7	12	T960105	BLOOD	1.7
934	8-990586	5	Palmerton Loc 2	25		2.6	12	T960105	BLOOD	2.6
947	8-990610	5	Palmerton Loc 2	25	<	1	12	T960105	BLOOD	0.5
954	8-990585	5	Palmerton Loc 2	25		1.6	12	T960105	BLOOD	1.6
903	8-990592	6	Palmerton Loc 2	75		2.5	12	T960105	BLOOD	2.5
910	8-990615	6	Palmerton Loc 2	75		5.9	12	T960105	BLOOD	5.9
938	8-990619	6	Palmerton Loc 2	75		3.8	12	T960105	BLOOD	3.8
951	8-990612	6	Palmerton Loc 2	75		6	12	T960105	BLOOD	6
955	8-990593	6	Palmerton Loc 2	75		6.5	12	T960105	BLOOD	6.5
906	8-990579	7	Palmerton Loc 2	225		7.1	12	T960105	BLOOD	7.1
908	8-990632	7	Palmerton Loc 2	225		4.3	12	T960105	BLOOD	4.3
916	8-990576	7	Palmerton Loc 2	225		6.4	12	T960105	BLOOD	6.4
918	8-990628	7	Palmerton Loc 2	225		6.1	12	T960105	BLOOD	6.1
922	8-990608	7	Palmerton Loc 2	225		5.6	12	T960105	BLOOD	5.6
913	8-990609	8	Palmerton Loc 4	25		1.7	12	T960105	BLOOD	1.7
914	8-990614	8	Palmerton Loc 4	25		1.6	12	T960105	BLOOD	1.6
932	8-990590	8	Palmerton Loc 4	25		1.9	12	T960105	BLOOD	1.9
937	8-990588	8	Palmerton Loc 4	25		1.9	12	T960105	BLOOD	1.9
946	8-990622	8	Palmerton Loc 4	25		2.3	12	T960105	BLOOD	2.3
924	8-990631	9	Palmerton Loc 4	75		3.7	12	T960105	BLOOD	3.7
926	8-990600	9	Palmerton Loc 4	75		2.4	12	T960105	BLOOD	2.4
944	8-990594	9	Palmerton Loc 4	75		1.5	12	T960105	BLOOD	1.5
949	8-990583	9	Palmerton Loc 4	75		3.3	12	T960105	BLOOD	3.3
957	8-990582	9	Palmerton Loc 4	75		3.2	12	T960105	BLOOD	3.2
917	8-990617	10	Palmerton Loc 4	225		8.4	12	T960105	BLOOD	8.4
921	8-990603	10	Palmerton Loc 4	225		4.9	12	T960105	BLOOD	4.9
939	8-990613	10	Palmerton Loc 4	225		5.8	12	T960105	BLOOD	5.8
941	8-990581	10	Palmerton Loc 4	225		4.2	12	T960105	BLOOD	4.2
945	8-990599	10	Palmerton Loc 4	225		6.4	12	T960105	BLOOD	6.4
907	8-990664	1	IV	100		22	15	T960105	BLOOD	22
912	8-990688	1	IV	100		15.7	15	T960105	BLOOD	15.7
919	8-990685	1	IV	100		17	15	T960105	BLOOD	17
930	8-990634	1	IV	100		17.5	15	T960105	BLOOD	17.5
942	8-990689	1	IV	100		18.7	15	T960105	BLOOD	18.7
943	8-990684	1	IV	100		15.5	15	T960105	BLOOD	15.5
953	8-990681	1	IV	100		19.5	15	T960105	BLOOD	19.5
901	8-990677	2	Control	0	<	1	15	T960105	BLOOD	0.5
902	8-990671	2	Control	0	<	1	15	T960105	BLOOD	0.5
920	8-990670	2	Control	0	<	1	15	T960105	BLOOD	0.5
925	8-990651	2	Control	0	<	1	15	T960105	BLOOD	0.5
928	8-990675	2	Control	0	<	1	15	T960105	BLOOD	0.5
905	8-990648	3	PbAc	25		1.8	15	T960105	BLOOD	1.8
909	8-990639	3	PbAc	25		2.2	15	T960105	BLOOD	2.2
927	8-990647	3	PbAc	25		2.8	15	T960105	BLOOD	2.8
931	8-990667	3	PbAc	25		2.1	15	T960105	BLOOD	2.1
940	8-990674	3	PbAc	25		3.1	15	T960105	BLOOD	3.1
923	8-990661	4	PbAc	75		5.9	15	T960105	BLOOD	5.9
933	8-990686	4	PbAc	75		7	15	T960105	BLOOD	7
948	8-990649	4	PbAc	75		6.9	15	T960105	BLOOD	6.9
950	8-990683	4	PbAc	75		4.9	15	T960105	BLOOD	4.9
956	8-990680	4	PbAc	75		5.4	15	T960105	BLOOD	5.4
911	8-990655	5	Palmerton Loc 2	25		2.4	15	T960105	BLOOD	2.4
929	8-990682	5	Palmerton Loc 2	25		3	15	T960105	BLOOD	3
934	8-990654	5	Palmerton Loc 2	25		2.2	15	T960105	BLOOD	2.2
947	8-990637	5	Palmerton Loc 2	25		2.1	15	T960105	BLOOD	2.1
954	8-990653	5	Palmerton Loc 2	25		2.4	15	T960105	BLOOD	2.4
903	8-990652	6	Palmerton Loc 2	75		3.2	15	T960105	BLOOD	3.2
910	8-990640	6	Palmerton Loc 2	75		5.6	15	T960105	BLOOD	5.6
938	8-990645	6	Palmerton Loc 2	75		4.3	15	T960105	BLOOD	4.3
951	8-990656	6	Palmerton Loc 2	75		6	15	T960105	BLOOD	6
955	8-990643	6	Palmerton Loc 2	75		3.7	15	T960105	BLOOD	3.7
906	8-990650	7	Palmerton Loc 2	225		7	15	T960105	BLOOD	7
908	8-990665	7	Palmerton Loc 2	225		4.4	15	T960105	BLOOD	4.4
916	8-990635	7	Palmerton Loc 2	225		7.9	15	T960105	BLOOD	7.9
918	8-990663	7	Palmerton Loc 2	225		6.7	15	T960105	BLOOD	6.7
922	8-990659	7	Palmerton Loc 2	225		6.3	15	T960105	BLOOD	6.3
913	8-990668	8	Palmerton Loc 4	25		2.4	15	T960105	BLOOD	2.4
914	8-990657	8	Palmerton Loc 4	25		2.2	15	T960105	BLOOD	2.2
932	8-990633	8	Palmerton Loc 4	25		2.1	15	T960105	BLOOD	2.1
937	8-990658	8	Palmerton Loc 4	25		2.2	15	T960105	BLOOD	2.2
946	8-990678	8	Palmerton Loc 4	25		3.2	15	T960105	BLOOD	3.2
924	8-990636	9	Palmerton Loc 4	75		4.1	15	T960105	BLOOD	4.1
926	8-990666	9	Palmerton Loc 4	75		3.5	15	T960105	BLOOD	3.5
944	8-990644	9	Palmerton Loc 4	75		2.6	15	T960105	BLOOD	2.6
949	8-990669	9	Palmerton Loc 4	75		3	15	T960105	BLOOD	3
957	8-990676	9	Palmerton Loc 4	75		4.4	15	T960105	BLOOD	4.4
917	8-990679	10	Palmerton Loc 4	225		9.1	15	T960105	BLOOD	9.1
921	8-990660	10	Palmerton Loc 4	225		6.7	15	T960105	BLOOD	6.7
939	8-990662	10	Palmerton Loc 4	225		5.7	15	T960105	BLOOD	5.7
941	8-990638	10	Palmerton Loc 4	225		4.7	15	T960105	BLOOD	4.7
945	8-990646	10	Palmerton Loc 4	225		6.5	15	T960105	BLOOD	6.5

a Non-detects evaluated using 1/2 the quantitation limit; laboratory results (ug/L) converted to concentration in blood (ug/dL) by dividing by dilution factor of 1 dL/L

TABLE A-4 BLOOD LEAD OUTLIERS

[shaded box] Flagged Data Points
[open box] Outliers (none selected)

test material	target dosage	Actual Dose*	group	pig#	BLOOD LEAD (ug/dL) BY DAY -4	0	1	2	3	5	7	9	12	15
IV	100	119.50	1	907	0.5	0.5	12	13.3	14.2	16.3	17.4	20.4	21.9	22
IV	100	99.13	1	912	0.5	0.5	10.7	10.9	12.6	13.7	13.5	16.8	16	15.7
IV	100	113.67	1	919	0.5	0.5	9.7	12	11.9	15.1	17.5	17.7	16.7	17
IV	100	108.87	1	930	0.5	0.5	11.1	12.1	13.5	14.5	16.7	17.1	17.2	17.5
IV	100	101.49	1	942	0.5	0.5	9.2	10.4	12.9	15.2	15	16.9	18.7	18.7
IV	100	94.26	1	943	0.5	1.3	9.3	9.2	10.8	13.5	13.7	15.5	14.9	15.5
IV	100	102.35	1	953	0.5	0.5	9.7	12.4	15.1	15	16.6	17.3	18	19.5
Control	0	0.00	2	901	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Control	0	0.00	2	902	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Control	0	0.00	2	920	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Control	0	0.00	2	925	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5
Control	0	0.00	2	928	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
PbAc	25	22.15	3	905	0.5	0.5	0.5	0.5	1.8	1.2	1.5	1.8	1.4	1.8
PbAc	25	23.78	3	909	0.5	0.5	0.5	1	0.5	1.7	1.1	2.3	3.6	2.2
PbAc	25	24.52	3	927	0.5	0.5	1.2	0.5	0.5	1.4	2.1	1.7	1.5	2.8
PbAc	25	26.64	3	931	0.5	0.5	1.4	1.1	1.3	1.1	2.1	2.7	2.6	2.1
PbAc	25	27.18	3	940	0.5	0.5	0.5	1.6	1.4	1.8	1.9	2	2.4	3.1
PbAc	75	88.61	4	923	0.5	0.5	0.5	2.1	1.3	2.2	2.1	2.2	2.7	5.9
PbAc	75	68.44	4	933	0.5	0.5	1.7	2.2	1.6	2.9	4.3	3.8	5.1	7
PbAc	75	72.19	4	948	0.5	0.5	1.7	3.2	4	4.1	4.5	5.7	6.8	6.9
PbAc	75	68.67	4	950	0.5	0.5	0.5	2.2	2.3	3	4.9	3	4.3	4.9
PbAc	75	75.81	4	956	0.5	0.5	1.9	3.6	1.5	3.5	3	3.8	4.7	5.4
Palmerton Loc 2	25	27.24	5	911	0.5	0.5	1.3	1.3	0.5	1.7	1.4	1.2	2.6	2.4
Palmerton Loc 2	25	26.00	5	929	0.5	0.5	0.5	0.5	1.1	0.5	1.1	1	1.7	3
Palmerton Loc 2	25	24.21	5	934	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	2.6	2.2
Palmerton Loc 2	25	23.48	5	947	0.5	0.5	1.2	0.5	0.5	1.4	1.3	1.1	0.5	2.1
Palmerton Loc 2	25	24.69	5	954	0.5	0.5	0.5	1.1	1.5	1.6	1.7	2.2	1.6	2.4
Palmerton Loc 2	75	69.33	6	903	0.5	0.5	0.5	2.1	3.6	3	2.2	2.8	2.5	3.2
Palmerton Loc 2	75	70.84	6	910	0.5	1.2	1.7	2.6	2	3.4	3.5	3.8	5.9	5.6
Palmerton Loc 2	75	82.92	6	938	0.5	0.5	0.5	2	0.5	2.2	3.9	3.9	3.8	4.3
Palmerton Loc 2	75	78.69	6	951	0.5	0.5	3.1	3.8	3.4	6.2	6.4	6.7	6	6
Palmerton Loc 2	75	72.50	6	955	0.5	0.5	2	2.3	1.5	3.2	3.3	3.6	6.5	3.7
Palmerton Loc 2	225	206.38	7	906	0.5	1.3	2.2	3.7	5.5	6	5.5	6.4	7.1	7
Palmerton Loc 2	225	242.17	7	908	0.5	1.8	4.4	5.1	3.8	6.8	4.3	4.7	4.3	4.4
Palmerton Loc 2	225	239.97	7	916	0.5	1.5	4.2	4.6	4.5	9.1	6.2	6.3	6.4	7.9
Palmerton Loc 2	225	242.12	7	918	0.5	1.1	2.2	2.6	3.7	5.9	5.5	4.8	6.1	6.7
Palmerton Loc 2	225	200.83	7	922	0.5	1.3	4	4.9	8.1	8.2	5.4	5.8	5.6	6.3
Palmerton Loc 4	25	29.77	8	913	0.5	0.5	0.5	1.6	2.2	1.5	1	1.6	1.7	2.4
Palmerton Loc 4	25	25.47	8	914	0.5	1	0.5	0.5	0.5	0.5	1.3	1.9	1.6	2.2
Palmerton Loc 4	25	22.21	8	932	0.5	0.5	0.5	1.3	0.5	1.4	1.8	1	1.9	2.1
Palmerton Loc 4	25	22.85	8	937	0.5	1.2	0.5	1.2	1.4	1.1	1.4	0.5	1.9	2.2
Palmerton Loc 4	25	25.45	8	946	0.5	0.5	0.5	0.5	1.3	1.5	1.4	1.2	2.3	3.2
Palmerton Loc 4	75	72.35	9	924	0.5	0.5	1.2	1.7	3.8	3.2	3.1	2.9	3.7	4.1
Palmerton Loc 4	75	84.89	9	926	0.5	0.5	1.2	1.4	0.5	3	2.4	1.8	2.4	3.5
Palmerton Loc 4	75	66.75	9	944	0.5	0.5	1	1.4	0.5	2.6	2.9	2	1.5	2.6
Palmerton Loc 4	75	75.79	9	949	0.5	0.5	1.1	1.7	1.4	2.8	3.4	2.6	3.3	3
Palmerton Loc 4	75	74.90	9	957	0.5	0.5	0.5	1.8	3.1	3.1	2.7	4.2	3.2	4.4
Palmerton Loc 4	225	265.86	10	917	0.5	0.5	4.1	5.4	3.6	5.2	5.6	8.3	8.4	9.1
Palmerton Loc 4	225	220.51	10	921	0.5	0.5	3.9	4.9	5.8	4.8	5	4.2	4.9	6.7
Palmerton Loc 4	225	192.62	10	939	0.5	0.5	2.3	4.7	3.9	5.8	4.6	6	5.8	5.7
Palmerton Loc 4	225	204.43	10	941	0.5	0.5	1.4	3.2	3.8	3.6	3.7	4.5	4.2	4.7
Palmerton Loc 4	225	239.02	10	945	0.5	0.5	2.6	3.5	2.2	4.2	5.9	5.4	6.4	6.5

* Average Time and Weight-Adjusted Dose for Each Pig

TABLE A-5 RATIONALE FOR PbB OUTLIER DECISIONS

No PbB Outliers Selected for this Study

TABLE A-6 Area Under Curve Determinations

Calculated using interpolated values for missing or excluded data

pig#	AUC (ug/dL-days) For Time Span Shown								AUC Total
	0-1	1-2	2-3	3-5	5-7	7-9	9-12	12-15	(ug/dL-days)
907	6.25	12.65	13.75	30.50	33.70	37.80	63.45	65.85	263.95
912	5.60	10.80	11.75	26.30	27.20	30.30	49.20	47.55	208.70
919	5.10	10.85	11.95	27.00	32.60	35.20	51.60	50.55	224.85
930	5.80	11.60	12.80	28.00	31.20	33.80	51.45	52.05	226.70
942	4.85	9.80	11.65	28.10	30.20	31.90	53.40	56.10	226.00
943	5.30	9.25	10.00	24.30	27.20	29.20	45.60	45.60	196.45
953	5.10	11.05	13.75	30.10	31.60	33.90	52.95	56.25	234.70
901	0.50	0.50	0.50	1.00	1.00	1.00	1.50	1.50	7.50
902	0.50	0.50	0.50	1.00	1.00	1.00	1.50	1.50	7.50
920	0.50	0.50	0.50	1.00	1.00	1.00	1.50	1.50	7.50
925	0.50	0.50	0.50	1.00	1.00	1.50	2.25	1.50	8.75
928	0.50	0.50	0.50	1.00	1.00	1.00	1.50	1.50	7.50
905	0.50	0.50	1.15	3.00	2.70	3.30	4.80	4.80	20.75
909	0.50	0.75	0.75	2.20	2.80	3.40	8.85	8.70	27.95
927	0.85	0.85	0.50	1.90	3.50	3.80	4.80	6.45	22.65
931	0.95	1.25	1.20	2.40	3.20	4.80	7.95	7.05	28.80
940	0.50	1.05	1.50	3.20	3.70	3.90	6.60	8.25	28.70
923	0.50	1.30	1.70	3.50	4.30	4.30	7.35	12.90	35.85
933	1.10	1.95	1.90	4.50	7.20	8.10	13.35	18.15	56.25
948	1.10	2.45	3.60	8.10	8.60	10.20	18.75	20.55	73.35
950	0.50	1.35	2.25	5.30	7.90	7.90	10.95	13.80	49.95
956	1.20	2.75	2.55	5.00	6.50	6.80	12.75	15.15	52.70
911	0.90	1.30	0.90	2.20	3.10	2.60	5.70	7.50	24.20
929	0.50	0.50	0.80	1.60	1.60	2.10	4.05	7.05	18.20
934	0.50	0.50	0.50	1.00	1.00	1.00	4.65	7.20	16.35
947	0.85	0.85	0.50	1.90	2.70	2.40	2.40	3.90	15.50
954	0.50	0.80	1.30	3.10	3.30	3.90	5.70	6.00	24.60
903	0.50	1.30	2.85	6.60	5.20	5.00	7.95	8.55	37.95
910	1.45	2.15	2.30	5.40	6.90	7.30	14.55	17.25	57.30
938	0.50	1.25	1.25	2.70	6.10	7.80	11.55	12.15	43.30
951	1.80	3.45	3.60	9.60	12.60	13.10	19.05	18.00	81.20
955	1.25	2.15	1.90	4.70	6.50	6.90	15.15	15.30	53.85
906	1.75	2.95	4.60	11.50	11.50	11.90	20.25	21.15	85.60
908	3.10	4.75	4.45	10.60	11.10	9.00	13.50	13.05	69.55
916	2.85	4.40	4.55	13.60	15.30	12.50	19.05	21.45	93.70
918	1.65	2.40	3.15	9.60	11.40	10.30	16.35	19.20	74.05
922	2.65	4.45	6.50	16.30	13.60	11.20	17.10	17.85	89.65
913	0.50	1.05	1.90	3.70	2.50	2.60	4.95	6.15	23.35
914	0.75	0.50	0.50	1.00	1.80	3.20	5.25	5.70	18.70
932	0.50	0.90	0.90	1.90	3.20	2.80	4.35	6.00	20.55
937	0.85	0.85	1.30	2.50	2.50	1.90	3.60	6.15	19.65
946	0.50	0.50	0.90	2.80	2.90	2.60	5.25	8.25	23.70
924	0.85	1.45	2.80	7.10	6.30	6.00	9.90	11.70	46.10
926	0.85	1.30	0.95	3.50	5.40	4.20	6.30	8.85	31.35
944	0.75	1.20	0.95	3.10	5.50	4.90	5.25	6.15	27.80
949	0.80	1.40	1.55	4.20	6.20	6.00	8.85	9.45	38.45
957	0.50	1.15	2.45	6.20	5.80	6.90	11.10	11.40	45.50
917	2.30	4.75	4.50	8.80	10.80	13.90	25.05	26.25	96.35
921	2.20	4.40	5.40	10.70	9.80	9.20	13.65	17.40	72.75
939	1.40	3.50	4.30	9.70	10.40	10.60	17.70	17.25	74.85
941	0.95	2.30	3.50	7.40	7.30	8.20	13.05	13.35	56.05
945	1.55	3.05	2.85	6.40	10.10	11.30	17.70	19.35	72.30

TABLE A - 7 TISSUE LEAD DATA

pig number	sample	group	material administered	dosage	qualifier	lab result (ug/L)	day	source file	MATRIX	Adjusted Value*
907	8-990853	1	IV	100		112	15	T960131F	FEMUR	56
912	8-990878	1	IV	100		84.8	15	T960131F	FEMUR	42.4
919	8-990872	1	IV	100		105	15	T960131F	FEMUR	52.5
930	8-990870	1	IV	100		92	15	T960131F	FEMUR	46
942	8-990886	1	IV	100		83.2	15	T960131F	FEMUR	41.6
943	8-990856	1	IV	100		84.3	15	T960131F	FEMUR	42.15
953	8-990857	1	IV	100		82	15	T960131F	FEMUR	41
901	8-990852	2	Control	0	<	2	15	T960131F	FEMUR	0.5
902	8-990888	2	Control	0	<	2	15	T960131F	FEMUR	0.5
920	8-990863	2	Control	0	<	2	15	T960131F	FEMUR	0.5
925	8-990889	2	Control	0	<	2	15	T960131F	FEMUR	0.5
928	8-990891	2	Control	0	<	2	15	T960131F	FEMUR	0.5
905	8-990879	3	PbAc	25		3.5	15	T960131F	FEMUR	1.75
909	8-990896	3	PbAc	25		3.3	15	T960131F	FEMUR	1.65
927	8-990887	3	PbAc	25		7.2	15	T960131F	FEMUR	3.6
931	8-990871	3	PbAc	25		6.2	15	T960131F	FEMUR	3.1
940	8-990858	3	PbAc	25		7.3	15	T960131F	FEMUR	3.65
923	8-990854	4	PbAc	75		9.6	15	T960131F	FEMUR	4.8
933	8-990877	4	PbAc	75		9.2	15	T960131F	FEMUR	4.6
948	8-990859	4	PbAc	75		14.5	15	T960131F	FEMUR	7.25
950	8-990851	4	PbAc	75		14.2	15	T960131F	FEMUR	7.1
956	8-990845	4	PbAc	75		8.4	15	T960131F	FEMUR	4.2
911	8-990862	5	Palmerton Loc 2	25		3.1	15	T960131F	FEMUR	1.55
929	8-990865	5	Palmerton Loc 2	25	<	2	15	T960131F	FEMUR	0.5
934	8-990882	5	Palmerton Loc 2	25		4.9	15	T960131F	FEMUR	2.45
947	8-990864	5	Palmerton Loc 2	25		2.7	15	T960131F	FEMUR	1.35
954	8-990880	5	Palmerton Loc 2	25		5.6	15	T960131F	FEMUR	2.8
903	8-990894	6	Palmerton Loc 2	75		5.7	15	T960131F	FEMUR	2.85
910	8-990867	6	Palmerton Loc 2	75		9.6	15	T960131F	FEMUR	4.8
938	8-990869	6	Palmerton Loc 2	75		5.9	15	T960131F	FEMUR	2.95
951	8-990890	6	Palmerton Loc 2	75		8.4	15	T960131F	FEMUR	4.2
955	8-990899	6	Palmerton Loc 2	75		5.2	15	T960131F	FEMUR	2.6
906	8-990883	7	Palmerton Loc 2	225		12.3	15	T960131F	FEMUR	6.15
908	8-990868	7	Palmerton Loc 2	225		15.5	15	T960131F	FEMUR	7.75
916	8-990885	7	Palmerton Loc 2	225		18.5	15	T960131F	FEMUR	9.25
918	8-990876	7	Palmerton Loc 2	225		17.3	15	T960131F	FEMUR	8.65
922	8-990895	7	Palmerton Loc 2	225		10.5	15	T960131F	FEMUR	5.25
913	8-990849	8	Palmerton Loc 4	25		3.4	15	T960131F	FEMUR	1.7
914	8-990866	8	Palmerton Loc 4	25		4.5	15	T960131F	FEMUR	2.25
932	8-990892	8	Palmerton Loc 4	25		3.5	15	T960131F	FEMUR	1.75
937	8-990848	8	Palmerton Loc 4	25		2.9	15	T960131F	FEMUR	1.45
946	8-990874	8	Palmerton Loc 4	25		3.9	15	T960131F	FEMUR	1.95
924	8-990846	9	Palmerton Loc 4	75		6.3	15	T960131F	FEMUR	3.15
926	8-990855	9	Palmerton Loc 4	75		7.5	15	T960131F	FEMUR	3.75
944	8-990881	9	Palmerton Loc 4	75		6.3	15	T960131F	FEMUR	3.15
949	8-990898	9	Palmerton Loc 4	75		5.2	15	T960131F	FEMUR	2.6
957	8-990893	9	Palmerton Loc 4	75		5	15	T960131F	FEMUR	2.5
917	8-990884	10	Palmerton Loc 4	225		12.3	15	T960131F	FEMUR	6.15
921	8-990847	10	Palmerton Loc 4	225		16.3	15	T960131F	FEMUR	8.15
939	8-990861	10	Palmerton Loc 4	225		14.1	15	T960131F	FEMUR	7.05
941	8-990873	10	Palmerton Loc 4	225		9.9	15	T960131F	FEMUR	4.95
945	8-990860	10	Palmerton Loc 4	225		11.5	15	T960131F	FEMUR	5.75
907	8-990823	1	IV	100		184	15	T960120K	KIDNEY	1840
912	8-990815	1	IV	100		170	15	T960120K	KIDNEY	1700
919	8-990795	1	IV	100		120	15	T960120K	KIDNEY	1200
930	8-990798	1	IV	100		125	15	T960120K	KIDNEY	1250
942	8-990811	1	IV	100		112	15	T960120K	KIDNEY	1120
943	8-990792	1	IV	100		111	15	T960120K	KIDNEY	1110
953	8-990819	1	IV	100		113	15	T960120K	KIDNEY	1130
901	8-990804	2	Control	0		2.3	15	T960120K	KIDNEY	23
902	8-990800	2	Control	0	<	2	15	T960120K	KIDNEY	10
920	8-990791	2	Control	0	<	2	15	T960120K	KIDNEY	10
925	8-990806	2	Control	0	<	2	15	T960120K	KIDNEY	10
928	8-990801	2	Control	0	<	2	15	T960120K	KIDNEY	10
905	8-990790	3	PbAc	25		3	15	T960120K	KIDNEY	30
909	8-990817	3	PbAc	25		5.7	15	T960120K	KIDNEY	57
927	8-990830	3	PbAc	25		6	15	T960120K	KIDNEY	60
931	8-990826	3	PbAc	25		5.5	15	T960120K	KIDNEY	55
940	8-990842	3	PbAc	25		11.7	15	T960120K	KIDNEY	117
923	8-990843	4	PbAc	75		18.7	15	T960120K	KIDNEY	187
933	8-990802	4	PbAc	75		18.5	15	T960120K	KIDNEY	185
948	8-990832	4	PbAc	75		31	15	T960120K	KIDNEY	310
950	8-990840	4	PbAc	75		15.3	15	T960120K	KIDNEY	153
956	8-990824	4	PbAc	75		24.6	15	T960120K	KIDNEY	246
911	8-990836	5	Palmerton Loc 2	25		2.9	15	T960120K	KIDNEY	29
929	8-990805	5	Palmerton Loc 2	25		4.1	15	T960120K	KIDNEY	41
934	8-990799	5	Palmerton Loc 2	25		24.1	15	T960120K	KIDNEY	241
947	8-990835	5	Palmerton Loc 2	25		6.4	15	T960120K	KIDNEY	64
954	8-990814	5	Palmerton Loc 2	25		10.9	15	T960120K	KIDNEY	109
903	8-990825	6	Palmerton Loc 2	75		10.2	15	T960120K	KIDNEY	102
910	8-990828	6	Palmerton Loc 2	75		47.6	15	T960120K	KIDNEY	476
938	8-990829	6	Palmerton Loc 2	75		8.1	15	T960120K	KIDNEY	81
951	8-990803	6	Palmerton Loc 2	75		47.6	15	T960120K	KIDNEY	476
955	8-990834	6	Palmerton Loc 2	75		13.6	15	T960120K	KIDNEY	136
906	8-990837	7	Palmerton Loc 2	225		26.1	15	T960120K	KIDNEY	261

pig number	sample	group	material administered	dosage	qualifier	lab result (ug/L)	day	source file	MATRIX	Adjusted Value[a]
908	8-990831	7	Palmerton Loc 2	225		18.3	15	T960120K	KIDNEY	183
916	8-990794	7	Palmerton Loc 2	225		25.5	15	T960120K	KIDNEY	255
918	8-990793	7	Palmerton Loc 2	225		21.9	15	T960120K	KIDNEY	219
922	8-990808	7	Palmerton Loc 2	225		19.1	15	T960120K	KIDNEY	191
913	8-990813	8	Palmerton Loc 4	25		3.3	15	T960120K	KIDNEY	33
914	8-990818	8	Palmerton Loc 4	25		5.4	15	T960120K	KIDNEY	54
932	8-990812	8	Palmerton Loc 4	25		4.8	15	T960120K	KIDNEY	48
937	8-990807	8	Palmerton Loc 4	25		3.9	15	T960120K	KIDNEY	39
946	8-990816	8	Palmerton Loc 4	25		14.4	15	T960120K	KIDNEY	144
924	8-990820	9	Palmerton Loc 4	75		9.9	15	T960120K	KIDNEY	99
926	8-990839	9	Palmerton Loc 4	75		8.2	15	T960120K	KIDNEY	82
944	8-990796	9	Palmerton Loc 4	75		11.5	15	T960120K	KIDNEY	115
949	8-990809	9	Palmerton Loc 4	75		7.7	15	T960120K	KIDNEY	77
957	8-990821	9	Palmerton Loc 4	75		5.7	15	T960120K	KIDNEY	57
917	8-990827	10	Palmerton Loc 4	225		22.8	15	T960120K	KIDNEY	228
921	8-990833	10	Palmerton Loc 4	225		24.4	15	T960120K	KIDNEY	244
939	8-990838	10	Palmerton Loc 4	225		28.2	15	T960120K	KIDNEY	282
941	8-990822	10	Palmerton Loc 4	225		13	15	T960120K	KIDNEY	130
945	8-990797	10	Palmerton Loc 4	225		16.1	15	T960120K	KIDNEY	161
907	8-990765	1	IV	100		166	15	T960120L	LIVER	1660
912	8-990737	1	IV	100		155	15	T960120L	LIVER	1550
919	8-990742	1	IV	100		241	15	T960120L	LIVER	2410
930	8-990752	1	IV	100		160	15	T960120L	LIVER	1600
942	8-990746	1	IV	100		88	15	T960120L	LIVER	880
943	8-990751	1	IV	100		149	15	T960120L	LIVER	1490
953	8-990789	1	IV	100		103	15	T960120L	LIVER	1030
901	8-990743	2	Control	0	<	2	15	T960120L	LIVER	10
902	8-990735	2	Control	0	<	2	15	T960120L	LIVER	10
920	8-990736	2	Control	0	<	2	15	T960120L	LIVER	10
925	8-990766	2	Control	0	<	2	15	T960120L	LIVER	10
928	8-990753	2	Control	0	<	2	15	T960120L	LIVER	10
905	8-990769	3	PbAc	25		4.1	15	T960120L	LIVER	41
909	8-990772	3	PbAc	25		5.7	15	T960120L	LIVER	57
927	8-990762	3	PbAc	25		6.1	15	T960120L	LIVER	61
931	8-990763	3	PbAc	25		3.9	15	T960120L	LIVER	39
940	8-990778	3	PbAc	25		11.1	15	T960120L	LIVER	111
923	8-990784	4	PbAc	75		20	15	T960120L	LIVER	200
933	8-990775	4	PbAc	75		21.2	15	T960120L	LIVER	212
948	8-990740	4	PbAc	75		32.6	15	T960120L	LIVER	326
950	8-990781	4	PbAc	75		10.2	15	T960120L	LIVER	102
956	8-990768	4	PbAc	75		18.4	15	T960120L	LIVER	184
911	8-990756	5	Palmerton Loc 2	25		4.4	15	T960120L	LIVER	44
929	8-990744	5	Palmerton Loc 2	25		3.9	15	T960120L	LIVER	39
934	8-990755	5	Palmerton Loc 2	25		12.8	15	T960120L	LIVER	128
947	8-990749	5	Palmerton Loc 2	25		9	15	T960120L	LIVER	90
954	8-990738	5	Palmerton Loc 2	25		5.5	15	T960120L	LIVER	55
903	8-990774	6	Palmerton Loc 2	75		12.3	15	T960120L	LIVER	123
910	8-990741	6	Palmerton Loc 2	75		44.5	15	T960120L	LIVER	445
938	8-990786	6	Palmerton Loc 2	75		5.8	15	T960120L	LIVER	58
951	8-990747	6	Palmerton Loc 2	75		39.2	15	T960120L	LIVER	392
955	8-990761	6	Palmerton Loc 2	75		9.2	15	T960120L	LIVER	92
906	8-990767	7	Palmerton Loc 2	225		23.9	15	T960120L	LIVER	239
908	8-990760	7	Palmerton Loc 2	225		22.2	15	T960120L	LIVER	222
916	8-990757	7	Palmerton Loc 2	225		35.1	15	T960120L	LIVER	351
918	8-990764	7	Palmerton Loc 2	225		22	15	T960120L	LIVER	220
922	8-990782	7	Palmerton Loc 2	225		19.7	15	T960120L	LIVER	197
913	8-990759	8	Palmerton Loc 4	25		6.1	15	T960120L	LIVER	61
914	8-990785	8	Palmerton Loc 4	25		4.8	15	T960120L	LIVER	48
932	8-990754	8	Palmerton Loc 4	25		3.2	15	T960120L	LIVER	32
937	8-990750	8	Palmerton Loc 4	25		3.5	15	T960120L	LIVER	35
946	8-990773	8	Palmerton Loc 4	25		8.1	15	T960120L	LIVER	81
924	8-990758	9	Palmerton Loc 4	75		7.1	15	T960120L	LIVER	71
926	8-990770	9	Palmerton Loc 4	75		13.1	15	T960120L	LIVER	131
944	8-990788	9	Palmerton Loc 4	75		11.5	15	T960120L	LIVER	115
949	8-990787	9	Palmerton Loc 4	75		16.7	15	T960120L	LIVER	167
957	8-990777	9	Palmerton Loc 4	75		6.2	15	T960120L	LIVER	62
917	8-990771	10	Palmerton Loc 4	225		26.8	15	T960120L	LIVER	268
921	8-990783	10	Palmerton Loc 4	225		28.8	15	T960120L	LIVER	288
939	8-990779	10	Palmerton Loc 4	225		27.7	15	T960120L	LIVER	277
941	8-990745	10	Palmerton Loc 4	225		12.3	15	T960120L	LIVER	123
945	8-990739	10	Palmerton Loc 4	225		25.3	15	T960120L	LIVER	253

a Non-detects evaluated using 1/2 the quantitation limit. Laboratory results (ug/L) converted to tissue concentrations by dividing by sample dilution factors of 0.1 kg/L (liver, kidney) or 2 g/L (ashed bone). Final units are ug Pb/kg wet weight (liver, kidney) or ug Pb/g ashed bone (femur)

TABLE A-8 SUMMARY OF ENDPOINT OUTLIERS

[ ] Selected Outliers

test material	target dosage	Actual Dose*	group	pig#	MEASUREMENT ENDPOINT Blood	Femur	Liver	Kidney
IV	100	119.50	1	**907**	263.95	56	1660	1840
IV	100	99.13	1	**912**	208.7	42.4	1550	1700
IV	100	113.67	1	**919**	224.85	52.5	2410	1200
IV	100	108.87	1	**930**	226.7	46	1600	1250
IV	100	101.49	1	**942**	226	41.6	880	1120
IV	100	94.26	1	**943**	196.45	42.15	1490	1110
IV	100	102.35	1	**953**	234.7	41	1030	1130
Control	0	0.00	2	**901**	7.5	0.5	10	23
Control	0	0.00	2	**902**	7.5	0.5	10	10
Control	0	0.00	2	**920**	7.5	0.5	10	10
Control	0	0.00	2	**925**	8.75	0.5	10	10
Control	0	0.00	2	**928**	7.5	0.5	10	10
PbAc	25	22.15	3	**905**	20.75	1.75	41	30
PbAc	25	23.78	3	**909**	27.95	1.65	57	57
PbAc	25	24.52	3	**927**	22.65	3.6	61	60
PbAc	25	26.64	3	**931**	28.8	3.1	39	55
PbAc	25	27.18	3	**940**	28.7	3.65	111	117
PbAc	75	88.61	4	**923**	[35.85] c	4.8	200	187
PbAc	75	68.44	4	**933**	56.25	4.6	212	185
PbAc	75	72.19	4	**948**	[73.35] b	7.25	[326] b	[310] b
PbAc	75	68.67	4	**950**	49.95	7.1	102	153
PbAc	75	75.81	4	**956**	52.7	4.2	184	246
Palmerton Loc 2	25	27.24	5	**911**	24.2	1.55	44	29
Palmerton Loc 2	25	26.00	5	**929**	18.2	0.5	39	41
Palmerton Loc 2	25	24.21	5	**934**	16.35	2.45	128	241
Palmerton Loc 2	25	23.48	5	**947**	15.5	1.35	90	64
Palmerton Loc 2	25	24.69	5	**954**	24.6	2.8	55	109
Palmerton Loc 2	75	69.33	6	**903**	37.95	2.85	123	102
Palmerton Loc 2	75	70.84	6	**910**	57.3	4.8	[445] b	[476] b
Palmerton Loc 2	75	82.92	6	**938**	43.3	2.95	58	81
Palmerton Loc 2	75	78.69	6	**951**	[81.2] b	4.2	[392] b	[476] b
Palmerton Loc 2	75	72.50	6	**955**	53.85	2.6	92	136
Palmerton Loc 2	225	206.38	7	**906**	85.6	6.15	239	261
Palmerton Loc 2	225	242.17	7	**908**	69.55	7.75	222	183
Palmerton Loc 2	225	239.97	7	**916**	93.7	9.25	351	255
Palmerton Loc 2	225	242.12	7	**918**	74.05	8.65	220	219
Palmerton Loc 2	225	200.83	7	**922**	89.65	5.25	197	191
Palmerton Loc 4	25	29.77	8	**913**	23.35	1.7	61	33
Palmerton Loc 4	25	25.47	8	**914**	18.7	2.25	48	54
Palmerton Loc 4	25	22.21	8	**932**	20.55	1.75	32	48
Palmerton Loc 4	25	22.85	8	**937**	19.65	1.45	35	39
Palmerton Loc 4	25	25.45	8	**946**	23.7	1.95	81	[144] b
Palmerton Loc 4	75	72.35	9	**924**	46.1	3.15	71	99
Palmerton Loc 4	75	84.89	9	**926**	31.35	3.75	131	82
Palmerton Loc 4	75	66.75	9	**944**	27.8	3.15	115	115
Palmerton Loc 4	75	75.79	9	**949**	38.45	2.6	167	77
Palmerton Loc 4	75	74.90	9	**957**	45.5	2.5	62	57
Palmerton Loc 4	225	265.86	10	**917**	96.35	6.15	268	228
Palmerton Loc 4	225	220.51	10	**921**	72.75	8.15	288	244
Palmerton Loc 4	225	192.62	10	**939**	74.85	7.05	277	[282] b
Palmerton Loc 4	225	204.43	10	**941**	56.05	4.95	[123] b	130
Palmerton Loc 4	225	239.02	10	**945**	72.3	5.75	253	161

a a priori outlier determinations (none selected in this study)

b Outside 95% Prediction Intervals

c In this dose group, 3 of 5 values are close to the mean. Of the remaining two one is above and one is below the mean. The one high value is outside the 95% Prediction Interval, but the low value is inside the 95% Prediction Interval. Thus, the default rule is to exclude the high point and retain the low data point. However, retaining the low point in the absence of the high point causes the best fit curve to plateau at a much lower level (58 ug/dL-days) than seen for PbAc in other studies (e.g., 159 ug/dL-days). In fact, the best fit line for PbAc drops below the best fit line for test material, yielding RBA values that are greater than one. This is considered to be biologically implausible and inappropriate. Therefore, the low data point and the high data point were both excluded. This yielded a best fit more nearly in accord with other studies (plateau = 118 ug/dL-days), and yielded RBA values considered to be more plausible.

TABLE A-9 Best Curve Fit Parameters

BLOOD

PbAc Curve -	Exp
a	7.22
b	
c	104
d	0.0081
R2	0.982

Loc 2 Curve -	Exp
a	7.22
b	
c	104
d	0.006
R2	0.935

Loc 4 Curve -	Exp
a	7.22
b	
c	104
d	0.0047
R2	0.934

BONE

PbAc Curve -	Linear
a	0.87
b	0.0634
c	
d	
R2	0.771

Loc 2 Curve -	Linear
a	0.87
b	0.0298
c	
d	
R2	0.904

Loc 4 Curve -	Linear
a	0.87
b	0.0249
c	
d	
R2	0.879

LIVER

PbAc Curve -	Linear
a	18.41
b	2.036
c	
d	
R2	0.854

Loc 2 Curve -	Linear
a	18.41
b	1.014
c	
d	
R2	0.843

Loc 4 Curve -	Linear
a	18.41
b	1.103
c	
d	
R2	0.913

KIDNEY

PbAc Curve -	Linear
a	25.06
b	2.14
c	
d	
R2	0.87

Loc 2 Curve -	Linear
a	25.06
b	0.896
c	
d	
R2	0.618

Loc 4 Curve -	Linear
a	25.06
b	0.725
c	
d	
R2	0.87

Equations Used	
EXP	Y=a+c*(1-exp(-d*dose))
LIN	Y=a+b*dose

TABLE A-10 Relative Bioavailability of Lead in Test Materials

Endpoint	Test Material	
	Location 2	Location 4
Blood	0.74	0.58
Kidney	0.42	0.34
Liver	0.50	0.54
Bone	0.47	0.39

Definitions

Plausible Range:	RBA(Blood) to mean RBA for Tissues
Preferred Range:	RBA(Blood) to (RBA(Blood) + RBA(Tissues))/2
Suggested Point Est:	1/2(RBA(Blood) + (RBA(Blood)+RBA(Tissues))/2)

Relative Bioavailability

	Location 2		Location 4	
Plausible Range	0.74	0.46	0.58	0.42
Preferred Range	0.74	0.60	0.58	0.50
Point Estimate	0.67		0.54	

Absolute Bioavailability

	Location 2		Location 4	
Plausible Range	37%	23%	29%	21%
Preferred Range	37%	30%	29%	25%
Point Estimate	34%		27%	

TABLE A-11 INTRALABORATORY DUPLICATES

RPD = Relative Percent Difference
RPD = 100*[Orig-Dup]/((Orig+Dup)/2

* Non detects evaluated at 1/2 DL

Orig. pig number	group	material administered	dosage	day	matrix	Duplicate Value*	Original Value*	Average	RPD	Avg RPD	
930	1	IV	100	-4	BLOOD	0.5	0.5	0.5	0%		
916	7	Palmerton Loc 2	25	-4	BLOOD	0.5	0.5	0.5	0%		
917	10	Palmerton Loc 4	0	-4	BLOOD	0.5	0.5	0.5	0%		
930	1	IV	100	0	BLOOD	0.5	0.5	0.5	0%		
916	7	Palmerton Loc 2	25	0	BLOOD	1.7	1.5	1.6	-13%		
917	10	Palmerton Loc 4	0	0	BLOOD	0.5	0.5	0.5	0%		
930	1	IV	100	1	BLOOD	11.5	11.1	11.3	-4%		
916	7	Palmerton Loc 2	25	1	BLOOD	3.6	4.2	3.9	15%		
917	10	Palmerton Loc 4	0	1	BLOOD	3.4	4.1	3.75	19%		
930	1	IV	100	2	BLOOD	14.4	12.1	13.25	-17%		
916	7	Palmerton Loc 2	25	2	BLOOD	4.7	4.6	4.65	-2%		
917	10	Palmerton Loc 4	0	2	BLOOD	5.6	5.4	5.5	-4%		
930	1	IV	100	3	BLOOD	15.2	13.5	14.35	-12%		
916	7	Palmerton Loc 2	25	3	BLOOD	5	4.5	4.75	-11%		
917	10	Palmerton Loc 4	0	3	BLOOD	6.3	3.6	4.95	-55%		
930	1	IV	100	5	BLOOD	16.1	14.5	15.3	-10%		
916	7	Palmerton Loc 2	25	5	BLOOD	10.2	9.1	9.65	-11%		
917	10	Palmerton Loc 4	0	5	BLOOD	6.3	5.2	5.75	-19%		
930	1	IV	100	7	BLOOD	16.4	16.7	16.55	2%		
916	7	Palmerton Loc 2	25	7	BLOOD	6.9	6.2	6.55	-11%		
917	10	Palmerton Loc 4	0	7	BLOOD	6.1	5.6	5.85	-9%		
930	1	IV	100	9	BLOOD	17.3	17.1	17.2	-1%		
916	7	Palmerton Loc 2	25	9	BLOOD	6.5	6.3	6.4	-3%		
917	10	Palmerton Loc 4	0	9	BLOOD	7.5	8.3	7.9	10%		
930	1	IV	100	12	BLOOD	19	17.2	18.1	-10%		
916	7	Palmerton Loc 2	25	12	BLOOD	7.1	6.4	6.75	-10%		
917	10	Palmerton Loc 4	0	12	BLOOD	8.4	8.4	8.4	0%		
930	1	IV	100	15	BLOOD	17.9	17.5	17.7	-2%		
916	7	Palmerton Loc 2	25	15	BLOOD	8.2	7.9	8.05	-4%		
917	10	Palmerton Loc 4	0	15	BLOOD	9.3	9.1	9.2	-2%	-0.054	**BLOOD**
930	1	IV	100	15	FEMUR	83	92	87.5	10%		
916	7	Palmerton Loc 2	25	15	FEMUR	19.1	18.5	18.8	-3%		
917	10	Palmerton Loc 4	0	15	FEMUR	12.9	12.3	12.6	-5%	0.008	**FEMUR**
930	1	IV	100	15	KIDNEY	134	125	129.5	-7%		
916	7	Palmerton Loc 2	25	15	KIDNEY	26	25.5	25.75	-2%		
917	10	Palmerton Loc 4	0	15	KIDNEY	27.1	22.8	24.95	-17%	-0.087	**KIDNEY**
930	1	IV	100	15	LIVER	115	160	137.5	33%		
916	7	Palmerton Loc 2	25	15	LIVER	33	35.1	34.05	6%		
917	10	Palmerton Loc 4	0	15	LIVER	25.6	26.8	26.2	5%	0.145	**LIVER**

TABLE A-12 CDC STANDARDS

Sample ID	Day	Q	Low Std	Measured Med Std	High Std	Nominal Concentration
9.1	-4	<	1.0			1.7
9.1	0		1.3			1.7
9.1	1		1.0			1.7
9.1	3	<	1.0			1.7
9.1	9	<	1.0			1.7
9.2	-4			3.2		4.8
9.2	0			3.8		4.8
9.2	1			4.3		4.8
9.2	2			4.0		4.8
9.2	5			4.3		4.8
9.2	7			4.6		4.8
9.2	12			4.5		4.8
9.2	15			4.1		4.8
9.3	2				12.7	14.9
9.3	3				13.4	14.9
9.3	5				16.1	14.9
9.3	7				15.3	14.9
9.3	9				12.9	14.9
9.3	12				16.5	14.9
9.3	15				14.9	14.9
Averages			1.1	4.1	14.5	NA

TABLE A-13 INTERLABORATORY COMPARISON

Tag Number	Pig Number	Group	Material Administered	Dosage	Qualifier		Result			RPD
					CDC	EPA	CDC	EPA	Average	
8-990127	916	7	Palmerton Loc 2	225	U	<	0.6	1.0	0.8	50
8-990154	910	6	Palmerton Loc 2	75	U	<	0.6	1.0	0.8	50
8-990196	927	3	PbAc	25	U	<	0.6	1.0	0.8	50
8-990225	903	6	Palmerton Loc 2	75	U	<	0.6	1.0	0.8	50
8-990269	903	6	Palmerton Loc 2	75		<	1.1	1.0	1.1	-10
8-990280	917	10	Palmerton Loc 4	225			4.0	4.1	4.1	2
8-990311	922	7	Palmerton Loc 2	225			5.5	4.9	5.2	-12
8-990332	906	7	Palmerton Loc 2	225			4.1	3.7	3.9	-10
8-990364	951	6	Palmerton Loc 2	75			5.5	3.4	4.5	-47
8-990371	920	2	Control	0	U	<	0.6	1.0	0.8	50
8-990409	932	8	Palmerton Loc 4	25			1.3	1.4	1.4	7
8-990417	9.2						4.8	4.3	4.6	-11
8-990475	931	3	PbAc	25			2.2	2.1	2.2	-5
8-990496	923	4	PbAc	75			2.1	2.1	2.1	0
8-990539	903	6	Palmerton Loc 2	75			2.8	2.8	2.8	0
8-990555	925	2	Control	0	U	<	0.6	1.0	0.8	50
8-990585	954	5	Palmerton Loc 2	25			2.3	1.6	2.0	-36
8-990591	923	4	PbAc	75			3.2	2.7	3.0	-17
8-990647	927	3	PbAc	25			2.4	2.8	2.6	15
8-990659	922	7	Palmerton Loc 2	225			5.6	6.3	6.0	12

FIGURE A-1 PbAc and IV Groups by Day
Raw Data

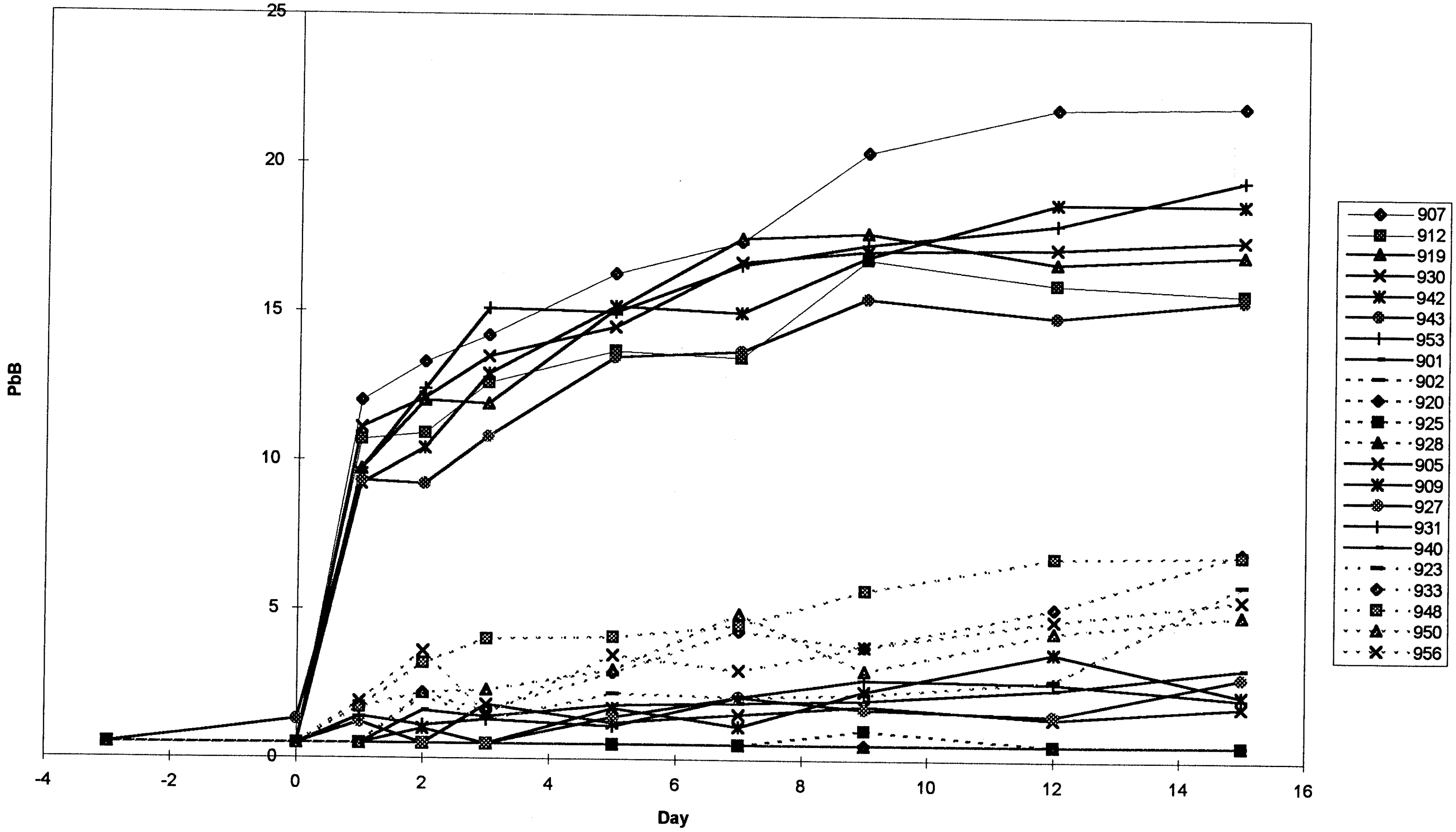


FIGURE A-2 Palmerton Location 2 Groups by Day
Raw Data

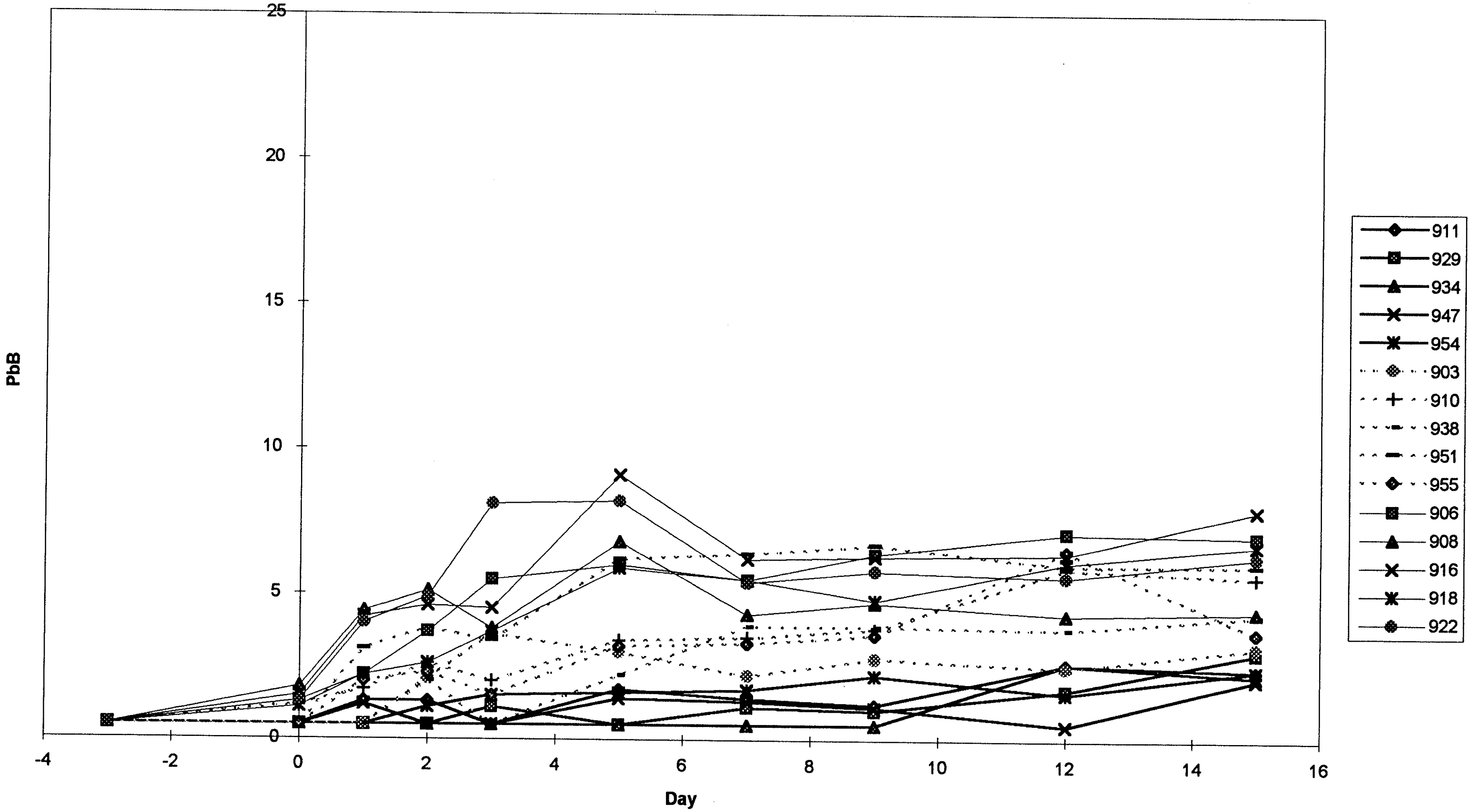


FIGURE A-3 Palmerton Location 4 Groups By Day
Raw Data

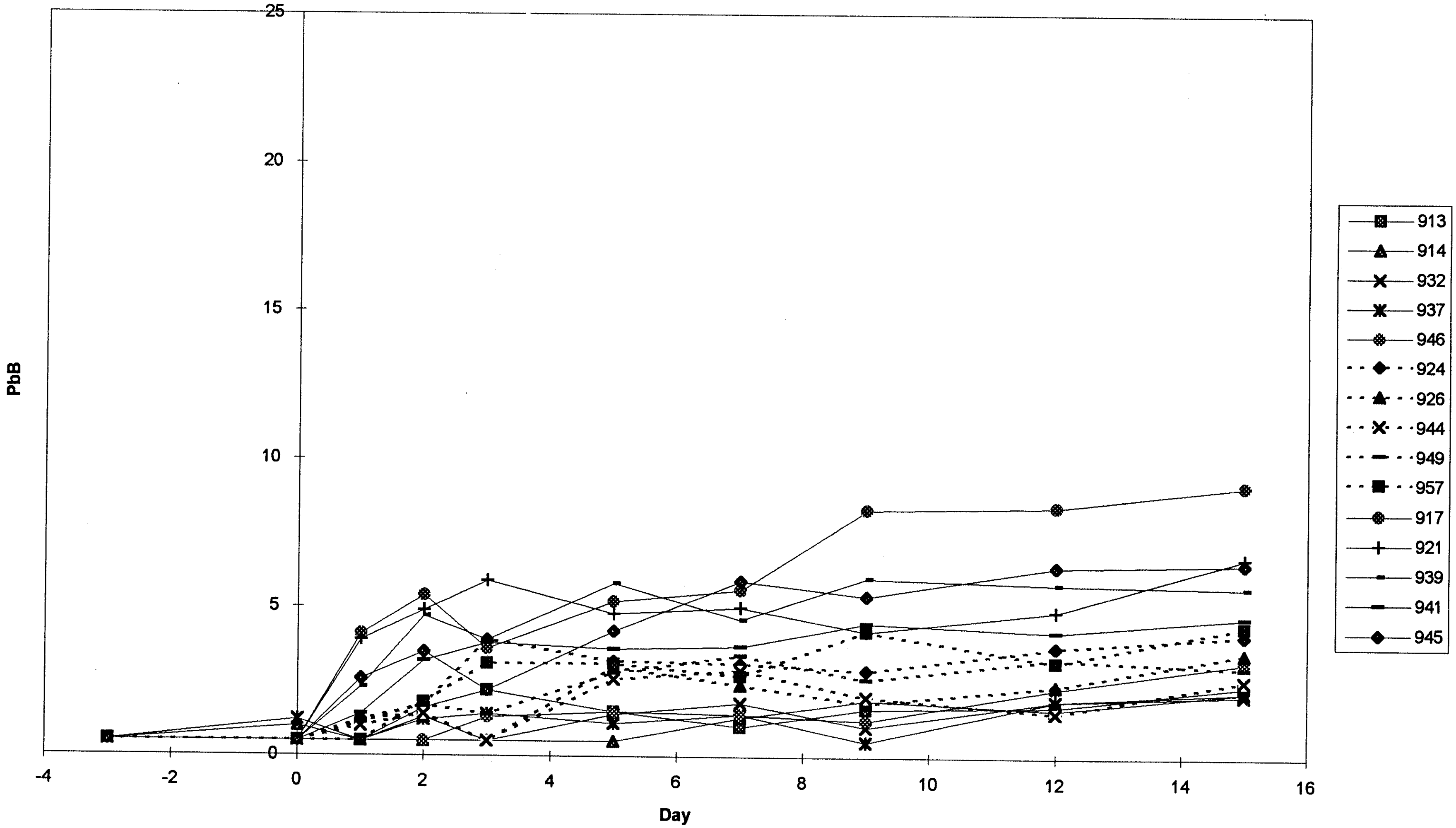


FIGURE A-4 Group Mean PbB vs. Day
Raw Data

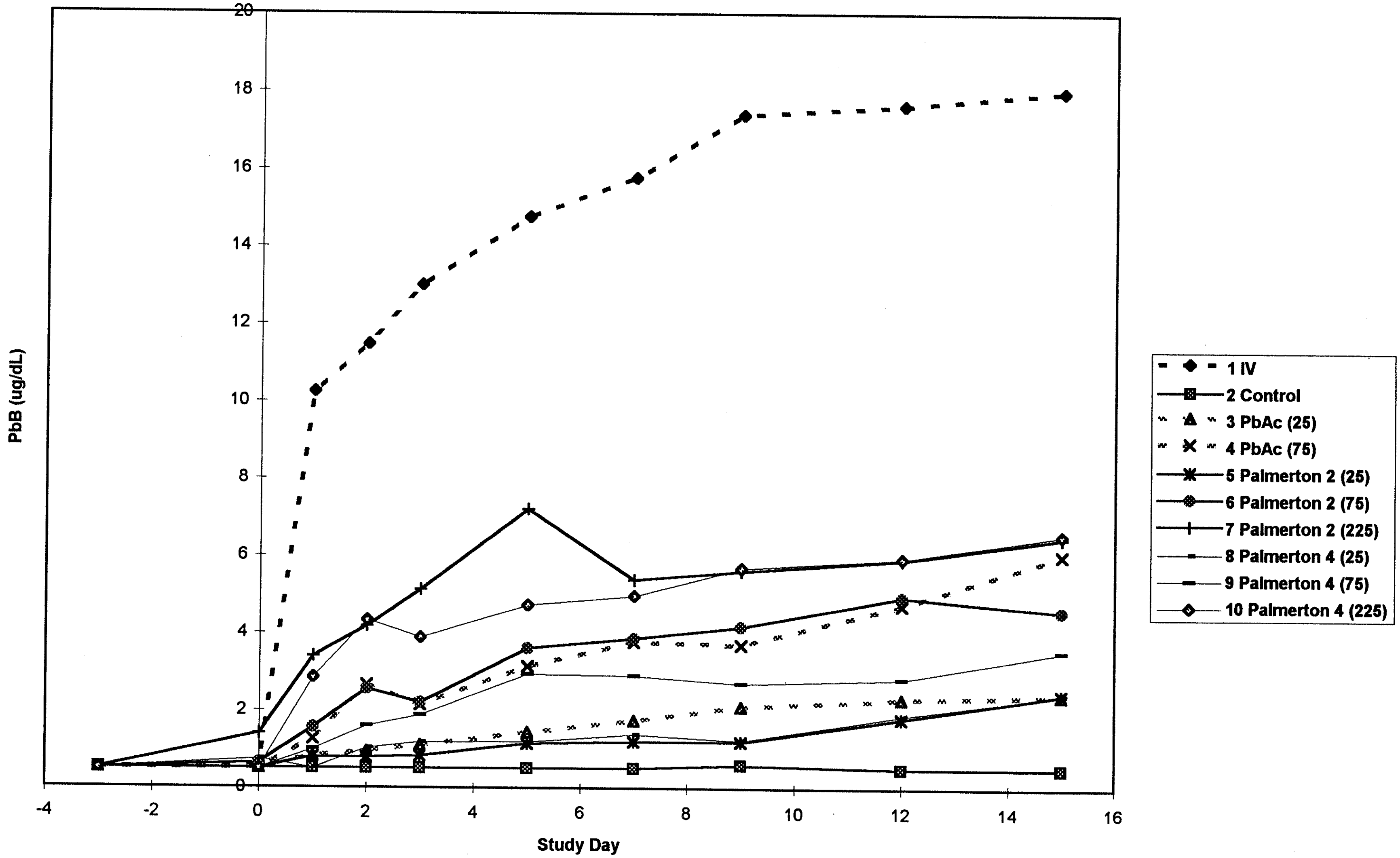
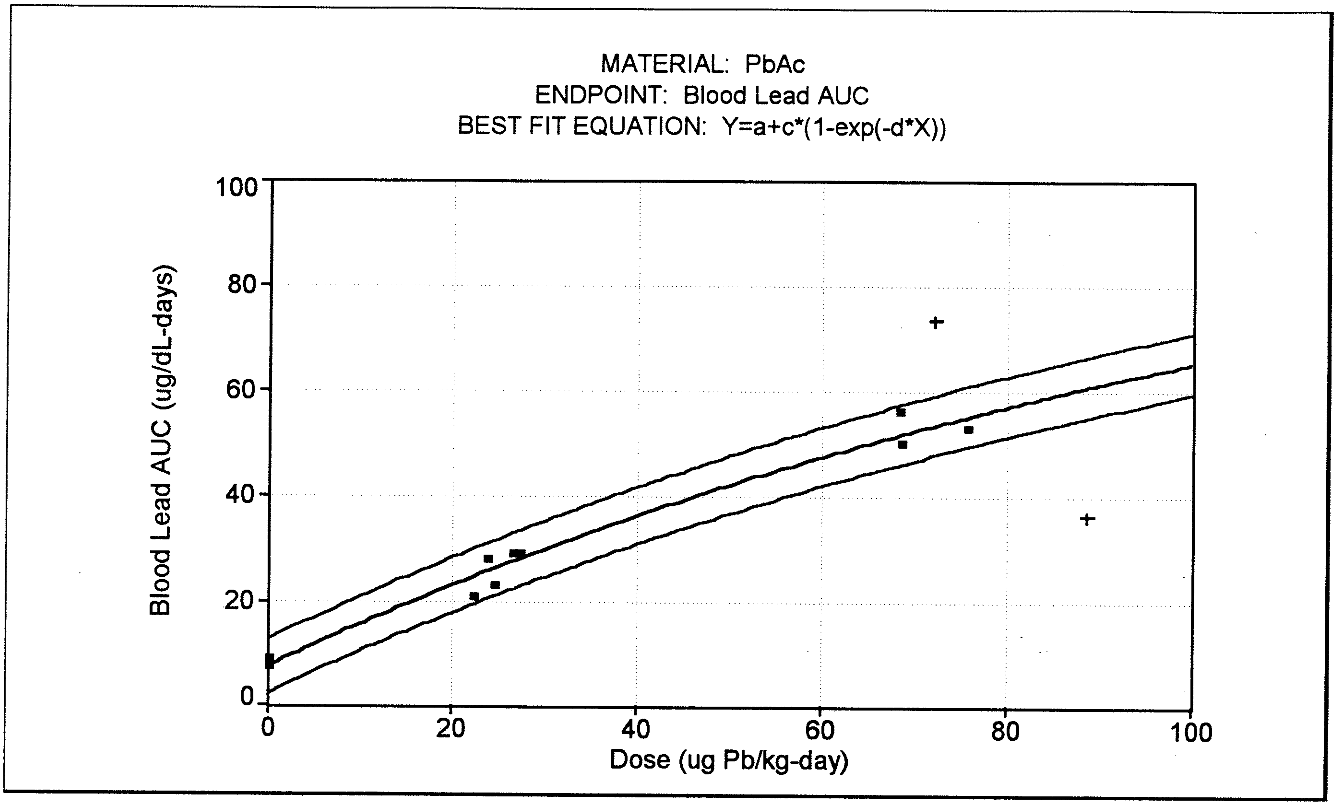


FIGURE A-5 BEST FIT CURVE WITH 95% PREDICTION INTERVALS*

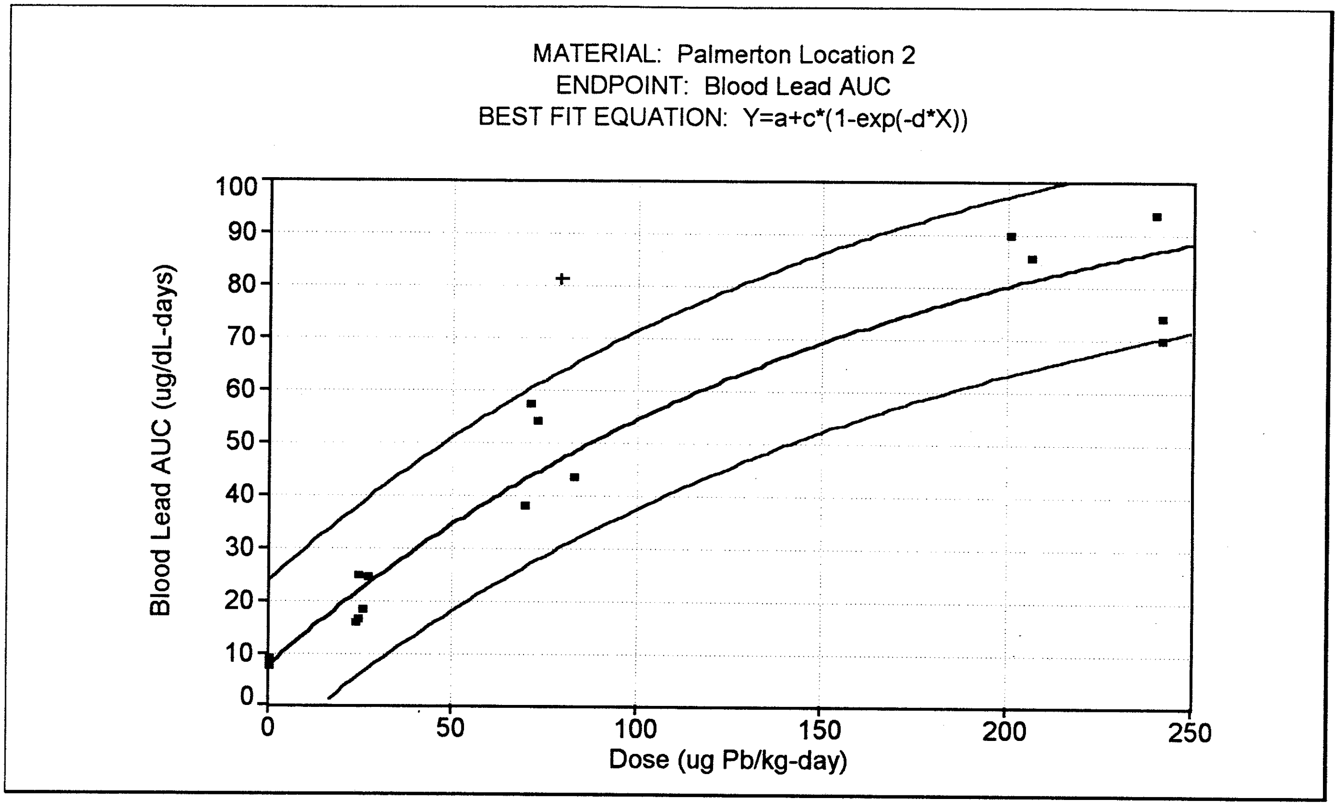


Parameters	Value	Std. Error	95% Confidence Limits	
a	7.22	fixed value	--	--
c	104	fixed value	--	--
d	0.0081	0.0003	0.0075	0.0087

Adj R^2	0.982

Generated using Table Curve 2D v. 3.0. Outliers represented by "+".

FIGURE A-6 BEST FIT CURVE WITH 95% PREDICTION INTERVALS*

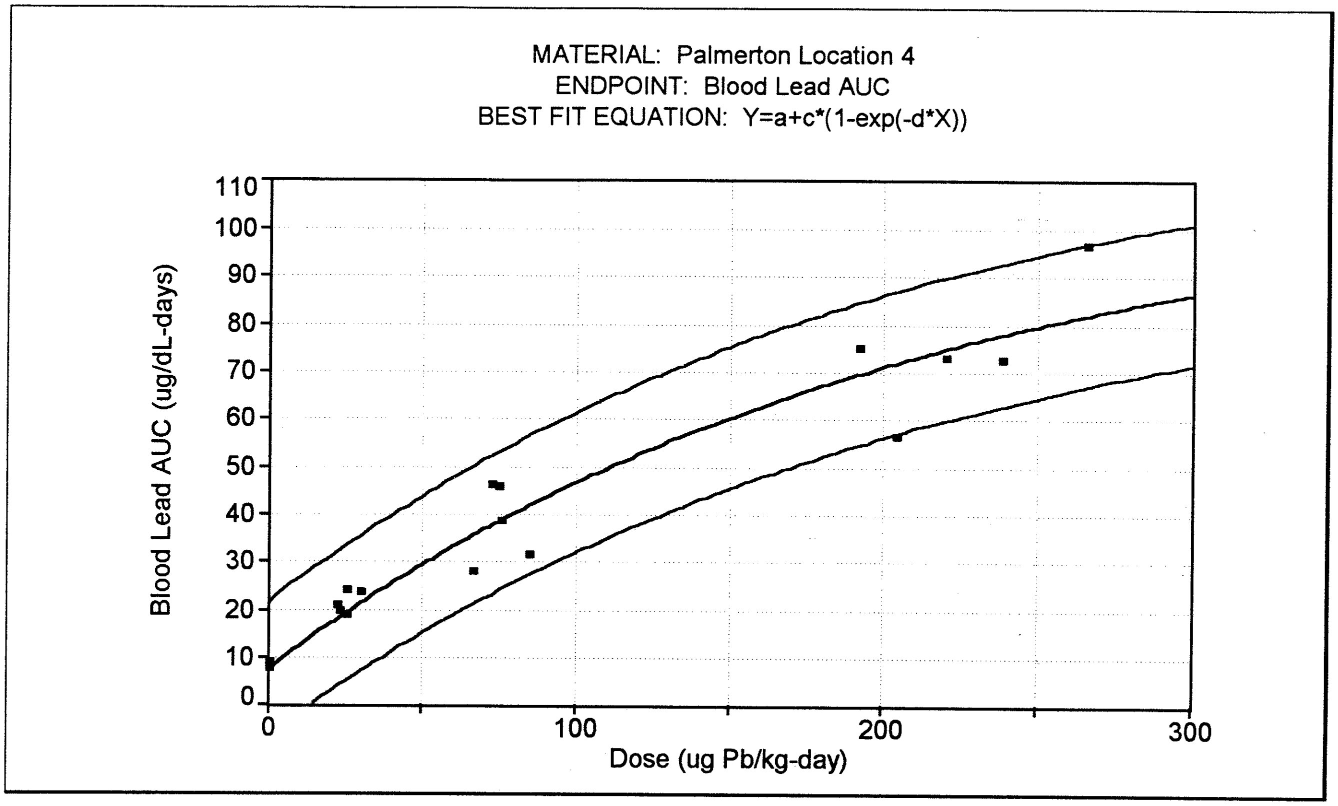


Parameters	Value	Std. Error	95% Confidence Limits	
a	7.22	fixed value	--	--
c	104	fixed value	--	--
d	0.006	0.0004	0.0051	0.0069

Adj R^2	0.935

Generated using Table Curve 2D v. 3.0. Outliers represented by "+".

FIGURE A-7 BEST FIT CURVE WITH 95% PREDICTION INTERVALS*

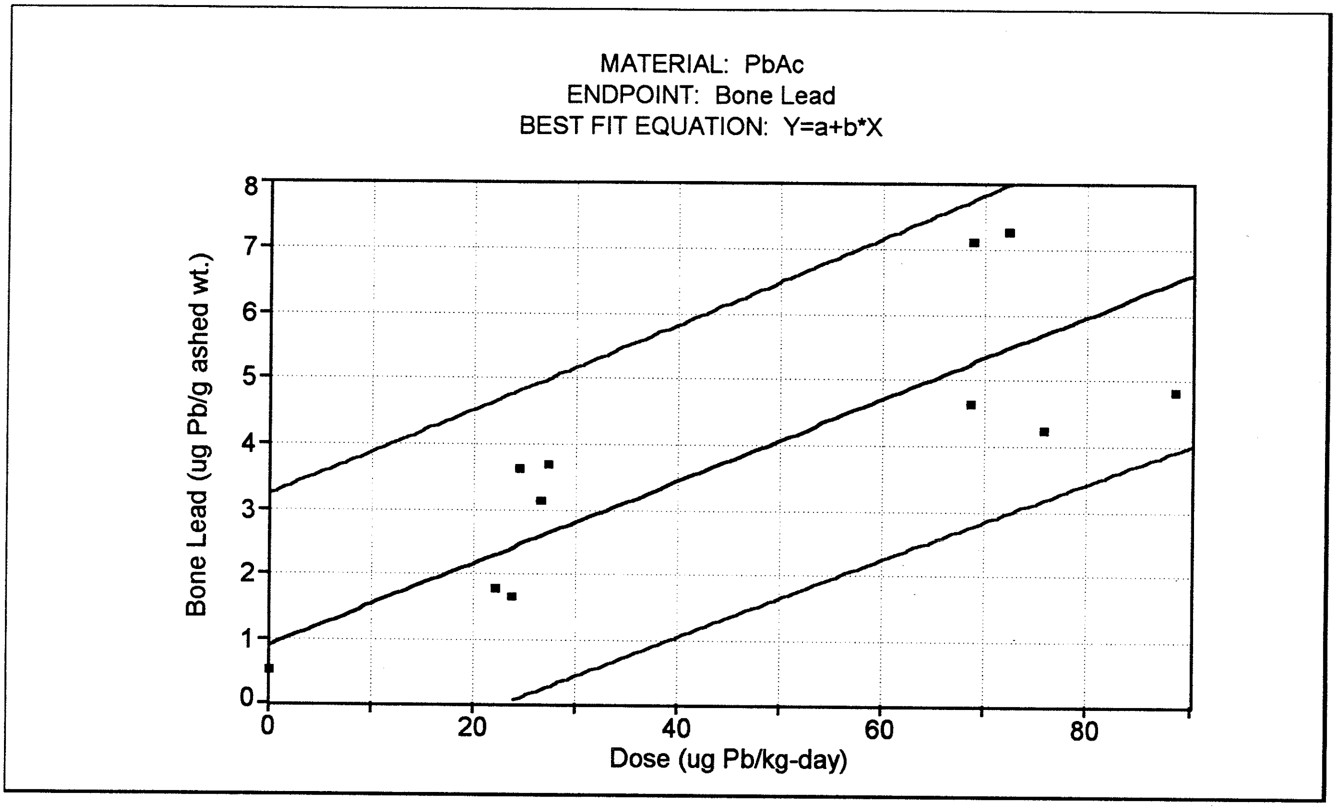


Parameters	Value	Std. Error	95% Confidence Limits	
a	7.22	fixed value	--	--
c	104	fixed value	--	--
d	0.0047	0.0003	0.0041	0.0053

Adj R^2	0.934

Generated using Table Curve 2D v. 3.0. Outliers represented by "+".

FIGURE A-8 BEST FIT CURVE WITH 95% PREDICTION INTERVALS*



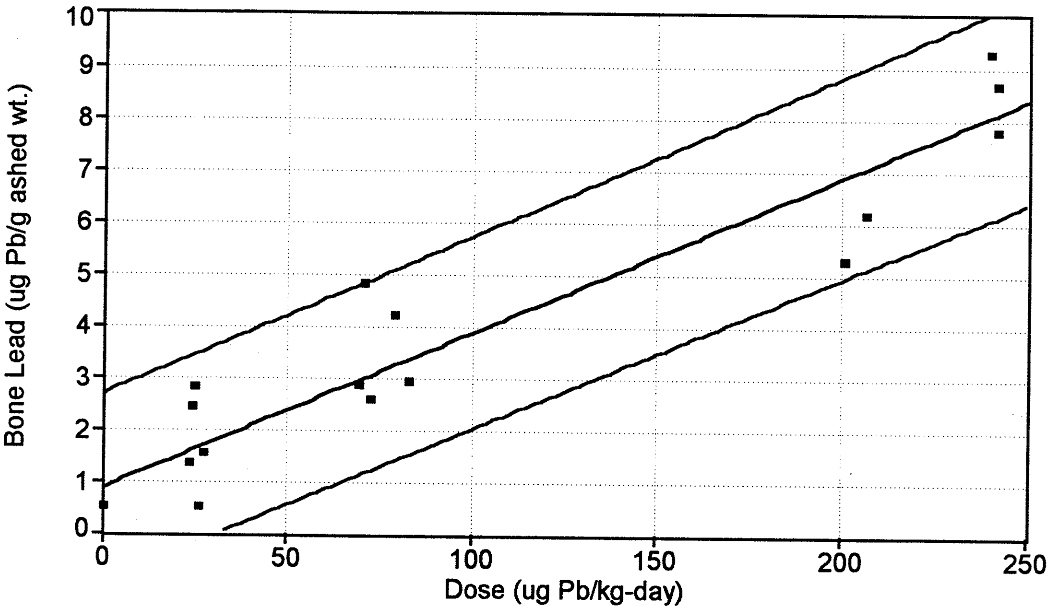
Parameters	Value	Std. Error	95% Confidence Limits	
a	0.87	fixed value	--	--
b	0.063	0.0061	0.0502	0.0765

Adj R^2	0.771

Generated using Table Curve 2D v. 3.0. Outliers represented by "+".

FIGURE A-9 BEST FIT CURVE WITH 95% PREDICTION INTERVALS*

MATERIAL: Palmerton Location 2
ENDPOINT: Bone Lead
BEST FIT EQUATION: Y=a+b*X

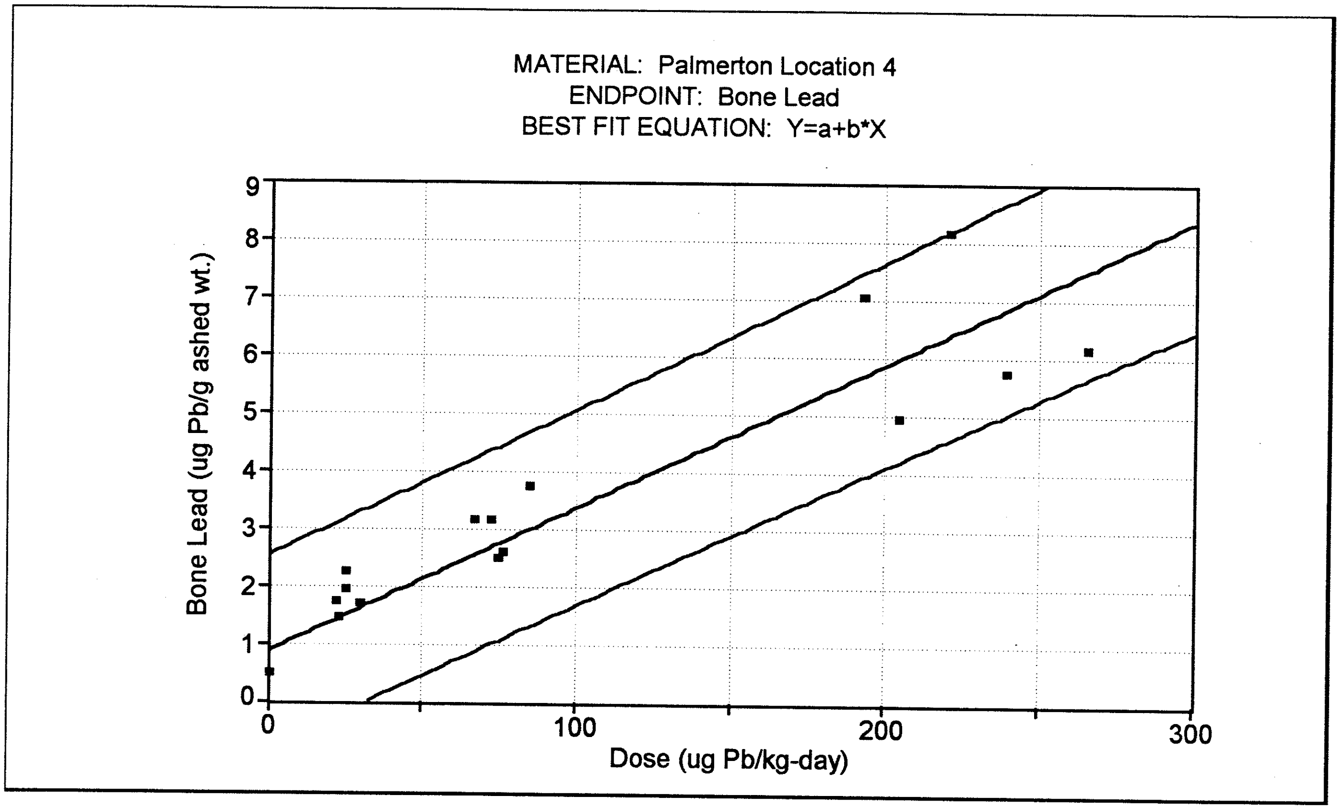


Parameters	Value	Std. Error	95% Confidence Limits	
a	0.87	fixed value	--	--
b	0.0298	0.0016	0.0264	0.0331

Adj R^2	0.903

Generated using Table Curve 2D v. 3.0. Outliers represented by "+".

FIGURE A-10 BEST FIT CURVE WITH 95% PREDICTION INTERVALS*

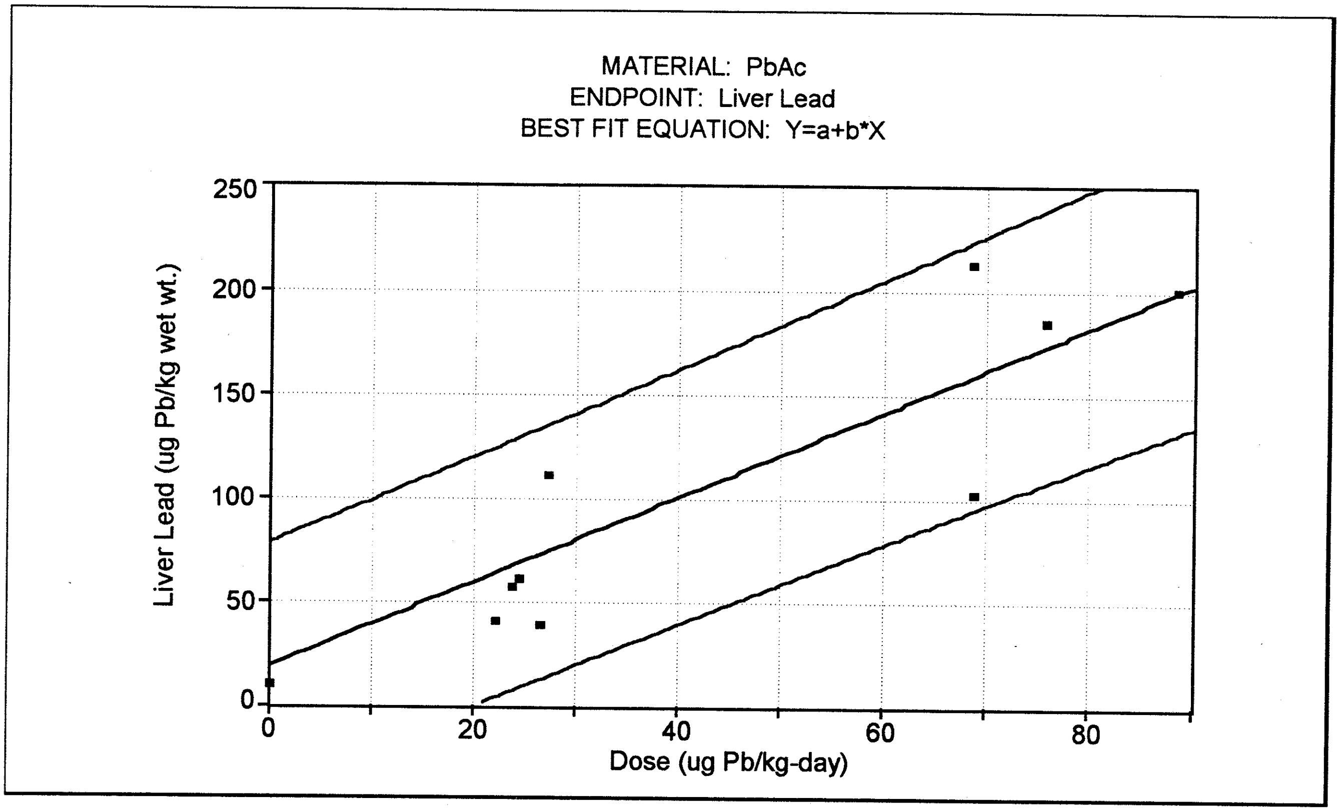


Parameters	Value	Std. Error	95% Confidence Limits	
a	0.87	fixed value	--	--
b	0.025	0.0015	0.022	0.028

Adj R^2	0.879

Generated using Table Curve 2D v. 3.0. Outliers represented by "+".

FIGURE A-11 BEST FIT CURVE WITH 95% PREDICTION INTERVALS*

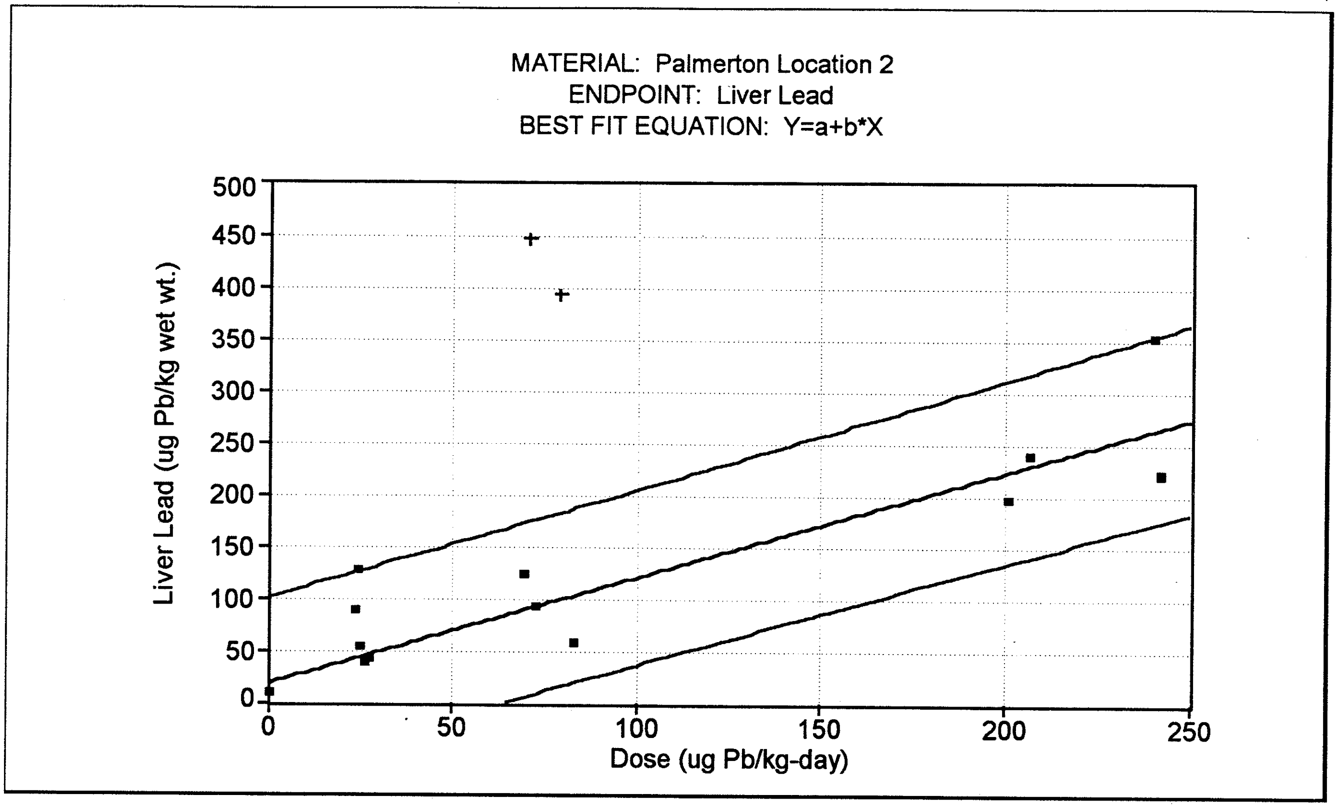


Parameters	Value	Std. Error	95% Confidence Limits	
a	18.41	fixed value	--	--
b	2.036	0.17	1.67	2.4

Adj R^2	0.854

Generated using Table Curve 2D v. 3.0. Outliers represented by "+".

FIGURE A-12 BEST FIT CURVE WITH 95% PREDICTION INTERVALS*

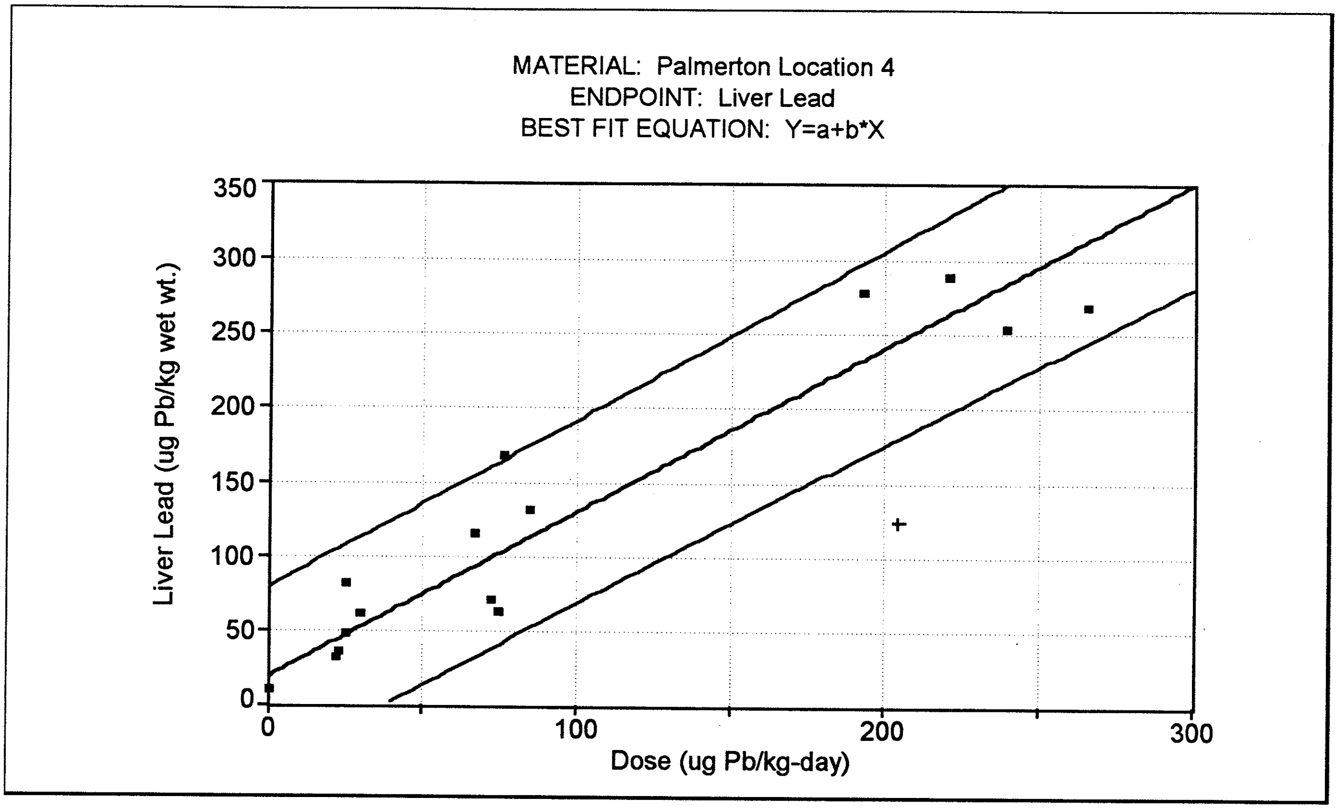


Parameters	Value	Std. Error	95% Confidence Limits	
a	18.41	fixed value	--	--
b	1.014	0.074	0.858	1.169

Adj R^2	0.843

Generated using Table Curve 2D v. 3.0. Outliers represented by "+".

FIGURE A-13 BEST FIT CURVE WITH 95% PREDICTION INTERVALS*



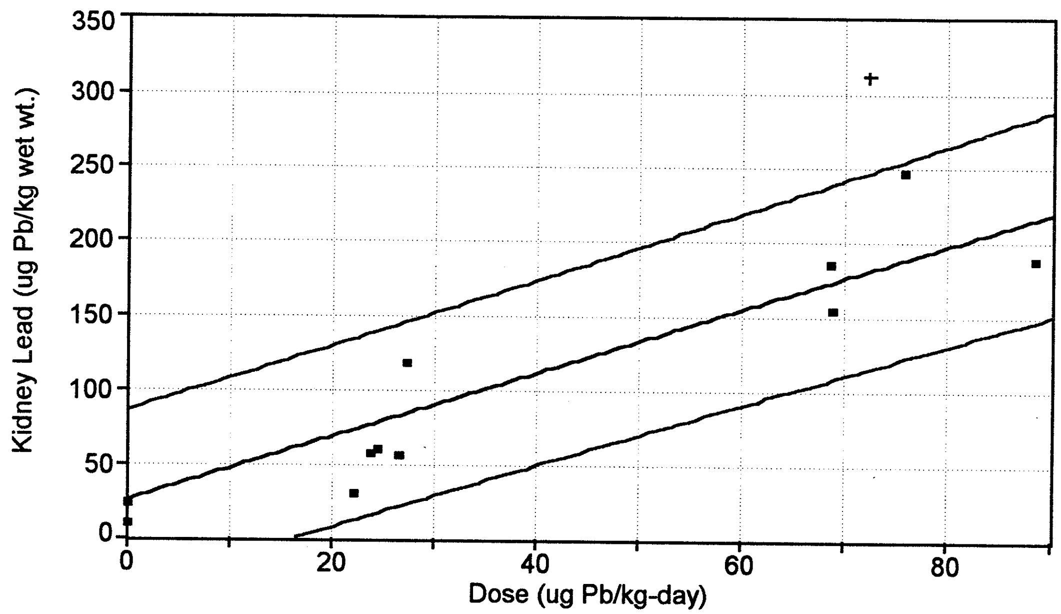
Parameters	Value	Std. Error	95% Confidence Limits	
a	18.41	fixed value	--	--
b	1.103	0.058	0.982	1.225

Adj R^2	0.913

Generated using Table Curve 2D v. 3.0. Outliers represented by "+".

FIGURE A-14 BEST FIT CURVE WITH 95% PREDICTION INTERVALS*

MATERIAL: PbAc
ENDPOINT: Kidney Lead
BEST FIT EQUATION: Y=a+b*X

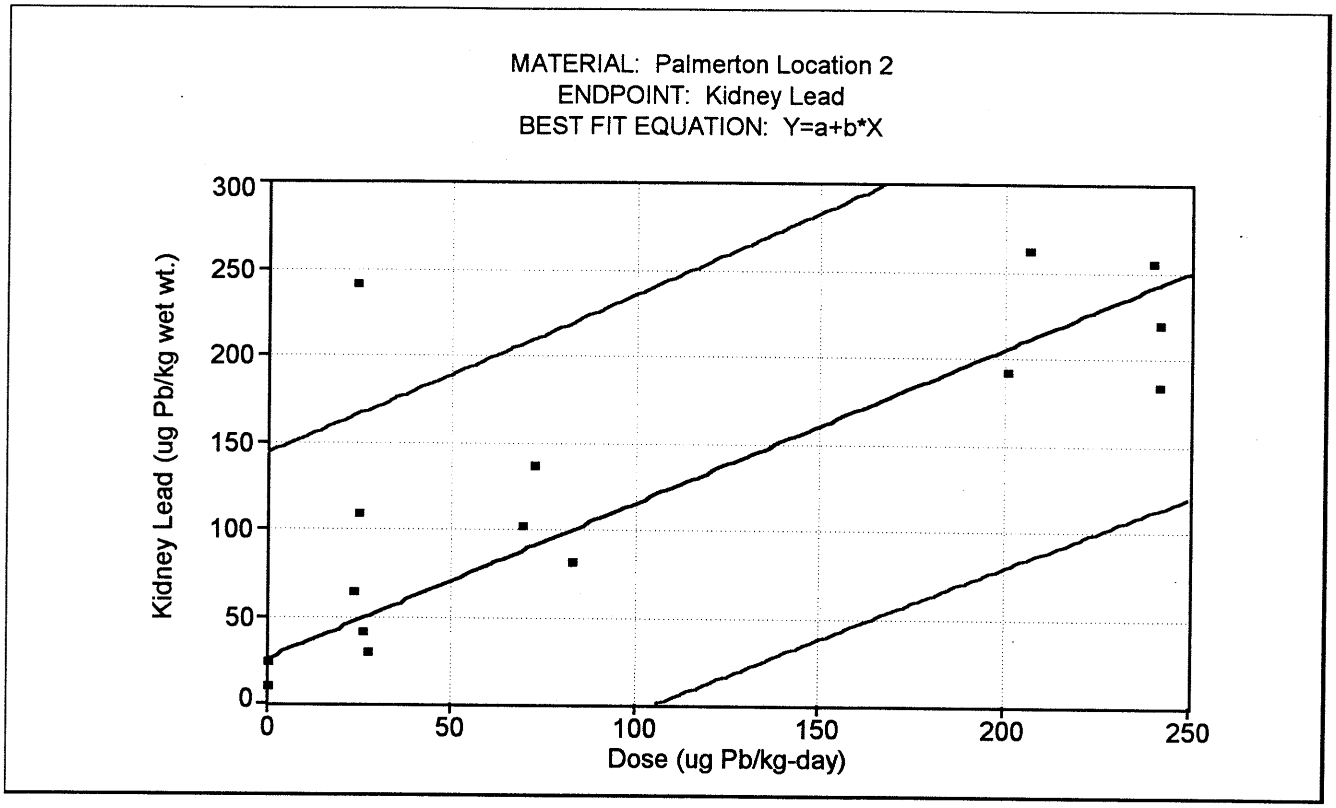


Parameters	Value	Std. Error	95% Confidence Limits	
a	25.06	fixed value	--	--
b	2.14	0.172	1.768	2.511

Adj R^2	0.87

Generated using Table Curve 2D v. 3.0. Outliers represented by "+".

FIGURE A-15 BEST FIT CURVE WITH 95% PREDICTION INTERVALS*

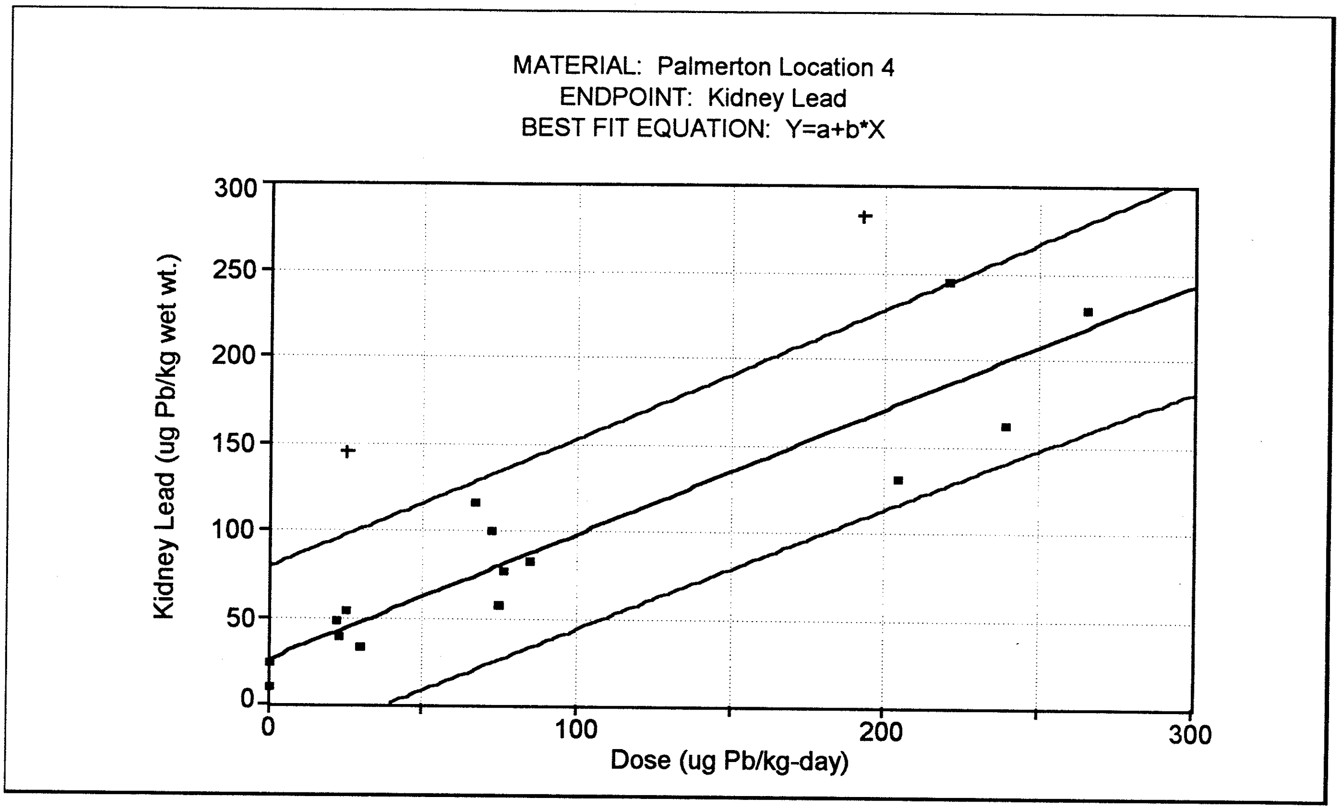


Parameters	Value	Std. Error	95% Confidence Limits	
a	25.06	fixed value	--	--
b	0.897	0.106	0.673	1.12

Adj R^2	0.618

Generated using Table Curve 2D v. 3.0. Outliers represented by "+".

FIGURE A-16 BEST FIT CURVE WITH 95% PREDICTION INTERVALS*



Parameters	Value	Std. Error	95% Confidence Limits	
a	25.06	fixed value	--	--
b	0.725	0.051	0.618	0.832

Adj R^2	0.87

Generated using Table Curve 2D v. 3.0. Outliers represented by "+".