BIOAVAILABILITY OF LEAD IN SLAG AND SOIL SAMPLES FROM THE MURRAY SMELTER SUPERFUND SITE

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EXECUTIVE SUMMARY

A study using young swine as test animals was performed to measure the gastrointestinal absorption of lead from a sample of slag and a sample of surface soil from the Murray Smelter Superfund site. 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 slag sample was a composite from 9 different sampling locations across the site where slag is exposed at the surface, and the soil sample was a composite of surface soil from 16 different locations across the site. Each sample was dried and sieved to yield only the fine fraction (less than 250 um), since human exposure is thought to be most likely for this size particle. The final lead concentration was 11,500 ppm in the slag sample, and 3200 ppm in the soil sample.

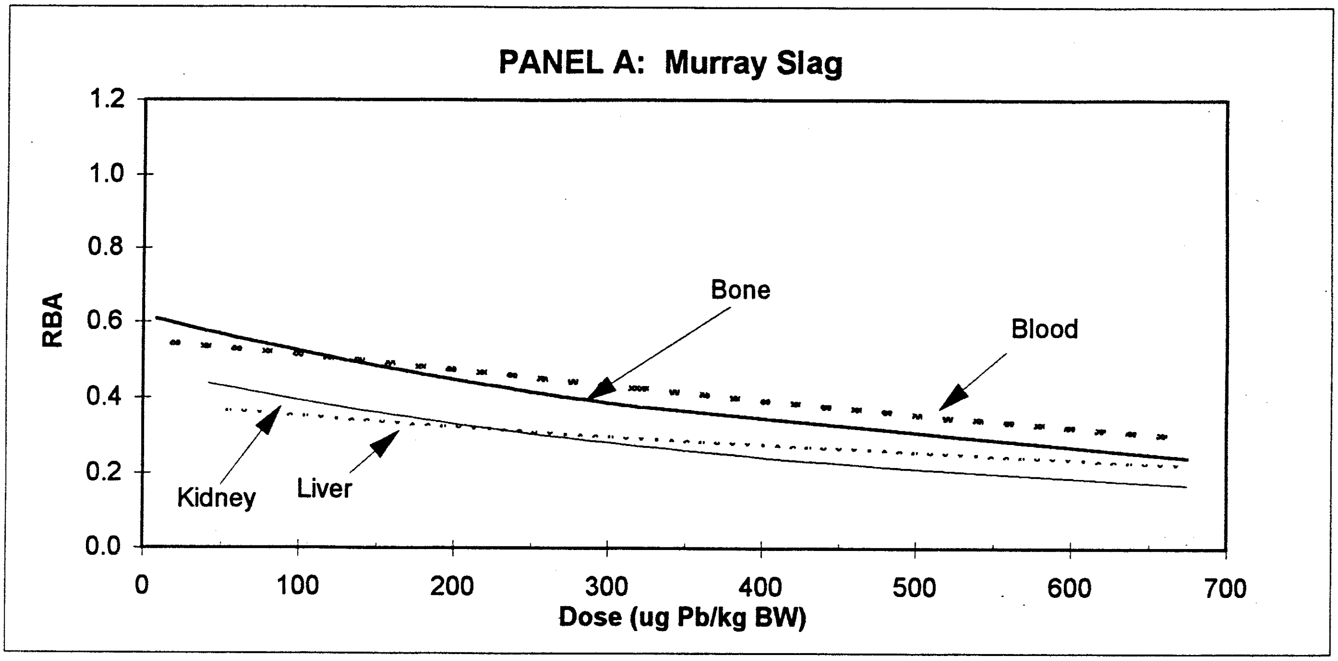
The absorption of lead from these two test materials was investigated in two separate studies. The basic protocols of each study are shown below:

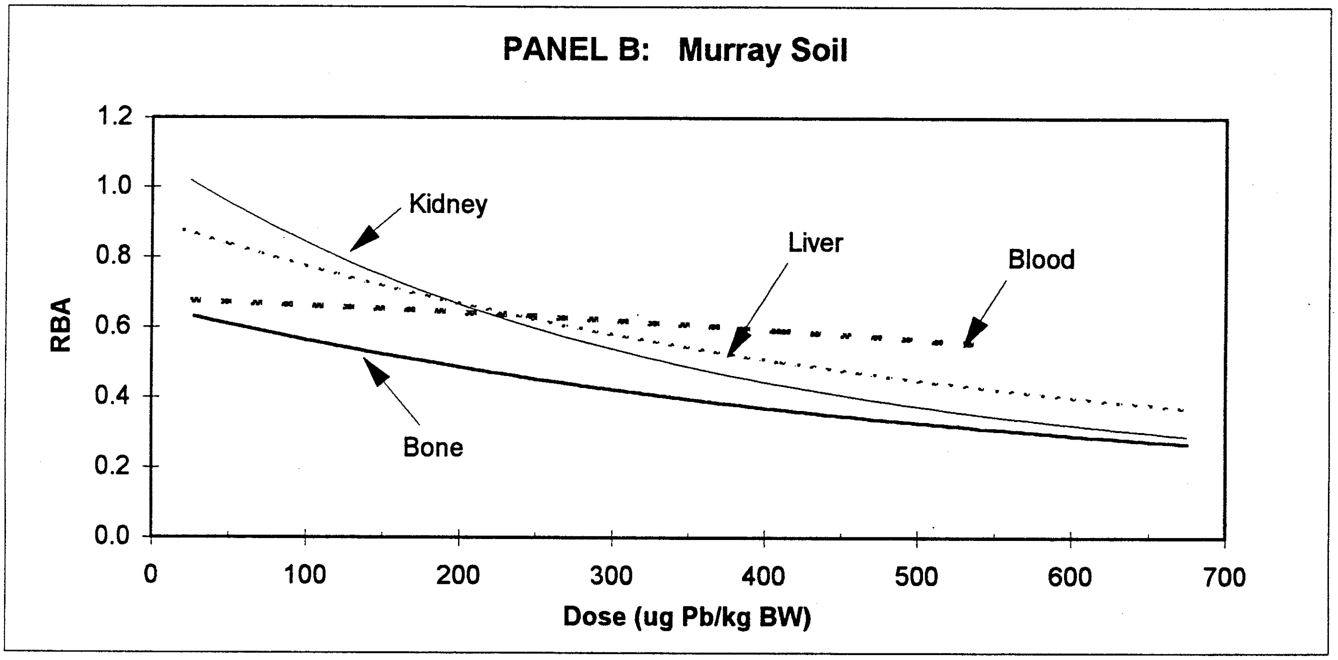
Study Number	Dose Material	Exposure Route	Dose levels (ug Pb/kg-day)
4	PbAc	IV	100
	PbAc	Oral	0, 75, 225
	Murray Slag	Oral	75, 225, 675
11	PbAc	Oral	0, 25, 75, 225
	Murray Soil	Oral	75, 225, 675

Groups of animals (usually 5/group) were exposed for 15 days, with each daily dose being administered in two equal portions at 9:00 AM and 3:00 PM. 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 resulting RBA estimates are shown in Figure ES-1. The upper panel (Panel A) shows the results for slag, and the lower panel (Panel B) shows the results for soil. As seen, the calculated values of RBA derived from most endpoints are apparently not constant, but tend to decrease with increasing dose. This apparent dose-dependency has not been observed in most other studies in this program, and the basis of the dose-dependency is not known. However, granted that the effect is real, the RBA values that are most relevant are at a dose near that which would

FIGURE ES-1 RELATIVE BIOAVAILABILITY OF LEAD IN MURRAY SMELTER SAMPLES





be expected for a child. In all cases, this is likely to be in the range of 5-50 ug/kg-day, at or below the low end of the exposure range investigated in this study. Thus, the point estimates for each endpoint are those at the lower end of the curves shown in Figure ES-1, as follows:

Measurement Endpoint	Low Dose RBA	
	Murray Slag	Murray Soil
Blood Lead AUC	0.55	0.67
Liver Lead	0.37	0.87
Kidney Lead	0.44	1.02
Bone Lead	0.61	0.63

Because these low-dose 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:

Test Material	Relative Bioavailability of Lead		
	Plausible Range	Preferred Range	Suggested Point Estimate
Murray Slag	0.55-0.47	0.55-0.51	0.53
Murray Soil	0.67-0.84	0.67-0.75	0.71

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 Murray Slag and Murray Soil samples are as follows:

Test Material	Absolute Bioavailability of Lead		
	Plausible Range	Preferred Range	Suggested Point Estimate
Murray Slag	28%-24%	28%-26%	27%
Murray Soil	34%-42%	34%-38%	36%

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) the unexpected non-linear dose-response patterns observed in liver, kidney and bone of animals exposed to slag or soil, 3) uncertainty in the relative accuracy and applicability of the different measurement endpoints, 4) the extrapolation of measured RBA values in swine to young children, and 5) 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.

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A DETAILED DATA REVIEW
Part 1 -- Experiment 4 (Murray Slag)
Part 2 -- Experiment 11 (Murray Soil)

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BIOAVAILABILITY OF LEAD IN SLAG AND SOIL SAMPLES FROM THE MURRAY SMELTER SITE

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, transport of lead across the gut may continuously shift the equilibrium of a poorly soluble lead compound in the direction of dissolution, and stomach fluid volume and pH may undergo changes over time. 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

The studies reported here were part of a larger project designed to investigate lead bioavailability in a wide variety of soils and other solid materials. A standardized protocol for measuring absolute and relative bioavailability of lead was developed for the studies in this program 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 team 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.

Two different samples from the Murray Smelter Superfund site were evaluated. These samples were each investigated in different studies. The first sample (a sample of slag) was evaluated in Study 4. The second sample (a sample of soil) was evaluated in Study 11. Both studies followed the same general design with specific details described in this section.

2.1 Test Materials

Test materials used for these investigations were prepared for administration by air drying (maximum temperature = 40°C) followed by sieving through a nylon mesh to yield particles less than about 250 um. This was done because it is believed that fine particles are most likely to adhere to the hands and be ingested by hand-to-mouth contact, and are most likely to be available for absorption. Grinding was not employed.

CLP Analysis

Table 2-1 lists the metal content of the composite slag and soil samples measured using standard EPA Contract Laboratory Program (CLP) methods.

Geochemical Speciation

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"), and c) approximately how much of the total amount of lead (by mass) 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 expected, the principle form of lead-bearing particle in the slag sample is slag (i.e., particles of glassy matrix with lead dissolved in the glassy phase). However, this type of particle contains a relatively low concentration of lead, and so does not account for most of the lead mass in the

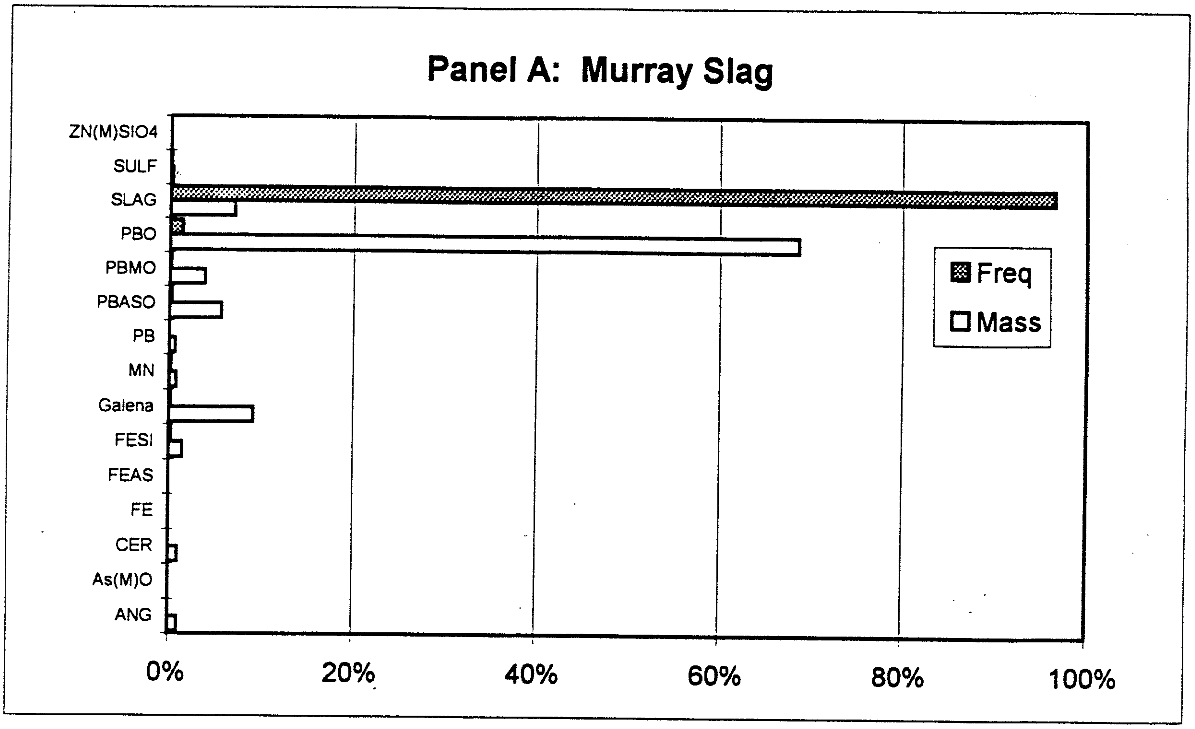
TABLE 2-1 METAL ANALYSIS OF TEST MATERIALS

Chemical	Concentration (ppm)	
	Murray Slag[a]	Murray Soil
Aluminum	9,230	6,520
Antimony	59.6	20
Arsenic	695	310
Barium	2,100	584
Beryllium	0.86	0.48
Cadmium	29.9	23.8
Calcium	88,100	69,000
Chromium	34.4	16.4
Cobalt	44.9	11.5
Copper	2,040	856
Iron	169,000	38,700
Lead	**11,500**	**3,200**[b]
Magnesium	11,000	15,000
Manganese	2,610	863
Mercury	1.0	0.59
Nickel	16.2	10.4
Potassium	2,380	2,040
Selenium	43.2	6.8
Silver	18.0	11.1
Sodium	810	532
Thallium	12.0	4.8
Vanadium	73.7	28.3
Zinc	48,900	10,400

a Mean of two replicate analyses

b Original value by ICP-Trace was 2,890 ppm, but this was flagged "E" due to concern over serial dilutions. Value based on ICP was 3,200 ppm. This value judged to be more reliable.

FIGURE 2-1 LEAD MINERALS OBSERVED IN SITE SOILS



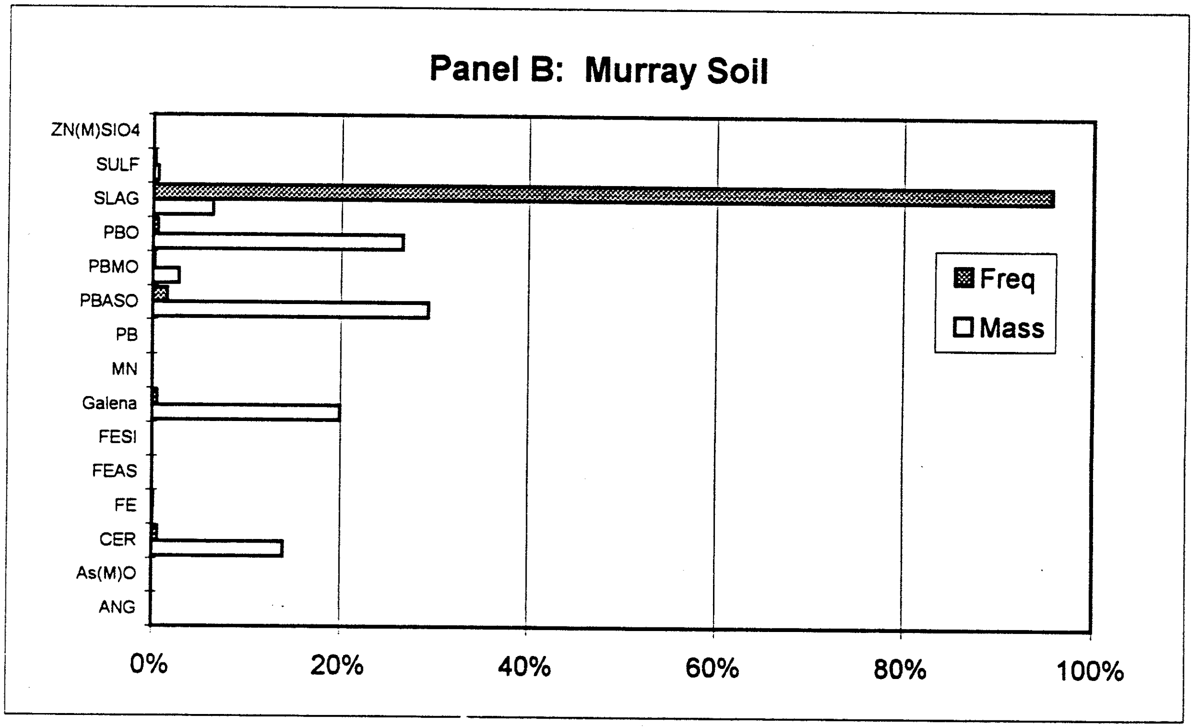


TABLE 2-2 GEOCHEMICAL CHARACTERISTICS OF TEST MATERIALS[a]

Mineral Form	Murray Slag						Murray Soil					
	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	
Anglesite	0.2	0.04	10	15	12	1.0	--	--	--	--	--	--
As(M)O	--	--	--	--	--	--	0.2	0.02	3	3	3	0.003*
Cerussite	0.3	0.04	3	15	8	1.1	1.6	0.66	5	40	14	14.0
Fe-Pb Oxide	0.2	0.07	8	35	18	0.04	0.9	0.22	8	8	8	0.1
FeAs	0.2	0.06	4	35	17	0	--	--	--	--	--	--
FeSi	0.7	0.32	8	80	28	1.5	--	--	--	--	--	--
Galena	7.2	0.27	1	15	2	9.2	12.9	0.62	1	30	2	20.0
Mn	0.5	0.28	8	110	31	0.8	--	--	--	--	--	--
Native Lead	0.2	0.01	2	4	3	0.7	--	--	--	--	--	--
PbAsO	2.9	0.30	1	60	6	5.7	10.3	1.59	1	55	5	29.4
Pb(M)O	0.6	0.19	2	110	18	3.9	1.4	0.27	2	15	7	2.8
PbO	10.5	1.48	1	100	8	68.7	2.3	0.61	2	25	9	26.6
Slag	76.1	96.7	5	310	73	7.0	70.0	95.8	5	310	47	6.4
Sulf	0.1	0.14	10	100	55	0.3	0.2	0.24	35	35	35	0.6
Zn(M)SiO4	0.3	0.08	10	30	16	0.03	--	--	--	--	--	--

[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

samples. Rather, the majority of the relative lead mass exists in the form of lead oxide (PbO) (about 69%), with smaller contributions from galena (9%), lead arsenic oxide (6%) and other metal lead oxides (4%). Slag is also the most common lead-bearing particle encountered in soil, but the majority of the relative lead mass in soil exists in the form of PbAsO (29%), PbO (27%), and galena (20%), with smaller contributions from cerussite (14%) and slag (6.4%).

Particle Size

Figure 2-2 shows the distribution of the size of lead-bearing particles in each sample. (Recall that each sample was sieved prior to analysis). As seen, the majority of lead bearing particles in both samples are less than 100 um in longest dimension, with 48% and 79% less than 50 um for slag and soil, respectively. 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 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).

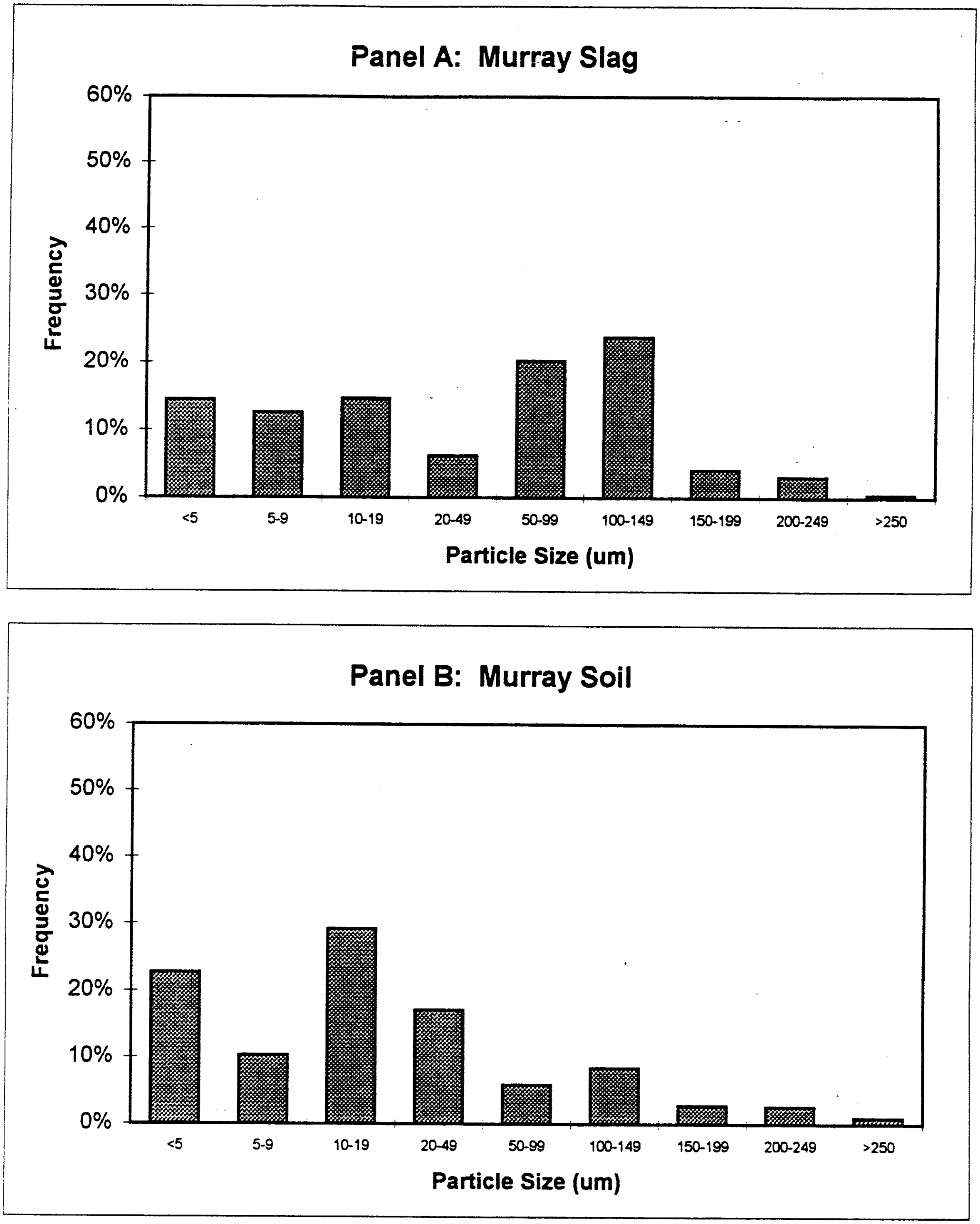
Matrix Association

Another property of lead particles that may be important in determining bioaccessability and/or bioavailability is the degree to which they are partially or entirely free from surrounding matrix ("liberated"). In the slag sample, about 87% of all lead-bearing particles are liberated, accounting for about 77% of the relative lead mass. In the soil sample, about 80% of all lead-bearing particles are liberated, accounting for about 70% of the relative lead mass. These high percentages of partially or entirely liberated grains may tend to increase the bioavailability of lead in these samples.

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 10.4 kg for Study 4 and 7.8 kg for Study 11. Animals were weighed every three days during the course of the studies. The group mean body weights over the course of the studies are shown

FIGURE 2-2 PARTICLE SIZE DISTRIBUTION



in Figure 2-3. As seen, on average, animals gained about 0.4 to 0.5 kg/day, and the rate of weight gain was comparable in most groups, although animals with indwelling catheters (Experiment 4, Group 10) gained weight more slowly than average.

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. Any animal that displayed significant signs of illness was given appropriate treatment, and was removed from study if the illness could not be promptly controlled. Blood samples were collected for clinical chemistry and hematological analysis on days -4, 7, and 15 to assist in clinical health assessments. Due to infections around the indwelling catheters in pigs from the IV dosing group in Study 4, five pigs were removed from this study. No pigs from the lead acetate groups or the Murray Soil groups were removed from Study 11.

2.3 Diet

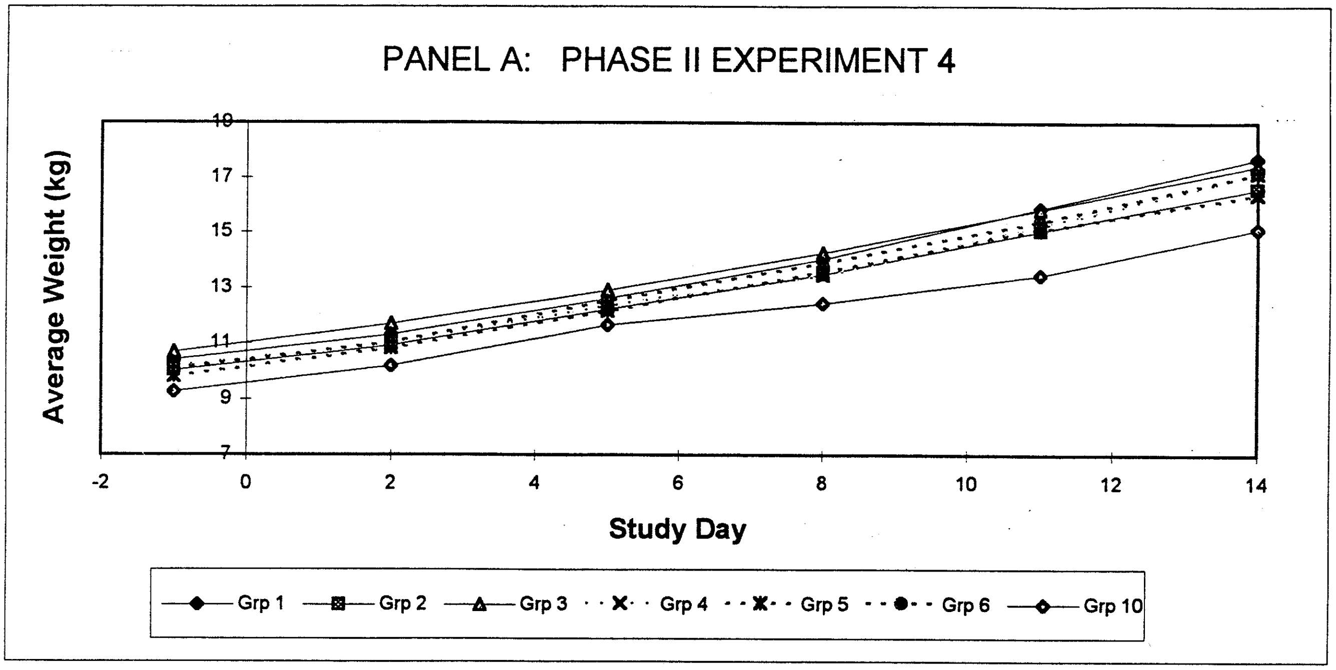
Animals provided by the supplier were weaned onto standard pig chow purchased from MFA Inc., Columbia, MO. In order to minimize lead exposure from the diet, the animals were gradually transitioned from the MFA feed to a special low-lead feed (guaranteed less than 0.2 ppm lead, purchased from Zeigler 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 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 protocols for exposing animals to lead in Experiments 4 and 11 are shown in Table 2-4. The dose levels for lead acetate were based on experience from previous investigations that showed that doses of 25-225 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 (675 ug Pb/kg-day) included in case the test materials were found to yield very low responses.

FIGURE 2-3 BODY WEIGHTS OF TEST ANIMALS



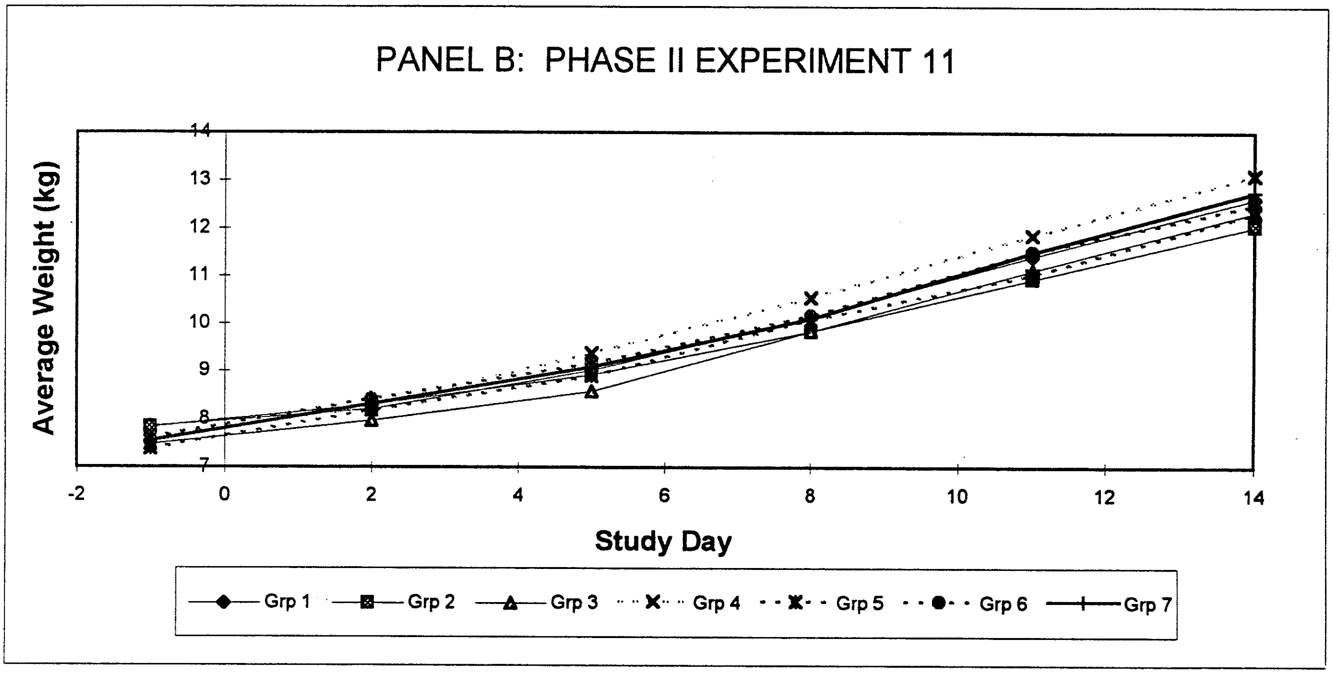


TABLE 2-3 TYPICAL FEED COMPOSITION[a]

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 PROTOCOLS

EXPERIMENT 4

Group	Number of Animals	Dose Material Administered	Exposure Route	Lead Dose (ug Pb/kg-d)	
				Target	Actual[a]
1	2	PbAc	Oral	0	0
2	5	PbAc	Oral	75	76.5
3	5	PbAc	Oral	225	216
4	5	Murray Slag	Oral	75	76.4
5	5	Murray Slag	Oral	225	231
6	5	Murray Slag	Oral	675	674
10	3[b]	PbAc	IV	100	101

EXPERIMENT 11

Group	Number of Animals	Dose Material Administered	Exposure Route	Lead Dose (ug Pb/kg-d)	
				Target	Actual[a]
1	5	PbAc	Oral	0	0
2	5	PbAc	Oral	25	27.7
3	5	PbAc	Oral	75	78.3
4	5	PbAc	Oral	225	233
5	5	Murray Soil	Oral	75	78.4
6	5	Murray Soil	Oral	225	235
7	5	Murray Soil	Oral	675	701

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.

b Eight animals started on study; 5 animals removed due to infection around catheters

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. 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·Dose

Exponential (EXP): Response = a + c·(1-exp(-d·Dose))

Combination (LIN+EXP): Response = a + b·Dose + c·(1-exp(-d·Dose))

Although underlying mechanism was not considered in selecting these equations, the linear equation allows fitting of 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 usually 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).

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 Low-Dose and High-Dose Uncertainty

The low-dose portions of the dose-response curves for lead acetate and/or test material are sometimes difficult to define. This is because the magnitude of the variability in responses between different animals in a group may be large compared to the mean response of the group. This low-dose uncertainty in the dose-response curves can introduce significant uncertainty into low-dose RBA calculations. To account for this, RBA values were not calculated for doses of test material lower than the dose of lead acetate that yielded a response three-times that of the mean of the control group.

In some cases, the response of the high dose of a test material was higher than the response of the highest dose of lead acetate given. This introduced uncertainty in RBA values at high doses, because calculation of the RBA values would require extrapolation of the lead acetate dose-response curve beyond the measured data. To limit the uncertainty introduced by this situation, the lead acetate standard curve was not extrapolated beyond the highest measured individual response observed in animals exposed to the high dose of lead acetate, and RBA values were not calculated for test material at doses which yielded responses above this value. In some cases, the best-fit curves for test materials plateaued prior to reaching response levels seen for lead acetate. In this situation, RBA values were not calculated for doses beyond the highest nominal dose level tested during the study.

In practice, most humans are likely to be exposed at the lower end of the dose range presented to the animals.

3.5 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.

<u>Duplicates</u>

A randomly selected set of about 5% of all samples generated during the studies were submitted to the laboratory in a blind fashion for duplicate analysis. The raw data for each study are presented in Appendix A, and Figure 3-1 plots the results (combined across studies) 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.

<u>Standards</u>

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 Studies 4 and 11 are presented in Appendix A, and the values are plotted in Figure 3-2. As seen, the analytical results obtained for the check samples in Study 4 tended to be about 1-1.5 ug/dL low in all groups (BDL vs 1.7, 3.6 vs 4.8, and 13.4 vs 14.9 ug/dL). In Study 11, there was better agreement for the check samples (2.1 vs 1.7, 4.6 vs 4.8, and 14.7 vs 14.9).

<u>Interlaboratory Comparison</u>

An interlaboratory comparison of blood lead analytical results was performed by sending a set of approximately 20 randomly selected whole blood samples from each study to CDCP for blind

FIGURE 3-1 COMPARISON OF DUPLICATE ANALYSES

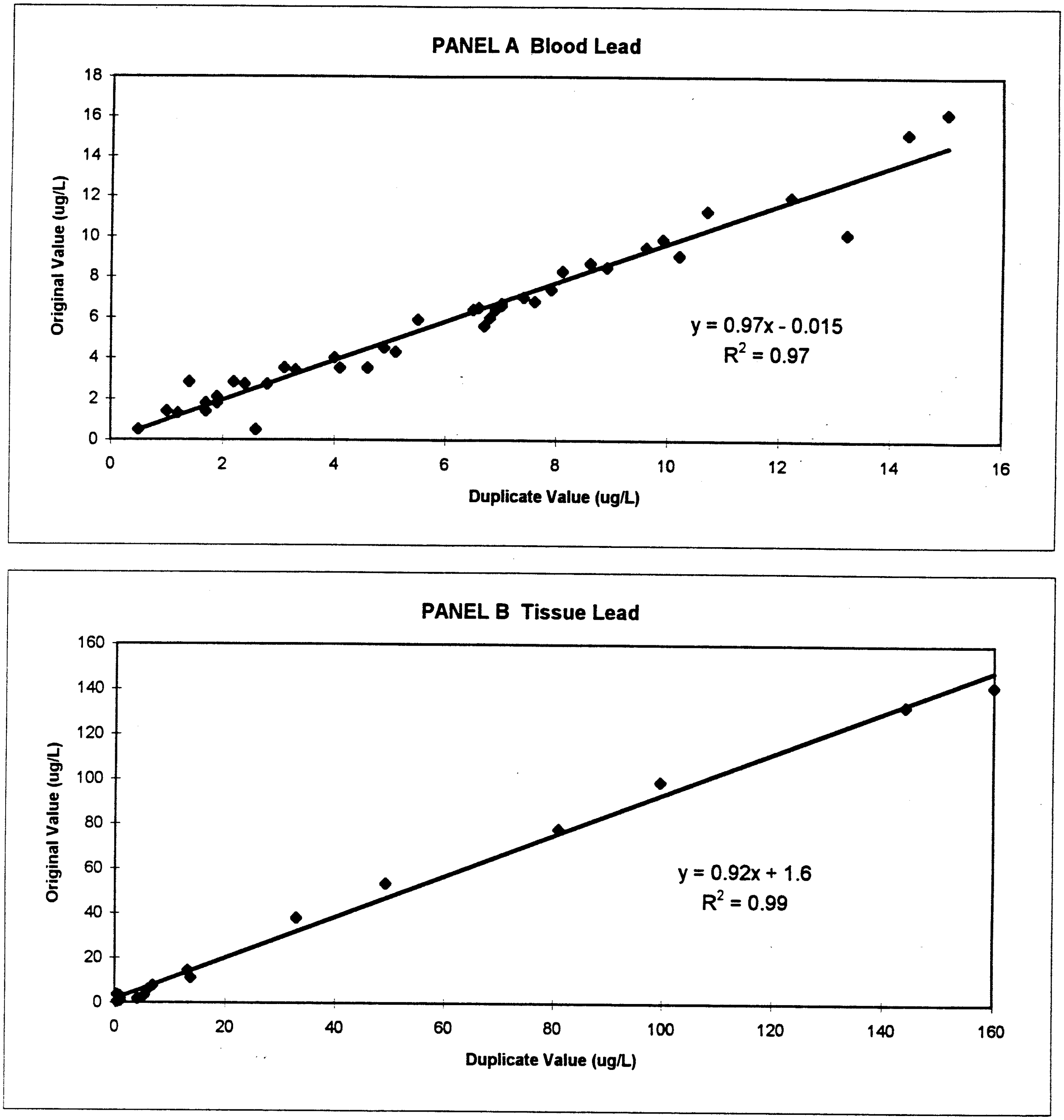
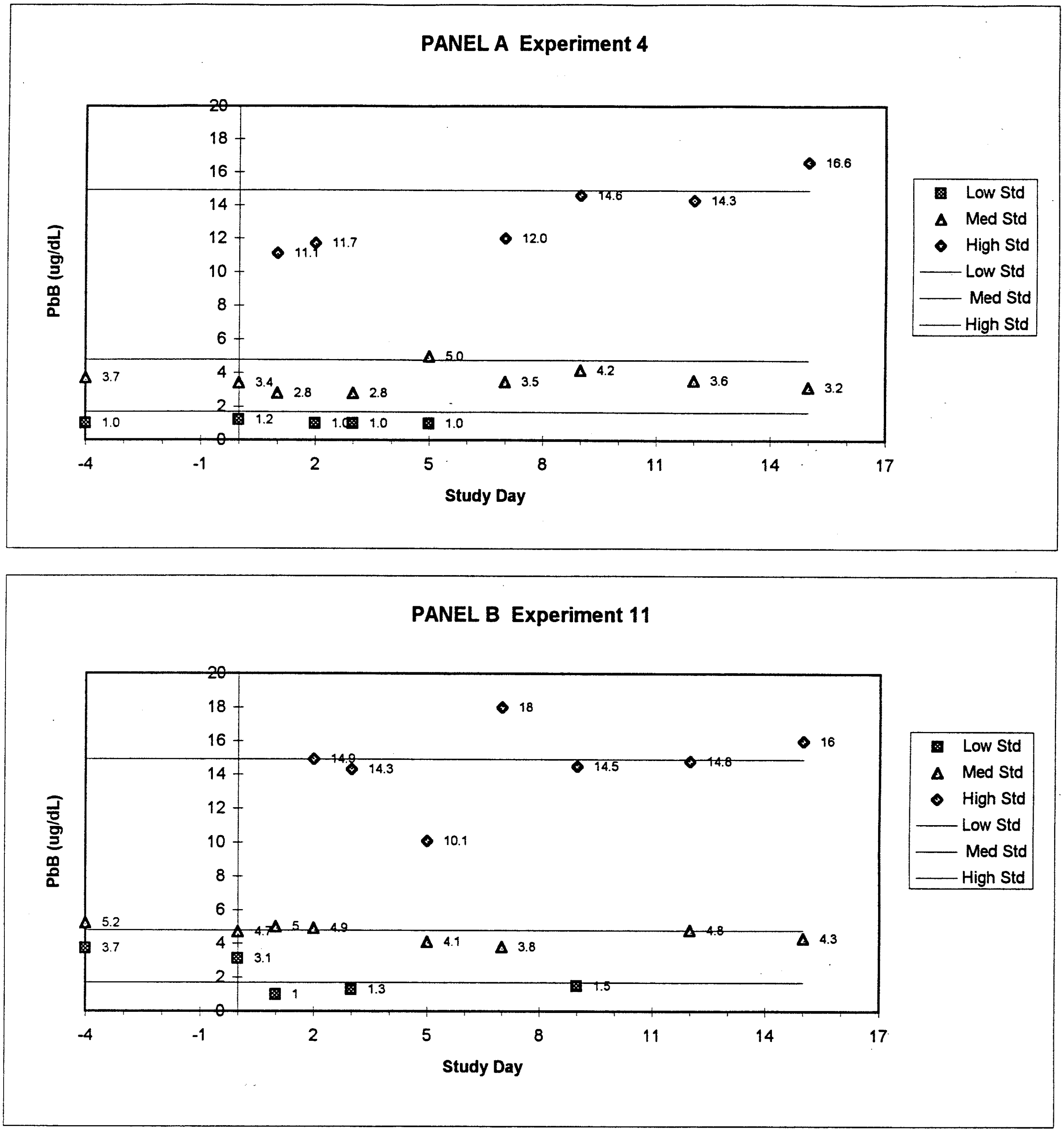


FIGURE 3-2 CDCP CHECK SAMPLES



independent analysis. The results are presented in Appendix A, and the values are plotted in Panel B (lower) of Figure 3-3. As seen, in Study 4 the results from EPA's laboratory appeared to be about 25% lower on average than the results from CDCP. In Study 11, the agreement between the laboratories was substantially better (Panel B).

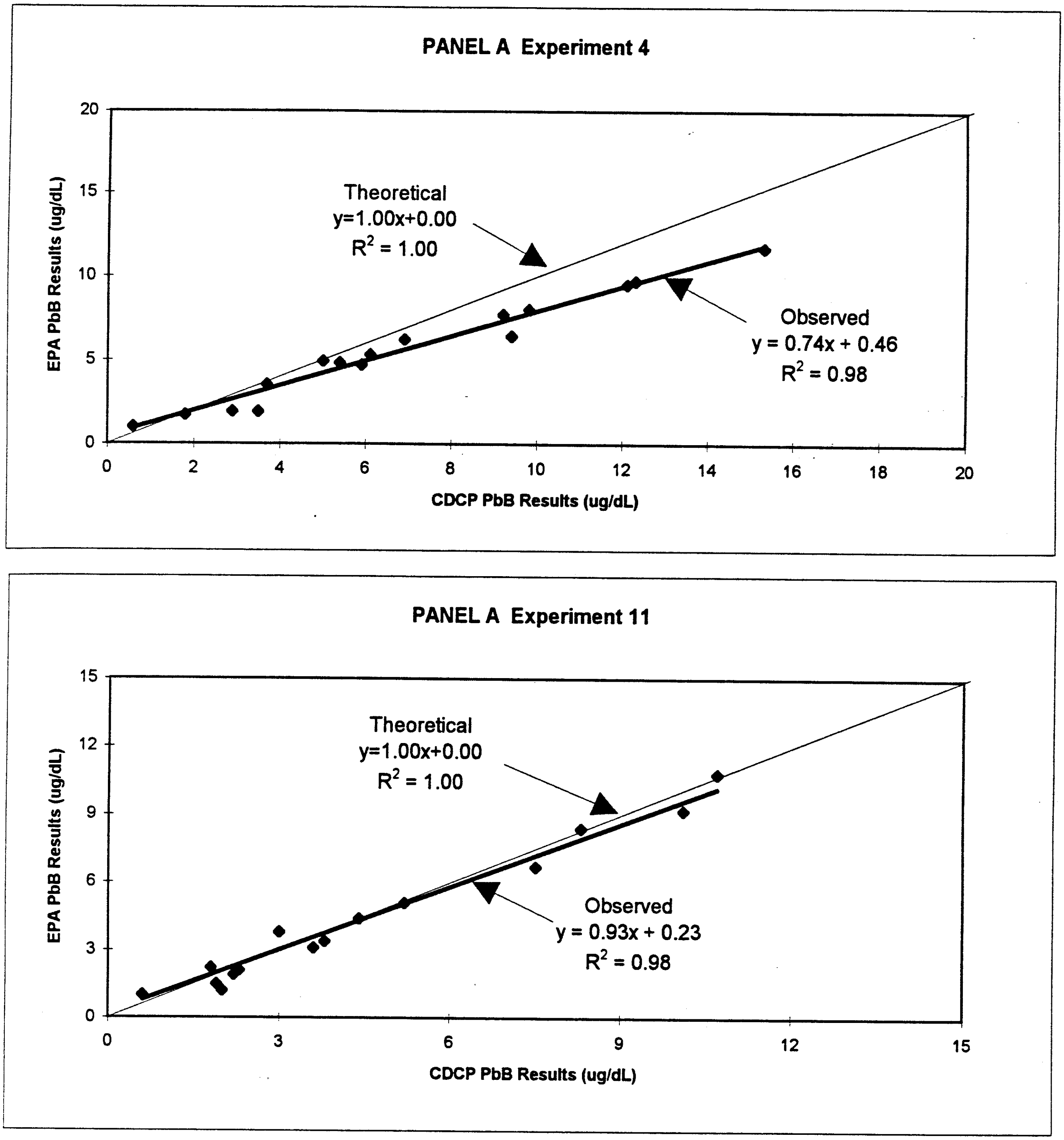
The reason for the apparent discrepancy in Study 4 between the observed and expected results for the check samples (Figure 3-2) and between the EPA laboratory and the CDCP laboratory (Figure 3-3) is not clear, but might be related to differences in sample preparation techniques. Regardless of the reason, 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 downloaded electronic files were printed out and compared to printouts of the tag assignments and the decoded data.

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

FIGURE 3-3 INTER-LABORATORY COMPARISON



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 (Panels A and B) show the group mean blood lead values as a function of time in animals exposed to each of the test materials. Each panel also shows the response of animals exposed to lead acetate in the corresponding 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 1). In animals given repeated oral doses of lead acetate, slag or soil, 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.

In Experiment 11, there is a possibility that measured blood lead values for Days 2 and 3 may have been switched due to a labelling error. No corrections were made in the data for this potential error, however, it should be noted that this will have no effect on the calculation of RBA, as AUC is unaffected.

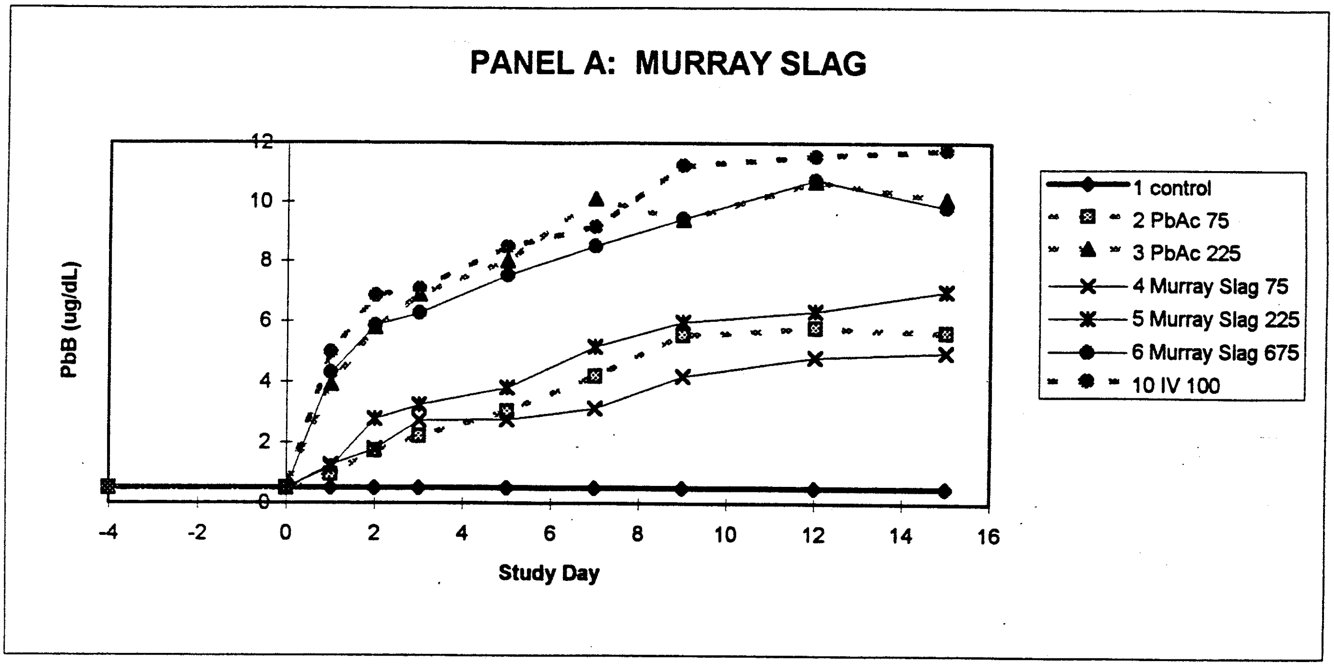
4.2 Dose-Response Patterns

Blood Lead

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 for each animal 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 panels also show the best-fit equation through each data set.

As seen, the dose response pattern is non-linear (exponential) for both lead acetate and test material, both in Study 4 and Study 11. Inspection of the best-fit equations reveals that the absorption of lead from slag (Panel A) and soil (Panel B) are both somewhat lower than for lead acetate, with the difference being more apparent for slag than soil.

FIGURE 4-1 GROUP MEAN BLOOD LEAD BY DAY FOR MURRAY SMELTER SAMPLES



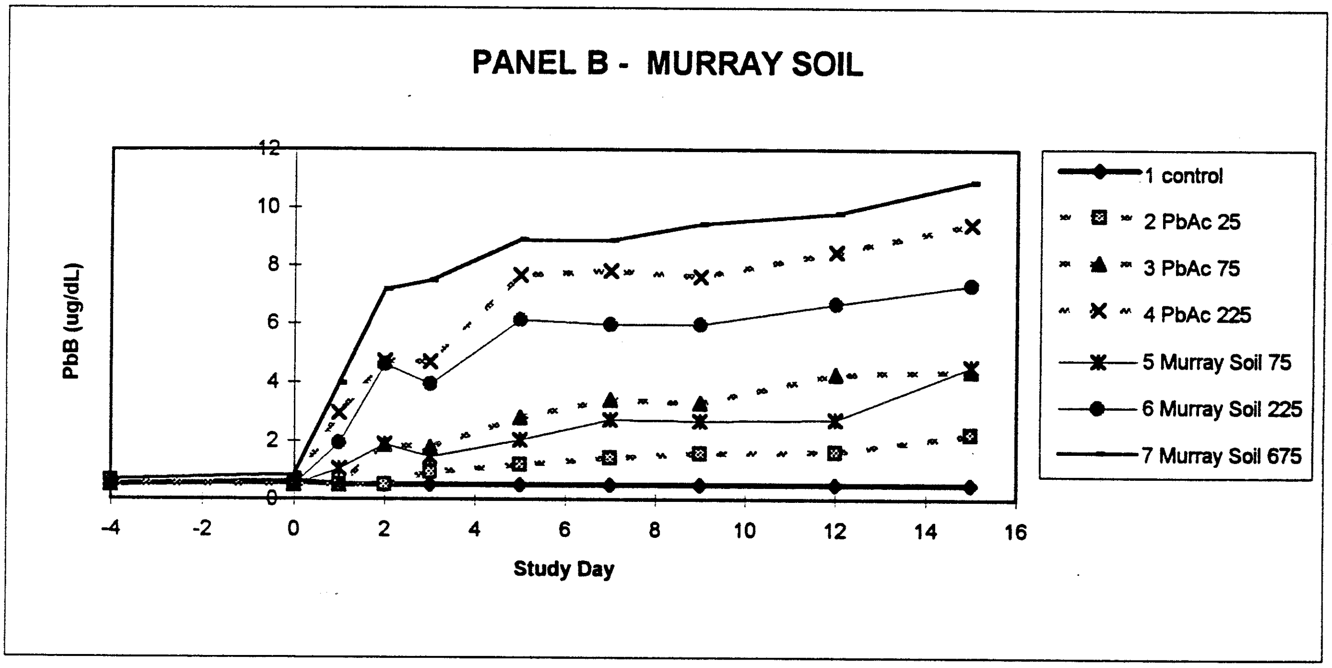
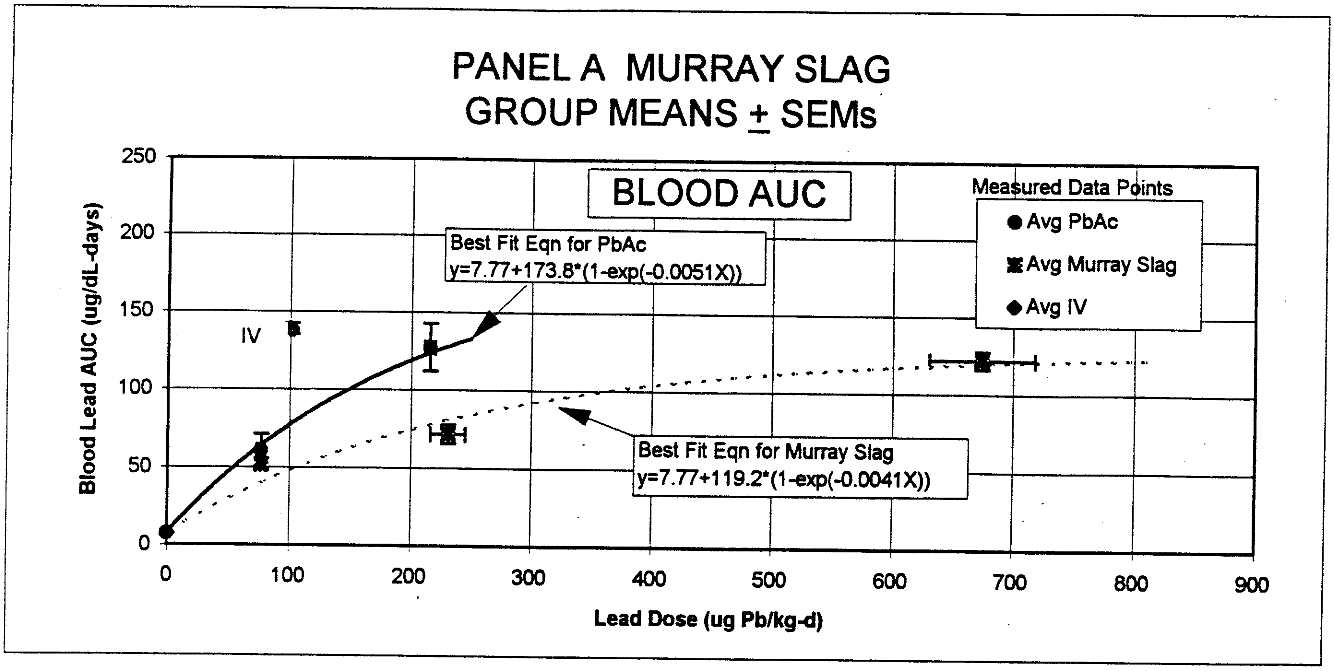
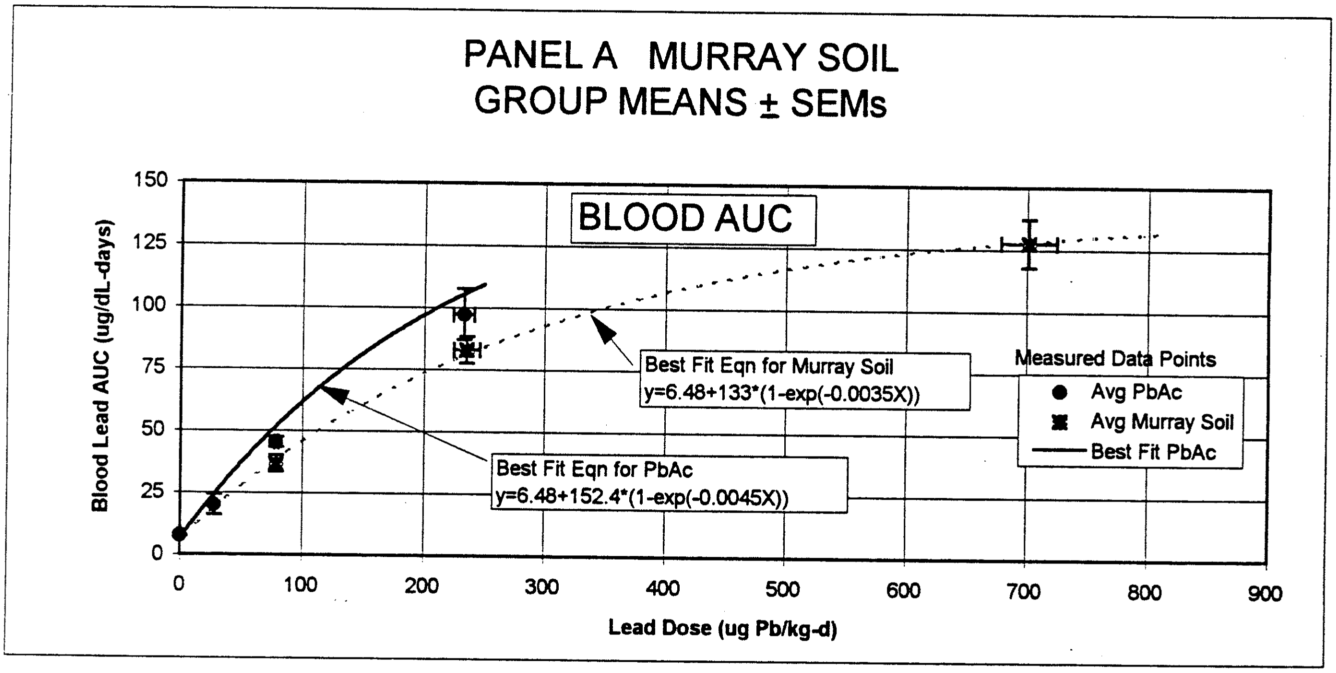


FIGURE 4-2 BLOOD LEAD DOSE-RESPONSE FOR MURRAY SMELTER SAMPLES





Tissue Lead

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.

As seen, the dose response curves for animals exposed to lead acetate are all reasonably-well fit by linear equations for all of the tissue endpoints (liver, kidney and bone). This pattern is similar to what has been observed in other studies that were part of this project. In contrast, the dose-response curves for test material (slag, soil) are generally non-linear, and are better fit with exponential than linear equations for all data sets except for liver in Study 4. In this case, both linerar and exponential yielded approximately equal quality fits, so the exponential fit was selected based on the non-linear behavior of all of the other tissue data sets. This non-linearity in the dose response of test materials in liver, kidney and bone was not expected, and has not been observed in liver, kidney and bone in most other studies. The basis for the non-linear response in not known.

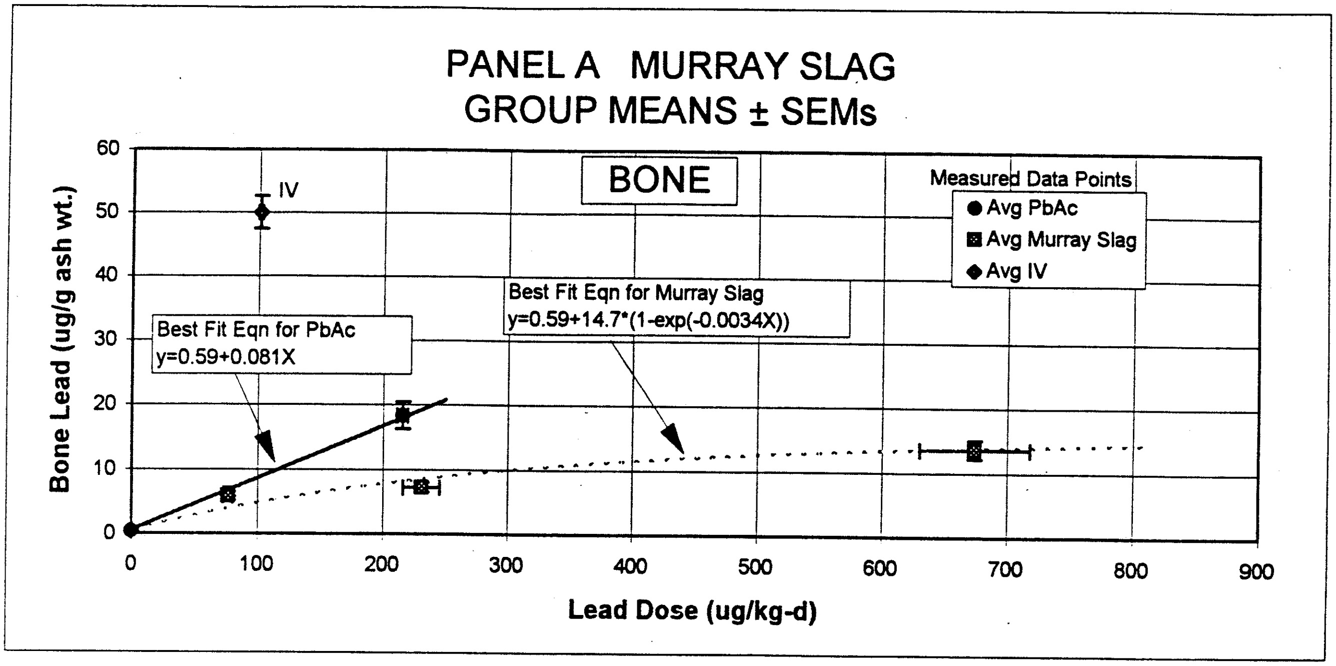
4.3 Calculated RBA Values

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 in Figure 4-6. Because of the difference in shape between the dose-response curves for lead acetate and test materials, most of the calculated RBA values are not constant, but tend to decrease with increasing dose. Assuming that this dose-dependency is real, the RBA values that are most relevant are at a dose near that which would be expected for a child. In all cases, this is likely to be in the range of 5-50 ug/kg-day, at or below the low end of the exposure range investigated in this study. Thus, the point estimates for each endpoint are those at the lower end of the curves shown in Figure 4-6, as follows:

Measurement Endpoint	Low Dose RBA	
	Murray Slag	Murray Soil
Blood Lead AUC	0.55	0.67
Liver Lead	0.37	0.87
Kidney Lead	0.44	1.02
Bone Lead	0.61	0.63

An important feature to note in all of the dose response data sets (see Figures 4-2 to 4-5) is that even though the resonses of test material are lower than for lead acetate at high dose (225 to 675 ug/kg-day), the responses are nearly identical at low dose (75 ug/kg-d). This supports the conclusion that RBA is dose dependent, and has a high value (perhaps even approaching 1.0) at very low dose.

FIGURE 4-3 BONE LEAD DOSE-RESPONSE FOR MURRAY SMELTER SAMPLES



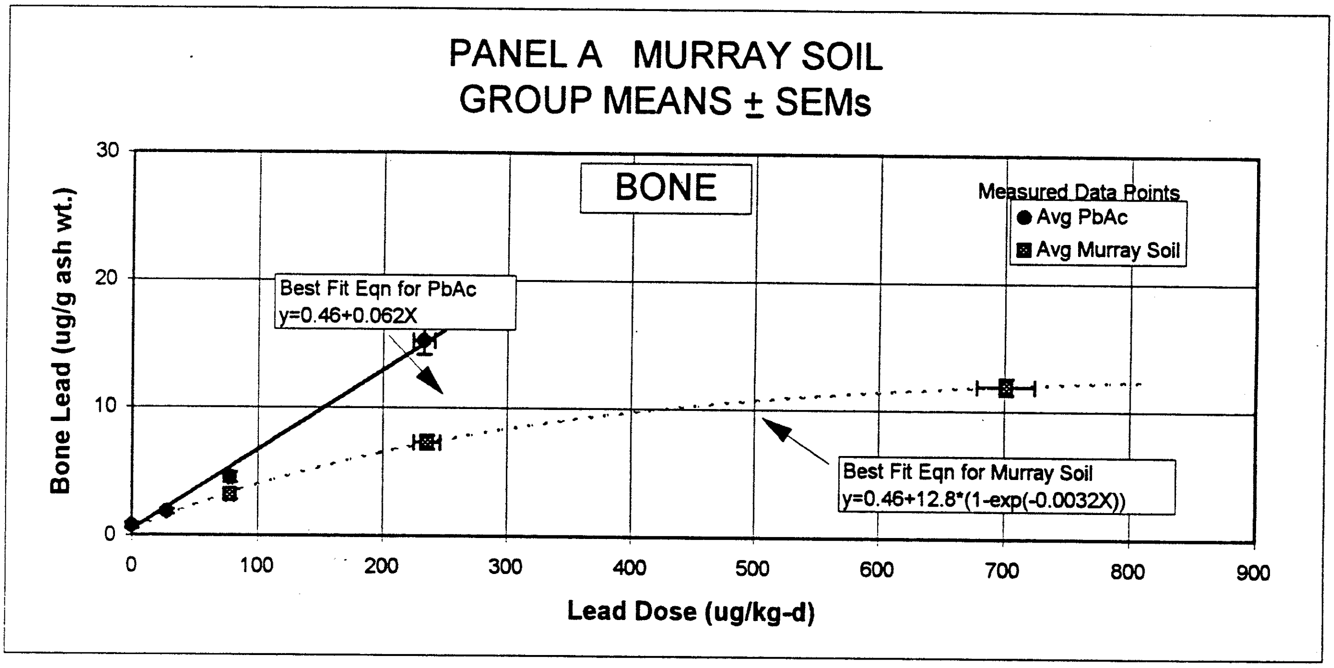
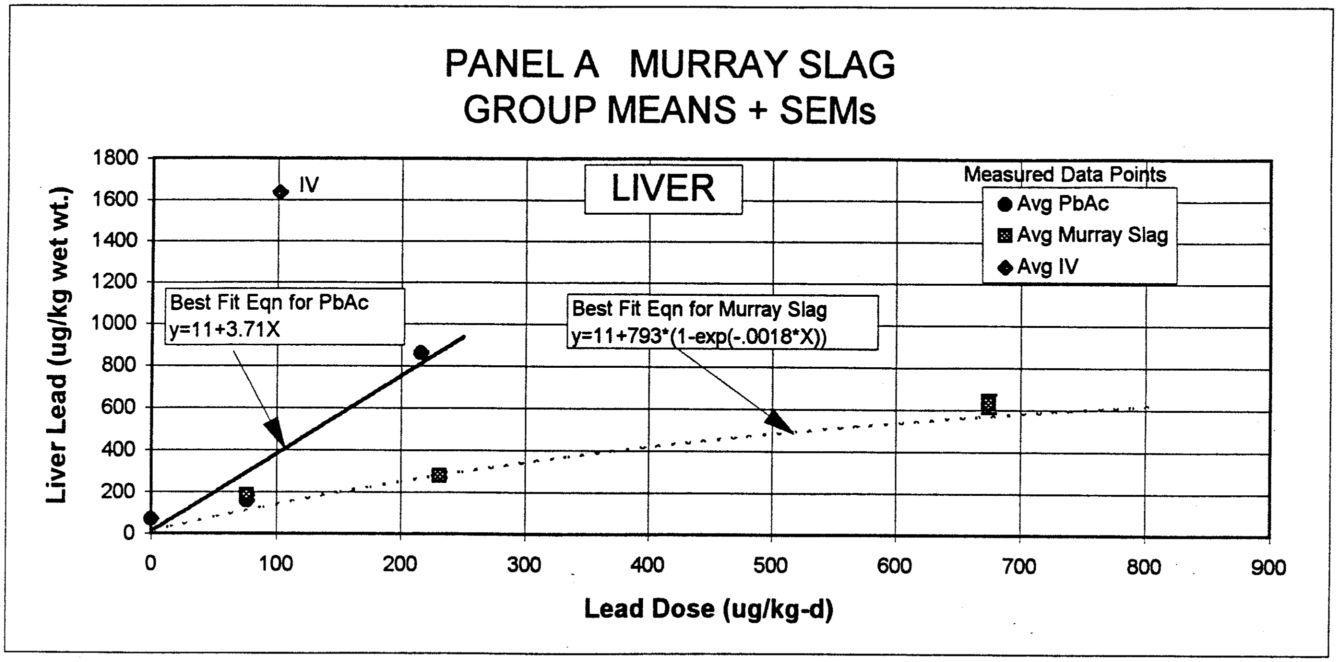


FIGURE 4-4 LIVER LEAD DOSE-RESPONSE FOR MURRAY SMELTER SAMPLES



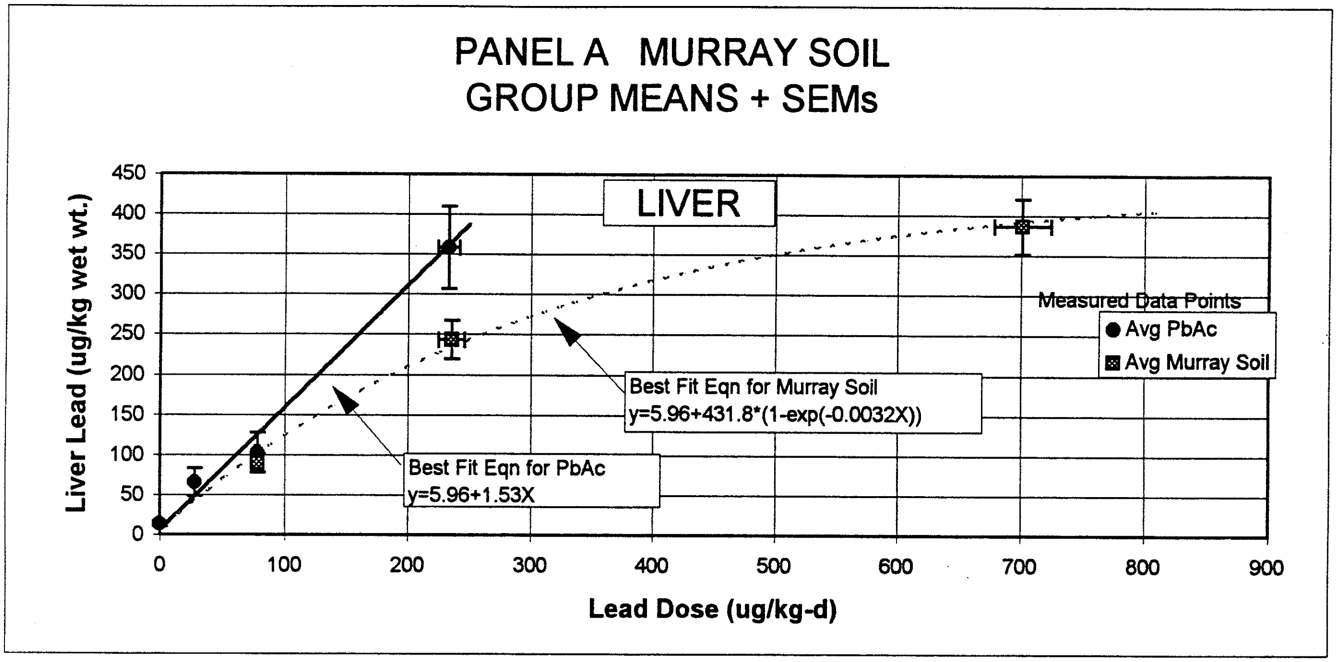
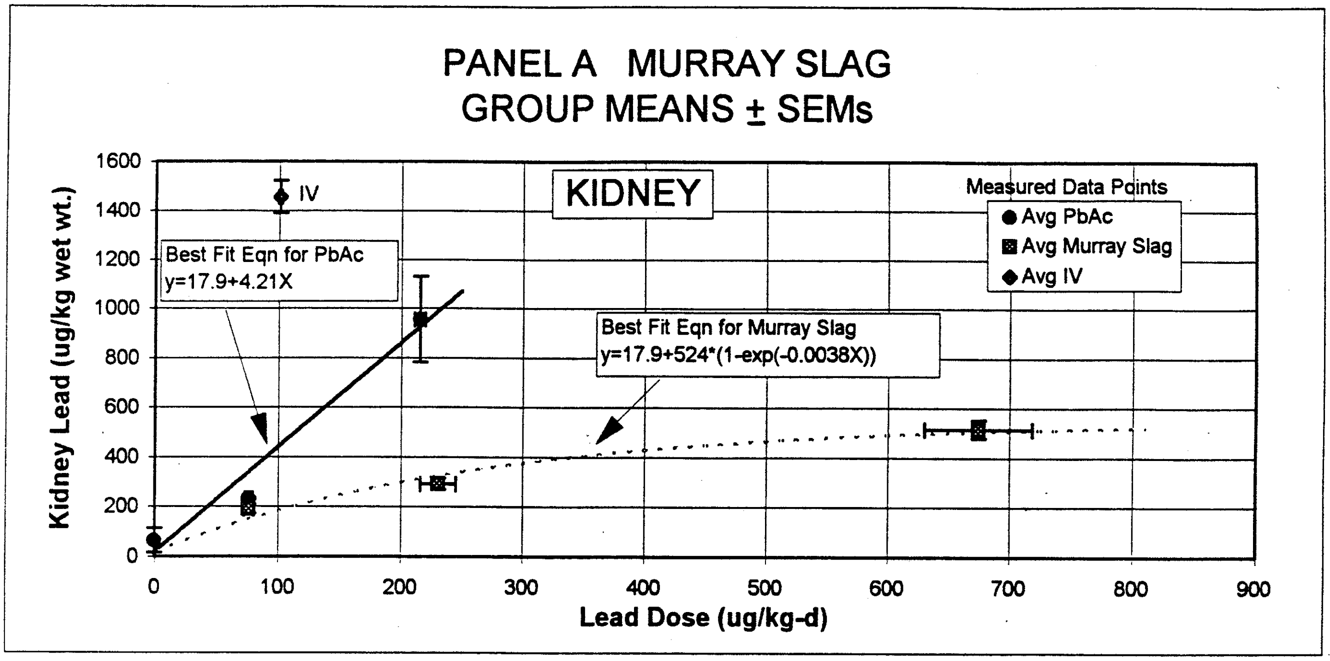


FIGURE 4-5 KIDNEY LEAD DOSE-RESPONSE FOR MURRAY SMELTER SAMPLES



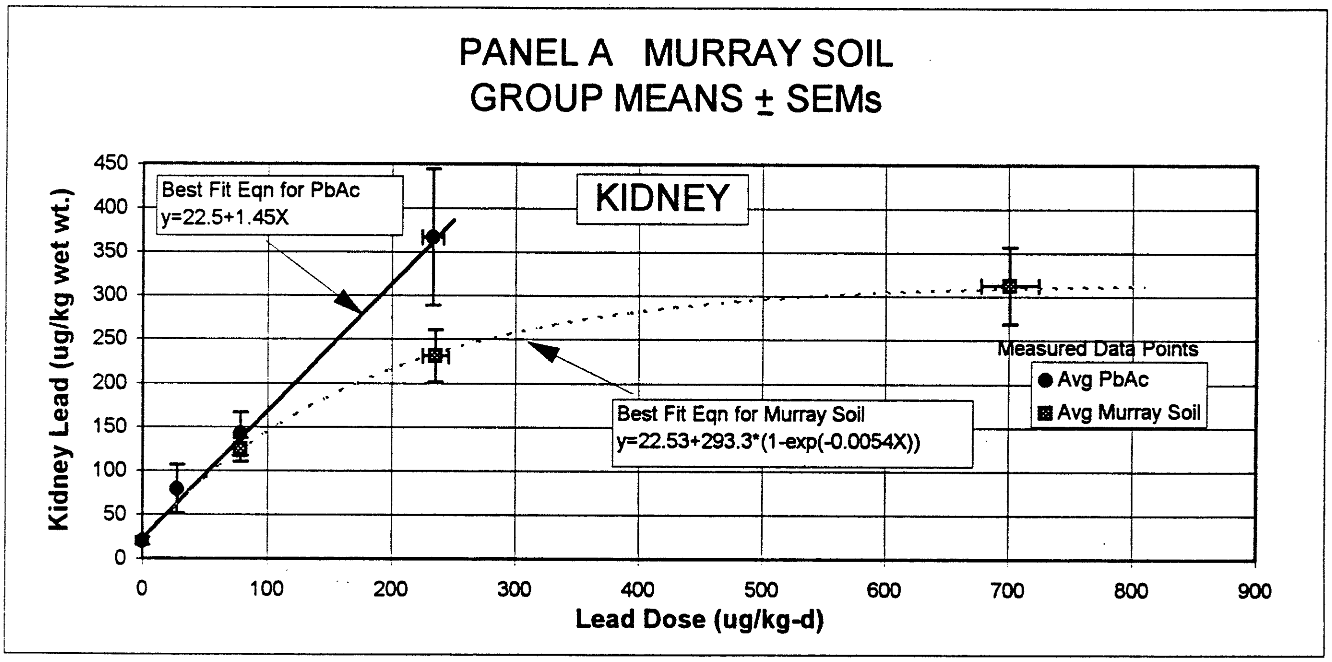
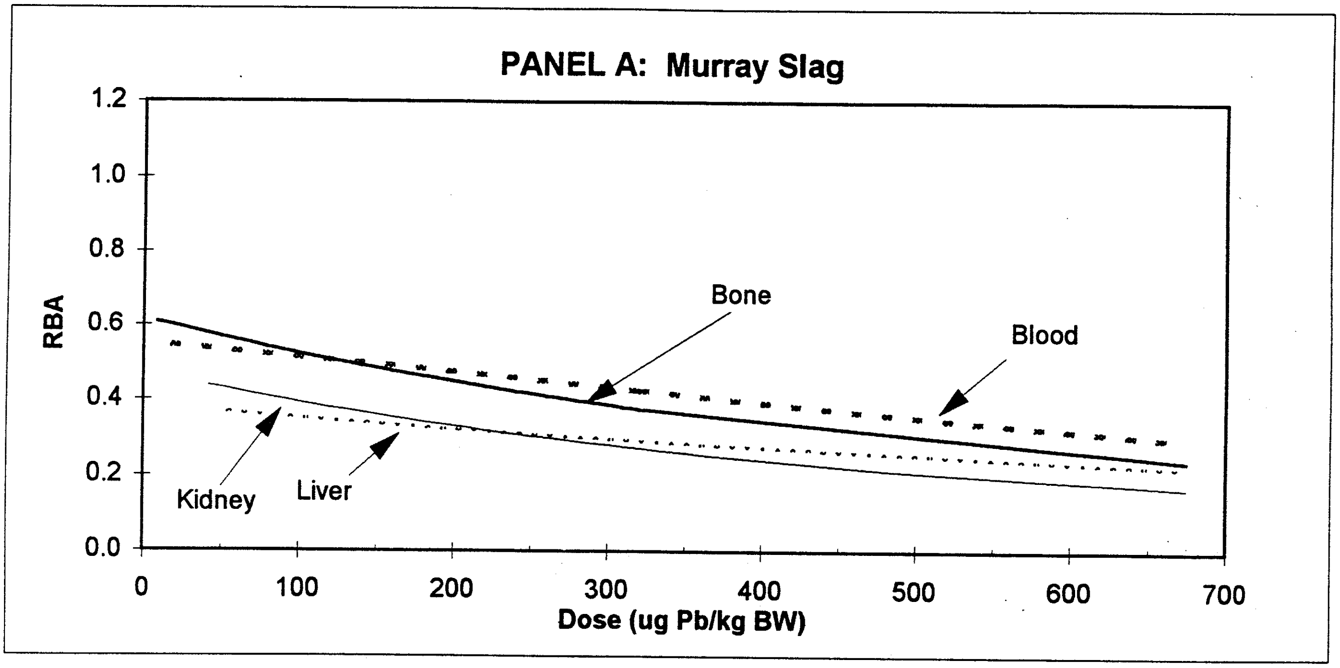
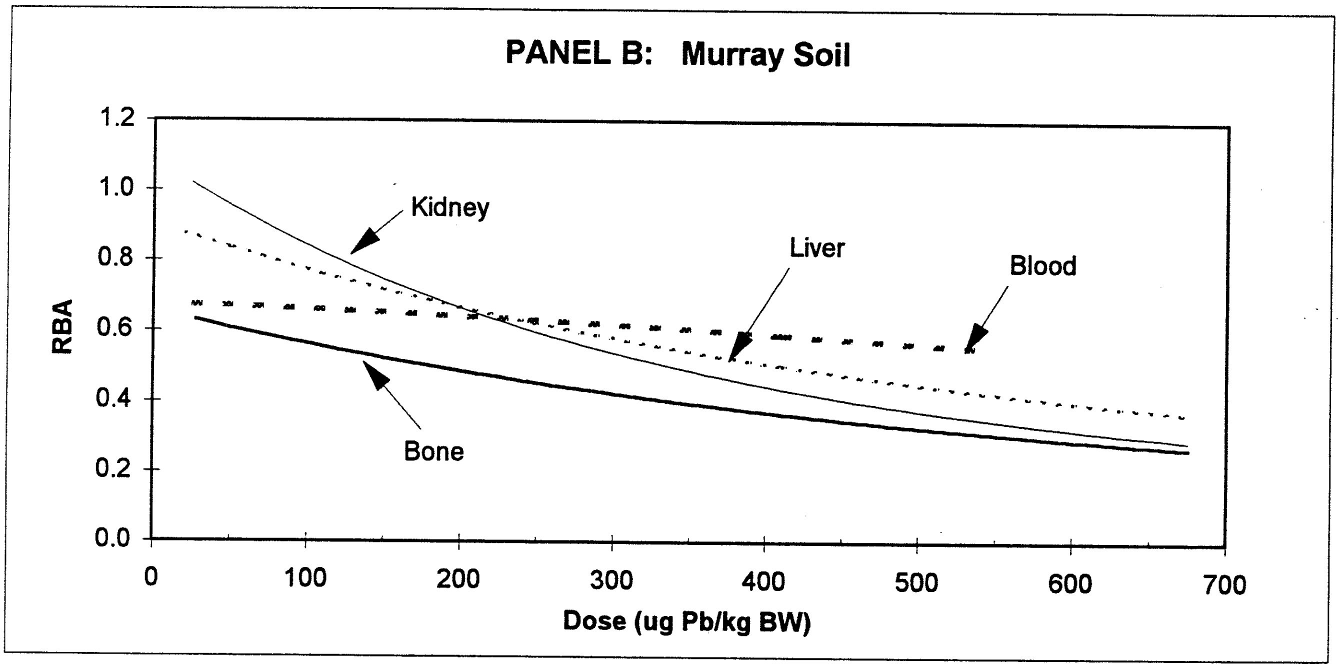


FIGURE 4-6 RELATIVE BIOAVAILABILITY OF LEAD IN MURRAY SMELTER SAMPLES





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 <u>plausible range</u> to extend from the RBA based on blood AUC to the mean of the other three tissues (liver, kidney, bone). The <u>preferred range</u> is the interval from the RBA based on blood to the mean of the blood RBA and the tissue mean RBA. Our <u>suggested point estimate</u> is the mid-point of the preferred range. These values are presented below:

Test Material	Relative Bioavailability of Lead		
	Plausible Range	Preferred Range	Suggested Point Estimate
Murray Slag	0.55-0.47	0.55-0.51	0.53
Murray Soil	0.67-0.84	0.67-0.75	0.71

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:

$$ABA_{\text{Murray Slag}} = 50\% \cdot RBA_{\text{Murray Slag}}$$

$$ABA_{\text{Murray Soil}} = 50\% \cdot RBA_{\text{Murray Soil}}$$

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

Test Material	Absolute Bioavailability of Lead		
	Plausible Range	Preferred Range	Suggested Point Estimate
Murray Slag	28%-24%	28%-26%	27%
Murray Soil	34%-42%	34%-38%	36%

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, uncertainty arises from the unexpected non-linear dose-response pattern observed in liver, kidney and bone of animals exposed to test material. Because RBA appears to depend on dose, the precise value that should be applied to a child depends on the exposure levels experienced by each child. Thus, use of a single low-end point estimate may not be accurate for all dose levels. Third, there is uncertainty in how to weight the low-dose RBA point estimate values based on the different endpoints, and how to select a point estimate for RBA that is applicable to typical site-specific exposure levels. Fourth, 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 RBAs 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, EXPERIMENTS 4 and 11

MURRAY SMELTER SUPERFUND SITE

APPENDIX A

DETAILED DATA SUMMARY

1.0 OVERVIEW

Performance of these studies 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 within two Microsoft Excel spreadsheets named "MURRAY1.XLS" and "MURRAY2.XLS" that are available upon request from the administrative record. MURRAY1.XLS contains data from Phase II Experiment 4 in which Murray slag was evaluated, and MURRAY2.XLS contains data for Murray soil evaluated in Phase II Experiment 11. These files are provided to allow detailed review and evaluation by outside parties of all aspects of the study.

All tables and figures referred to in this Appendix are printouts of selected tables and graphs from the XLS files. These tables and graphs are all presented at the end of the text section, grouped by experiment. That is, all tables and graphs from Experiment 4 (Murray Slag) are presented together, followed by an analogous series of tables and graphs from Experiment 11 (Murray Soil). These tables and graphs provide a more detailed documentation of the individual animal data and the data reduction steps performed in these studies than was presented in the main text. Any additional details of interest to a reader can be found in the XLS spreadsheets.

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.

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. Those which were judged to warrant exclusion are shown by a heavy black box around the value. All other flagged values were retained.

Rarely, a value not flagged by the computer was judged to be an outlier that should be excluded. These are shown by unshaded cells surrounded by a heavy black box. (There are none in this study).

Table A-5 provided a discussion of the rationale used to decide if a blood lead value should be designated as an outlier or not.

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 $\pm$ 20% (typically 7.5 $\pm$ 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. In most studies this parameter was also forced to be the same for the reference material (lead acetate) and the test material because it is expected on theoretical grounds that the plateau (saturation level) should be the same regardless of the source of lead. However, in these studies the data for several endpoints indicated that the plateau value may not be the same. The basis for this unexpected result is not clear, but the curves were fit without forcing the plateaus to be the same for lead acetate and test material.

- 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.

<u>Outlier Identification</u>

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.

Curve Fit Results

Table A-8 lists the data used to fit these curves, indicating which endpoints were excluded as outliers and why. The corresponding best fit equations are shown in Figures A-5 to A-12. 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. In other cases, RBA is not constant but depends on dose.

Table A-9 shows the appropriate low-dose and high-dose truncation (confidence) limits for each curve, and gives the predicted values of RBA as a function of dose. Figure A-13 plots the calculated RBA values as a function of dose.

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 approximately 20 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.

TABLES AND GRAPHS FROM EXPERIMENT 4

MURRAY SLAG SAMPLE

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 BW (kg)	Day -1 ug Pb per day	Day 0 BW (kg)	Day 0 ug Pb per day	Day 1 BW (kg)	Day 1 ug Pb per day	Day 2 BW (kg)	Day 2 ug Pb per day	Day 3 BW (kg)	Day 3 ug Pb per day	Day 4 BW (kg)	Day 4 ug Pb per day	Day 5 BW (kg)	Day 5 ug Pb per day	Day 6 BW (kg)	Day 6 ug Pb per day
1	417	12.1	0	12.5	0	12.8	0	13.2	0	13.7	0	14.1	0	14.6	0	15.1	0
1	430	8.7	0	8.9	0	9.2	0	9.4	0	9.8	0	10.2	0	10.6	0	11.1	0
2	409	10.7	0	11.1	827	11.4	827	11.8	827	12.3	894	12.9	894	13.4	894	13.9	992
2	419	11.9	0	12.1	827	12.2	827	12.4	827	12.7	894	13.1	894	13.4	894	13.8	992
2	429	10	0	10.3	827	10.5	827	10.8	827	11.3	894	11.7	894	12.2	894	12.7	992
2	443	8.7	0	9.1	827	9.5	827	9.9	827	10.2	894	10.6	894	10.9	894	11.3	992
2	444	8.8	0	9.1	827	9.4	827	9.7	827	10.2	894	10.7	894	11.2	894	11.6	992
3	408	9.8	0	10.3	2480	10.8	2480	11.3	2480	11.7	2682	12.0	2682	12.4	2682	12.9	2975
3	410	10.8	0	11.0	2480	11.1	2480	11.3	2480	11.7	2682	12.0	2682	12.4	2682	12.8	2975
3	426	10.8	0	11.1	2480	11.4	2480	11.7	2480	12.2	2682	12.7	2682	13.2	2682	13.7	2975
3	449	10.9	0	11.2	2480	11.4	2480	11.7	2480	12.1	2682	12.4	2682	12.8	2682	13.2	2975
3	455	11.1	0	11.5	2480	12.0	2480	12.4	2480	12.8	2682	13.3	2682	13.7	2682	14.2	2975
4	402	11.2	0	11.5	837	11.8	837	12.1	837	12.7	900	13.2	900	13.8	900	14.2	1002
4	407	9.3	0	9.6	837	9.9	837	10.2	837	10.5	900	10.9	900	11.2	900	11.4	1002
4	411	11.4	0	11.7	837	12.1	837	12.4	837	13.0	900	13.5	900	14.1	900	14.5	1002
4	423	9.3	0	9.4	837	9.5	837	9.6	837	9.9	900	10.3	900	10.6	900	11.0	1002
4	450	9.6	0	10.0	837	10.3	837	10.7	837	11.2	900	11.6	900	12.1	900	12.5	1002
5	420	10.5	0	10.9	2430	11.3	2430	11.7	2430	12.1	2660	12.5	2660	12.9	2660	13.4	2957
5	431	10.7	0	11.1	2430	11.6	2430	12	2430	12.5	2660	13.0	2660	13.5	2660	14.0	2957
5	432	7.3	0	7.7	2430	8.0	2430	8.4	2430	8.8	2660	9.1	2660	9.5	2660	10.0	2957
5	440	10.9	0	11.3	2430	11.7	2430	12.1	2430	12.5	2660	13.0	2660	13.4	2660	13.9	2957
5	446	9.6	0	9.7	2430	9.8	2430	9.9	2430	10.4	2660	10.9	2660	11.4	2660	11.9	2957
6	412	7.3	0	7.7	7331	8.0	7331	8.4	7331	8.9	7898	9.3	7898	9.8	7898	10.2	8883
6	418	12.3	0	12.6	7331	12.8	7331	13.1	7331	13.6	7898	14.1	7898	14.6	7898	15.1	8883
6	427	9.4	0	9.8	7331	10.3	7331	10.7	7331	11.2	7898	11.6	7898	12.1	7898	12.6	8883
6	437	10.6	0	11.0	7331	11.3	7331	11.7	7331	12.1	7898	12.5	7898	12.9	7898	13.4	8883
6	442	10.8	0	10.9	7331	11.1	7331	11.2	7331	11.8	7898	12.5	7898	13.1	7898	13.5	8883
10	415																
10	421																
10	424																
10	425	9.8	0	10.2	1026	10.5	1026	10.9	1026	11.2	1118	11.4	1118	11.7	1118	12.2	1263
10	438	8.8	0	9.1	1026	9.3	1026	9.6	1026	10.0	1118	10.4	1118	10.8	1118	11.2	1263
10	439	10.1	0	10.4	1026	10.7	1026	11	1026	11.0	1118	11.1	1118	11.1	1118	11.4	1263
10	445																
10	451																

Group	ID #	Day 7 BW (kg)	Day 7 ug Pb per day	Day 8 BW (kg)	Day 8 ug Pb per day	Day 9 BW (kg)	Day 9 ug Pb per day	Day 10 BW (kg)	Day 10 ug Pb per day	Day 11 BW (kg)	Day 11 ug Pb per day	Day 12 BW (kg)	Day 12 ug Pb per day	Day 13 BW (kg)	Day 13 ug Pb per day	Day 14 BW (kg)	Day 14 ug Pb per day	Day 15 BW (kg)	Day 15 ug Pb per day
1	417	15.5	0	16	0	16.6	0	17.3	0	17.9	0	18.4	0	18.9	0	19.4	0	19.9	0
1	430	11.6	0	12.1	0	12.7	0	13.3	0	13.9	0	14.6	0	15.3	0	16	0	16.7	0
2	409	14.4	992	14.9	992	15.4	1088	16.0	1088	16.5	1088	17.1	1205	17.7	1205	18.3	1205	18.9	0
2	419	14.1	992	14.5	992	15.0	1088	15.6	1088	16.1	1088	16.2	1205	16.4	1205	16.5	1205	16.6	0
2	429	13.3	992	13.8	992	14.3	1088	14.9	1088	15.4	1088	16.0	1205	16.7	1205	17.3	1205	17.9	0
2	443	11.6	992	12	992	12.4	1088	12.8	1088	13.2	1088	13.8	1205	14.3	1205	14.9	1205	15.5	0
2	444	11.9	992	12.3	992	12.9	1088	13.5	1088	14.1	1088	14.7	1205	15.4	1205	16	1205	16.6	0
3	408	13.4	2975	13.9	2975	14.4	3263	14.8	3263	15.3	3263	16.0	3614	16.7	3614	17.4	3614	18.1	0
3	410	13.1	2975	13.5	2975	14.0	3263	14.5	3263	15	3263	15.4	3614	15.8	3614	16.2	3614	16.6	0
3	426	14.2	2975	14.7	2975	15.2	3263	15.7	3263	16.2	3263	16.9	3614	17.6	3614	18.3	3614	19.0	0
3	449	13.6	2975	14	2975	14.6	3263	15.1	3263	15.7	3263	16.0	3614	16.2	3614	16.5	3614	16.8	0
3	455	14.8	2975	15.3	2975	15.9	3263	16.4	3263	17	3263	17.6	3614	18.2	3614	18.8	3614	19.4	0
4	402	14.7	1002	15.1	1002	15.7	1085	16.2	1085	16.8	1085	17.6	1217	18.3	1217	19.1	1217	19.9	0
4	407	11.6	1002	11.8	1002	12.5	1085	13.3	1085	14	1085	14.5	1217	15.1	1217	15.6	1217	16.1	0
4	411	14.9	1002	15.3	1002	15.8	1085	16.3	1085	16.8	1085	17.6	1217	18.3	1217	19.1	1217	19.9	0
4	423	11.4	1002	11.8	1002	12.3	1085	12.8	1085	13.3	1085	13.9	1217	14.6	1217	15.2	1217	15.8	0
4	450	12.9	1002	13.3	1002	13.9	1085	14.6	1085	15.2	1085	15.8	1217	16.3	1217	16.9	1217	17.5	0
5	420	13.8	2957	14.3	2957	14.9	3281	15.5	3281	16.1	3281	16.5	3627	16.8	3627	17.2	3627	17.6	0
5	431	14.4	2957	14.9	2957	15.4	3281	16.0	3281	16.5	3281	16.6	3627	16.8	3627	16.9	3627	17.0	0
5	432	10.4	2957	10.9	2957	11.4	3281	12.0	3281	12.5	3281	13.0	3627	13.5	3627	14	3627	14.5	0
5	440	14.3	2957	14.8	2957	15.2	3281	15.7	3281	16.1	3281	16.6	3627	17.1	3627	17.6	3627	18.1	0
5	446	12.5	2957	13	2957	13.5	3281	13.9	3281	14.4	3281	15.0	3627	15.7	3627	16.3	3627	16.9	0
6	412	10.7	8883	11.1	8883	11.7	9747	12.2	9747	12.8	9747	13.4	10922	14.1	10922	14.7	10922	15.3	0
6	418	15.5	8883	16	8883	16.5	9747	17.1	9747	17.6	9747	18.2	10922	18.8	10922	19.4	10922	20.0	0
6	427	13.1	8883	13.6	8883	14.0	9747	14.5	9747	14.9	9747	15.4	10922	16.0	10922	16.5	10922	17.0	0
6	437	14.0	8883	14.5	8883	15.1	9747	15.6	9747	16.2	9747	16.9	10922	17.5	10922	18.2	10922	18.9	0
6	442	13.9	8883	14.3	8883	14.7	9747	15.2	9747	15.6	9747	16.1	10922	16.6	10922	17.1	10922	17.6	0
10	415																		
10	421																		
10	424																		
10	425	12.7	1263	13.2	1263	13.7	1343	14.3	1343	14.8	1343	15.3	1447	15.8	1447	16.3	1447	16.8	0
10	438	11.6	1263	12	1263	12.6	1343	13.2	1343	13.8	1343	14.2	1447	14.7	1447	15.1	1447	15.5	0
10	439	11.8	1263	12.1	1263	12.0	1343	11.9	1343	11.8	1343	12.5	1447	13.3	1447	14	796	14.7	0
10	445																		
10	451																		

Animal removed during course of study

Days which required adjustment due to deviations in dosing (i.e., Missed doses)

Day 14

Group 10 - Pig 439 did not receive most of one dose due to syringe coming off stopcock during injection. Daily dose adjusted to 55%.

* Groups 7, 8, & 9 not shown (data for samples from a different site)

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	417	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0		
1	430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0		
2	409	74.68	72.29	70.04	72.49	69.48	66.72	71.33	68.85	66.54	70.46	68.11	65.91	70.44	68.05	65.82	69.41	75	93	
2	419	68.49	67.56	66.65	70.21	68.42	66.72	72.02	70.15	68.38	72.34	69.86	67.55	74.20	73.59	73.00	69.94	75	93	
2	429	80.50	78.47	76.53	79.35	76.19	73.28	77.87	74.74	71.85	75.87	73.15	70.62	75.12	72.27	69.62	75.03	75	100	
2	443	90.82	87.00	83.48	87.36	84.61	82.02	88.00	85.23	82.63	87.70	84.96	82.39	87.49	84.03	80.84	85.24	75	114	
2	444	90.82	87.93	85.21	87.65	83.55	79.82	85.72	83.09	80.61	84.30	80.56	77.13	81.75	78.38	75.28	82.79	75	110	102
3	408	240.73	229.58	219.42	229.89	222.88	216.29	230.58	221.98	213.99	227.09	219.94	213.24	225.84	216.38	207.67	222.37	225	99	
3	410	226.09	222.71	219.42	229.89	222.88	216.29	232.99	226.48	220.33	233.04	225.00	217.50	234.64	228.70	223.06	225.27	225	100	
3	426	223.38	217.50	211.92	219.84	211.18	203.18	217.12	209.47	202.35	214.64	207.80	201.39	213.82	205.31	197.46	210.42	225	94	
3	449	222.04	216.87	211.92	222.27	215.71	209.53	225.34	218.71	212.46	223.97	215.58	207.80	226.32	222.60	219.00	218.01	225	97	
3	455	214.99	207.20	199.96	208.99	202.16	195.77	208.98	201.43	194.41	205.62	198.53	191.91	205.31	198.54	192.21	201.73	225	90	96
4	402	72.78	70.93	69.17	71.05	68.01	65.22	70.40	68.32	66.36	69.22	66.81	64.55	69.25	66.35	63.69	68.14	75	91	
4	407	87.19	84.55	82.06	85.44	82.82	80.36	87.89	86.38	84.92	86.53	81.75	77.46	83.70	80.74	77.98	83.32	75	111	
4	411	71.34	69.36	67.50	69.41	66.50	63.83	69.10	67.25	65.49	68.64	66.53	64.55	69.25	66.35	63.69	67.25	75	90	
4	423	89.04	88.11	87.19	90.60	87.66	84.91	91.09	87.89	84.92	88.17	84.73	81.54	87.31	83.51	80.03	86.45	75	115	
4	450	83.98	81.00	78.22	80.60	77.36	74.38	80.16	77.67	75.34	77.83	74.45	71.35	77.16	74.48	71.98	77.06	75	103	102
5	420	222.94	215.04	207.69	219.79	212.76	206.16	221.18	213.72	206.75	220.17	211.65	203.76	220.26	215.47	210.87	213.88	225	95	
5	431	218.26	210.09	202.50	212.76	204.58	197.00	211.68	204.84	198.42	212.56	205.46	198.82	218.06	216.32	214.62	208.40	225	93	
5	432	316.96	302.49	289.29	303.37	291.19	279.95	296.64	283.37	271.24	286.92	274.14	262.44	279.00	268.67	259.07	284.31	225	126	
5	440	215.04	207.69	200.83	212.19	205.10	198.47	213.21	206.27	199.76	215.35	209.39	203.76	218.49	212.11	206.08	208.25	225	93	
5	446	250.52	247.96	245.45	255.72	243.99	233.29	247.75	237.15	227.42	243.60	235.44	227.81	241.26	231.51	222.52	239.43	225	106	103
6	412	956.15	912.51	872.68	890.70	846.16	805.87	868.05	832.78	800.27	835.46	796.76	761.48	813.01	776.41	742.96	834.08	675	124	
6	418	583.33	571.21	559.58	580.70	560.11	540.92	589.58	571.87	555.19	589.54	571.11	553.81	600.08	580.93	562.96	571.39	675	85	
6	427	745.47	714.01	685.09	707.24	678.87	652.69	705.00	678.09	653.16	694.56	673.76	654.16	707.66	684.02	661.91	686.38	675	102	
6	437	668.43	646.81	626.54	652.69	631.80	612.21	661.27	636.01	612.62	646.92	623.48	601.67	647.52	622.90	600.08	632.73	675	94	
6	442	670.47	662.39	654.51	667.39	633.49	602.86	658.00	639.06	621.19	661.56	642.66	624.81	678.35	657.92	638.68	647.56	675	96	100
10	415																	100		
10	421																	100		
10	424																	100		
10	425	100.92	97.41	94.13	100.12	97.78	95.56	103.48	99.41	95.64	97.82	94.16	90.77	94.55	91.56	88.75	96.14	100	96	
10	438	113.16	109.93	106.88	111.80	107.50	103.52	112.72	108.84	105.21	106.61	101.77	97.34	101.64	98.64	95.81	105.42	100	105	
10	439	98.65	95.89	93.27	101.33	101.02	100.72	110.42	107.29	104.34	111.94	112.89	113.84	115.43	109.05	56.83	102.19	100	102	
10	445																	100		
10	451																	100		101

(hatched) Animal removed during course of study

TABLE A - 3 RAW AND ADJUSTED BLOOD LEAD DATA BY DAY

PHASE II EXPERIMENT 4 (Data not shown for groups 7, 8, & 9)

pig number	sample	group	material administered	dosage	qualifier	Lab result (ug/L)	day	source file	MATRIX	Adjusted Value (ug/dL)[a]	Notes
417	8-904105	1	control	0	<	1	-4	a:pig31.da	BLOOD	0.5	
430	8-904153	1	control	0	<	1	-4	a:pig31.da	BLOOD	0.5	
409	8-904147	2	PbAc	75	<	1	-4	a:pig31.da	BLOOD	0.5	
419	8-904142	2	PbAc	75	<	1	-4	a:pig31.da	BLOOD	0.5	
429	8-904125	2	PbAc	75	<	1	-4	a:pig31.da	BLOOD	0.5	
443	8-904108	2	PbAc	75	<	1	-4	a:pig31.da	BLOOD	0.5	
444	8-904103	2	PbAc	75	<	1	-4	a:pig31.da	BLOOD	0.5	
408	8-904121	3	PbAc	225	<	1	-4	a:pig31.da	BLOOD	0.5	
410	8-904116	3	PbAc	225	<	1	-4	a:pig31.da	BLOOD	0.5	
426	8-904140	3	PbAc	225	<	1	-4	a:pig31.da	BLOOD	0.5	
449	8-904145	3	PbAc	225	<	1	-4	a:pig31.da	BLOOD	0.5	
455	8-904100	3	PbAc	225	<	1	-4	a:pig31.da	BLOOD	0.5	
402	8-904122	4	Murray Slag	75	<	1	-4	a:pig31.da	BLOOD	0.5	
407	8-904144	4	Murray Slag	75	<	1	-4	a:pig31.da	BLOOD	0.5	
411	8-904106	4	Murray Slag	75	<	1	-4	a:pig31.da	BLOOD	0.5	
423	8-904149	4	Murray Slag	75	<	1	-4	a:pig31.da	BLOOD	0.5	
450	8-904107	4	Murray Slag	75	<	1	-4	a:pig31.da	BLOOD	0.5	
420	8-904104	5	Murray Slag	225	<	1	-4	a:pig31.da	BLOOD	0.5	
431	8-904110	5	Murray Slag	225	<	1	-4	a:pig31.da	BLOOD	0.5	
432	8-904129	5	Murray Slag	225	<	1	-4	a:pig31.da	BLOOD	0.5	
440	8-904123	5	Murray Slag	225	<	1	-4	a:pig31.da	BLOOD	0.5	
446	8-904118	5	Murray Slag	225	<	1	-4	a:pig31.da	BLOOD	0.5	
412	8-904128	6	Murray Slag	675	<	1	-4	a:pig31.da	BLOOD	0.5	
418	8-904150	6	Murray Slag	675	<	1	-4	a:pig31.da	BLOOD	0.5	
427	8-904130	6	Murray Slag	675	<	1	-4	a:pig31.da	BLOOD	0.5	
437	8-904146	6	Murray Slag	675	<	1	-4	a:pig31.da	BLOOD	0.5	
442	8-904111	6	Murray Slag	675	<	1	-4	a:pig31.da	BLOOD	0.5	
415	8-904120	10	IV	100	<	1	-4	a:pig31.da	BLOOD	0.5	
421	8-904127	10	IV	100	<	1	-4	a:pig31.da	BLOOD	0.5	
424	8-904137	10	IV	100	<	1	-4	a:pig31.da	BLOOD	0.5	
425	8-904117	10	IV	100	<	1	-4	a:pig31.da	BLOOD	0.5	
438	8-904152	10	IV	100	<	1	-4	a:pig31.da	BLOOD	0.5	
439	8-904119	10	IV	100	<	1	-4	a:pig31.da	BLOOD	0.5	
445	8-904135	10	IV	100	<	1	-4	a:pig31.da	BLOOD	0.5	
451	8-904143	10	IV	100			-4		BLOOD		removed
417	8-904180	1	control	0	<	1	0	a:pig31.da	BLOOD	0.5	
430	8-904179	1	control	0	<	1	0	a:pig31.da	BLOOD	0.5	
409	8-904169	2	PbAc	75	<	1	0	a:pig31.da	BLOOD	0.5	
419	8-904185	2	PbAc	75	<	1	0	a:pig31.da	BLOOD	0.5	
429	8-904172	2	PbAc	75	<	1	0	a:pig31.da	BLOOD	0.5	
443	8-904181	2	PbAc	75	<	1	0	a:pig31.da	BLOOD	0.5	
444	8-904193	2	PbAc	75	<	1	0	a:pig31.da	BLOOD	0.5	
408	8-904173	3	PbAc	225	<	1	0	a:pig31.da	BLOOD	0.5	
410	8-904200	3	PbAc	225	<	1	0	a:pig31.da	BLOOD	0.5	
426	8-904205	3	PbAc	225	<	1	0	a:pig31.da	BLOOD	0.5	
449	8-904176	3	PbAc	225	<	1	0	a:pig31.da	BLOOD	0.5	
455	8-904161	3	PbAc	225	<	1	0	a:pig31.da	BLOOD	0.5	
402	8-904201	4	Murray Slag	75	<	1	0	a:pig31.da	BLOOD	0.5	
407	8-904208	4	Murray Slag	75	<	1	0	a:pig31.da	BLOOD	0.5	
411	8-904197	4	Murray Slag	75	<	1	0	a:pig31.da	BLOOD	0.5	
423	8-904182	4	Murray Slag	75	<	1	0	a:pig31.da	BLOOD	0.5	
450	8-904178	4	Murray Slag	75	<	1	0	a:pig31.da	BLOOD	0.5	
420	8-904166	5	Murray Slag	225	<	1	0	a:pig31.da	BLOOD	0.5	
431	8-904189	5	Murray Slag	225	<	1	0	a:pig31.da	BLOOD	0.5	
432	8-904188	5	Murray Slag	225	<	1	0	a:pig31.da	BLOOD	0.5	
440	8-904203	5	Murray Slag	225	<	1	0	a:pig31.da	BLOOD	0.5	
446	8-904190	5	Murray Slag	225	<	1	0	a:pig31.da	BLOOD	0.5	
412	8-904175	6	Murray Slag	675	<	1	0	a:pig31.da	BLOOD	0.5	
418	8-904171	6	Murray Slag	675	<	1	0	a:pig31.da	BLOOD	0.5	
427	8-904162	6	Murray Slag	675	<	1	0	a:pig31.da	BLOOD	0.5	
437	8-904174	6	Murray Slag	675	<	1	0	a:pig31.da	BLOOD	0.5	
442	8-904160	6	Murray Slag	675	<	1	0	a:pig31.da	BLOOD	0.5	
415	8-904192	10	IV	100		5	0	a:pig31.da	BLOOD	5	
421	8-904202	10	IV	100			0		BLOOD		removed
424	8-904194	10	IV	100	<	1	0	a:pig31.da	BLOOD	0.5	
425	8-904157	10	IV	100	<	1	0	a:pig31.da	BLOOD	0.5	
438	8-904196	10	IV	100	<	1	0	a:pig31.da	BLOOD	0.5	
439	8-904204	10	IV	100	<	1	0	a:pig31.da	BLOOD	0.5	
445	8-904163	10	IV	100	<	1	0	a:pig31.da	BLOOD	0.5	
451	8-904183	10	IV	100			0		BLOOD		removed
417	8-904243	1	control	0	<	1	1	a:pig32.da	BLOOD	0.5	
430	8-904226	1	control	0	<	1	1	a:pig32.da	BLOOD	0.5	
409	8-904248	2	PbAc	75	<	1	1	a:pig32.da	BLOOD	0.5	
419	8-904237	2	PbAc	75		2.7	1	a:pig32.da	BLOOD	2.7	
429	8-904232	2	PbAc	75	<	1	1	a:pig32.da	BLOOD	0.5	
443	8-904250	2	PbAc	75	<	1	1	a:pig32.da	BLOOD	0.5	
444	8-904236	2	PbAc	75	<	1	1	a:pig32.da	BLOOD	0.5	

pig number	sample	group	material administered	dosage	qualifier	(ug/L)	day	source file	MATRIX	(ug/dL)[a]	Notes
408	8-904252	3	PbAc	225		1.4	1	a:pig32.da	BLOOD	1.4	
410	8-904220	3	PbAc	225		5	1	a:pig32.da	BLOOD	5	
426	8-904217	3	PbAc	225		2.8	1	a:pig32.da	BLOOD	2.8	
449	8-904216	3	PbAc	225		7.3	1	a:pig32.da	BLOOD	7.3	
455	8-904213	3	PbAc	225		3.1	1	a:pig32.da	BLOOD	3.1	
402	8-904240	4	Murray Slag	75	<	1	1	a:pig32.da	BLOOD	0.5	
407	8-904223	4	Murray Slag	75		1	1	a:pig32.da	BLOOD	1	
411	8-904231	4	Murray Slag	75		2	1	a:pig32.da	BLOOD	2	
423	8-904239	4	Murray Slag	75		1.8	1	a:pig32.da	BLOOD	1.8	
450	8-904221	4	Murray Slag	75		1	1	a:pig32.da	BLOOD	1	
420	8-904255	5	Murray Slag	225	<	1	1	a:pig32.da	BLOOD	0.5	
431	8-904227	5	Murray Slag	225		2.3	1	a:pig32.da	BLOOD	2.3	
432	8-904242	5	Murray Slag	225		1.3	1	a:pig32.da	BLOOD	1.3	
440	8-904241	5	Murray Slag	225		1.4	1	a:pig32.da	BLOOD	1.4	
446	8-904215	5	Murray Slag	225	<	1	1	a:pig32.da	BLOOD	0.5	
412	8-904238	6	Murray Slag	675		3	1	a:pig32.da	BLOOD	3	
418	8-904258	6	Murray Slag	675		7.5	1	a:pig32.da	BLOOD	7.5	
427	8-904224	6	Murray Slag	675		3.6	1	a:pig32.da	BLOOD	3.6	
437	8-904259	6	Murray Slag	675		4.4	1	a:pig32.da	BLOOD	4.4	
442	8-904211	6	Murray Slag	675		3	1	a:pig32.da	BLOOD	3	
415	8-904219	10	IV	100		6.6	1	a:pig32.da	BLOOD	6.6	
421	8-904222	10	IV	100			1		BLOOD		removed
424	8-904253	10	IV	100		6.4	1	a:pig32.da	BLOOD	6.4	
425	8-904257	10	IV	100		5.3	1	a:pig32.da	BLOOD	5.3	
438	8-904246	10	IV	100		3.9	1	a:pig32.da	BLOOD	3.9	
439	8-904225	10	IV	100		5.7	1	a:pig32.da	BLOOD	5.7	
445	8-904210	10	IV	100			1		BLOOD		removed
451	8-904249	10	IV	100			1		BLOOD		removed
417	8-904267	1	control	0	<	1	2	a:pig32.da	BLOOD	0.5	
430	8-904314	1	control	0	<	1	2	a:pig32.da	BLOOD	0.5	
409	8-904283	2	PbAc	75		1	2	a:pig32.da	BLOOD	1	
419	8-904303	2	PbAc	75		4	2	a:pig32.da	BLOOD	4	
429	8-904275	2	PbAc	75		1.9	2	a:pig32.da	BLOOD	1.9	
443	8-904279	2	PbAc	75	<	1	2	a:pig32.da	BLOOD	0.5	
444	8-904311	2	PbAc	75		1.2	2	a:pig32.da	BLOOD	1.2	
408	8-904288	3	PbAc	225		2.5	2	a:pig32.da	BLOOD	2.5	
410	8-904271	3	PbAc	225		5.8	2	a:pig32.da	BLOOD	5.8	
426	8-904266	3	PbAc	225		4.8	2	a:pig32.da	BLOOD	4.8	
449	8-904289	3	PbAc	225		10.5	2	a:pig32.da	BLOOD	10.5	
455	8-904306	3	PbAc	225		5.4	2	a:pig32.da	BLOOD	5.4	
402	8-904315	4	Murray Slag	75		1.9	2	a:pig32.da	BLOOD	1.9	
407	8-904295	4	Murray Slag	75		1.8	2	a:pig32.da	BLOOD	1.8	
411	8-904299	4	Murray Slag	75		2.2	2	a:pig32.da	BLOOD	2.2	
423	8-904273	4	Murray Slag	75		1.9	2	a:pig32.da	BLOOD	1.9	
450	8-904312	4	Murray Slag	75		1.2	2	a:pig32.da	BLOOD	1.2	
420	8-904313	5	Murray Slag	225		3.5	2	a:pig32.da	BLOOD	3.5	
431	8-904305	5	Murray Slag	225		3.9	2	a:pig32.da	BLOOD	3.9	
432	8-904297	5	Murray Slag	225		2.5	2	a:pig32.da	BLOOD	2.5	
440	8-904310	5	Murray Slag	225		2.8	2	a:pig32.da	BLOOD	2.8	
446	8-904300	5	Murray Slag	225		1.2	2	a:pig32.da	BLOOD	1.2	
412	8-904302	6	Murray Slag	675		5.4	2	a:pig32.da	BLOOD	5.4	
418	8-904284	6	Murray Slag	675		7.6	2	a:pig32.da	BLOOD	7.6	
427	8-904268	6	Murray Slag	675		4.4	2	a:pig32.da	BLOOD	4.4	
437	8-904269	6	Murray Slag	675		6	2	a:pig32.da	BLOOD	6	
442	8-904308	6	Murray Slag	675		4.3	2	a:pig32.da	BLOOD	4.3	
415	8-904301	10	IV	100		8	2	a:pig32.da	BLOOD	8	
421	8-904276	10	IV	100			2		BLOOD		removed
424	8-904281	10	IV	100		7.6	2	a:pig32.da	BLOOD	7.6	
425	8-904292	10	IV	100		7.6	2	a:pig32.da	BLOOD	7.6	
438	8-904309	10	IV	100		6.6	2	a:pig32.da	BLOOD	6.6	
439	8-904319	10	IV	100		6.3	2	a:pig32.da	BLOOD	6.3	
445	8-904282	10	IV	100			2		BLOOD		removed
451	8-904293	10	IV	100			2		BLOOD		removed
417	8-904334	1	control	0	<	1	3	a:pig32.da	BLOOD	0.5	
430	8-904358	1	control	0	<	1	3	a:pig32.da	BLOOD	0.5	
409	8-904355	2	PbAc	75		1.5	3	a:pig32.da	BLOOD	1.5	
419	8-904357	2	PbAc	75		3.9	3	a:pig32.da	BLOOD	3.9	
429	8-904346	2	PbAc	75		2.5	3	a:pig32.da	BLOOD	2.5	
443	8-904320	2	PbAc	75		1.5	3	a:pig32.da	BLOOD	1.5	
444	8-904333	2	PbAc	75		1.7	3	a:pig32.da	BLOOD	1.7	
408	8-904332	3	PbAc	225		4.9	3	a:pig32.da	BLOOD	4.9	
410	8-904336	3	PbAc	225		8.1	3	a:pig32.da	BLOOD	8.1	
426	8-904368	3	PbAc	225		5.3	3	a:pig32.da	BLOOD	5.3	
449	8-904364	3	PbAc	225		10.2	3	a:pig32.da	BLOOD	10.2	
455	8-904335	3	PbAc	225		5.8	3	a:pig32.da	BLOOD	5.8	
402	8-904340	4	Murray Slag	75		2.4	3	a:pig32.da	BLOOD	2.4	
407	8-904327	4	Murray Slag	75		2.8	3	a:pig32.da	BLOOD	2.8	
411	8-904323	4	Murray Slag	75		3.1	3	a:pig32.da	BLOOD	3.1	
423	8-904352	4	Murray Slag	75		2.6	3	a:pig32.da	BLOOD	2.6	
450	8-904372	4	Murray Slag	75		2.8	3	a:pig32.da	BLOOD	2.8	
420	8-904349	5	Murray Slag	225		3.6	3	a:pig32.da	BLOOD	3.6	
431	8-904367	5	Murray Slag	225		3.4	3	a:pig32.da	BLOOD	3.4	
432	8-904339	5	Murray Slag	225		4.3	3	a:pig32.da	BLOOD	4.3	

pig number	sample	group	material administered	dosage	qualifier	(ug/L)	day	source file	MATRIX	(ug/dL)[a]	Notes
440	8-904343	5	Murray Slag	225		3.6	3	a:pig32.da	BLOOD	3.6	
446	8-904322	5	Murray Slag	225		1.3	3	a:pig32.da	BLOOD	1.3	
412	8-904351	6	Murray Slag	675		5.2	3	a:pig32.da	BLOOD	5.2	
418	8-904362	6	Murray Slag	675		5.8	3	a:pig32.da	BLOOD	5.8	
427	8-904359	6	Murray Slag	675		4.8	3	a:pig32.da	BLOOD	4.8	
437	8-904366	6	Murray Slag	675		9.2	3	a:pig32.da	BLOOD	9.2	
442	8-904373	6	Murray Slag	675		4.8	3	a:pig32.da	BLOOD	4.8	
415	8-904354	10	IV	100		9.7	3	a:pig32.da	BLOOD	9.7	
421	8-904321	10	IV	100			3		BLOOD		removed
424	8-904370	10	IV	100		6.6	3	a:pig32.da	BLOOD	6.6	
425	8-904345	10	IV	100		7.6	3	a:pig32.da	BLOOD	7.6	
438	8-904326	10	IV	100		7.3	3	a:pig32.da	BLOOD	7.3	
439	8-904353	10	IV	100		6.8	3	a:pig32.da	BLOOD	6.8	
445	8-904348	10	IV	100			3		BLOOD		removed
451	8-904365	10	IV	100			3		BLOOD		removed
417	8-904447	1	control	0	<	1	5	a:pig32.da	BLOOD	0.5	
430	8-904417	1	control	0	<	1	5	a:pig32.da	BLOOD	0.5	
409	8-904421	2	PbAc	75		2.4	5	a:pig32.da	BLOOD	2.4	
419	8-904440	2	PbAc	75		5.6	5	a:pig32.da	BLOOD	5.6	
429	8-904420	2	PbAc	75		3.1	5	a:pig32.da	BLOOD	3.1	
443	8-904409	2	PbAc	75		2	5	a:pig32.da	BLOOD	2	
444	8-904444	2	PbAc	75		2.1	5	a:pig32.da	BLOOD	2.1	
408	8-904426	3	PbAc	225		4.5	5	a:pig32.da	BLOOD	4.5	
410	8-904435	3	PbAc	225		7.4	5	a:pig32.da	BLOOD	7.4	
426	8-904423	3	PbAc	225		8	5	a:pig32.da	BLOOD	8	
449	8-904422	3	PbAc	225		13.1	5	a:pig32.da	BLOOD	13.1	
455	8-904393	3	PbAc	225		7	5	a:pig32.da	BLOOD	7	
402	8-904434	4	Murray Slag	75		1.9	5	a:pig32.da	BLOOD	1.9	
407	8-904427	4	Murray Slag	75		3.3	5	a:pig32.da	BLOOD	3.3	
411	8-904407	4	Murray Slag	75		3.1	5	a:pig32.da	BLOOD	3.1	
423	8-904394	4	Murray Slag	75		2.6	5	a:pig32.da	BLOOD	2.6	
450	8-904410	4	Murray Slag	75		2.9	5	a:pig32.da	BLOOD	2.9	
420	8-904400	5	Murray Slag	225		3.9	5	a:pig32.da	BLOOD	3.9	
431	8-904425	5	Murray Slag	225		4.4	5	a:pig32.da	BLOOD	4.4	
432	8-904398	5	Murray Slag	225		5.1	5	a:pig32.da	BLOOD	5.1	
440	8-904436	5	Murray Slag	225		4.1	5	a:pig32.da	BLOOD	4.1	
446	8-904399	5	Murray Slag	225		1.6	5	a:pig32.da	BLOOD	1.6	
412	8-904430	6	Murray Slag	675		6.2	5	a:pig32.da	BLOOD	6.2	
418	8-904429	6	Murray Slag	675		7.7	5	a:pig32.da	BLOOD	7.7	
427	8-904414	6	Murray Slag	675		8.1	5	a:pig32.da	BLOOD	8.1	
437	8-904424	6	Murray Slag	675		9.7	5	a:pig32.da	BLOOD	9.7	
442	8-904397	6	Murray Slag	675		5.9	5	a:pig32.da	BLOOD	5.9	
415	8-904446	10	IV	100		8.4	5	a:pig32.da	BLOOD	8.4	
421	8-904404	10	IV	100			5		BLOOD		removed
424	8-904413	10	IV	100			5		BLOOD		removed
425	8-904411	10	IV	100		8.7	5	a:pig32.da	BLOOD	8.7	
438	8-904433	10	IV	100		8.2	5	a:pig32.da	BLOOD	8.2	
439	8-904442	10	IV	100		8.5	5	a:pig32.da	BLOOD	8.5	
445	8-904439	10	IV	100			5		BLOOD		removed
451	8-904403	10	IV	100			5		BLOOD		removed
417	8-904481	1	control	0	<	1	7	a:pig35.da	BLOOD	0.5	
430	8-904456	1	control	0	<	1	7	a:pig35.da	BLOOD	0.5	
409	8-904485	2	PbAc	75		3.4	7	a:pig35.da	BLOOD	3.4	
419	8-904497	2	PbAc	75		6.6	7	a:pig35.da	BLOOD	6.6	
429	8-904453	2	PbAc	75		5.1	7	a:pig35.da	BLOOD	5.1	
443	8-904452	2	PbAc	75		2.5	7	a:pig35.da	BLOOD	2.5	
444	8-904449	2	PbAc	75		3.4	7	a:pig35.da	BLOOD	3.4	
408	8-904454	3	PbAc	225		8.9	7	a:pig35.da	BLOOD	8.9	
410	8-904458	3	PbAc	225		9.7	7	a:pig35.da	BLOOD	9.7	
426	8-904451	3	PbAc	225		8.9	7	a:pig35.da	BLOOD	8.9	
449	8-904502	3	PbAc	225		15.6	7	a:pig35.da	BLOOD	15.6	
455	8-904450	3	PbAc	225		7.4	7	a:pig35.da	BLOOD	7.4	
402	8-904459	4	Murray Slag	75		2.6	7	a:pig35.da	BLOOD	2.6	
407	8-904486	4	Murray Slag	75		4	7	a:pig35.da	BLOOD	4	
411	8-904462	4	Murray Slag	75		4.1	7	a:pig35.da	BLOOD	4.1	
423	8-904476	4	Murray Slag	75		2.3	7	a:pig35.da	BLOOD	2.3	
450	8-904482	4	Murray Slag	75		2.7	7	a:pig35.da	BLOOD	2.7	
420	8-904487	5	Murray Slag	225		6.2	7	a:pig35.da	BLOOD	6.2	
431	8-904465	5	Murray Slag	225		5.6	7	a:pig35.da	BLOOD	5.6	
432	8-904500	5	Murray Slag	225		5.3	7	a:pig35.da	BLOOD	5.3	
440	8-904455	5	Murray Slag	225		4.9	7	a:pig35.da	BLOOD	4.9	
446	8-904472	5	Murray Slag	225		3.8	7	a:pig35.da	BLOOD	3.8	
412	8-904471	6	Murray Slag	675		8.9	7	a:pig35.da	BLOOD	8.9	
418	8-904498	6	Murray Slag	675		8	7	a:pig35.da	BLOOD	8	
427	8-904480	6	Murray Slag	675		8	7	a:pig35.da	BLOOD	8	
437	8-904468	6	Murray Slag	675		9.6	7	a:pig35.da	BLOOD	9.6	
442	8-904492	6	Murray Slag	675		8	7	a:pig35.da	BLOOD	8	
415	8-904464	10	IV	100			7		BLOOD		removed
421	8-904495	10	IV	100			7		BLOOD		removed
424	8-904501	10	IV	100			7		BLOOD		removed
425	8-904479	10	IV	100		8.9	7	a:pig35.da	BLOOD	8.9	
438	8-904494	10	IV	100		9.3	7	a:pig35.da	BLOOD	9.3	
439	8-904473	10	IV	100		9.3	7	a:pig35.da	BLOOD	9.3	

pig number	sample	group	material administered	dosage	qualifier	(ug/L)	day	source file	MATRIX	(ug/dL)[a]	Notes
445	8-904493	10	IV	100			7		BLOOD		removed
451	8-904496	10	IV	100			7		BLOOD		removed
417	8-904516	1	control	0	<	1	9	a:pig34.da	BLOOD	0.5	
430	8-904552	1	control	0	<	1	9	a:pig34.da	BLOOD	0.5	
409	8-904542	2	PbAc	75		4.9	9	a:pig34.da	BLOOD	4.9	
419	8-904530	2	PbAc	75		9.3	9	a:pig34.da	BLOOD	9.3	
429	8-904520	2	PbAc	75		5.6	9	a:pig34.da	BLOOD	5.6	
443	8-904517	2	PbAc	75		3.5	9	a:pig34.da	BLOOD	3.5	
444	8-904553	2	PbAc	75		4.4	9	a:pig34.da	BLOOD	4.4	
408	8-904503	3	PbAc	225		9.2	9	a:pig34.da	BLOOD	9.2	
410	8-904529	3	PbAc	225		9	9	a:pig34.da	BLOOD	9	
426	8-904507	3	PbAc	225		8.2	9	a:pig34.da	BLOOD	8.2	
449	8-904506	3	PbAc	225		12.6	9	a:pig34.da	BLOOD	12.6	
455	8-904511	3	PbAc	225		7.9	9	a:pig34.da	BLOOD	7.9	
402	8-904513	4	Murray Slag	75		3.3	9	a:pig34.da	BLOOD	3.3	
407	8-904523	4	Murray Slag	75		5.3	9	a:pig34.da	BLOOD	5.3	
411	8-904508	4	Murray Slag	75		5.3	9	a:pig34.da	BLOOD	5.3	
423	8-904544	4	Murray Slag	75		3	9	a:pig34.da	BLOOD	3	
450	8-904534	4	Murray Slag	75		4	9	a:pig34.da	BLOOD	4	
420	8-904551	5	Murray Slag	225		6.4	9	a:pig34.da	BLOOD	6.4	
431	8-904536	5	Murray Slag	225		7.2	9	a:pig34.da	BLOOD	7.2	
432	8-904549	5	Murray Slag	225		6.6	9	a:pig34.da	BLOOD	6.6	
440	8-904556	5	Murray Slag	225		5.2	9	a:pig34.da	BLOOD	5.2	
446	8-904510	5	Murray Slag	225		4.5	9	a:pig34.da	BLOOD	4.5	
412	8-904555	6	Murray Slag	675		10.7	9	a:pig34.da	BLOOD	10.7	
418	8-904514	6	Murray Slag	675		9	9	a:pig34.da	BLOOD	9	
427	8-904512	6	Murray Slag	675		7.9	9	a:pig34.da	BLOOD	7.9	
437	8-904554	6	Murray Slag	675		11.1	9	a:pig34.da	BLOOD	11.1	
442	8-904504	6	Murray Slag	675		8.5	9	a:pig34.da	BLOOD	8.5	
415	8-904550	10	IV	100			9		BLOOD		removed
421	8-904526	10	IV	100			9		BLOOD		removed
424	8-904522	10	IV	100			9		BLOOD		removed
425	8-904527	10	IV	100		10.9	9	a:pig34.da	BLOOD	10.9	
438	8-904531	10	IV	100		11.3	9	a:pig34.da	BLOOD	11.3	
439	8-904538	10	IV	100		11.5	9	a:pig34.da	BLOOD	11.5	
445	8-904535	10	IV	100			9		BLOOD		removed
451	8-904540	10	IV	100			9		BLOOD		removed
417	8-904612	1	control	0	<	1	12	a:pig38.da	BLOOD	0.5	
430	8-904574	1	control	0	<	1	12	a:pig38.da	BLOOD	0.5	
409	8-904579	2	PbAc	75		5.3	12	a:pig38.da	BLOOD	5.3	
419	8-904563	2	PbAc	75		8.8	12	a:pig38.da	BLOOD	8.8	
429	8-904591	2	PbAc	75		6.2	12	a:pig38.da	BLOOD	6.2	
443	8-904599	2	PbAc	75		4	12	a:pig38.da	BLOOD	4	
444	8-904593	2	PbAc	75		4.7	12	a:pig38.da	BLOOD	4.7	
408	8-904606	3	PbAc	225		11.4	12	a:pig38.da	BLOOD	11.4	
410	8-904584	3	PbAc	225		11.7	12	a:pig38.da	BLOOD	11.7	
426	8-904576	3	PbAc	225		7.8	12	a:pig38.da	BLOOD	7.8	
449	8-904570	3	PbAc	225		14.7	12	a:pig38.da	BLOOD	14.7	
455	8-904594	3	PbAc	225		7.9	12	a:pig38.da	BLOOD	7.9	
402	8-904611	4	Murray Slag	75		4.8	12	a:pig38.da	BLOOD	4.8	
407	8-904609	4	Murray Slag	75		5	12	a:pig38.da	BLOOD	5	
411	8-904601	4	Murray Slag	75		5.8	12	a:pig38.da	BLOOD	5.8	
423	8-904598	4	Murray Slag	75		3.6	12	a:pig38.da	BLOOD	3.6	
450	8-904573	4	Murray Slag	75		4.9	12	a:pig38.da	BLOOD	4.9	
420	8-904587	5	Murray Slag	225		6.3	12	a:pig38.da	BLOOD	6.3	
431	8-904562	5	Murray Slag	225		6.3	12	a:pig38.da	BLOOD	6.3	
432	8-904590	5	Murray Slag	225		8.1	12	a:pig38.da	BLOOD	8.1	
440	8-904602	5	Murray Slag	225		6.1	12	a:pig38.da	BLOOD	6.1	
446	8-904600	5	Murray Slag	225		4.9	12	a:pig38.da	BLOOD	4.9	
412	8-904560	6	Murray Slag	675		12	12	a:pig38.da	BLOOD	12	
418	8-904565	6	Murray Slag	675		9.7	12	a:pig38.da	BLOOD	9.7	
427	8-904586	6	Murray Slag	675		9.9	12	a:pig38.da	BLOOD	9.9	
437	8-904585	6	Murray Slag	675		11.7	12	a:pig38.da	BLOOD	11.7	
442	8-904605	6	Murray Slag	675		10.5	12	a:pig38.da	BLOOD	10.5	
415	8-904558	10	IV	100			12		BLOOD		removed
421	8-904572	10	IV	100			12		BLOOD		removed
424	8-904582	10	IV	100			12		BLOOD		removed
425	8-904592	10	IV	100		10.5	12	a:pig38.da	BLOOD	10.5	
438	8-904568	10	IV	100		11.4	12	a:pig38.da	BLOOD	11.4	
439	8-904580	10	IV	100		12.8	12	a:pig38.da	BLOOD	12.8	
445	8-904607	10	IV	100			12		BLOOD		removed
451	8-904608	10	IV	100			12		BLOOD		removed
417	8-904650	1	control	0	<	1	15	a:pig38.da	BLOOD	0.5	
430	8-904634	1	control	0	<	1	15	a:pig38.da	BLOOD	0.5	
409	8-904619	2	PbAc	75		4.3	15	a:pig38.da	BLOOD	4.3	
419	8-904656	2	PbAc	75		8.2	15	a:pig38.da	BLOOD	8.2	
429	8-904661	2	PbAc	75		6	15	a:pig38.da	BLOOD	6	
443	8-904624	2	PbAc	75		4.5	15	a:pig38.da	BLOOD	4.5	
444	8-904636	2	PbAc	75		5.2	15	a:pig38.da	BLOOD	5.2	
408	8-904647	3	PbAc	225		9.5	15	a:pig38.da	BLOOD	9.5	
410	8-904641	3	PbAc	225		12.8	15	a:pig38.da	BLOOD	12.8	
426	8-904628	3	PbAc	225		8.1	15	a:pig38.da	BLOOD	8.1	

pig number	sample	group	material administered	dosage	qualifier	(ug/L)	day	source file	MATRIX	(ug/dL)[a]	Notes
449	8-904665	3	PbAc	225		11.7	15	a:pig38.da	BLOOD	11.7	
455	8-904667	3	PbAc	225		8.4	15	a:pig38.da	BLOOD	8.4	
402	8-904617	4	Murray Slag	75		4.3	15	a:pig38.da	BLOOD	4.3	
407	8-904621	4	Murray Slag	75	<	1	15	a:pig38.da	BLOOD	0.5	
411	8-904640	4	Murray Slag	75		6	15	a:pig38.da	BLOOD	6	
423	8-904632	4	Murray Slag	75		3.8	15	a:pig38.da	BLOOD	3.8	
450	8-904615	4	Murray Slag	75		6.2	15	a:pig38.da	BLOOD	6.2	
420	8-904662	5	Murray Slag	225		7.9	15	a:pig38.da	BLOOD	7.9	
431	8-904644	5	Murray Slag	225		7.4	15	a:pig38.da	BLOOD	7.4	
432	8-904622	5	Murray Slag	225		7.9	15	a:pig38.da	BLOOD	7.9	
440	8-904666	5	Murray Slag	225		5.9	15	a:pig38.da	BLOOD	5.9	
446	8-904630	5	Murray Slag	225		6	15	a:pig38.da	BLOOD	6	
412	8-904658	6	Murray Slag	675		9.5	15	a:pig38.da	BLOOD	9.5	
418	8-904638	6	Murray Slag	675		9.5	15	a:pig38.da	BLOOD	9.5	
427	8-904655	6	Murray Slag	675		9.5	15	a:pig38.da	BLOOD	9.5	
437	8-904631	6	Murray Slag	675		10.4	15	a:pig38.da	BLOOD	10.4	
442	8-904646	6	Murray Slag	675		10.3	15	a:pig38.da	BLOOD	10.3	
415	8-904613	10	IV	100			15		BLOOD		removed
421	8-904637	10	IV	100			15		BLOOD		removed
424	8-904659	10	IV	100			15		BLOOD		removed
425	8-904657	10	IV	100		10.7	15	a:pig38.da	BLOOD	10.7	
438	8-904626	10	IV	100		11	15	a:pig38.da	BLOOD	11	
439	8-904642	10	IV	100		13.6	15	a:pig38.da	BLOOD	13.6	
445	8-904629	10	IV	100			15		BLOOD		removed
451	8-904614	10	IV	100			15		BLOOD		removed

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

Flagged Data Points
Outliers

test material	target dosage	Actual Dose*	group	pig#	BLOOD LEAD (ug/dL) BY DAY -4	0	1	2	3	5	7	9	12	15
control	0	0.00	1	417	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
control	0	0.00	1	430	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
PbAc	75	69.41	2	409	0.5	0.5	0.5	1	1.5	2.4	3.4	4.9	5.3	4.3
PbAc	75	69.94	2	419	0.5	0.5	2.7	4	3.9	5.6	6.6	9.3	8.8	8.2
PbAc	75	75.03	2	429	0.5	0.5	0.5	1.9	2.5	3.1	5.1	5.6	6.2	6
PbAc	75	85.24	2	443	0.5	0.5	0.5	0.5	1.5	2	2.5	3.5	4	4.5
PbAc	75	82.79	2	444	0.5	0.5	0.5	1.2	1.7	2.1	3.4	4.4	4.7	5.2
PbAc	225	222.37	3	408	0.5	0.5	1.4	2.5	4.9	4.5	8.9	9.2	11.4	9.5
PbAc	225	225.27	3	410	0.5	0.5	5	5.8	8.1	7.4	9.7	9	11.7	12.8
PbAc	225	210.42	3	426	0.5	0.5	2.8	4.8	5.3	8	8.9	8.2	7.8	8.1
PbAc	225	218.01	3	449	0.5	0.5	7.3	10.5	10.2	13.1	15.6	12.6	14.7	11.7
PbAc	225	201.73	3	455	0.5	0.5	3.1	5.4	5.8	7	7.4	7.9	7.9	8.4
Murray Slag	75	68.14	4	402	0.5	0.5	0.5	1.9	2.4	1.9	2.6	3.3	4.8	4.3
Murray Slag	75	83.32	4	407	0.5	0.5	1	1.8	2.8	3.3	4	5.3	5	0.5
Murray Slag	75	67.25	4	411	0.5	0.5	2	2.2	3.1	3.1	4.1	5.3	5.8	6
Murray Slag	75	86.45	4	423	0.5	0.5	1.8	1.9	2.6	2.6	2.3	3	3.6	3.8
Murray Slag	75	77.06	4	450	0.5	0.5	1	1.2	2.8	2.9	2.7	4	4.9	6.2
Murray Slag	225	213.88	5	420	0.5	0.5	0.5	3.5	3.6	3.9	6.2	6.4	6.3	7.9
Murray Slag	225	208.40	5	431	0.5	0.5	2.3	3.9	3.4	4.4	5.6	7.2	6.3	7.4
Murray Slag	225	284.31	5	432	0.5	0.5	1.3	2.5	4.3	5.1	5.3	6.6	8.1	7.9
Murray Slag	225	208.25	5	440	0.5	0.5	1.4	2.8	3.6	4.1	4.9	5.2	6.1	5.9
Murray Slag	225	239.43	5	446	0.5	0.5	0.5	1.2	1.3	1.6	3.8	4.5	4.9	6
Murray Slag	675	834.08	6	412	0.5	0.5	3	5.4	5.2	6.2	8.9	10.7	12	9.5
Murray Slag	675	571.39	6	418	0.5	0.5	7.5	7.6	5.8	7.7	8	9	9.7	9.5
Murray Slag	675	686.38	6	427	0.5	0.5	3.6	4.4	4.8	8.1	8	7.9	9.9	9.5
Murray Slag	675	632.73	6	437	0.5	0.5	4.4	6	9.2	9.7	9.6	11.1	11.7	10.4
Murray Slag	675	647.56	6	442	0.5	0.5	3	4.3	4.8	5.9	8	8.5	10.5	10.3
IV	100		10	415										
IV	100		10	421										
IV	100		10	424										
IV	100	96.14	10	425	0.5	0.5	5.3	7.6	7.6	8.7	8.9	10.9	10.5	10.7
IV	100	105.42	10	438	0.5	0.5	3.9	6.6	7.3	8.2	9.3	11.3	11.4	11
IV	100	102.19	10	439	0.5	0.5	5.7	6.3	6.8	8.5	9.3	11.5	12.8	13.6
IV	100		10	445										
IV	100		10	451										

*** Average Time and Weight-Adjusted Dose for Each Pig**

Animal removed from study

TABLE A-5 RATIONALE FOR OUTLIER DECISIONS - PBB BY DAY

Pig # 407 Group 4 Day 15	Value was below the detection limit on day 15 of the study. This is unexpected when compared to the individual animals dose-response time trend, and is considered anomalous. This value has been excluded and was interpolated to a value of 4.7

TABLE A-6 Area Under Curve Determinations

Calculated using interpolated values for excluded data as noted in Table A-5

		AUC (ug/dL-days) For Time Span Shown								
group	pig#	0-1	1-2	2-3	3-5	5-7	7-9	9-12	12-15	AUC Total (ug/dL-days)
1	417	0.50	0.50	0.50	1.00	1.00	1.00	1.50	1.50	7.50
1	430	0.50	0.50	0.50	1.00	1.00	1.00	1.50	1.50	7.50
2	409	0.50	0.75	1.25	3.90	5.80	8.30	15.30	14.40	50.20
2	419	1.60	3.35	3.95	9.50	12.20	15.90	27.15	25.50	99.15
2	429	0.50	1.20	2.20	5.60	8.20	10.70	17.70	18.30	64.40
2	443	0.50	0.50	1.00	3.50	4.50	6.00	11.25	12.75	40.00
2	444	0.50	0.85	1.45	3.80	5.50	7.80	13.65	14.85	48.40
3	408	0.95	1.95	3.70	9.40	13.40	18.10	30.90	31.35	109.75
3	410	2.75	5.40	6.95	15.50	17.10	18.70	31.05	36.75	134.20
3	426	1.65	3.80	5.05	13.30	16.90	17.10	24.00	23.85	105.65
3	449	3.90	8.90	10.35	23.30	28.70	28.20	40.95	39.60	183.90
3	455	1.80	4.25	5.60	12.80	14.40	15.30	23.70	24.45	102.30
4	402	0.50	1.20	2.15	4.30	4.50	5.90	12.15	13.65	44.35
4	407	0.75	1.40	2.30	6.10	7.30	9.30	15.45	14.55	57.15
4	411	1.25	2.10	2.65	6.20	7.20	9.40	16.65	17.70	63.15
4	423	1.15	1.85	2.25	5.20	4.90	5.30	9.90	11.10	41.65
4	450	0.75	1.10	2.00	5.70	5.60	6.70	13.35	16.65	51.85
5	420	0.50	2.00	3.55	7.50	10.10	12.60	19.05	21.30	76.60
5	431	1.40	3.10	3.65	7.80	10.00	12.80	20.25	20.55	79.55
5	432	0.90	1.90	3.40	9.40	10.40	11.90	22.05	24.00	83.95
5	440	0.95	2.10	3.20	7.70	9.00	10.10	16.95	18.00	68.00
5	446	0.50	0.85	1.25	2.90	5.40	8.30	14.10	16.35	49.65
6	412	1.75	4.20	5.30	11.40	15.10	19.60	34.05	32.25	123.65
6	418	4.00	7.55	6.70	13.50	15.70	17.00	28.05	28.80	121.30
6	427	2.05	4.00	4.60	12.90	16.10	15.90	26.70	29.10	111.35
6	437	2.45	5.20	7.60	18.90	19.30	20.70	34.20	33.15	141.50
6	442	1.75	3.65	4.55	10.70	13.90	16.50	28.50	31.20	110.75
10	415									
10	421									
10	424									
10	425	2.90	6.45	7.60	16.30	17.60	19.80	32.10	31.80	134.55
10	438	2.20	5.25	6.95	15.50	17.50	20.60	34.05	33.60	135.65
10	439	3.10	6.00	6.55	15.30	17.80	20.80	36.45	39.60	145.60
10	445									
10	451									

(hatched) **Animal removed from study**

TABLE A - 7 TISSUE LEAD DATA

PHASE II EXPERIMENT 4 (Data not shown for groups 7, 8, & 9)

pig number	sample	group	material administered	dosage	qualifier	Lab result (ug/L)	day	source file	MATRIX	Adjusted Value ([illegible])[a]	Notes
417	8-904862	1	control	0	<	1	15	a:pig34.da	FEMUR	0.25	
430	8-904847	1	control	0		1.2	15	a:pig34.da	FEMUR	0.6	
409	8-904815	2	PbAc	75			15		FEMUR		
419	8-904854	2	PbAc	75		14.3	15	a:pig34.da	FEMUR	7.15	
429	8-904852	2	PbAc	75		11.7	15	a:pig34.da	FEMUR	5.85	
443	8-904830	2	PbAc	75		10.8	15	a:pig34.da	FEMUR	5.4	
444	8-904831	2	PbAc	75		12.3	15	a:pig34.da	FEMUR	6.15	
408	8-904824	3	PbAc	225		28.9	15	a:pig34.da	FEMUR	14.45	
410	8-904838	3	PbAc	225			15		FEMUR		Sample Lost
426	8-904816	3	PbAc	225			15		FEMUR		Sample Lost
449	8-904866	3	PbAc	225		43.2	15	a:pig34.da	FEMUR	21.6	
455	8-904820	3	PbAc	225		37.9	15	a:pig34.da	FEMUR	18.95	
402	8-904853	4	Murray Slag	75		13	15	a:pig34.da	FEMUR	6.5	
407	8-904821	4	Murray Slag	75		13.1	15	a:pig34.da	FEMUR	6.55	
411	8-904863	4	Murray Slag	75		14.7	15	a:pig34.da	FEMUR	7.35	
423	8-904846	4	Murray Slag	75		7.7	15	a:pig34.da	FEMUR	3.85	
450	8-904822	4	Murray Slag	75		9.6	15	a:pig34.da	FEMUR	4.8	
420	8-904814	5	Murray Slag	225		18.4	15	a:pig34.da	FEMUR	9.2	
431	8-904827	5	Murray Slag	225		14.2	15	a:pig34.da	FEMUR	7.1	
432	8-904835	5	Murray Slag	225			15		FEMUR		Sample Lost
440	8-904836	5	Murray Slag	225		14.3	15	a:pig34.da	FEMUR	7.15	
446	8-904856	5	Murray Slag	225		11.2	15	a:pig34.da	FEMUR	5.6	
412	8-904813	6	Murray Slag	675		38	15	a:pig34.da	FEMUR	19	
418	8-904839	6	Murray Slag	675		24.4	15	a:pig34.da	FEMUR	12.2	
427	8-904849	6	Murray Slag	675		27.2	15	a:pig34.da	FEMUR	13.6	
437	8-904865	6	Murray Slag	675		26.4	15	a:pig34.da	FEMUR	13.2	
442	8-904832	6	Murray Slag	675		20.1	15	a:pig34.da	FEMUR	10.05	
415	8-904829	10	IV	100			15		FEMUR		removed
421	8-904817	10	IV	100			15		FEMUR		removed
424	8-904855	10	IV	100			15		FEMUR		removed
425	8-904844	10	IV	100		96.5	15	a:pig34.da	FEMUR	48.25	
438	8-904826	10	IV	100		93.5	15	a:pig34.da	FEMUR	46.75	
439	8-904828	10	IV	100		110	15	a:pig34.da	FEMUR	55	
445	8-904834	10	IV	100			15		FEMUR		removed
451	8-904859	10	IV	100			15		FEMUR		removed
417	8-904787	1	control	0		1.5	15	a:pig32.da	KIDNEY	15	
430	8-904781	1	control	0		11.4	15	a:pig32.da	KIDNEY	114	
409	8-904783	2	PbAc	75		22.8	15	a:pig32.da	KIDNEY	228	
419	8-904762	2	PbAc	75		25	15	a:pig32.da	KIDNEY	250	
429	8-904776	2	PbAc	75		22.7	15	a:pig32.da	KIDNEY	227	
443	8-904803	2	PbAc	75		23.2	15	a:pig32.da	KIDNEY	232	
444	8-904793	2	PbAc	75		22.4	15	a:pig32.da	KIDNEY	224	
408	8-904797	3	PbAc	225		121	15	a:pig32.da	KIDNEY	1210	
410	8-904809	3	PbAc	225		122	15	a:pig32.da	KIDNEY	1220	
426	8-904782	3	PbAc	225		37.5	15	a:pig32.da	KIDNEY	375	
449	8-904804	3	PbAc	225		124	15	a:pig32.da	KIDNEY	1240	
455	8-904775	3	PbAc	225		73	15	a:pig32.da	KIDNEY	730	
402	8-904778	4	Murray Slag	75		21.1	15	a:pig32.da	KIDNEY	211	
407	8-904784	4	Murray Slag	75		20.4	15	a:pig32.da	KIDNEY	204	
411	8-904794	4	Murray Slag	75		23.4	15	a:pig32.da	KIDNEY	234	
423	8-904799	4	Murray Slag	75		12.5	15	a:pig32.da	KIDNEY	125	
450	8-904780	4	Murray Slag	75		17.9	15	a:pig32.da	KIDNEY	179	
420	8-904770	5	Murray Slag	225		29.6	15	a:pig32.da	KIDNEY	296	
431	8-904798	5	Murray Slag	225		24.9	15	a:pig32.da	KIDNEY	249	
432	8-904774	5	Murray Slag	225		36	15	a:pig32.da	KIDNEY	360	
440	8-904800	5	Murray Slag	225		31.3	15	a:pig32.da	KIDNEY	313	
446	8-904802	5	Murray Slag	225		23.7	15	a:pig32.da	KIDNEY	237	
412	8-904790	6	Murray Slag	675		53.4	15	a:pig32.da	KIDNEY	534	
418	8-904760	6	Murray Slag	675		61	15	a:pig32.da	KIDNEY	610	
427	8-904766	6	Murray Slag	675		47.3	15	a:pig32.da	KIDNEY	473	
437	8-904758	6	Murray Slag	675		91.5	15	a:pig32.da	KIDNEY	915	
442	8-904792	6	Murray Slag	675		43.5	15	a:pig32.da	KIDNEY	435	
415	8-904795	10	IV	100			15		KIDNEY		removed
421	8-904767	10	IV	100			15		KIDNEY		removed
424	8-904788	10	IV	100			15		KIDNEY		removed
425	8-904810	10	IV	100		156	15	a:pig32.da	KIDNEY	1560	
438	8-904801	10	IV	100		148	15	a:pig32.da	KIDNEY	1480	
439	8-904806	10	IV	100		133	15	a:pig32.da	KIDNEY	1330	
445	8-904777	10	IV	100			15		KIDNEY		removed
451	8-904764	10	IV	100			15		KIDNEY		removed
417	8-904735	1	control	0		3.6	15	a:pig32.da	LIVER	36	
430	8-904750	1	control	0		10.4	15	a:pig32.da	LIVER	104	
409	8-904736	2	PbAc	75		10.6	15	a:pig32.da	LIVER	106	
419	8-904741	2	PbAc	75		18.7	15	a:pig32.da	LIVER	187	
429	8-904717	2	PbAc	75		20.9	15	a:pig32.da	LIVER	209	
443	8-904716	2	PbAc	75		13.6	15	a:pig32.da	LIVER	136	
444	8-904757	2	PbAc	75		14.5	15	a:pig32.da	LIVER	145	

pig number	sample	group	material administered	dosage	qualifier	(ug/L)	day	source file	MATRIX	([illegible])[a]	Notes
408	8-904725	3	PbAc	225		105	15	a:pig32.da	LIVER	1050	
410	8-904709	3	PbAc	225		72	15	a:pig32.da	LIVER	720	
426	8-904744	3	PbAc	225		48	15	a:pig32.da	LIVER	480	
449	8-904749	3	PbAc	225		111	15	a:pig32.da	LIVER	1110	
455	8-904719	3	PbAc	225		94.5	15	a:pig32.da	LIVER	945	
402	8-904731	4	Murray Slag	75		15.9	15	a:pig32.da	LIVER	159	
407	8-904737	4	Murray Slag	75		21.3	15	a:pig32.da	LIVER	213	
411	8-904718	4	Murray Slag	75		20.9	15	a:pig32.da	LIVER	209	
423	8-904733	4	Murray Slag	75		10.6	15	a:pig32.da	LIVER	106	
450	8-904729	4	Murray Slag	75		23.5	15	a:pig32.da	LIVER	235	
420	8-904710	5	Murray Slag	225		32.2	15	a:pig32.da	LIVER	322	
431	8-904727	5	Murray Slag	225		34.6	15	a:pig32.da	LIVER	346	
432	8-904752	5	Murray Slag	225		38.5	15	a:pig32.da	LIVER	385	
440	8-904747	5	Murray Slag	225		18.2	15	a:pig32.da	LIVER	182	
446	8-904726	5	Murray Slag	225		16.5	15	a:pig32.da	LIVER	165	
412	8-904715	6	Murray Slag	675		78	15	a:pig32.da	LIVER	780	
418	8-904746	6	Murray Slag	675		48.7	15	a:pig32.da	LIVER	487	
427	8-904714	6	Murray Slag	675		75	15	a:pig32.da	LIVER	750	
437	8-904705	6	Murray Slag	675		50.3	15	a:pig32.da	LIVER	503	
442	8-904704	6	Murray Slag	675		26.7	15	a:pig32.da	LIVER	267	
415	8-904739	10	IV	100			15		LIVER		removed
421	8-904721	10	IV	100			15		LIVER		removed
424	8-904740	10	IV	100			15		LIVER		removed
425	8-904753	10	IV	100		188	15	a:pig32.da	LIVER	1880	
438	8-904728	10	IV	100		175	15	a:pig32.da	LIVER	1750	
439	8-904742	10	IV	100		128	15	a:pig32.da	LIVER	1280	
445	8-904756	10	IV	100			15		LIVER		removed
451	8-904723	10	IV	100			15		LIVER		removed

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
[hatched] Animal removed from study

test material	target dosage	Actual Dose*	group	pig#	Blood	Femur	Liver	Kidney
					MEASUREMENT ENDPOINT			
control	0	0.00	1	**417**	7.5	0.25	36	15
control	0	0.00	1	**430**	7.5	0.6	104	114
PbAc	75	69.41	2	**409**	50.2	Missing c	106	228
PbAc	75	69.94	2	**419**	99.15	7.15	187	250
PbAc	75	75.03	2	**429**	64.4	5.85	209	227
PbAc	75	85.24	2	**443**	40	5.4	136	232
PbAc	75	82.79	2	**444**	48.4	6.15	145	224
PbAc	225	222.37	3	**408**	109.75	14.45	1050	1210
PbAc	225	225.27	3	**410**	134.2	Missing c	720	1220
PbAc	225	210.42	3	**426**	105.65	Missing c	480	375
PbAc	225	218.01	3	**449**	183.9	21.6	1110	1240
PbAc	225	201.73	3	**455**	102.3	18.95	945	730
Murray Slag	75	68.14	4	**402**	44.35	6.5	159	211
Murray Slag	75	83.32	4	**407**	57.15	6.55	213	204
Murray Slag	75	67.25	4	**411**	63.15	7.35	209	234
Murray Slag	75	86.45	4	**423**	41.65	3.85	106	125
Murray Slag	75	77.06	4	**450**	51.85	4.8	235	179
Murray Slag	225	213.88	5	**420**	76.6	9.2	322	296
Murray Slag	225	208.40	5	**431**	79.55	7.1	346	249
Murray Slag	225	284.31	5	**432**	83.95	Missing c	385	360
Murray Slag	225	208.25	5	**440**	68	7.15	182	313
Murray Slag	225	239.43	5	**446**	49.65	5.6	165	237
Murray Slag	675	834.08	6	**412**	123.65	19	780	534
Murray Slag	675	571.39	6	**418**	121.3	12.2	487	610
Murray Slag	675	686.38	6	**427**	111.35	13.6	750	473
Murray Slag	675	632.73	6	**437**	141.5	13.2	503	[915] b
Murray Slag	675	647.56	6	**442**	110.75	10.05	[267] b	435
IV	100		10	**415**				
IV	100		10	**421**				
IV	100		10	**424**				
IV	100	96.14	10	**425**	134.55	48.25	1880	1560
IV	100	105.42	10	**438**	135.65	46.75	1750	1480
IV	100	102.19	10	**439**	145.6	55	1280	1330
IV	100		10	**445**				
IV	100		10	**451**				

a *a priori* outlier determinations (none in this study)
b Outside 95% Prediction Intervals
c Missing data explained in Table A-7

TABLE A-9 CALCULATION OF RBA FOR MURRAY SLAG

For Curve Comparison the following methods are used

1. For a series of doses, curve fit parameters are used to determine the response from test material
2. For each response calculated, the dose of Reference material which would result in the same response is calculated
3. The ratio of the doses is then used to calculate RBA (Ref Dose/Test Dose)

Curve Fit Parameters (from previous worksheet)

Blood		Bone		Liver		Kidney	
PbAc		PbAc		PbAc		PbAc	
a	7.77	a	0.588	a	11	a	17.9
b	0	b	0.0807	b	3.71	b	4.207
c	173.78	c	0	c	0	c	0
d	0.0051	d	0	d	0	d	0
Soil		Soil		Soil		Soil	
a	7.77	a	0.588	a	11	a	17.9
b	0	b	0	b	0	b	0
c	119.2	c	14.67	c	793.7	c	524.4
d	0.0041	d	0.0034	d	0.0018	d	0.0038

TRUNCATION LIMITS

	Dose Range Blood				Dose Range Bone				Dose Range Liver				Dose Range Kidney		
3xLow Res	22.5	Dose PbAc	17.37	3xLow Resp	1.275	Dose PbAc	8.51	3xLow Res	210	Dose PbAc	53.64	3xLow Res	193.5	Dose PbAc	41.74
HighResp	183.9	Dose Soil	#NUM!	HighResp	21.6	Dose Soil	#NUM!	HighResp	1110	Dose Soil	#DIV/0!	HighResp	1240	Dose Soil	#NUM!

#NUM indicates that the plateau in soil would be exceeded in order to reach the response indicated. Therefore the highest dose tested was substituted (675)

Curve Fit RBA

Blood

Dose	Resp Soil	Dose PbAc	AUC RBA
17.37	15.96	9.47	0.55
30	21.57	16.22	0.54
40	25.80	21.48	0.54
50	29.86	26.66	0.53
60	33.76	31.77	0.53
70	37.51	36.80	0.53
80	41.10	41.76	0.52
90	44.55	46.63	0.52
100	47.86	51.43	0.51
110	51.04	56.15	0.51
120	54.09	60.78	0.51
130	57.02	65.34	0.50
140	59.83	69.81	0.50
150	62.53	74.21	0.49
160	65.11	78.52	0.49
170	67.60	82.75	0.49
180	69.98	86.90	0.48
190	72.27	90.96	0.48
200	74.47	94.94	0.47
210	76.58	98.85	0.47
220	78.60	102.66	0.47
230	80.55	106.40	0.46
240	82.41	110.05	0.46
250	84.20	113.63	0.45
260	85.92	117.12	0.45
270	87.57	120.53	0.45
280	89.15	123.86	0.44
290	90.67	127.11	0.44
300	92.13	130.28	0.43
310	93.53	133.37	0.43
320	94.87	136.39	0.43
330	96.16	139.33	0.42
340	97.40	142.19	0.42
350	98.59	144.98	0.41
360	99.73	147.69	0.41
370	100.82	150.33	0.41
380	101.87	152.90	0.40
390	102.88	155.40	0.40
400	103.85	157.82	0.39
410	104.78	160.18	0.39
420	105.67	162.47	0.39
430	106.52	164.70	0.38
440	107.35	166.85	0.38
450	108.13	168.95	0.38
460	108.89	170.98	0.37
470	109.62	172.95	0.37
480	110.31	174.86	0.36
490	110.98	176.71	0.36
500	111.62	178.50	0.36
510	112.24	180.24	0.35
675	119.48	201.87	0.30

Bone

Dose	Resp Soil	Dose PbAc	Bone RBA
8.51	1.01	5.19	0.61
20	1.55	11.95	0.60
30	2.01	17.63	0.59
40	2.45	23.12	0.58
50	2.88	28.42	0.57
60	3.30	33.55	0.56
70	3.70	38.50	0.55
80	4.08	43.29	0.54
90	4.46	47.92	0.53
100	4.82	52.40	0.52
110	5.17	56.72	0.52
120	5.50	60.90	0.51
130	5.83	64.94	0.50
140	6.14	68.85	0.49
150	6.45	72.62	0.48
160	6.74	76.27	0.48
170	7.03	79.80	0.47
180	7.30	83.21	0.46
190	7.57	86.50	0.46
200	7.83	89.69	0.45
210	8.07	92.77	0.44
220	8.31	95.74	0.44
230	8.55	98.62	0.43
240	8.77	101.40	0.42
250	8.99	104.09	0.42
260	9.20	106.68	0.41
270	9.40	109.19	0.40
280	9.60	111.62	0.40
290	9.79	113.97	0.39
300	9.97	116.23	0.39
310	10.14	118.43	0.38
320	10.32	120.54	0.38
675.00	13.78	163.47	0.24

Liver

Dose	Resp Soil	Dose PbAc	Liver RBA
53.64	84.05	19.69	0.37
60	92.25	21.90	0.37
70	104.96	25.33	0.36
80	117.44	28.69	0.36
90	129.70	32.00	0.36
100	141.75	35.24	0.35
110	153.57	38.43	0.35
120	165.19	41.56	0.35
130	176.60	44.64	0.34
140	187.80	47.66	0.34
150	198.81	50.62	0.34
160	209.61	53.53	0.33
170	220.23	56.40	0.33
180	230.66	59.21	0.33
190	240.90	61.97	0.33
200	250.95	64.68	0.32
210	260.83	67.34	0.32
220	270.53	69.96	0.32
230	280.06	72.52	0.32
240	289.42	75.05	0.31
250	298.61	77.52	0.31
260	307.64	79.96	0.31
270	316.51	82.35	0.30
280	325.22	84.69	0.30
290	333.77	87.00	0.30
300	342.17	89.26	0.30
310	350.42	91.49	0.30
320	358.53	93.67	0.29
330	366.49	95.82	0.29
340	374.30	97.93	0.29
675.00	569.20	150.46	0.22

Kidney

Dose	Resp Soil	Dose PbAc	Kidney RBA
41.74	94.82	18.28	0.44
50	108.64	21.57	0.43
60	124.81	25.41	0.42
70	140.38	29.11	0.42
80	155.37	32.68	0.41
90	169.79	36.10	0.40
100	183.68	39.41	0.39
110	197.05	42.58	0.39
120	209.93	45.64	0.38
130	222.32	48.59	0.37
140	234.25	51.43	0.37
150	245.74	54.16	0.36
160	256.80	56.79	0.35
170	267.44	59.32	0.35
180	277.69	61.75	0.34
190	287.56	64.10	0.34
200	297.06	66.36	0.33
210	306.20	68.53	0.33
220	315.00	70.62	0.32
230	323.48	72.64	0.32
240	331.64	74.58	0.31
250	339.49	76.44	0.31
260	347.06	78.24	0.30
270	354.34	79.97	0.30
280	361.34	81.64	0.29
290	368.09	83.24	0.29
300	374.59	84.78	0.28
310	380.84	86.27	0.28
320	386.86	87.70	0.27
330	392.66	89.08	0.27
340	398.24	90.41	0.27
350	403.61	91.68	0.26
360	408.78	92.91	0.26
370	413.76	94.10	0.25
380	418.55	95.23	0.25
390	423.17	96.33	0.25
400	427.61	97.39	0.24
410	431.88	98.40	0.24
420	436.00	99.38	0.24
430	439.96	100.32	0.23
440	443.78	101.23	0.23
450	447.45	102.10	0.23
460	450.99	102.95	0.22
470	454.40	103.75	0.22
480	457.67	104.53	0.22
675.00	501.96	115.06	0.17

TABLE A-10

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TABLE A-11 INTRALABORATORY DUPLICATES

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

* Non detects evaluated at 1/2 DL

Pig number	group	material administered	dosage	day	matrix	Duplicate Value*	Original Value*	Average	RPD	Avg RPD	
426	3	PbAc	225	-4	BLOOD	0.5	0.5	0.5	0%		
450	4	Murray Slag	75	-4	BLOOD	0.5	0.5	0.5	0%		
440	5	Murray Slag	225	-4	BLOOD	0.5	0.5	0.5	0%		
408	3	PbAc	225	0	BLOOD	0.5	0.5	0.5	0%		
431	5	Murray Slag	225	0	BLOOD	0.5	0.5	0.5	0%		
424	10	IV	100	0	BLOOD	0.5	0.5	0.5	0%		
419	2	PbAc	75	1	BLOOD	2.8	2.7	2.75	-4%		
423	4	Murray Slag	75	1	BLOOD	1.9	1.8	1.85	-5%		
441	8	HL Mill	225	1	BLOOD	2.2	2.8	2.5	24%		
407	4	Murray Slag	75	2	BLOOD	1.7	1.8	1.75	6%		
434	8	HL Mill	225	2	BLOOD	5.5	5.9	5.7	7%		
449	3	PbAc	225	3	BLOOD	13.2	10.2	11.7	-26%		
401	8	HL Mill	225	3	BLOOD	8.1	8.3	8.2	2%		
439	10	IV	100	3	BLOOD	7.6	6.8	7.2	-11%		
410	3	PbAc	225	5	BLOOD	7.9	7.4	7.65	-7%		
428	7	HL Mill	75	5	BLOOD	4.0	4.0	4	0%		
425	10	IV	100	5	BLOOD	8.6	8.7	8.65	1%		
444	2	PbAc	75	7	BLOOD	3.3	3.4	3.35	3%		
406	7	HL Mill	75	7	BLOOD	4.6	3.5	4.05	-27%		
429	2	PbAc	75	9	BLOOD	6.7	5.6	6.15	-18%		
442	6	Murray Slag	675	9	BLOOD	8.9	8.5	8.7	-5%		
453	9	HL Mill	675	9	BLOOD	10.7	11.3	11	5%		
409	2	PbAc	75	12	BLOOD	5.1	4.3	4.7	-17%		
427	6	Murray Slag	675	12	BLOOD	9.9	9.9	9.9	0%		
413	9	HL Mill	675	12	BLOOD	15.0	16.2	15.6	8%		
417	1	control	0	15	BLOOD	0.5	0.5	0.5	0%		
412	6	Murray Slag	675	15	BLOOD	9.6	9.5	9.55	-1%		
405	9	HL Mill	675	15	BLOOD	14.3	15.2	14.75	6%	-2%	**BLOOD**
417	1	control	0	15	FEMUR	0.5	0.5	0.5	0%		
412	6	Murray Slag	675	15	FEMUR	33.0	38.0	35.5	14%		
405	9	HL Mill	675	15	FEMUR	99.5	99.0	99.25	-1%	5%	**FEMUR**
417	1	control	0	15	KIDNEY	1.0	1.5	1.25	40%		
412	6	Murray Slag	675	15	KIDNEY	49.3	53.4	51.35	8%		
405	9	HL Mill	675	15	KIDNEY	144.0	133.0	138.5	-8%	13%	**KIDNEY**
417	1	control	0	15	LIVER	0.5	3.6	2.05	151%		
412	6	Murray Slag	675	15	LIVER	81.0	78.0	79.5	-4%		
405	9	HL Mill	675	15	LIVER	160.0	142.0	151	-12%	45%	**LIVER**

This table includes results for both test materials from this experiment (HL Mill, Murray Slag)

TABLE A-12 CDC STANDARDS

Sample ID	Day	Q	Measured* Low Std	Measured* Med Std	Measured* High Std	Nominal Low Std	Nominal Med Std	Nominal High Std
4.1	-4	<	1.0			1.7	4.8	14.9
4.1	0		1.2			1.7	4.8	14.9
4.1	2	<	1.0			1.7	4.8	14.9
4.1	3	<	1.0			1.7	4.8	14.9
4.1	5	<	1.0			1.7	4.8	14.9
4.2	-4			3.7		1.7	4.8	14.9
4.2	0			3.4		1.7	4.8	14.9
4.2	1			2.8		1.7	4.8	14.9
4.2	3			2.8		1.7	4.8	14.9
4.2	5			5.0		1.7	4.8	14.9
4.2	7			3.5		1.7	4.8	14.9
4.2	9			4.2		1.7	4.8	14.9
4.2	12			3.6		1.7	4.8	14.9
4.2	15			3.2		1.7	4.8	14.9
4.3	1				11.1	1.7	4.8	14.9
4.3	2				11.7	1.7	4.8	14.9
4.3	7				12.0	1.7	4.8	14.9
4.3	9				14.6	1.7	4.8	14.9
4.3	12				14.3	1.7	4.8	14.9
4.3	15				16.6	1.7	4.8	14.9
		Avg	1.0	3.6	13.4			

* Non-detects evaluated at the detection limit

TABLE A-13 INTERLABORATORY COMPARISON

Tag Number	Pig Number	Group	Material Administered	Dosage	Qualifier		Result			
					CDC	ESD	CDC	ESD	Average	RPD
8-904106	411	4	Murray	75	U	<	0.6	1	0.8	50
8-904108	443	2	PbAc	75	U	<	0.6	1	0.8	50
8-904169	409	2	PbAc	75	U	<	0.6	1	0.8	50
8-904189	431	5	Murray	225	U	<	0.6	1	0.8	50
8-904248	409	2	PbAc	75		<	0.6	1	0.8	50
8-904253	424	10	IV	100			9.4	6.4	7.9	-38
8-904273	423	4	Murray	75			3.5	1.9	2.7	-59
8-904275	429	2	PbAc	75			2.9	1.9	2.4	-42
8-904333	444	2	PbAc	75			1.8	1.7	1.75	-6
8-904373	442	6	Murray	675			5.4	4.8	5.1	-12
8-904396	434	8	HL Mill	225			9.2	7.7	8.45	-18
8-904423	426	3	PbAc	225			9.8	8	8.9	-20
8-904458	410	3	PbAc	225			12.3	9.7	11	-24
8-904477	406	7	HL Mill	75			5.9	4.7	5.3	-23
8-904517	443	2	PbAc	75			3.7	3.5	3.6	-6
8-904523	407	4	Murray	75			6.1	5.3	5.7	-14
8-904573	450	4	Murray	75			5	4.9	4.95	-2
8-904591	429	2	PbAc	75			6.9	6.2	6.55	-11
8-904655	427	6	Murray	675			12.1	9.5	10.8	-24
8-904665	449	3	PbAc	225			15.3	11.7	13.5	-27

This table includes results for both test materials from this experiment (HL Mill, Murray)

FIGURE A-1 PbAc and IV Groups by Day
Raw Data - Phase II Experiment 4

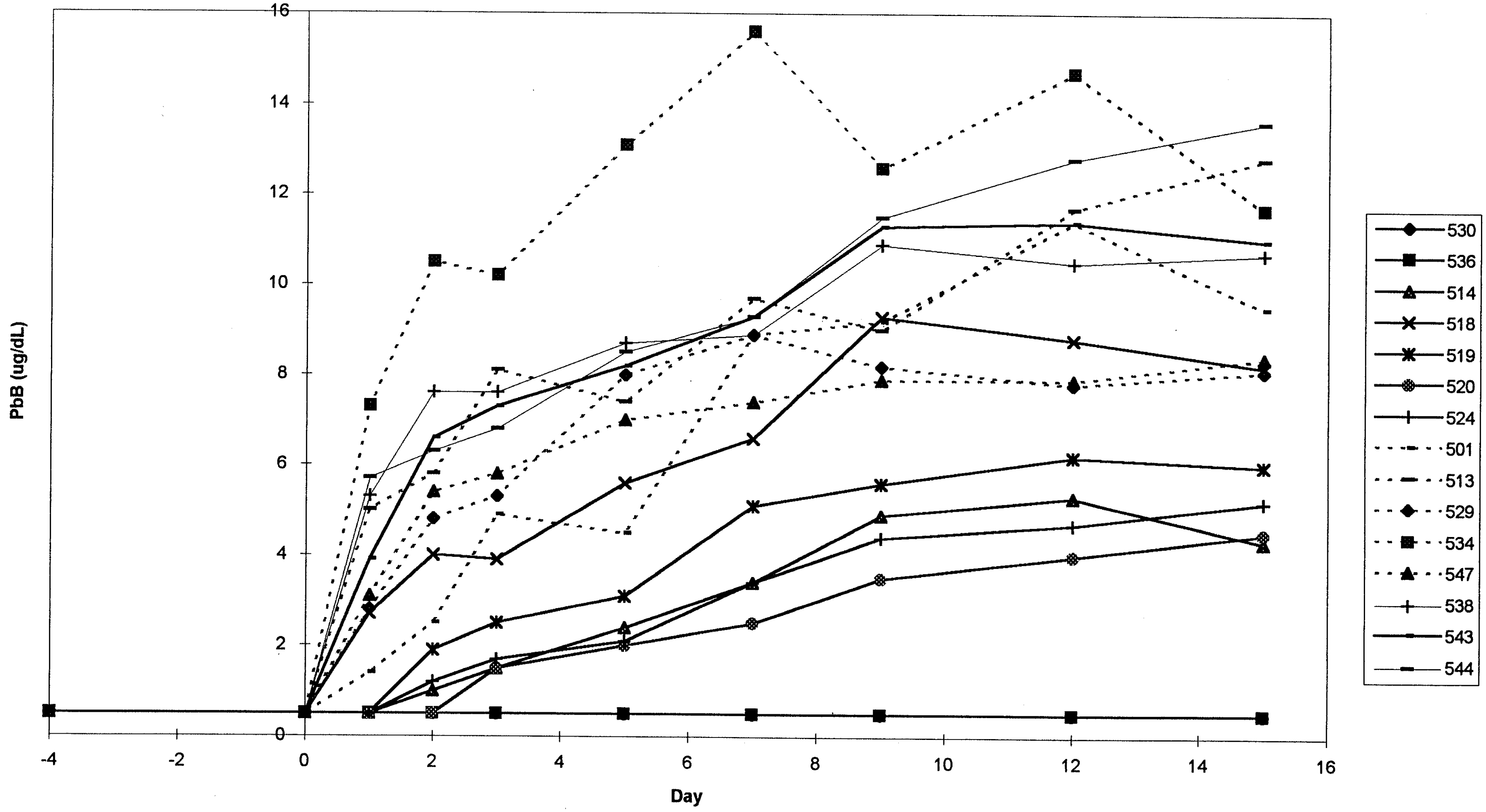

FIGURE A-2 Murray Slag Groups by Day
Raw Data

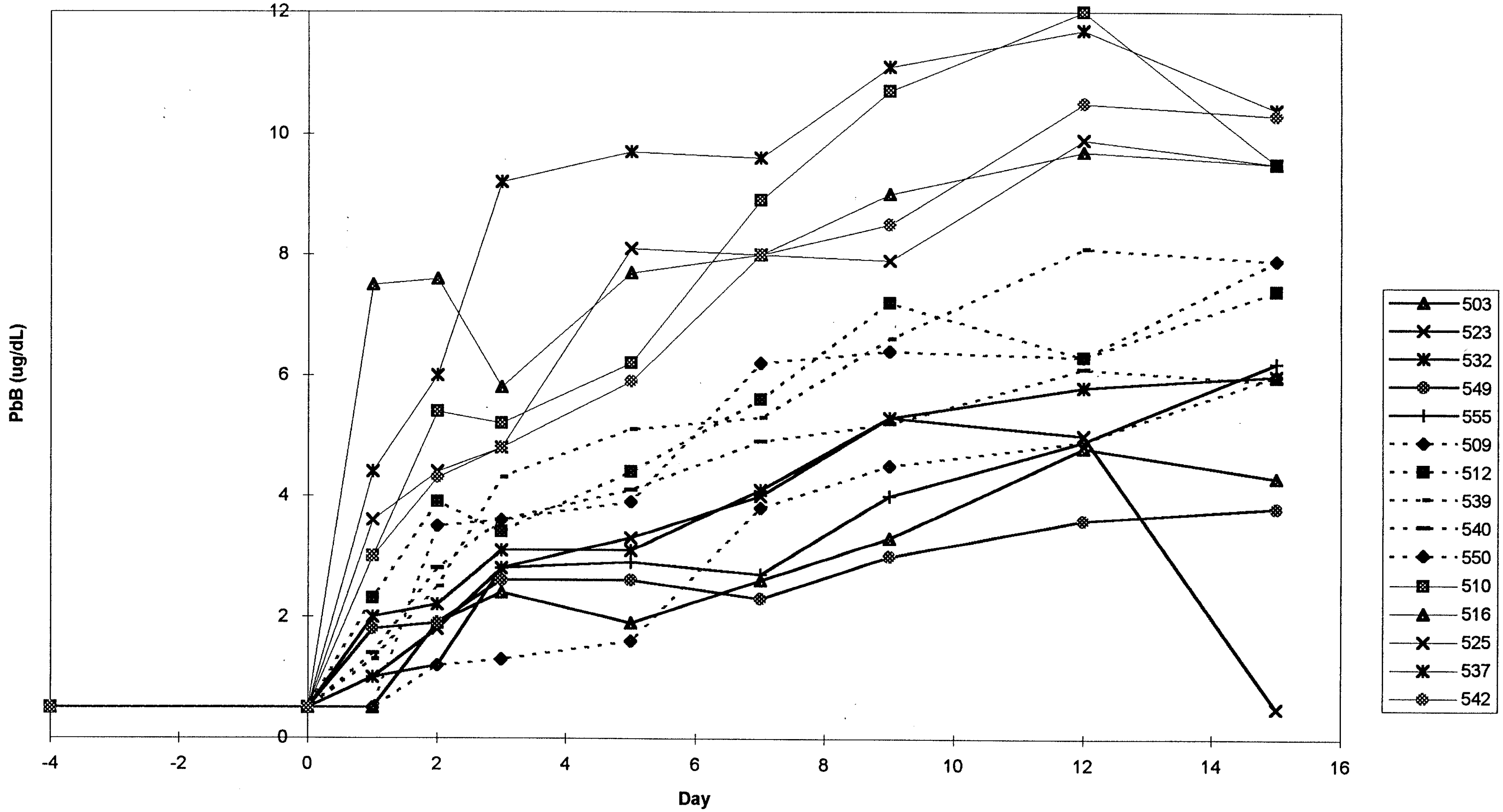

FIGURE A-3 Group Mean PbB By Day
Murray Slag - Raw Data

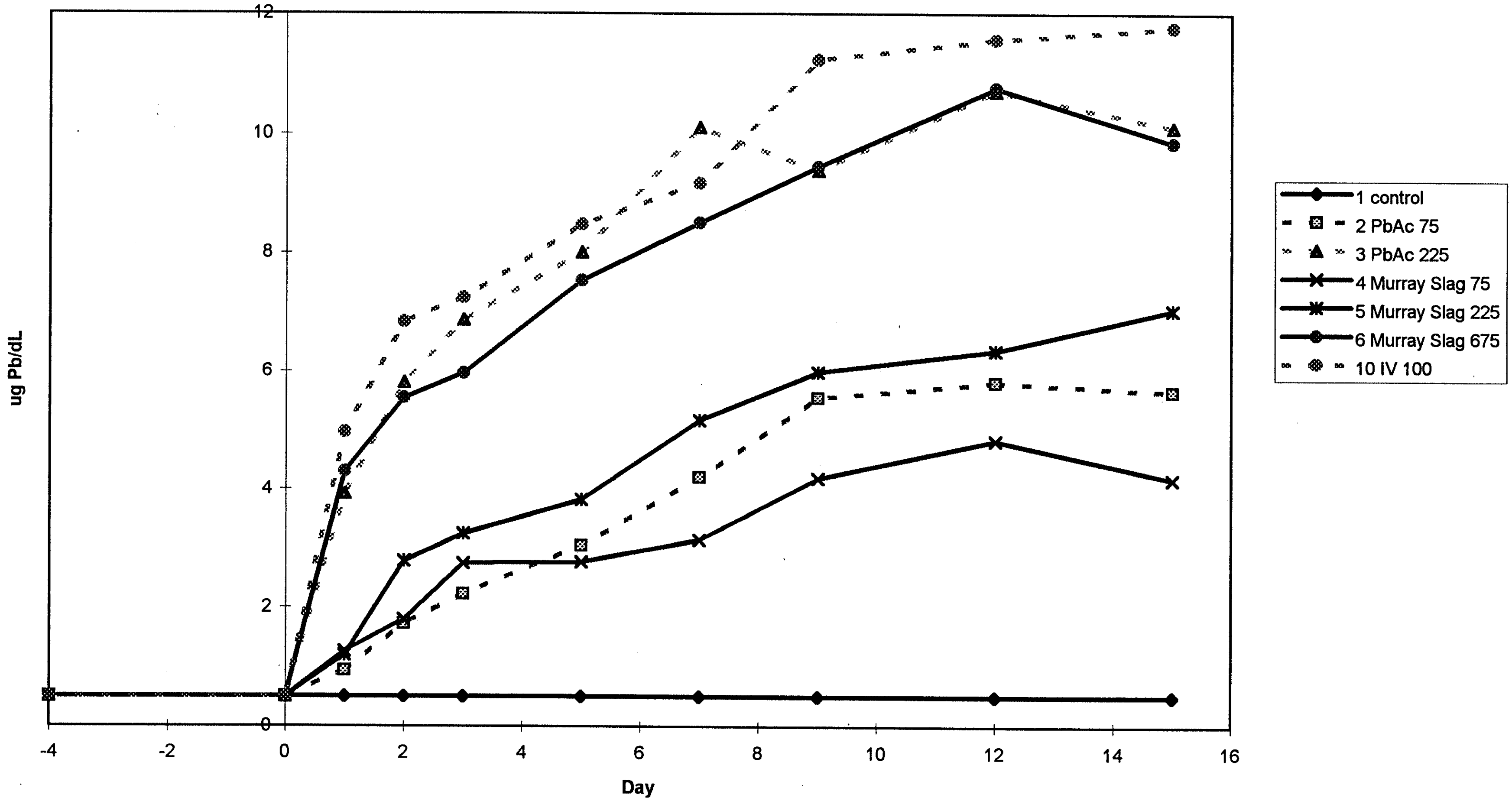

FIGURE A-4

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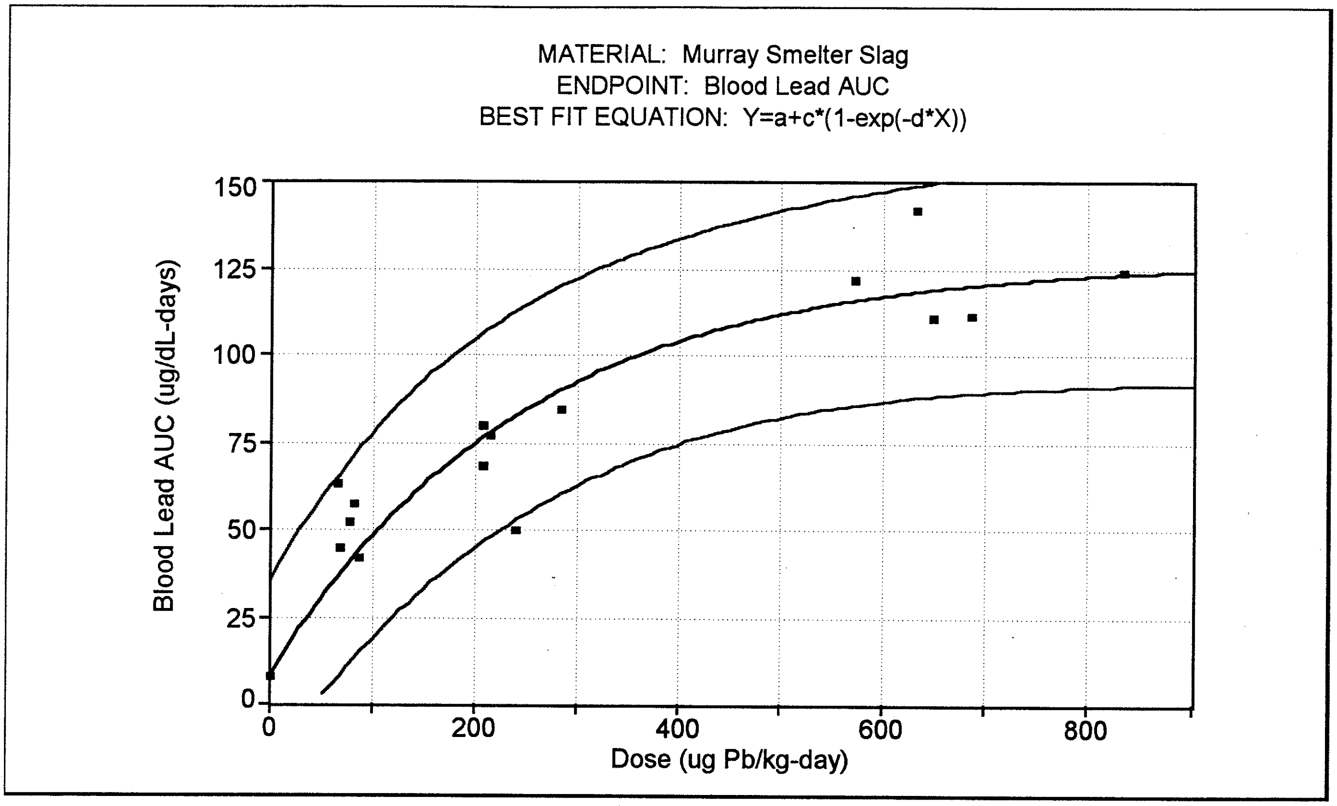
FIGURE A-6 BEST FIT CURVE WITH 95% PREDICTION INTERVALS*

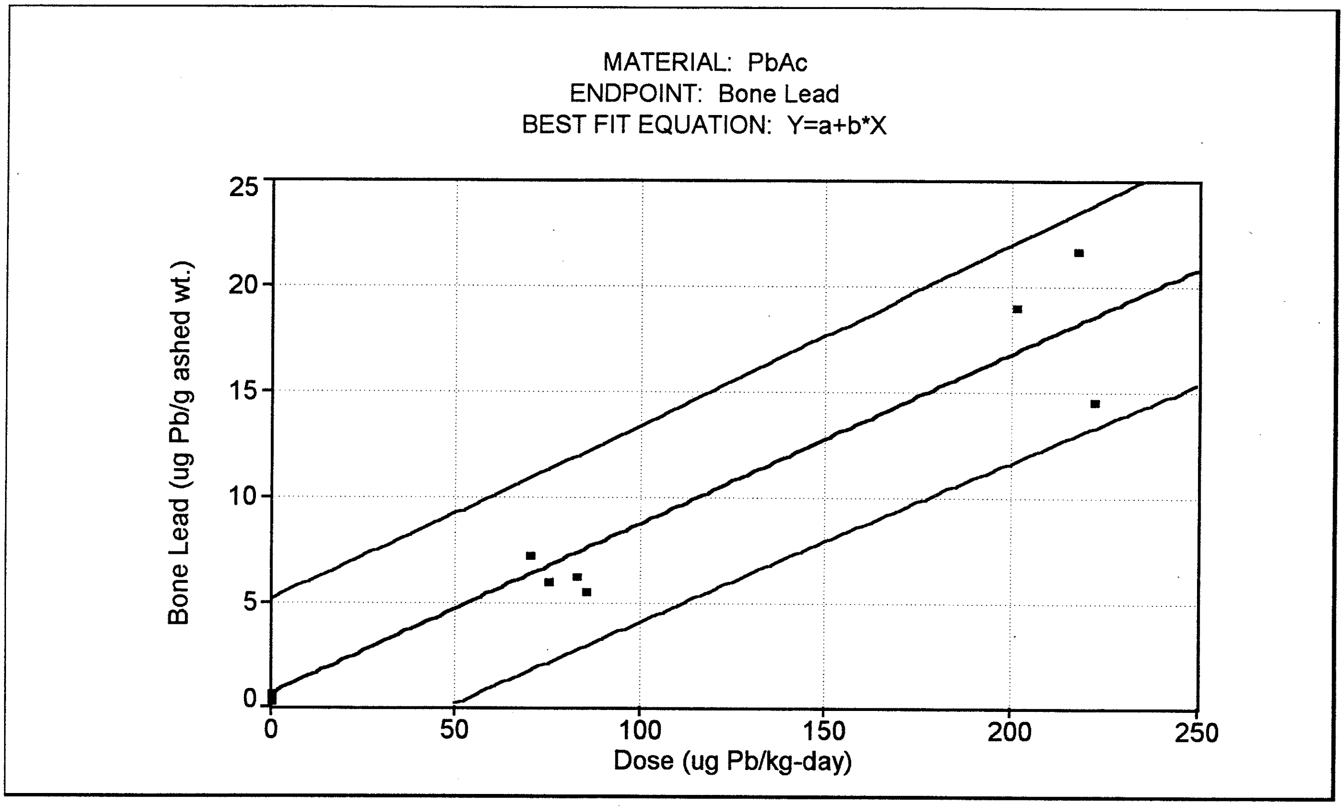


Parameters	Value	Std. Error	95% Confidence Limits	
a	7.77	fixed value	--	--
c	119.2	10.1	97.7	140.7
d	0.0041	0.00085	0.0023	0.0059

Adj R^2	0.903

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

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

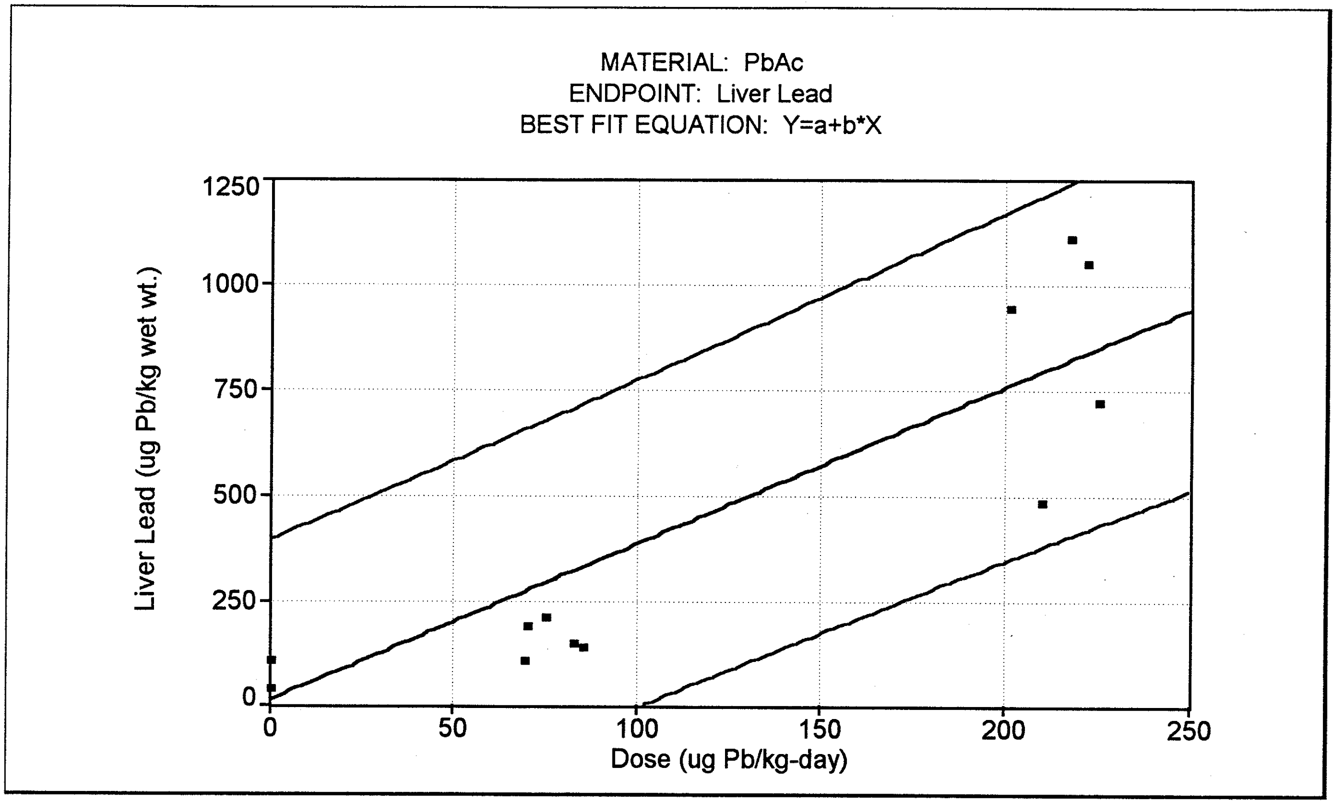


Parameters	Value	Std. Error	95% Confidence Limits	
a	0.588	fixed value	--	--
b	0.0807	0.0055	0.068	0.093

Adj R^2	0.928

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

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

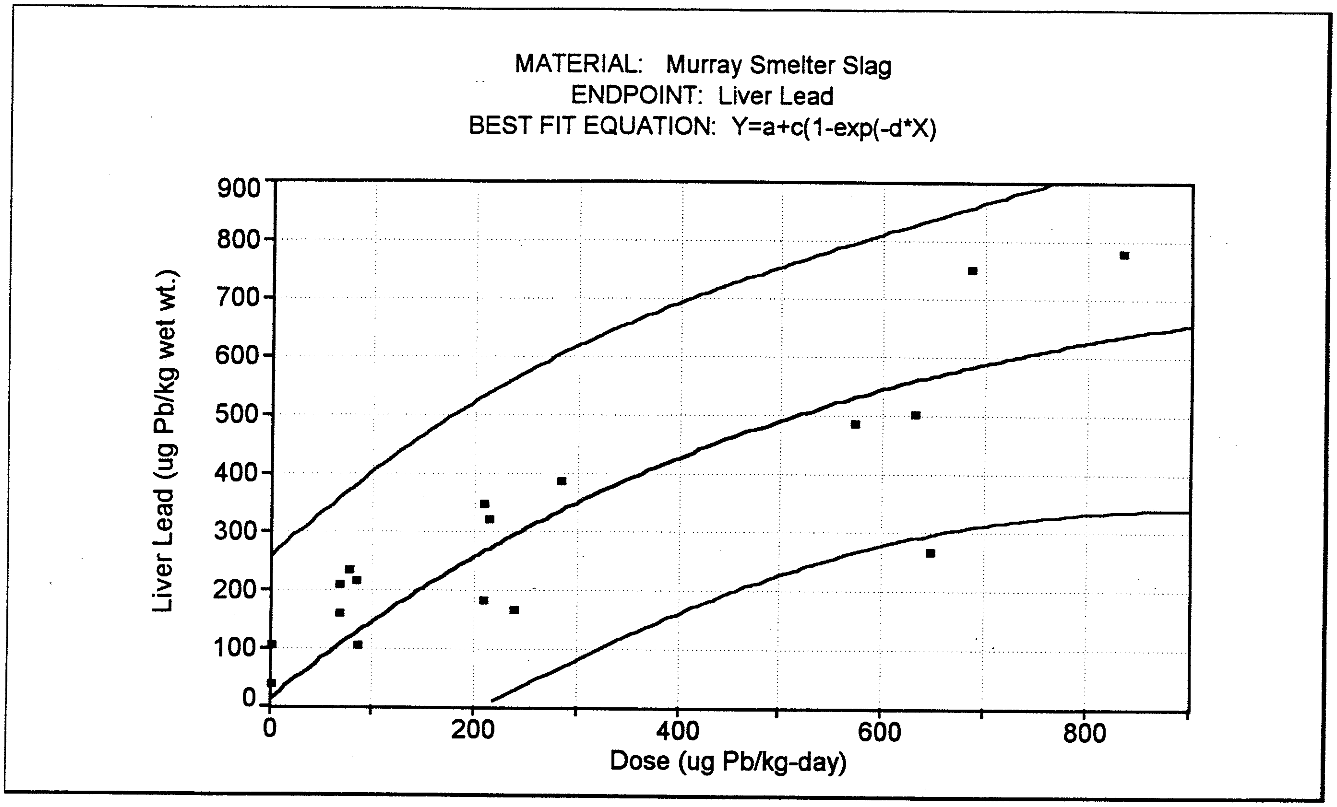


Parameters	Value	Std. Error	95% Confidence Limits	
a	11	fixed value	--	--
b	3.71	0.376	2.88	4.54

Adj R^2	0.793

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

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

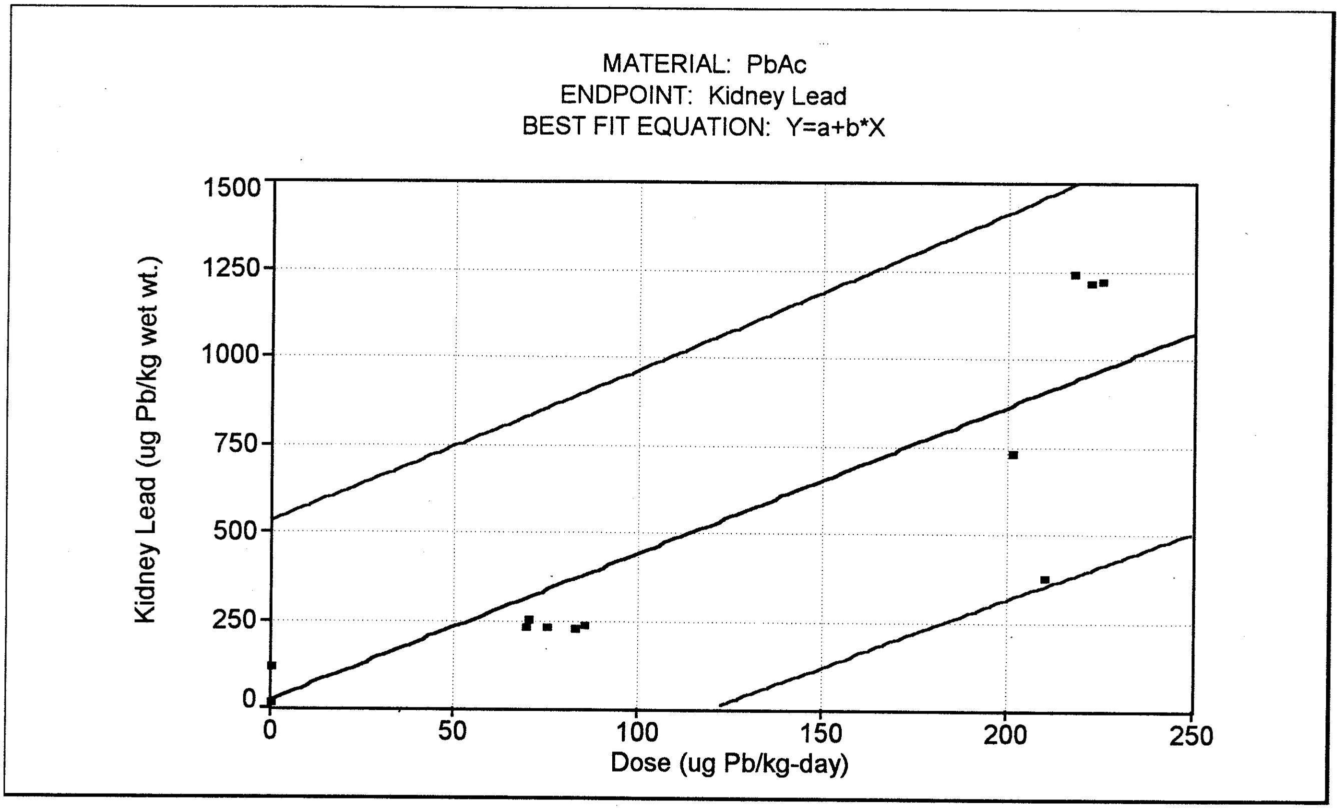


Parameters	Value	Std. Error	95% Confidence Limits	
a	11	fixed value	--	--
c	793.7	297	162.9	1424
d	0.0018	0.0012	-0.0007	0.0044

Adj R^2	0.693

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

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

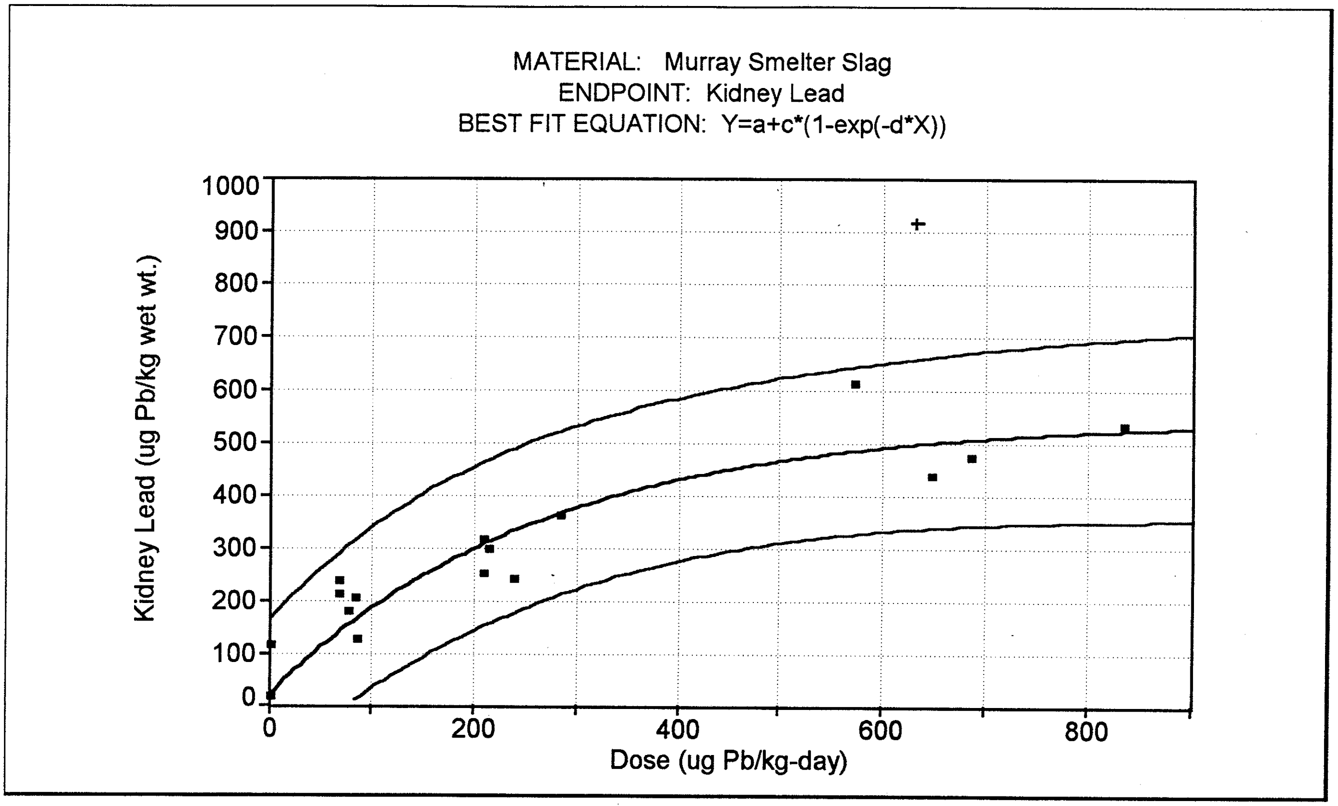


Parameters	Value	Std. Error	95% Confidence Limits	
a	17.9	fixed value	--	--
b	4.21	0.459	3.19	5.22

Adj R^2	0.766

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	17.9	fixed value	--	--
c	524.4	61.7	392	657
d	0.0038	0.001	0.0016	0.0059

Adj R^2	0.832

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

TABLES AND GRAPHS FROM EXPERIMENT 11

MURRAY SOIL SAMPLE

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 per day	BW (kg)	ug Pb per day	BW (kg)	ug Pb per day	BW (kg)	ug Pb per day	BW (kg)	ug Pb per day	BW (kg)	ug Pb per day	BW (kg)	ug Pb per day	BW (kg)	ug Pb per day
1	1109	7.1	0	7.3	0	7.4	0	7.58	0	7.8	0	8.0	0	8.28	0	8.8	0
1	1124	7.94	0	8.2	0	8.4	0	8.6	0	9.0	0	9.3	0	9.66	0	10.0	0
1	1135	7.66	0	7.7	0	7.7	0	7.66	0	8.0	0	8.3	0	8.56	0	8.9	0
1	1139	7.9	0	7.9	0	8.0	0	8.02	0	8.0	0	8.0	0	7.98	0	8.3	0
1	1151	8.66	0	8.8	0	9.0	0	9.18	0	9.7	0	10.1	0	10.62	0	10.9	0
2	1103	7.28	0	7.5	221	7.8	221	8.04	221	8.3	232	8.5	232	8.68	232	9.1	271
2	1104	8.06	0	8.1	221	8.2	221	8.24	221	8.5	232	8.7	232	8.94	232	9.2	271
2	1116	7.58	0	7.9	221	8.2	221	8.48	221	8.7	232	8.9	232	9.06	232	9.4	271
2	1117	7.7	0	7.8	221	7.9	221	7.98	221	8.2	232	8.5	232	8.7	232	8.9	271
2	1118	8.54	0	8.6	221	8.7	221	8.74	221	8.9	232	9.1	232	9.26	232	9.6	271
3	1105	7.56	0	7.7	636	7.8	636	7.92	636	8.1	673	8.3	673	8.52	673	8.7	718
3	1123	7	0	7.1	636	7.1	636	7.18	636	7.6	673	7.9	673	8.32	673	8.9	718
3	1129	7.78	0	7.8	636	7.9	636	7.92	636	8.1	673	8.2	673	8.38	673	8.8	718
3	1130	8.06	0	8.4	636	8.7	636	9.02	636	9.1	673	9.2	673	9.28	673	9.8	718
3	1144	7.02	0	7.3	636	7.5	636	7.8	636	8.0	673	8.2	673	8.38	673	8.7	718
4	1121	7.48	0	7.7	1939	7.9	1939	8.18	1939	8.6	2085	9.0	2085	9.34	2085	9.8	2336
4	1136	6.68	0	6.9	1939	7.2	1939	7.42	1939	7.7	2085	8.0	2085	8.34	2085	8.7	2336
4	1138	6.96	0	7.3	1939	7.5	1939	7.84	1939	8.2	2085	8.5	2085	8.84	2085	9.2	2336
4	1146	8.6	0	8.7	1939	8.8	1939	8.96	1939	9.4	2085	9.8	2085	10.16	2085	10.6	2336
4	1150	8.36	0	8.6	1939	8.7	1939	8.94	1939	9.4	2085	9.8	2085	10.22	2085	10.5	2336
5	1106	8.68	0	9.0	629	9.3	629	9.56	629	9.8	689	10.1	689	10.4	689	10.7	743
5	1112	7.6	0	7.6	629	7.7	629	7.7	629	8.1	689	8.4	689	8.76	689	9.1	743
5	1133	6.72	0	7.0	629	7.3	629	7.64	629	7.8	689	7.9	689	8.06	689	8.8	743
5	1142	6.66	0	6.9	629	7.2	629	7.4	629	7.6	689	7.9	689	8.12	689	8.4	743
5	1149	7.26	0	7.7	629	8.2	629	8.62	629	8.8	689	9.0	689	9.16	689	9.4	743
6	1102	8.16	0	8.5	1940	8.8	1940	9.08	1940	9.3	2120	9.6	2120	9.88	2120	10.4	2286
6	1122	6.92	0	7.1	1940	7.2	1940	7.38	1940	7.7	2120	8.0	2120	8.28	2120	8.5	2286
6	1128	8.44	0	8.7	1940	8.9	1940	9.18	1940	9.3	2120	9.4	2120	9.48	2120	9.8	2286
6	1143	6.74	0	7.1	1940	7.5	1940	7.82	1940	8.0	2120	8.2	2120	8.32	2120	8.6	2286
6	1154	7.86	0	8.1	1940	8.4	1940	8.64	1940	9.0	2120	9.4	2120	9.84	2120	10.2	2286
7	1126	6.5	0	6.9	5766	7.3	5766	7.64	5766	7.8	6291	7.9	6291	8.04	6291	8.2	6807
7	1137	7.24	0	7.5	5766	7.7	5766	7.96	5766	8.4	6291	8.9	6291	9.32	6291	9.8	6807
7	1140	7.9	0	8.2	5766	8.4	5766	8.7	5766	8.9	6291	9.0	6291	9.18	6291	9.5	6807
7	1141	8.52	0	8.7	5766	8.9	5766	9.04	5766	9.3	6291	9.5	6291	9.7	6291	10.1	6807
7	1155	7.55	0	7.8	5766	8.0	5766	8.26	5766	8.6	6291	8.9	6291	9.18	6291	9.6	6807

Group	ID #	Day 7		Day 8		Day 9		Day 10		Day 11		Day 12		Day 13		Day 14		Day 15	
		BW (kg)	ug Pb per day	BW (kg)	ug Pb per day	BW (kg)	ug Pb per day	BW (kg)	ug Pb per day	BW (kg)	ug Pb per day	BW (kg)	ug Pb per day	BW (kg)	ug Pb per day	BW (kg)	ug Pb per day	BW (kg)	ug Pb per day
1	1109	9.3	0	9.74	0	10.1	0	10.4	0	10.79	0	11.3	0	11.8	0	12.34	0	12.9	0
1	1124	10.4	0	10.76	0	11.3	0	11.8	0	12.3	0	12.6	0	12.9	0	13.24	0	13.6	0
1	1135	9.3	0	9.72	0	10.1	0	10.4	0	10.78	0	11.2	0	11.6	0	12	0	12.4	0
1	1139	8.6	0	8.98	0	9.5	0	10.0	0	10.52	0	10.8	0	11.1	0	11.4	0	11.7	0
1	1151	11.2	0	11.5	0	11.9	0	12.3	0	12.68	0	13.2	0	13.7	0	14.14	0	14.6	0
2	1103	9.5	271	9.92	271	10.3	298	10.7	298	11.02	298	11.4	326	11.7	326	12.02	326	12.4	0
2	1104	9.4	271	9.7	271	10.1	298	10.5	298	10.84	298	11.2	326	11.7	326	12.06	326	12.5	0
2	1116	9.7	271	10.08	271	10.5	298	10.9	298	11.38	298	11.9	326	12.4	326	12.86	326	13.4	0
2	1117	9.2	271	9.4	271	9.7	298	10.0	298	10.32	298	10.6	326	10.9	326	11.14	326	11.4	0
2	1118	9.8	271	10.14	271	10.5	298	10.8	298	11.12	298	11.4	326	11.8	326	12.08	326	12.4	0
3	1105	9.0	718	9.18	718	9.6	814	10.1	814	10.58	814	10.9	909	11.3	909	11.66	909	12.0	0
3	1123	9.5	718	10.04	718	10.3	814	10.6	814	10.94	814	11.4	909	11.9	909	12.36	909	12.8	0
3	1129	9.3	718	9.74	718	10.2	814	10.6	814	10.98	814	11.3	909	11.7	909	12.02	909	12.4	0
3	1130	10.3	718	10.84	718	11.3	814	11.8	814	12.24	814	12.6	909	13.0	909	13.44	909	13.8	0
3	1144	9.1	718	9.44	718	9.9	814	10.4	814	10.86	814	11.3	909	11.8	909	12.24	909	12.7	0
4	1121	10.2	2336	10.66	2336	11.2	2597	11.6	2597	12.14	2597	12.7	2890	13.2	2890	13.7	2890	14.2	0
4	1136	9.0	2336	9.4	2336	9.9	2597	10.3	2597	10.76	2597	11.0	2890	11.2	2890	11.46	2890	11.7	0
4	1138	9.6	2336	9.96	2336	10.4	2597	10.8	2597	11.28	2597	11.6	2890	12.0	2890	12.34	2890	12.7	0
4	1146	11.1	2336	11.52	2336	11.9	2597	12.2	2597	12.56	2597	13.0	2890	13.5	2890	13.96	2890	14.4	0
4	1150	10.8	2336	11.16	2336	11.6	2597	12.0	2597	12.48	2597	13.0	2890	13.5	2890	14.08	2890	14.6	0
5	1106	11.1	743	11.38	743	11.7	831	12.0	831	12.38	831	12.8	902	13.2	902	13.64	902	14.1	0
5	1112	9.4	743	9.76	743	10.1	831	10.4	831	10.78	831	11.4	902	11.9	902	12.52	902	13.1	0
5	1133	9.6	743	10.3	743	10.3	831	10.3	831	10.26	831	10.5	902	10.8	902	11.08	902	11.4	0
5	1142	8.7	743	9	743	9.4	831	9.8	831	10.18	831	10.6	902	11.0	902	11.48	902	11.9	0
5	1149	9.7	743	9.96	743	10.5	831	11.0	831	11.52	831	12.0	902	12.4	902	12.86	902	13.3	0
6	1102	10.9	2286	11.44	2286	11.9	2515	12.4	2515	12.88	2515	13.3	2813	13.8	2813	14.24	2813	14.7	0
6	1122	8.7	2286	8.86	2286	9.1	2515	9.4	2515	9.7	2515	10.0	2813	10.3	2813	10.58	2813	10.9	0
6	1128	10.2	2286	10.5	2286	10.8	2515	11.2	2515	11.54	2515	11.8	2813	12.1	2813	12.42	2813	12.7	0
6	1143	8.9	2286	9.26	2286	9.8	2515	10.4	2515	10.9	2515	11.2	2813	11.5	2813	11.86	2813	12.2	0
6	1154	10.5	2286	10.82	2286	11.4	2515	11.9	2515	12.48	2515	12.8	2813	13.1	2813	13.36	2813	13.7	0
7	1126	8.5	6807	8.66	6807	9.2	7498	9.7	7498	10.2	7498	10.6	8432	11.0	8432	11.4	8432	11.8	0
7	1137	10.2	6807	10.62	6807	11.0	7498	11.4	7498	11.82	7498	12.2	8432	12.6	8432	12.98	8432	13.4	0
7	1140	9.8	6807	10.08	6807	10.6	7498	11.1	7498	11.62	7498	12.0	8432	12.5	8432	12.88	8432	13.3	0
7	1141	10.5	6807	10.88	6807	11.3	7498	11.8	7498	12.24	7498	12.7	8432	13.2	8432	13.66	8432	14.1	0
7	1155	9.9	6807	10.3	6807	10.7	7498	11.2	7498	11.58	7498	12.0	8432	12.4	8432	12.84	8432	13.3	0

Shaded boxes show days in which adminstered doses were ingested late

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	1109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0		
1	1124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0		
1	1135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0		
1	1139	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0		
1	1151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0		
2	1103	29.310	28.356	27.463	28.158	27.449	26.774	29.824	28.527	27.339	29.008	28.010	27.078	28.696	27.878	27.105	28.07	25	112	
2	1104	27.192	26.993	26.796	27.427	26.692	25.996	29.500	28.709	27.959	29.603	28.528	27.528	28.969	27.958	27.015	27.79	25	111	
2	1116	28.020	26.993	26.038	26.795	26.211	25.651	28.851	27.844	26.905	28.383	27.259	26.221	27.440	26.345	25.334	26.95	25	108	
2	1117	28.332	27.997	27.669	28.273	27.470	26.713	30.358	29.585	28.851	30.742	29.800	28.915	30.755	29.982	29.246	28.98	25	116	
2	1118	25.655	25.457	25.263	26.073	25.576	25.097	28.388	27.542	26.746	28.510	27.647	26.835	28.479	27.704	26.970	26.80	25	107	111
3	1105	82.852	81.577	80.341	82.833	80.841	78.944	82.174	80.156	78.235	84.340	80.448	76.900	83.090	80.442	77.959	80.74	75	108	
3	1123	90.127	89.368	88.621	88.968	84.710	80.841	80.757	75.866	71.534	78.685	76.466	74.369	79.644	76.472	73.544	80.66	75	108	
3	1129	81.299	80.817	80.341	83.311	81.759	80.263	81.306	77.337	73.737	80.131	76.997	74.098	80.253	77.870	75.624	79.01	75	105	
3	1130	75.931	73.138	70.543	73.858	73.162	72.478	73.286	69.593	66.255	71.958	69.105	66.471	71.915	69.709	67.634	71.00	75	95	
3	1144	87.404	84.390	81.577	84.145	82.158	80.263	82.237	79.039	76.081	82.071	78.331	74.917	80.300	77.165	74.265	80.29	75	107	104
4	1121	251.331	243.951	236.993	243.420	232.908	223.266	238.804	228.523	219.090	232.800	222.939	213.880	228.270	219.264	210.942	229.76	225	102	
4	1136	279.875	270.251	261.267	269.884	259.581	250.036	268.654	258.161	248.457	263.515	251.924	241.310	262.878	257.414	252.173	259.69	225	115	
4	1138	267.270	256.882	247.270	255.135	245.137	235.894	253.491	243.620	234.488	249.663	239.530	230.186	248.415	241.093	234.190	245.48	225	109	
4	1146	222.317	219.299	216.362	222.788	213.658	205.246	220.053	211.039	202.734	218.806	212.596	206.728	221.845	214.172	207.013	214.31	225	95	
4	1150	226.648	221.639	216.846	222.630	212.931	204.041	221.725	215.320	209.274	223.836	215.656	208.053	222.072	213.329	205.249	215.95	225	96	104
5	1106	70.074	67.856	65.774	70.000	68.063	66.231	69.220	67.174	65.246	70.945	68.982	67.124	70.453	68.215	66.114	68.10	75	91	
5	1112	82.376	82.017	81.662	85.530	81.935	78.630	81.653	78.766	76.076	82.277	79.598	77.087	79.384	75.528	72.029	79.64	75	106	
5	1133	89.488	85.745	82.304	88.535	86.970	85.459	84.311	77.722	72.087	80.784	80.889	80.994	85.614	83.448	81.390	83.05	75	111	
5	1142	91.042	87.903	84.973	90.157	87.411	84.828	88.253	85.279	82.500	88.467	84.911	81.631	84.969	81.635	78.554	85.50	75	114	
5	1149	81.521	76.996	72.947	78.273	76.704	75.197	78.766	76.599	74.548	79.294	75.545	72.135	75.359	72.648	70.124	75.78	75	101	105
6	1102	229.181	221.170	213.700	226.765	220.475	214.524	219.808	209.341	199.825	210.956	202.790	195.233	210.938	204.001	197.507	211.75	225	94	
6	1122	274.326	268.506	262.927	275.977	265.602	255.978	269.788	263.769	258.014	275.120	266.943	259.237	281.438	273.412	265.832	267.79	225	119	
6	1128	223.377	217.209	211.373	228.394	225.959	223.576	232.790	225.000	217.714	231.832	224.652	217.903	237.676	231.927	226.449	225.06	225	100	
6	1143	273.296	260.107	248.133	265.380	259.955	254.748	264.788	255.514	246.868	256.417	242.878	230.697	250.668	243.718	237.142	252.69	225	112	
6	1154	238.966	231.551	224.583	234.458	224.523	215.396	224.852	217.853	211.275	221.096	210.838	201.490	220.185	215.242	210.516	220.19	225	98	105
7	1126	838.060	794.194	754.692	809.305	795.658	782.463	825.388	805.209	785.993	817.358	774.043	735.088	795.481	766.555	739.658	787.94	675	117	
7	1137	770.836	746.872	724.353	747.742	709.511	675.000	697.884	668.197	640.932	680.390	656.559	634.340	690.778	669.569	649.622	690.84	675	102	
7	1140	706.022	683.698	662.741	710.045	697.450	685.294	718.006	695.982	675.268	707.794	675.081	645.258	700.341	676.734	654.666	686.29	675	102	
7	1141	663.250	650.284	637.815	679.374	663.608	648.557	674.376	649.081	625.616	661.579	636.134	612.574	663.249	639.441	617.284	648.15	675	96	
7	1155	740.477	718.635	698.045	734.358	708.978	685.294	712.495	685.698	660.845	698.996	672.256	647.487	702.675	678.913	656.706	693.46	675	103	104

TABLE A - 3 RAW AND ADJUSTED BLOOD LEAD DATA

xperiment 11 (Data not shown for groups 8, 9, & 10)

pig number	sample	reansample	group	material administered	dosage	qualifier	reanqualifier	reanresult	result	day	source file	reansource	MATRIX	Adjusted Value (ug/dL) [a]	Notes
1109	8-911-0168		1	Control	0	<			1	-4	T960313B		BLOOD	0.5	
1124	8-911-0157		1	Control	0	<			1	-4	T960313B		BLOOD	0.5	
1135	8-911-0174		1	Control	0	<			1	-4	T960313B		BLOOD	0.5	
1139	8-911-0165		1	Control	0	<			1	-4	T960313B		BLOOD	0.5	
1151	8-911-0121		1	Control	0	<			1	-4	T960313B		BLOOD	0.5	
1103	8-911-0125		2	PbAc	25		<	1	567	-4	T960313B		BLOOD	0.5	
1104	8-911-0147		2	PbAc	25	<			1	-4	T960313B		BLOOD	0.5	
1116	8-911-0158		2	PbAc	25	<			1	-4	T960313B		BLOOD	0.5	
1117	8-911-0133		2	PbAc	25				1.2	-4	T960313B		BLOOD	1.2	
1118	8-911-0145		2	PbAc	25	<			1	-4	T960313B		BLOOD	0.5	
1105	8-911-0161		3	PbAc	75	<			1	-4	T960313B		BLOOD	0.5	
1123	8-911-0146		3	PbAc	75	<			1	-4	T960313B		BLOOD	0.5	
1129	8-911-0149		3	PbAc	75	<			1	-4	T960313B		BLOOD	0.5	
1130	8-911-0172		3	PbAc	75	<			1	-4	T960313B		BLOOD	0.5	
1144	8-911-0142		3	PbAc	75	<			1	-4	T960313B		BLOOD	0.5	
1121	8-911-0171		4	PbAc	225	<			1	-4	T960313B		BLOOD	0.5	
1136	8-911-0151		4	PbAc	225	<			1	-4	T960313B		BLOOD	0.5	
1138	8-911-0153		4	PbAc	225	<			1	-4	T960313B		BLOOD	0.5	
1146	8-911-0148		4	PbAc	225	<			1	-4	T960313B		BLOOD	0.5	
1150	8-911-0135		4	PbAc	225	<			1	-4	T960313B		BLOOD	0.5	
1106	8-911-0144		5	Murray Res. Soil	75	<			1	-4	T960313B		BLOOD	0.5	
1112	8-911-0156		5	Murray Res. Soil	75	<			1	-4	T960313B		BLOOD	0.5	
1133	8-911-0134		5	Murray Res. Soil	75	<			1	-4	T960313B		BLOOD	0.5	
1142	8-911-0139		5	Murray Res. Soil	75	<			1	-4	T960313B		BLOOD	0.5	
1149	8-911-0122		5	Murray Res. Soil	75	<			1	-4	T960313B		BLOOD	0.5	
1102	8-911-0130		6	Murray Res. Soil	225	<			1	-4	T960313B		BLOOD	0.5	
1122	8-911-0160		6	Murray Res. Soil	225	<			1	-4	T960313B		BLOOD	0.5	
1128	8-911-0163		6	Murray Res. Soil	225	<			1	-4	T960313B		BLOOD	0.5	
1143	8-911-0120		6	Murray Res. Soil	225	<			1	-4	T960313B		BLOOD	0.5	
1154	8-911-0155		6	Murray Res. Soil	225	<			1	-4	T960313B		BLOOD	0.5	
1126	8-911-0126		7	Murray Res. Soil	675	<			1	-4	T960313B		BLOOD	0.5	
1137	8-911-0159		7	Murray Res. Soil	675	<			1	-4	T960313B		BLOOD	0.5	
1140	8-911-0129		7	Murray Res. Soil	675				1.4	-4	T960313B		BLOOD	1.4	
1141	8-911-0162		7	Murray Res. Soil	675	<			1	-4	T960313B		BLOOD	0.5	
1155	8-911-0154		7	Murray Res. Soil	675	<			1	-4	T960313B		BLOOD	0.5	
1109	8-911-0205		1	Control	0	<			1	0	T960313B		BLOOD	0.5	
1124	8-911-0209		1	Control	0	<			1	0	T960313B		BLOOD	0.5	
1135	8-911-0223		1	Control	0	<			1	0	T960313B		BLOOD	0.5	
1139	8-911-0213	8-911-2213	1	Control	0	<	<	1	1	0	T960313B	T960427B	BLOOD	0.5	
1151	8-911-0211		1	Control	0				1.1	0	T960313B		BLOOD	1.1	
1103	8-911-0229		2	PbAc	25	<			1	0	T960313B		BLOOD	0.5	
1104	8-911-0216		2	PbAc	25	<			1	0	T960313B		BLOOD	0.5	
1116	8-911-0200		2	PbAc	25	<			1	0	T960313B		BLOOD	0.5	
1117	8-911-0225		2	PbAc	25	<			1	0	T960313B		BLOOD	0.5	
1118	8-911-0189	8-911-2189	2	PbAc	25	<	<	1	1	0	T960313B	T960427B	BLOOD	0.5	
1105	8-911-0187		3	PbAc	75	<			1	0	T960313B		BLOOD	0.5	
1123	8-911-0226		3	PbAc	75	<			1	0	T960313B		BLOOD	0.5	
1129	8-911-0183		3	PbAc	75	<			1	0	T960313B		BLOOD	0.5	
1130	8-911-0186		3	PbAc	75	<			1	0	T960313B		BLOOD	0.5	
1144	8-911-0177	8-911-2177	3	PbAc	75	<	<	1	1	0	T960313B	T960427B	BLOOD	0.5	
1121	8-911-0176		4	PbAc	225	<			1	0	T960313B		BLOOD	0.5	
1136	8-911-0193		4	PbAc	225	<			1	0	T960313B		BLOOD	0.5	
1138	8-911-0190		4	PbAc	225	<			1	0	T960313B		BLOOD	0.5	
1146	8-911-0181		4	PbAc	225	<			1	0	T960313B		BLOOD	0.5	
1150	8-911-0227	8-911-2227	4	PbAc	225	<	<	1	1	0	T960313B	T960427B	BLOOD	0.5	
1106	8-911-0217		5	Murray Res. Soil	75	<			1	0	T960313B		BLOOD	0.5	

pig number	sample	reansample	group	material administered	dosage	qualifier	reanqualifier	reanresult	result	day	source file	reansource	MATRIX	Adjusted Value (ug/dL) [a]	Notes
1112	8-911-0201		5	Murray Res. Soil	75	<			1	0	T960313B		BLOOD	0.5	
1133	8-911-0218		5	Murray Res. Soil	75	<			1	0	T960313B		BLOOD	0.5	
1142	8-911-0188		5	Murray Res. Soil	75	<			1	0	T960313B		BLOOD	0.5	
1149	8-911-0182		5	Murray Res. Soil	75	<			1	0	T960313B		BLOOD	0.5	
1102	8-911-0206		6	Murray Res. Soil	225	<			1	0	T960313B		BLOOD	0.5	
1122	8-911-0179	8-911-2179	6	Murray Res. Soil	225	<	<	1	1	0	T960313B	T960427B	BLOOD	0.5	
1128	8-911-0196		6	Murray Res. Soil	225	<			1	0	T960313B		BLOOD	0.5	
1143	8-911-0214		6	Murray Res. Soil	225	<			1	0	T960313B		BLOOD	0.5	
1154	8-911-0199		6	Murray Res. Soil	225	<			1	0	T960313B		BLOOD	0.5	
1126	8-911-0203		7	Murray Res. Soil	675	<			1	0	T960313B		BLOOD	0.5	
1137	8-911-0228	8-911-2228	7	Murray Res. Soil	675	<	<	1	1	0	T960313B	T960427B	BLOOD	0.5	
1140	8-911-0180		7	Murray Res. Soil	675	<			1	0	T960313B		BLOOD	0.5	
1141	8-911-0212		7	Murray Res. Soil	675				1.6	0	T960313B		BLOOD	1.6	
1155	8-911-0222		7	Murray Res. Soil	675				1.2	0	T960313B		BLOOD	1.2	
1109	8-911-0250	8-911-2250	1	Control	0		<	1	2	1	T960313B	T960427B	BLOOD	0.5	
1124	8-911-0280	8-911-2280	1	Control	0		<	1	1.4	1	T960313B	T960427B	BLOOD	0.5	
1135	8-911-0272	8-911-2272	1	Control	0		<	1	1.8	1	T960313B	T960427B	BLOOD	0.5	
1139	8-911-0236	8-911-2236	1	Control	0		<	1	4.4	1	T960313B	T960427B	BLOOD	0.5	
1151	8-911-0251	8-911-2251	1	Control	0		<	1	3.6	1	T960313B	T960427B	BLOOD	0.5	
1103	8-911-0243	8-911-2243	2	PbAc	25		<	1	2.3	1	T960313B	T960427B	BLOOD	0.5	
1104	8-911-0266	8-911-2266	2	PbAc	25		<	1	5.8	1	T960313B	T960427B	BLOOD	0.5	
1116	8-911-0257	8-911-2257	2	PbAc	25		<	1	4.8	1	T960313B	T960427B	BLOOD	0.5	
1117	8-911-0241	8-911-2241	2	PbAc	25		<	1	4	1	T960313B	T960427B	BLOOD	0.5	
1118	8-911-0258	8-911-2258	2	PbAc	25			5.8	1.9	1	T960313B	T960427B	BLOOD	5.8	
1105	8-911-0237	8-911-2237	3	PbAc	75		<	1	4.6	1	T960313B	T960427B	BLOOD	0.5	
1123	8-911-0246	8-911-2246	3	PbAc	75		<	1	3.7	1	T960313B	T960427B	BLOOD	0.5	
1129	8-911-0247	8-911-2247	3	PbAc	75		<	1	1.1	1	T960313B	T960427B	BLOOD	0.5	
1130	8-911-0277	8-911-2277	3	PbAc	75		<	1	5.9	1	T960313B	T960427B	BLOOD	0.5	
1144	8-911-0240	8-911-2240	3	PbAc	75		<	1	2.8	1	T960313B	T960427B	BLOOD	0.5	
1121	8-911-0233	8-911-2233	4	PbAc	225			3.3	6.2	1	T960313B	T960427B	BLOOD	3.3	
1136	8-911-0276	8-911-2276	4	PbAc	225			1.4	4.8	1	T960313B	T960427B	BLOOD	1.4	
1138	8-911-0248	8-911-2248	4	PbAc	225			2	5.6	1	T960313B	T960427B	BLOOD	2	
1146	8-911-0282	8-911-2282	4	PbAc	225			3.6	3	1	T960313B	T960427B	BLOOD	3.6	
1150	8-911-0284	8-911-2284	4	PbAc	225			4.5	4.2	1	T960313B	T960427B	BLOOD	4.5	
1106	8-911-0264	8-911-2264	5	Murray Res. Soil	75			2.6	3	1	T960313B	T960427B	BLOOD	2.6	
1112	8-911-0269	8-911-2269	5	Murray Res. Soil	75		<	1	2.4	1	T960313B	T960427B	BLOOD	0.5	
1133	8-911-0245	8-911-2245	5	Murray Res. Soil	75	<		1.1	1	1	T960313B	T960427B	BLOOD	1.1	
1142	8-911-0273	8-911-2273	5	Murray Res. Soil	75		<	1	1.9	1	T960313B	T960427B	BLOOD	0.5	
1149	8-911-0275	8-911-2275	5	Murray Res. Soil	75	<	<	1	1	1	T960313B	T960427B	BLOOD	0.5	
1102	8-911-0230	8-911-2230	6	Murray Res. Soil	225			2.4	3.9	1	T960313B	T960427B	BLOOD	2.4	
1122	8-911-0254	8-911-2254	6	Murray Res. Soil	225			1.5	1.2	1	T960313B	T960427B	BLOOD	1.5	
1128	8-911-0253	8-911-2253	6	Murray Res. Soil	225			1.9	3	1	T960313B	T960427B	BLOOD	1.9	
1143	8-911-0278	8-911-2278	6	Murray Res. Soil	225			1.2	2.4	1	T960313B	T960427B	BLOOD	1.2	
1154	8-911-0262	8-911-2262	6	Murray Res. Soil	225			2.7	3.6	1	T960313B	T960427B	BLOOD	2.7	
1126	8-911-0234	8-911-2234	7	Murray Res. Soil	675			5.2	7	1	T960313B	T960427B	BLOOD	5.2	
1137	8-911-0267	8-911-2267	7	Murray Res. Soil	675			3.2	3.4	1	T960313B	T960427B	BLOOD	3.2	
1140	8-911-0274	8-911-2274	7	Murray Res. Soil	675			4.4	4	1	T960313B	T960427B	BLOOD	4.4	
1141	8-911-0232	8-911-2232	7	Murray Res. Soil	675			2.9	3.5	1	T960313B	T960427B	BLOOD	2.9	
1155	8-911-0231	8-911-2231	7	Murray Res. Soil	675			4.1	15.7	1	T960313B	T960427B	BLOOD	4.1	
1109	8-911-0301		1	Control	0	<			1	2	T960330B		BLOOD	0.5	
1124	8-911-0320	8-911-2320	1	Control	0	<	<	1	1	2	T960330B	T960427B	BLOOD	0.5	
1135	8-911-0338		1	Control	0	<			1	2	T960330B		BLOOD	0.5	
1139	8-911-0334	8-911-2334	1	Control	0		<	1	1.3	2	T960330B	T960427B	BLOOD	0.5	
1151	8-911-0324		1	Control	0	<			1	2	T960330B		BLOOD	0.5	
1103	8-911-0304	8-911-2304	2	PbAc	25	<	<	1	1	2	T960330B	T960427B	BLOOD	0.5	
1104	8-911-0303		2	PbAc	25	<			1	2	T960330B		BLOOD	0.5	
1116	8-911-0302		2	PbAc	25	<			1	2	T960330B		BLOOD	0.5	
1117	8-911-0307		2	PbAc	25	<			1	2	T960330B		BLOOD	0.5	
1118	8-911-0309		2	PbAc	25	<			1	2	T960330B		BLOOD	0.5	
1105	8-911-0289		3	PbAc	75				1.3	2	T960330B		BLOOD	1.3	
1123	8-911-0318		3	PbAc	75				2.7	2	T960330B		BLOOD	2.7	

pig number	sample	reansample	group	material administered	dosage	qualifier	reanqualifier	reanresult	result	day	source file	reansource	MATRIX	Adjusted Value (ug/dL) [a]	Notes
1129	8-911-0298	8-911-2298	3	PbAc	75	<		1.2	1	2	T960330B	T960427B	BLOOD	1.2	
1130	8-911-0326		3	PbAc	75				2.8	2	T960330B		BLOOD	2.8	
1144	8-911-0285	8-911-2285	3	PbAc	75			1.4	1.6	2	T960330B	T960427B	BLOOD	1.4	
1121	8-911-0311		4	PbAc	225				5.9	2	T960330B		BLOOD	5.9	
1136	8-911-0305		4	PbAc	225				2.9	2	T960330B		BLOOD	2.9	
1138	8-911-0288		4	PbAc	225				3.4	2	T960330B		BLOOD	3.4	
1146	8-911-0337		4	PbAc	225				5.2	2	T960330B		BLOOD	5.2	
1150	8-911-0310		4	PbAc	225				6.2	2	T960330B		BLOOD	6.2	
1106	8-911-0332		5	Murray Res. Soil	75				2.7	2	T960330B		BLOOD	2.7	
1112	8-911-0312		5	Murray Res. Soil	75	<			1	2	T960330B		BLOOD	0.5	
1133	8-911-0292	8-911-2292	5	Murray Res. Soil	75	<		2.1	1	2	T960330B	T960427B	BLOOD	2.1	
1142	8-911-0333		5	Murray Res. Soil	75				1.8	2	T960330B		BLOOD	1.8	
1149	8-911-0319		5	Murray Res. Soil	75				2.4	2	T960330B		BLOOD	2.4	
1102	8-911-0331		6	Murray Res. Soil	225				5.1	2	T960330B		BLOOD	5.1	
1122	8-911-0325		6	Murray Res. Soil	225				5	2	T960330B		BLOOD	5	
1128	8-911-0300		6	Murray Res. Soil	225				3.8	2	T960330B		BLOOD	3.8	
1143	8-911-0322	8-911-2322	6	Murray Res. Soil	225			3.4	3.7	2	T960330B	T960427B	BLOOD	3.4	
1154	8-911-0328		6	Murray Res. Soil	225				5.8	2	T960330B		BLOOD	5.8	
1126	8-911-0323		7	Murray Res. Soil	675				7.9	2	T960330B		BLOOD	7.9	
1137	8-911-0335		7	Murray Res. Soil	675				6.4	2	T960330B		BLOOD	6.4	
1140	8-911-0329		7	Murray Res. Soil	675				9.2	2	T960330B		BLOOD	9.2	
1141	8-911-0299		7	Murray Res. Soil	675				5.8	2	T960330B		BLOOD	5.8	
1155	8-911-0293		7	Murray Res. Soil	675				6.5	2	T960330B		BLOOD	6.5	
1109	8-911-0367		1	Control	0	<			1	3	T960330B		BLOOD	0.5	
1124	8-911-0375		1	Control	0	<			1	3	T960330B		BLOOD	0.5	
1135	8-911-0357		1	Control	0	<			1	3	T960330B		BLOOD	0.5	
1139	8-911-0340		1	Control	0	<			1	3	T960330B		BLOOD	0.5	
1151	8-911-0345		1	Control	0	<			1	3	T960330B		BLOOD	0.5	
1103	8-911-0384		2	PbAc	25				1.1	3	T960330B		BLOOD	1.1	
1104	8-911-0370		2	PbAc	25				1	3	T960330B		BLOOD	1	
1116	8-911-0353		2	PbAc	25				1.6	3	T960330B		BLOOD	1.6	
1117	8-911-0379		2	PbAc	25	<			1	3	T960330B		BLOOD	0.5	
1118	8-911-0374		2	PbAc	25	<			1	3	T960330B		BLOOD	0.5	
1105	8-911-0342		3	PbAc	75				2.4	3	T960330B		BLOOD	2.4	
1123	8-911-0351		3	PbAc	75				2.8	3	T960330B		BLOOD	2.8	
1129	8-911-0372		3	PbAc	75	<			1	3	T960330B		BLOOD	0.5	
1130	8-911-0391		3	PbAc	75				1.9	3	T960330B		BLOOD	1.9	
1144	8-911-0360		3	PbAc	75				1.3	3	T960330B		BLOOD	1.3	
1121	8-911-0377		4	PbAc	225				5.9	3	T960330B		BLOOD	5.9	
1136	8-911-0390		4	PbAc	225				2.7	3	T960330B		BLOOD	2.7	
1138	8-911-0355		4	PbAc	225				4.3	3	T960330B		BLOOD	4.3	
1146	8-911-0356		4	PbAc	225				5.2	3	T960330B		BLOOD	5.2	
1150	8-911-0386		4	PbAc	225				5.4	3	T960330B		BLOOD	5.4	
1106	8-911-0387		5	Murray Res. Soil	75				3.2	3	T960330B		BLOOD	3.2	
1112	8-911-0381		5	Murray Res. Soil	75	<			1	3	T960330B		BLOOD	0.5	
1133	8-911-0389		5	Murray Res. Soil	75				1.5	3	T960330B		BLOOD	1.5	
1142	8-911-0346		5	Murray Res. Soil	75				1.6	3	T960330B		BLOOD	1.6	
1149	8-911-0392		5	Murray Res. Soil	75	<			1	3	T960330B		BLOOD	0.5	
1102	8-911-0362		6	Murray Res. Soil	225				3.2	3	T960330B		BLOOD	3.2	
1122	8-911-0341		6	Murray Res. Soil	225				4.5	3	T960330B		BLOOD	4.5	
1128	8-911-0380		6	Murray Res. Soil	225				3.1	3	T960330B		BLOOD	3.1	
1143	8-911-0344		6	Murray Res. Soil	225				3.3	3	T960330B		BLOOD	3.3	
1154	8-911-0352		6	Murray Res. Soil	225				5.6	3	T960330B		BLOOD	5.6	
1126	8-911-0348		7	Murray Res. Soil	675				8.6	3	T960330B		BLOOD	8.6	
1137	8-911-0359		7	Murray Res. Soil	675				6.1	3	T960330B		BLOOD	6.1	
1140	8-911-0358		7	Murray Res. Soil	675				9.7	3	T960330B		BLOOD	9.7	
1141	8-911-0368		7	Murray Res. Soil	675				6.1	3	T960330B		BLOOD	6.1	
1155	8-911-0364		7	Murray Res. Soil	675				6.9	3	T960330B		BLOOD	6.9	
1109	8-911-0418		1	Control	0				12.6	5	T960330B		BLOOD	12.6	
1124	8-911-0425		1	Control	0	<			1	5	T960330B		BLOOD	0.5	
1135	8-911-0438		1	Control	0	<			1	5	T960330B		BLOOD	0.5	

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pig number	sample	reansample	group	material administered	dosage	qualifier	reanqualifier	reanresult	result	day	source file	reansource	MATRIX	Adjusted Value (ug/dL) ª	Notes
1139	8-911-0434		1	Control	0	<			1	5	T960330B		BLOOD	0.5	
1151	8-911-0417		1	Control	0	<			1	5	T960330B		BLOOD	0.5	
1103	8-911-0415		2	PbAc	25				1	5	T960330B		BLOOD	1	
1104	8-911-0405		2	PbAc	25				1.3	5	T960330B		BLOOD	1.3	
1116	8-911-0399		2	PbAc	25	<			1	5	T960330B		BLOOD	0.5	
1117	8-911-0437		2	PbAc	25				1.8	5	T960330B		BLOOD	1.8	
1118	8-911-0413		2	PbAc	25				1.4	5	T960330B		BLOOD	1.4	
1105	8-911-0442		3	PbAc	75				3.4	5	T960330B		BLOOD	3.4	
1123	8-911-0443		3	PbAc	75				3.9	5	T960330B		BLOOD	3.9	
1129	8-911-0409		3	PbAc	75				2.7	5	T960330B		BLOOD	2.7	
1130	8-911-0398		3	PbAc	75				2.1	5	T960330B		BLOOD	2.1	
1144	8-911-0432		3	PbAc	75				1.9	5	T960330B		BLOOD	1.9	
1121	8-911-0430		4	PbAc	225				9.6	5	T960330B		BLOOD	9.6	
1136	8-911-0397		4	PbAc	225				5.4	5	T960330B		BLOOD	5.4	
1138	8-911-0424		4	PbAc	225				6.5	5	T960330B		BLOOD	6.5	
1146	8-911-0427		4	PbAc	225				8.4	5	T960330B		BLOOD	8.4	
1150	8-911-0407		4	PbAc	225				8.4	5	T960330B		BLOOD	8.4	
1106	8-911-0406		5	Murray Res. Soil	75				2.9	5	T960330B		BLOOD	2.9	
1112	8-911-0447		5	Murray Res. Soil	75				2	5	T960330B		BLOOD	2	
1133	8-911-0426		5	Murray Res. Soil	75				1.9	5	T960330B		BLOOD	1.9	
1142	8-911-0404		5	Murray Res. Soil	75				1.2	5	T960330B		BLOOD	1.2	
1149	8-911-0410		5	Murray Res. Soil	75				2.2	5	T960330B		BLOOD	2.2	
1102	8-911-0436		6	Murray Res. Soil	225				7.6	5	T960330B		BLOOD	7.6	
1122	8-911-0419		6	Murray Res. Soil	225				4.3	5	T960330B		BLOOD	4.3	
1128	8-911-0440		6	Murray Res. Soil	225				6.7	5	T960330B		BLOOD	6.7	
1143	8-911-0449		6	Murray Res. Soil	225				5.7	5	T960330B		BLOOD	5.7	
1154	8-911-0422		6	Murray Res. Soil	225				6.4	5	T960330B		BLOOD	6.4	
1126	8-911-0439		7	Murray Res. Soil	675				9.7	5	T960330B		BLOOD	9.7	
1137	8-911-0446		7	Murray Res. Soil	675				8	5	T960330B		BLOOD	8	
1140	8-911-0421		7	Murray Res. Soil	675				10.5	5	T960330B		BLOOD	10.5	
1141	8-911-0402		7	Murray Res. Soil	675				7.4	5	T960330B		BLOOD	7.4	
1155	8-911-0431		7	Murray Res. Soil	675				8.8	5	T960330B		BLOOD	8.8	
1109	8-911-0453		1	Control	0	<			1	7	T960330B		BLOOD	0.5	
1124	8-911-0485		1	Control	0	<			1	7	T960330B		BLOOD	0.5	
1135	8-911-0479		1	Control	0	<			1	7	T960330B		BLOOD	0.5	
1139	8-911-0466		1	Control	0	<			1	7	T960330B		BLOOD	0.5	
1151	8-911-0492		1	Control	0	<			1	7	T960330B		BLOOD	0.5	
1103	8-911-0471		2	PbAc	25				1.5	7	T960330B		BLOOD	1.5	
1104	8-911-0451		2	PbAc	25				1.5	7	T960330B		BLOOD	1.5	
1116	8-911-0491		2	PbAc	25	<			1	7	T960330B		BLOOD	0.5	
1117	8-911-0464		2	PbAc	25				2.5	7	T960330B		BLOOD	2.5	
1118	8-911-0472		2	PbAc	25				1.2	7	T960330B		BLOOD	1.2	
1105	8-911-0489		3	PbAc	75				3.8	7	T960330B		BLOOD	3.8	
1123	8-911-0501		3	PbAc	75				4.3	7	T960330B		BLOOD	4.3	
1129	8-911-0461		3	PbAc	75				3	7	T960330B		BLOOD	3	
1130	8-911-0454		3	PbAc	75				2.9	7	T960330B		BLOOD	2.9	
1144	8-911-0480		3	PbAc	75				3.1	7	T960330B		BLOOD	3.1	
1121	8-911-0474		4	PbAc	225				7.6	7	T960330B		BLOOD	7.6	
1136	8-911-0496		4	PbAc	225				5.9	7	T960330B		BLOOD	5.9	
1138	8-911-0469		4	PbAc	225				5.9	7	T960330B		BLOOD	5.9	
1146	8-911-0484		4	PbAc	225				8	7	T960330B		BLOOD	8	
1150	8-911-0450		4	PbAc	225				11.7	7	T960330B		BLOOD	11.7	
1106	8-911-0473		5	Murray Res. Soil	75				2.4	7	T960330B		BLOOD	2.4	
1112	8-911-0458		5	Murray Res. Soil	75				2.8	7	T960330B		BLOOD	2.8	
1133	8-911-0483		5	Murray Res. Soil	75				3.1	7	T960330B		BLOOD	3.1	
1142	8-911-0455		5	Murray Res. Soil	75				3.2	7	T960330B		BLOOD	3.2	
1149	8-911-0452		5	Murray Res. Soil	75				2.2	7	T960330B		BLOOD	2.2	
1102	8-911-0482		6	Murray Res. Soil	225				6	7	T960330B		BLOOD	6	
1122	8-911-0475		6	Murray Res. Soil	225				4.7	7	T960330B		BLOOD	4.7	
1128	8-911-0468		6	Murray Res. Soil	225				5.9	7	T960330B		BLOOD	5.9	
1143	8-911-0499		6	Murray Res. Soil	225				5.3	7	T960330B		BLOOD	5.3	

pig number	sample	reansample	group	material administered	dosage	qualifier	reanqualifier	reanresult	result	day	source file	reansource	MATRIX	Adjusted Value (ug/dL) [a]	Notes
1154	8-911-0463		6	Murray Res. Soil	225				8	7	T960330B		BLOOD	8	
1126	8-911-0476		7	Murray Res. Soil	675				10.9	7	T960330B		BLOOD	10.9	
1137	8-911-0481		7	Murray Res. Soil	675				6.7	7	T960330B		BLOOD	6.7	
1140	8-911-0498		7	Murray Res. Soil	675				11.3	7	T960330B		BLOOD	11.3	
1141	8-911-0460		7	Murray Res. Soil	675				7.5	7	T960330B		BLOOD	7.5	
1155	8-911-0497		7	Murray Res. Soil	675				7.9	7	T960330B		BLOOD	7.9	
1109	8-911-0533		1	Control	0	<			1	9	T960330B		BLOOD	0.5	
1124	8-911-0546		1	Control	0	<			1	9	T960330B		BLOOD	0.5	
1135	8-911-0510		1	Control	0	<			1	9	T960330B		BLOOD	0.5	
1139	8-911-0556		1	Control	0	<			1	9	T960410B		BLOOD	0.5	
1151	8-911-0527		1	Control	0	<			1	9	T960330B		BLOOD	0.5	
1103	8-911-0543		2	PbAc	25				1.6	9	T960330B		BLOOD	1.6	
1104	8-911-0524		2	PbAc	25	<			1	9	T960330B		BLOOD	0.5	
1116	8-911-0551		2	PbAc	25	<			1	9	T960410B		BLOOD	0.5	
1117	8-911-0507		2	PbAc	25				3.3	9	T960330B		BLOOD	3.3	
1118	8-911-0536		2	PbAc	25				2.1	9	T960330B		BLOOD	2.1	
1105	8-911-0559		3	PbAc	75				3.4	9	T960410B		BLOOD	3.4	
1123	8-911-0544		3	PbAc	75				3.3	9	T960330B		BLOOD	3.3	
1129	8-911-0534		3	PbAc	75				3.9	9	T960330B		BLOOD	3.9	
1130	8-911-0520		3	PbAc	75				3.1	9	T960330B		BLOOD	3.1	
1144	8-911-0553		3	PbAc	75				2.8	9	T960410B		BLOOD	2.8	
1121	8-911-0542		4	PbAc	225				8.8	9	T960330B		BLOOD	8.8	
1136	8-911-0511		4	PbAc	225				5.8	9	T960330B		BLOOD	5.8	
1138	8-911-0547		4	PbAc	225				4.9	9	T960330B		BLOOD	4.9	
1146	8-911-0529		4	PbAc	225				8.3	9	T960330B		BLOOD	8.3	
1150	8-911-0521		4	PbAc	225				10.3	9	T960330B		BLOOD	10.3	
1106	8-911-0535		5	Murray Res. Soil	75				2.9	9	T960330B		BLOOD	2.9	
1112	8-911-0554		5	Murray Res. Soil	75				2.8	9	T960410B		BLOOD	2.8	
1133	8-911-0509		5	Murray Res. Soil	75				3.5	9	T960330B		BLOOD	3.5	
1142	8-911-0549		5	Murray Res. Soil	75				1.9	9	T960410B		BLOOD	1.9	
1149	8-911-0512		5	Murray Res. Soil	75				2.4	9	T960330B		BLOOD	2.4	
1102	8-911-0513		6	Murray Res. Soil	225				7	9	T960330B		BLOOD	7	
1122	8-911-0545		6	Murray Res. Soil	225				5.6	9	T960330B		BLOOD	5.6	
1128	8-911-0552		6	Murray Res. Soil	225				5.4	9	T960410B		BLOOD	5.4	
1143	8-911-0515		6	Murray Res. Soil	225				5.5	9	T960330B		BLOOD	5.5	
1154	8-911-0532		6	Murray Res. Soil	225				6.5	9	T960330B		BLOOD	6.5	
1126	8-911-0523		7	Murray Res. Soil	675				11.7	9	T960330B		BLOOD	11.7	
1137	8-911-0557		7	Murray Res. Soil	675				7.6	9	T960410B		BLOOD	7.6	
1140	8-911-0516		7	Murray Res. Soil	675				11.7	9	T960330B		BLOOD	11.7	
1141	8-911-0518		7	Murray Res. Soil	675				9.2	9	T960330B		BLOOD	9.2	
1155	8-911-0530		7	Murray Res. Soil	675				7	9	T960330B		BLOOD	7	
1109	8-911-0585		1	Control	0	<			1	12	T960410B		BLOOD	0.5	
1124	8-911-0595		1	Control	0	<			1	12	T960410B		BLOOD	0.5	
1135	8-911-0566		1	Control	0	<			1	12	T960410B		BLOOD	0.5	
1139	8-911-0573		1	Control	0	<			1	12	T960410B		BLOOD	0.5	
1151	8-911-0600		1	Control	0	<			1	12	T960410B		BLOOD	0.5	
1103	8-911-0580		2	PbAc	25	<			1	12	T960410B		BLOOD	0.5	
1104	8-911-0564		2	PbAc	25				1.2	12	T960410B		BLOOD	1.2	
1116	8-911-0574		2	PbAc	25	<			1	12	T960410B		BLOOD	0.5	
1117	8-911-0578		2	PbAc	25				3.5	12	T960410B		BLOOD	3.5	
1118	8-911-0588		2	PbAc	25				2.5	12	T960410B		BLOOD	2.5	
1105	8-911-0593		3	PbAc	75				5	12	T960410B		BLOOD	5	
1123	8-911-0599		3	PbAc	75				3.7	12	T960410B		BLOOD	3.7	
1129	8-911-0612		3	PbAc	75				5.1	12	T960410B		BLOOD	5.1	
1130	8-911-0571		3	PbAc	75				3.8	12	T960410B		BLOOD	3.8	
1144	8-911-0610		3	PbAc	75				3.8	12	T960410B		BLOOD	3.8	
1121	8-911-0570		4	PbAc	225				9.5	12	T960410B		BLOOD	9.5	
1136	8-911-0611		4	PbAc	225				6.4	12	T960410B		BLOOD	6.4	
1138	8-911-0581		4	PbAc	225				7.3	12	T960410B		BLOOD	7.3	
1146	8-911-0607		4	PbAc	225				8.3	12	T960410B		BLOOD	8.3	
1150	8-911-0609		4	PbAc	225				10.9	12	T960410B		BLOOD	10.9	

pig number	sample	reansample	group	material administered	dosage	qualifier	reanqualifier	reanresult	result	day	source file	reansource	MATRIX	Adjusted Value (ug/dL) [a]	Notes
1106	8-911-0565		5	Murray Res. Soil	75				3.1	12	T960410B		BLOOD	3.1	
1112	8-911-0567		5	Murray Res. Soil	75				2.8	12	T960410B		BLOOD	2.8	
1133	8-911-0561		5	Murray Res. Soil	75				3.1	12	T960410B		BLOOD	3.1	
1142	8-911-0568		5	Murray Res. Soil	75				3	12	T960410B		BLOOD	3	
1149	8-911-0579		5	Murray Res. Soil	75				1.7	12	T960410B		BLOOD	1.7	
1102	8-911-0602		6	Murray Res. Soil	225				7	12	T960410B		BLOOD	7	
1122	8-911-0575		6	Murray Res. Soil	225				4.5	12	T960410B		BLOOD	4.5	
1128	8-911-0590		6	Murray Res. Soil	225				7.5	12	T960410B		BLOOD	7.5	
1143	8-911-0569		6	Murray Res. Soil	225				6.4	12	T960410B		BLOOD	6.4	
1154	8-911-0584		6	Murray Res. Soil	225				8	12	T960410B		BLOOD	8	
1126	8-911-0572		7	Murray Res. Soil	675				11.5	12	T960410B		BLOOD	11.5	
1137	8-911-0606		7	Murray Res. Soil	675				9.1	12	T960410B		BLOOD	9.1	
1140	8-911-0603		7	Murray Res. Soil	675				11.4	12	T960410B		BLOOD	11.4	
1141	8-911-0594		7	Murray Res. Soil	675				8.9	12	T960410B		BLOOD	8.9	
1155	8-911-0562		7	Murray Res. Soil	675				8.1	12	T960410B		BLOOD	8.1	
1109	8-911-0633		1	Control	0	<			1	15	T960410B		BLOOD	0.5	
1124	8-911-0659		1	Control	0	<			1	15	T960410B		BLOOD	0.5	
1135	8-911-0638		1	Control	0	<			1	15	T960410B		BLOOD	0.5	
1139	8-911-0622		1	Control	0	<			1	15	T960410B		BLOOD	0.5	
1151	8-911-0627		1	Control	0	<			1	15	T960410B		BLOOD	0.5	
1103	8-911-0666		2	PbAc	25				2.1	15	T960410B		BLOOD	2.1	
1104	8-911-0637		2	PbAc	25				1.6	15	T960410B		BLOOD	1.6	
1116	8-911-0665		2	PbAc	25				1.4	15	T960410B		BLOOD	1.4	
1117	8-911-0653		2	PbAc	25				3.2	15	T960410B		BLOOD	3.2	
1118	8-911-0652		2	PbAc	25				2.9	15	T960410B		BLOOD	2.9	
1105	8-911-0660		3	PbAc	75				4.4	15	T960410B		BLOOD	4.4	
1123	8-911-0628		3	PbAc	75				3.8	15	T960410B		BLOOD	3.8	
1129	8-911-0631		3	PbAc	75				4.9	15	T960410B		BLOOD	4.9	
1130	8-911-0643		3	PbAc	75				4.9	15	T960410B		BLOOD	4.9	
1144	8-911-0632		3	PbAc	75				4	15	T960410B		BLOOD	4	
1121	8-911-0636		4	PbAc	225				10.8	15	T960410B		BLOOD	10.8	
1136	8-911-0650		4	PbAc	225				7.4	15	T960410B		BLOOD	7.4	
1138	8-911-0619		4	PbAc	225				8.4	15	T960410B		BLOOD	8.4	
1146	8-911-0657		4	PbAc	225				9.8	15	T960410B		BLOOD	9.8	
1150	8-911-0664		4	PbAc	225				10.8	15	T960410B		BLOOD	10.8	
1106	8-911-0662		5	Murray Res. Soil	75				6.9	15	T960410B		BLOOD	6.9	
1112	8-911-0656		5	Murray Res. Soil	75				4.3	15	T960410B		BLOOD	4.3	
1133	8-911-0621		5	Murray Res. Soil	75				4.1	15	T960410B		BLOOD	4.1	
1142	8-911-0669		5	Murray Res. Soil	75				4.1	15	T960410B		BLOOD	4.1	
1149	8-911-0646		5	Murray Res. Soil	75				3.4	15	T960410B		BLOOD	3.4	
1102	8-911-0661		6	Murray Res. Soil	225				5.4	15	T960410B		BLOOD	5.4	
1122	8-911-0634		6	Murray Res. Soil	225				6.3	15	T960410B		BLOOD	6.3	
1128	8-911-0620		6	Murray Res. Soil	225				8.7	15	T960410B		BLOOD	8.7	
1143	8-911-0663		6	Murray Res. Soil	225				7.1	15	T960410B		BLOOD	7.1	
1154	8-911-0617		6	Murray Res. Soil	225				9.2	15	T960410B		BLOOD	9.2	
1126	8-911-0630		7	Murray Res. Soil	675				11	15	T960410B		BLOOD	11	
1137	8-911-0658		7	Murray Res. Soil	675				10.5	15	T960410B		BLOOD	10.5	
1140	8-911-0651		7	Murray Res. Soil	675				12.7	15	T960410B		BLOOD	12.7	
1141	8-911-0668		7	Murray Res. Soil	675				10	15	T960410B		BLOOD	10	
1155	8-911-0624		7	Murray Res. Soil	675				10.2	15	T960410B		BLOOD	10.2	

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

Flagged Data Points
Outliers

test material	target dosage	Actual Dose*	group	pig#	BLOOD LEAD (ug/dL) BY DAY -4	0	1	2	3	5	7	9	12	15
Control	0	0.00	1	1109	0.5	0.5	0.5	0.5	0.5	12.6	0.5	0.5	0.5	0.5
Control	0	0.00	1	1124	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Control	0	0.00	1	1135	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Control	0	0.00	1	1139	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Control	0	0.00	1	1151	0.5	1.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
PbAc	25	28.07	2	1103	0.5	0.5	0.5	0.5	1.1	1	1.5	1.6	0.5	2.1
PbAc	25	27.79	2	1104	0.5	0.5	0.5	0.5	1	1.3	1.5	0.5	1.2	1.6
PbAc	25	26.95	2	1116	0.5	0.5	0.5	0.5	1.6	0.5	0.5	0.5	0.5	1.4
PbAc	25	28.98	2	1117	1.2	0.5	0.5	0.5	0.5	1.8	2.5	3.3	3.5	3.2
PbAc	25	26.80	2	1118	0.5	0.5	5.8	0.5	0.5	1.4	1.2	2.1	2.5	2.9
PbAc	75	80.74	3	1105	0.5	0.5	0.5	1.3	2.4	3.4	3.8	3.4	5	4.4
PbAc	75	80.66	3	1123	0.5	0.5	0.5	2.7	2.8	3.9	4.3	3.3	3.7	3.8
PbAc	75	79.01	3	1129	0.5	0.5	0.5	1.2	0.5	2.7	3	3.9	5.1	4.9
PbAc	75	71.00	3	1130	0.5	0.5	0.5	2.8	1.9	2.1	2.9	3.1	3.8	4.9
PbAc	75	80.29	3	1144	0.5	0.5	0.5	1.4	1.3	1.9	3.1	2.8	3.8	4
PbAc	225	229.76	4	1121	0.5	0.5	3.3	5.9	5.9	9.6	7.6	8.8	9.5	10.8
PbAc	225	259.69	4	1136	0.5	0.5	1.4	2.9	2.7	5.4	5.9	5.8	6.4	7.4
PbAc	225	245.48	4	1138	0.5	0.5	2	3.4	4.3	6.5	5.9	4.9	7.3	8.4
PbAc	225	214.31	4	1146	0.5	0.5	3.6	5.2	5.2	8.4	8	8.3	8.3	9.8
PbAc	225	215.95	4	1150	0.5	0.5	4.5	6.2	5.4	8.4	11.7	10.3	10.9	10.8
Murray Soil	75	68.10	5	1106	0.5	0.5	2.6	2.7	3.2	2.9	2.4	2.9	3.1	6.9
Murray Soil	75	79.64	5	1112	0.5	0.5	0.5	0.5	0.5	2	2.8	2.8	2.8	4.3
Murray Soil	75	83.05	5	1133	0.5	0.5	1.1	2.1	1.5	1.9	3.1	3.5	3.1	4.1
Murray Soil	75	85.50	5	1142	0.5	0.5	0.5	1.8	1.6	1.2	3.2	1.9	3	4.1
Murray Soil	75	75.78	5	1149	0.5	0.5	0.5	2.4	0.5	2.2	2.2	2.4	1.7	3.4
Murray Soil	225	211.75	6	1102	0.5	0.5	2.4	5.1	3.2	7.6	6	7	7	5.4
Murray Soil	225	267.79	6	1122	0.5	0.5	1.5	5	4.5	4.3	4.7	5.6	4.5	6.3
Murray Soil	225	225.06	6	1128	0.5	0.5	1.9	3.8	3.1	6.7	5.9	5.4	7.5	8.7
Murray Soil	225	252.69	6	1143	0.5	0.5	1.2	3.4	3.3	5.7	5.3	5.5	6.4	7.1
Murray Soil	225	220.19	6	1154	0.5	0.5	2.7	5.8	5.6	6.4	8	6.5	8	9.2
Murray Soil	675	787.94	7	1126	0.5	0.5	5.2	7.9	8.6	9.7	10.9	11.7	11.5	11
Murray Soil	675	690.84	7	1137	0.5	0.5	3.2	6.4	6.1	8	6.7	7.6	9.1	10.5
Murray Soil	675	686.29	7	1140	1.4	0.5	4.4	9.2	9.7	10.5	11.3	11.7	11.4	12.7
Murray Soil	675	648.15	7	1141	0.5	1.6	2.9	5.8	6.1	7.4	7.5	9.2	8.9	10
Murray Soil	675	693.46	7	1155	0.5	1.2	4.1	6.5	6.9	8.8	7.9	7	8.1	10.2

*** Average Time and Weight-Adjusted Dose for Each Pig**

TABLE A-5 RATIONALE FOR PbB OUTLIER DECISIONS

Pig # 1118 Group 2 Day 1	The measured value for this data point was 12.6. This was deemed anomalous based on the individual animals dose-response trend, and based on values for other animals in this group. This animal was in the control group and was not expected to have this rise in blood lead. The value was interpolated to 0.5.
Pig # 1118 Group 2 Day 1	The measured value for this data point was 5.8. This was deemed anomalous based on the individual animals dose-response trend, and based on values for other animals in this group. All animals in group 2 had non-detect levels of blood lead on days 0, 1, and 2 with the exception of #1118. This value was interpolated to 0.5.

TABLE A-6 Area Under Curve Determinations

Calculated using interpolated values for excluded data as noted in Table A-5

		AUC (ug/dL-days) For Time Span Shown								
group	pig#	0-1	1-2	2-3	3-5	5-7	7-9	9-12	12-15	AUC Total (ug/dL-days)
1	1109	0.50	0.50	0.50	1.00	1.00	1.00	1.50	1.50	7.50
1	1124	0.50	0.50	0.50	1.00	1.00	1.00	1.50	1.50	7.50
1	1135	0.50	0.50	0.50	1.00	1.00	1.00	1.50	1.50	7.50
1	1139	0.50	0.50	0.50	1.00	1.00	1.00	1.50	1.50	7.50
1	1151	0.80	0.50	0.50	1.00	1.00	1.00	1.50	1.50	7.80
2	1103	0.50	0.50	0.80	2.10	2.50	3.10	3.15	3.90	16.55
2	1104	0.50	0.50	0.75	2.30	2.80	2.00	2.55	4.20	15.60
2	1116	0.50	0.50	1.05	2.10	1.00	1.00	1.50	2.85	10.50
2	1117	0.50	0.50	0.50	2.30	4.30	5.80	10.20	10.05	34.15
2	1118	0.50	0.50	0.50	1.90	2.60	3.30	6.90	8.10	24.30
3	1105	0.50	0.90	1.85	5.80	7.20	7.20	12.60	14.10	50.15
3	1123	0.50	1.60	2.75	6.70	8.20	7.60	10.50	11.25	49.10
3	1129	0.50	0.85	0.85	3.20	5.70	6.90	13.50	15.00	46.50
3	1130	0.50	1.65	2.35	4.00	5.00	6.00	10.35	13.05	42.90
3	1144	0.50	0.95	1.35	3.20	5.00	5.90	9.90	11.70	38.50
4	1121	1.90	4.60	5.90	15.50	17.20	16.40	27.45	30.45	119.40
4	1136	0.95	2.15	2.80	8.10	11.30	11.70	18.30	20.70	76.00
4	1138	1.25	2.70	3.85	10.80	12.40	10.80	18.30	23.55	83.65
4	1146	2.05	4.40	5.20	13.60	16.40	16.30	24.90	27.15	110.00
4	1150	2.50	5.35	5.80	13.80	20.10	22.00	31.80	32.55	133.90
5	1106	1.55	2.65	2.95	6.10	5.30	5.30	9.00	15.00	47.85
5	1112	0.50	0.50	0.50	2.50	4.80	5.60	8.40	10.65	33.45
5	1133	0.80	1.60	1.80	3.40	5.00	6.60	9.90	10.80	39.90
5	1142	0.50	1.15	1.70	2.80	4.40	5.10	7.35	10.65	33.65
5	1149	0.50	1.45	1.45	2.70	4.40	4.60	6.15	7.65	28.90
6	1102	1.45	3.75	4.15	10.80	13.60	13.00	21.00	18.60	86.35
6	1122	1.00	3.25	4.75	8.80	9.00	10.30	15.15	16.20	68.45
6	1128	1.20	2.85	3.45	9.80	12.60	11.30	19.35	24.30	84.85
6	1143	0.85	2.30	3.35	9.00	11.00	10.80	17.85	20.25	75.40
6	1154	1.60	4.25	5.70	12.00	14.40	14.50	21.75	25.80	100.00
7	1126	2.85	6.55	8.25	18.30	20.60	22.60	34.80	33.75	147.70
7	1137	1.85	4.80	6.25	14.10	14.70	14.30	25.05	29.40	110.45
7	1140	2.45	6.80	9.45	20.20	21.80	23.00	34.65	36.15	154.50
7	1141	2.25	4.35	5.95	13.50	14.90	16.70	27.15	28.35	113.15
7	1155	2.65	5.30	6.70	15.70	16.70	14.90	22.65	27.45	112.05

TABLE A - 7 TISSUE LEAD DATA

xperiment 11 (Data not shown for groups 8, 9, & 10)

pig number	sample	group	material administered	dosage	qualifier	result	day	source file	MATRIX	Adjusted Value [a]	Notes
1109	8-911-0843	1	Control	0		3.2	15	T960501F	FEMUR	1.6	
1124	8-911-0836	1	Control	0	<	2	15	T960501F	FEMUR	0.5	
1135	8-911-0832	1	Control	0	<	2	15	T960501F	FEMUR	0.5	
1139	8-911-0851	1	Control	0	<	2	15	T960501F	FEMUR	0.5	
1151	8-911-0812	1	Control	0	<	2	15	T960501F	FEMUR	0.5	
1103	8-911-0831	2	PbAc	25		2.4	15	T960501F	FEMUR	1.2	
1104	8-911-0856	2	PbAc	25		3.8	15	T960501F	FEMUR	1.9	
1116	8-911-0828	2	PbAc	25		3.2	15	T960501F	FEMUR	1.6	
1117	8-911-0842	2	PbAc	25		4.8	15	T960501F	FEMUR	2.4	
1118	8-911-0855	2	PbAc	25		4.2	15	T960501F	FEMUR	2.1	
1105	8-911-0859	3	PbAc	75		9.3	15	T960501F	FEMUR	4.65	
1123	8-911-0825	3	PbAc	75		7.2	15	T960501F	FEMUR	3.6	
1129	8-911-0833	3	PbAc	75		12	15	T960501F	FEMUR	6	
1130	8-911-0844	3	PbAc	75		8.5	15	T960501F	FEMUR	4.25	
1144	8-911-0848	3	PbAc	75		8.1	15	T960501F	FEMUR	4.05	
1121	8-911-0822	4	PbAc	225		38.8	15	T960501F	FEMUR	19.4	
1136	8-911-0829	4	PbAc	225		23.5	15	T960501F	FEMUR	11.75	
1138	8-911-0837	4	PbAc	225		26.3	15	T960501F	FEMUR	13.15	
1146	8-911-0864	4	PbAc	225		31.5	15	T960501F	FEMUR	15.75	
1150	8-911-0816	4	PbAc	225		33.4	15	T960501F	FEMUR	16.7	
1106	8-911-0815	5	Murray Res. Soil	75		4.1	15	T960501F	FEMUR	2.05	
1112	8-911-0850	5	Murray Res. Soil	75		7.4	15	T960501F	FEMUR	3.7	
1133	8-911-0830	5	Murray Res. Soil	75		8.6	15	T960501F	FEMUR	4.3	
1142	8-911-0845	5	Murray Res. Soil	75		6.2	15	T960501F	FEMUR	3.1	
1149	8-911-0835	5	Murray Res. Soil	75		5.2	15	T960501F	FEMUR	2.6	
1102	8-911-0823	6	Murray Res. Soil	225		14.9	15	T960501F	FEMUR	7.45	
1122	8-911-0817	6	Murray Res. Soil	225		12	15	T960501F	FEMUR	6	
1128	8-911-0840	6	Murray Res. Soil	225		12.7	15	T960501F	FEMUR	6.35	
1143	8-911-0862	6	Murray Res. Soil	225		15.1	15	T960501F	FEMUR	7.55	
1154	8-911-0858	6	Murray Res. Soil	225		18.3	15	T960501F	FEMUR	9.15	
1126	8-911-0821	7	Murray Res. Soil	675		26.4	15	T960501F	FEMUR	13.2	
1137	8-911-0834	7	Murray Res. Soil	675		23.6	15	T960501F	FEMUR	11.8	
1140	8-911-0841	7	Murray Res. Soil	675		31.7	15	T960501F	FEMUR	15.85	
1141	8-911-0852	7	Murray Res. Soil	675		25	15	T960501F	FEMUR	12.5	
1155	8-911-0818	7	Murray Res. Soil	675		20.3	15	T960501F	FEMUR	10.15	
1109	8-911-0800	1	Control	0		1.3	15	T960420K	KIDNEY	13	
1124	8-911-0772	1	Control	0		2.9	15	T960420K	KIDNEY	29	
1135	8-911-0760	1	Control	0		3	15	T960420K	KIDNEY	30	
1139	8-911-0765	1	Control	0	<	2	15	T960420K	KIDNEY	10	
1151	8-911-0805	1	Control	0		1.5	15	T960420K	KIDNEY	15	
1103	8-911-0778	2	PbAc	25		3.6	15	T960420K	KIDNEY	36	
1104	8-911-0796	2	PbAc	25		14.4	15	T960420K	KIDNEY	144	
1116	8-911-0783	2	PbAc	25		3.1	15	T960420K	KIDNEY	31	
1117	8-911-0759	2	PbAc	25		3.5	15	T960420K	KIDNEY	35	
1118	8-911-0787	2	PbAc	25		14.8	15	T960420K	KIDNEY	148	
1105	8-911-0785	3	PbAc	75		9.4	15	T960420K	KIDNEY	94	
1123	8-911-0761	3	PbAc	75		12.3	15	T960420K	KIDNEY	123	
1129	8-911-0802	3	PbAc	75		22.8	15	T960420K	KIDNEY	228	
1130	8-911-0781	3	PbAc	75		10	15	T960420K	KIDNEY	100	
1144	8-911-0762	3	PbAc	75		16.3	15	T960420K	KIDNEY	163	
1121	8-911-0797	4	PbAc	225		59.9	15	T960420K	KIDNEY	599	
1136	8-911-0770	4	PbAc	225		29.5	15	T960420K	KIDNEY	295	
1138	8-911-0801	4	PbAc	225		30.2	15	T960420K	KIDNEY	302	
1146	8-911-0771	4	PbAc	225		27	15	T960420K	KIDNEY	270	
1150	8-911-0792	4	PbAc	225		59.9	15	T960420K	KIDNEY	599	
1106	8-911-0804	5	Murray Res. Soil	75		11.4	15	T960420K	KIDNEY	114	
1112	8-911-0793	5	Murray Res. Soil	75		16.1	15	T960420K	KIDNEY	161	
1133	8-911-0773	5	Murray Res. Soil	75		13.5	15	T960420K	KIDNEY	135	
1142	8-911-0811	5	Murray Res. Soil	75		12.9	15	T960420K	KIDNEY	129	
1149	8-911-0807	5	Murray Res. Soil	75		7.8	15	T960420K	KIDNEY	78	
1102	8-911-0776	6	Murray Res. Soil	225		19.2	15	T960420K	KIDNEY	192	
1122	8-911-0803	6	Murray Res. Soil	225		18.3	15	T960420K	KIDNEY	183	
1128	8-911-0809	6	Murray Res. Soil	225		29.6	15	T960420K	KIDNEY	296	
1143	8-911-0788	6	Murray Res. Soil	225		17.4	15	T960420K	KIDNEY	174	
1154	8-911-0795	6	Murray Res. Soil	225		30.9	15	T960420K	KIDNEY	309	
1126	8-911-0794	7	Murray Res. Soil	675		27.7	15	T960420K	KIDNEY	277	
1137	8-911-0790	7	Murray Res. Soil	675		44.5	15	T960420K	KIDNEY	445	
1140	8-911-0806	7	Murray Res. Soil	675		52.4	15	T960420K	KIDNEY	524	
1141	8-911-0774	7	Murray Res. Soil	675		25.6	15	T960420K	KIDNEY	256	
1155	8-911-0789	7	Murray Res. Soil	675		27.2	15	T960420K	KIDNEY	272	
1109	8-911-0750	1	Control	0	<	2	15	T960420L	LIVER	10	
1124	8-911-0730	1	Control	0		2.6	15	T960420L	LIVER	26	
1135	8-911-0744	1	Control	0	<	2	15	T960420L	LIVER	10	
1139	8-911-0716	1	Control	0	<	2	15	T960420L	LIVER	10	
1151	8-911-0706	1	Control	0	<	2	15	T960420L	LIVER	10	
1103	8-911-0708	2	PbAc	25		6	15	T960420L	LIVER	60	
1104	8-911-0735	2	PbAc	25		11.3	15	T960420L	LIVER	113	
1116	8-911-0738	2	PbAc	25		2.4	15	T960420L	LIVER	24	
1117	8-911-0722	2	PbAc	25		3.2	15	T960420L	LIVER	32	
1118	8-911-0752	2	PbAc	25		10	15	T960420L	LIVER	100	

pig number	sample	group	material administered	dosage	qualifier	result	day	source file	MATRIX	Adjusted Value [a]	Notes
1105	8-911-0732	3	PbAc	75		6.7	15	T960420L	LIVER	67	
1123	8-911-0740	3	PbAc	75		5.2	15	T960420L	LIVER	52	
1129	8-911-0756	3	PbAc	75		14.5	15	T960420L	LIVER	145	
1130	8-911-0748	3	PbAc	75		7.4	15	T960420L	LIVER	74	
1144	8-911-0754	3	PbAc	75		17.7	15	T960420L	LIVER	177	
1121	8-911-0741	4	PbAc	225		46	15	T960420L	LIVER	460	
1136	8-911-0727	4	PbAc	225		17.8	15	T960420L	LIVER	178	
1138	8-911-0720	4	PbAc	225		34	15	T960420L	LIVER	340	
1146	8-911-0747	4	PbAc	225		22.3	15	T960420L	LIVER	223	
1150	8-911-0717	4	PbAc	225		41	15	T960420L	LIVER	410	
1106	8-911-0737	5	Murray Res. Soil	75		6.5	15	T960420L	LIVER	65	
1112	8-911-0710	5	Murray Res. Soil	75		11.8	15	T960420L	LIVER	118	
1133	8-911-0719	5	Murray Res. Soil	75		11.8	15	T960420L	LIVER	118	
1142	8-911-0745	5	Murray Res. Soil	75		7.5	15	T960420L	LIVER	75	
1149	8-911-0736	5	Murray Res. Soil	75		7.1	15	T960420L	LIVER	71	
1102	8-911-0753	6	Murray Res. Soil	225		16.2	15	T960420L	LIVER	162	
1122	8-911-0714	6	Murray Res. Soil	225		23.6	15	T960420L	LIVER	236	
1128	8-911-0709	6	Murray Res. Soil	225		28.2	15	T960420L	LIVER	282	
1143	8-911-0724	6	Murray Res. Soil	225		24	15	T960420L	LIVER	240	
1154	8-911-0749	6	Murray Res. Soil	225		29.6	15	T960420L	LIVER	296	
1126	8-911-0723	7	Murray Res. Soil	675		44.6	15	T960420L	LIVER	446	
1137	8-911-0733	7	Murray Res. Soil	675		44.2	15	T960420L	LIVER	442	
1140	8-911-0713	7	Murray Res. Soil	675		64	15	T960420L	LIVER	640	
1141	8-911-0758	7	Murray Res. Soil	675		30.7	15	T960420L	LIVER	307	
1155	8-911-0718	7	Murray Res. Soil	675		35	15	T960420L	LIVER	350	

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

[box] Selected Outliers

test material	target dosage	Actual Dose*	group	pig#	MEASUREMENT ENDPOINT Blood	Femur	Liver	Kidney
Control	0	0.00	1	**1109**	7.5	1.6	10	13
Control	0	0.00	1	**1124**	7.5	0.5	26	29
Control	0	0.00	1	**1135**	7.5	0.5	10	30
Control	0	0.00	1	**1139**	7.5	0.5	10	10
Control	0	0.00	1	**1151**	7.8	0.5	10	15
PbAc	25	28.07	2	**1103**	16.6	1.2	60	36
PbAc	25	27.79	2	**1104**	15.6	1.9	113	144
PbAc	25	26.95	2	**1116**	10.5	1.6	24	31
PbAc	25	28.98	2	**1117**	34.2	2.4	32	35
PbAc	25	26.80	2	**1118**	24.3	2.1	100	148
PbAc	75	80.74	3	**1105**	50.2	4.65	67	94
PbAc	75	80.66	3	**1123**	49.1	3.6	52	123
PbAc	75	79.01	3	**1129**	46.5	6	145	228
PbAc	75	71.00	3	**1130**	42.9	4.25	74	100
PbAc	75	80.29	3	**1144**	38.5	4.05	177	163
PbAc	225	229.76	4	**1121**	119.4	[19.4] b	460	599
PbAc	225	259.69	4	**1136**	76.0	[11.75] b	[178] b	295
PbAc	225	245.48	4	**1138**	83.7	13.15	340	302
PbAc	225	214.31	4	**1146**	110.0	15.75	223	270
PbAc	225	215.95	4	**1150**	[133.9] b	16.7	410	[599] b
Murray Soil	75	68.10	5	**1106**	47.9	2.05	65	114
Murray Soil	75	79.64	5	**1112**	33.5	3.7	118	161
Murray Soil	75	83.05	5	**1133**	39.9	4.3	118	135
Murray Soil	75	85.50	5	**1142**	33.7	3.1	75	129
Murray Soil	75	75.78	5	**1149**	28.9	2.6	71	78
Murray Soil	225	211.75	6	**1102**	86.4	7.45	162	192
Murray Soil	225	267.79	6	**1122**	68.5	6	236	183
Murray Soil	225	225.06	6	**1128**	84.9	6.35	282	296
Murray Soil	225	252.69	6	**1143**	75.4	7.55	240	174
Murray Soil	225	220.19	6	**1154**	100.0	9.15	296	309
Murray Soil	675	787.94	7	**1126**	147.7	13.2	446	277
Murray Soil	675	690.84	7	**1137**	110.5	11.8	442	445
Murray Soil	675	686.29	7	**1140**	154.5	[15.85] b	[640] b	[524] b
Murray Soil	675	648.15	7	**1141**	113.2	12.5	307	256
Murray Soil	675	693.46	7	**1155**	112.1	10.15	350	272

a *a priori* outlier determinations (none selected in this study)
b Outside 95% Prediction Intervals

TABLE A-9 CALCULATION OF RBA FOR Murray Soil

For Curve Comparison the following methods are used

1. For a series of doses, curve fit parameters are used to determine the response from test material
2. For each response calculated, the dose of Reference material which would result in the same response is calculated
3. The ratio of the doses is then used to calculate RBA (Ref Dose/Test Dose)

Curve Fit Parameters (from previous worksheet)

Blood		Bone		Liver		Kidney	
PbAc		PbAc		PbAc		PbAc	
a	6.48	a	0.46	a	5.96	a	22.53
b	0	b	0.0623	b	1.526	b	1.454
c	152.4	c	0	c	0	c	0
d	0.0045	d	0	d	0	d	0
Soil		Soil		Soil		Soil	
a	6.48	a	0.46	a	5.96	a	22.53
b	0	b	0	b	0	b	0
c	133	c	12.83	c	431.8	c	293.3
d	0.0035	d	0.0032	d	0.0032	d	0.0054

TRUNCATION LIMITS

	Dose Range Blood				Dose Range Bone				Dose Range Liver				Dose Range Kidney		
3xLow Res	22.68	Dose PbAc	24.97	3xLow Resp	2.16	Dose PbAc	27.29	3xLow Res	39.6	Dose PbAc	22.04	3xLow Res	58.2	Dose PbAc	24.53
HighResp	119.4	Dose Soil	540.18	HighResp	16.7	Dose Soil	675	HighResp	460	Dose Soil	675	HighResp	599	Dose Soil	675

Curve Fit RBA

Blood

Dose	Resp Soil	Dose PbAc	AUC RBA
24.97	17.61	16.86	0.67
30	19.74	20.22	0.67
40	23.86	26.90	0.67
50	27.83	33.54	0.67
60	31.67	40.15	0.67
70	35.38	46.73	0.67
80	38.96	53.26	0.67
90	42.42	59.77	0.66
100	45.76	66.23	0.66
110	48.98	72.65	0.66
120	52.09	79.04	0.66
130	55.10	85.38	0.66
140	58.00	91.69	0.65
150	60.80	97.95	0.65
160	63.51	104.16	0.65
170	66.12	110.34	0.65
180	68.65	116.47	0.65
190	71.08	122.55	0.64
200	73.43	128.58	0.64
210	75.71	134.57	0.64
220	77.90	140.51	0.64
230	80.02	146.40	0.64
240	82.06	152.24	0.63
250	84.04	158.03	0.63
260	85.94	163.76	0.63
270	87.79	169.44	0.63
280	89.56	175.07	0.63
290	91.28	180.65	0.62
300	92.94	186.16	0.62
310	94.54	191.63	0.62
320	96.08	197.03	0.62
330	97.58	202.37	0.61
340	99.02	207.66	0.61
350	100.41	212.89	0.61
360	101.75	218.06	0.61
370	103.05	223.16	0.60
380	104.30	228.21	0.60
390	105.51	233.19	0.60
400	106.68	238.11	0.60
410	107.81	242.96	0.59
420	108.90	247.75	0.59
430	109.95	252.48	0.59
440	110.97	257.14	0.58
450	111.95	261.74	0.58
460	112.89	266.26	0.58
470	113.81	270.73	0.58
480	114.69	275.12	0.57
490	115.54	279.45	0.57
500	116.37	283.72	0.57
510	117.16	287.91	0.56
520	117.93	292.04	0.56
530	118.67	296.10	0.56
540.18	119.40	300.16	0.56

Bone

Dose	Resp Soil	Dose PbAc	Bone RBA
27.29	1.53	17.22	0.63
40	2.00	24.74	0.62
50	2.36	30.45	0.61
60	2.70	35.98	0.60
70	3.03	41.33	0.59
80	3.36	46.51	0.58
90	3.67	51.53	0.57
100	3.97	56.40	0.56
110	4.27	61.11	0.56
120	4.55	65.67	0.55
130	4.83	70.09	0.54
140	5.09	74.36	0.53
150	5.35	78.51	0.52
160	5.60	82.52	0.52
170	5.84	86.41	0.51
180	6.08	90.17	0.50
190	6.30	93.82	0.49
200	6.52	97.35	0.49
210	6.74	100.77	0.48
220	6.94	104.08	0.47
230	7.14	107.29	0.47
240	7.34	110.40	0.46
250	7.53	113.40	0.45
260	7.71	116.32	0.45
270	7.88	119.14	0.44
280	8.05	121.87	0.44
290	8.22	124.52	0.43
300	8.38	127.09	0.42
310	8.53	129.57	0.42
320	8.68	131.97	0.41
330	8.83	134.30	0.41
340	8.97	136.56	0.40
350	9.10	138.75	0.40
360	9.24	140.86	0.39
370	9.36	142.91	0.39
380	9.49	144.90	0.38
390	9.61	146.82	0.38
400	9.72	148.68	0.37
410	9.84	150.48	0.37
420	9.94	152.23	0.36
430	10.05	153.92	0.36
440	10.15	155.56	0.35
450	10.25	157.15	0.35
460	10.35	158.68	0.34
470	10.44	160.17	0.34
480	10.53	161.61	0.34
490	10.62	163.01	0.33
500	10.70	164.36	0.33
510	10.78	165.67	0.32
520	10.86	166.94	0.32
530	10.94	168.17	0.32
540	11.01	169.36	0.31
550	11.08	170.51	0.31
560	11.15	171.62	0.31
570	11.22	172.70	0.30
580	11.28	173.75	0.30
590	11.35	174.77	0.30
600	11.41	175.75	0.29
610	11.47	176.70	0.29
620	11.53	177.62	0.29
630	11.58	178.51	0.28
640	11.64	179.37	0.28
650	11.69	180.21	0.28
660	11.74	181.02	0.27
670	11.79	181.81	0.27
675	11.81	182.19	0.27

Liver

Dose	Resp Soil	Dose PbAc	Liver RBA
22.04	35.37	19.27	0.87
20	32.73	17.54	0.88
30	45.49	25.90	0.86
40	57.84	34.00	0.85
50	69.80	41.84	0.84
60	81.39	49.43	0.82
70	92.62	56.79	0.81
80	103.49	63.91	0.80
90	114.01	70.81	0.79
100	124.21	77.49	0.77
110	134.08	83.96	0.76
120	143.65	90.23	0.75
130	152.91	96.30	0.74
140	161.88	102.18	0.73
150	170.57	107.87	0.72
160	178.98	113.38	0.71
170	187.13	118.72	0.70
180	195.03	123.90	0.69
190	202.67	128.91	0.68
200	210.08	133.76	0.67
210	217.25	138.46	0.66
220	224.19	143.01	0.65
230	230.92	147.42	0.64
240	237.43	151.68	0.63
250	243.74	155.82	0.62
260	249.85	159.82	0.61
270	255.77	163.70	0.61
280	261.50	167.46	0.60
290	267.05	171.09	0.59
300	272.43	174.62	0.58
310	277.63	178.03	0.57
320	282.68	181.33	0.57
330	287.56	184.54	0.56
340	292.29	187.64	0.55
350	296.87	190.64	0.54
360	301.31	193.54	0.54
370	305.61	196.36	0.53
380	309.77	199.09	0.52
390	313.80	201.73	0.52
400	317.70	204.29	0.51
410	321.48	206.77	0.50
420	325.15	209.17	0.50
430	328.69	211.49	0.49
440	332.13	213.74	0.49
450	335.45	215.92	0.48
460	338.68	218.03	0.47
470	341.80	220.08	0.47
480	344.82	222.06	0.46
490	347.75	223.98	0.46
500	350.58	225.83	0.45
510	353.33	227.63	0.45
520	355.99	229.37	0.44
530	358.56	231.06	0.44
540	361.06	232.70	0.43
550	363.47	234.28	0.43
560	365.81	235.81	0.42
570	368.08	237.30	0.42
580	370.27	238.74	0.41
590	372.40	240.13	0.41
600	374.46	241.48	0.40
610	376.45	242.78	0.40
620	378.38	244.05	0.39
630	380.25	245.28	0.39
640	382.06	246.46	0.39
650	383.82	247.61	0.38
660	385.51	248.72	0.38
670	387.16	249.80	0.37
675	387.96	250.33	0.37

Kidney

Dose	Resp Soil	Dose PbAc	Kidney RBA
24.53	58.92	25.03	1.02
30	66.40	30.17	1.01
40	79.51	39.19	0.98
50	91.93	47.73	0.95
60	103.70	55.83	0.93
70	114.85	63.50	0.91
80	125.42	70.76	0.88
90	135.43	77.65	0.86
100	144.91	84.17	0.84
110	153.89	90.35	0.82
120	162.41	96.20	0.80
130	170.47	101.75	0.78
140	178.11	107.00	0.76
150	185.35	111.98	0.75
160	192.21	116.70	0.73
170	198.71	121.17	0.71
180	204.87	125.40	0.70
190	210.70	129.42	0.68
200	216.23	133.22	0.67
210	221.46	136.82	0.65
220	226.42	140.23	0.64
230	231.12	143.46	0.62
240	235.58	146.52	0.61
250	239.79	149.43	0.60
260	243.79	152.17	0.59
270	247.58	154.78	0.57
280	251.17	157.25	0.56
290	254.57	159.58	0.55
300	257.79	161.80	0.54
310	260.84	163.90	0.53
320	263.73	165.89	0.52
330	266.47	167.77	0.51
340	269.06	169.55	0.50
350	271.52	171.25	0.49
360	273.85	172.85	0.48
370	276.06	174.36	0.47
380	278.15	175.80	0.46
390	280.13	177.17	0.45
400	282.01	178.46	0.45
410	283.78	179.68	0.44
420	285.47	180.84	0.43
430	287.06	181.94	0.42
440	288.58	182.98	0.42
450	290.01	183.96	0.41
460	291.37	184.89	0.40
470	292.65	185.78	0.40
480	293.87	186.62	0.39
490	295.02	187.41	0.38
500	296.12	188.16	0.38
510	297.15	188.88	0.37
520	298.14	189.55	0.36
530	299.07	190.19	0.36
540	299.95	190.80	0.35
550	300.78	191.37	0.35
560	301.57	191.91	0.34
570	302.32	192.43	0.34
580	303.03	192.92	0.33
590	303.71	193.38	0.33
600	304.34	193.82	0.32
610	304.95	194.23	0.32
620	305.52	194.63	0.31
630	306.06	195.00	0.31
640	306.57	195.35	0.31
650	307.06	195.69	0.30
660	307.52	196.01	0.30
670	307.96	196.31	0.29
675	308.17	196.45	0.29

TABLE A-10

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TABLE A-11 INTRALABORATORY DUPLICATES

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

* Non detects evaluated at 1/2 DL

Pig number	group	material administered	dosage	day	matrix	Duplicate Value*	Original Value*	Average	RPD	Avg RPD	
1109	1	Control	0	-4	BLOOD	0.5	0.5	0.5	0%		
1136	4	PbAc	225	-4	BLOOD	0.5	0.5	0.5	0%		
1141	7	Murray Res. Soil	675	-4	BLOOD	0.5	0.5	0.5	0%		
1116	2	PbAc	25	0	BLOOD	0.5	0.5	0.5	0%		
1110	8	NIST Paint	75	0	BLOOD	0.5	0.5	0.5	0%		
1125	10	NIST Paint	675	0	BLOOD	0.5	0.5	0.5	0%		
1104	2	PbAc	25	1	BLOOD	0.5	0.5	0.5	0%		
1132	9	NIST Paint	225	1	BLOOD	1.2	1.3	1.25	8%		
1147	10	NIST Paint	675	1	BLOOD	6.8	6	6.4	-13%		
1139	1	Control	0	2	BLOOD	0.5	0.5	0.5	0%		
1144	3	PbAc	75	2	BLOOD	1.7	1.4	1.55	-19%		
1153	8	NIST Paint	75	2	BLOOD	2.6	0.5	1.55	-135%		
1123	3	PbAc	75	3	BLOOD	1.4	2.8	2.1	67%		
1122	6	Murray Res. Soil	225	3	BLOOD	4.9	4.5	4.7	-9%		
1134	8	NIST Paint	75	3	BLOOD	1	1.4	1.2	33%		
1129	3	PbAc	75	5	BLOOD	2.4	2.7	2.55	12%		
1138	4	PbAc	225	5	BLOOD	6.6	6.5	6.55	-2%		
1154	6	Murray Res. Soil	225	5	BLOOD	6.5	6.4	6.45	-2%		
1137	7	Murray Res. Soil	675	7	BLOOD	7	6.7	6.85	-4%		
1111	9	NIST Paint	225	7	BLOOD	10.2	9.1	9.65	-11%		
1120	10	NIST Paint	675	7	BLOOD	12.2	12	12.1	-2%		
1124	1	Control	0	9	BLOOD	0.5	0.5	0.5	0%		
1118	2	PbAc	25	9	BLOOD	1.9	2.1	2	10%		
1133	5	Murray Res. Soil	75	9	BLOOD	3.1	3.5	3.3	12%		
1117	2	PbAc	25	12	BLOOD	4.1	3.5	3.8	-16%		
1102	6	Murray Res. Soil	225	12	BLOOD	7.4	7	7.2	-6%		
1143	6	Murray Res. Soil	225	12	BLOOD	6.9	6.4	6.65	-8%		
1151	1	Control	0	15	BLOOD	0.5	0.5	0.5	0%		
1136	4	PbAc	225	15	BLOOD	7.9	7.4	7.65	-7%		
1132	9	NIST Paint	225	15	BLOOD	7	6.6	6.8	-6%	-3%	**BLOOD**
1124	1	Control	0	15	FEMUR	1	1	1	0%		
1104	2	PbAc	25	15	FEMUR	4.1	1.9	3	-73%		
1134	8	NIST Paint	75	15	FEMUR	5.4	3.3	4.35	-48%	-41%	**FEMUR**
1124	1	Control	0	15	KIDNEY	1	2.9	1.95	97%		
1104	2	PbAc	25	15	KIDNEY	13.2	14.4	13.8	9%		
1134	8	NIST Paint	75	15	KIDNEY	6	5.9	5.95	-2%	35%	**KIDNEY**
1124	1	Control	0	15	LIVER	1	2.6	1.8	89%		
1104	2	PbAc	25	15	LIVER	13.8	11.3	12.55	-20%		
1134	8	NIST Paint	75	15	LIVER	6.9	7.6	7.25	10%	26%	**LIVER**

TABLE A-12 CDC STANDARDS

Sample ID	Day	Q	Measured* Low Std	Measured* Med Std	Measured* High Std	Nominal Low Std	Nominal Med Std	Nominal High Std
11.1	-4		3.7			1.7	4.8	14.9
11.1	0		3.1			1.7	4.8	14.9
11.1	1	<	1			1.7	4.8	14.9
11.1	3		1.3			1.7	4.8	14.9
11.1	9		1.5			1.7	4.8	14.9
11.2	-4			5.2		1.7	4.8	14.9
11.2	0			4.7		1.7	4.8	14.9
11.2	1			5		1.7	4.8	14.9
11.2	2			4.9		1.7	4.8	14.9
11.2	5			4.1		1.7	4.8	14.9
11.2	7			3.8		1.7	4.8	14.9
11.2	12			4.8		1.7	4.8	14.9
11.2	15			4.3		1.7	4.8	14.9
11.3	2				14.9	1.7	4.8	14.9
11.3	3				14.3	1.7	4.8	14.9
11.3	5				10.1	1.7	4.8	14.9
11.3	7				18	1.7	4.8	14.9
11.3	9				14.5	1.7	4.8	14.9
11.3	12				14.8	1.7	4.8	14.9
11.3	15				16	1.7	4.8	14.9
		Avg	2.12	4.6	14.66			

* Non-detects evaluated at the detection limit

TABLE A-13 INTERLABORATORY COMPARISON

Tag Number	Pig Number	Group	Material Administered	Dosage	Qualifier			Result			
					CDC	EPA		CDC	EPA	Average	RPD
8-911-0120	1143	6	Murray Res. Soil	225	<	<		0.6	1	0.8	50
8-911-0125	1103	2	PbAc	25	<	<		0.6	1	0.8	50
8-911-0171	1121	4	PbAc	225	<	<		0.6	1	0.8	50
8-911-0194	1113	10	NIST Paint	675	<	<		0.6	1	0.8	50
8-911-0217	1106	5	Murray Res. Soil	75		<		0.6	1	0.8	50
8-911-0274	1140	7	Murray Res. Soil	675				4.4	4.4	4.4	0
8-911-0281	1108	9	NIST Paint	225				2.3	2.1	2.2	-9
8-911-0288	1138	4	PbAc	225				3.8	3.4	3.6	-11
8-911-0330	1148	8	NIST Paint	75				1.8	2.2	2	20
8-911-0389	1133	5	Murray Res. Soil	75				1.9	1.5	1.7	-24
8-911-0391	1130	3	PbAc	75				2.2	1.9	2.05	-15
8-911-0425	1124	1	Control	0	<	<		0.6	1	0.8	50
8-911-0427	1146	4	PbAc	225				8.3	8.4	8.35	1
8-911-0472	1118	2	PbAc	25				2	1.2	1.6	-50
8-911-0481	1137	7	Murray Res. Soil	675				7.5	6.7	7.1	-11
8-911-0518	1141	7	Murray Res. Soil	675				10.1	9.2	9.65	-9
8-911-0520	1130	3	PbAc	75				3.6	3.1	3.35	-15
8-911-0573	1139	1	Control	0	<	<		0.6	1	0.8	50
8-911-0612	1129	3	PbAc	75				5.2	5.1	5.15	-2
8-911-0628	1123	3	PbAc	75				3	3.8	3.4	24
8-911-0664	1150	4	PbAc	225				10.7	10.8	10.75	1

FIGURE A-1 PbAc Groups by Day
Raw Data

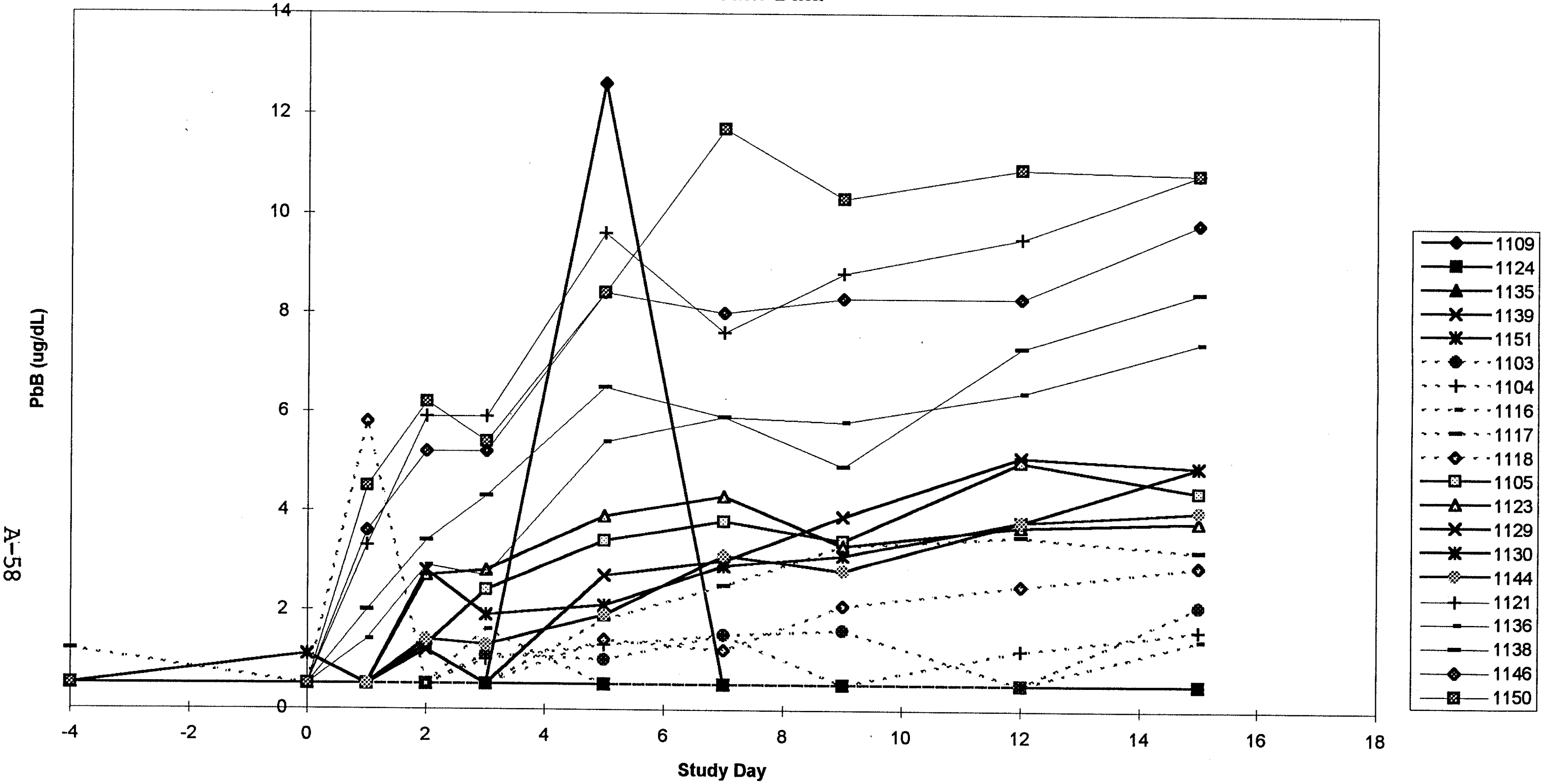

FIGURE A-2 Murray Soil Groups by Day
Raw Data

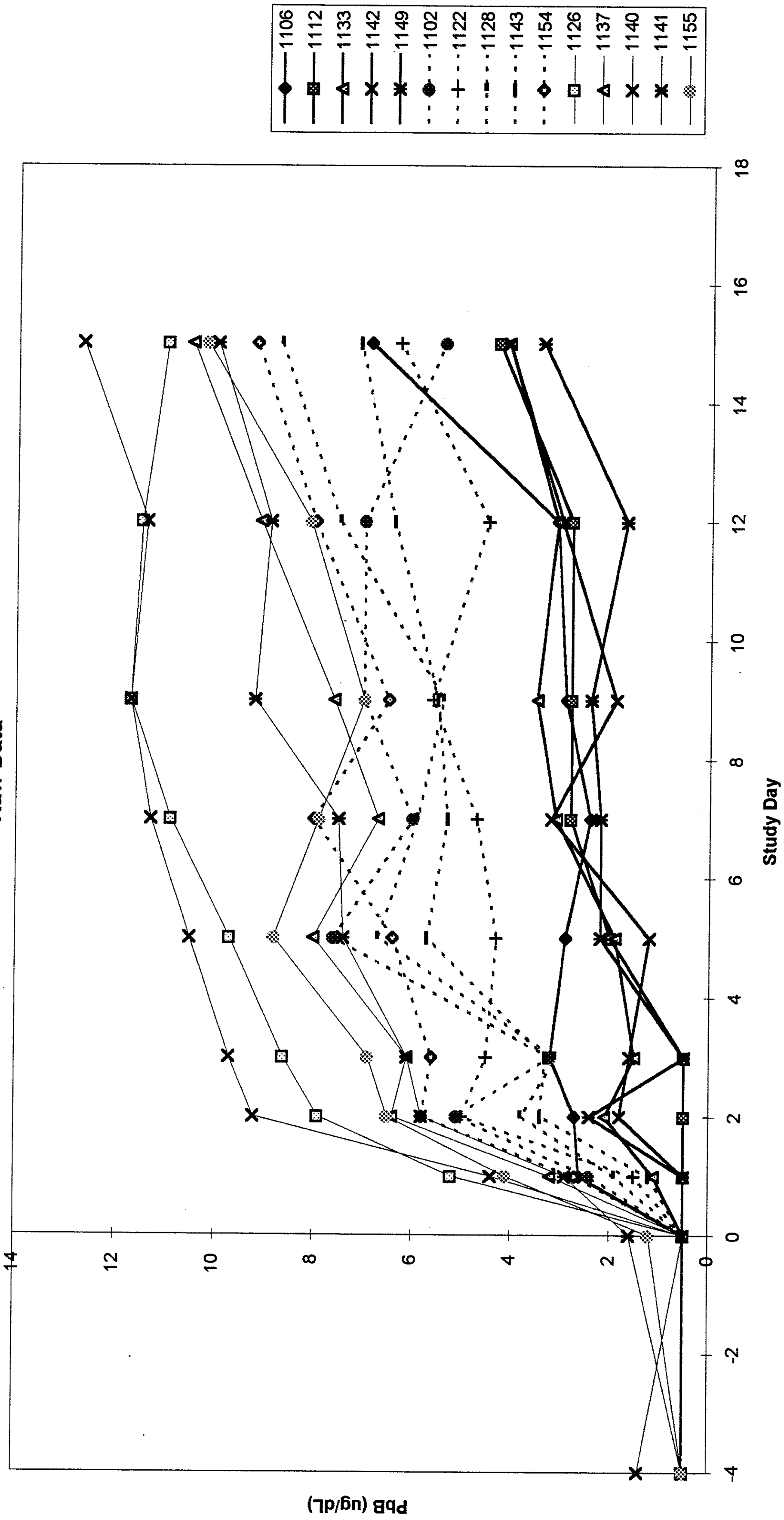

FIGURE A-3

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FIGURE A-4 Group Mean PbB By Day
Raw Data

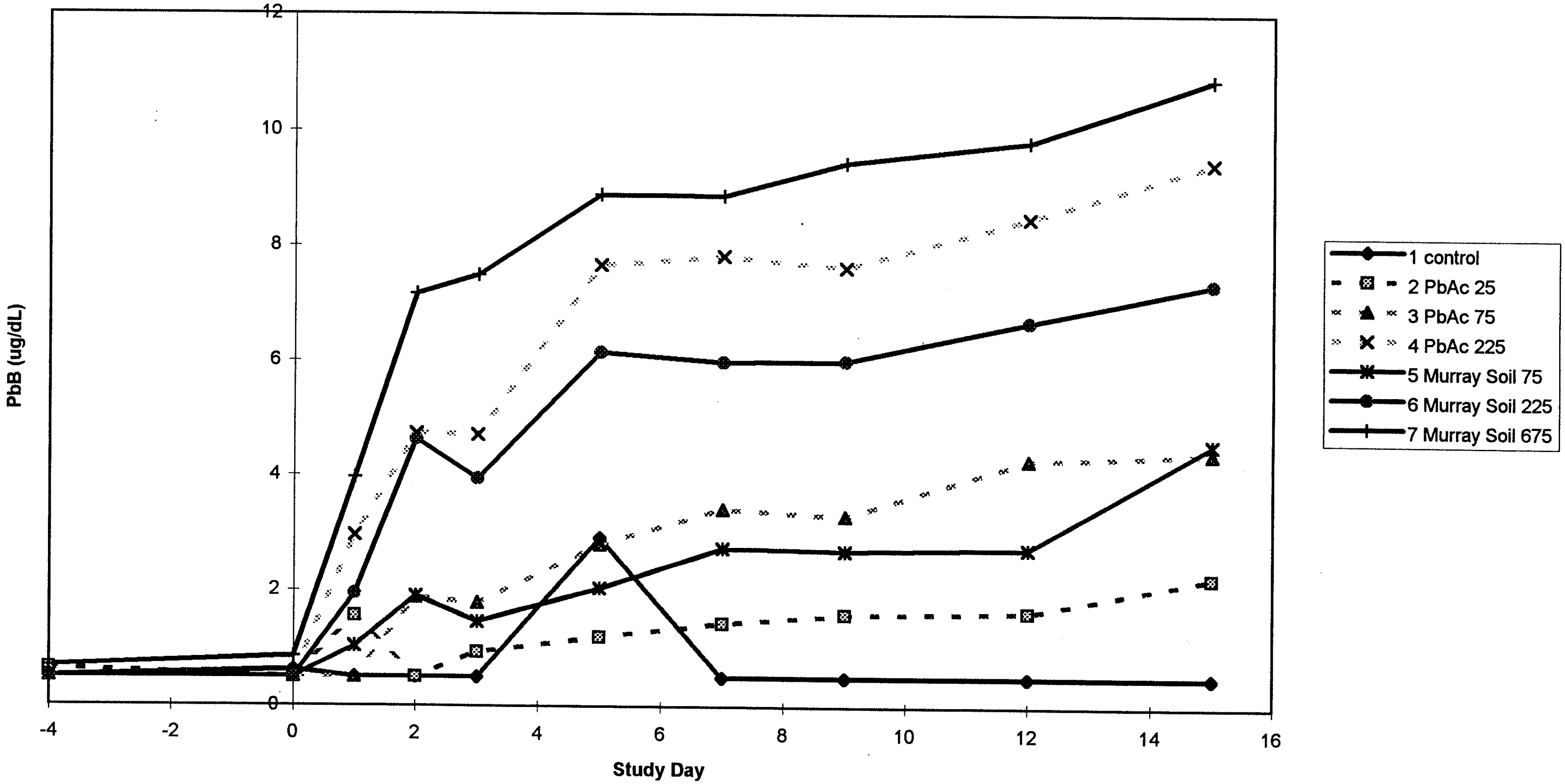
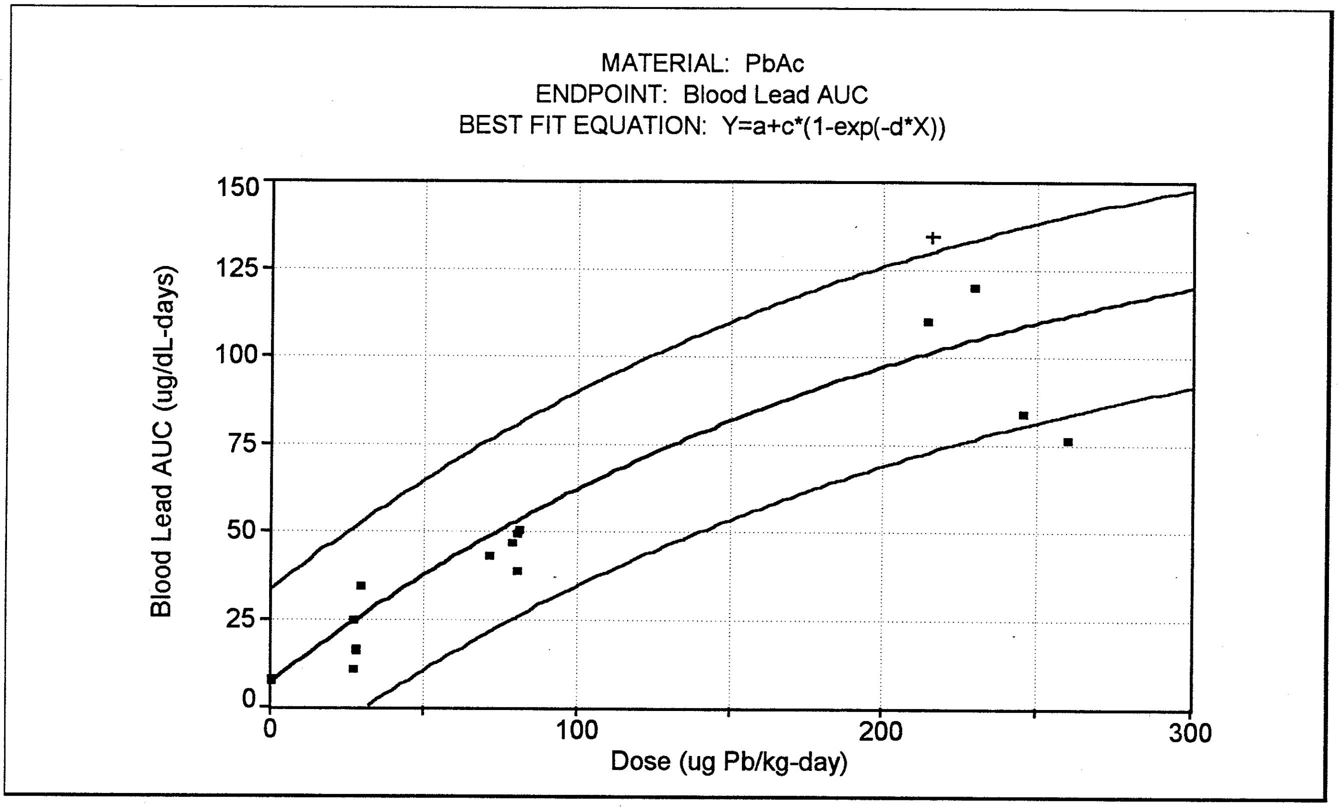


FIGURE A-5 BEST FIT CURVE WITH 95% PREDICTION INTERVALS*

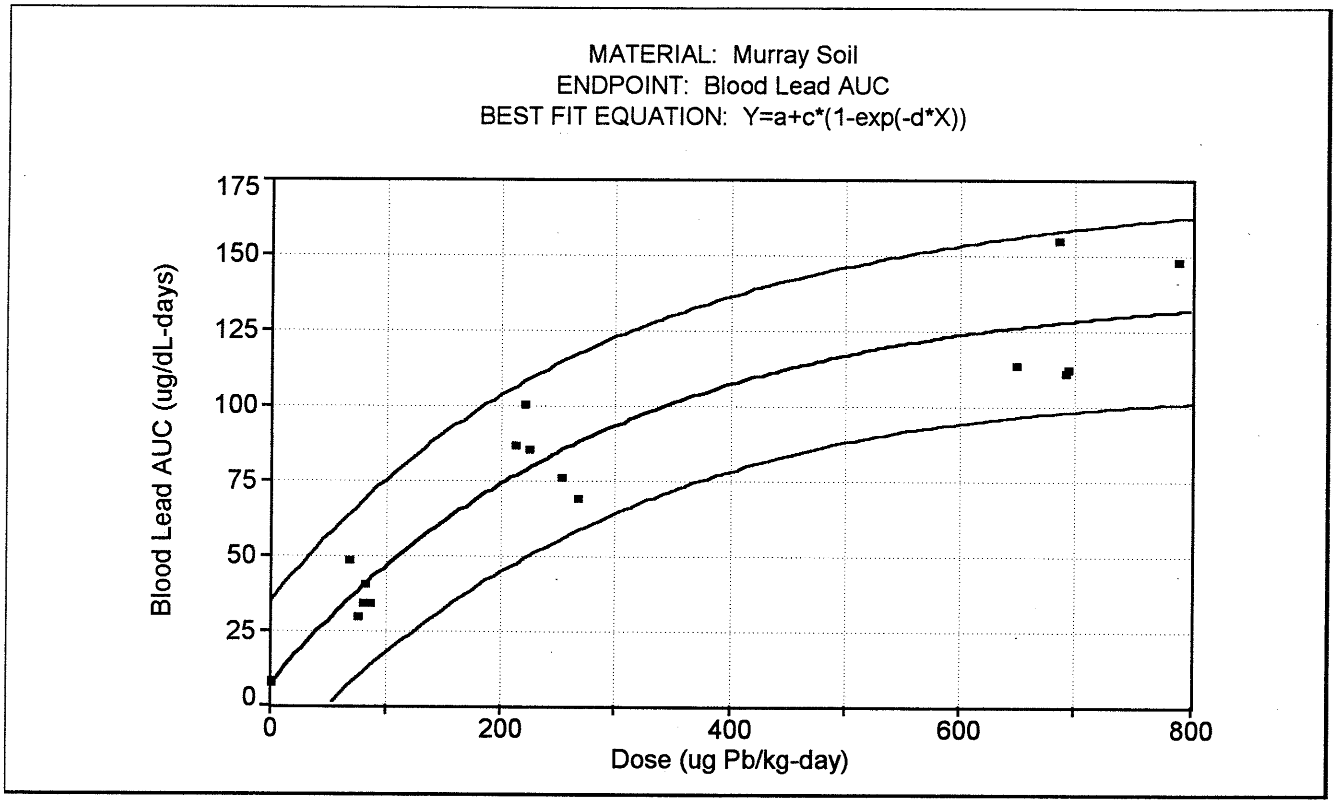


Parameters	Value	Std. Error	95% Confidence Limits	
a	6.48	fixed value	--	--
c	152.4	fixed value	--	--
d	0.0045	0.0004	0.0037	0.0053

Adj R^2	0.863

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

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

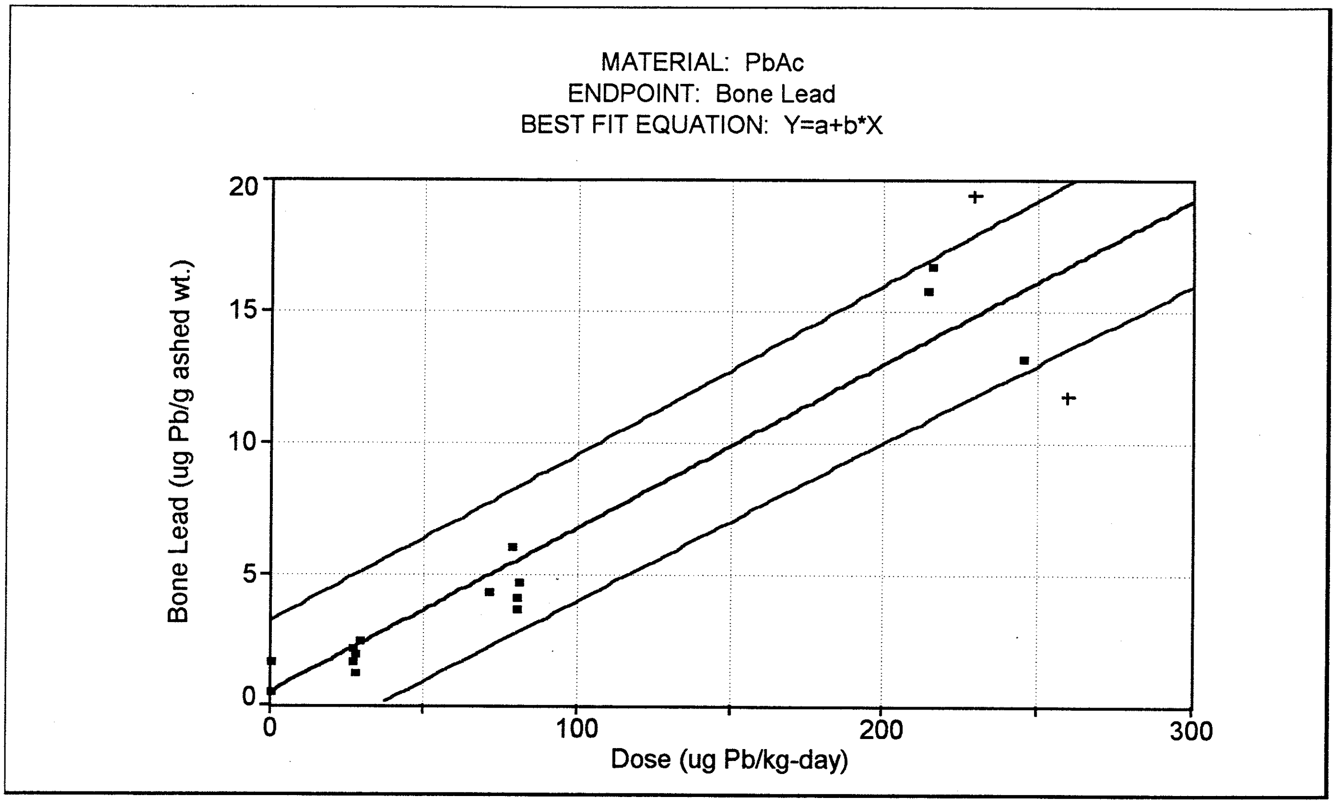


Parameters	Value	Std. Error	95% Confidence Limits	
a	6.48	fixed value	--	--
c	133	10.7	110.4	155.6
d	0.0035	0.0007	0.002	0.005

Adj R^2	0.922

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

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

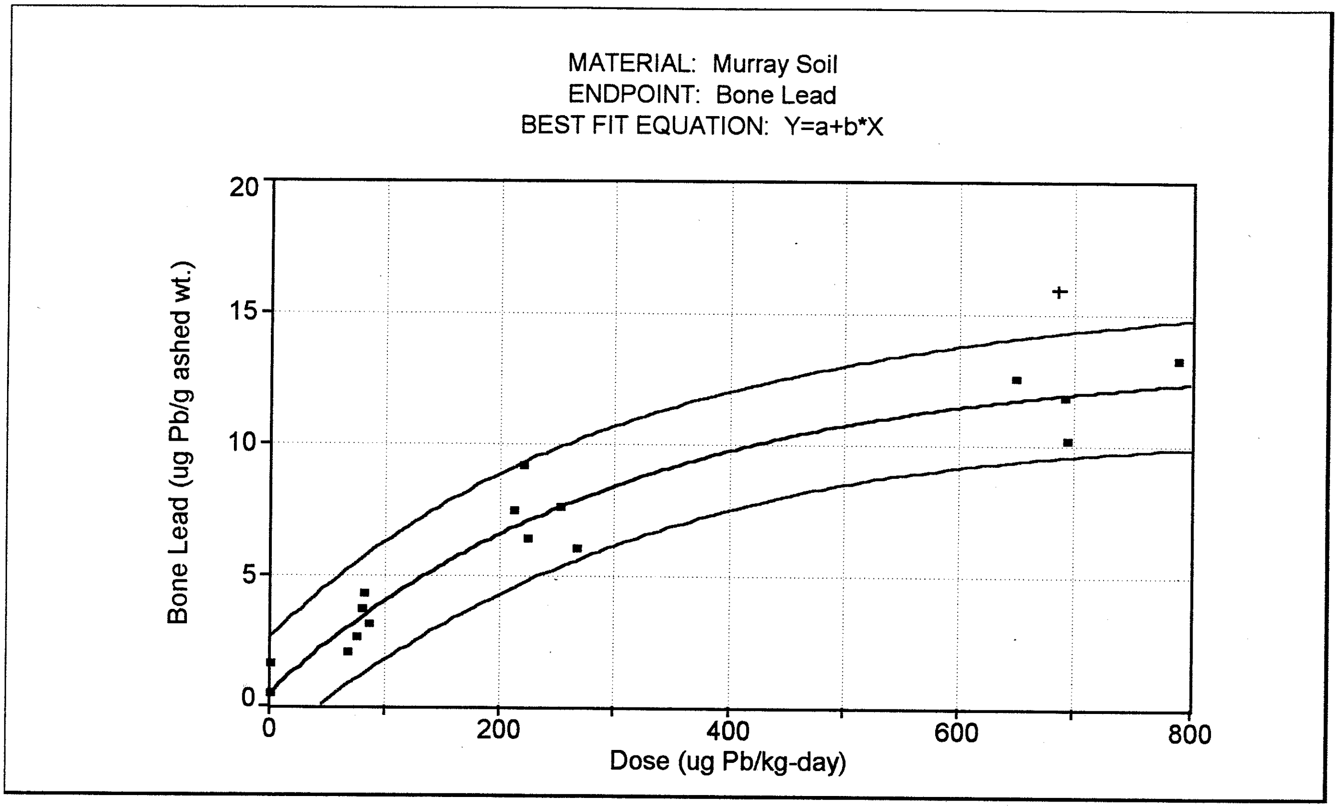


Parameters	Value	Std. Error	95% Confidence Limits	
a	0.46	fixed value	--	--
b	0.062	0.003	0.056	0.069

Adj R^2	0.935

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	0.46	fixed value	--	--
b	0.003	0.0005	0.002	0.004

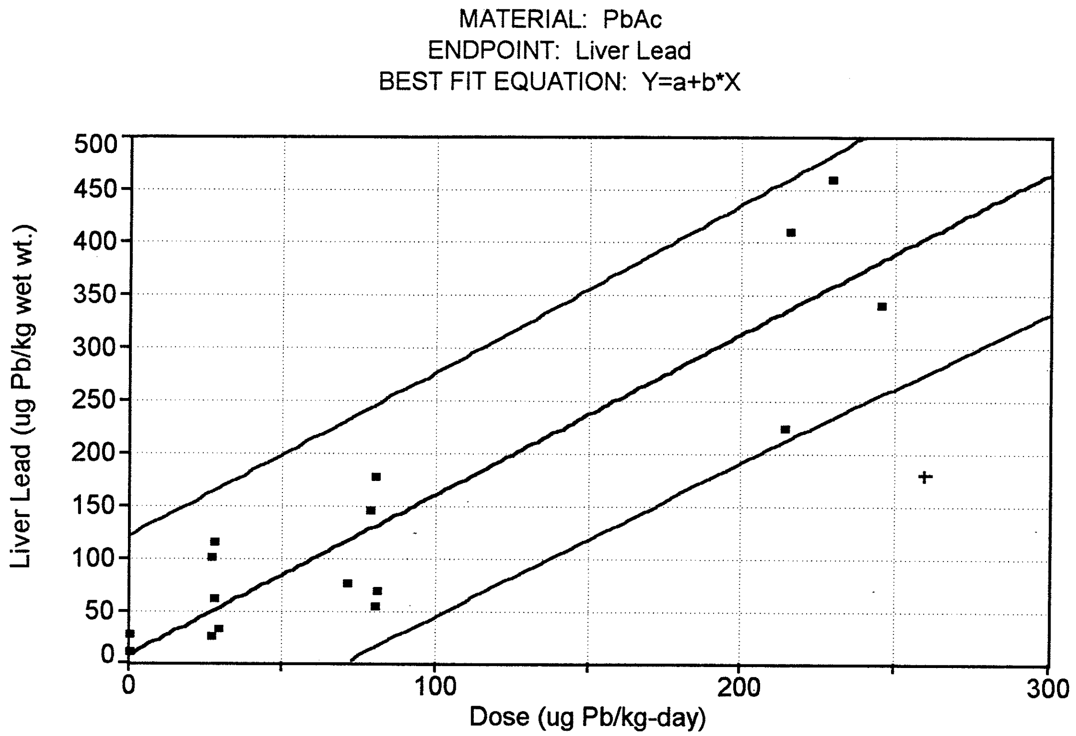
Adj R^2	0.942

ERROR

NON-LINEAR

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

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



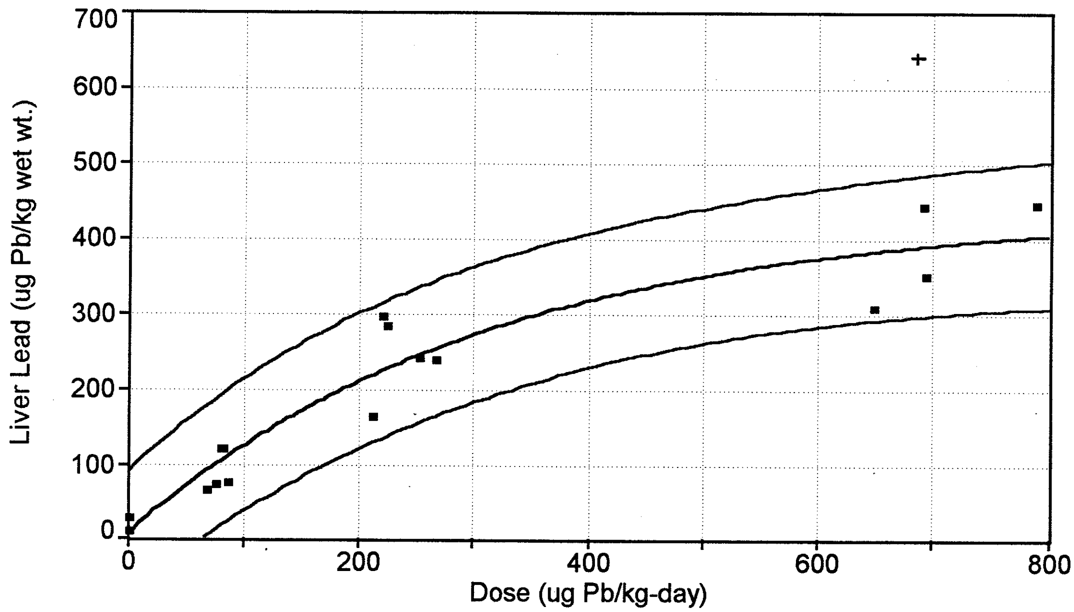
Parameters	Value	Std. Error	95% Confidence Limits	
a	5.96	fixed value	--	--
b	1.53	0.11	1.29	1.76

Adj R^2	0.841

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

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

MATERIAL: Murray Soil
ENDPOINT: Liver Lead
BEST FIT EQUATION: Y=a+b*X

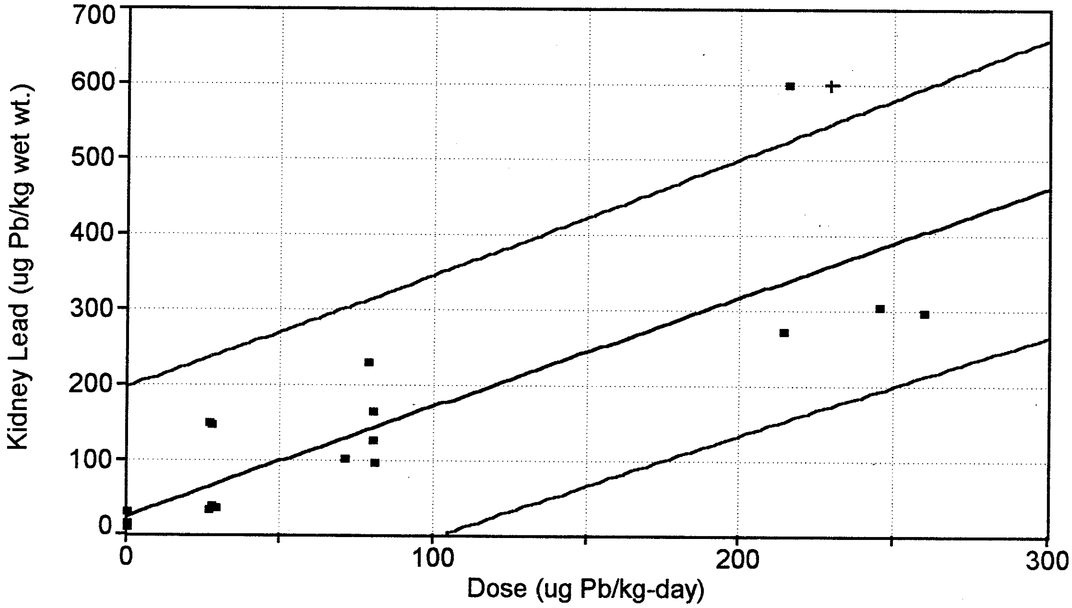


Parameters	Value	Std. Error	95% Confidence Limits	
a	5.96	fixed value	--	--
c	431.8	40.1	347.1	516.6
d	0.003	0.0006	0.0018	0.0045

Adj R^2	0.923

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

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

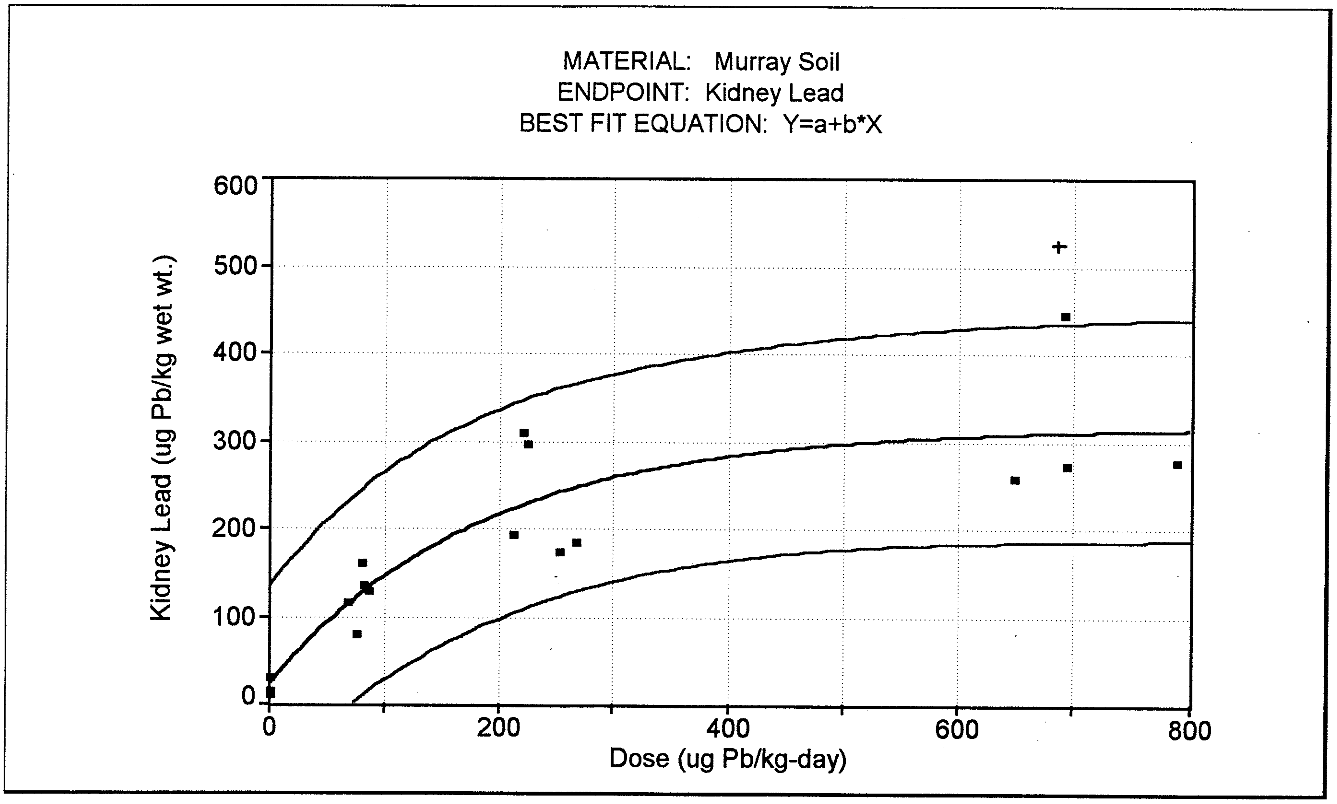


Parameters	Value	Std. Error	95% Confidence Limits	
a	22.53	fixed value	--	--
b	1.45	0.152	1.13	1.77

Adj R^2	0.71

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	22.53	fixed value	--	--
c	293.3	31.7	226.4	360.2
d	0.005	0.001	0.0022	0.0086

Adj R^2	0.798

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