

FINAL REPORT

RELATIVE BIOAVAILABILITY OF ARSENIC IN SOILS FROM THE VBI70 SITE

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EXECUTIVE SUMMARY

The gastrointestinal absorption of arsenic from soil samples collected from residential properties at the Vasquez Boulevard and I-70 (VBI70) Superfund site was measured using young swine. Test materials include composite soil samples from five different residences with arsenic levels ranging from 290 to 860 ppm. In addition, one sample was prepared by mixing clean site soil (arsenic < 10 ppm) with an arsenical herbicide (PAX) to yield a concentration of about 460 ppm. Groups of animals (four animals per dose group) were given oral doses of reference material (sodium arsenate) or test material twice a day for 12 days. Urine excreted by each animal was collected on days 6-7, 8-9 and 10-11. The urinary excretion fraction (UEF) (the ratio of the amount excreted per 48 hours divided by the dose given per 48 hours) was calculated for each test material using linear regression analysis. The relative bioavailability (RBA) of arsenic in test material compared to that in sodium arsenate (abbreviated NaAs) was calculated as:

$$RBA = \frac{UEF(\text{test material})}{UEF(\text{NaAs})}$$

The results are summarized below:

Test Material	Description	Neighborhood	Arsenic Conc. (ppm)	Relative Bioavailability	
				Best Est.	90% CI
TM1	Soil composite from impacted residential property	Eastern Swansea/Elyria	312	0.35	0.26 – 0.45
TM2	Soil composite from impacted residential property	Western Swansea/Elyria	983	0.45	0.38 – 0.52
TM3	Soil composite from impacted residential property	Eastern Cole	390	0.36	0.31 – 0.42
TM4	Soil composite from impacted residential property	Western Cole	813	0.21	0.17 – 0.25
TM5	Soil composite from impacted residential property	Clayton	368	0.18	0.15 – 0.21
TM6	Clean site soil plus added PAX	Swansea/Elyria	516	0.23	0.19 – 0.28

An estimate of the site-wide mean RBA value may be derived by combining the values across all five site samples (TM1–TM5). Because of the inherent variability and uncertainty in the data, the 95% UCL of the site-wide mean RBA value is recommended for use in calculation of human risk from ingestion of arsenic in site soils. The results are shown below:

Statistic	Value
Mean	0.31
95% UCL	0.42

Based on a consideration of all available data, a final RBA value of 0.42 is recommended.

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RELATIVE BIOAVAILABILITY OF ARSENIC IN VBI70 SITE SOILS

1.0 INTRODUCTION

Accurate assessment of the health risks resulting from oral exposure to any chemical frequently requires knowledge of the amount of the chemical absorbed from the gastrointestinal tract into the body. This information on absorption may be described either in absolute or relative terms:

Absolute Bioavailability (ABA) is the ratio of the amount of chemical absorbed compared to the amount of chemical ingested:

$$ABA = \frac{\text{Absorbed Dose}}{\text{Ingested Dose}}$$

This ratio is also referred to as the oral absorption fraction (AF_0).

Relative Bioavailability (RBA) is the ratio of the absolute bioavailability of some test material compared to the absolute bioavailability of some appropriate reference material, usually the chemical dissolved in water or some fully soluble form that completely dissolves when ingested:

$$RBA = \frac{ABA(\text{test material})}{ABA(\text{reference material})}$$

For example, if 100 ug of arsenic dissolved in drinking water were ingested and a total of 90 ug entered the body, the ABA would be 0.90 (90%). Likewise, if 100 ug of arsenic contained in soil were ingested and 30 ug entered the body, the ABA for soil would be 0.30 (30%). If the arsenic dissolved in water were used as the reference substance for describing the relative amount of arsenic absorbed from soil, the RBA would be $0.30/0.90 = 0.33$ (33%).

Using Bioavailability Data to Improve Risk Calculations for Arsenic

When reliable data are available on the bioavailability of arsenic in soil, dust or other soil-like waste material at a site, this information can be used to improve the accuracy of exposure and risk calculations at that site. Because the reference dose (RfD) and the slope factor (SF) for arsenic are both expressed in terms of dose of soluble arsenic ingested in water, the adjustment is most conveniently achieved by using the bioavailability data to modify the toxicity values to account for differences in absorption between arsenic ingested in water and the absorption of arsenic from site media. This is done as follows:

$$RfD(\text{adjusted}) = RfD(IRIS) \cdot \frac{ABA(\text{water})}{ABA(\text{site medium})}$$

$$SF(adjusted) = SF(IRIS) \cdot \frac{ABA(site\ medium)}{ABA(water)}$$

If an RBA value is available that is based on a reference form of arsenic that is as well absorbed as arsenic in water, then the adjustments may be made as follows:

$$RfD(adjusted) = \frac{RfD(IRIS)}{RBA}$$

$$SF(adjusted) = SF(IRIS) \cdot RBA$$

Alternatively, it is also acceptable to adjust the dose (rather than the toxicity factors) as follows:

$$Dose(adjusted) = Dose(default) \cdot RBA$$

This adjustment in dose is mathematically equivalent to adjusting the toxicity factors as described above.

Purpose of this Study

Investigations performed at the Vasquez Boulevard and I-70 (VBI70) Superfund site in Denver, Colorado, have revealed that some residential properties have yard soil that is contaminated with elevated levels of arsenic. This study was performed in order to obtain site-specific data on the relative bioavailability of arsenic in yard soils in order to help improve the accuracy of risk calculations for residents who may be exposed to arsenic in soil.

2.0 STUDY DESIGN

This investigation of arsenic absorption and excretion was performed in two sequential studies. The basic design for each of these two studies is presented in Table 2-1. As shown, each study investigated arsenic absorption from sodium arsenate (the reference material) and from three site-specific soils, each administered to groups of animals at two different dose levels for 12 days. All doses were administered orally.

2.1 Test Materials

Sample Selection

Test Materials 1 to 5 were samples of residential yard soil that were collected during Phase 3 or the risk-based sampling activities at the VBI70 site. Samples were selected to cover a range of arsenic concentrations in soil, and were also selected to provide reasonable spatial representativeness across the site, including samples from the Swansea/Elyria, Cole and Clayton neighborhoods. Soils with arsenic concentrations less than 200-250 ppm were not included because the mass of soil required for swine dosing was not available. Test Material 6 was prepared by mixing clean site soil ($As < 10$ ppm) with sufficient PAX (an arsenical herbicide that is considered to be a potential source material) to yield a concentration of approximately 516 ppm arsenic.

Sample Preparation

In all cases, each Test Material was prepared by combining all soil samples that had been collected from the selected property. For example, for properties that had been sampled during the risk-based sampling program (Test Materials 1 and 2), over 100 subsamples of soil were combined. For properties selected from the Phase 3 program (Test Materials 3-5), three samples (each a composite of 10 subsamples) were combined.

All sub-samples from a property were composited using a stainless steel bowl and mixing spoon. The composites were then air dried, homogenized, and sieved to < 250 Fm. Soil for Test Material 6 was also prepared by drying and sieving prior to the addition of the PAX.

Arsenic Concentration

After compositing, drying, mixing, and sieving, the concentration of arsenic was measured in each Test Material by several techniques. An initial estimate was derived by x-ray fluorescence (XRF), and these initial values were used to calculate the dose of each soil to administer to the test animals. Subsequently, additional aliquots of each Test Material were re-analyzed by XRF and also by inductively coupled plasma (ICP) spectroscopy and by neutron activation analysis (NAA). The results from these analyses are presented in Table 2-2 and are shown graphically in Figure 2-1. As seen, although there is reasonable agreement among the different measurements, the initial set of XRF values (XRF-1) tended to be somewhat higher than the second set of XRF values (XRF-2) and the ICP and NAA values. For this reason, all

final calculations of administered dose were based on the mean of the XRF-2, ICP and NAA values.

Sample Speciation

An aliquot of each test material was analyzed by electron microprobe in order to identify the different mineral forms of arsenic that were present in the sample and to estimate approximately how much of the total arsenic was present in each form. The detailed results are presented in Appendix A, and the results are summarized below:

Arsenic Speciation Data							
Test Material	Number of Grains Counted	Relative Arsenic Mass			Particle Size (um)		
		As₂O₃	PbAsO	All Other	<10	10-50	>50
TM1	262	54.3%	31.9%	13.8%	88.5%	10.7%	0.4%
TM2	128	22.1%	70.0%	7.9%	78.1%	19.5%	0.0%
TM3	104	81.0%	5.6%	13.4%	72.1%	26.9%	0.0%
TM4	144	87.1%	10.0%	3.0%	73.6%	24.3%	1.4%
TM5	134	96.8%	--	3.2%	72.4%	27.6%	0.0%
TM6	133	80.1%	18.2%	1.7%	86.5%	12.0%	0.0%

Inspection of these data reveals the following main observations:

- Arsenic in most site soils consists mainly as arsenic trioxide (As₂O₃) and lead arsenic oxide (PbAsO).
- Most arsenic (72% to 88%) occurs in particles that are smaller than 10 um in diameter.
- Essentially all arsenic-bearing grains are “liberated” (i.e., they are not contained within any other matrix).

It is important to note that these quantitative estimates of particle frequency and relative arsenic mass are based on examination of a relatively small number of arsenic-bearing particles (N = 104 to 262) in each sample. Consequently, the quantitative values reported should not be considered to be highly precise, and apparent differences between samples may be due to random variation in the analysis rather than authentic differences in composition.

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 Pig Improvement Corporation (PIC) genetically defined Line 26, and were purchased from Chinn Farms, Clarence, MO. Animals used in study 1 were intact males, while animals used for study 2 were castrated males.

The animals were housed in individual stainless steel cages. All animals were held for several days prior to beginning exposure to test materials to allow them to adapt to their new environment and to ensure that all of the animals were healthy. In order to help minimize weight variations between animals and groups, three animals most different in body weight on day -1 (either heavier or lighter) were also excluded. The remaining animals were assigned to dose groups at random. When exposure began (day zero), the animals were about 5-6 weeks old and weighed an average of about 8.9 kg (Study 1) or 7.0 kg (Study 2). Animals were weighed every three days during the course of each study. On average, animals gained about 0.4 to 0.5 kg/day, and the rate of weight gain was comparable in all groups. These body weight data are summarized in Figure 2-2.

2.3 Diet

Each day every animal was given an amount of standard swine chow (University Feed Mill S II (2) starter ration without added antibiotics) equal to 5% of the mean body weight of all animals on study. Feed was administered in two equal portions (2.5% of the mean body weight) 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 four water and two feed samples during this program yielded the following:

Water (ug/L)	Diet (ug/g)
2	
<1	0.23
<1	0.15
<1	

Based on these data, estimated intake of arsenic in unexposed animals is less than 0.1 ug/kg-day via water and about 10 ug/kg-day via the diet.

2.4 Dosing

Animals were exposed to sodium arsenate (abbreviated in this report as "NaAs") or test material (site soil) for 12 days, with the dose for each day being administered in two equal portions given at 9:00 AM and 3:00 PM (two hours before feeding). Dose material was placed in the center of a small portion (about 5 grams) of moistened feed (this is referred to as a doughball"), and this was administered to the animals by hand.

The dose levels administered were based on the arsenic content of the test material, with target doses of 50 and 125 ug/kg-day for NaAs and each test material. As noted previously (see Section 2.1), original dose calculations were made using the initial XRF analysis of arsenic concentrations in the test materials (see XRF-1 values in Table 2-2). Actual administered arsenic doses were re-calculated using the mean of subsequent analyses of the samples by XRF, ICP and NAA (see Table 2-2) and measured body weights. These actual administered doses are presented in Appendix B (Study 1) and Appendix C (Study 2).

2.5 Collection and Preparation of Samples

Urine

Samples of urine were collected from each animal for three consecutive 48-hour periods, on days 6/7, 8/9 and 10/11. Collection began at 9AM and ended 48 hours later. The urine was collected in a stainless steel pan placed beneath each cage, which drained into a plastic storage bottle. Each collection pan was fitted with a nylon screen to minimize contamination with feces, spilled food or other debris. Plastic diverters were used to minimize urine dilution with drinking water spilled by the animals from the watering nozzle into the collection pan, although this was not always effective in preventing dilution of the urine with water. Due to the length of the collection period, collection containers were emptied at least twice daily into a separate holding container. This ensured that there was no loss of sample due to overflow.

At the end of each collection period, the urine volume was measured and 60-mL portions were removed for analysis. A separate 250-mL aliquot was retained as an archive sample. Each sample was acidified by the addition of concentrated nitric acid. The samples were stored refrigerated until arsenic analysis.

Feces

Feces were collected by placing a fine-mesh nylon screen beneath each cage. Samples were transferred from the screen into a storage container twice per day, and the final sample (collected over 48 hours) was weighed. Aliquots of 20-25 grams of feces were weighed and freeze dried.

2.6 Arsenic Analysis

Urine

Urine samples were arranged in a random sequence and submitted to the laboratory for analysis in a blind fashion.

Details of urine sample preparation and analysis are provided in the study project plan (EPA 1999). In brief, 25 mL samples of urine were digested by refluxing and then heating to dryness in the presence of magnesium nitrate and concentrated nitric acid. Following magnesium nitrate digestion, samples were transferred to a muffle furnace and ashed at 500°C. The digested and ashed residue was dissolved in hydrochloric acid and analyzed by the hydride

generation technique using a Perkin-Elmer 3100 atomic absorption spectrometer. Preliminary tests of this method established that each of the different forms of arsenic which may occur in urine, including trivalent inorganic arsenic (As+3), pentavalent inorganic arsenic (As+5), mono-methyl arsenic (MMA) and di-methyl arsenic (DMA) are all recovered with high efficiency.

A number of quality assurance steps were taken during this project to evaluate the accuracy of the analytical procedures. Steps performed by the analytical laboratory included:

Spike Recovery

Randomly selected samples were spiked with known amounts of arsenic (usually 5-10 ug, as sodium arsenate) and the recovery of the added arsenic was measured. Recovery for individual samples typically ranged from 87% to 115%, with an average across all analyses of $103 \pm 5.2 \%$ (N = 41).

Duplicate Analysis

Random samples were selected for duplicate analysis by the laboratory analyst. Duplicate results typically had a relative percent difference (RPD) of 1-10%, with an average of 8.7 % (N = 81).

Standards

Samples of two different urine standards were run with each set of test samples. One standard was a urine standard obtained from NIST (sample number 2670 Elevated) with a nominal arsenic concentration of 480 ± 100 ug/L. Results for this standard ranged from 530 to 560 ug/L, with a mean across all samples of 544.3 ± 9.6 ug/L (N = 7). The second standard was an aqueous solution obtained from ERA (sample 9978) with a nominal concentration of 92.9 ug/L. Results for this standard ranged from 92 to 102 ug/L, with a mean across all samples of 96.2 ± 1.7 ug/L (N=90).

Blanks

Blank samples run along with each batch of samples never yielded a measurable level of arsenic, with all values being reported as less than 0.05 ug of arsenic.

In addition to these laboratory-sponsored QA procedures, an additional series of QA samples were submitted to the laboratory in a blind fashion. This included a number of Performance Evaluation (PE) samples (urines of known arsenic concentration) as well as a number of blind duplicates.

The results for the PE samples are shown in Figure 2-3. As seen, the PE samples included several different concentrations each of several different types of arsenic (As+3, As+5, MMA and DMA, both alone and in a mixture). In nearly all cases, there was good recovery of the arsenic in both the first and the second study.

The results for blind duplicates are shown in Figure 2-4. As seen, there was good agreement between results for the duplicate pairs in both the first and second study.

As a final check, a series of samples were submitted to a second laboratory for inter-laboratory comparison of results. This included investigative samples (urines collected from study animals) as well as several PE samples. The results are shown in Figure 2-5. As seen, there is generally good agreement between the two laboratories.

Based on the results of all of the quality assurance samples and steps described above, it is concluded that the analytical results for samples of urine are of high quality and are suitable for derivation of reliable estimates of arsenic absorption from test materials.

Feces

After drying, 1.0 gram of fecal material was removed and digested with 10 mL of magnesium nitrate and nitric acid using the same approach as described above for urine. Following digestion, all sample preparation and analytical steps are the same as for urine.

3.0 DATA ANALYSIS

Figure 3-1 shows a conceptual model for the toxicokinetic fate of ingested arsenic. Key points of this model are as follows:

- In most animals (including humans), absorbed arsenic is excreted mainly in the urine over the course of several days. Thus, the urinary excretion fraction (UEF), defined as the amount excreted in the urine divided by the amount given, is usually a reasonable approximation of the oral absorption fraction or ABA. However, this ratio will underestimate total absorption, because some absorbed arsenic is excreted in the feces via the bile, and some absorbed arsenic enters tissue compartments (e.g., skin, hair, etc.) from which it is cleared very slowly or not at all. Thus the urinary excretion fraction should not be equated with the absolute absorption fraction.
- The relative bioavailability (RBA) of two orally administered materials (e.g., test material and reference material) can be calculated from the ratio of the urinary excretion fraction of the two materials. This calculation is independent of the extent of tissue binding and of biliary excretion:

$$RBA(test\ vs\ ref) = \frac{AF_o(test)}{AF_o(ref)} = \frac{D \cdot AF_o(test) \cdot K_u}{D \cdot AF_o(ref) \cdot K_u} = \frac{UEF(test)}{UEF(ref)}$$

Based on the conceptual model above, raw data from this study were reduced and analyzed as follows:

- The amount of arsenic excreted in urine by each animal over each collection period was calculated by multiplying the urine volume by the urine concentration:

$$\text{Excreted (ug/48hr)} = \text{Conc (ug/L)} \cdot \text{Volume (L/48hr)}$$

- For each test material, the amount of arsenic excreted by each animal was plotted as a function of the amount administered (ug/48 hours), and the best fit straight line (calculated by linear regression) through the data (ug excreted per ug administered) was used as the best estimate of the urinary excretion fraction (UEF).
- The relative bioavailability of arsenic in test material was calculated as:

$$RBA = \text{UEF(test)} / \text{UEF(NaAs)}$$

where sodium arsenate (NaAs) is used as the frame of reference.

- As noted above, each RBA value is calculated as the ratio of two slopes (UEFs), each of which is estimated by linear regression through a set of data points. Because of the variability in the data, there is uncertainty in the estimated slope

(UEF) for each material. This uncertainty in the slope is described by the standard error of the mean (SEM) for the slope parameter. Given the best estimate and the SEM for each slope, the uncertainty in the ratio may be estimated using Monte Carlo simulation. The probability density function describing the confidence around each slope (UEF) term was assumed to be characterized by a t-distribution with n-2 degrees of freedom :

$$\frac{UEF(measured) - UEF(true)}{SEM} \sim t_{n-2}$$

For convenience, this PDF is abbreviated T(slope, sem, n), where slope = best estimate of the slope derived by linear regression, sem = standard deviation in the best estimate of the slope, and n = number of data points upon which the regression analysis was performed. Thus, the confidence distribution around each ratio was simulated as:

$$PDF(RBA) = \frac{T(slope, sem, n)_{test}}{T(slope, sem, n)_{ref}}$$

Using this equation, a Monte Carlo simulation was run for each RBA calculation. The 5th and 95th percentile values from the simulated distribution of RBA values were then taken to be the 90% confidence interval for the RBA.

4.0 RESULTS

The doses of arsenic administered in this study are below a level that is expected to cause toxicological responses in swine, and no clinical signs of arsenic-induced toxicity were noted in any of the animals used in either Study 1 or Study 2.

4.1 Urinary Excretion Fractions

Detailed results from Study 1 and Study 2 are presented in Appendices B and C, respectively. The results for urinary excretion of arsenic are summarized in Figures 4-1 to 4-8. Although there is variability in the data, most dose-response curves are approximately linear, with the slope of the best-fit straight line being equal to the best estimate of the urinary excretion fraction (UEF). This finding is consistent with results from both animals and humans, which suggest that there is no threshold for arsenic absorption or excretion up to doses of at least 5,000 ug/day (EPA 1995).

An exception to this pattern is observed for sodium arsenate in Study 1. As seen in Figure 4-1, the dose-response curves on days 6-7 and days 8-9 are not well-described by a linear model. The basis of this unexpected result appears to be the values derived for the low dose group. Indeed, the amount of arsenic recovered in the urine of low-dose group animals on days 6-7 and 8-9 was more than the nominal dose administered. Therefore, samples of the doughballs administered for the time interval in question were analyzed in order to determine if the actual dose delivered to the animals was that which was intended. The results are shown in Figure 4-9. As seen, it is clear that an error occurred in the preparation of doughballs that were administered to Dose Group 2 on study days 6-8. This in turn explains why the amount excreted in urine of animals from this group was much higher than expected on days 6-7, and was somewhat higher than expected on days 8-9. For this reason, the data points for animals in Dose Group 2 (the low dose of sodium arsenate) in Study 1 on days 6-7 and 8-9 are judged to be erroneous and were excluded from the analysis. Figure 4-10 shows the data set for sodium arsenate from Study 1 and Study 2 combined after exclusion of these data points, along with the best fit regression line through the data.

The following table summarizes the best fit slopes (urinary excretion fractions) for sodium arsenate and each of the test materials.

Summary of UEF Values

Test Material	Slope (UEF) $\pm$ SEM
NaAs	0.695 $\pm$ 0.038
TM1	0.243 $\pm$ 0.036
TM2	0.310 $\pm$ 0.023
TM3	0.254 $\pm$ 0.017
TM4	0.145 $\pm$ 0.015
TM5	0.122 $\pm$ 0.010
TM6	0.159 $\pm$ 0.016

4.2 Calculation of Relative Bioavailability

As discussed above, the relative bioavailability of arsenic in a specific test material is calculated as follows:

$$\text{RBA}(\text{test vs NaAs}) = \text{UEF}(\text{test}) / \text{UEF}(\text{NaAs, oral})$$

The results are summarized below:

Test Material	Relative Bioavailability	
	Best Estimate	90% Confidence Interval
TM1	0.35	0.26 - 0.45
TM2	0.45	0.38 – 0.52
TM3	0.36	0.31 – 0.42
TM4	0.21	0.17 – 0.25
TM5	0.18	0.15 – 0.21
TM6	0.23	0.19 – 0.28

4.3 Fecal Excretion and Mass Balance

As shown in Figure 3-1, the amount of arsenic excreted in the feces is the sum of that which is ingested but never absorbed, and that which is absorbed and then secreted in bile back into the intestines. Assuming that biliary excretion of absorbed arsenic is a relatively minor metabolic pathway, then the amount of arsenic excreted in the feces is expected to be high when the urinary excretion fraction (and hence the RBA) is low.

Figure 4-11 plots the fecal excretion fraction (defined as the mass of arsenic excreted in feces in 48 hours divided by the oral dose of arsenic administered in 48 hours) as a function of the urinary excretion fraction. As seen, there is a clear negative trend, with low urinary excretion being associated with high fecal excretion.

The sum of the two excretion fractions is equal to the total fraction of the administered dose recovered in urine plus feces. These data are summarized below.

Mass Balance for Arsenic			
Test Material	UEF	FEF	Total
NaAs	0.695	0.040	0.74
TM1	0.243	0.417	0.66
TM2	0.310	0.408	0.72
TM3	0.254	0.272	0.53
TM4	0.145	0.476	0.62
TM5	0.122	0.646	0.77
TM6	0.159	0.689	0.85

As seen, the total fraction of the administered arsenic that was recovered in urine and feces averaged about 70% (range = 53%-85%). This recovery is consistent with most other studies of arsenic excretion in animals (USEPA 1995).

4.4 In Vitro Bioaccessibility

Recently, an alternative approach for estimating the solubility (and hence the potential toxicity) of arsenic in soils and other solid material has been developed. The details of the approach are described in the project plan for this study (USEPA 1999). In brief, samples of soil are placed in a test fluid designed to be similar to gastric fluid, and the fraction of the total amount of arsenic in the sample which dissolves into the fluid under a specified set of conditions (temperature, time, pH) is measured. This fraction of the total that is solubilized is referred to as the *in vitro* bioaccessibility (IVBA). IVBA results for the six test materials in this study are summarized below:

Test Material	IVBA (%)
TM1	41.8
TM2	33.2
TM3	40.3
TM4	22.0
TM5	19.3
TM5 (dup)	18.2
TM6	17.6
TM6 (dup)	19.6

Because of the many differences between the *in vitro* test system and the gastrointestinal tract of a living organism (swine, human), it is not expected that the IVBA for a sample should be equal to the ABA or the RBA for that sample. However, if solubility is a key determinant of ABA and RBA, then it is expected that there should be a correlation between IVBA and RBA. Figure 4-12 plots the measured IVBA values as a function of the measured RBA values. As seen, there is a moderately good correlation between RBA and IVBA ($R^2 = 0.645$), with a slope of 0.8 and an intercept near zero. This indicates that, at this site, an *in vitro* measurement of bioaccessibility is a moderately good predictor of *in vivo* gastrointestinal absorption.

5.0 DISCUSSION AND RECOMMENDATIONS

The RBA results for site soils collected from the VBI70 study area range from about 0.18 to 0.45, with a mean of about 0.31. These values are all less than the default value of 0.8 recommended by USEPA Region VIII, supporting the conclusion that arsenic in VBI70 site soils is not as well absorbed as soluble arsenic. The detailed chemical mechanism accounting for this reduced bioavailability of arsenic in site soils is not known, but almost certainly is related to the chemical form of arsenic in the soils.

As shown in Appendix A and discussed in Section 2.1, all of the site soils evaluated in this study are characterized by a mixture of arsenic trioxide and lead arsenic oxide particles, with most of the particles being less than 10 um in diameter. Based on this general similarity in composition and particle size distribution, it is concluded that the apparent variations in RBA between different site samples is likely to be due mainly to random variations in bioassay results, and that the best estimate of an RBA value for the site should be based on the combined information from all five site soils (TM1 to TM5). Since TM6 is not an actual site sample, data from TM6 were not included in the summary statistics. Because of the inherent variability and uncertainty in the data, the 95% UCL of the mean is recommended as the most appropriate statistic for use in assessing human health risk from arsenic in soil. Summary statistics for the combined data are presented below:

Estimated Site-Wide RBA for Arsenic in Soil

Statistic	Value
Mean	0.31
Stdev	0.11
95% UCL ^a	0.42

a Assumes a normal distribution

6.0 REFERENCES

USEPA. 1999. Quality Assurance Project Plan for Vasquez Blvd-I70. Bioavailability of Arsenic in Site Soils Using Juvenile Swine as an Animal Model. Report prepared by ISSI Consulting Group for USEPA Region VIII. September, 1999.

Weis, C.P. and LaVelle, J.M. 1991. Characteristics to consider when choosing an animal model for the study of lead bioavailability. In: The Proceedings of the International Symposium on the Bioavailability and Dietary Uptake of Lead. Science and Technology Letters 3:113-119.

TABLE 2-1 STUDY DESIGN**Study 1**

Group	Number of Animals	Material Administered	Dose Route	Target Dose (ug As/kg-day)
1	3	Control	Oral	0
2	4	NaAs	Oral	50
3	4	NaAs	Oral	125
4	4	Test material 1	Oral	50
5	4	Test material 1	Oral	125
6	4	Test material 2	Oral	50
7	4	Test material 2	Oral	125
8	4	Test material 3	Oral	50
9	4	Test material 3	Oral	125

Study 2

Group	Number of Animals	Material Administered	Dose Route	Target Dose (ug As/kg-day)
1	3	Control	Oral	0
2	4	NaAs	Oral	50
3	4	NaAs	Oral	125
4	4	Test material 4	Oral	50
5	4	Test material 4	Oral	125
6	4	Test material 5	Oral	50
7	4	Test material 5	Oral	125
8	4	Test material 6	Oral	50
9	4	Test material 6	Oral	125

TABLE 2-2 ARSENIC CONCENTRATIONS IN TEST MATERIALS

Test Material	Description	XRF-1	XRF-2	ICP	NAA	Mean^a
1	Soil composite from a residential property in eastern Swansea/Elyria	422	318	290	328	312
2	Soil composite from a residential property in western Swansea/Elyria	1450	1041	856	1053	983
3	Soil composite from a residential property in eastern Cole	710	419	343	408	390
4	Soil composite from a residential property in western Cole	1087	821	756	862	813
5	Soil composite from a residential property in Clayton	448	352	329	423	368
6	PAX added to a clean site soil from a property in Swansea/Elyria	796	503	459	586	516

a Mean excludes XRF-1

FIGURE 2-1 ARSENIC CONCENTRATIONS IN TEST MATERIALS

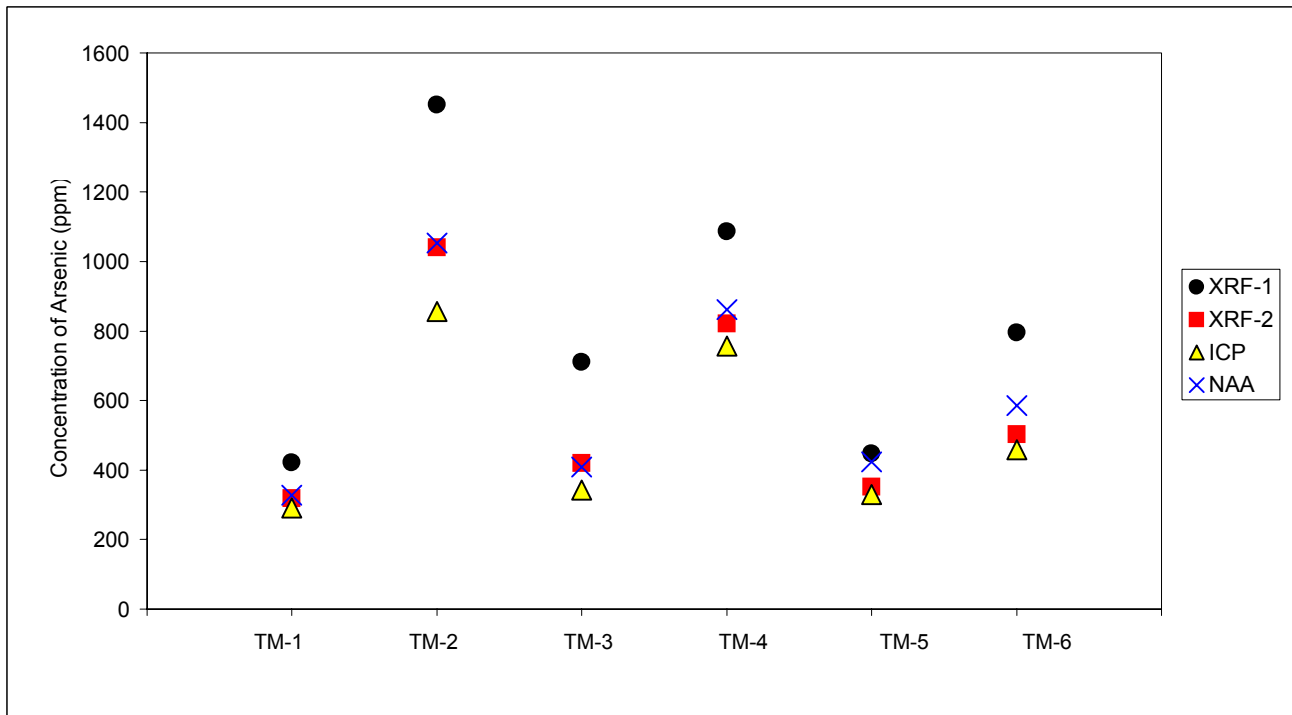


FIGURE 2-2 BODY WEIGHT GAIN

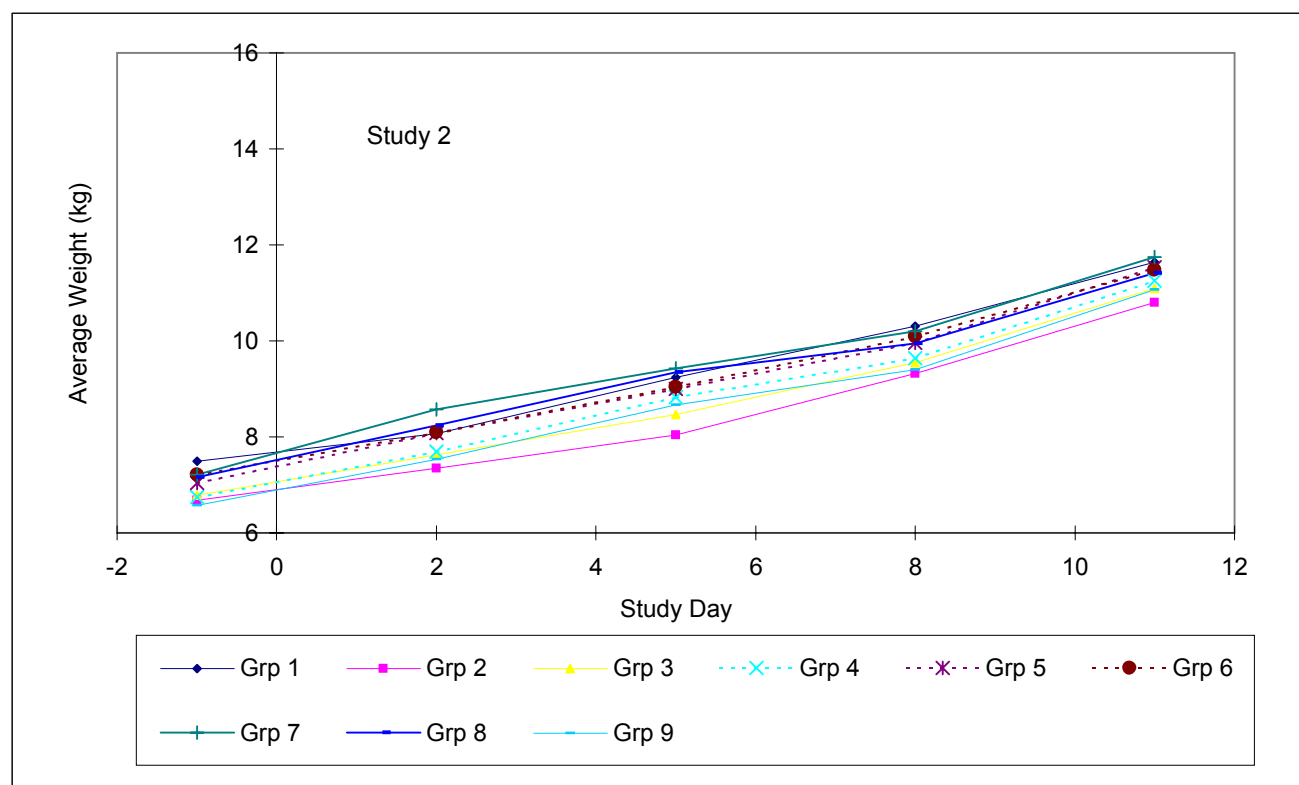
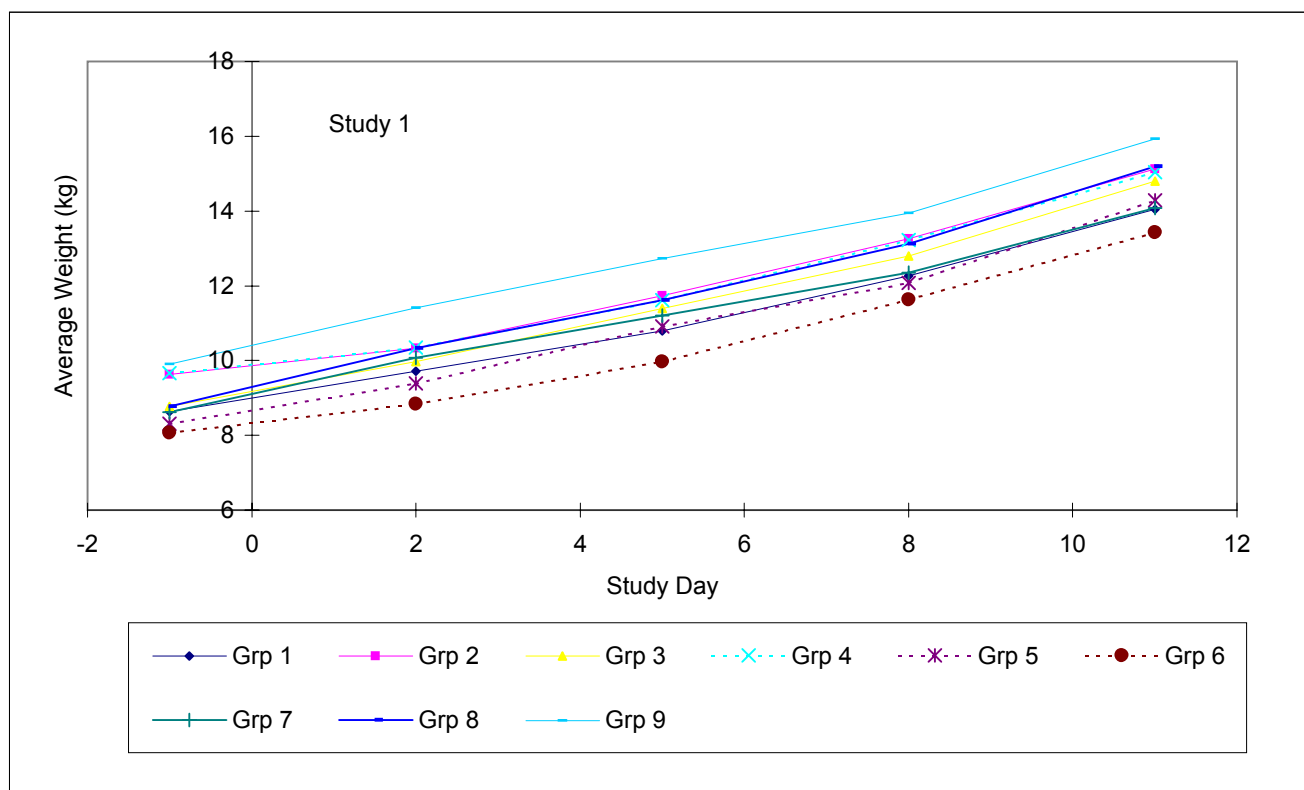


FIGURE 2-3 PERFORMANCE EVALUATION SAMPLES

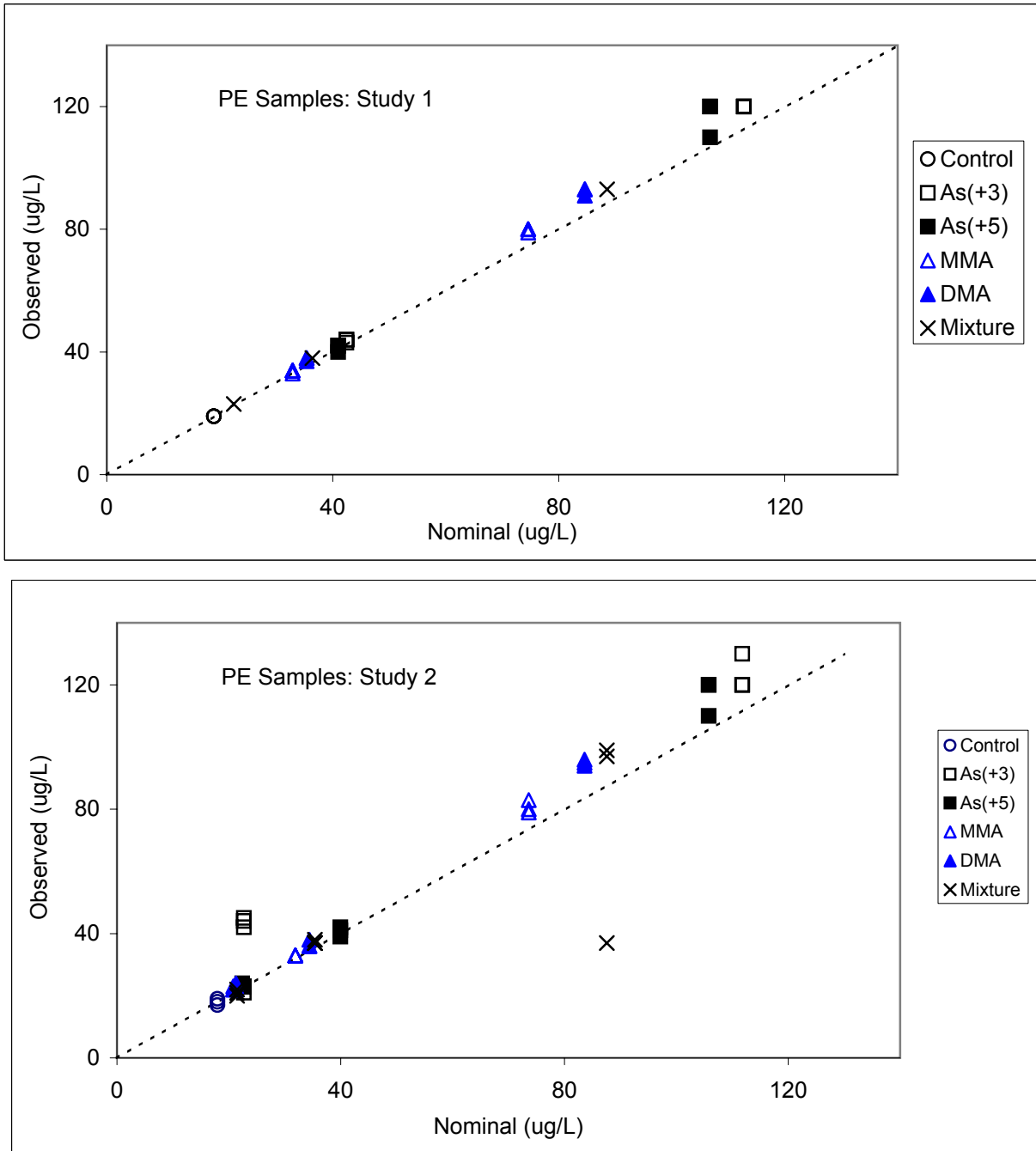


FIGURE 2-4 BLIND DUPLICATE SAMPLES

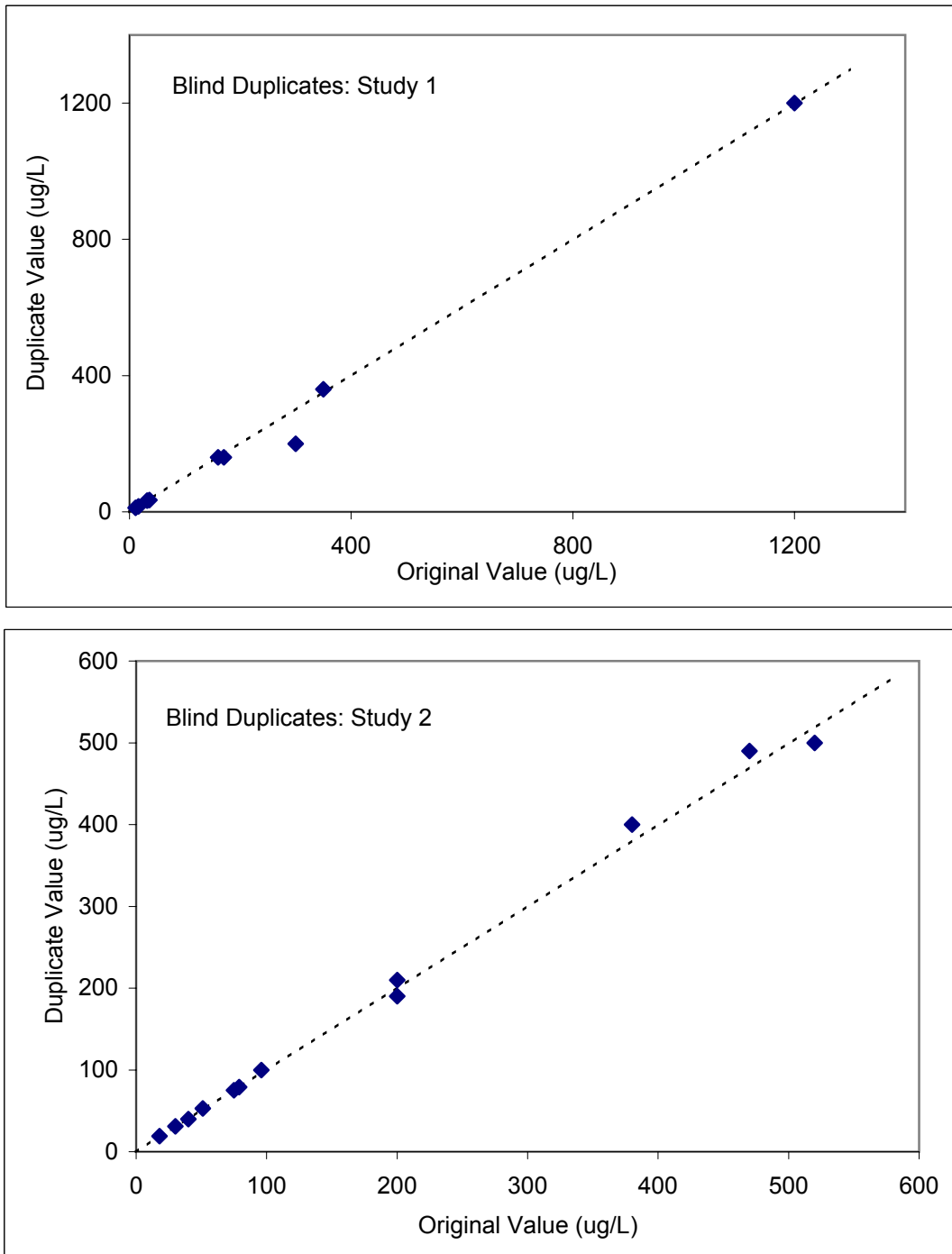


FIGURE 2-5. INTER-LABORATORY COMPARISON

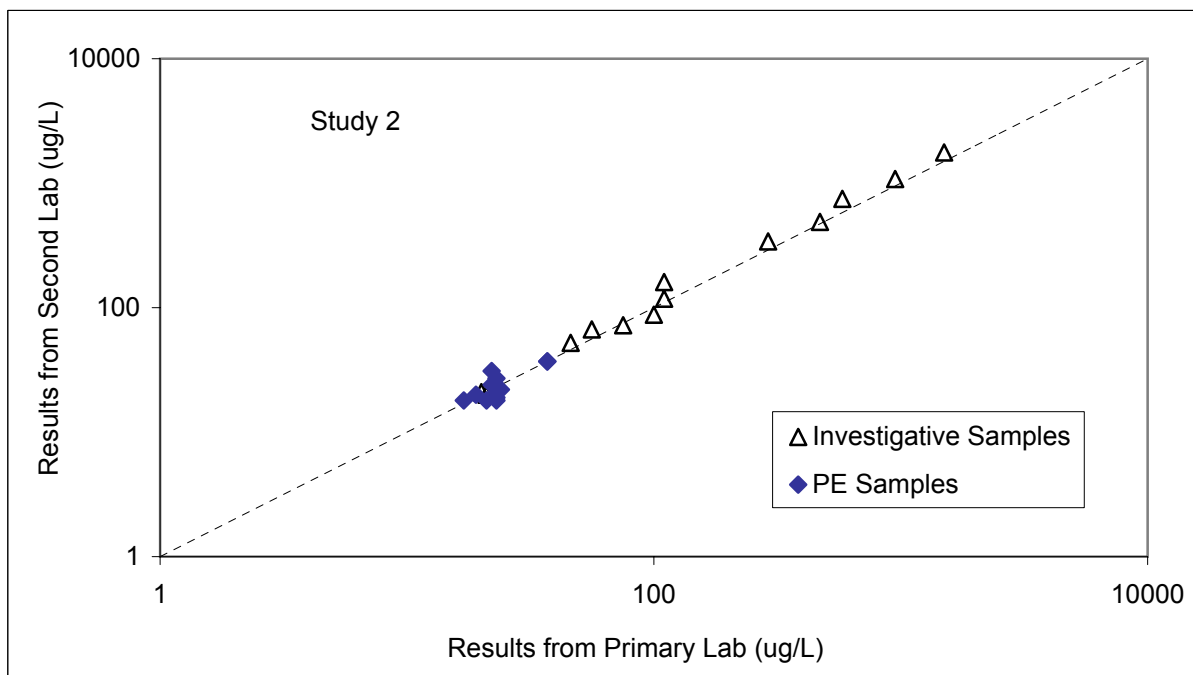
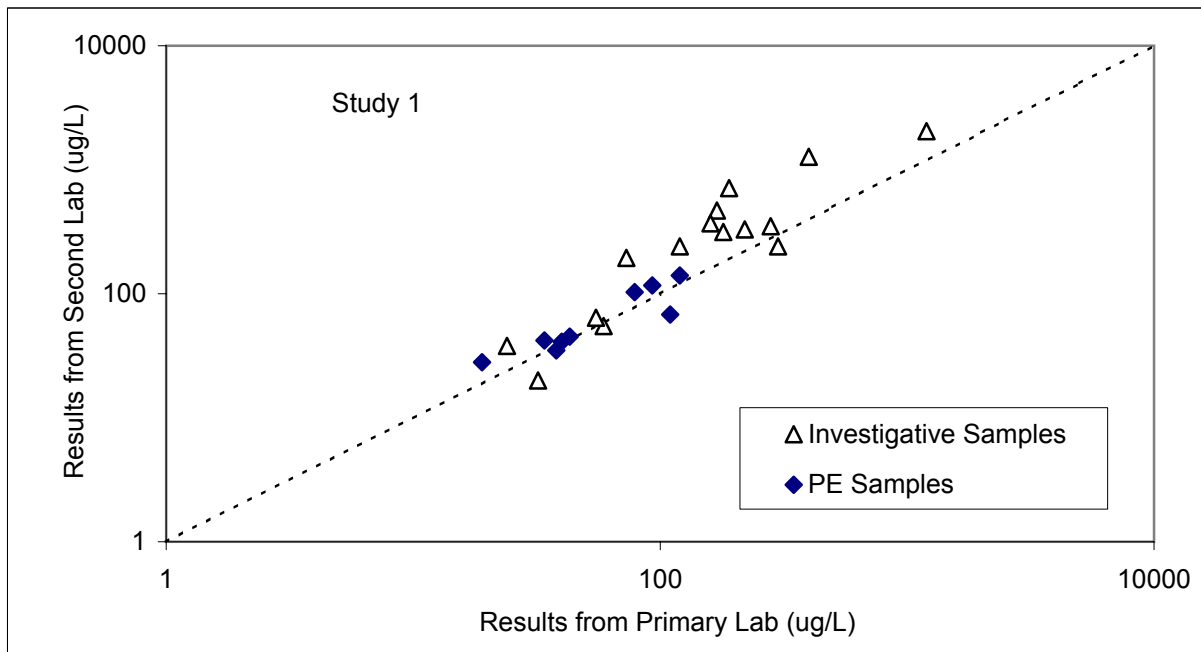
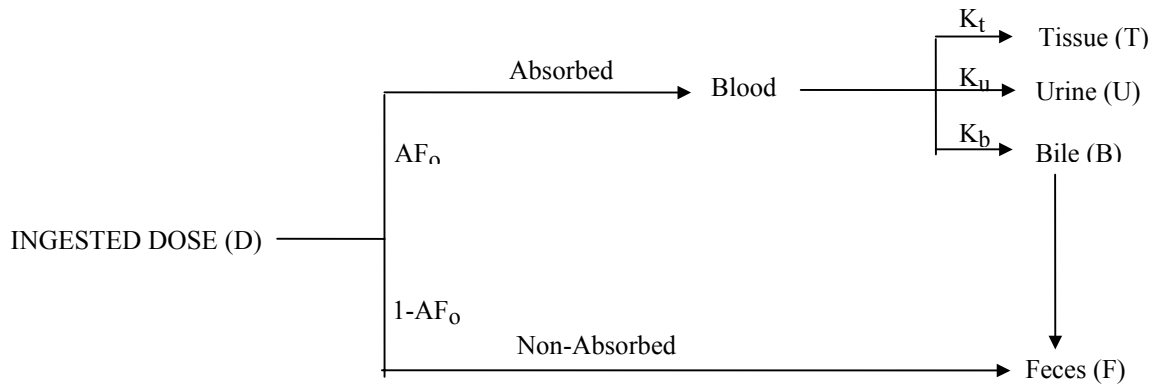


FIGURE 3-1 CONCEPTUAL MODEL FOR ARSENIC TOXICOKINETICS



where:

AF_o = Oral Absorption Fraction

K_t = Fraction of absorbed arsenic which is retained in tissues

K_u = Fraction of absorbed arsenic which is excreted in urine

K_b = Fraction of absorbed arsenic which is excreted in the bile

BASIC EQUATIONS:

Amount in Urine

$$U_{oral} = D \cdot AF_o \cdot K_u$$

$$U_{iv} = D \cdot K_u$$

Urinary Excretion Fraction (UEF)

$$UEF_{oral} = \frac{U_{oral}}{D_{oral}} = AF_o \cdot K_u$$

$$UEF_{iv} = \frac{U_{iv}}{D_{iv}} = K_u$$

Bioavailability

$$ABA = \frac{UEF_{oral}}{UEF_{iv}} = \frac{AF_o \cdot K_u}{K_u} = AF_o$$

$$RBA(x \text{ vs. } y) = \frac{UEF_{x,oral}}{UEF_{y,oral}} = \frac{AF_o(x) \cdot K_u}{AF_o(y) \cdot K_u} = \frac{AF_o(x)}{AF_o(y)}$$

**FIGURE 4-1 URINARY EXCRETION OF ARSENIC FROM SODIUM ARSENATE
(Study 1)**

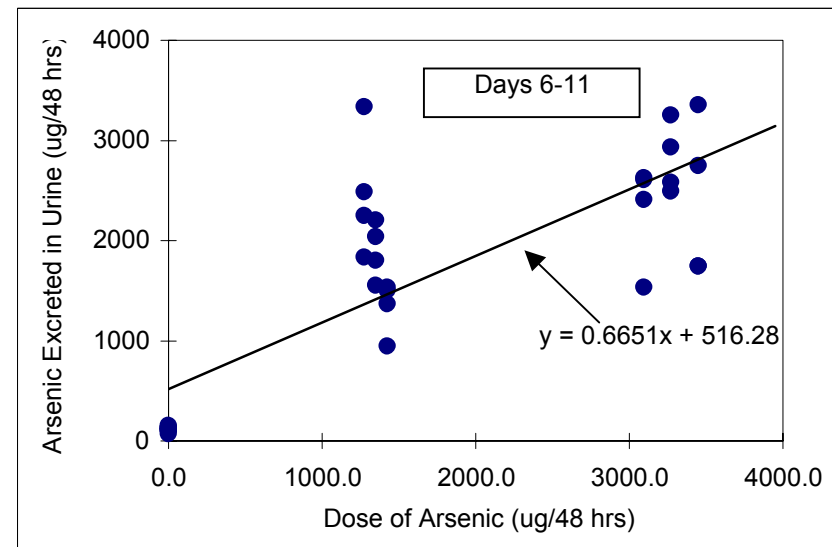
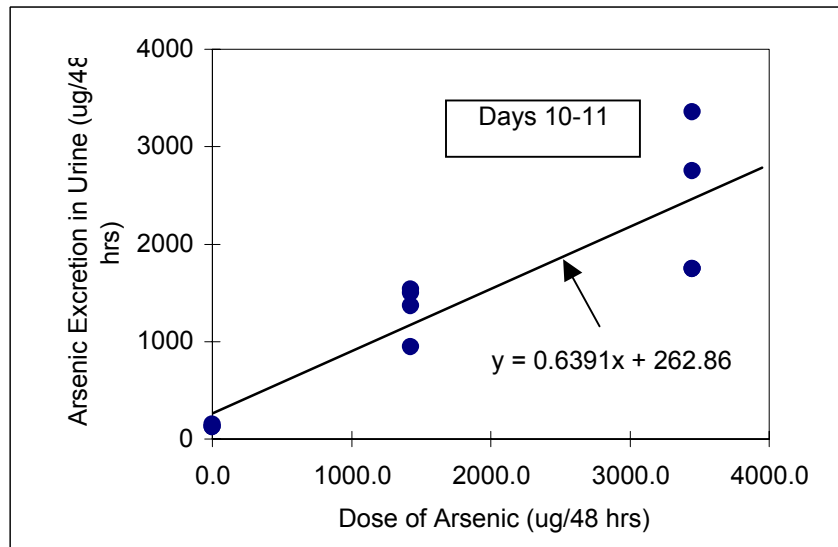
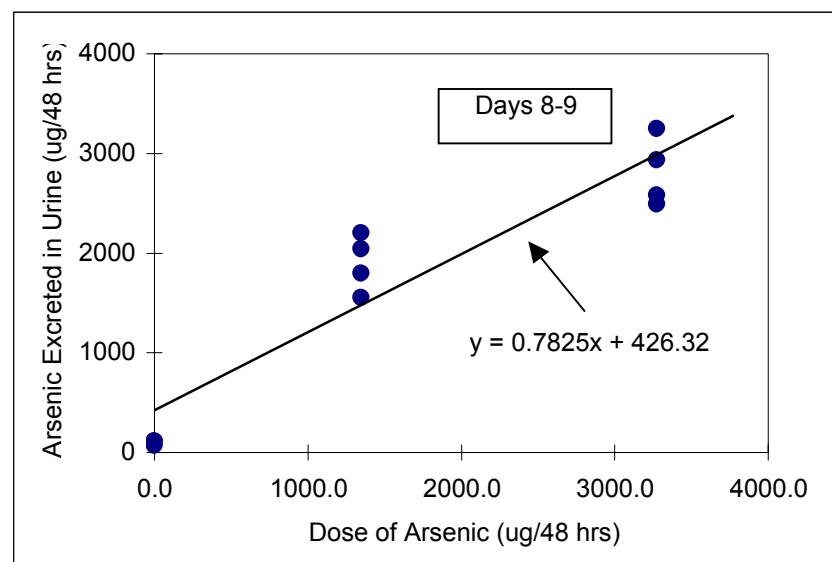
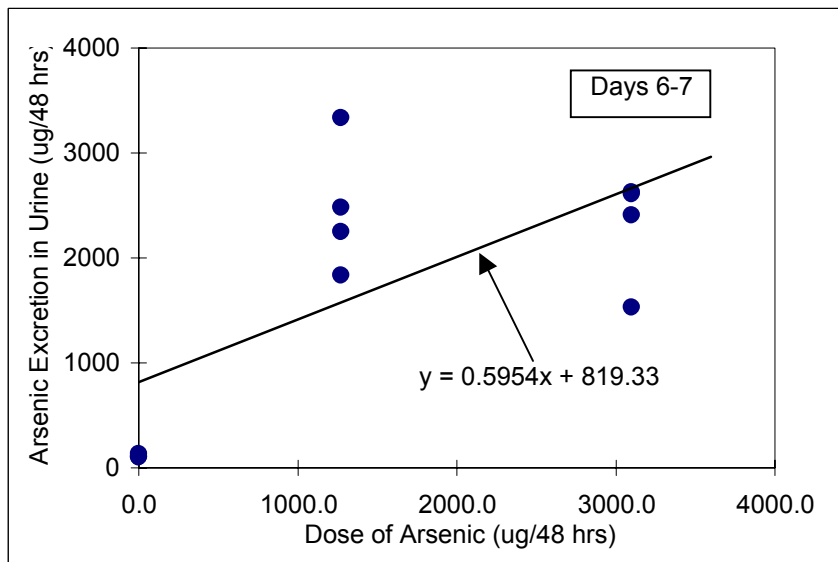
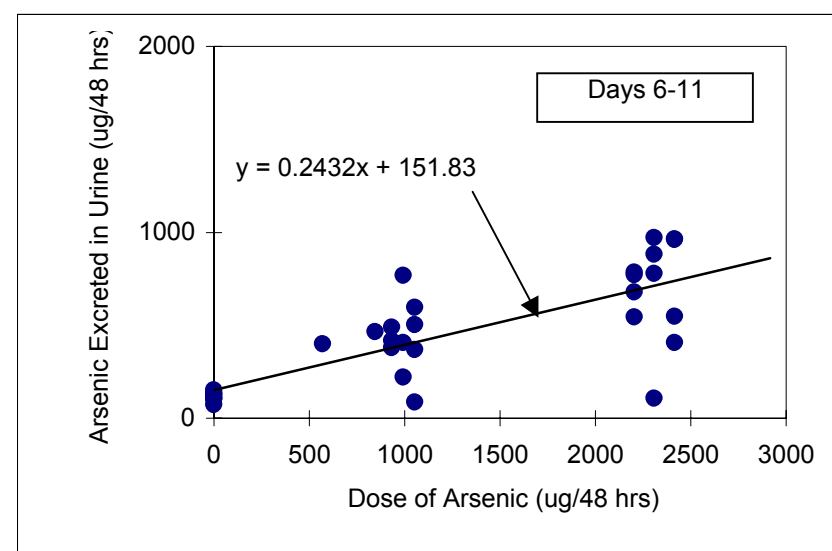
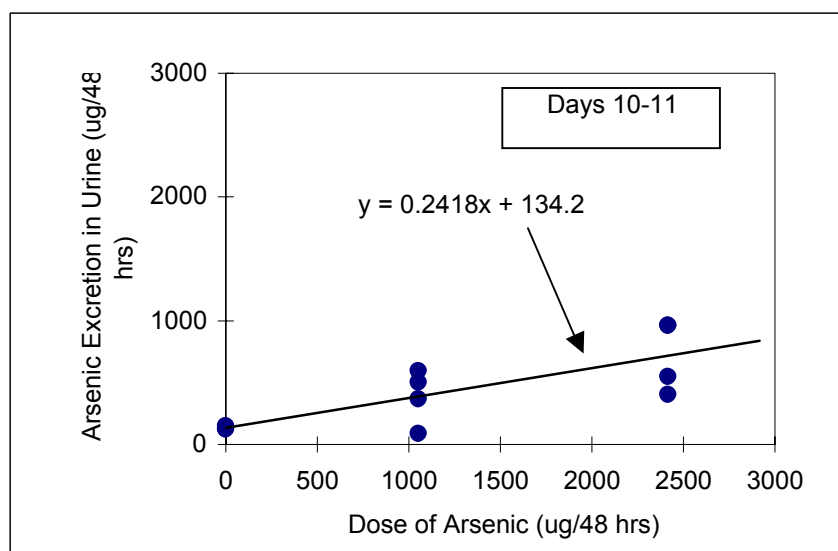
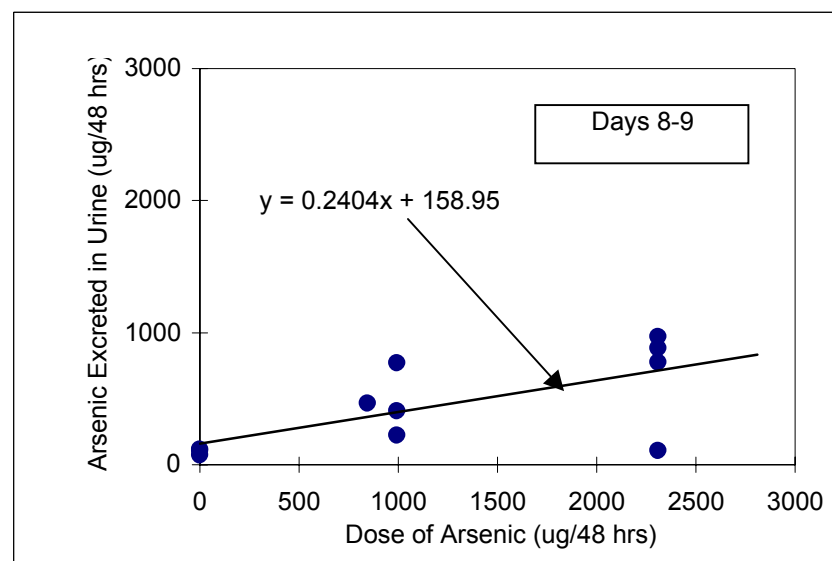
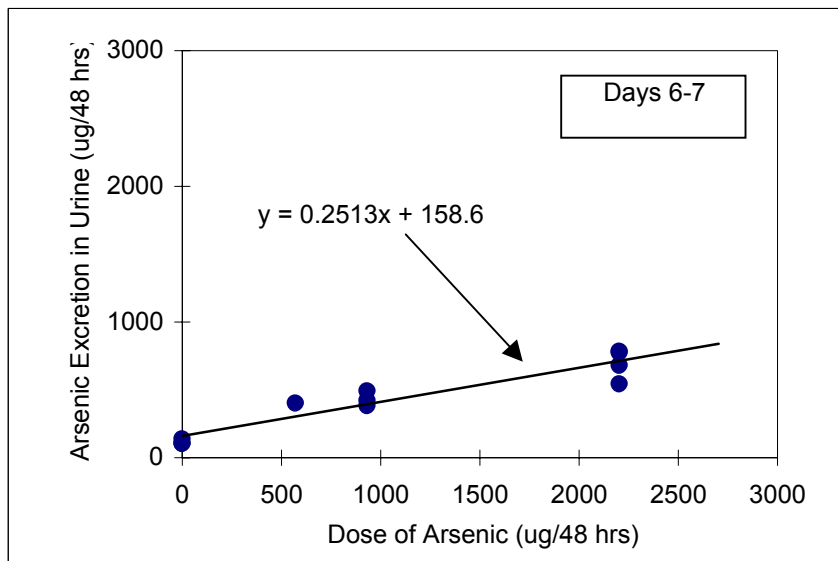
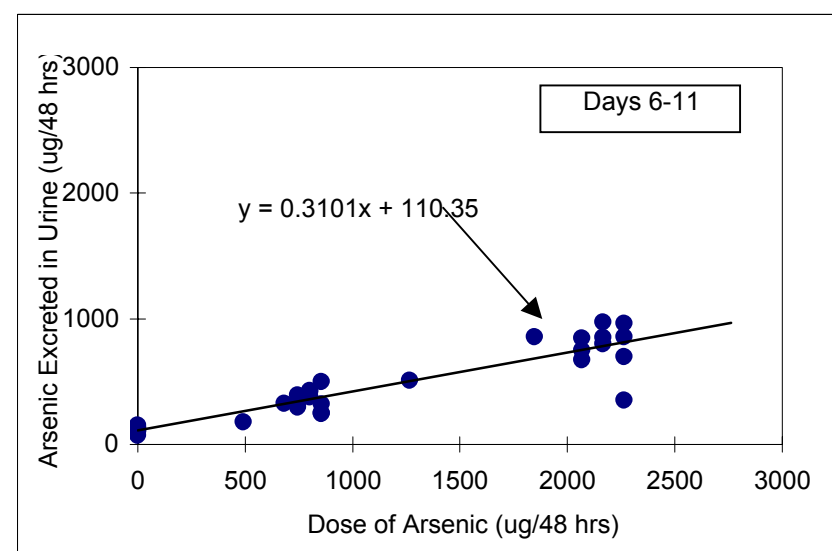
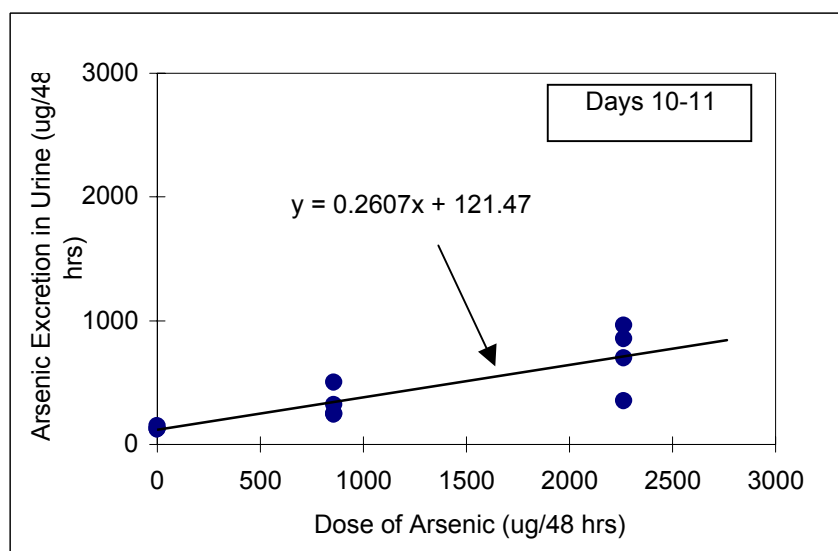
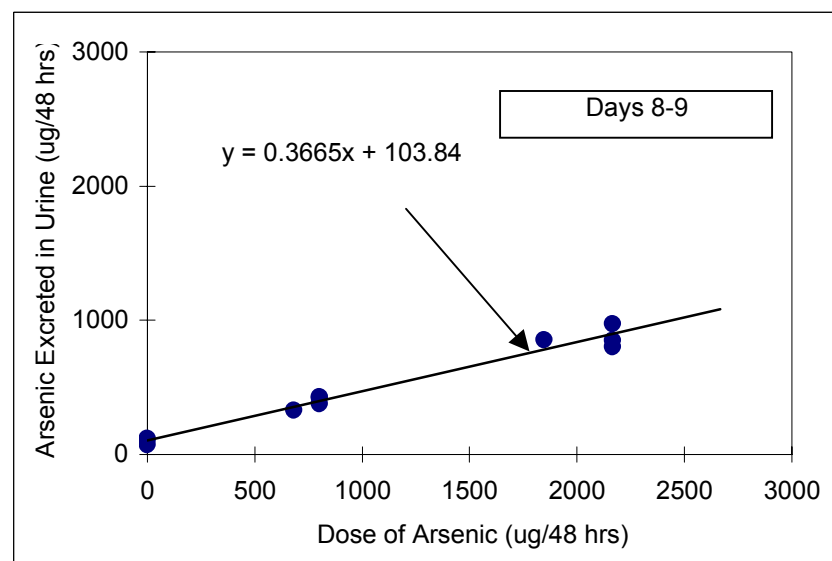
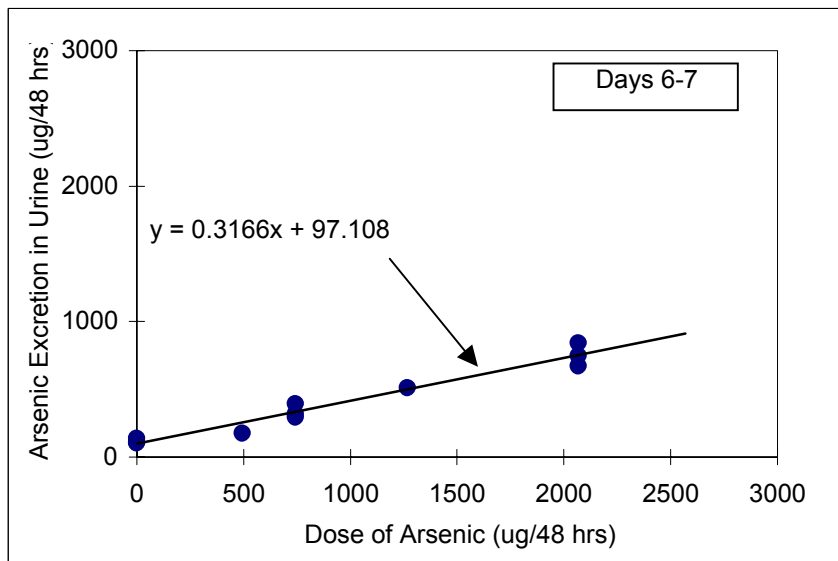


FIGURE 4-2 URINARY EXCRETION OF ARSENIC FROM TEST SOIL 1
(Study 1)



**FIGURE 4-3 URINARY EXCRETION OF ARSENIC FROM TEST SOIL 2
(Study 1)**



**FIGURE 4-4 URINARY EXCRETION OF ARSENIC FROM TEST SOIL 3
(Study 1)**

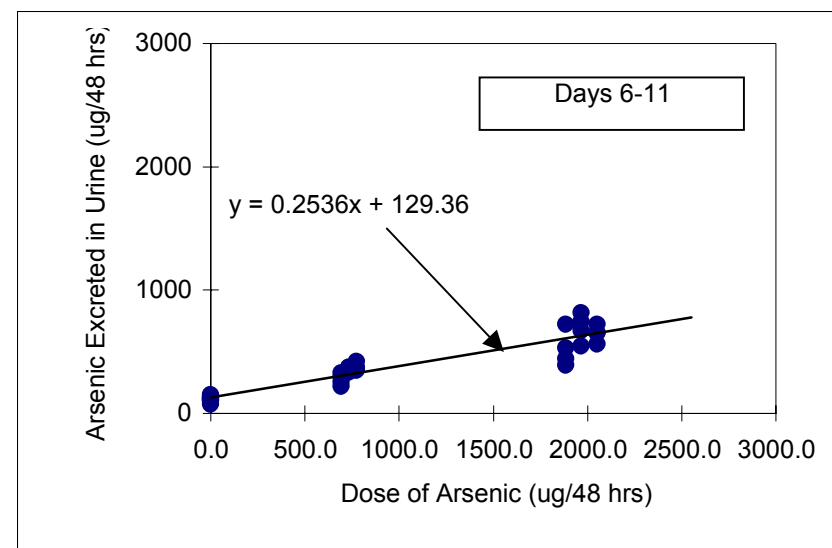
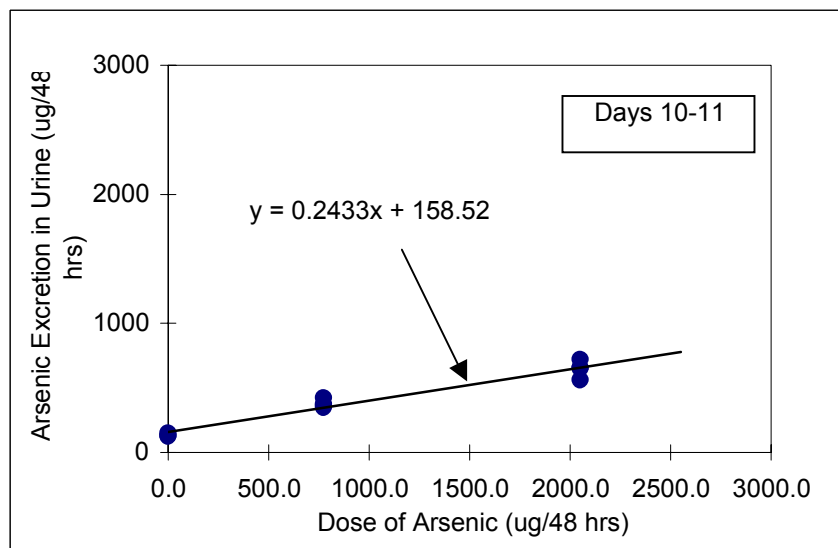
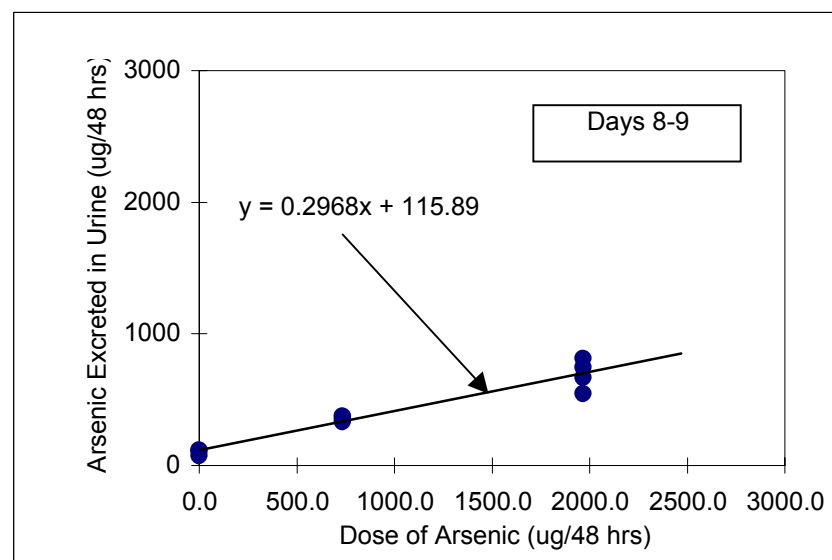
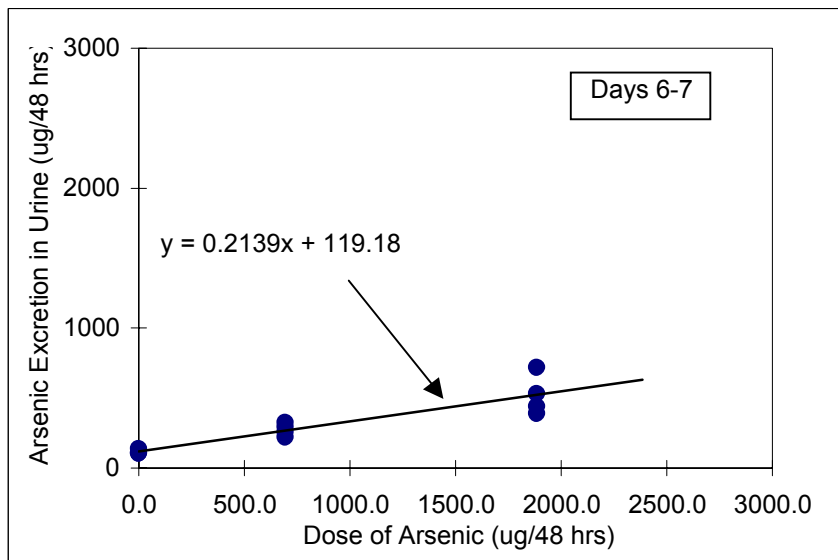


FIGURE 4-5 URINARY EXCRETION OF ARSENIC FROM SODIUM ARSENATE
(Study 2)

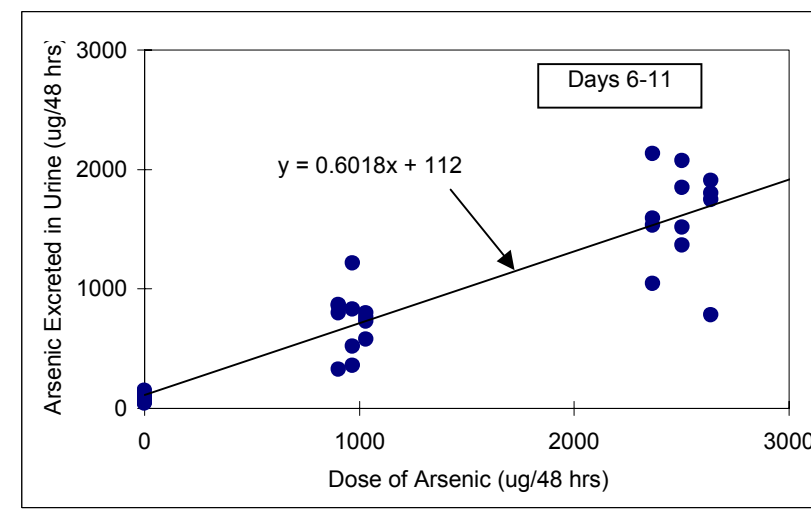
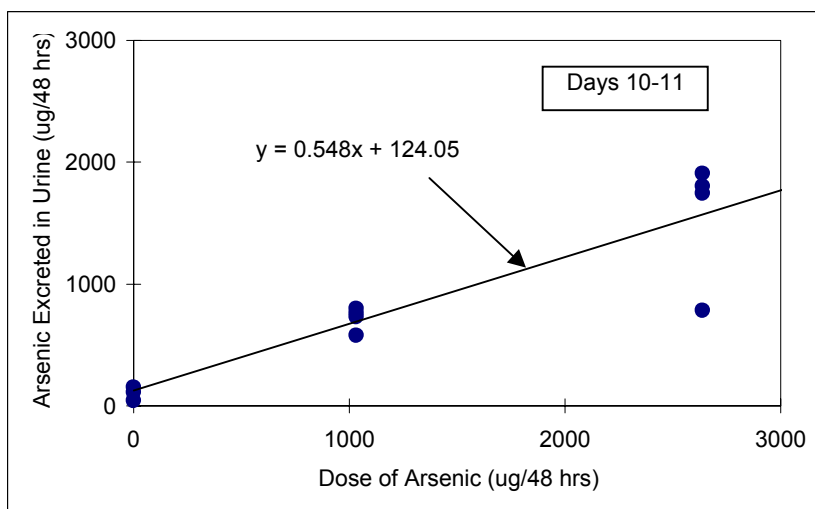
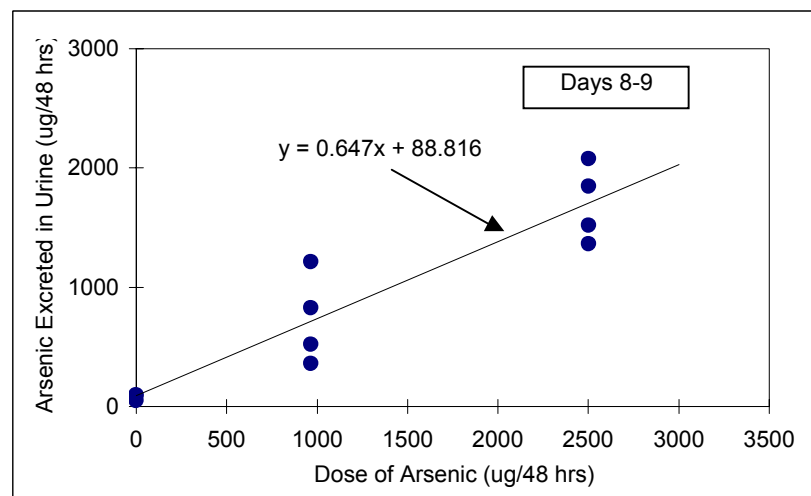
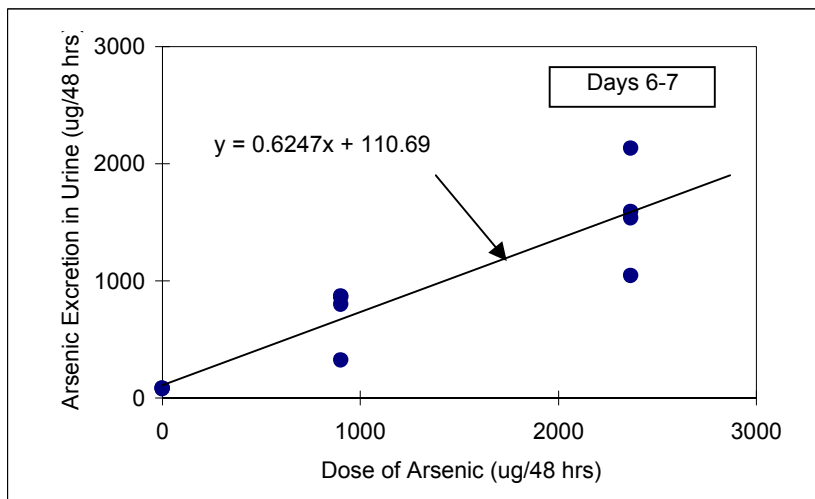


FIGURE 4-6 URINARY EXCRETION OF ARSENIC FROM TEST SOIL 4
(Study 2)

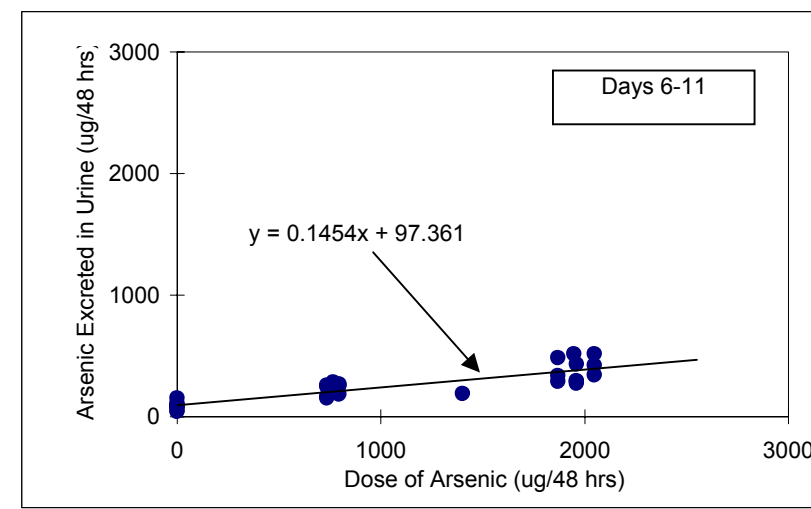
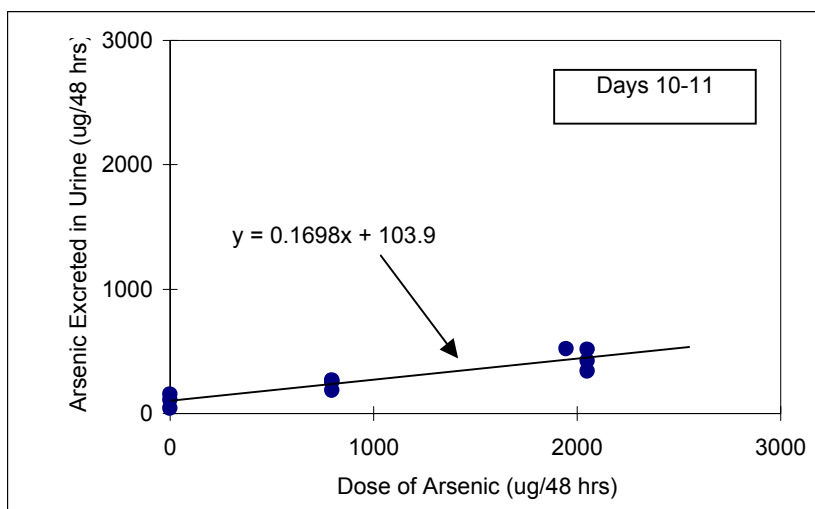
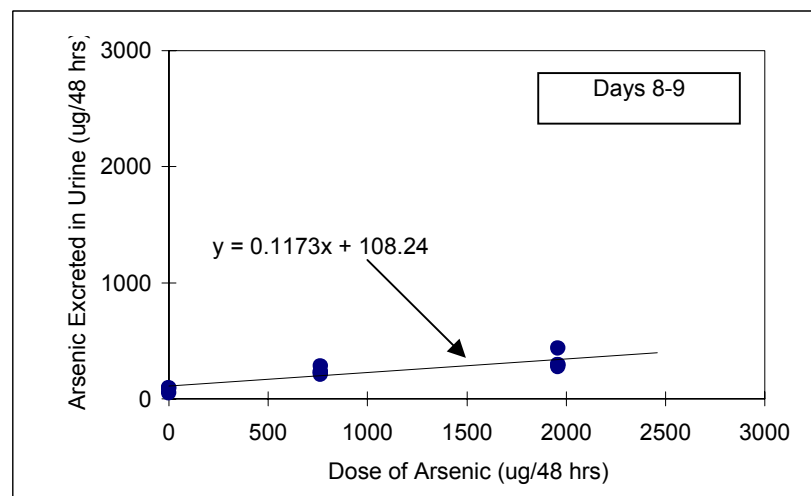
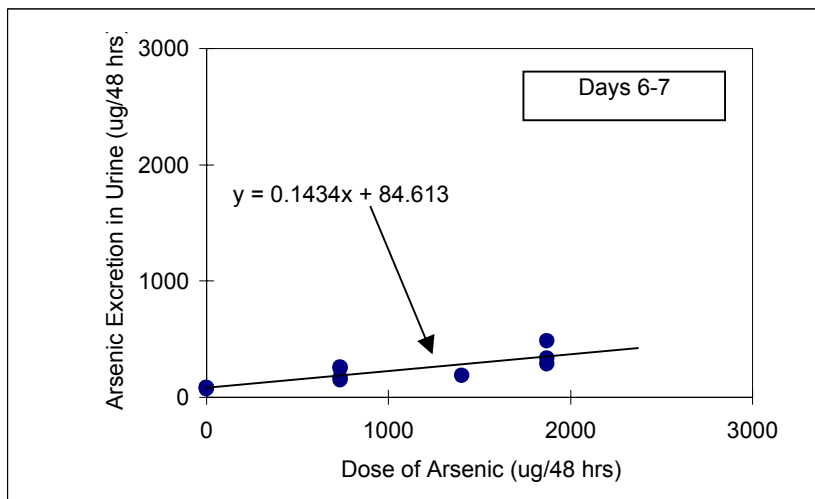


FIGURE 4-7 URINARY EXCRETION OF ARSENIC FROM TEST SOIL 5
(Study 2)

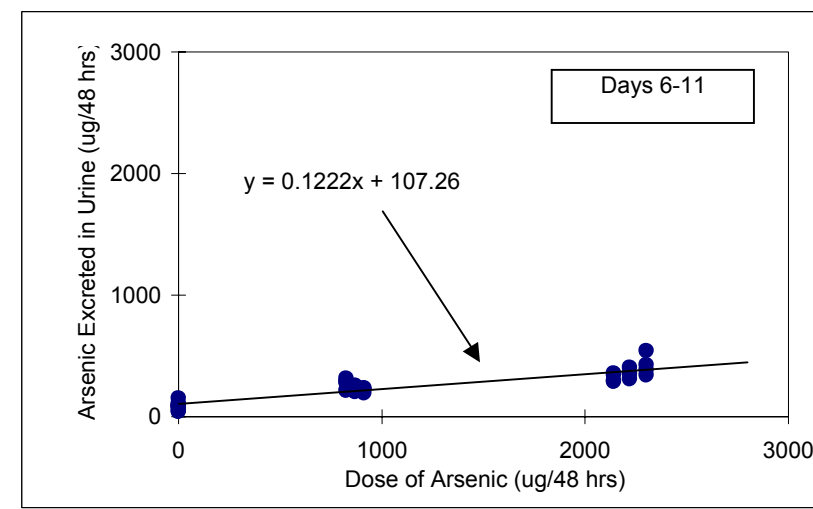
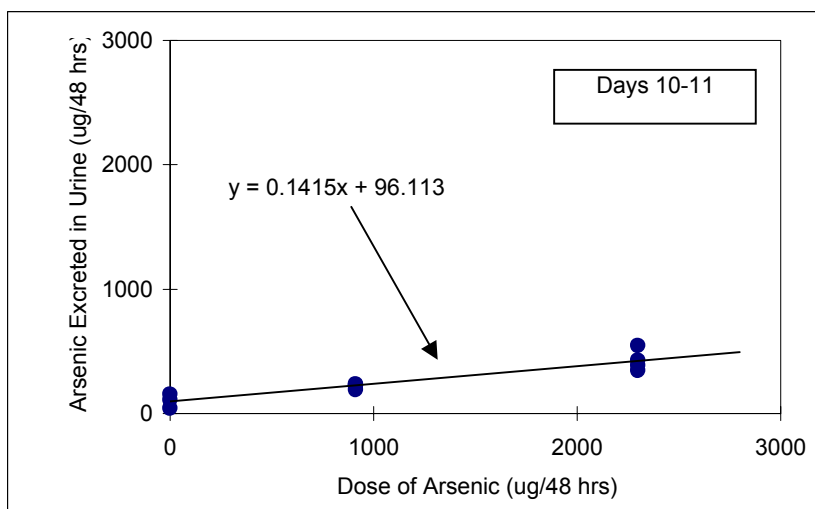
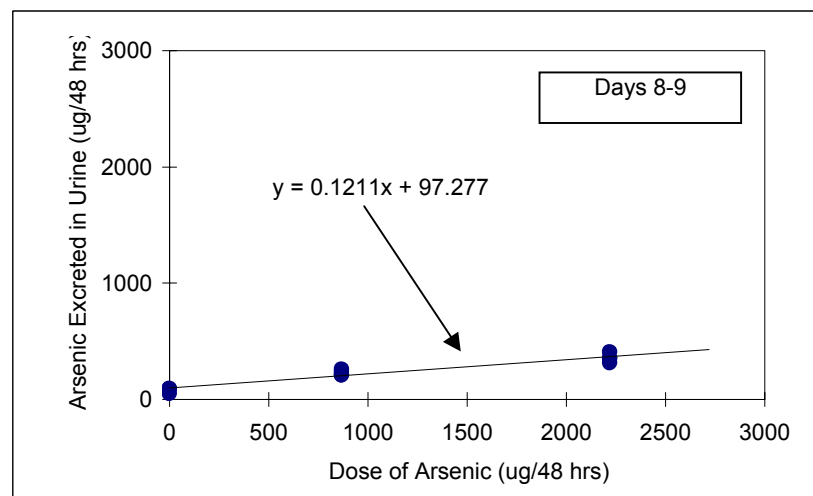
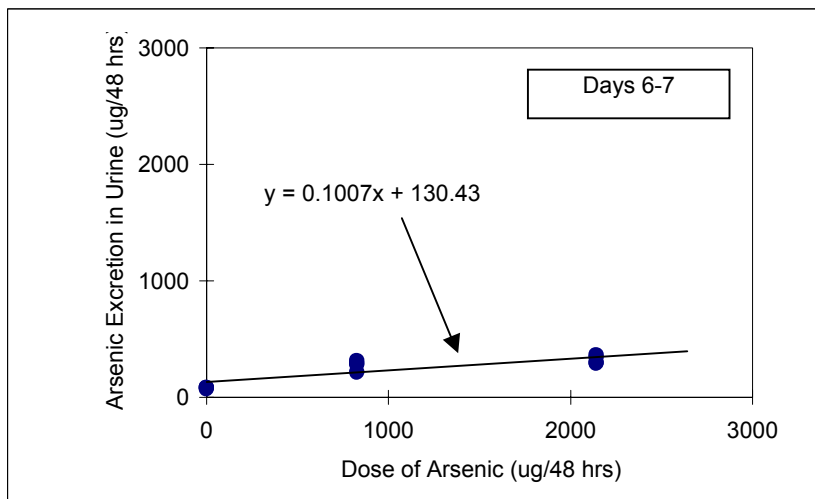


FIGURE 4-8 URINARY EXCRETION OF ARSENIC FROM TEST SOIL 6
(Study 2)

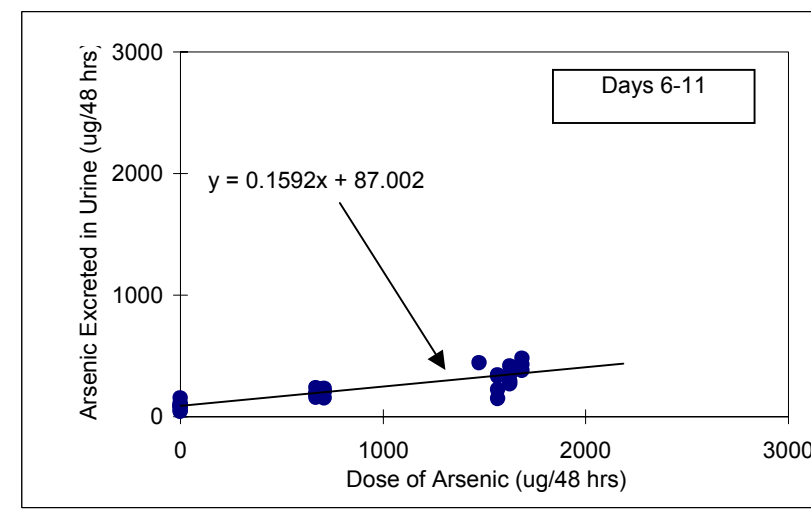
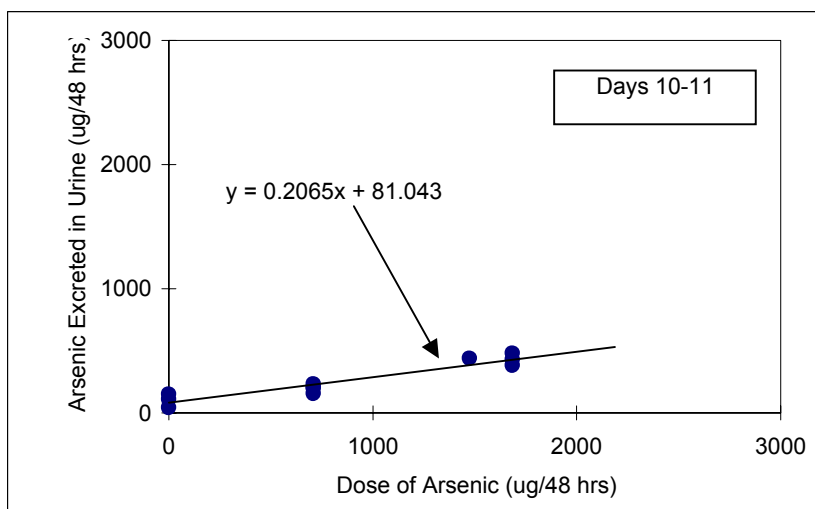
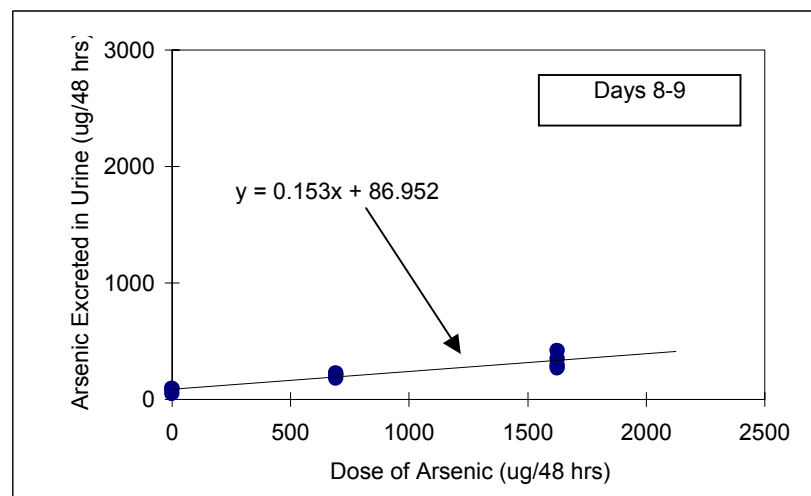
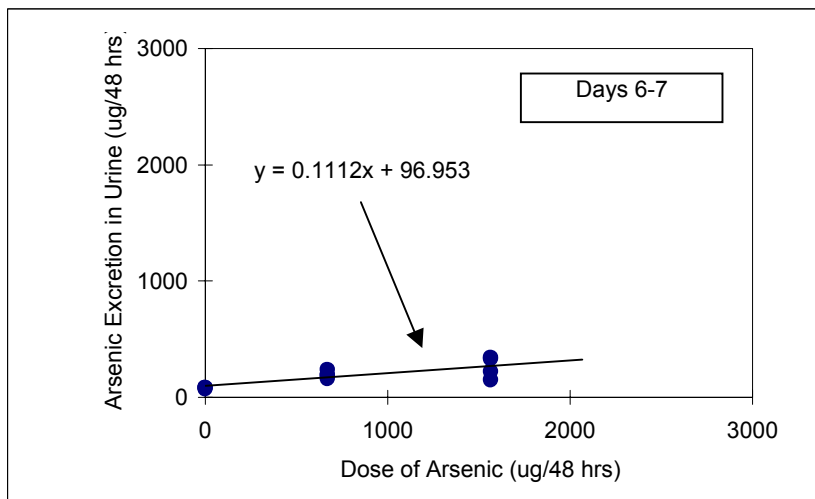


FIGURE 4-9 DOSE CONFIRMATION SAMPLE RESULTS

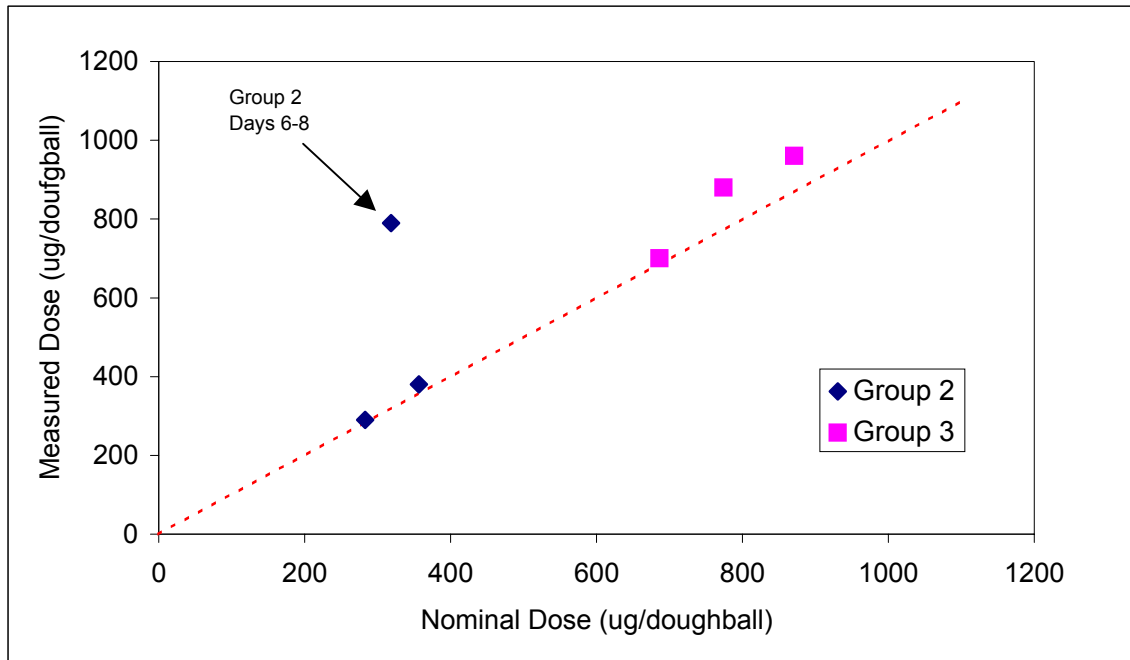
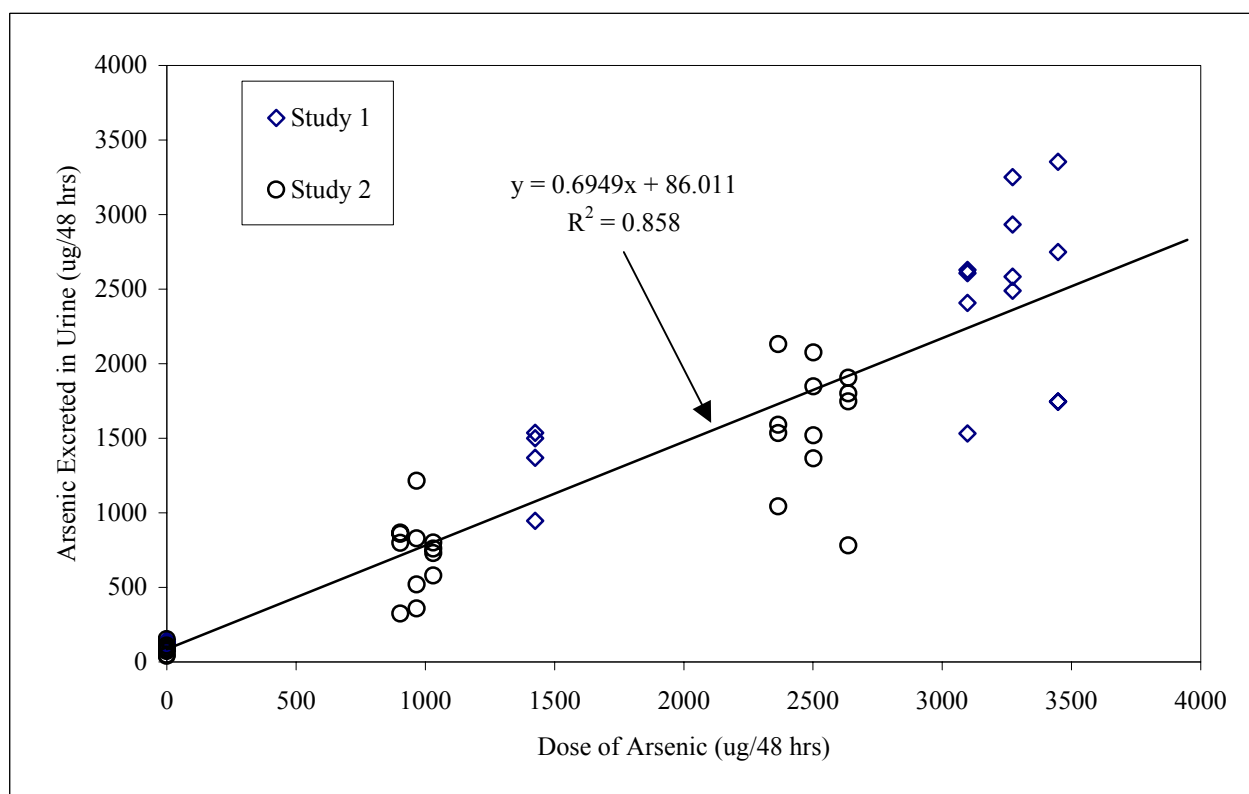
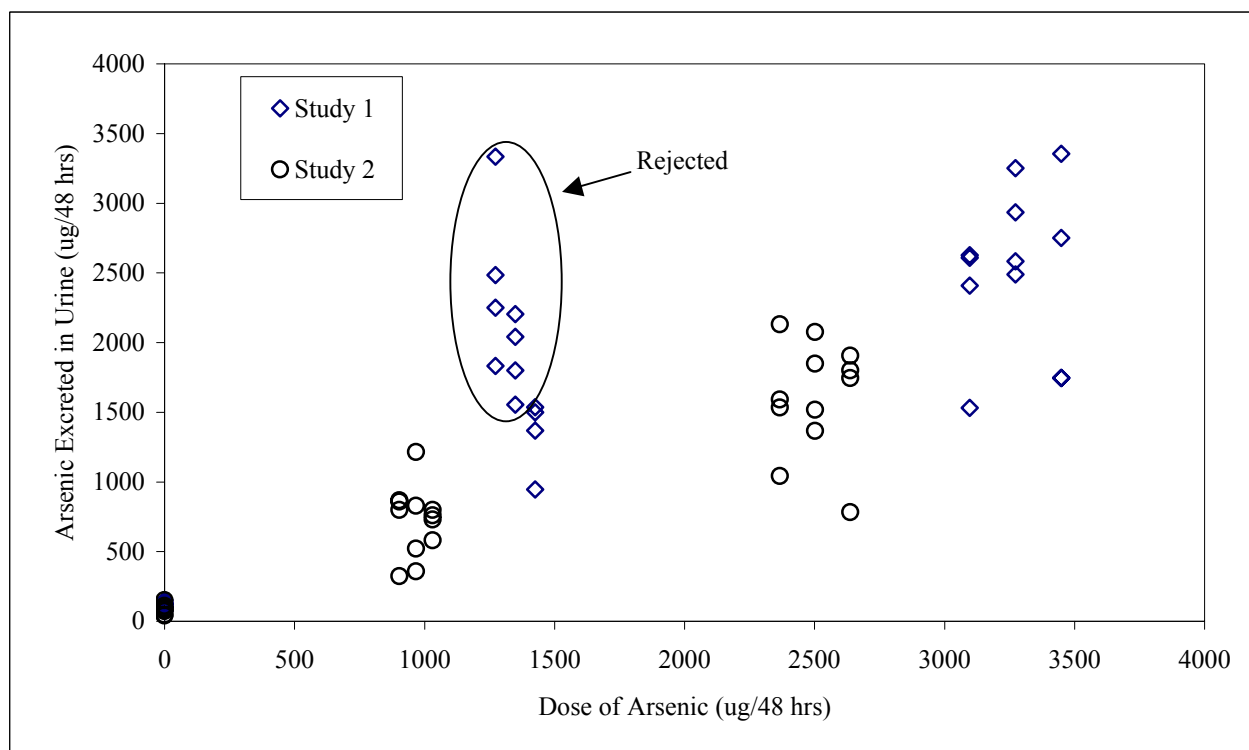


FIGURE 4-10 COMBINED DATA FOR SODIUM ARSENATE



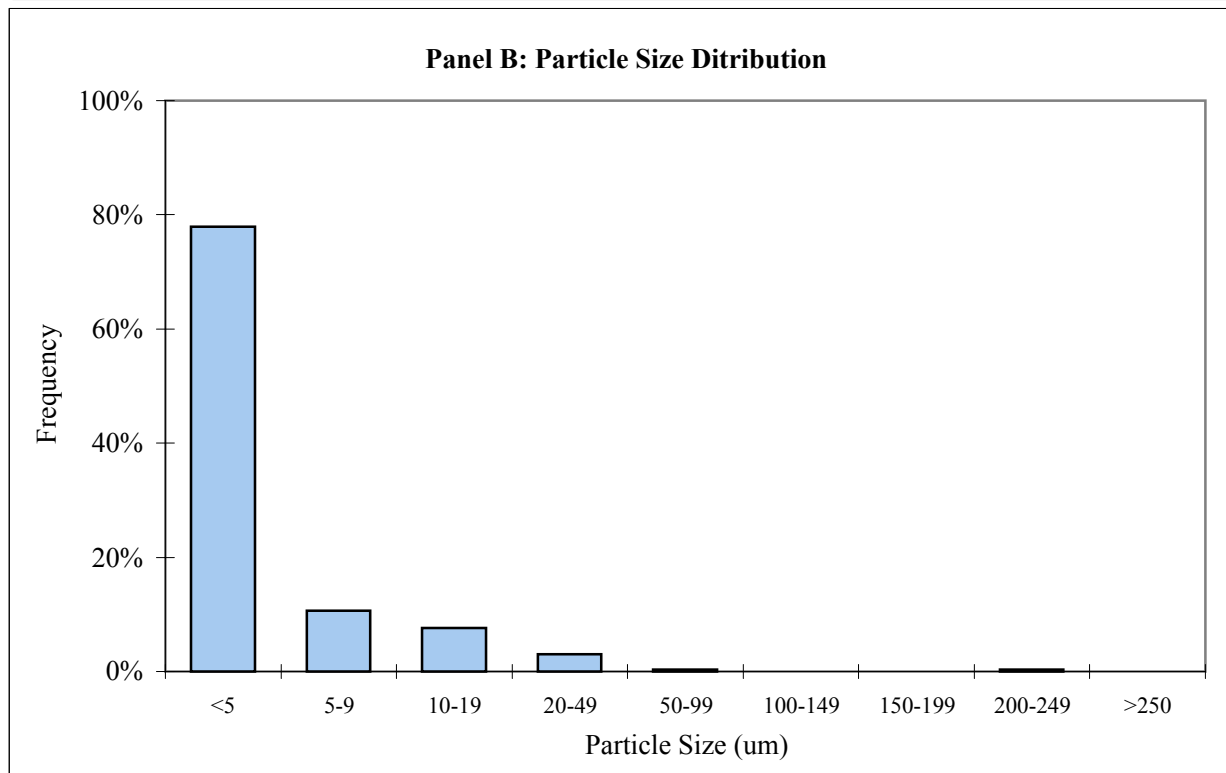
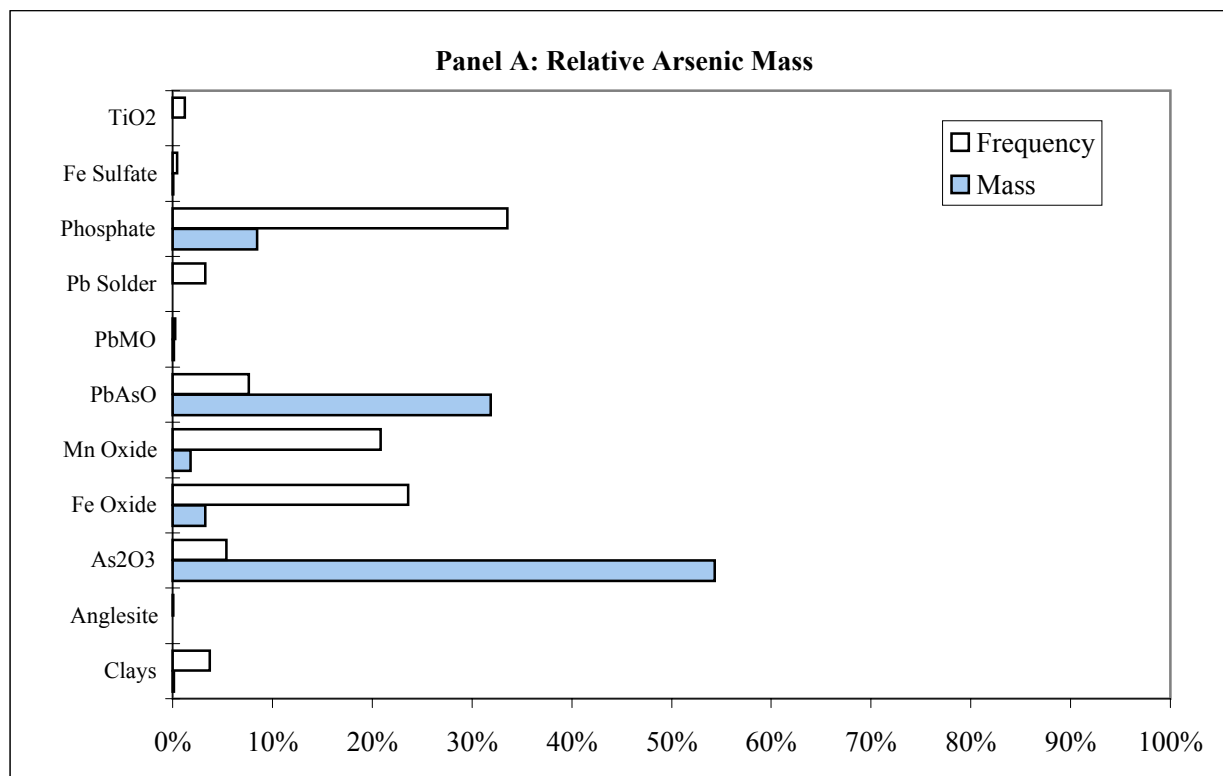
APPENDIX A

DETAILED ARSENIC SPECIATION RESULTS

Test Material 1 - Arsenic
Speciation Summary Statistics

Mineral	COUNTS		SIZE			Count Freq (%)		LW Freq (%)		Rel. Arsenic Mass (%)	
	Total	Lib	Avg	Min	Max	Total	Liberated	Total	Liberated	Total	Liberated
Clays	5	5	9	2	30	1.9%	1.9%	3.7%	3.7%	0.2%	0.2%
Anglesite	1	1	1	1	1	0.4%	0.4%	0.1%	0.1%	0.0%	0.0%
As ₂ O ₃	7	7	10	7	11	2.7%	2.7%	5.4%	5.4%	54.3%	54.3%
Fe Oxide	25	25	12	2	42	9.5%	9.5%	23.6%	23.6%	3.2%	3.2%
Mn Oxide	39	39	7	1	50	14.9%	14.9%	20.8%	20.8%	1.8%	1.8%
PbAsO	52	52	2	1	11	19.8%	19.8%	7.6%	7.6%	31.9%	31.9%
PbMO	1	1	3	3	3	0.4%	0.4%	0.2%	0.2%	0.1%	0.1%
Pb Solder	2	2	21	1	40	0.8%	0.8%	3.3%	3.3%	0.0%	0.0%
Phosphate	128	128	3	1	200	48.9%	48.9%	33.5%	33.5%	8.5%	8.5%
Fe Sulfate	1	1	6	6	6	0.4%	0.4%	0.5%	0.5%	0.1%	0.1%
TiO ₂	1	1	15	15	15	0.4%	0.4%	1.2%	1.2%	0.0%	0.0%
TOTAL	262	262	5			100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

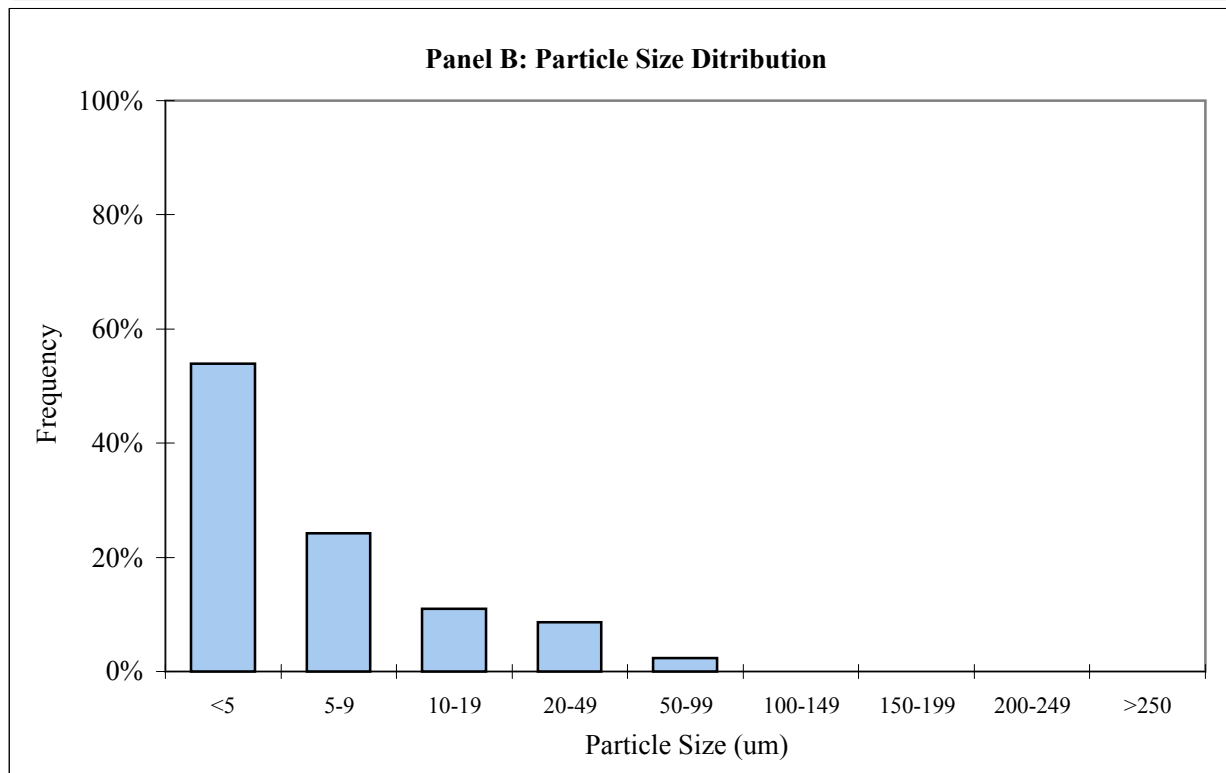
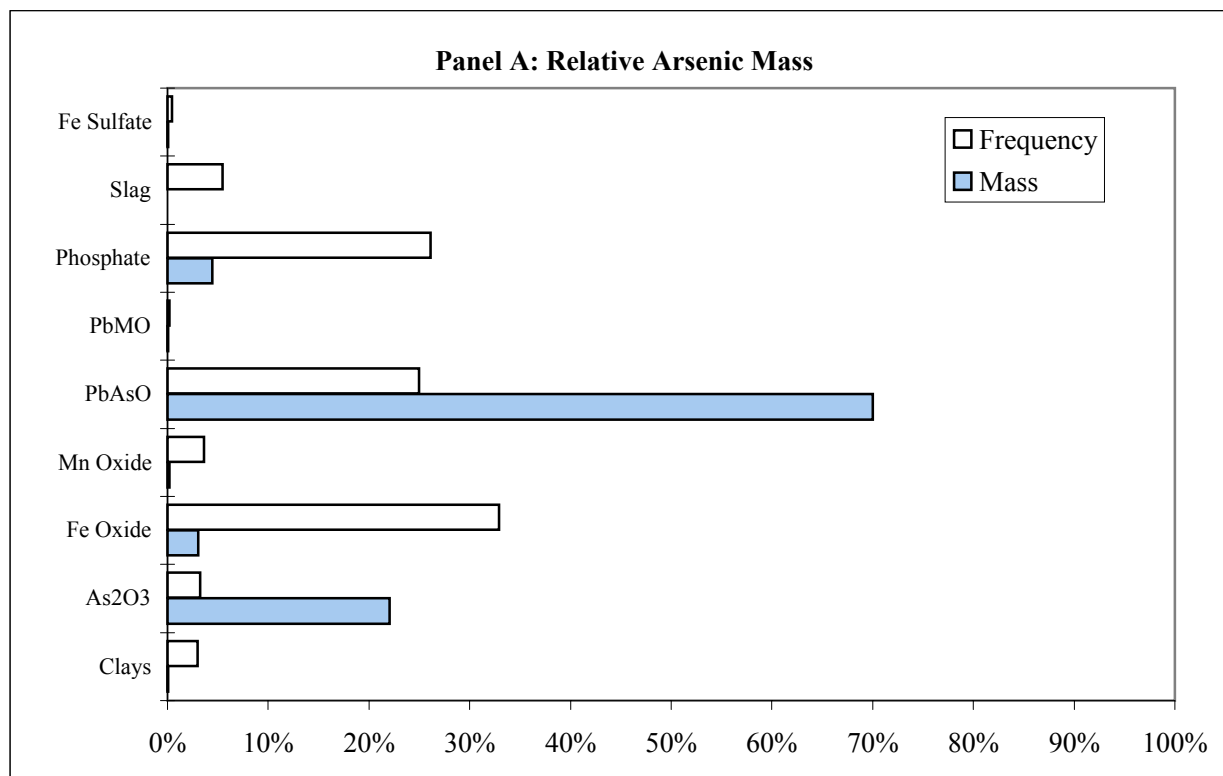
Test Material 1 - Speciation and Particle Size Data



Test Material 2 - Arsenic
Speciation Summary Statistics

Mineral	COUNTS		SIZE			Count Freq (%)		LW Freq (%)		Rel. As Mass (%)	
	Total	Lib	Avg	Min	Max	Total	Liberated	Total	Liberated	Total	Liberated
Clays	5	5	7	2	25	3.9%	3.9%	3.0%	3.0%	0.1%	0.1%
As ₂ O ₃	7	7	5	1	12	5.5%	5.5%	3.3%	3.3%	22.1%	22.1%
Fe Oxide	24	24	15	3	88	18.8%	18.8%	32.9%	32.9%	3.0%	3.0%
Mn Oxide	5	5	8	3	12	3.9%	3.9%	3.6%	3.6%	0.2%	0.2%
PbAsO	54	54	5	1	80	42.2%	42.2%	25.0%	25.0%	70.0%	70.0%
PbMO	2	2	1	1	1	1.6%	1.6%	0.2%	0.2%	0.1%	0.1%
Phosphate	28	28	10	1	45	21.9%	21.9%	26.1%	26.1%	4.4%	4.4%
Slag	2	2	30	28	32	1.6%	1.6%	5.4%	5.4%	0.0%	0.0%
Fe Sulfate	1	1	5	5	5	0.8%	0.8%	0.5%	0.5%	0.0%	0.0%
TOTAL	128	128	9			100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

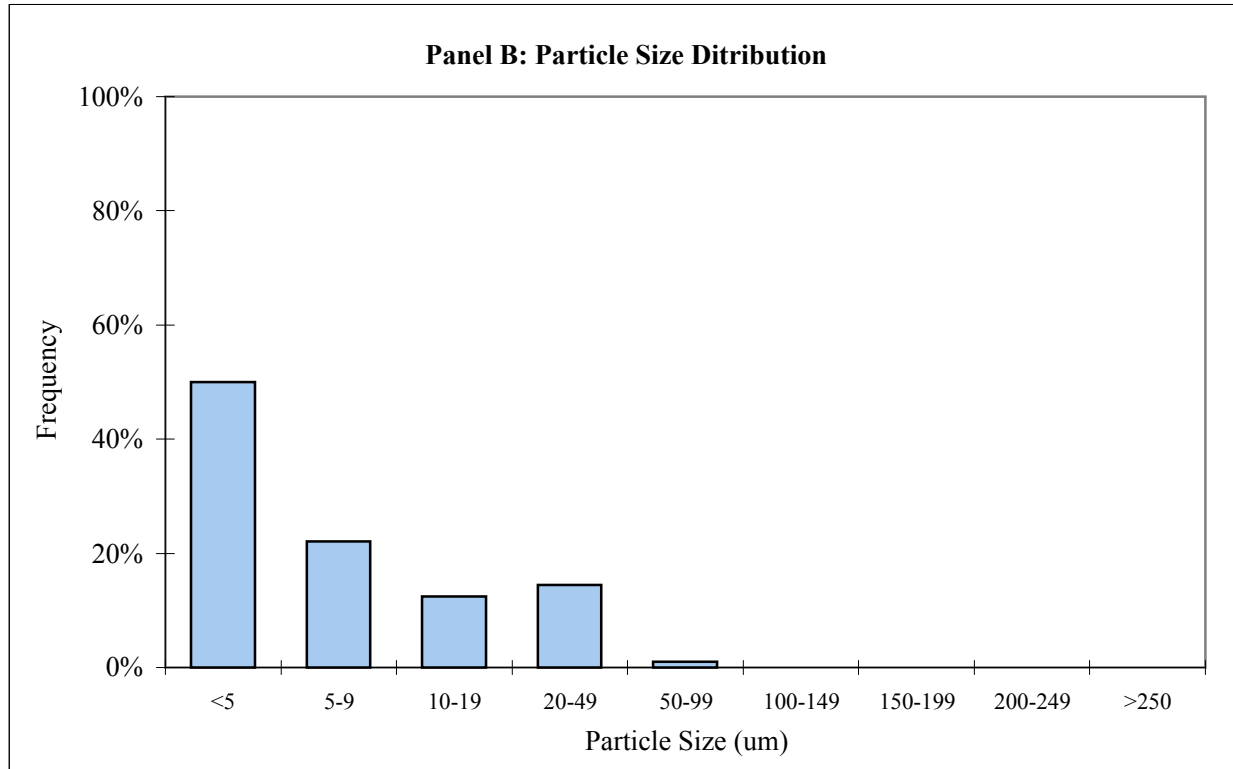
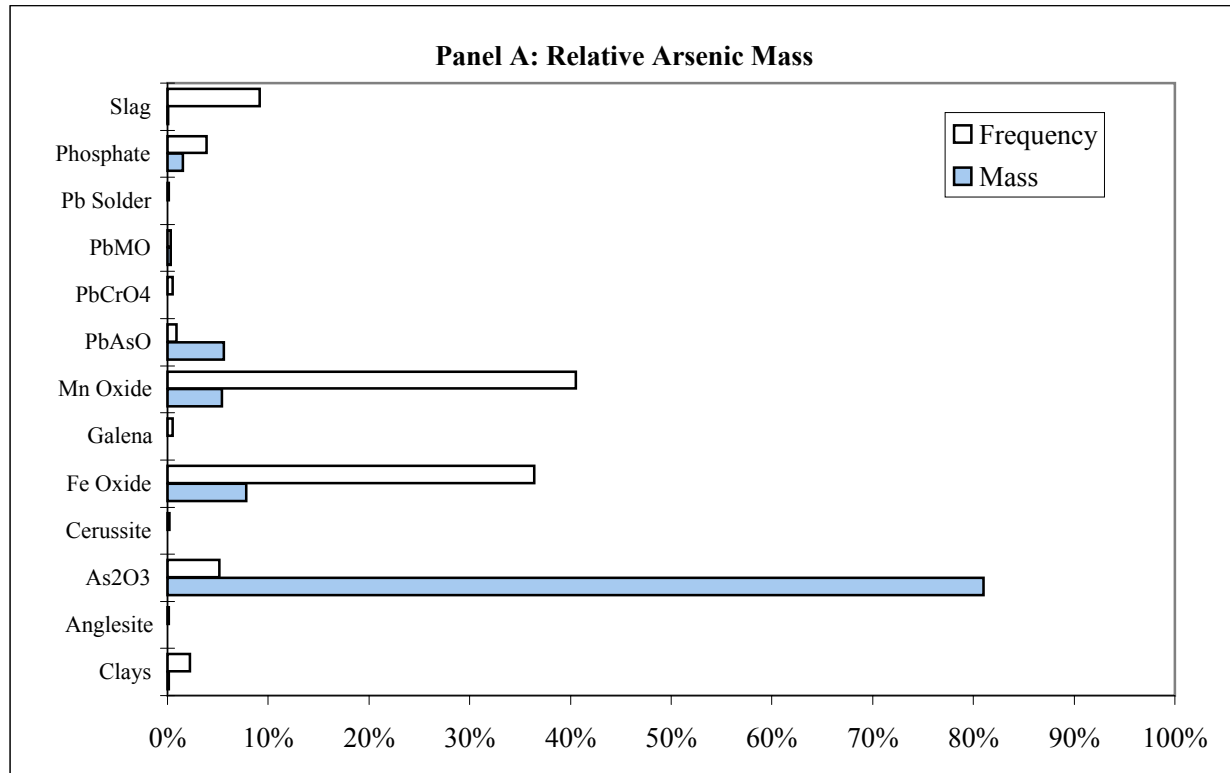
Test Material 2 - Speciation and Particle Size Data



Test Material 3 - Arsenic
Speciation Summary Statistics

Mineral	COUNTS		SIZE			Count Freq (%)		LW Freq (%)		Rel. As Mass (%)	
	Total	Lib	Avg	Min	Max	Total	Liberated	Total	Liberated	Total	Liberated
Clays	7	7	3	1	8	6.7%	6.7%	2.3%	2.3%	0.1%	0.1%
Anglesite	1	1	1	1	1	1.0%	1.0%	0.1%	0.1%	0.0%	0.0%
As ₂ O ₃	8	8	6	2	9	7.7%	7.7%	5.2%	5.2%	81.0%	81.0%
Cerussite	2	2	1	1	1	1.9%	1.9%	0.2%	0.2%	0.0%	0.0%
Fe Oxide	28	28	12	1	45	26.9%	26.9%	36.4%	36.4%	7.8%	7.8%
Galena	4	4	1	1	2	3.8%	3.8%	0.5%	0.5%	0.0%	0.0%
Mn Oxide	22	22	17	2	38	21.2%	21.2%	40.6%	40.6%	5.4%	5.4%
PbAsO	6	6	1	1	3	5.8%	5.8%	0.9%	0.9%	5.6%	5.6%
PbCrO ₄	1	1	5	5	5	1.0%	1.0%	0.5%	0.5%	0.0%	0.0%
PbMO	3	3	1	1	1	2.9%	2.9%	0.3%	0.3%	0.3%	0.3%
Pb Solder	1	1	1	1	1	1.0%	1.0%	0.1%	0.1%	0.0%	0.0%
Phosphate	20	20	2	1	8	19.2%	19.2%	3.9%	3.9%	1.5%	1.5%
Slag	1	1	85	85	85	1.0%	1.0%	9.1%	9.1%	0.0%	0.0%
TOTAL	104	104	9			76.0%	76.0%	100.0%	100.0%	100.0%	100.0%

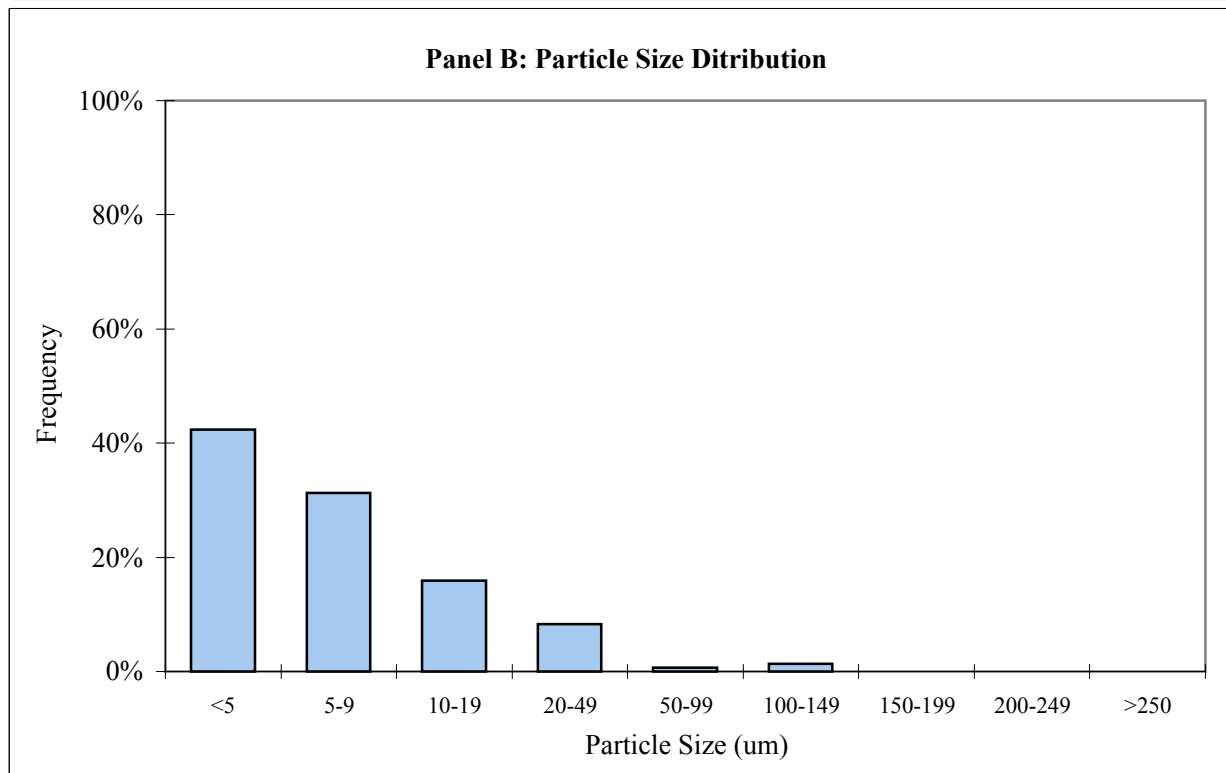
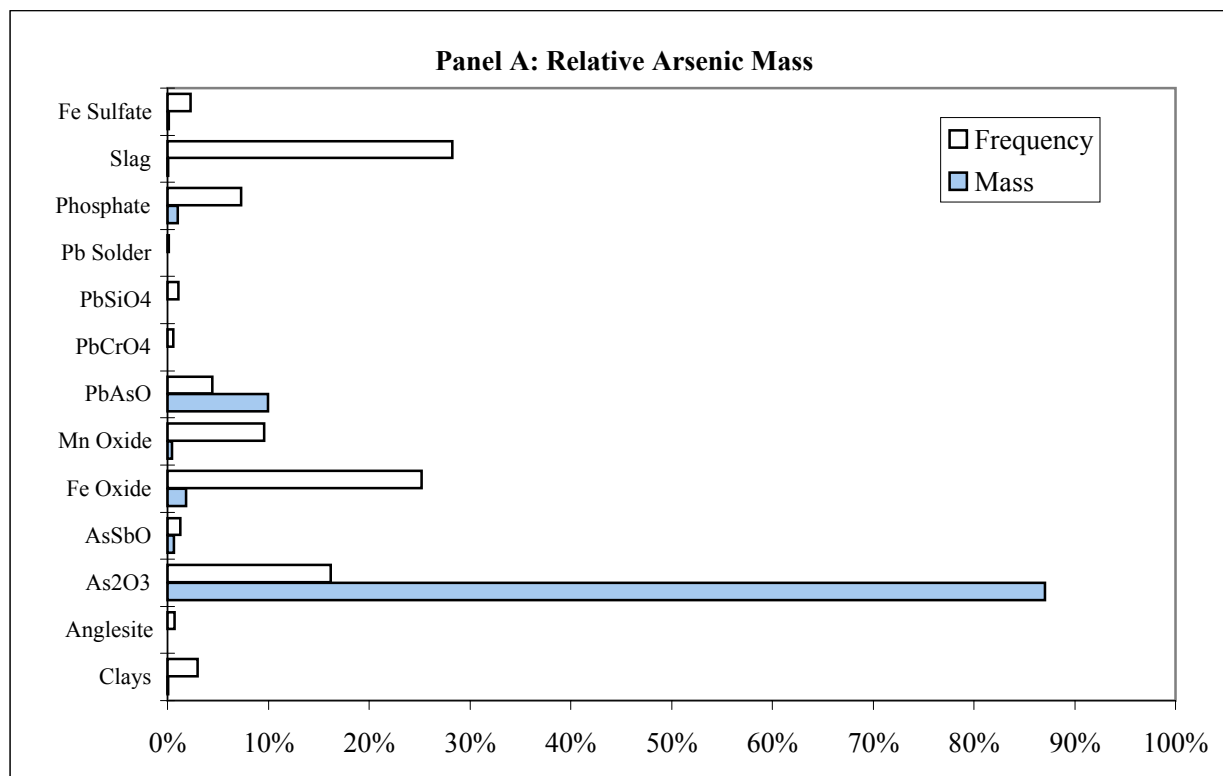
Test Material 3 - Speciation and Particle Size Data



Test Material 4 - Arsenic
Speciation Summary Statistics

Mineral	COUNTS		SIZE			Count Freq (%)		LW Freq (%)		Rel. As Mass (%)	
	Total	Lib	Avg	Min	Max	Total	Liberated	Total	Liberated	Total	Liberated
Clays	9	9	5	1	11	6.3%	6.3%	3.0%	3.0%	0.1%	0.1%
Anglesite	3	3	3	1	8	2.1%	2.1%	0.7%	0.7%	0.0%	0.0%
As ₂ O ₃	33	33	7	1	22	22.9%	22.9%	16.2%	16.2%	87.1%	87.1%
AsSbO	3	3	6	2	8	2.1%	2.1%	1.3%	1.3%	0.6%	0.6%
Fe Oxide	40	40	9	1	32	27.8%	27.8%	25.2%	25.2%	1.9%	1.9%
Mn Oxide	14	14	10	2	25	9.7%	9.7%	9.6%	9.6%	0.4%	0.4%
PbAsO	4	4	16	1	60	2.8%	2.8%	4.5%	4.5%	10.0%	10.0%
PbCrO ₄	1	1	8	8	8	0.7%	0.7%	0.6%	0.6%	0.0%	0.0%
PbSiO ₄	2	2	8	3	12	1.4%	1.4%	1.1%	1.1%	0.0%	0.0%
Pb Solder	1	1	2	2	2	0.7%	0.7%	0.1%	0.1%	0.0%	0.0%
Phosphate	20	20	5	1	38	13.9%	13.9%	7.3%	7.3%	1.0%	1.0%
Slag	8	8	50	8	125	5.6%	5.6%	28.3%	28.3%	0.0%	0.0%
Fe Sulfate	6	6	5	2	8	4.2%	4.2%	2.3%	2.3%	0.2%	0.2%
TOTAL	144	144	10			75.7%	75.7%	100.00%	100.00%	100.0%	100.0%

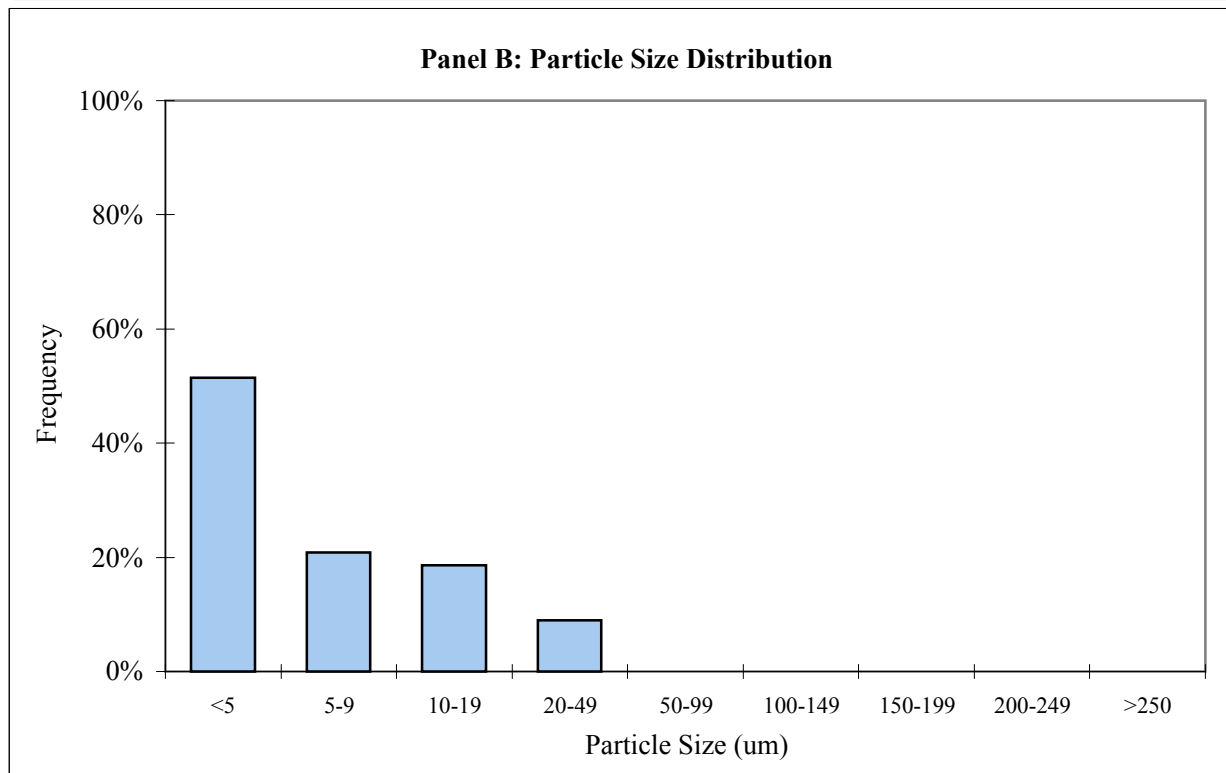
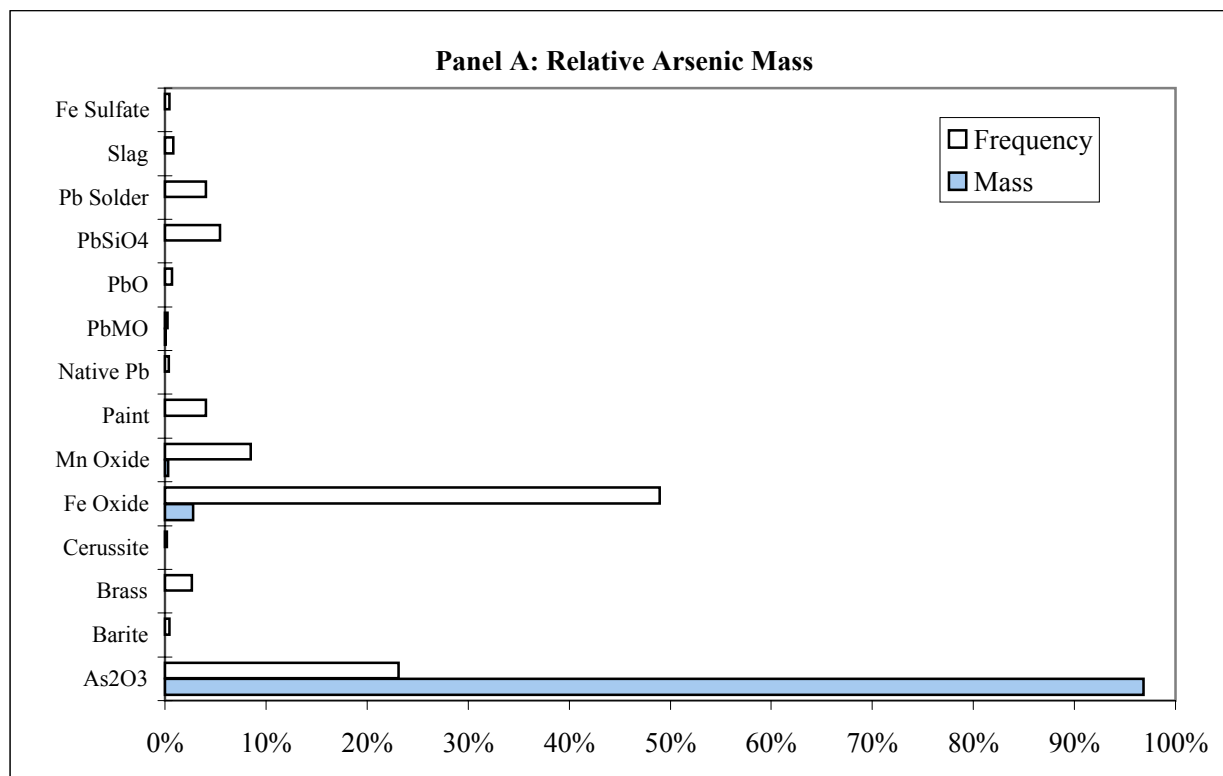
Test Material 4 - Speciation and Particle Size Data



Test Material 5 - Arsenic
Speciation Summary Statistics

Mineral	Counts		Size (um)			Count Freq (%)		LW Freq (%)		Rel. As Mass (%)	
	Total	Lib	Avg	Min	Max	Total	Liberated	Total	Liberated	Total	Liberated
As ₂ O ₃	35	35	7	2	17	26.1%	26.1%	23.1%	23.1%	96.8%	96.8%
Barite	2	2	3	2	3	1.5%	1.5%	0.4%	0.4%	0.0%	0.0%
Brass	3	3	10	2	25	2.2%	2.2%	2.7%	2.7%	0.0%	0.0%
Cerussite	2	2	1	1	1	1.5%	1.5%	0.2%	0.2%	0.0%	0.0%
Fe Oxide	38	38	14	2	45	28.4%	28.4%	48.9%	48.9%	2.8%	2.8%
Mn Oxide	3	3	32	15	42	2.2%	2.2%	8.5%	8.5%	0.3%	0.3%
Paint	1	1	45	45	45	0.7%	0.7%	4.0%	4.0%	0.0%	0.0%
Native Pb	1	1	4	4	4	0.7%	0.7%	0.4%	0.4%	0.0%	0.0%
PbMO	1	1	3	3	3	0.7%	0.7%	0.3%	0.3%	0.1%	0.1%
PbO	1	1	8	8	8	0.7%	0.7%	0.7%	0.7%	0.0%	0.0%
PbSiO ₄	24	24	3	1	8	17.9%	17.9%	5.5%	5.5%	0.0%	0.0%
Pb Solder	16	16	3	1	15	11.9%	11.9%	4.0%	4.0%	0.0%	0.0%
Slag	6	6	2	1	3	4.5%	4.5%	0.8%	0.8%	0.0%	0.0%
Fe Sulfate	1	1	5	5	5	0.7%	0.7%	0.4%	0.4%	0.0%	0.0%
TOTAL	134	134	8.3			100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

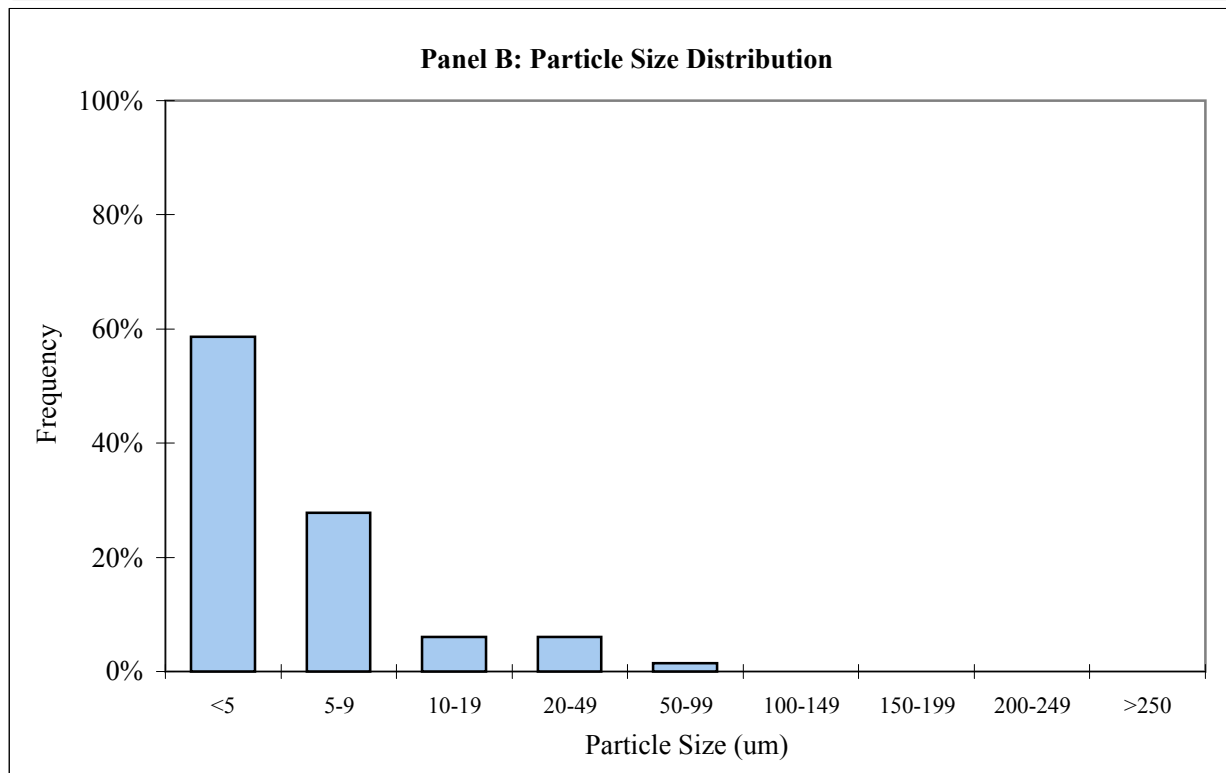
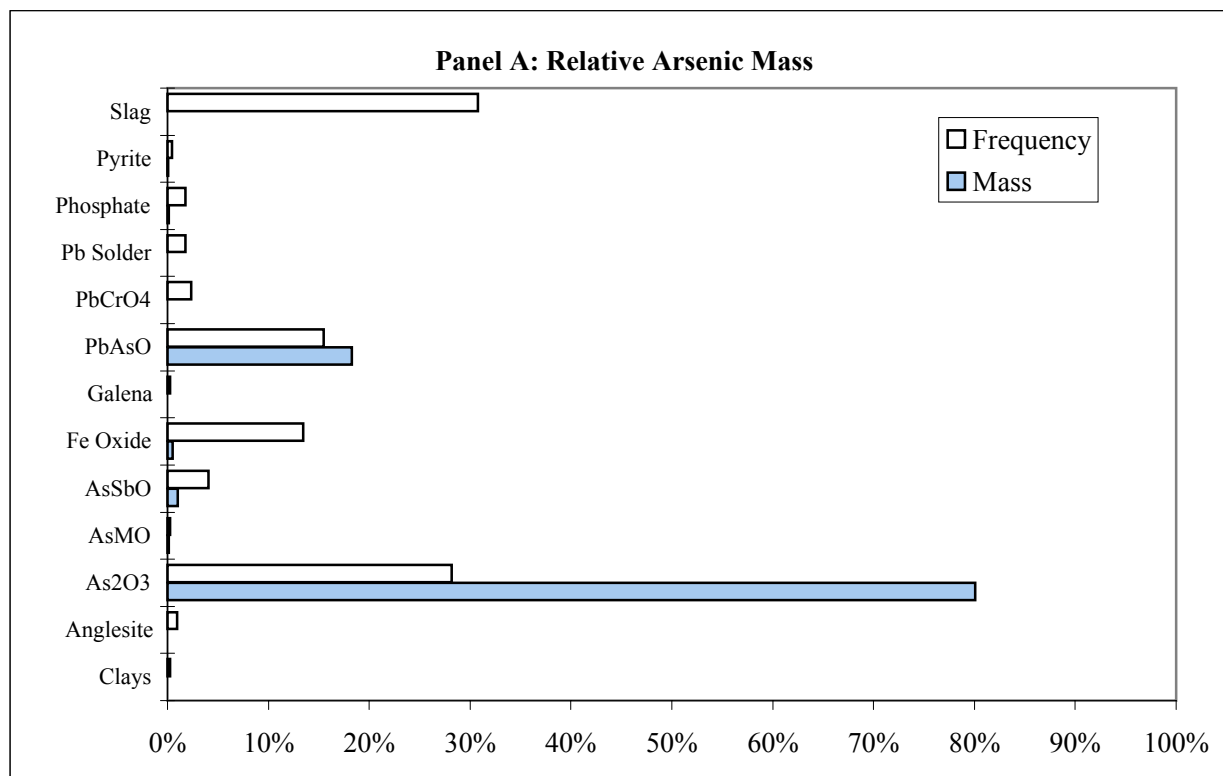
Test Material 5 - Speciation and Particle Size Data



Test Material 6 - Arsenic
Speciation Summary Statistics

Mineral	COUNTS		SIZE			Count Freq (%)		LW Freq (%)		Rel. As Mass (%)	
	Total	Lib	Avg	Min	Max	Total	Liberated	Total	Liberated	Total	Liberated
Clays	1	1	2	2	2	0.8%	0.8%	0.2%	0.2%	0.0%	0.0%
Anglesite	8	8	1	1	1	6.0%	6.0%	1.0%	1.0%	0.0%	0.0%
As ₂ O ₃	30	30	8	2	26	22.6%	22.6%	28.2%	28.2%	80.1%	80.1%
AsMO	1	1	2	2	2	0.8%	0.8%	0.2%	0.2%	0.1%	0.1%
AsSbO	7	7	5	1	9	5.3%	5.3%	4.0%	4.0%	1.0%	1.0%
Fe Oxide	7	7	16	3	48	5.3%	5.3%	13.4%	13.4%	0.5%	0.5%
Galena	1	1	2	2	2	0.8%	0.8%	0.2%	0.2%	0.0%	0.0%
PbAsO	47	47	3	1	8	35.3%	35.3%	15.5%	15.5%	18.2%	18.2%
PbCrO ₄	20	20	1	1	1	15.0%	15.0%	2.4%	2.4%	0.0%	0.0%
Pb Solder	1	1	15	15	15	0.8%	0.8%	1.8%	1.8%	0.0%	0.0%
Phosphate	2	2	8	1	14	1.5%	1.5%	1.8%	1.8%	0.1%	0.1%
Pyrite	1	1	4	4	4	0.8%	0.8%	0.5%	0.5%	0.0%	0.0%
Slag	7	7	37	20	58	5.3%	5.3%	30.8%	30.8%	0.0%	0.0%
TOTAL	133	133	6			91.7%	91.7%	100.00%	100.00%	100.0%	100.0%

Test Material 6 - Speciation and Particle Size Data



APPENDIX B

DETAILED RESULTS FROM STUDY 1

VB Experiment 1 Schedule

Time Detail #	Study						Cull Pigs/ Assign Dose Group	48 hr Urine Collection	Sacrifice
	Day	Date	Dose Administration	Feed	Weigh	Dose Prep			
	-4	Tuesday	9/14/1999		X				
	-3	Wednesday	9/15/1999		X				
	-2	Thursday	9/16/1999		X				
	-1	Friday	9/17/1999		X	X	X		
	0	Saturday	9/18/1999	X	X				
	1	Sunday	9/19/1999	X	X				
	2	Monday	9/20/1999	X	X	X			
	3	Tuesday	9/21/1999	X	X				
	4	Wednesday	9/22/1999	X	X				
	5	Thursday	9/23/1999	X	X	X			
	6	Friday	9/24/1999	X	X			↕	
	7	Saturday	9/25/1999	X	X			↕	
	8	Sunday	9/26/1999	X	X	X		↕	
	9	Monday	9/27/1999	X	X			↕	
	10	Tuesday	9/28/1999	X	X			↕	
	11	Wednesday	9/29/1999	X	X	X		↕	
	12	Thursday	9/30/1999						X

VB1 Pig Group Assignments

pig number	group	dosage	material
809	1	0	None
828	1		
831	1		
815	2	50	NaAs
821	2		
825	2		
842	2		
826	3	125	NaAs
827	3		
835	3		
841	3		
802	4	50	Test Material 1
804	4		
807	4		
813	4		
819	5	125	Test Material 1
822	5		
834	5		
840	5		
801	6	50	Test Material 2
812	6		
823	6		
836	6		
806	7	125	Test Material 2
811	7		
816	7		
820	7		
803	8	50	Test Material 3
808	8		
810	8		
833	8		
818	9	125	Test Material 3
829	9		
830	9		
832	9		

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

Body weights were measured on days -1, 2, 5, 8, 11. 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		Day 7		Day 8		Day 9		Day 10		Day 11	
		BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day
1	809	8.79	0	9.2	0	9.6	0	9.96	0	10.4	0	10.7	0	11.13	0	11.6	0	12.0	0	12.47	0	13.1	0	13.7	0	14.28	0
1	828	8.14	0	8.4	0	8.7	0	9.05	0	9.5	0	10.0	0	10.43	0	10.9	0	11.4	0	11.88	0	12.5	0	13.1	0	13.73	0
1	831	8.97	0	9.4	0	9.7	0	10.11	0	10.4	0	10.6	0	10.83	0	11.4	0	11.9	0	12.47	0	13.0	0	13.6	0	14.11	0
2	815	7.73	0	8.2	531	8.6	531	9.03	531	9.4	566	9.8	566	10.21	566	10.6	637	11.1	637	11.51	637	12.1	713	12.8	713	13.41	713
2	821	10.94	0	11.1	531	11.2	531	11.4	531	11.9	566	12.4	566	12.85	566	13.4	637	14.0	637	14.57	637	15.2	713	15.9	713	16.54	713
2	825	10.54	0	10.5	531	10.6	531	10.56	531	11.1	566	11.6	566	12.1	566	12.7	637	13.3	637	13.88	637	14.4	713	14.9	713	15.44	713
2	842	9.29	0	9.6	531	10.0	531	10.31	531	10.8	566	11.3	566	11.76	566	12.2	637	12.6	637	13.06	637	13.8	713	14.4	713	15.13	713
3	826	8.5	0	8.9	1223	9.4	1223	9.83	1223	10.3	1373	10.8	1373	11.34	1373	11.8	1548	12.3	1548	12.78	1548	13.5	1724	14.3	1724	15.02	1724
3	827	8.87	0	9.1	1223	9.3	1223	9.55	1223	10.0	1373	10.5	1373	11	1373	11.4	1548	11.9	1548	12.28	1548	12.8	1724	13.3	1724	13.82	1724
3	835	9.44	0	9.8	1223	10.1	1223	10.47	1223	10.9	1373	11.4	1373	11.84	1373	12.3	1548	12.8	1548	13.29	1548	14.0	1724	14.8	1724	15.52	1724
3	841	8.31	0	8.9	1223	9.5	1223	10.07	1223	10.5	1373	10.9	1373	11.37	1373	11.9	1548	12.3	1548	12.82	1548	13.5	1724	14.2	1724	14.82	1724
4	802	9.24	0	9.47	394	9.7	394	9.92	394	10.4	419	10.9	419	11.45	419	11.8	466	12.1	466	12.46	466	13.4	526	14.3	526	15.19	526
4	804	10.83	0	11.0	394	11.2	394	11.4	394	11.7	419	12.0	419	12.33	419	13.0	466	13.6	466	14.28	466	14.7	526	15.2	526	15.62	526
4	807	10.26	0	10.4	394	10.6	394	10.82	394	11.3	419	11.8	367	12.3	335	12.9	280	13.5	292	14.1	373	14.5	474	14.8	526	15.15	526
4	813	8.29	0	8.6	394	8.9	394	9.23	394	9.6	419	10.0	419	10.39	419	11.0	466	11.5	466	12.09	466	12.8	526	13.5	526	14.16	526
5	819	8.45	0	9.0	860	9.5	860	10.08	860	10.4	960	10.7	960	10.96	960	11.4	1102	11.9	1102	12.36	1102	13.2	1208	14.1	1208	15.01	1208
5	822	9.34	0	9.6	860	9.8	860	10.06	860	10.7	960	11.4	960	12.06	960	12.3	1102	12.6	1102	12.89	1102	13.6	1208	14.3	1208	15.01	1208
5	834	7.39	0	7.8	860	8.2	860	8.57	860	9.0	960	9.4	960	9.84	960	10.2	1102	10.5	1102	10.87	1102	11.6	1208	12.3	1208	13	1208
5	840	8.03	0	8.3	860	8.6	860	8.84	860	9.5	960	10.2	960	10.82	960	11.3	1102	11.7	1102	12.18	1102	12.8	1208	13.5	1208	14.15	1208
6	801	7.97	0	8.5	307	9.0	307	9.45	307	9.7	334	9.9	334	10.08	334	10.7	372	11.3	372	11.84	372	12.5	428	13.1	428	13.8	428
6	812	7.42	0	7.9	307	8.4	307	8.92	307	9.4	334	9.8	334	10.21	334	10.8	372	11.3	372	11.88	372	12.4	428	13.0	428	13.52	428
6	823	9.12	0	8.7	307	8.3	307	7.82	307	8.3	167	8.7	300	9.12	267	9.7	223	10.3	270	10.96	298	11.7	385	12.5	428	13.2	428
6	836	7.76	0	8.2	307	8.7	307	9.17	307	9.6	334	10.1	334	10.5	334	10.9	372	11.4	372	11.82	372	12.3	428	12.8	428	13.22	428
7	806	8.19	0	8.8	815	9.4	815	10.05	815	10.5	939	10.9	939	11.34	939	11.7	1034	12.1	1034	12.49	1034	13.2	1132	14.0	1132	14.76	1132
7	811	10.14	0	10.5	815	10.9	815	11.23	815	11.8	939	12.3	939	12.83	939	13.1	1034	13.5	1034	13.78	1034	13.9	1132	14.0	1132	14.16	1132
7	816	8.13	0	8.5	815	8.8	815	9.17	652	9.4	939	9.7	751	10	704	10.4	620	10.8	646	11.18	827	11.9	1018	12.6	1132	13.29	1132
7	820	8	0	8.6	815	9.2	815	9.85	815	10.1	939	10.4	939	10.64	939	11.1	1034	11.5	1034	11.96	1034	12.7	1132	13.4	1132	14.14	1132
8	803	8.22	0	8.7	268	9.1	268	9.54	268	10.1	311	10.6	311	11.1	311	11.7	346	12.4	346	12.99	346	13.5	388	14.0	388	14.52	388
8	808	9.08	0	9.6	268	10.1	268	10.56	268	11.1	311	11.6	311	12.05	311	12.5	346	12.9	346	13.38	346	14.1	388	14.7	388	15.39	388
8	810	8.89	0	9.5	268	10.1	268	10.76	268	11.0	311	11.3	311	11.56	311	12.0	346	12.5	346	12.98	346	13.7	388	14.5	388	15.25	388
8	833	8.9	0	9.4	268	10.0	268	10.48	268	10.9	311	11.3	311	11.75	311	12.2	346	12.7	346	13.12	346	13.9	388	14.8	388	15.6	388
9	818	9.44	0	10.0	748	10.6	748	11.16	748	11.7	852	12.3	852	12.81	852	13.2	943	13.6	943	13.93	943	14.5	1026	15.2	1026	15.78	1026
9	829	9.87	0	10.4	748	11.0	748	11.49	748	12.0	852	12.5	852	12.95	852	13.3	943	13.6	943	13.98	943	14.6	1026	15.3	1026	15.94	1026
9	830	10.62	0	11.1	748	11.5	748	12.01	748	12.4	852	12.7	852	13.08	852	13.5	943	13.9	943	14.32	943	15.0	1026	15.7	1026	16.35	1026
9	832	9.65	0	10.1	748	10.6	748	11	748	11.4	852	11.7	852	12.1	852	12.6	943	13.0	943	13.52	943	14.2	1026	14.9	1026	15.63	1026

Day 2 - Pig 816 did not eat entire afternoon dose (ate approximately 60%). Daily dose adjusted to 80%

Day 3 - Pig 823 did not eat entire morning dose. Daily dose adjusted to 50%

Day 4 - Pig 823 did not eat entire afternoon dose (ate approximately 80%). Daily dose adjusted to 90%

Day 4 - Pig 816 did not eat entire morning dose (ate approximately 60%). Daily dose adjusted to 80%

Day 4 - Pig 807 did not eat entire afternoon dose (ate approximately 75%). Daily dose adjusted to 87.5%

Day 5 - Pig 823 did not eat entire morning dose (ate approximately 60%). Daily dose adjusted to 80%

Day 5 - Pig 807 did not eat entire morning dose (ate approximately 60%). Daily dose adjusted to 80%

Day 5 - Pig 816 did not eat entire morning dose (ate approximately 50%). Daily dose adjusted to 75%

Day 6 - Pig 823 did not eat entire morning or afternoon dose (ate approximately 60% of each). Daily dose adjusted to 60%

Day 6 - Pig 807 did not eat entire morning or afternoon dose (ate approximately 60% of each). Daily dose adjusted to 60%

Day 6 - Pig 816 did not eat entire morning or afternoon dose (ate approximately 60% of each). Daily dose adjusted to 60%

Day 7 - Pig 823 did not eat entire morning or afternoon dose (ate approximately 85% & 60%, respectively). Daily dose adjusted to 72.5%

Day 7 - Pig 807 did not eat entire morning or afternoon dose (ate approximately 75% & 50%, respectively). Daily dose adjusted to 62.5%

Day 7 - Pig 816 did not eat entire morning or afternoon dose (ate approximately 65% & 60%, respectively). Daily dose adjusted to 62.5%

Day 8 - Pig 823 did not eat entire morning dose (ate approximately 60%). Daily dose adjusted to 80%

Day 8 - Pig 807 did not eat entire morning dose (ate approximately 60%). Daily dose adjusted to 80%

Day 8 - Pig 816 did not eat entire morning dose (ate approximately 60%). Daily dose adjusted to 80%

Day 9 - Pig 823 did not eat entire morning or afternoon dose (ate approximately 90% of each). Daily dose adjusted to 90%

Day 9 - Pig 807 did not eat entire morning or afternoon dose (ate approximately 90% of each). Daily dose adjusted to 90%

Day 9 - Pig 816 did not eat entire morning or afternoon dose (ate approximately 90% of each). Daily dose adjusted to 90%

TABLE B-2

Body Weight Adjusted Doses (ug/kg-day)

(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	Avg Dose	Target Dose	% Target	Avg %
1	809	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0		
1	828	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0		
1	831	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0		
2	815	65.08	61.80	58.83	60.09	57.68	55.46	59.80	57.46	55.30	58.69	55.79	53.15	58.26	50	117	
2	821	47.89	47.24	46.60	47.65	45.79	44.07	47.42	45.48	43.69	46.81	44.87	43.09	45.88	50	92	
2	825	50.37	50.34	50.31	51.14	48.87	46.80	50.14	47.91	45.86	49.50	47.77	46.16	48.76	50	98	
2	842	55.17	53.28	51.53	52.46	50.21	48.15	52.20	50.41	48.74	51.84	49.36	47.11	50.87	50	102	102
3	826	136.69	130.24	124.36	132.82	126.65	121.03	131.00	125.89	121.16	127.46	120.79	114.78	126.07	125	101	
3	827	134.39	131.12	128.01	136.79	130.51	124.77	135.51	130.63	126.09	134.76	129.56	124.75	130.58	125	104	
3	835	124.96	120.72	116.76	125.61	120.57	115.92	125.65	120.91	116.51	122.85	116.67	111.09	119.85	125	96	
3	841	137.41	128.91	121.40	130.67	125.50	120.71	130.63	125.52	120.78	127.83	121.81	116.33	125.63	125	101	100
4	802	41.61	40.63	39.71	40.20	38.33	36.62	39.57	38.47	37.43	39.35	36.84	34.64	38.62	50	77	
4	804	35.74	35.14	34.55	35.81	34.88	34.01	35.93	34.22	32.66	35.73	34.67	33.68	34.75	50	70	
4	807	37.70	37.04	36.40	37.06	31.07	27.27	21.69	21.59	26.46	32.77	35.55	34.73	31.61	50	63	
4	813	45.78	44.17	42.67	43.60	41.92	40.36	42.57	40.48	38.58	41.17	39.06	37.16	41.46	50	83	73
5	819	95.59	90.15	85.29	92.54	90.00	87.59	96.41	92.62	89.13	91.24	85.54	80.50	89.72	125	72	
5	822	89.74	87.55	85.46	89.49	84.26	79.60	89.30	87.34	85.46	88.87	84.48	80.50	86.00	125	69	
5	834	110.46	105.14	100.32	106.74	101.95	97.56	108.18	104.65	101.34	104.35	98.32	92.95	102.66	125	82	
5	840	103.58	100.32	97.25	101.05	94.49	88.72	97.72	93.94	90.44	94.13	89.55	85.40	94.72	125	76	75
6	801	36.32	34.32	32.52	34.53	33.79	33.09	34.88	33.07	31.43	34.25	32.55	31.01	33.48	50	67	
6	812	38.81	36.50	34.46	35.67	34.10	32.67	34.56	32.86	31.32	34.44	32.99	31.65	34.17	50	68	
6	823	35.38	37.24	39.30	20.21	34.56	29.26	22.94	26.07	27.16	32.90	34.36	32.42	30.98	50	62	
6	836	37.35	35.33	33.52	34.70	33.17	31.77	34.01	32.70	31.48	34.83	33.56	32.37	33.73	50	67	66
7	806	92.48	86.40	81.07	89.55	86.02	82.76	88.21	85.41	82.79	85.42	80.80	76.66	84.80	125	68	
7	811	77.57	74.98	72.55	79.78	76.32	73.15	78.66	76.81	75.04	81.36	80.63	79.91	77.23	125	62	
7	816	96.12	92.34	71.08	99.35	77.22	70.39	59.70	59.92	73.99	85.70	89.90	85.14	80.07	125	64	
7	820	94.56	88.24	82.72	92.80	90.44	88.21	93.33	89.76	86.46	89.19	84.36	80.02	88.34	125	71	66
8	803	30.99	29.49	28.13	30.95	29.42	28.05	29.54	28.03	26.67	28.72	27.68	26.70	28.70	50	57	
8	808	28.04	26.66	25.42	28.16	26.95	25.84	27.73	26.78	25.89	27.60	26.34	25.19	26.72	50	53	
8	810	28.21	26.48	24.94	28.23	27.57	26.93	28.79	27.70	26.69	28.23	26.75	25.43	27.16	50	54	
8	833	28.47	26.97	25.61	28.55	27.48	26.49	28.38	27.36	26.41	27.80	26.25	24.85	27.05	50	54	55
9	818	74.71	70.66	67.03	72.80	69.53	66.54	71.54	69.57	67.70	70.51	67.64	65.00	69.43	125	56	
9	829	71.86	68.32	65.11	71.17	68.40	65.83	70.94	69.16	67.46	70.09	67.09	64.34	68.31	125	55	
9	830	67.50	64.79	62.29	68.93	67.00	65.17	69.89	67.81	65.86	68.39	65.44	62.73	66.32	125	53	
9	832	74.07	70.91	68.01	74.99	72.65	70.45	75.01	72.28	69.75	72.11	68.71	65.62	71.21	125	57	55

TABLE B-3 VB Experiment 1 Urine Volumes - 48 hour collections

Units of Volume: mls

Group	Pig ID	Day		
		6-7 9/24-9/26	8-9 9/26-9/28	10-11 9/28-9/30
1	809	9740	9100	15100
	828	2240	2860	3420
	831	1320	1330	2430
2	815	2320	1690	1820
	821	2250	1500	3700
	825	3510	2790	3840
	842	2700	2430	5000
3	826	15340	20320	22360
	827	6690	8300	8320
	835	2190	2970	4360
	841	2220	3860	2500
4	802	9490	11310	7820
	804	13210	6920	4200
	807	1050	1190	2200
	813	1900	1560	2300
5	819	9310	1110	3680
	822	4520	2680	3200
	834	6540	7460	3900
	840	4290	4190	4820
6	801	19790	17860	10300
	812	890	900	1000
	823	2640	2520	3360
	836	10880	11660	7660
7	806	5610	4000	2800
	811	4160	2360	2440
	816	4250	7120	4020
	820	13820	15000	14800
8	803	3640	5820	6560
	808	2980	3000	3700
	810	2830	3780	7060
	833	5320	6660	6580
9	818	2300	3340	4000
	829	2440	2480	2000
	830	3320	2560	3100
	832	3790	3540	2980

Volume measured by:

Date:

DD	DD/MD	KM
9/26/1999	9/26/1999	9/30/1999

Diarrhea urines: 819-see above 804-1320mls
 Ones with volumes 810-510ml
 were kept separate.

TABLE B-4 URINE ANALYTICAL RESULTS

tag number	pig number	day	group	material administered	dosage	Q	Urine Conc	Units
VB-01-00049	809	6/7	1	Control	0		14	ng/mL
VB-01-00044	828	6/7	1	Control	0		46	ng/mL
VB-01-00050	831	6/7	1	Control	0		78	ng/mL
VB-01-00061	815	6/7	2	NaAs	50		790	ng/mL
VB-01-00051	821	6/7	2	NaAs	50		1000	ng/mL
VB-01-00047	825	6/7	2	NaAs	50		950	ng/mL
VB-01-00034	842	6/7	2	NaAs	50		920	ng/mL
VB-01-00048	826	6/7	3	NaAs	125		170	ng/mL
VB-01-00045	827	6/7	3	NaAs	125		360	ng/mL
VB-01-00070	835	6/7	3	NaAs	125		1200	ng/mL
VB-01-00038	841	6/7	3	NaAs	125		690	ng/mL
VB-01-00042	802	6/7	4	TM1	50		44	ng/mL
VB-01-00054	804	6/7	4	TM1	50		37	ng/mL
VB-01-00035	807	6/7	4	TM1	50		380	ng/mL
VB-01-00033	813	6/7	4	TM1	50		200	ng/mL
VB-01-00039	819	6/7	5	TM1	125		73	ng/mL
VB-01-00053	822	6/7	5	TM1	125		120	ng/mL
VB-01-00043	834	6/7	5	TM1	125		120	ng/mL
VB-01-00036	840	6/7	5	TM1	125		180	ng/mL
VB-01-00064	801	6/7	6	TM2	50		16	ng/mL
VB-01-00052	812	6/7	6	TM2	50		440	ng/mL
VB-01-00062	823	6/7	6	TM2	50		67	ng/mL
VB-01-00069	836	6/7	6	TM2	50		27	ng/mL
VB-01-00063	806	6/7	7	TM2	125		120	ng/mL
VB-01-00055	811	6/7	7	TM2	125		180	ng/mL
VB-01-00031	816	6/7	7	TM2	125		120	ng/mL
VB-01-00060	820	6/7	7	TM2	125		61	ng/mL
VB-01-00046	803	6/7	8	TM3	50		81	ng/mL
VB-01-00071	808	6/7	8	TM3	50		86	ng/mL
VB-01-00066	810	6/7	8	TM3	50		77	ng/mL
VB-01-00041	833	6/7	8	TM3	50		61	ng/mL
VB-01-00056	818	6/7	9	TM3	125		170	ng/mL
VB-01-00059	829	6/7	9	TM3	125		180	ng/mL
VB-01-00068	830	6/7	9	TM3	125		160	ng/mL
VB-01-00040	832	6/7	9	TM3	125		190	ng/mL
VB-01-00058	2830	6/7	9	TM3	125		160	ng/mL
VB-01-00067	2826	6/7	3	NaAs	125		160	ng/mL
VB-01-00057	2801	6/7	6	TM2	50		16	ng/mL
VB-01-00065	AsCtrl	6/7					19	ng/mL
VB-01-00032	AsIA100	6/7					120	ng/mL
VB-01-00037	AsIB100	6/7					110	ng/mL
VB-01-00304	AsOA100	6/7					79	ng/mL
VB-01-00305	AsOB100	6/7					93	ng/mL
VB-01-00306	AsIA25	6/7					43	ng/mL
VB-01-00307	AsIB25	6/7					40	ng/mL
VB-01-00308	AsOA25	6/7					34	ng/mL
VB-01-00309	AsOB25	6/7					38	ng/mL
VB-01-00090	809	8/9	1	Control	0		8	ng/mL
VB-01-00109	828	8/9	1	Control	0		41	ng/mL
VB-01-00098	831	8/9	1	Control	0		80	ng/mL

tag number	pig number	day	group	material administered	dosage	Q	Urine Conc	Units
VB-01-00099	815	8/9	2	NaAs	50		920	ng/mL
VB-01-00077	821	8/9	2	NaAs	50		1200	ng/mL
VB-01-00110	825	8/9	2	NaAs	50		790	ng/mL
VB-01-00105	842	8/9	2	NaAs	50		840	ng/mL
VB-01-00104	826	8/9	3	NaAs	125		160	ng/mL
VB-01-00075	827	8/9	3	NaAs	125		300	ng/mL
VB-01-00085	835	8/9	3	NaAs	125		870	ng/mL
VB-01-00095	841	8/9	3	NaAs	125		760	ng/mL
VB-01-00096	802	8/9	4	TM1	50		68	ng/mL
VB-01-00106	804	8/9	4	TM1	50		32	ng/mL
VB-01-00086	807	8/9	4	TM1	50		390	ng/mL
VB-01-00091	813	8/9	4	TM1	50		260	ng/mL
VB-01-00074	819	8/9	5	TM1	125		95	ng/mL
VB-01-00112	822	8/9	5	TM1	125		290	ng/mL
VB-01-00101	834	8/9	5	TM1	125		130	ng/mL
VB-01-00087	840	8/9	5	TM1	125		210	ng/mL
VB-01-00083	801	8/9	6	TM2	50		24	ng/mL
VB-01-00081	812	8/9	6	TM2	50		420	ng/mL
VB-01-00107	823	8/9	6	TM2	50		130	ng/mL
VB-01-00108	836	8/9	6	TM2	50		36	ng/mL
VB-01-00092	806	8/9	7	TM2	125		200	ng/mL
VB-01-00089	811	8/9	7	TM2	125		360	ng/mL
VB-01-00079	816	8/9	7	TM2	125		120	ng/mL
VB-01-00088	820	8/9	7	TM2	125		65	ng/mL
VB-01-00100	803	8/9	8	TM3	50		59	ng/mL
VB-01-00072	808	8/9	8	TM3	50		110	ng/mL
VB-01-00084	810	8/9	8	TM3	50		98	ng/mL
VB-01-00094	833	8/9	8	TM3	50		56	ng/mL
VB-01-00111	818	8/9	9	TM3	125		200	ng/mL
VB-01-00093	829	8/9	9	TM3	125		220	ng/mL
VB-01-00103	830	8/9	9	TM3	125		290	ng/mL
VB-01-00082	832	8/9	9	TM3	125		230	ng/mL
VB-01-00076	2836	8/9	6	TM2	50		35	ng/mL
VB-01-00080	2821	8/9	2	NaAs	50		1200	ng/mL
VB-01-00073	2804	8/9	4	TM1	50		33	ng/mL
VB-01-00102	AsCtrl	8/9					19	ng/mL
VB-01-00097	AsIA100	8/9					120	ng/mL
VB-01-00078	AsIB100	8/9					120	ng/mL
VB-01-00310	AsOA100	8/9					80	ng/mL
VB-01-00311	AsOB100	8/9					93	ng/mL
VB-01-00312	AsIA25	8/9					44	ng/mL
VB-01-00313	AsIB25	8/9					42	ng/mL
VB-01-00314	AsOA25	8/9					33	ng/mL
VB-01-00315	AsOB25	8/9					38	ng/mL
VB-01-00125	809	10/11	1	Control	0		10	ng/mL
VB-01-00137	828	10/11	1	Control	0		37	ng/mL
VB-01-00127	831	10/11	1	Control	0		52	ng/mL
VB-01-00124	815	10/11	2	NaAs	50		520	ng/mL
VB-01-00147	821	10/11	2	NaAs	50		370	ng/mL
VB-01-00134	825	10/11	2	NaAs	50		400	ng/mL
VB-01-00116	842	10/11	2	NaAs	50		300	ng/mL
VB-01-00129	826	10/11	3	NaAs	125		150	ng/mL

tag number	pig number	day	group	material administered	dosage	Q	Urine Conc	Units
VB-01-00143	827	10/11	3	NaAs	125		210	ng/mL
VB-01-00133	835	10/11	3	NaAs	125		400	ng/mL
VB-01-00114	841	10/11	3	NaAs	125		1100	ng/mL
VB-01-00126	802	10/11	4	TM1	50		11	ng/mL
VB-01-00139	804	10/11	4	TM1	50		120	ng/mL
VB-01-00128	807	10/11	4	TM1	50		270	ng/mL
VB-01-00149	813	10/11	4	TM1	50		160	ng/mL
VB-01-00138	819	10/11	5	TM1	125		110	ng/mL
VB-01-00152	822	10/11	5	TM1	125		300	ng/mL
VB-01-00117	834	10/11	5	TM1	125		140	ng/mL
VB-01-00141	840	10/11	5	TM1	125		200	ng/mL
VB-01-00113	801	10/11	6	TM2	50		24	ng/mL
VB-01-00120	812	10/11	6	TM2	50		500	ng/mL
VB-01-00123	823	10/11	6	TM2	50		96	ng/mL
VB-01-00146	836	10/11	6	TM2	50		32	ng/mL
VB-01-00151	806	10/11	7	TM2	125		250	ng/mL
VB-01-00148	811	10/11	7	TM2	125		350	ng/mL
VB-01-00135	816	10/11	7	TM2	125		88	ng/mL
VB-01-00118	820	10/11	7	TM2	125		65	ng/mL
VB-01-00122	803	10/11	8	TM3	50		55	ng/mL
VB-01-00136	808	10/11	8	TM3	50		94	ng/mL
VB-01-00144	810	10/11	8	TM3	50		53	ng/mL
VB-01-00119	833	10/11	8	TM3	50		64	ng/mL
VB-01-00153	818	10/11	9	TM3	125		180	ng/mL
VB-01-00121	829	10/11	9	TM3	125		280	ng/mL
VB-01-00132	830	10/11	9	TM3	125		210	ng/mL
VB-01-00131	832	10/11	9	TM3	125		220	ng/mL
VB-01-00150	2811	10/11	7	TM2	125		360	ng/mL
VB-01-00140	2842	10/11	2	NaAs	50		200	ng/mL
VB-01-00130	2802	10/11	4	TM1	50		12	ng/mL
VB-01-00142	AsCtrl	10/11					19	ng/mL
VB-01-00115	AsIA100	10/11					120	ng/mL
VB-01-00145	AsIB100	10/11					120	ng/mL
VB-01-00316	AsOA100	10/11					80	ng/mL
VB-01-00317	AsOB100	10/11					91	ng/mL
VB-01-00318	AsIA25	10/11					44	ng/mL
VB-01-00319	AsIB25	10/11					42	ng/mL
VB-01-00320	AsOA25	10/11					34	ng/mL
VB-01-00321	AsOB25	10/11					37	ng/mL
VB-01-00322	AsMix1	-99					93	ng/mL
VB-01-00323	AsMix2	-99					38	ng/mL
VB-01-00324	AsMix3	-99					23	ng/mL

TABLE B-5 VB Experiment 1 Fecal Weights - 48 hour collections

Units of Weight: ____ grams

Group	Pig ID	Day		
		6-7 9/24-9/26	8-9 9/26-9/28	10-11 9/28-9/30
1	809	295.61	218.99	261.17
	828	198.25	191.25	188
	831	216.61	118.64	262.91
2	815	147.44	107.92	274.15
	821	145.06	128.51	351.98
	825	129.99	266.4	276.38
	842	274.67	185.7	283.33
3	826	199.69	189.51	220.02
	827	229.99	225.15	180.77
	835	304.87	235.9	406.71
	841	215.65	246.15	256.68
4	802	222.6	322.21	246.59
	804	199.52	270.14	287.04
	807	214.37	127.28	248.76
	813	287.64	64.05	155.44
5	819	320.06	184.76	305.67
	822	375.46	401.48	329.43
	834	309.24	342.81	471.02
	840	308.47	195.08	338.68
6	801	185.23	310.07	231
	812	342.87	292.14	403.56
	823	263.49	221.76	861.03
	836	326.16	293.89	377.69
7	806	310.95	207.28	291.17
	811	280.08	269.37	457.79
	816	166.77	208.12	354.04
	820	328.65	177.66	307.77
8	803	192.44	314.75	393.19
	808	388.13	352.86	267.33
	810	426.34	240.72	487.79
	833	265.66	289.35	486.25
9	818	302.95	285.9	443.79
	829	223.93	152.02	338.55
	830	294.09	206.98	317.78
	832	419.49	222.97	303.41

Weighed by:

Date:

FW	FW	DED
36431	36431	36434

TABLE B-6 FECES ANALYTICAL RESULTS

tag number	pig number	day	group	material administered	dosage	Q	Feces Conc	Units
VB-01-00162	809	6/7	1	Control	0		90	ng/g
VB-01-00158	828	6/7	1	Control	0		280	ng/g
VB-01-00189	831	6/7	1	Control	0		130	ng/g
VB-01-00168	815	6/7	2	NaAs	50		440	ng/g
VB-01-00179	821	6/7	2	NaAs	50		450	ng/g
VB-01-00164	825	6/7	2	NaAs	50		270	ng/g
VB-01-00184	842	6/7	2	NaAs	50		490	ng/g
VB-01-00159	826	6/7	3	NaAs	125		1900	ng/g
VB-01-00176	827	6/7	3	NaAs	125		330	ng/g
VB-01-00181	835	6/7	3	NaAs	125		230	ng/g
VB-01-00157	841	6/7	3	NaAs	125		330	ng/g
VB-01-00191	802	6/7	4	TM1	50		1800	ng/g
VB-01-00154	804	6/7	4	TM1	50		1600	ng/g
VB-01-00169	807	6/7	4	TM1	50		730	ng/g
VB-01-00178	813	6/7	4	TM1	50		1000	ng/g
VB-01-00156	819	6/7	5	TM1	125		2000	ng/g
VB-01-00165	822	6/7	5	TM1	125		2500	ng/g
VB-01-00155	834	6/7	5	TM1	125		3100	ng/g
VB-01-00186	840	6/7	5	TM1	125		3200	ng/g
VB-01-00161	801	6/7	6	TM2	50		970	ng/g
VB-01-00172	812	6/7	6	TM2	50		950	ng/g
VB-01-00166	823	6/7	6	TM2	50		660	ng/g
VB-01-00170	836	6/7	6	TM2	50		1100	ng/g
VB-01-00167	806	6/7	7	TM2	125		3300	ng/g
VB-01-00188	811	6/7	7	TM2	125		3500	ng/g
VB-01-00173	816	6/7	7	TM2	125		1900	ng/g
VB-01-00171	820	6/7	7	TM2	125		3800	ng/g
VB-01-00190	803	6/7	8	TM3	50		720	ng/g
VB-01-00174	808	6/7	8	TM3	50		480	ng/g
VB-01-00187	810	6/7	8	TM3	50		400	ng/g
VB-01-00180	833	6/7	8	TM3	50		670	ng/g
VB-01-00160	818	6/7	9	TM3	125		1500	ng/g
VB-01-00177	829	6/7	9	TM3	125		1600	ng/g
VB-01-00185	830	6/7	9	TM3	125		1100	ng/g
VB-01-00175	832	6/7	9	TM3	125		1500	ng/g
VB-01-00163	2834	6/7	5	TM1	125		2200	ng/g
VB-01-00183	2816	6/7	7	TM2	125		2400	ng/g
VB-01-00182	2802	6/7	4	TM1	50		1300	ng/g
VB-01-00193	809	8/9	1	Control	0		160	ng/g
VB-01-00208	828	8/9	1	Control	0		200	ng/g
VB-01-00219	831	8/9	1	Control	0		210	ng/g
VB-01-00227	815	8/9	2	NaAs	50		910	ng/g
VB-01-00220	821	8/9	2	NaAs	50		1300	ng/g
VB-01-00222	825	8/9	2	NaAs	50		370	ng/g
VB-01-00203	842	8/9	2	NaAs	50		1100	ng/g
VB-01-00194	826	8/9	3	NaAs	125		900	ng/g
VB-01-00216	827	8/9	3	NaAs	125		380	ng/g
VB-01-00206	835	8/9	3	NaAs	125		620	ng/g
VB-01-00217	841	8/9	3	NaAs	125		340	ng/g
VB-01-00229	802	8/9	4	TM1	50		1400	ng/g

tag number	pig number	day	group	material administered	dosage	Q	Feces Conc	Units
VB-01-00215	804	8/9	4	TM1	50		1400	ng/g
VB-01-00198	807	8/9	4	TM1	50		1100	ng/g
VB-01-00213	813	8/9	4	TM1	50		2100	ng/g
VB-01-00202	819	8/9	5	TM1	125		2200	ng/g
VB-01-00210	822	8/9	5	TM1	125		2100	ng/g
VB-01-00228	834	8/9	5	TM1	125		7900	ng/g
VB-01-00211	840	8/9	5	TM1	125		2900	ng/g
VB-01-00201	801	8/9	6	TM2	50		900	ng/g
VB-01-00192	812	8/9	6	TM2	50		720	ng/g
VB-01-00218	823	8/9	6	TM2	50		930	ng/g
VB-01-00207	836	8/9	6	TM2	50		1500	ng/g
VB-01-00195	806	8/9	7	TM2	125		4500	ng/g
VB-01-00196	811	8/9	7	TM2	125		2300	ng/g
VB-01-00197	816	8/9	7	TM2	125		1700	ng/g
VB-01-00226	820	8/9	7	TM2	125		3000	ng/g
VB-01-00221	803	8/9	8	TM3	50		510	ng/g
VB-01-00223	808	8/9	8	TM3	50		1300	ng/g
VB-01-00225	810	8/9	8	TM3	50		540	ng/g
VB-01-00199	833	8/9	8	TM3	50		790	ng/g
VB-01-00205	818	8/9	9	TM3	125		1500	ng/g
VB-01-00209	829	8/9	9	TM3	125		2000	ng/g
VB-01-00224	830	8/9	9	TM3	125		2700	ng/g
VB-01-00214	832	8/9	9	TM3	125		1400	ng/g
VB-01-00200	2801	8/9	6	TM2	50		1000	ng/g
VB-01-00204	2813	8/9	4	TM1	50		2500	ng/g
VB-01-00212	2820	8/9	7	TM2	125		3400	ng/g
VB-01-00267	809	10/11	1	Control	0		160	ng/g
VB-01-00248	828	10/11	1	Control	0		170	ng/g
VB-01-00264	831	10/11	1	Control	0		190	ng/g
VB-01-00244	815	10/11	2	NaAs	50		370	ng/g
VB-01-00242	821	10/11	2	NaAs	50		400	ng/g
VB-01-00259	825	10/11	2	NaAs	50		240	ng/g
VB-01-00230	842	10/11	2	NaAs	50		510	ng/g
VB-01-00254	826	10/11	3	NaAs	125		2600	ng/g
VB-01-00262	827	10/11	3	NaAs	125		410	ng/g
VB-01-00233	835	10/11	3	NaAs	125		420	ng/g
VB-01-00255	841	10/11	3	NaAs	125		520	ng/g
VB-01-00250	802	10/11	4	TM1	50		1700	ng/g
VB-01-00253	804	10/11	4	TM1	50		1500	ng/g
VB-01-00240	807	10/11	4	TM1	50		1100	ng/g
VB-01-00236	813	10/11	4	TM1	50		1800	ng/g
VB-01-00252	819	10/11	5	TM1	125		3400	ng/g
VB-01-00257	822	10/11	5	TM1	125		2400	ng/g
VB-01-00237	834	10/11	5	TM1	125		2000	ng/g
VB-01-00258	840	10/11	5	TM1	125		2600	ng/g
VB-01-00235	801	10/11	6	TM2	50		1400	ng/g
VB-01-00251	812	10/11	6	TM2	50		2100	ng/g
VB-01-00241	823	10/11	6	TM2	50		620	ng/g
VB-01-00265	836	10/11	6	TM2	50		1100	ng/g
VB-01-00243	806	10/11	7	TM2	125		3500	ng/g
VB-01-00260	811	10/11	7	TM2	125		2400	ng/g
VB-01-00234	816	10/11	7	TM2	125		2500	ng/g

tag number	pig number	day	group	material administered	dosage	Q	Feces Conc	Units
VB-01-00249	820	10/11	7	TM2	125		4000	ng/g
VB-01-00266	803	10/11	8	TM3	50		750	ng/g
VB-01-00239	808	10/11	8	TM3	50		1300	ng/g
VB-01-00231	810	10/11	8	TM3	50		660	ng/g
VB-01-00238	833	10/11	8	TM3	50		650	ng/g
VB-01-00232	818	10/11	9	TM3	125		2100	ng/g
VB-01-00246	829	10/11	9	TM3	125		2200	ng/g
VB-01-00263	830	10/11	9	TM3	125		2900	ng/g
VB-01-00261	832	10/11	9	TM3	125		2600	ng/g
VB-01-00245	2822	10/11	5	TM1	125		3200	ng/g
VB-01-00247	2818	10/11	9	TM3	125		1700	ng/g
VB-01-00256	2827	10/11	3	NaAs	125		840	ng/g

APPENDIX C

DETAILED RESULTS FROM STUDY 2

VB Experiment 2 Schedule

Study Day	Day	Date	Dose Administration	Feed	Weigh	Dose Prep	Cull Pigs/ Pregn Dose C	48 hr Urine Collection	Sacrifice
-4	Tuesday	9/28/99		X					
-3	Wednesday	9/29/1999		X					
-2	Thursday	9/30/1999		X			X		
-1	Friday	10/1/1999		X	X	X		24-hr Collection	
0	Saturday	10/2/1999	X	X					
1	Sunday	10/3/1999	X	X					
2	Monday	10/4/1999	X	X	X	X			
3	Tuesday	10/5/1999	X	X					
4	Wednesday	10/6/1999	X	X					
5	Thursday	10/7/1999	X	X	X	X			
6	Friday	10/8/1999	X	X				↕	
7	Saturday	10/9/1999	X	X				↕	
8	Sunday	10/10/1999	X	X	X	X		↕	
9	Monday	10/11/1999	X	X				↕	
10	Tuesday	10/12/1999	X	X				↕	
11	Wednesday	10/13/1999	X	X	X			↕	
12	Thursday	10/14/1999							X

VB2 Pig Group Assignments

pig number	group	dosage	material
903	1	0	None
935	1		
940	1		
902	2	50	NaAs
910	2		
911	2		
938	2		
909	3	125	NaAs
912	3		
925	3		
936	3		
918	4	50	Test Material 4
929	4		
932	4		
937	4		
913	5	125	Test Material 4
914	5		
919	5		
939	5		
901	6	50	Test Material 5
922	6		
930	6		
933	6		
915	7	125	Test Material 5
921	7		
924	7		
934	7		
905	8	50	Test Material 6
917	8		
920	8		
927	8		
904	9	125	Test Material 6
908	9		
926	9		
931	9		

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

Body weights were measured on days -1, 2, 5, 8, 11. 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		Day 7		Day 8		Day 9		Day 10		Day 11	
		BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day	BW (kg)	ug As per day
1	903	8.13	0	8.3	0	8.5	0	8.62	0	9.0	0	9.4	0	9.81	0	10.3	0	10.7	0	11.2	0	11.5	0	11.8	0	12.14	0
1	935	7.56	0	7.8	0	8.1	0	8.34	0	8.6	0	8.8	0	9.03	0	9.4	0	9.7	0	10.09	0	10.6	0	11.2	0	11.68	0
1	940	6.81	0	7.0	0	7.1	0	7.25	0	7.8	0	8.3	0	8.89	0	9.1	0	9.4	0	9.64	0	10.1	0	10.6	0	11.11	0
2	902	7.17	0	7.5	384	7.8	384	8.16	384	8.4	418	8.7	418	8.94	418	9.3	452	9.7	452	10.05	452	10.4	516	10.8	516	11.24	516
2	910	7.17	0	7.3	384	7.4	384	7.53	384	7.6	418	7.6	418	7.65	418	8.2	452	8.8	452	9.33	452	9.9	516	10.6	516	11.17	516
2	911	5.69	0	5.9	384	6.1	384	6.23	384	6.4	418	6.7	418	6.87	418	7.3	452	7.6	452	8.01	452	8.6	516	9.3	516	9.9	516
2	938	6.68	0	6.9	384	7.2	384	7.48	384	7.9	418	8.3	418	8.68	418	9.1	452	9.5	452	9.87	452	10.2	516	10.6	516	10.9	516
3	909	6.58	0	7.0	973	7.4	973	7.83	973	8.1	1078	8.4	1078	8.74	1078	9.1	1183	9.4	1183	9.76	1183	10.3	1319	10.9	1319	11.51	1319
3	912	6.69	0	7.0	973	7.4	973	7.73	973	8.2	1078	8.7	1078	9.17	1078	9.4	1183	9.6	1183	9.85	1183	10.4	1319	10.9	1319	11.49	1319
3	925	7.35	0	7.6	973	7.8	973	8.03	973	8.2	1078	8.3	1078	8.41	1078	8.9	1183	9.5	1183	10.02	1183	10.5	1319	10.9	1319	11.31	1319
3	936	6.52	0	6.7	973	6.8	973	6.92	973	7.1	1078	7.3	1078	7.54	1078	7.9	1183	8.2	1183	8.57	1183	9.1	1319	9.6	1319	10.05	1319
4	918	6.46	0	6.7	289	7.0	289	7.25	289	7.7	325	8.2	325	8.67	325	8.9	367	9.1	367	9.31	367	9.8	398	10.3	398	10.85	398
4	929	8.11	0	8.4	289	8.6	289	8.86	289	9.2	325	9.6	325	10.01	325	10.2	367	10.4	367	10.55	367	11.1	398	11.6	398	12.12	398
4	932	6.35	0	6.8	289	7.3	289	7.79	289	8.1	325	8.3	325	8.57	325	8.9	367	9.3	367	9.64	367	10.1	398	10.6	398	11.11	398
4	937	6.04	0	6.3	289	6.6	289	6.87	289	7.3	325	7.7	325	8.05	325	8.4	367	8.7	367	9.05	367	9.7	398	10.3	398	10.96	398
5	913	6.04	0	6.3	752	6.6	752	6.92	752	7.3	848	7.7	848	8.07	848	8.4	935	8.7	935	8.99	935	9.4	1025	9.9	1025	10.32	1025
5	914	6.93	0	7.3	752	7.7	752	8.14	752	8.5	848	8.9	848	9.22	848	9.4	467	9.5	935	9.71	935	10.5	1025	11.2	1025	11.93	922
5	919	6.34	0	6.6	752	6.8	752	7.06	752	7.3	848	7.5	848	7.74	848	8.1	935	8.5	935	8.85	935	9.3	1025	9.7	1025	10.19	1025
5	939	8.86	0	9.3	752	9.7	752	10.2	752	10.4	848	10.7	848	10.96	848	11.4	935	11.8	935	12.29	935	12.8	1025	13.2	1025	13.67	1025
6	901	6.83	0	7.2	337	7.5	337	7.8	337	8.1	374	8.3	374	8.61	374	8.9	413	9.3	413	9.58	413	10.1	456	10.6	456	11.13	456
6	922	6.24	0	6.5	337	6.8	337	7.02	337	7.4	374	7.7	374	8.06	374	8.4	413	8.8	413	9.12	413	9.6	456	10.1	456	10.59	456
6	930	7.38	0	7.6	337	7.9	337	8.11	337	8.4	374	8.7	374	9.06	374	9.3	413	9.5	413	9.74	413	10.3	456	10.9	456	11.43	456
6	933	8.4	0	8.8	337	9.1	337	9.47	337	9.8	374	10.1	374	10.45	374	10.9	413	11.4	413	11.94	413	12.2	456	12.5	456	12.75	456
7	915	6.67	0	7.0	844	7.4	844	7.77	844	8.1	983	8.4	983	8.75	983	9.1	1070	9.4	1070	9.67	1070	10.2	1150	10.7	1150	11.25	1150
7	921	8.43	0	8.8	844	9.1	844	9.41	633	9.8	860	10.2	983	10.6	983	10.8	1070	11.0	1070	11.2	1070	11.8	1150	12.3	1150	12.92	1150
7	924	6.5	0	7.2	844	7.8	844	8.48	844	8.7	983	8.9	983	9.1	983	9.4	1070	9.6	1070	9.88	1070	10.4	1150	10.8	1150	11.3	1150
7	934	7.26	0	7.7	844	8.2	844	8.65	844	8.9	983	9.1	983	9.25	983	9.5	1070	9.8	1070	10.05	1070	10.5	1150	11.0	1150	11.54	1150
8	905	6.5	0	6.9	265	7.3	265	7.77	265	8.0	300	8.3	300	8.59	300	8.8	335	9.0	335	9.22	335	9.9	355	10.5	355	11.15	355
8	917	7.93	0	8.2	265	8.5	265	8.78	265	9.4	300	9.9	300	10.5	300	10.6	335	10.7	335	10.82	335	10.8	355	10.8	355	10.77	355
8	920	6.8	0	7.3	265	7.8	265	8.31	265	8.6	300	8.9	300	9.12	300	9.4	335	9.6	335	9.85	335	10.4	355	10.9	355	11.37	355
8	927	7.43	0	7.7	265	7.9	265	8.11	265	8.5	300	8.8	300	9.18	300	9.4	335	9.7	335	9.89	335	10.7	355	11.6	355	12.38	355
9	904	6.2	0	6.7	614	7.2	614	7.65	614	7.9	692	8.2	692	8.41	692	8.8	783	9.2	783	9.61	783	10.3	843	10.9	843	11.61	843
9	908	7	0	7.3	614	7.6	614	7.85	614	8.3	692	8.8	692	9.27	692	9.4	783	9.6	783	9.71	783	10.3	843	10.8	843	11.39	843
9	926	6.39	0	6.5	614	6.7	614	6.82	614	7.2	692	7.6	692	7.97	692	8.1	783	8.2	783	8.27	783	8.8	843	9.4	738	9.93	738
9	931	6.71	0	7.1	614	7.5	614	7.84	614	8.2	692	8.6	692	9	692	9.3	783	9.7	783	10.02	783	10.5	843	10.9	843	11.32	843

	Day 2 - Pig 921 did not eat entire afternoon dose (ate approximately 50%). Daily dose adjusted to 75%
	Day 3 - Pig 921 did not eat entire morning dose (ate approximately 75%). Daily dose adjusted to 87.5%.
	Day 6 - Pig 914 did not eat one dose. Daily dose adjusted to 50%.
	Day 10 - Pig 926 did not eat entire morning dose (ate approximately 75%). Daily dose adjusted to 87.5%.
	Day 11 - Pig 914 did not eat entire morning dose (ate approximately 80%). Daily dose adjusted to 90%.
	Day 11 - Pig 926 did not eat entire morning dose (ate approximately 75%). Daily dose adjusted to 87.5%.

TABLE C-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	Avg Dose	Target Dose	% Target	Avg %
1	903	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0		
1	935	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0		
1	940	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0		
2	902	51.18	49.03	47.04	49.58	48.10	46.70	48.52	46.67	44.95	49.37	47.56	45.89	47.88	50	96	
2	910	52.66	51.80	50.98	55.15	54.86	54.58	55.02	51.51	48.42	51.87	48.86	46.17	51.82	50	104	
2	911	65.40	63.45	61.62	64.80	62.72	60.77	62.31	59.21	56.40	59.69	55.64	52.10	60.34	50	121	
2	938	55.26	53.22	51.32	52.98	50.42	48.10	49.77	47.69	45.77	50.50	48.86	47.32	50.10	50	100	105
3	909	139.08	131.27	124.28	132.59	127.83	123.39	130.30	125.60	121.22	127.50	120.69	114.57	126.53	125	101	
3	912	138.29	131.80	125.89	131.36	124.10	117.60	125.91	122.94	120.11	126.84	120.51	114.77	125.01	125	100	
3	925	128.44	124.71	121.19	132.22	130.19	128.23	132.24	124.76	118.08	126.20	121.21	116.60	125.34	125	100	
3	936	146.26	143.39	140.63	151.32	147.06	143.03	150.08	143.82	138.05	145.50	137.99	131.22	143.20	125	115	104
4	918	43.05	41.43	39.92	42.09	39.66	37.49	41.36	40.39	39.47	40.50	38.48	36.66	40.04	50	80	
4	929	34.62	33.62	32.67	35.17	33.77	32.47	36.06	35.43	34.83	35.92	34.30	32.82	34.31	50	69	
4	932	42.38	39.60	37.16	40.38	39.12	37.93	41.16	39.58	38.11	39.27	37.46	35.81	39.00	50	78	
4	937	45.82	43.90	42.13	44.75	42.46	40.38	43.83	42.15	40.60	41.07	38.53	36.30	41.83	50	84	78
5	913	118.72	113.47	108.66	116.17	110.38	105.13	111.58	107.64	103.97	108.62	103.75	99.29	108.95	125	87	
5	914	102.53	97.19	92.37	99.82	95.76	92.02	49.81	97.91	96.26	98.05	91.57	77.30	90.88	125	73	
5	919	114.27	110.25	106.50	116.44	112.92	109.62	115.25	110.22	105.61	110.22	105.17	100.56	109.75	125	88	
5	939	80.85	77.20	73.86	81.27	79.29	77.41	81.97	78.90	76.05	80.37	77.57	74.96	78.31	125	63	78
6	901	47.15	45.11	43.24	46.31	44.81	43.41	46.18	44.57	43.06	45.13	42.94	40.94	44.41	50	89	
6	922	51.89	49.90	48.05	50.74	48.46	46.37	49.04	47.06	45.24	47.42	45.12	43.03	47.69	50	95	
6	930	44.25	42.88	41.59	44.35	42.75	41.25	44.43	43.37	42.36	44.23	41.93	39.87	42.77	50	86	
6	933	38.52	37.01	35.62	38.15	36.92	35.77	37.69	36.05	34.55	37.32	36.51	35.74	36.65	50	73	86
7	915	119.87	113.94	108.56	121.46	116.75	112.39	118.19	114.32	110.70	112.78	107.24	102.22	113.20	125	91	
7	921	96.33	92.86	67.23	87.74	96.38	92.77	99.11	97.31	95.57	97.68	93.14	89.01	92.10	125	74	
7	924	117.81	107.87	99.47	113.21	110.58	108.07	114.36	111.27	108.34	111.08	106.22	101.77	109.17	125	87	
7	934	109.22	103.03	97.51	111.12	108.66	106.31	112.48	109.41	106.51	109.04	104.14	99.65	106.42	125	85	84
8	905	38.23	36.02	34.06	37.24	36.02	34.87	38.11	37.22	36.38	35.97	33.76	31.82	35.81	50	72	
8	917	32.22	31.15	30.14	32.03	30.18	28.53	31.62	31.31	31.00	32.84	32.89	32.94	31.40	50	63	
8	920	36.24	33.90	31.85	34.91	33.85	32.85	35.82	34.91	34.05	34.25	32.66	31.20	33.87	50	68	
8	927	34.56	33.57	32.63	35.38	33.95	32.63	35.62	34.74	33.91	33.09	30.71	28.66	33.29	50	67	67
9	904	91.84	85.65	80.24	87.56	84.84	82.28	88.87	85.01	81.47	82.02	77.03	72.60	83.28	125	67	
9	908	84.28	81.12	78.19	83.14	78.67	74.65	83.15	81.87	80.63	82.08	77.83	74.00	79.97	125	64	
9	926	93.95	91.93	90.00	96.07	91.21	86.83	97.02	95.83	94.67	95.53	78.66	74.28	90.50	125	72	
9	931	86.61	82.24	78.29	84.12	80.34	76.89	83.83	80.88	78.14	80.64	77.43	74.46	80.32	125	64	67

TABLE C-3 VB Experiment 2 Urine Volumes - 48 hour collections

Units of Volume: _____ ml

Group	Pig ID	Day			
		-1 to 0* 10/1/99-10/2/99	6-7 10/8/99-10/10/99	8-9 10/10/99-10/12/99	10-11 10/12/99-10/14/99
1	903	800	4700	2240	5240
	935	400	1860	2290	4000
	940	124	960	430	580
2	902	198	2100	1020	4000
	910	126	620	810	800
	911	400	560	650	2900
	938	142	1320	690	1090
3	909	800	1940	3640	2540
	912	1400	4440	2980	3880
	925	400	2220	3330	10000
	936	800	4260	2920	4600
4	918	2200	10740	10030	12260
	929	3200	8600	6750	5860
	932	800	4520	4000	8660
	937	107	1380	860	880
5	913	400	2220	1820	2000
	914	200	1440	1320	1400
	919	1200	5300	5420	7440
	939	1200	2100	1400	2000
6	901	400	2320	1920	1500
	922	1400	2300	2740	2800
	930	600	3100	2720	2960
	933	800	5640	5140	5040
7	915	1600	5280	6240	5800
	921	2000	10540	10160	16000
	924	2800	4400	5700	7100
	934	2000	5460	3200	4260
8	905	400	1840	1200	1800
	917	2000	6220	2600	1660
	920	108	660	560	1300
	927	600	6840	8360	10420
9	904	800	4360	5540	6400
	908	192	2640	1040	3200
	926	600	1240	1700	3140
	931	2400	3460	2460	4000

Volume measured by:	ZL	CG	CG/TE	MD
Date:	10/2/1999	10/10/1999	10/12/1999	10/14/1999

* 24 hour collection pre-dosing

TABLE C-4 URINE ANALYTICAL RESULTS

tag number	pig number	day	group	material administered	dosage	Q	Urine Conc	Units
VB-02-00056	903	-1	1	Control	0		11	ng/mL
VB-02-00063	935	-1	1	Control	0		36	ng/mL
VB-02-00037	940	-1	1	Control	0		130	ng/mL
VB-02-00032	902	-1	2	NaAs	50		69	ng/mL
VB-02-00038	910	-1	2	NaAs	50		41	ng/mL
VB-02-00062	911	-1	2	NaAs	50		32	ng/mL
VB-02-00036	938	-1	2	NaAs	50		150	ng/mL
VB-02-00059	909	-1	3	NaAs	125		34	ng/mL
VB-02-00052	912	-1	3	NaAs	125		13	ng/mL
VB-02-00039	925	-1	3	NaAs	125		39	ng/mL
VB-02-00041	936	-1	3	NaAs	125		11	ng/mL
VB-02-00035	918	-1	4	TM4	50		81	ng/mL
VB-02-00031	929	-1	4	TM4	50		41	ng/mL
VB-02-00053	932	-1	4	TM4	50		22	ng/mL
VB-02-00054	937	-1	4	TM4	50		150	ng/mL
VB-02-00042	913	-1	5	TM4	125		33	ng/mL
VB-02-00051	914	-1	5	TM4	125		68	ng/mL
VB-02-00068	919	-1	5	TM4	125		10	ng/mL
VB-02-00064	939	-1	5	TM4	125		10	ng/mL
VB-02-00044	901	-1	6	TM5	50		51	ng/mL
VB-02-00046	922	-1	6	TM5	50		18	ng/mL
VB-02-00067	930	-1	6	TM5	50		18	ng/mL
VB-02-00050	933	-1	6	TM5	50		29	ng/mL
VB-02-00060	915	-1	7	TM5	125		14	ng/mL
VB-02-00058	921	-1	7	TM5	125		12	ng/mL
VB-02-00055	924	-1	7	TM5	125		9	ng/mL
VB-02-00065	934	-1	7	TM5	125		7	ng/mL
VB-02-00045	905	-1	8	TM6	50		62	ng/mL
VB-02-00040	917	-1	8	TM6	50		4	ng/mL
VB-02-00033	920	-1	8	TM6	50		110	ng/mL
VB-02-00048	927	-1	8	TM6	50		18	ng/mL
VB-02-00061	904	-1	9	TM6	125		10	ng/mL
VB-02-00057	908	-1	9	TM6	125		83	ng/mL
VB-02-00043	926	-1	9	TM6	125		30	ng/mL
VB-02-00047	931	-1	9	TM6	125		4	ng/mL
VB-02-00034	2930	-1	6	TM5	50		19	ng/mL
VB-02-00066	2926	-1	9	TM6	125		31	ng/mL
VB-02-00049	2901	-1	6	TM5	50		53	ng/mL
VB-02-00075	903	6/7	1	Control	0		18	ng/mL
VB-02-00086	935	6/7	1	Control	0		44	ng/mL
VB-02-00102	940	6/7	1	Control	0		77	ng/mL
VB-02-00120	902	6/7	2	NaAs	50		380	ng/mL
VB-02-00092	910	6/7	2	NaAs	50		1400	ng/mL
VB-02-00082	911	6/7	2	NaAs	50		580	ng/mL
VB-02-00115	938	6/7	2	NaAs	50		650	ng/mL
VB-02-00118	909	6/7	3	NaAs	125		820	ng/mL
VB-02-00094	912	6/7	3	NaAs	125		480	ng/mL
VB-02-00106	925	6/7	3	NaAs	125		470	ng/mL
VB-02-00076	936	6/7	3	NaAs	125		360	ng/mL
VB-02-00072	918	6/7	4	TM4	50		14	ng/mL

tag number	pig number	day	group	material administered	dosage	Q	Urine Conc	Units
VB-02-00111	929	6/7	4	TM4	50		30	ng/mL
VB-02-00077	932	6/7	4	TM4	50		55	ng/mL
VB-02-00087	937	6/7	4	TM4	50		120	ng/mL
VB-02-00078	913	6/7	5	TM4	125		130	ng/mL
VB-02-00097	914	6/7	5	TM4	125		130	ng/mL
VB-02-00108	919	6/7	5	TM4	125		91	ng/mL
VB-02-00071	939	6/7	5	TM4	125		160	ng/mL
VB-02-00093	901	6/7	6	TM5	50		120	ng/mL
VB-02-00116	922	6/7	6	TM5	50		93	ng/mL
VB-02-00084	930	6/7	6	TM5	50		94	ng/mL
VB-02-00074	933	6/7	6	TM5	50		56	ng/mL
VB-02-00098	915	6/7	7	TM5	125		55	ng/mL
VB-02-00083	921	6/7	7	TM5	125		28	ng/mL
VB-02-00073	924	6/7	7	TM5	125		78	ng/mL
VB-02-00105	934	6/7	7	TM5	125		66	ng/mL
VB-02-00069	905	6/7	8	TM6	50		130	ng/mL
VB-02-00100	917	6/7	8	TM6	50		30	ng/mL
VB-02-00095	920	6/7	8	TM6	50		290	ng/mL
VB-02-00079	927	6/7	8	TM6	50		23	ng/mL
VB-02-00103	904	6/7	9	TM6	125		51	ng/mL
VB-02-00104	908	6/7	9	TM6	125		130	ng/mL
VB-02-00099	926	6/7	9	TM6	125		120	ng/mL
VB-02-00081	931	6/7	9	TM6	125		96	ng/mL
VB-02-00110	2931	6/7	9	TM6	125		100	ng/mL
VB-02-00089	2925	6/7	3	NaAs	125		490	ng/mL
VB-02-00101	2902	6/7	2	NaAs	50		400	ng/mL
VB-02-00121	AsCtrl	6/7					17	ng/mL
VB-02-00117	AsIA100	6/7					120	ng/mL
VB-02-00091	AsIB100	6/7					110	ng/mL
VB-02-00114	AsOA100	6/7					80	ng/mL
VB-02-00107	AsOB100	6/7					94	ng/mL
VB-02-00119	AsIA25	6/7					42	ng/mL
VB-02-00085	AsIB25	6/7					41	ng/mL
VB-02-00090	AsOA25	6/7					33	ng/mL
VB-02-00113	AsOB25	6/7					36	ng/mL
VB-02-00096	AsIA5	6/7					21	ng/mL
VB-02-00070	AsIB5	6/7					23	ng/mL
VB-02-00088	AsOA5	6/7					23	ng/mL
VB-02-00122	AsOB5	6/7					22	ng/mL
VB-02-00109	AsMix1	6/7					97	ng/mL
VB-02-00112	AsMix2	6/7					37	ng/mL
VB-02-00080	AsMix3	6/7					20	ng/mL
VB-02-00145	903	8/9	1	Control	0		21	ng/mL
VB-02-00136	935	8/9	1	Control	0		38	ng/mL
VB-02-00156	940	8/9	1	Control	0		220	ng/mL
VB-02-00155	902	8/9	2	NaAs	50		510	ng/mL
VB-02-00163	910	8/9	2	NaAs	50		1500	ng/mL
VB-02-00158	911	8/9	2	NaAs	50		550	ng/mL
VB-02-00127	938	8/9	2	NaAs	50		1200	ng/mL
VB-02-00167	909	8/9	3	NaAs	125		570	ng/mL
VB-02-00152	912	8/9	3	NaAs	125		620	ng/mL
VB-02-00147	925	8/9	3	NaAs	125		410	ng/mL

tag number	pig number	day	group	material administered	dosage	Q	Urine Conc	Units
VB-02-00159	936	8/9	3	NaAs	125		520	ng/mL
VB-02-00168	918	8/9	4	TM4	50		21	ng/mL
VB-02-00169	929	8/9	4	TM4	50		42	ng/mL
VB-02-00130	932	8/9	4	TM4	50		58	ng/mL
VB-02-00160	937	8/9	4	TM4	50		260	ng/mL
VB-02-00166	913	8/9	5	TM4	125		150	ng/mL
VB-02-00137	914	8/9	5	TM4	125		220	ng/mL
VB-02-00125	919	8/9	5	TM4	125		80	ng/mL
VB-02-00174	939	8/9	5	TM4	125		210	ng/mL
VB-02-00128	901	8/9	6	TM5	50		110	ng/mL
VB-02-00134	922	8/9	6	TM5	50		87	ng/mL
VB-02-00129	930	8/9	6	TM5	50		76	ng/mL
VB-02-00150	933	8/9	6	TM5	50		50	ng/mL
VB-02-00175	915	8/9	7	TM5	125		50	ng/mL
VB-02-00142	921	8/9	7	TM5	125		40	ng/mL
VB-02-00173	924	8/9	7	TM5	125		62	ng/mL
VB-02-00148	934	8/9	7	TM5	125		110	ng/mL
VB-02-00132	905	8/9	8	TM6	50		190	ng/mL
VB-02-00171	917	8/9	8	TM6	50		70	ng/mL
VB-02-00157	920	8/9	8	TM6	50		370	ng/mL
VB-02-00170	927	8/9	8	TM6	50		25	ng/mL
VB-02-00161	904	8/9	9	TM6	125		75	ng/mL
VB-02-00138	908	8/9	9	TM6	125		260	ng/mL
VB-02-00146	926	8/9	9	TM6	125		170	ng/mL
VB-02-00165	931	8/9	9	TM6	125		140	ng/mL
VB-02-00126	2936	8/9	3	NaAs	125		500	ng/mL
VB-02-00144	2921	8/9	7	TM5	125		40	ng/mL
VB-02-00131	2904	8/9	9	TM6	125		75	ng/mL
VB-02-00133	AsCtrl	8/9					19	ng/mL
VB-02-00153	AsIA100	8/9					120	ng/mL
VB-02-00151	AsIB100	8/9					120	ng/mL
VB-02-00123	AsOA100	8/9					79	ng/mL
VB-02-00143	AsOB100	8/9					96	ng/mL
VB-02-00176	AsIA25	8/9					45	ng/mL
VB-02-00139	AsIB25	8/9					39	ng/mL
VB-02-00162	AsOA25	8/9					33	ng/mL
VB-02-00124	AsOB25	8/9					36	ng/mL
VB-02-00140	AsIA5	8/9					23	ng/mL
VB-02-00172	AsIB5	8/9					23	ng/mL
VB-02-00135	AsOA5	8/9					22	ng/mL
VB-02-00164	AsOB5	8/9					24	ng/mL
VB-02-00149	AsMix1	8/9					37	ng/mL
VB-02-00154	AsMix2	8/9					37	ng/mL
VB-02-00141	AsMix3	8/9					21	ng/mL
VB-02-00212	903	1	1	Control	0		21	ng/mL
VB-02-00204	935	1	1	Control	0		38	ng/mL
VB-02-00218	940	1	1	Control	0		71	ng/mL
VB-02-00184	902	1	2	NaAs	50		200	ng/mL
VB-02-00216	910	1	2	NaAs	50		950	ng/mL
VB-02-00226	911	1	2	NaAs	50		200	ng/mL
VB-02-00203	938	1	2	NaAs	50		670	ng/mL

tag number	pig number	day	group	material administered	dosage	Q	Urine Conc	Units
VB-02-00219	909	1	3	NaAs	125		750	ng/mL
VB-02-00181	912	1	3	NaAs	125		450	ng/mL
VB-02-00194	925	1	3	NaAs	125		180	ng/mL
VB-02-00208	936	1	3	NaAs	125		170	ng/mL
VB-02-00190	918	1	4	TM4	50		21	ng/mL
VB-02-00221	929	1	4	TM4	50		46	ng/mL
VB-02-00222	932	1	4	TM4	50		29	ng/mL
VB-02-00186	937	1	4	TM4	50		210	ng/mL
VB-02-00177	913	1	5	TM4	125		170	ng/mL
VB-02-00228	914	1	5	TM4	125		370	ng/mL
VB-02-00179	919	1	5	TM4	125		69	ng/mL
VB-02-00201	939	1	5	TM4	125		210	ng/mL
VB-02-00202	901	1	6	TM5	50		150	ng/mL
VB-02-00214	922	1	6	TM5	50		79	ng/mL
VB-02-00198	930	1	6	TM5	50		65	ng/mL
VB-02-00220	933	1	6	TM5	50		47	ng/mL
VB-02-00205	915	1	7	TM5	125		59	ng/mL
VB-02-00188	921	1	7	TM5	125		34	ng/mL
VB-02-00200	924	1	7	TM5	125		54	ng/mL
VB-02-00195	934	1	7	TM5	125		100	ng/mL
VB-02-00223	905	1	8	TM6	50		110	ng/mL
VB-02-00182	917	1	8	TM6	50		93	ng/mL
VB-02-00185	920	1	8	TM6	50		180	ng/mL
VB-02-00192	927	1	8	TM6	50		20	ng/mL
VB-02-00213	904	1	9	TM6	125		67	ng/mL
VB-02-00230	908	1	9	TM6	125		150	ng/mL
VB-02-00187	926	1	9	TM6	125		140	ng/mL
VB-02-00191	931	1	9	TM6	125		95	ng/mL
VB-02-00210	2911	1	2	NaAs	50		190	ng/mL
VB-02-00183	2922	1	6	TM5	50		79	ng/mL
VB-02-00211	2902	1	2	NaAs	50		210	ng/mL
VB-02-00199	AsCtrl	1					18	ng/mL
VB-02-00189	AsIA100	1					130	ng/mL
VB-02-00206	AsIB100	1					120	ng/mL
VB-02-00227	AsOA100	1					83	ng/mL
VB-02-00215	AsOB100	1					95	ng/mL
VB-02-00207	AsIA25	1					44	ng/mL
VB-02-00209	AsIB25	1					42	ng/mL
VB-02-00178	AsOA25	1					33	ng/mL
VB-02-00229	AsOB25	1					38	ng/mL
VB-02-00193	AsIA5	1					23	ng/mL
VB-02-00180	AsIB5	1					24	ng/mL
VB-02-00217	AsOA5	1					22	ng/mL
VB-02-00196	AsOB5	1					23	ng/mL
VB-02-00224	AsMix1	1					99	ng/mL
VB-02-00197	AsMix2	1					38	ng/mL
VB-02-00225	AsMix3	1					22	ng/mL

TABLE C-5 VB Experiment 2 Fecal Weights - 48 hour collections

Units of Weight: ____ g

Group	Pig ID	Day		
		6-7 10/8/99-10/10/99	8-9 10/10/99-10/12/99	10-11 10/12/99-10/14/99
1	903	245.19	266.19	267.9
	935	383.48	162.39	159.68
	940	192.53	137.66	129.01
2	902	121.91	179.59	248.34
	910	169.06	65.98	238.39
	911	198.38	189.91	245.14
	938	173.4	173.5	157.42
3	909	92.53	179.86	185.08
	912	156.18	141.49	209.51
	925	191.43	71.26	135.81
	936	197.43	241.75	259.44
4	918	223.11	202.48	213.82
	929	316.77	304.92	393.77
	932	59.55	205.08	187.51
	937	83.31	59.4	330.39
5	913	288.48	260.72	357.49
	914	442.41	288.52	407.72
	919	212.17	266.36	305.39
	939	235.19	207.61	215.17
6	901	202.43	240.4	317.85
	922	149.62	187.38	184.16
	930	214.24	257.42	288.63
	933	201.4	189.68	248.28
7	915	146.66	154.33	247.97
	921	314.49	219.73	297.13
	924	300.09	236.33	141.96
	934	323.47	247.98	465.07
8	905	180.79	139.98	165.15
	917	299.25	234.58	213.3
	920	227.19	225.14	314
	927	336.79	205.54	369.78
9	904	326.3	392.19	341.52
	908	277.89	221.89	294.4
	926	257.14	249.45	503.91
	931	237.3	231.63	359.32

Weighed by:

Date:

DD	DD	DD
10/26/1999	10/26/1999	10/26/1999

TABLE C-6 FECES ANALYTICAL RESULTS

tag number	pig number	day	group	material administered	dosage	Q	Feces Conc	Units
VB-02-00250	903	6/7	1	Control	0		160	ng/g ww
VB-02-00243	935	6/7	1	Control	0		89	ng/g ww
VB-02-00261	940	6/7	1	Control	0		100	ng/g ww
VB-02-00256	902	6/7	2	NaAs	50		330	ng/g ww
VB-02-00264	910	6/7	2	NaAs	50		410	ng/g ww
VB-02-00259	911	6/7	2	NaAs	50		310	ng/g ww
VB-02-00267	938	6/7	2	NaAs	50		550	ng/g ww
VB-02-00238	909	6/7	3	NaAs	125		490	ng/g ww
VB-02-00248	912	6/7	3	NaAs	125		530	ng/g ww
VB-02-00231	925	6/7	3	NaAs	125		560	ng/g ww
VB-02-00244	936	6/7	3	NaAs	125		650	ng/g ww
VB-02-00257	918	6/7	4	TM4	50		2400	ng/g ww
VB-02-00233	929	6/7	4	TM4	50		1600	ng/g ww
VB-02-00249	932	6/7	4	TM4	50		2100	ng/g ww
VB-02-00246	937	6/7	4	TM4	50		3100	ng/g ww
VB-02-00254	913	6/7	5	TM4	125		2100	ng/g ww
VB-02-00253	914	6/7	5	TM4	125		1500	ng/g ww
VB-02-00240	919	6/7	5	TM4	125		4300	ng/g ww
VB-02-00268	939	6/7	5	TM4	125		4000	ng/g ww
VB-02-00242	901	6/7	6	TM5	50		2300	ng/g ww
VB-02-00236	922	6/7	6	TM5	50		4100	ng/g ww
VB-02-00252	930	6/7	6	TM5	50		2800	ng/g ww
VB-02-00251	933	6/7	6	TM5	50		3000	ng/g ww
VB-02-00258	915	6/7	7	TM5	125		1100	ng/g ww
VB-02-00235	921	6/7	7	TM5	125		4000	ng/g ww
VB-02-00263	924	6/7	7	TM5	125		4900	ng/g ww
VB-02-00237	934	6/7	7	TM5	125		4200	ng/g ww
VB-02-00232	905	6/7	8	TM6	50		2000	ng/g ww
VB-02-00265	917	6/7	8	TM6	50		920	ng/g ww
VB-02-00266	920	6/7	8	TM6	50		2300	ng/g ww
VB-02-00234	927	6/7	8	TM6	50		730	ng/g ww
VB-02-00255	904	6/7	9	TM6	125		3800	ng/g ww
VB-02-00239	908	6/7	9	TM6	125		5000	ng/g ww
VB-02-00260	926	6/7	9	TM6	125		1200	ng/g ww
VB-02-00241	931	6/7	9	TM6	125		3500	ng/g ww
VB-02-00262	2934	6/7	7	TM5	125		4200	ng/g ww
VB-02-00247	2908	6/7	9	TM6	125		4300	ng/g ww
VB-02-00245	2902	6/7	2	NaAs	50		310	ng/g ww
VB-02-00278	903	8/9	1	Control	0		190	ng/g ww
VB-02-00306	935	8/9	1	Control	0		170	ng/g ww
VB-02-00271	940	8/9	1	Control	0		160	ng/g ww
VB-02-00275	902	8/9	2	NaAs	50		300	ng/g ww
VB-02-00304	910	8/9	2	NaAs	50		620	ng/g ww
VB-02-00294	911	8/9	2	NaAs	50		290	ng/g ww
VB-02-00292	938	8/9	2	NaAs	50		620	ng/g ww
VB-02-00301	909	8/9	3	NaAs	125		620	ng/g ww
VB-02-00296	912	8/9	3	NaAs	125		600	ng/g ww
VB-02-00272	925	8/9	3	NaAs	125		650	ng/g ww
VB-02-00303	936	8/9	3	NaAs	125		910	ng/g ww
VB-02-00279	918	8/9	4	TM4	50		2100	ng/g ww

tag number	pig number	day	group	material administered	dosage	Q	Feces Conc	Units
VB-02-00285	929	8/9	4	TM4	50		1800	ng/g ww
VB-02-00276	932	8/9	4	TM4	50		3400	ng/g ww
VB-02-00299	937	8/9	4	TM4	50		4100	ng/g ww
VB-02-00277	913	8/9	5	TM4	125		3500	ng/g ww
VB-02-00287	914	8/9	5	TM4	125		1800	ng/g ww
VB-02-00291	919	8/9	5	TM4	125		5100	ng/g ww
VB-02-00305	939	8/9	5	TM4	125		3900	ng/g ww
VB-02-00295	901	8/9	6	TM5	50		3000	ng/g ww
VB-02-00288	922	8/9	6	TM5	50		4500	ng/g ww
VB-02-00282	930	8/9	6	TM5	50		2600	ng/g ww
VB-02-00293	933	8/9	6	TM5	50		4500	ng/g ww
VB-02-00290	915	8/9	7	TM5	125		11000	ng/g ww
VB-02-00283	921	8/9	7	TM5	125		5500	ng/g ww
VB-02-00269	924	8/9	7	TM5	125		10000	ng/g ww
VB-02-00297	934	8/9	7	TM5	125		7400	ng/g ww
VB-02-00284	905	8/9	8	TM6	50		7600	ng/g ww
VB-02-00302	917	8/9	8	TM6	50		2000	ng/g ww
VB-02-00298	920	8/9	8	TM6	50		1700	ng/g ww
VB-02-00280	927	8/9	8	TM6	50		1700	ng/g ww
VB-02-00270	904	8/9	9	TM6	125		4600	ng/g ww
VB-02-00286	908	8/9	9	TM6	125		4900	ng/g ww
VB-02-00274	926	8/9	9	TM6	125		2400	ng/g ww
VB-02-00289	931	8/9	9	TM6	125		4300	ng/g ww
VB-02-00300	2901	8/9	6	TM5	50		4700	ng/g ww
VB-02-00273	2913	8/9	5	TM4	125		3600	ng/g ww
VB-02-00281	2920	8/9	8	TM6	50		2500	ng/g ww
VB-02-00312	903	10/11	1	Control	0		160	ng/g ww
VB-02-00307	935	10/11	1	Control	0		170	ng/g ww
VB-02-00334	940	10/11	1	Control	0		330	ng/g ww
VB-02-00332	902	10/11	2	NaAs	50		100	ng/g ww
VB-02-00336	910	10/11	2	NaAs	50		530	ng/g ww
VB-02-00313	911	10/11	2	NaAs	50		320	ng/g ww
VB-02-00344	938	10/11	2	NaAs	50		530	ng/g ww
VB-02-00321	909	10/11	3	NaAs	125		650	ng/g ww
VB-02-00320	912	10/11	3	NaAs	125		570	ng/g ww
VB-02-00331	925	10/11	3	NaAs	125		810	ng/g ww
VB-02-00324	936	10/11	3	NaAs	125		1600	ng/g ww
VB-02-00333	918	10/11	4	TM4	50		2400	ng/g ww
VB-02-00319	929	10/11	4	TM4	50		1200	ng/g ww
VB-02-00317	932	10/11	4	TM4	50		3100	ng/g ww
VB-02-00325	937	10/11	4	TM4	50		1900	ng/g ww
VB-02-00339	913	10/11	5	TM4	125		2700	ng/g ww
VB-02-00329	914	10/11	5	TM4	125		2600	ng/g ww
VB-02-00328	919	10/11	5	TM4	125		4700	ng/g ww
VB-02-00330	939	10/11	5	TM4	125		5500	ng/g ww
VB-02-00341	901	10/11	6	TM5	50		2400	ng/g ww
VB-02-00342	922	10/11	6	TM5	50		3900	ng/g ww
VB-02-00308	930	10/11	6	TM5	50		2200	ng/g ww
VB-02-00314	933	10/11	6	TM5	50		2600	ng/g ww
VB-02-00316	915	10/11	7	TM5	125		4400	ng/g ww
VB-02-00323	921	10/11	7	TM5	125		6000	ng/g ww
VB-02-00326	924	10/11	7	TM5	125		4200	ng/g ww

tag number	pig number	day	group	material administered	dosage	Q	Feces Conc	Units
VB-02-00343	934	10/11	7	TM5	125		6200	ng/g ww
VB-02-00340	905	10/11	8	TM6	50		2700	ng/g ww
VB-02-00337	917	10/11	8	TM6	50		1500	ng/g ww
VB-02-00327	920	10/11	8	TM6	50		2300	ng/g ww
VB-02-00310	927	10/11	8	TM6	50		1400	ng/g ww
VB-02-00335	904	10/11	9	TM6	125		3700	ng/g ww
VB-02-00338	908	10/11	9	TM6	125		3800	ng/g ww
VB-02-00318	926	10/11	9	TM6	125		3500	ng/g ww
VB-02-00315	931	10/11	9	TM6	125		3600	ng/g ww
VB-02-00309	2922	10/11	6	TM5	50		4100	ng/g ww
VB-02-00322	2918	10/11	4	TM4	50		1900	ng/g ww
VB-02-00311	2927	10/11	8	TM6	50		1400	ng/g ww

FIGURE 4-11 RELATION BETWEEN URINARY AND FECAL EXCRETION

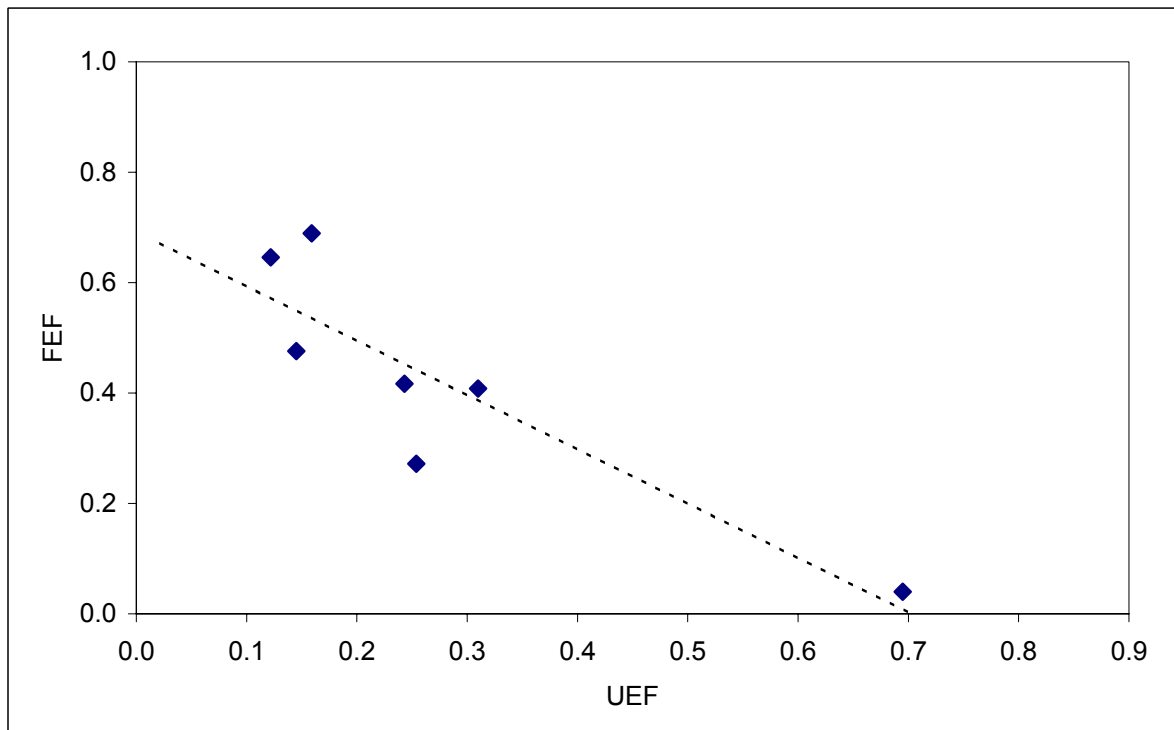


FIGURE 4-12 In Vivo RBA vs In Vitro BA

