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Vasquez Boulevard and I-70 Site
Pilot-Scale Soil Characterization Study

Mineral Phase Speciation and Bioaccessability

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Prepared For

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with comments F/1

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1.0 INTRODUCTION

The Vasquez Boulevard and I-70 (VBI70) Superfund site is a largely residential area near Denver, Colorado, in which a number of residential properties have concentrations of arsenic and/or lead in yard soil that are elevated over what is considered to be typical for the area. The source of these elevated metal concentrations is not known. Two hypotheses which have been advanced include releases from nearby smelter operations and application of arsenic and/or lead-containing lawn care products or pesticides.

The U.S. Environmental Protection Agency (USEPA), Region 8, is working in cooperation with the Vasquez Boulevard and I-70 (VBI70) Working Group [City and County of Denver (CCOD), the Colorado Department of Public Health and Environment (CDPHE), the Agency for Toxic Substances and Disease Registry (ATSDR), the Colorado Peoples Environmental and Economic Network (COPEEN) and members of the public] to collect data that will help determine which candidate sources are and are not likely to be responsible for the elevations.

This plan for this project, referred to as the Pilot-Scale Soil Characterization Study, is detailed in USEPA (1999). In brief, multiple lines of investigation have been pursued in the hopes of identifying one or more measurements that may be collected from contaminated soil that will be diagnostic of the contamination source. One component of the Soil Characterization Study is the collection of data on the mineralogical and solubility characteristics of lead and arsenic in impacted soils, and comparing those to similar measurements performed in candidate source materials. This report describes the details of this phase of the project, and presents the findings.

2.0 METHODS

2.1 Test Materials

Thirty-five samples were shipped under chain of custody from the USEPA to the Laboratory for Environmental and Geological Studies for analysis. The nature and identity of these samples is summarized in Table 1. These samples consisted on two main groups: candidate source materials and residential soils. The candidate source materials included two commercially available products (PAX and ACME), and several samples of soil or white material collected from the Globe smelter site. Residential soils included those that were from locations with clearly elevated concentrations of lead and/or arsenic ("focal"), as well as samples from near-by

("adjacent") locations where contamination was low or absent. In addition, a set of sample with high lead but relatively low arsenic levels were evaluated.

Information on the type or significance of these samples was not revealed to the laboratory until all analyses were completed.

2.2 Speciation

Metal speciation of test materials was conducted on a JOEL 8600 electron microprobe (EMPA) at the Laboratory for Geological Studies at the University of Colorado following the laboratories SOP, as outlined in the work plan (USEPA 1999).

2.3 In Vitro Bioaccessability

BIOACCESSABILITY

In vitro bioavailabilty (BAC) tests were conducted using the method developed at the University of Colorado, Boulder and calibrated to EPA's Region VIII Swine Model (Medlin and Drexler 1996, Medlin 1997, Drexler 1997). This method has a high level of correlation to in vivo bioavailability measurements for lead (R^2=0.96), and a moderate correlation for arsenic (R^2=0.86). The method follows a carefully designed laboratory SOP, which is included in the work plan (USEPA 1999).

2.4 Microscopic Perlite Examination

THERE WAS/IS AN SOP FOR QUANTIFICATION OF PERLITE

A microscopic examination of a bulk split from each soil sample was performed in an attempt to identify perlite particles. No SOP was furnished to our laboratory nor is there an established method one can reference, however, a brief description of our procedure will follow. A split from each sample was taken using a disposable plastic spoon (1 full teaspoons per sample) and placed in a disposable 14cm, plastic tray. The samples were examined for material having the morphological characteristics of perlite using a Fisher Stereomaster® binocular microscope with 20-40X total magnification. The morphological characteristics of perlite, its highly vesiculated glassy appearance, was first observed in both the PAX sample and a commercial sample of perlite (Black Gold ®) following this procedure. Samples were traversed once, in a grid-like format, recording each positive identification.

NOT CONSISTENT W/ THE SOP

2.5 WDSXRF Analyses

Bulk concentration levels for an extensive list of metals in test materials was determined by inductively-coupled plasma-mass spectroscopy (ICP-MS), as described in a separate report. The ICP-MS results for lead and arsenic in the PAX and ACME sample were judged to be unreliable, since the measured values were far from the expected values based on reported content. This was suspected to be a result of difficulties (high dilution error and heterogeneous sample) in measuring non-trace concentration levels by ICP-MS. For this reason, these two samples were analyzed by wavelength dispersive x-ray fluorescence (WDSXRF) for lead and arsenic. Additionally, each of the other 29 samples were analyzed by WDSXRF for Pb, As, Cd and Zn. Samples were analyzed on a PHILIPS PW1400 WDSXRF operating at 60 Kv and 40 mA, following our laboratory SOP. Background corrected peak counts in unknowns are fit to a calibration curve generated from a combination of NIST standards.

How do these results compare to ICP-MS? Why were these analyses done?

2.6 Quality Control

The primary objectives to the series of analyses provided by the University of Colorado are to obtain validated, accurate, and representative results on provided samples. The quality of the data will be assessed based on method QC samples. The type, frequency, and role of QC samples for each analytical method are outlined below. In addition to QC samples, all analyzed materials were subject to method holding times and COC procedures.

The precision of the EMPA speciation will be based on sample duplicates run as required by the SOP, USEPA (1999). Although no criteria have been established for evaluation of precision the objective will be to determine qualitatively how well the method finds the dominant phase(s). The accuracy of the analysis will be estimated based on a statistical evaluation of the point counting following the method of Mosimann (1965). Ninety-five percent confidence values (for frequency of occurrence estimates) are reported in Table 5A for each sample. Again, although no control limits have been determined the data will be used to qualitatively evaluate frequency of occurrence and relative mass estimates.

Bioaccessability

Quality assurance for the in vitro bioavailability procedure are based on the following QA samples: reagent blank, bottle blank, blank spike, matrix spike, duplicate samples, and control soil(s) with defined analysis frequency and control limits. The accuracy and precision of the in vitro method itself is provided in references cited in USEPA (1999).

Perlite is a major component of one of the proposed sources to the site contamination. As such the identification of perlite in soil samples could be a fingerprint of that source. No QA was established for the microscopic examination for perlite, however a qualitative estimate of precision can be obtained from duplicate results.

Precision and accuracy of WDSXRF will be evaluated based on duplicate analyses (20% interval) and RPD control limits on NIST standards run with every sample batch, respectively. In addition, method detection limits and equations (with R^2 values) for calibration curves will be provided in Appendix II.

3.0 RESULTS

3.1 Mineral Phase Speciation

3.1.1 Potential Sources Materials

PAX

WHAT DOES THIS MEAN ?

A sample of the herbicide "PAX" was examined by the laboratory. As shown in Figure 1, this material is primarily composed of perlite, lead arsenate, and arsenic trioxide. Bulk metal concentrations include; 152, 220000, 56000, and 10 mg/kg Zn, As, Pb and Cd, respectively. These measurements are based on average analyses from ICP-MS and WDSXRF. Lead and arsenic values are based on manufactures patent concentrations. Approximately 98% of the lead mass occurs in small (4 um) particles of lead arsenate (PbAsO), of which 73% are liberated and 26% are found rimming other particles. The dominant source of arsenic (89%) are IS subhedral 12 um particles of arsenic trioxide (As_2O_3), which are typically liberated (98%). A representative photomicrograph of PAX is presented in Photo 1. Minor occurrences of accessory phases include AsSbO, PbMO, $PbCO_3$, and AsMCl. Although perlite contains no metal, the large (89 um) liberated and vesiculated particles dominate the sample (see Photo 2).

Of the other trace metals referenced in the Project Plan (zinc, indium, thallium, antimony, selenium, cadmium, and mercury) only antimony is found concentrated, in a phase(s), with any significant frequency to render it as possible markers for PAX. It is primarily found as AsSbO.

A small number of Hg or HgCl particles were also found in this PAX split.

ACME Arsenate of Lead

A sample of "ACME" arsenate of lead, a herbicide, was also speciated. The results are shown in Table 2 and Figure 2. Bulk metal concentrations include; 39, 251300, 694600, and 11 mg/kg Zn, As, Pb and Cd, respectively. These measurements are based on average analyses from ICP-MS and WDXRF. Lead and arsenic values are based on manufactures patent concentrations. The sample is composed entirely of very small (3 um) liberated particles of lead arsenate (PbAsO). A representative photomicrograph of the ACME material is presented in Photo 3. No other metal-bearing phases are found in this sample. No trace element marker phases were found in this material.

Smelter Soils

Four soil samples from the local ASARCO Globe smelter were collected for speciation. Bulk metal concentrations in soils ranged from 190-2470 mg/kg Zn, 7600-27,000 mg/kg As, 2100-5600 mg/kg Pb and 1080-7650 mg/kg Cd. These measurements are based on average analyses from ICP-MS and WDSXRF. As shown in Figure 3, approximately 68% of the lead mass occurs in small (8 um) particles of lead arsenate (PbAsO). Morphologically, 70% of the particles are cemented, 18% are liberated, and 10% are included in other particles. The dominant sources of arsenic (85%) are larger (5-1000 um) subhedral particles of AsCdO, AsMO, As_2O_3, AsCaO, and AsAlO, Photo 4. In general, 65% of these phases are cemented, while 25% are found liberated. The exception is arsenic trioxide, which is found to be liberated 90% of the time. As shown in Table 4, particles of several accessory phases (slag, PbMO, PbS, CdMO, Se, SeMO, SeHg, and Tl) are also common. PbAsO too

Smelter Material

One sample (SC-00023) of smelter material from the ASARCO Globe smelter was collected. Its bulk chemistry and speciation for metals of concern was only slightly different from the other four soils collected at the plant site, Figure 3, with perhaps a greater frequency of AsMO and AsAlO. However, in visual appearance it contained a large percentage of a "white" material, Photo 5, that initially was thought to be arsenic trioxide. Neither EMPA nor bulk arsenic analysis supported this observation. A split of the "white" material was made of the sample and analyzed

by x-ray diffraction on a Scintag® XRD. The material was confirmed to be a mixture of tridymite (a high temperature form of silicon dioxide) and mullite (a high temperature aluminum silicate). XRD scans and library matching spectra are presented in Appendix II.

3.1.2 Residential Soils

"Focal" Residential Soils

Twelve residential soil samples from the VBI70 site, selected because they contain elevated arsenic concentrations were collected for speciation. Bulk soil concentrations ranged from 111-574 mg/kg Zn, 23-1490 mg/kg As, 92-1560 mg/kg Pb and 2-12 mg/kg Cd. These measurements are based on average analyses from ICP-MS and WDSXRF. Approximately 70% of the lead mass occurs in small (3 um) particles of lead arsenate (PbAsO), 82% which are found cemented to other particles. As shown in Figure 4, the dominant source of arsenic (57%) are subhedral 16 um particles of As_2O_3. Morphologically, 70% of these particles are liberated and 29% are found cemented to other particles.

When this group is subdivided based on total arsenic concentration a very characteristic trend in mineralogy can be seen. Low-focal samples all have their arsenic relative mass in Fe-Mn-P (Fe oxide, Mn oxide and Phosphate). The intermediate-focal soils are dominated by As_2O_3, and the high-focal are dominated by As_2O_3-PbAsO.

Table 5 summarizes the occurrences of non lead-arsenic accessory phases. Again, when antimony, is observed it is found in AsSbO, and it poorly correlates with bulk arsenic concentrations. Other tracer-accessory phases observed including Se, SeMO, and Se-In-Cu. Although their abundances are much lower, some similarity to plant soils are noted.

"Adjacent" Residential Soils

Eight residential soil samples from locations adjacent to clearly contaminated soils were collected for speciation. Bulk soil concentrations ranged from 60-396 mg/kg Zn, 9-35 mg/kg As, 39-261 mg/kg Pb and 1-7 mg/kg Cd. These measurements are based on average analyses from ICP-MS and WDSXRF. Approximately 75% of the lead mass occurs in 1-80 um particles of PbMO, Pb-Phosphate, and Pb-Mn Oxide. Morphologically, 70% of the Pb-phosphate and Pb-Mn oxide particles are found cementing other soil particles, while 66% of the PbMO particles are found liberated. The dominant phase (87%) of arsenic is As_2O_3, which occurs in particles ranging from 1 to 195 um in size (see Figure 5). These particles are typically found either cemented and liberated. Because the bulk arsenic concentrations are relatively low for all adjacent samples (therefore total particle counts are low and errors are high) it is difficult to discern a trend in speciation. It would appear however, that low-adjacent soils are similar to low-focal soils, having Fe-Mn-P as their dominant arsenic phases. In contrast to focal soils, both the intermediate and high-adjacent soils have As_2O_3 as their dominant arsenic phase and PbAsO is distinctly sparse.

ADJ. TO INT → AsSbO
ADJ TO LOW → PbSbO

Again, when antimony, is observed it is found in AsSbO, and it poorly correlates with bulk arsenic concentrations. Other tracer-accessory phases observed including Se, SeMO, and Se-In-Cu , Table 6. Although their abundances are much lower, some similarity to plant soils are noted.

AsSbO NOT FOUND IN SAMPLES FROM YARDS ADJ. TO HIGH AS FOCAL YARDS

Background Residential Soil

One background, soil sample and a blind duplicate from the VBI70 site, were collected for speciation. Bulk soil concentrations ranged from 137-184 mg/kg Zn, 6-22 mg/kg As, 82-101 mg/kg Pb and 2-3 mg/kg Cd. These measurements are based on average analyses from ICP-MS and WDSXRF. Approximately 98% of the lead mass occurs in small (1-12 um) particles of PbS, which are always included in slag particles. The dominant source of arsenic (80%) is particles of Fe Oxide that are typically 3-35 um in size (see Figure 6). Morphologically, these Fe oxide particles are found to be liberated 60% and cemented 30% of the time. Antimony is found predominantly in Fe oxide or PbSbO, while the only other tracer-accessory phase observed is Se-In-Cu , Table 7.

High-Lead Soils

Six "high-lead" soil samples from the VBI70 site were collected for speciation. Bulk soil concentrations ranged from 285-784 mg/kg Zn, 14-310 mg/kg As, 236-1209 mg/kg Pb and 6-14 mg/kg Cd. These measurements are based on average analyses from ICP-MS and WDSXRF. Approximately 80% of the lead mass occurs as particles of Pb-Phosphate (1-110 um), Cerussite (1-25 um) and large particles of lead paint (3-500 um). Morphologically, the Pb phosphate particles are found cemented (64%) while the cerussite particles are more commonly liberated (63%). The paint particles are either found liberated or cemented to other particles. The dominant sources of arsenic (86%) are particles of arsenic phosphate (1-100 um) and Fe Oxide (see Figure 7 and Table 8). Both Pb phosphate and Fe Oxide occur as cemented (64%, 51%) or liberated (35%, 39%) particles, respectively.

The "high lead" soils have a characteristic lack of tracer-accessory phases.

Comparison of Particle-Size Distributions

Table 3 presents a comparison of the particle-size distribution data for the common mineral phases found in potential source materials (PAX, ACME, smelter soils) to those found in residential yard soils. As seen, the mean and median particle sizes of the common phases are generally very similar in residential soils, PAX, and ACME samples, while the particles in plant soils are consistently coarser. The range in particle size for As_2O_3 and PbAsO is greater in residential soils than that observed in either PAX or ACME and narrower than plant soils.

3.1.3 Quality Evaluation for EMPA Speciation

The precision of the EMPA speciation is based on sample duplicates run every 6 samples, which represents an increase in QA from the 1 in 20 required by the SOP.

In general, duplicates (SC00015, SC00046) and (SC00027, SC00043) provided very good to good reproducibility, finding the same dominant phases in similar frequency. Duplicates (SC00039, SC00114) provided fair reproducibility. Duplicates (SC00065, SC00071) provided very poor reproducibility because total particles counts were very low do to low metal concentrations.

Calc poor GIVE RPD ?

The accuracy of the analysis is estimated based on a statistical evaluation of point counting following the method of Mosimann (1965). Ninety-five percent confidence values (for frequency of occurrence estimates) are reported in Table 5A for each sample. In comparison of results on

sample duplicates it is apparent that frequency of occurrence estimates will not fall within the 95% confidence value. However, in all duplicates with elevated metals concentrations the primary phases, representing those metals, are identified (relative mass) within the 95% confidence value. Evaluation of these data would suggest that although the method is not sensitive to small variations in the frequency of observed metal phases, it is highly accurate in the determination of those phases which contribute to a particular metal mass. No quantitative control limits for agreement between duplicates were specified for this project., therefore no corrective actions are required.

3.2 In Vitro Bioaccessability

Results

All test materials except the "high lead" samples were analyzed using the in vitro bioaccessability test procedure (BAC) to determine relative lead and arsenic in vitro bioaccessability. Individual sample results are presented in Table 6A, while mean values and ranges are given in Table 9. In general, the soils have a greater lead in vitro bioavailability than any of the three potential sources tested, while the arsenic in vitro bioavailability is most similar to that found in the ASARCO plant samples.

EQUALLY SIMILAR TO PLANT SOILS & ACME

Data Quality

Based on the twenty-nine samples requested for BAC testing the laboratory performed or exceeded all of the SOP requirements for frequency and type of QA sample. In addition, all QA samples performed within control limits. A summary of QA results are provided below.

NOTE PAC & ACM NOT MEAS W/ SOIL

	SOP Analysis Frequency	Project Frequency Performed	Control Limits	Project Limits
Reagent Blank	once per batch	2	<25 μg/L lead	<10 μg/L lead <10 μg/L arsenic
Bottle Blank	5%	7%	<50 μg/L lead	<30 μg/L lead <22 μg/L arsenic
Blank Spike	5%	7%	85-115% recovery	90-100%
Matrix Spike	10%	7%	75-125% recovery	91-95%
Duplicate Sample	10%	38%	20% RPD	4.5% lead 14% arsenic
Control Soil	5%	7%	10% RPD	2%

3.3 WDSXRF Evaluation

Results

WDSXRF results are provided in Table 11 for the four elements analyzed, Zn, Pb, As, and Cd.

Data Quality

Of the thirty-five samples submitted for WDSXRF seven duplicate analyses were performed. Duplicate analyses were within 2%, 18%, 5%, and 32% (Zn As, Pb, Cd) on average. Only 6 of the 28 duplicate concentrations exceeded SOP limits of +/- 30%. No action was taken as these higher values only occurred near instrument detection limits.

WDSXRF accuracy and traceability to NIST are acceptable. Only one element (Cd) during one batch analysis failed the 20% RPD control limit. Average RPD values were 4%, 5%, 7%, and 20% for Zn, As, Pb, and Cd, respectively. No action was taken as two NIST standards were run in that batch and the second standard was within 5% RPD.

4.0 DISCUSSION AND EVALUATION

The USEPA provided a series of questions to facilitate evaluation and interpretation of the data. These questions and the responses are provided below. In order to best answer some of the questions data from previous studies, CDPHE, 1998 and USEPA, 1998.

Questions #1 What are the physical-chemical attributes of arsenic-bearing particles in residential site soils, and how does this depend on the level of arsenic in the sample?

NOT A PREDOMINANT FORM

The predominant forms of arsenic in residential soils are As_2O_3, PbAsO, and AsSbO. When residential soil concentrations for arsenic exceed approximately 150 mg/kg (thirty-nine samples), a large percentage of the bulk arsenic is found in As_2O_3 (36 out of 39), and only at the highest arsenic concentrations do AsSbO, and PbAsO play any significant role (2 out of 39 and 6 out of 39, respectively), see Figure 8. Below 150 mg/kg total arsenic, the soils are still often times (15 out of 33) dominated by arsenic trioxide. However, when accounting for all of the soil samples NO correlation is found between bulk arsenic and the relative mass nor frequency of occurrence for any of the arsenic phases common to PAX, (Figures 9 and 10).

A NOT SUPPORTED BY DATA — AsSbO ONLY SIG IN 2 SAMPLES — 185 ppm 23 ppm

DEPENDS ON LOCATION

Question #2 Do the physical-chemical attributes of arsenic-bearing particles in residential site soils resemble the characteristics in one or more of the potential source materials provided to you (Globe soil, PAX, ACME)? How does this depend on the level of arsenic in the residential soil sample?

If the assemblage (As_2O_3-PbAsO) is considered to be consistent with the herbicide PAX , less than 50% (26 out of 72) of the samples even contain both arsenic forms. Of these 26 samples, only 6 contain As_2O_3+PbAsO in a ratio that could be considered PAX-like. Further, only 9 out of the 72 residential soils could have ACME as a predominant contamination source. Finally, under no circumstances could the soils from the ASARCO plant (**that have been influenced by the cadmium production**) have contributed significantly to the residential anomaly.

The physical-chemical attributes of the arsenic-bearing particles in residential soils suggest a yet unidentified source which is dominated by As_2O_3. Forty-three of the 72 soil samples with arsenic speciation, support this observation.

Question #3 What are the physical-chemical attributes of lead-bearing particles in

residential site soils, and how does this depend on the level of lead in the sample?

The predominant forms of lead in residential soils are PbAsO, Pb-Phosphate and Pb-MnOOH. When residential soil concentrations for lead exceed approximately 375 mg/kg (eighteen samples), a moderate percentage of the bulk lead is found in PbAsO (10 out of 18), however, only at the highest lead concentrations does PbAsO play a significant role (3 out of 18), see Figure 8. Pb-Phosphate and Pb-MnOOH dominate the lead mass in most samples (14 out of 18) above 375 mg/kg lead and in 32 out of 42 for the complete data set. Below 375 mg/kg total lead, the soils are never dominated by PbAsO.

Below 375 mg/kg total lead, the soils contain predominantly; Pb-phosphate, Pb-Mn Oxide, paint, PbMO, and PbS.

Question#4 Do the physical-chemical attributes of lead-bearing particles in residential site soils resemble the characteristics in one or more of the potential source materials provided to you (Globe soil, PAX, ACME)? How does this depend on the level of lead in the residential soil sample?

Based upon lead mineralogy only, PbAsO would be considered to be consistent with either the herbicide PAX or the rodenticide ACME, in less than 43% (18 out of 42) of the samples . Of these 18 samples, only 11 contain PbAsO in a sufficient quantity that would suggest a major contribution from either source. Finally, under no circumstances could the soils from the ASARCO plant (**that have been influenced by the cadmium production**) have contributed significantly to the residential anomaly.

The physical-chemical attributes of the lead-bearing particles in residential soils suggest a yet unidentified (**but very soluble**) source of lead which is now sequestered in Pb-phosphate and Pb-Mn Oxide. Thirty-two of the 42 soil samples with lead speciation, support this observation.

Question #5 Are there any other types of particles that are characteristic of residential site soils that are elevated either in arsenic and/or in lead? If so, are these particles diagnostic of one or more of the potential source materials provided to you?

The following phases are characteristic of the identified source:

$PbSO_4$, $PbCO_3$, $PbCrO_4$, paint chips---------- Paint
PbMO, PbS, Slag, PbFeO, AsFeO, ZnS, ---------- Smelter
SnMO, SnPb, SnCuPb----------Solder
Se, In, Se-In, Se-Cu-In----------Smelter/Electronics

Question#6 Does this approach allow you to identify one or more of the potential source materials as being more likely for the observed contamination in site soils than the other potential source materials?

The data support the conclusion that of the residential soils with highly elevated arsenic and lead concentrations, only a few soils could be, contaminated primarily by PAX or a PAX-like (i.e., lead arsenate {pesticide} and arsenic trioxide {rodenticide}) combination. In fact, the high-adjacent soils, with their observed enrichment in As_2O_3 and lack of PbAsO, would suggest at least a two source mechanism. The current body of information would conclude that the yards are contaminated with an arsenic trioxide source over printed by smelter, paint and perhaps pecticides.

The data clearly illustrate that the ASARCO globe plant soils, as collected, could not have contributed significantly to the residential soil contamination. It is the authors opinion that no surface, soil collected post 1940 could be a potential contributor based on elevated cadmium concentrations. The data also indicate that the presence or absence of perlite can not be used to distinguish potential sources. There is no significant difference in frequency of occurrence of perlite among the residential soils, Figure 9, and even though the plant soils do contain significantly less perlite it is still present.

4.1 Further Questions

The arsenic anomaly in the greater Denver area has been studied intensely for the past decade by numerous individuals, corporations and governmental agencies. Because of the site complexity, both geochemically, environmentally, and socially no one study has been able scientifically determine the source(s) of the contamination. One reason is that no one study has yet addressed all of the complexities. To date, some questions still remain unanswered. I offer them as suggestions for further work.

1). What would PAX look like mineralogically after 20-30 years?

2). *Even though available solubility data does not support this scenario: could PAX weather to an arsenic trioxide dominated mineralogy?*

3). *Again, even though available solubility data does not support this scenario: how does one get such elevated arsenic concentrations in soils, after 20-30 years, with* ***normal*** *application rates?*

4). *How does one produce bulk arsenic and lead areal distribution patterns, as reveled in USEPA's "dense sampling", in contaminated yards by application of a product?*

5). *Could the sampling method (used by ASARCO) of compositing front and backyard samples produced the apparent clean/dirty yard scenario?*

6). *Why is this anomaly restricted to the general Globeville area?*

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Photo1. General appearance of PAX herbicide, larger, (grey-white) As2O3 and small (white) PbAsO.

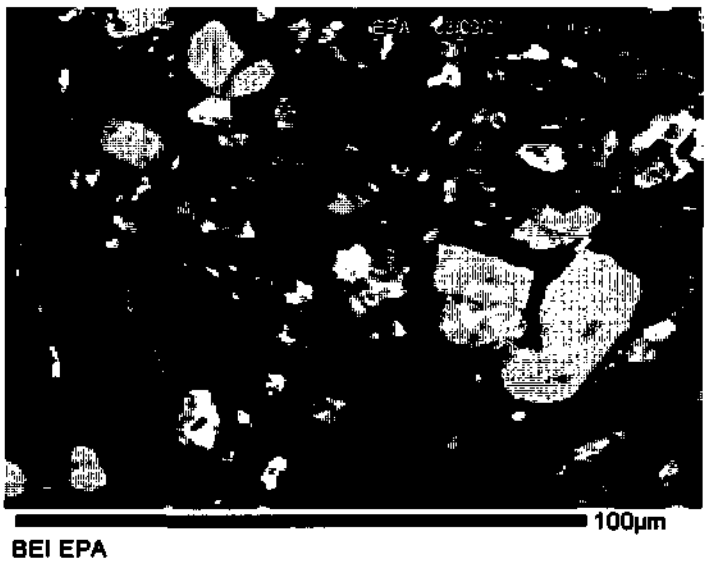


Photo 2. Large particle of perlite with inter-dispersed PbAsO and As2O3 particles.

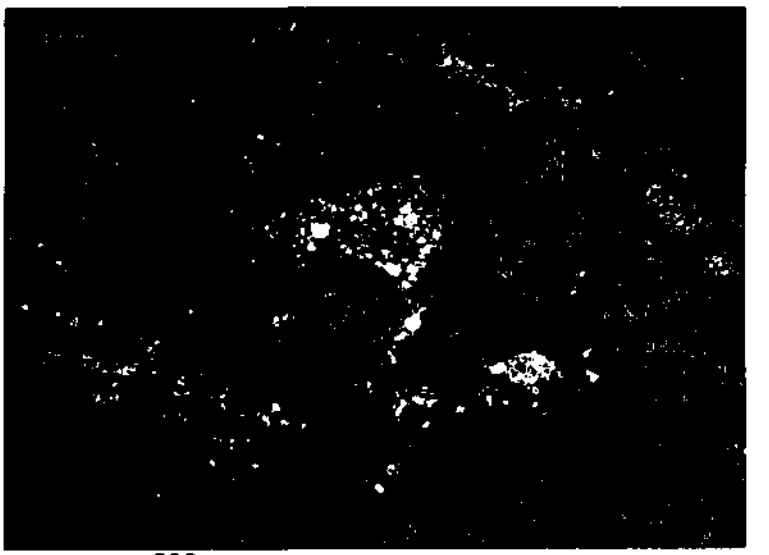
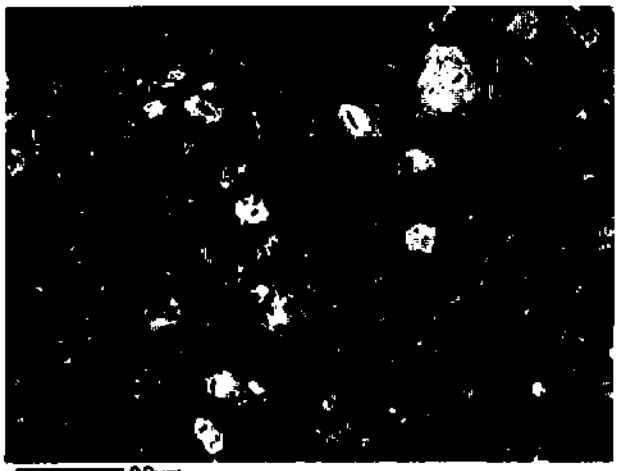
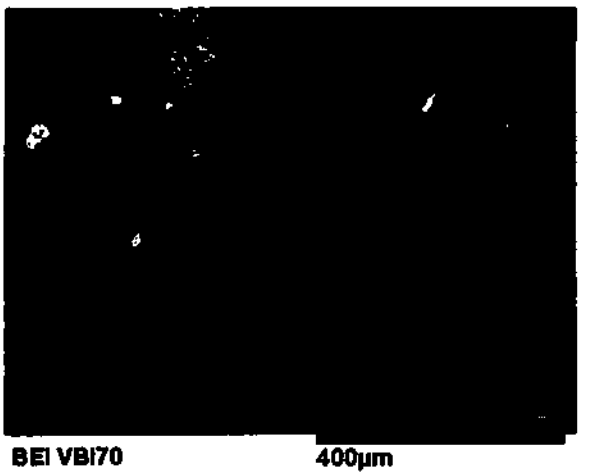


Photo 3. Backscatter image of ACME pesticide. All particles are PbAsO.



BEI EPA

PHOTO 4. Representative photomicrographs from plant soils.



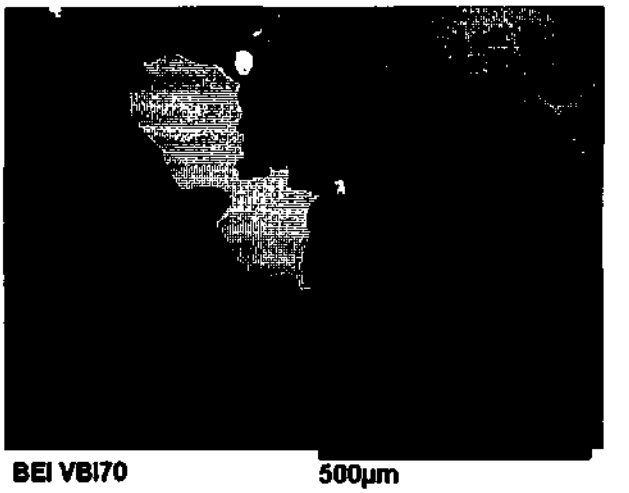
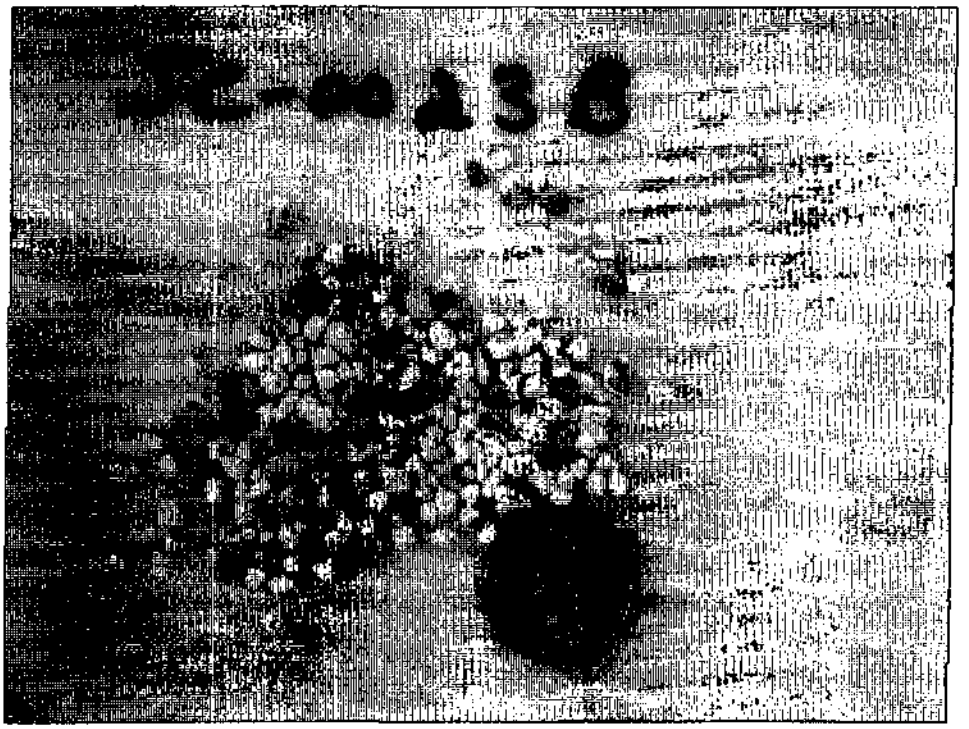


PHOTO 5. Large "white" crystals from sample SC00023, plant material.



Color Chart(s)

The following pages contain color that does not appear in the scanned images.

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Figure 1. Speciation results for PAX herbicide.

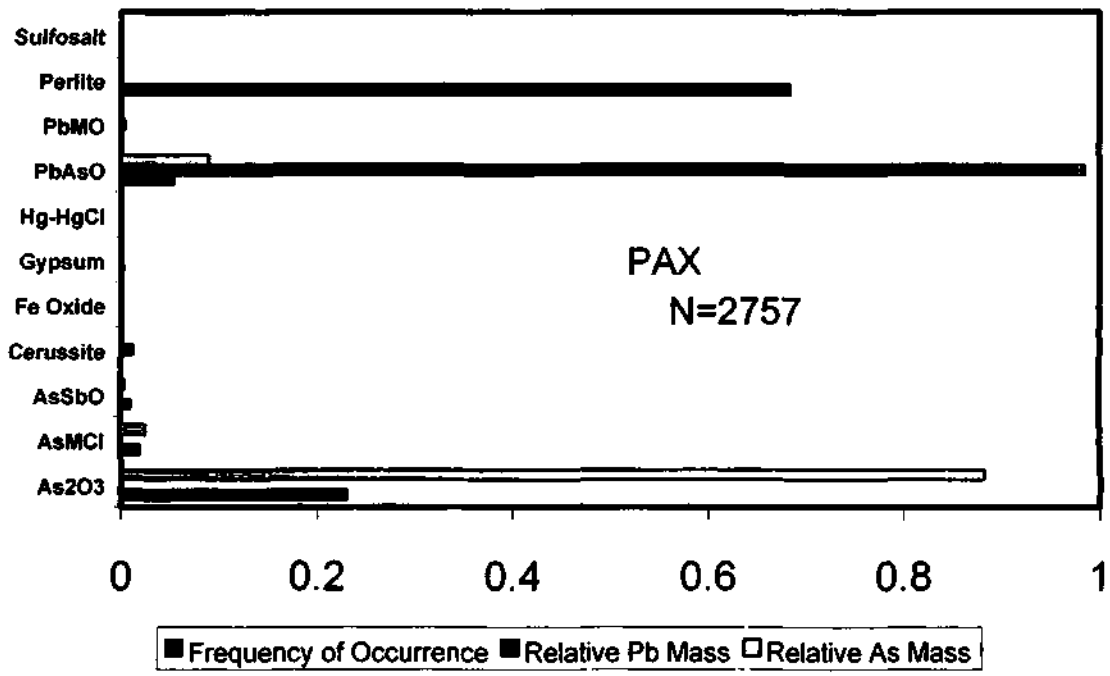


FIGURE 2. ACME speciation Results.

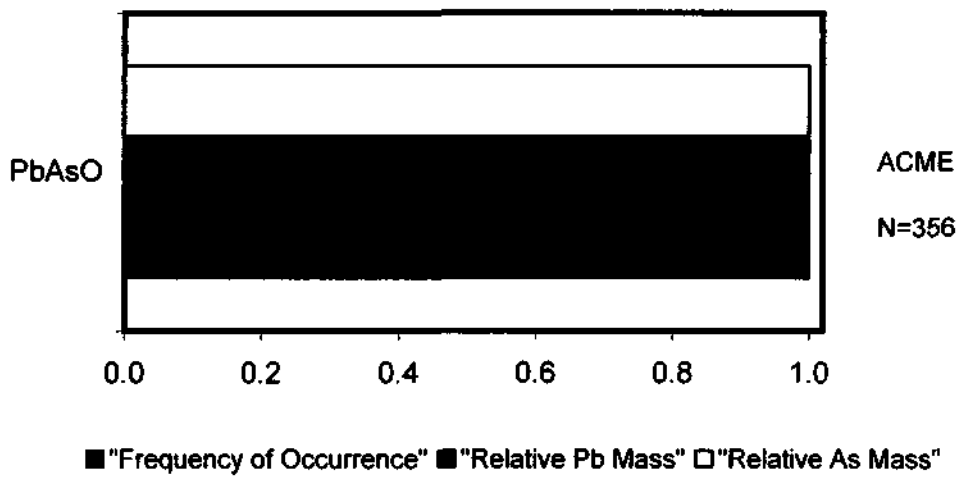
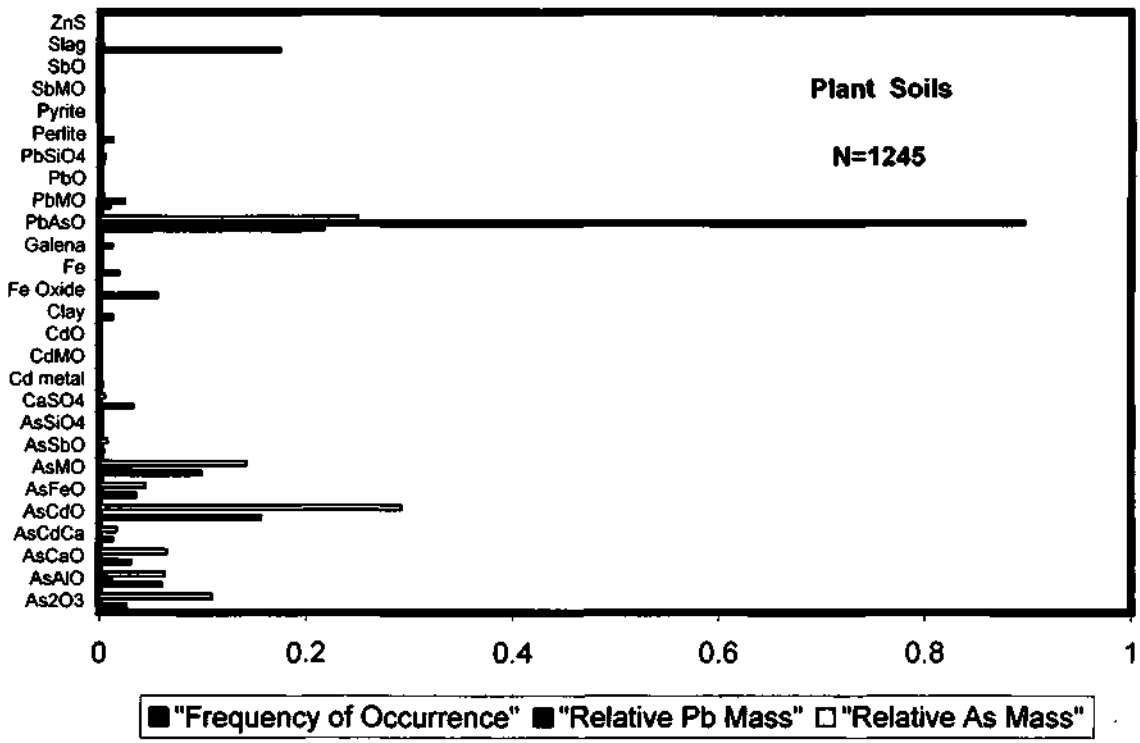


Figure 3. Speciation results for ASARCO plant soils.



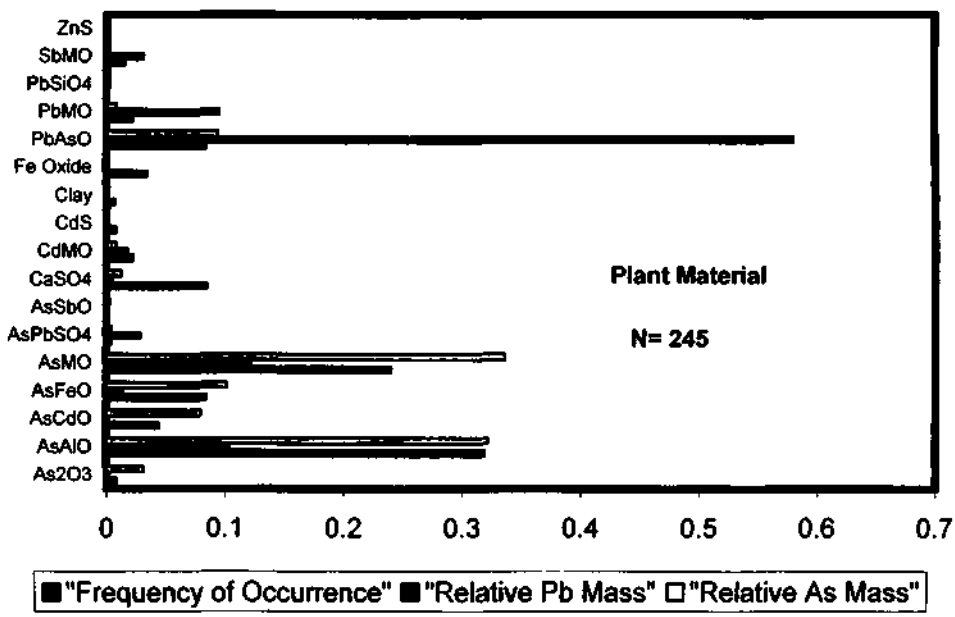


Figure 4 Speciation results for Focal soils.

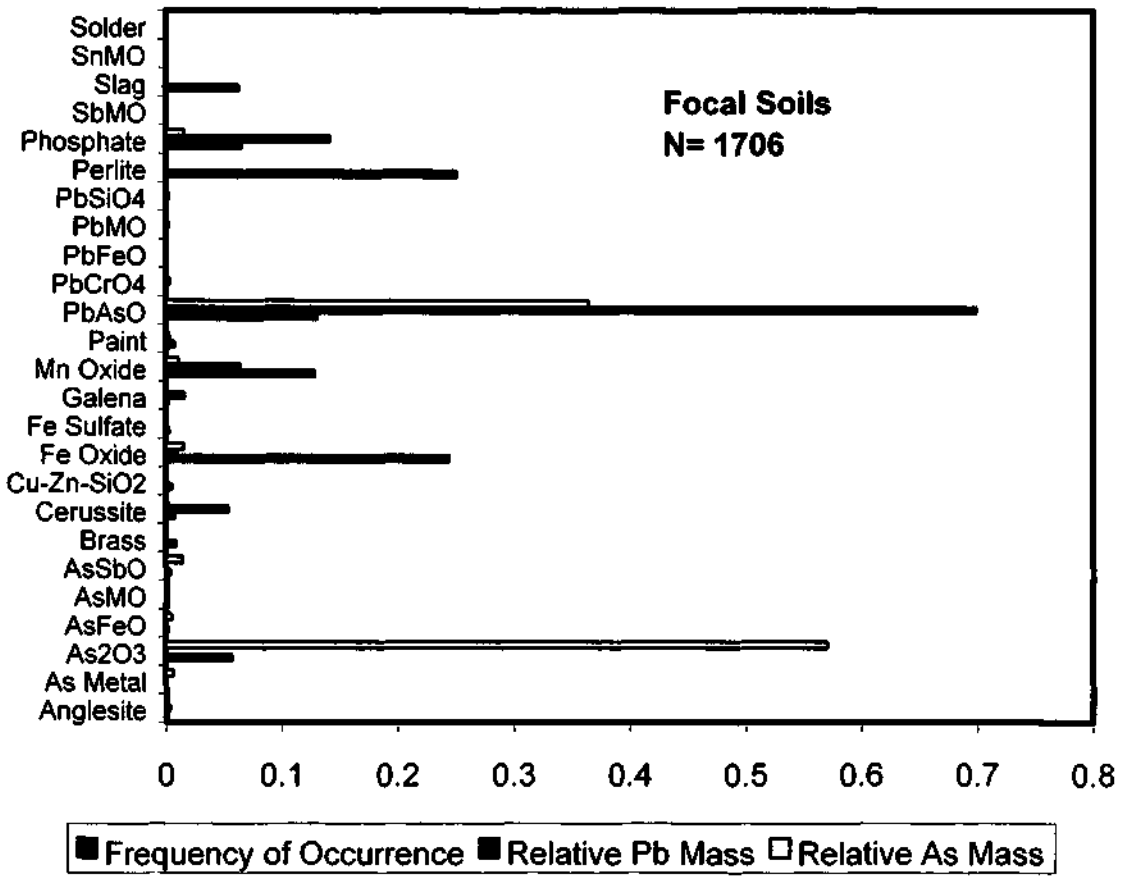


Figure 5. Speciation results for Adjacent soils.

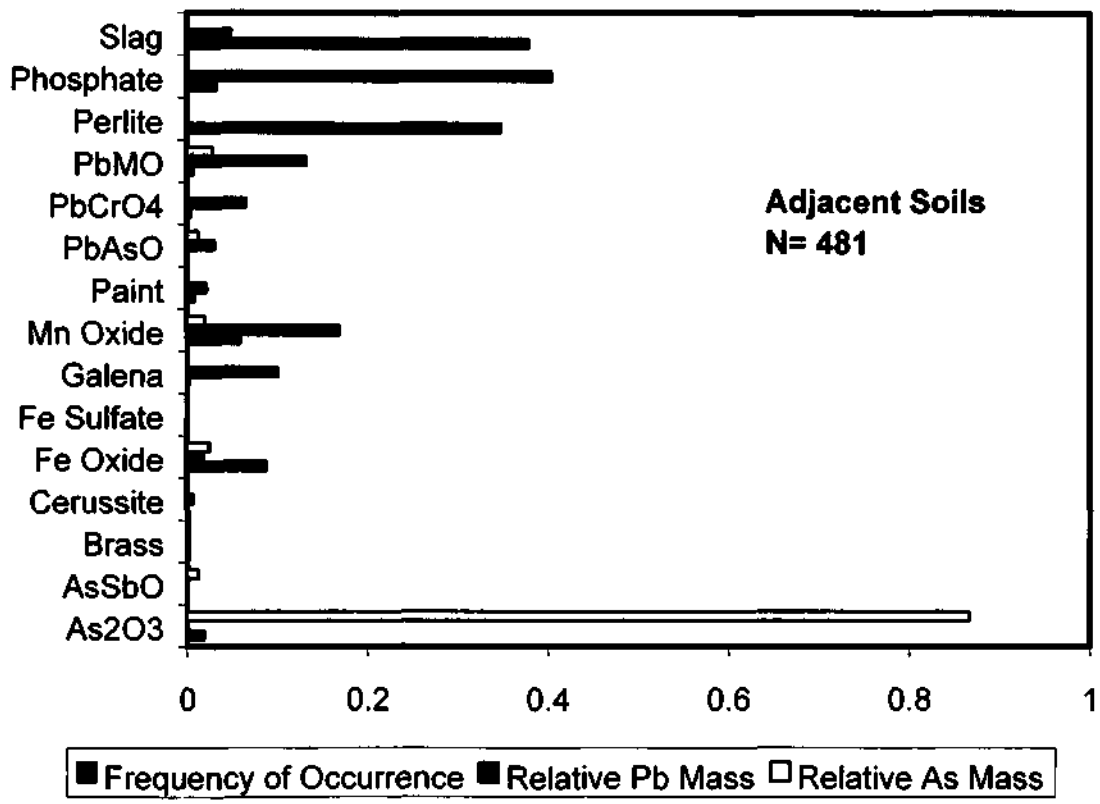


Figure 6. Speciation results for background soils.

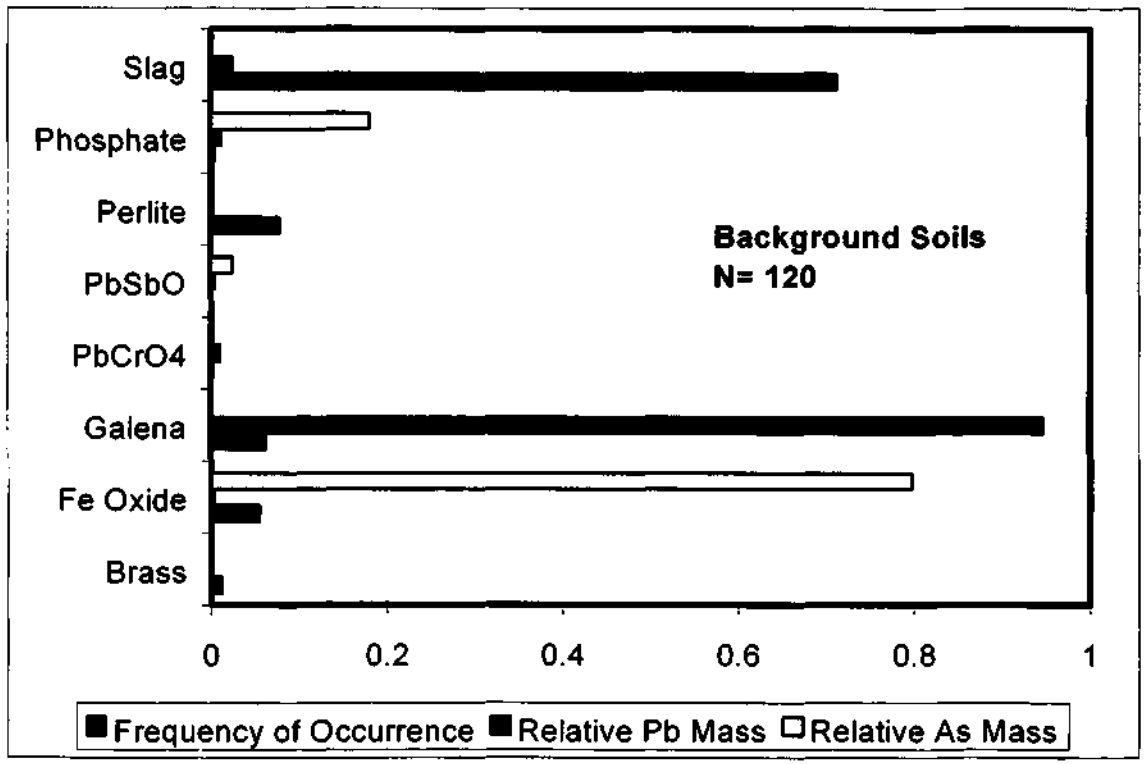


Figure 7. Speciation results for High Lead soils.

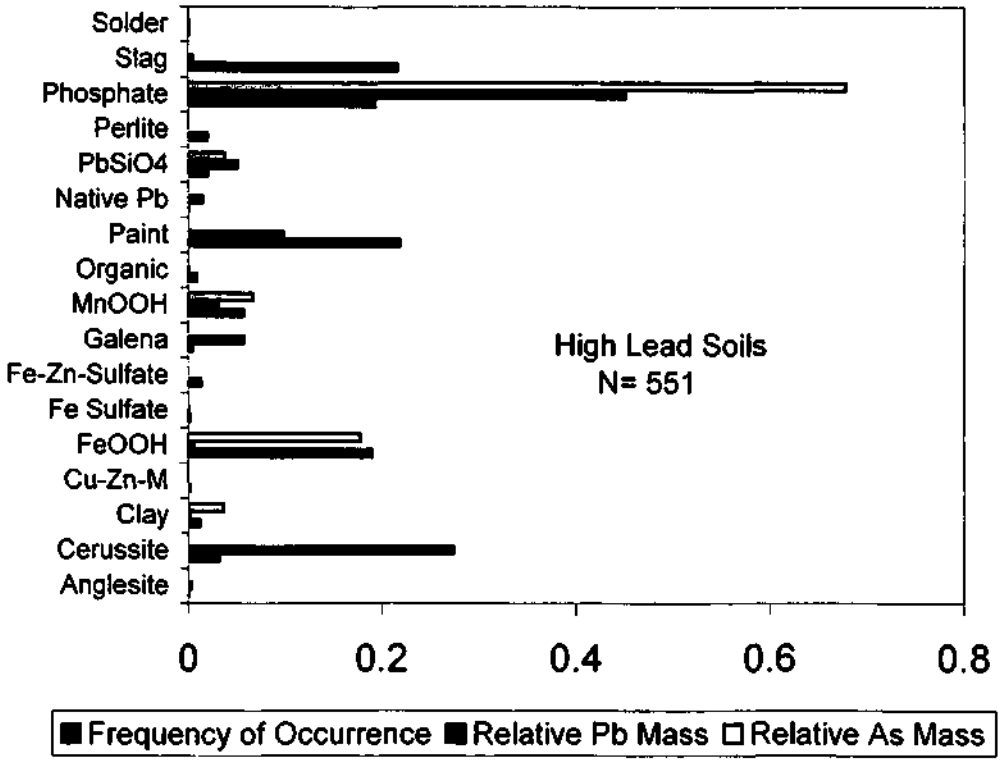


Figure 8. Variation in mineral mass, and bulk metal with speciation for site soils.

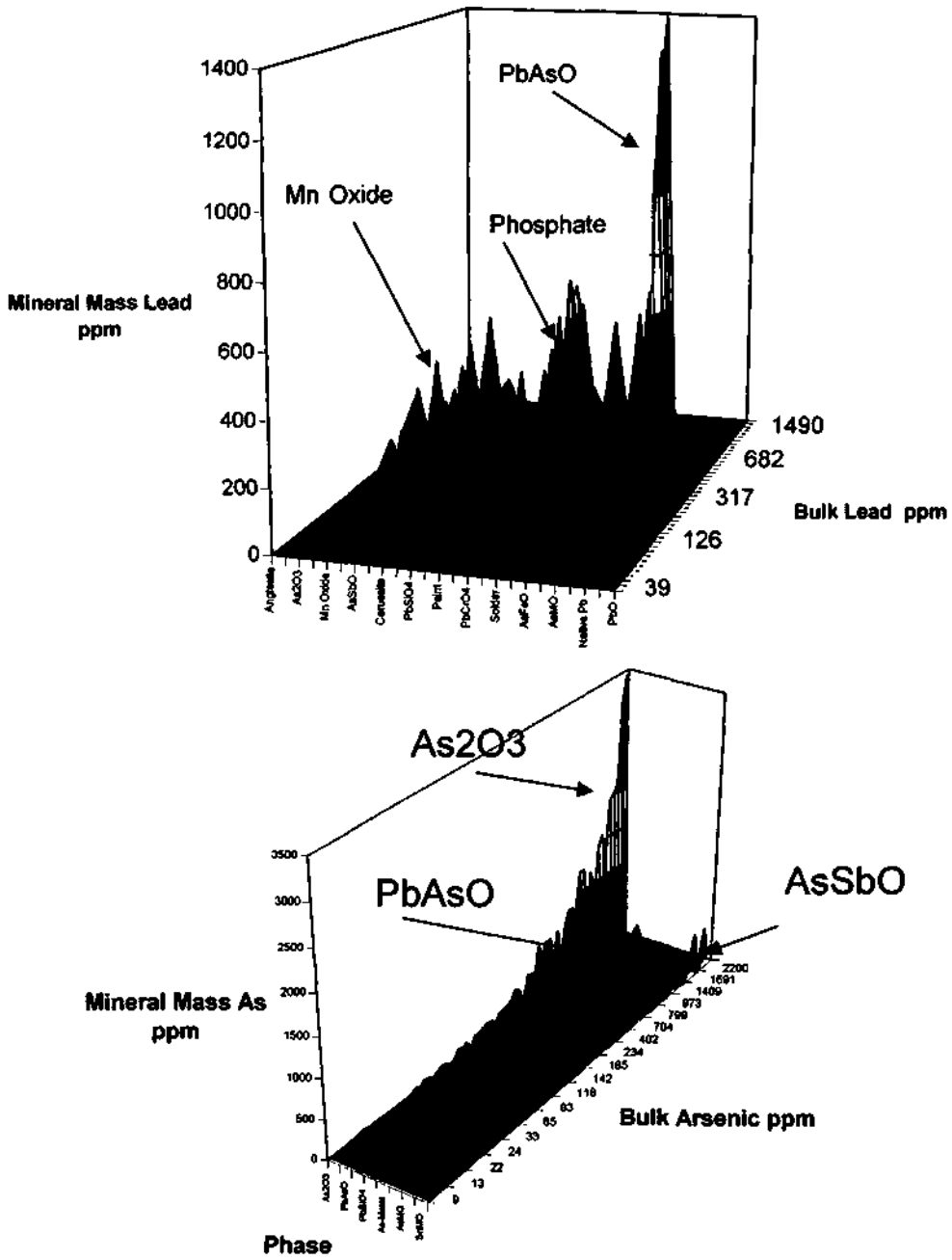
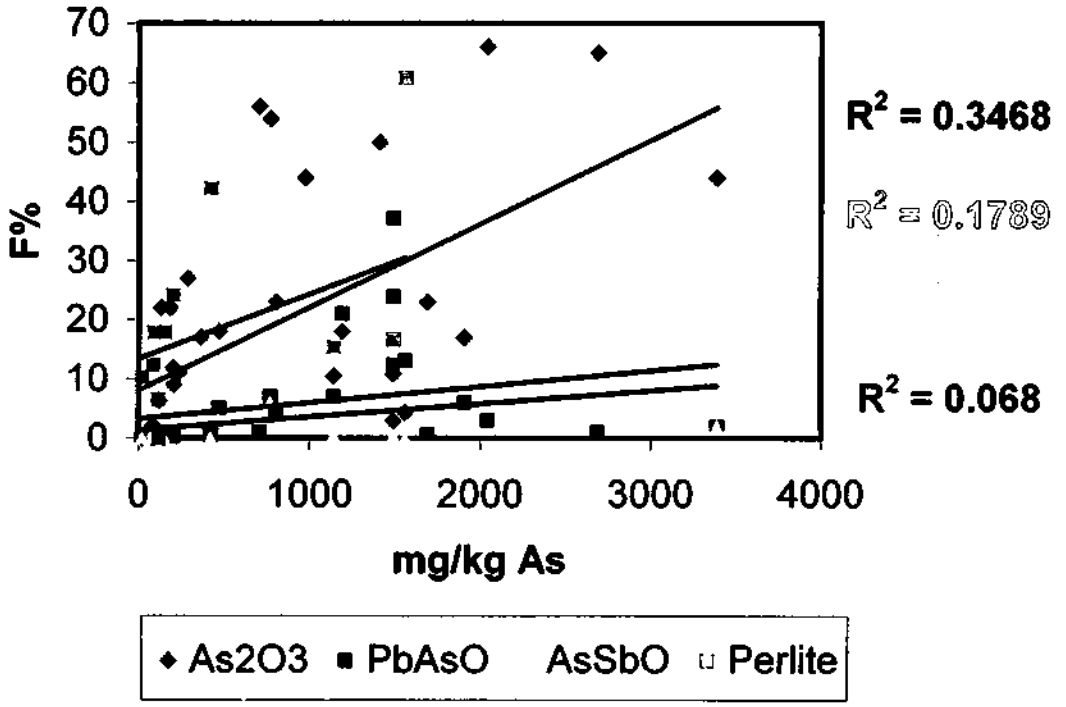


Figure 9. Correlations between frequency of occuurence PAX related phases to bulk metal concentration.



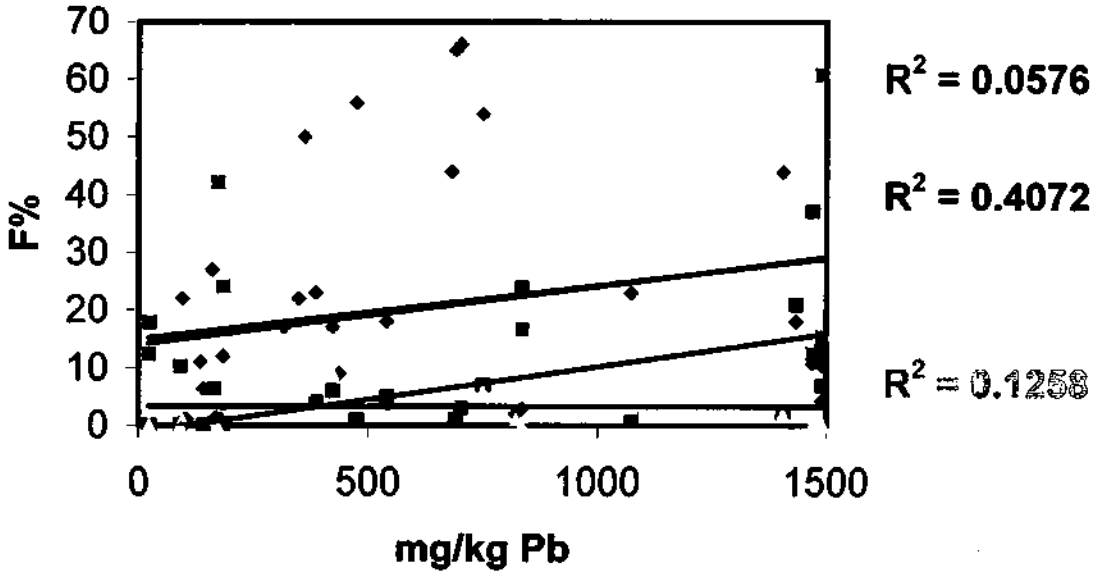
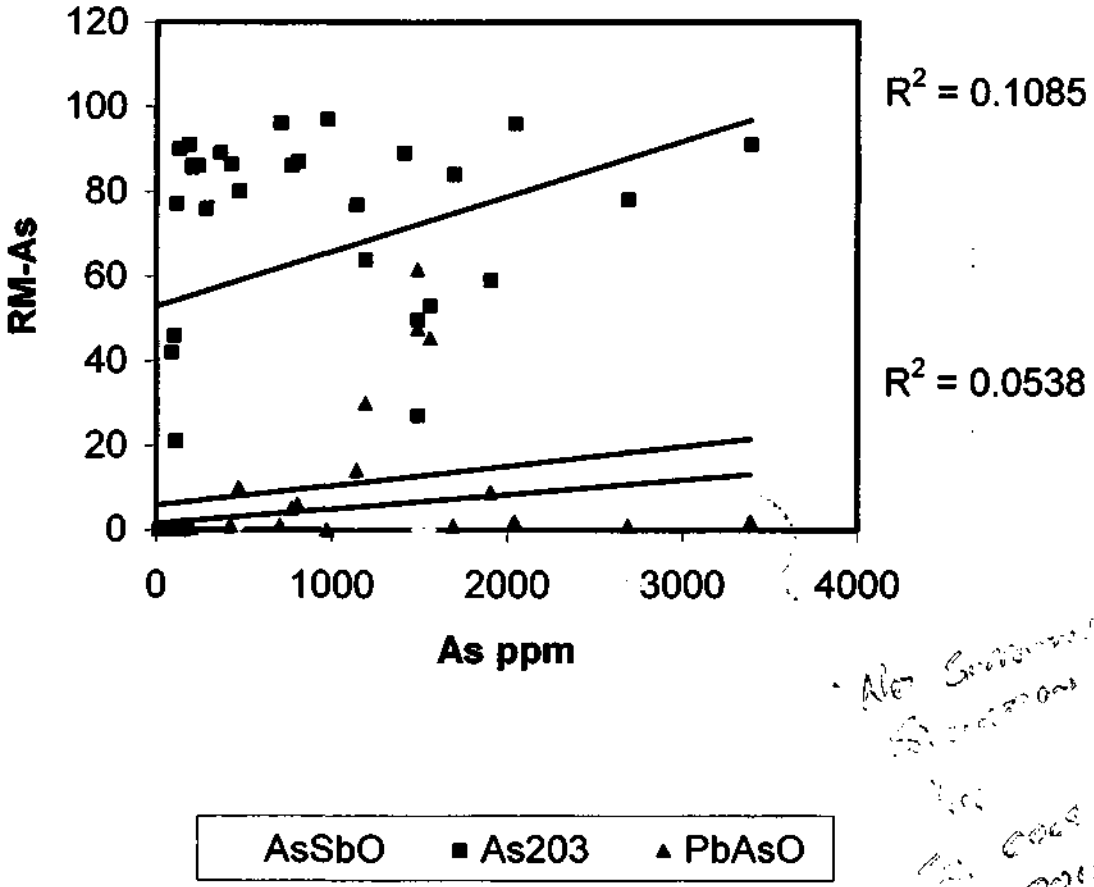


Figure 10. Correlations between relative mass metal in PAX related phases to bulk metal concentration.



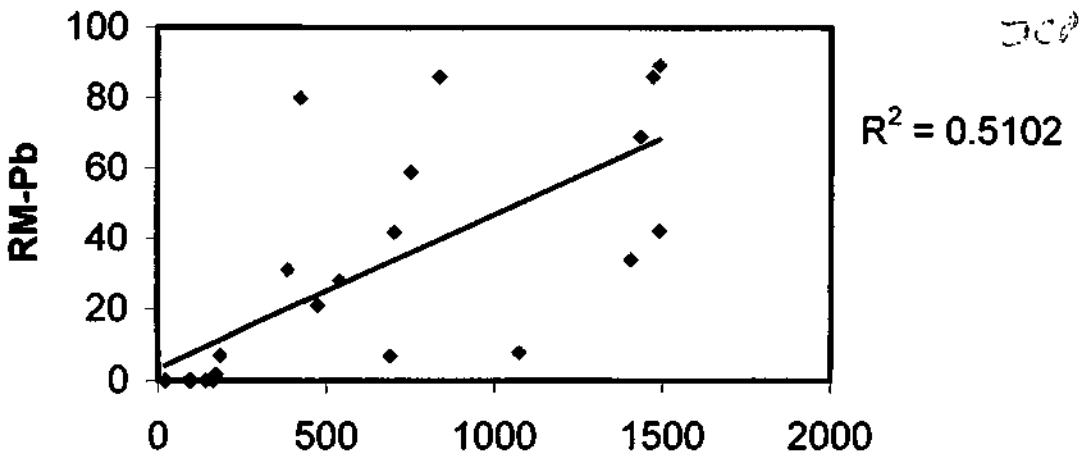


Table 1. Summary of Samples Evaluated

Sample Category	Sample Description	Number of Samples		Analyses Performed			
		Field	Duplicates	Speciation	Perlite	BAC	WDXRF
Candidate Source Materials	PAX	1		X	X	X	X
	ACME	1		X	X	X	X
	Smelter Material	1		X	X	X	X
	Smelter Soils	4		X	X	X	X
Residential Soils	Focal	9	3	X	X	X	X
	Adjacent	8		X	X	X	X
	Background	1	1	X	X	X	X
	High lead	6		X	X	X	X

TABLE 2. Speciation summary for ACME pesticide and PAX herbicide

	Phase	F%	E%-95**	RM-Pb	RM-As	RM-Zn	RM-Cd	RM-Sb	RM-Se	RM-Tl	RM-Hg	RM-In
ACME	PbAsO	1	0	1	1	1	1	1				
				RM-As	RM-Pb	?						
PAX	As2O3	0.230424	0.015719	0.881755	0	0	0.022					
	AsMCl	0.019572	0.005171	0.025048	0.000337	0.007879						
	AsSbO	0.009595	0.003639	0.003471	8.08E-05	0	0.153	0.964				
	Cerussite	0.000458	0.000799	0	0.011307	0						
	Fe Oxide	0.000703	0.000989	0.000175	2.03E-05	0	0.0003					
	Gypsum	0.00191	0.00163	0.000242	2.12E-05	0						
	Hg-HgCl	7.64E-05	0.000326	0	0	0					1	
	PbAsO	0.053079	0.008369	0.088953	0.984283	0.783491	0.802					
	PbMO	0.000428	0.000772	0.0003	0.00395	0.203797	0.021	0.034				
	Perlite	0.683708	0.017359	0	0	0						
	Sulfosalt	4.58E-05	0.000253	5.56E-05	1.18E-06	0.004833		0.0019				

Table 3. Particle-size summary for primary phases; perlite, As2O3, PbAsO, and AsSbO.

	Phase	Mean	Median	Standard Deviation	Range
Acme Pesticide	PbAsO	2.9	2.0	3.9	1-40
PAX	PbAsO	3.9	2.0	5.2	1-65
	Perlite	88.8	12.0	284.7	1-2400
	As_2O_3	12.5	9.0	23.9	1-530
	AsSbO	8.4	4.0	12.0	1-80
Plant Soils	PbAsO	7.7	2.0	17.6	1-220
	Perlite	99.2	85	79.7	15-240
	As_2O_3	107	62	137.4	3-500
	AsSbO	27.9	22	19.3	5-60
Soils	PbAsO	2.7	1.0	5.4	1-100
	Perlite	46.0	20.0	140.3	5-2050
	As_2O_3	16.4	7.0	64.2	1-620
	AsSbO	5.5	5.0	2.6	2-9

TABLE 4. Summary of EMPA Speciation from Plant Soils, for lead, arsenic, zinc, cadmium, and antimony.

		F%	RM-Pb	RM-As	RM-Zn	RM-Cd	RM-Sb
sc00011	Anglesite	1.2%	15.9%	0.0%	0.0%	0.0%	0.0%
	As2O3	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%
	AsCaO	0.8%	0.0%	3.0%	0.2%	0.2%	0.0%
	AsCdO	19.6%	0.6%	65.7%	23.1%	68.6%	13.4%
	AsFeO	5.1%	1.2%	11.3%	2.5%	0.9%	3.4%
	AsMO	3.3%	2.5%	8.5%	2.0%	0.9%	16.8%
	Cd metal	1.3%	0.0%	0.0%	0.0%	22.5%	0.0%
	CdMO	0.3%	0.3%	0.2%	0.0%	3.6%	0.8%
	CdMSiO4	0.4%	0.0%	0.0%	0.0%	2.8%	0.5%
	Fe Oxide	3.2%	0.2%	0.1%	1.2%	0.0%	0.4%
	Fe Sulfate	8.0%	2.9%	0.0%	0.5%	0.0%	0.5%
	FeCuZnS	0.2%	0.0%	0.0%	3.3%	0.0%	0.0%
	Galena	0.8%	15.3%	0.0%	0.0%	0.0%	0.0%
	PbAsO	5.2%	54.2%	10.6%	0.4%	0.2%	1.7%
	PbMO	0.7%	4.3%	0.4%	0.5%	0.1%	34.2%
	PbO	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%
	Perlite	4.5%	0.0%	0.0%	0.0%	0.0%	0.0%
	SbO	0.1%	0.0%	0.0%	0.0%	0.0%	26.7%
	Se	1.8%	0.0%	0.0%	0.0%	0.0%	0.0%
	SeHg	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
	SeO	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Slag	43.2%	1.9%	0.0%	62.6%	0.0%	1.6%
	Tl	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	ZnS	0.2%	0.0%	0.0%	4.0%	0.0%	0.0%
sc-00018	As2O3	6.5%	0.0%	26.9%	0.1%	0.0%	1.1%
	AsAlO	8.2%	4.4%	8.6%	2.8%	1.6%	3.3%
	AsCaO	4.0%	0.0%	8.6%	1.2%	2.0%	0.0%
	AsCdO	6.9%	0.2%	13.0%	12.4%	38.8%	1.0%
	AsFeO	1.0%	0.3%	1.2%	0.7%	0.3%	0.1%
	AsMO	22.1%	18.3%	32.1%	20.3%	9.8%	24.7%
	AsSbO	0.5%	0.1%	0.9%	0.0%	0.0%	5.9%
	CaSO4	9.9%	0.8%	1.6%	0.4%	2.3%	1.8%
	CdO	1.9%	0.0%	0.0%	0.0%	44.6%	0.0%
	Fe Oxide	0.8%	0.1%	0.0%	0.4%	0.0%	0.0%
	PbAsO	6.2%	70.5%	7.2%	0.7%	0.5%	0.4%
	SbMO	1.2%	4.0%	0.1%	0.1%	0.1%	37.2%
	SbO	0.3%	0.0%	0.0%	0.0%	0.0%	24.2%
	Se	3.1%	0.0%	0.0%	0.0%	0.0%	0.0%
	SeHg	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
	Slag	27.3%	1.3%	0.0%	60.8%	0.0%	0.2%
	Tl	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%
sc00023	As2O3	0.8%	0.0%	3.1%	0.0%	0.0%	0.1%
	AsAlO	31.9%	10.4%	32.2%	18.1%	6.2%	10.7%
	AsCdO	4.4%	0.1%	8.0%	13.1%	24.1%	0.5%
	AsFeO	8.4%	1.3%	10.1%	10.3%	2.4%	1.0%
	AsMO	24.0%	12.1%	33.6%	36.4%	10.4%	22.5%
	AsPbSO4	0.4%	2.8%	0.4%	0.0%	0.0%	0.0%
	AsSbO	0.1%	0.0%	0.3%	0.0%	0.0%	1.5%
	CaSO4	8.4%	0.4%	1.3%	0.6%	1.9%	1.3%
	CdMO	2.2%	1.8%	0.8%	0.6%	44.7%	1.1%
	CdS	0.7%	0.0%	0.0%	0.0%	8.9%	0.0%
	Clay	0.6%	0.1%	0.0%	0.0%	0.0%	0.0%

TABLE 4. Summary of EMPA Speciation from Plant Soils, for lead, arsenic, zinc, cadmium, and antimony.

		F%	RM-Pb	RM-As	RM-Zn	RM-Cd	RM-Sb
	Fe Oxide	3.4%	0.2%	0.1%	3.1%	0.0%	0.1%
	PbAsO	8.4%	58.0%	9.3%	1.5%	0.6%	0.5%
	PbMO	2.2%	9.5%	0.8%	4.0%	0.7%	21.2%
	PbSiO4	0.1%	0.2%	0.0%	0.4%	0.0%	0.0%
	SbMO	1.5%	3.1%	0.1%	0.2%	0.1%	39.2%
	Se	2.2%	0.0%	0.0%	0.0%	0.0%	0.0%
	ZnS	0.2%	0.0%	0.0%	11.5%	0.0%	0.0%
sc00070	AsAlO	9.8%	5.2%	9.3%	2.7%	0.9%	10.4%
	AsCaO	4.9%	0.0%	9.6%	1.2%	1.2%	0.0%
	AsCdCaO	6.9%	2.1%	7.8%	4.1%	5.5%	9.9%
	AsCdO	34.6%	1.1%	59.3%	49.7%	91.3%	13.6%
	AsFeO	3.1%	0.8%	3.5%	1.8%	0.4%	1.2%
	AsMO	1.4%	1.1%	1.8%	1.0%	0.3%	4.1%
	AsSbO	0.6%	0.1%	1.1%	0.0%	0.0%	21.1%
	Clay	1.9%	0.3%	0.1%	0.1%	0.0%	0.1%
	Fe Oxide	6.3%	0.5%	0.1%	2.8%	0.0%	0.5%
	Fe Sulfate	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
	PbAsO	6.5%	72.7%	6.8%	0.6%	0.2%	1.2%
	PbMO	1.2%	8.2%	0.4%	1.0%	0.2%	35.5%
	PbSIO4	1.4%	6.9%	0.1%	3.7%	0.0%	1.9%
	Pyrite	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%
	Se	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	SeHg	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%
	SeMO	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%
	Slag	17.6%	0.8%	0.0%	31.3%	0.0%	0.4%
sc00077	As2O3	7.3%	0.0%	24.5%	0.1%	0.0%	1.6%
	AsAlO	10.7%	6.9%	9.1%	5.6%	2.1%	5.7%
	AsCaO	4.7%	0.0%	8.1%	2.1%	2.3%	0.0%
	AsCdO	14.8%	0.6%	22.5%	40.3%	82.8%	2.9%
	AsFeO	7.0%	2.2%	7.0%	7.8%	2.0%	1.4%
	AsMO	19.2%	19.1%	22.4%	26.5%	8.5%	28.2%
	AsSbO	0.7%	0.1%	1.0%	0.1%	0.1%	11.2%
	AsSIO4	0.4%	0.0%	0.2%	0.0%	0.0%	0.0%
	CaSO4	5.1%	0.5%	0.6%	0.3%	1.1%	1.2%
	Clay	2.6%	0.4%	0.2%	0.2%	0.0%	0.1%
	Fe Oxide	14.5%	1.4%	0.3%	12.3%	0.0%	0.6%
	Fe Sulfate	1.0%	0.5%	0.0%	0.1%	0.0%	0.0%
	PbAsO	3.5%	47.1%	3.2%	0.6%	0.3%	0.3%
	PbMO	2.4%	20.0%	0.7%	3.9%	0.8%	35.4%
	Perlite	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	SbMO	0.3%	1.1%	0.0%	0.0%	0.0%	11.4%
	Se	4.7%	0.0%	0.0%	0.0%	0.0%	0.0%
	SeHg	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	SeTl	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%

TABLE 5. Summary of EMPA Speciation in Focal Soils, for lead, arsenic, zinc, cadmium, and antimony.

		F%	RM-Pb	RM-As	RM-Zn	RM-Cd	RM-Sb
sc00010	Anglesite	0.4%	17.1%	0.0%	0.0%	0.0%	0.0%
	As2O3	1.5%	0.0%	86.3%	0.0%	0.5%	21.4%
Int:	Fe Oxide	18.1%	4.0%	6.3%	10.0%	28.5%	45.6%
	Galena	0.3%	19.3%	0.0%	0.0%	0.0%	0.0%
	Mn Oxide	7.6%	22.7%	3.3%	7.0%	60.1%	7.5%
As = 173ppm	PbAsO	0.1%	1.7%	0.9%	0.0%	2.5%	0.3%
Pb = 422ppm	Perlite	42.2%	0.0%	0.0%	0.0%	0.0%	0.0%
	Phosphate	2.5%	31.9%	3.2%	0.8%	6.9%	7.9%
	Slag	25.1%	3.4%	0.0%	54.8%	0.9%	17.3%
	ZnS	0.2%	0.0%	0.0%	5.0%	0.1%	0.0%
	ZnSO4	2.1%	0.0%	0.0%	22.4%	0.7%	0.0%
sc00015	As2O3	10.8%	0.0%	49.7%	0.3%	0.2%	16.8%
	AsSbO	0.4%	0.0%	0.9%	0.1%	1.1%	49.4%
	Brass	0.2%	0.0%	0.0%	14.1%	0.0%	0.1%
High:	Cu-Se	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
	Fe Oxide	11.4%	0.2%	0.3%	15.3%	1.0%	3.2%
	Mn Oxide	12.0%	2.6%	0.4%	26.7%	5.1%	1.3%
As = 1470ppm	PbasO	37.2%	86.0%	47.5%	9.6%	90.9%	24.9%
	Perlite	12.5%	0.0%	0.0%	0.0%	0.0%	0.0%
Pb = 1490ppm	Phosphate	12.0%	11.2%	1.3%	9.0%	1.8%	4.2%
	Se-Cu	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%
	Se-Cu-In	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%
	SeCuO	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Se-In	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
	Slag	1.9%	0.0%	0.0%	10.3%	0.0%	0.1%
	ZnS	0.2%	0.0%	0.0%	14.5%	0.0%	0.0%
sc00025	Cerussite	11.7%	78.6%	0.0%	0.0%	0.0%	0.0%
	Fe Oxide	57.8%	1.8%	60.4%	55.8%	76.5%	68.1%
	Fe Sulfate	0.8%	0.1%	0.0%	0.1%	0.6%	0.4%
Low	PbSiO4	0.7%	1.4%	1.4%	4.0%	0.1%	14.2%
	Perlite	10.2%	0.0%	0.0%	0.0%	0.0%	0.0%
As = 21ppm	Phosphate	9.7%	17.9%	38.2%	5.3%	22.6%	14.4%
	Slag	9.1%	0.2%	0.0%	34.9%	0.3%	2.9%
Pb = 126ppm							
sc00027	As2O3	1.1%	0.0%	77.1%	0.0%	0.2%	10.8%
	Brass	1.3%	0.2%	0.0%	19.5%	0.0%	2.2%
	Fe Oxide	33.2%	9.1%	14.3%	9.3%	28.7%	58.8%
	Fe-Zn Sulfat	0.2%	0.0%	0.0%	0.2%	0.0%	0.0%
Int	Mn Oxide	15.7%	58.6%	8.5%	7.3%	68.2%	10.9%
	Paint	7.9%	24.5%	0.0%	27.7%	2.1%	1.3%
Dup of	PbFeO	0.6%	0.6%	0.0%	0.2%	0.0%	0.0%
	Perlite	6.4%	0.0%	0.0%	0.0%	0.0%	0.0%
	Phosphate	0.1%	1.6%	0.2%	0.0%	0.2%	0.2%
SC00013	Se-Cu	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%
	Se-In-Cu	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%

TABLE 5. Summary of EMPA Speciation in Focal Soils, for lead, arsenic, zinc, cadmium, and antimony.

		F%	RM-Pb	RM-As	RM-Zn	RM-Cd	RM-Sb
	Slag	32.5%	5.4%	0.0%	35.9%	0.6%	15.8%
sc00038	Fe Oxide	35.6%	6.1%	44.6%	25.1%	16.7%	28.4%
	Mn Oxide	32.2%	74.1%	50.3%	37.7%	75.4%	10.0%
Low	PbMO	0.1%	2.0%	2.4%	0.2%	7.7%	40.0%
	PbSiO4	0.9%	9.7%	2.3%	3.8%	0.0%	12.6%
As = 23	Perlite	17.8%	0.0%	0.0%	0.0%	0.0%	0.0%
	Slag	12.0%	1.2%	0.0%	33.3%	0.1%	2.6%
Pb = 151	Solder	1.3%	6.9%	0.4%	0.0%	0.0%	6.3%
sc00039	Cu-Se-In	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%
	Fe Oxide	59.2%	6.6%	51.0%	73.1%	47.3%	75.9%
Low	Mn Oxide	8.9%	13.5%	9.6%	18.4%	35.6%	4.5%
	Perlite	17.8%	0.0%	0.0%	0.0%	0.0%	0.0%
	Phosphate	12.2%	79.8%	39.4%	8.5%	17.1%	19.6%
sc00043	As2O3	6.3%	0.0%	90.7%	0.1%	0.6%	33.2%
	Fe Oxide	54.0%	7.8%	4.8%	37.0%	24.2%	51.2%
Test	Mn Oxide	32.3%	63.1%	3.6%	36.9%	72.5%	12.0%
As = 1424 ppm	Paint	2.9%	4.7%	0.0%	24.8%	0.4%	0.3%
	Phosphate	2.9%	24.4%	1.0%	1.1%	2.3%	3.4%
Pb = 119 ppm	Se-Cu-In	1.7%	0.0%	0.0%	0.0%	0.0%	0.0%
sc00046	As2O3	4.3%	0.0%	53.1%	0.1%	0.2%	33.7%
	Brass	1.0%	0.0%	0.0%	40.1%	0.0%	1.3%
	Cu-Zn-SiO2	2.1%	0.0%	0.0%	38.7%	0.0%	0.0%
High	Fe Oxide	10.2%	0.5%	0.8%	7.8%	2.5%	14.4%
	Fe Sulfate	0.5%	0.1%	0.0%	0.1%	0.1%	0.3%
Dup of	Galena	0.1%	1.3%	0.0%	0.0%	0.0%	0.0%
	Mn Oxide	1.9%	1.2%	0.2%	2.4%	2.3%	1.0%
sc00015	PbAsO	13.1%	89.3%	45.3%	1.9%	94.0%	44.5%
	PbCrO4	0.5%	1.9%	0.0%	0.0%	0.0%	0.0%
	Perlite	60.8%	0.0%	0.0%	0.0%	0.0%	0.0%
	Phosphate	2.0%	5.5%	0.6%	0.9%	0.9%	3.5%
	Se	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%
	Se-In-Cu	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%
	Slag	2.7%	0.1%	0.0%	8.1%	0.0%	1.0%
sc0006	As Metal	0.3%	0.0%	6.7%	0.0%	0.0%	0.0%
	As2O3	2.9%	0.0%	27.1%	0.1%	0.1%	13.8%
	AsFeO	0.5%	0.0%	1.3%	0.9%	6.0%	2.0%
High	Chalcopyrite	7.3%	0.0%	0.0%	0.0%	0.0%	0.0%
	Fe Oxide	24.7%	0.6%	1.4%	37.5%	2.8%	21.0%
As = 836	Fe Sulfate	1.2%	0.1%	0.0%	0.3%	0.1%	0.5%
	Galena	0.3%	2.2%	0.0%	0.0%	0.0%	0.0%

Pb = 1490 ppm

TABLE 5. Summary of EMPA Speciation in Focal Soils, for lead, arsenic, zinc, cadmium, and antimony.

		F%	RM-Pb	RM-As	RM-Zn	RM-Cd	RM-Sb
	Mn Oxide	19.4%	6.5%	1.4%	49.0%	11.1%	6.4%
	PbAsO	23.9%	86.0%	61.6%	7.0%	79.3%	48.8%
	PbSIO4	0.3%	0.5%	0.0%	2.9%	0.0%	4.8%
	Perlite	16.6%	0.0%	0.0%	0.0%	0.0%	0.0%
	Phosphate	2.7%	3.9%	0.6%	2.3%	0.5%	2.8%
sc00086	As2O3	11.9%	0.1%	85.6%	0.4%	0.8%	4.2%
	AsMO	0.2%	0.5%	0.5%	0.4%	11.0%	0.5%
	AsSbO	3.2%	1.7%	10.4%	0.7%	31.2%	87.4%
INT	Fe Oxide	36.8%	8.7%	1.6%	47.8%	11.4%	2.3%
	Mn Oxide	23.1%	73.5%	1.3%	49.9%	35.8%	0.6%
As = 185 ppm	PbAsO	0.2%	7.0%	0.4%	0.1%	1.8%	0.0%
	PbMO	0.2%	4.3%	0.1%	0.5%	7.9%	4.9%
Pb = 203 ppm	Perlite	24.1%	0.0%	0.0%	0.0%	0.0%	0.0%
	Phosphate	0.3%	4.2%	0.1%	0.2%	0.2%	0.0%
sc00104	As2O3	10.5%	0.0%	76.8%	0.2%	0.5%	10.8%
	AsFeO	0.7%	0.1%	1.5%	0.6%	16.2%	0.6%
	AsSbO	0.5%	0.1%	1.8%	0.1%	3.6%	42.1%
	Brass	1.5%	0.0%	0.0%	50.0%	0.0%	0.3%
HIGH	Cerussite	0.3%	2.4%	0.0%	0.0%	0.0%	0.0%
	Clay	4.6%	0.3%	0.6%	0.2%	0.8%	0.8%
As = 1490 ppm	Fe Oxide	24.1%	1.0%	1.1%	15.3%	5.2%	4.4%
	Galena	0.1%	0.8%	0.0%	0.0%	0.0%	0.0%
Pb = 1140 ppm	HgS	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Mn Oxide	15.9%	9.1%	0.9%	16.9%	17.3%	1.1%
	Mo-Cu-Ga-I	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%
	PbAsO	7.0%	42.3%	14.2%	0.9%	43.8%	3.1%
	PbMO	0.2%	0.7%	0.1%	0.2%	5.4%	13.8%
	Perlite	15.4%	0.0%	0.0%	0.0%	0.0%	0.0%
	Phosphate	17.6%	43.0%	2.9%	6.3%	6.7%	4.1%
	SbMO	0.1%	0.2%	0.0%	0.0%	0.6%	18.8%
	SnMO	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%
	ZnS	0.3%	0.0%	0.0%	9.4%	0.0%	0.0%
Dup of sc-39							
sc00114	Brass	7.4%	0.6%	0.0%	69.9%	0.0%	10.7%
	Fe Oxide	43.7%	8.1%	53.0%	7.6%	21.8%	64.9%
	Mn Oxide	30.9%	77.3%	46.8%	9.0%	77.1%	17.9%
LOW	Paint	4.9%	10.3%	0.0%	10.8%	0.7%	0.7%
	Perlite	12.3%	0.0%	0.0%	0.0%	0.0%	0.0%
As = [illegible] ppm	Solder	0.7%	3.7%	0.2%	0.0%	0.0%	5.8%
	ZnO	0.2%	0.0%	0.0%	2.7%	0.3%	0.0%
Pb = 82 ppm							

TABLE 6. Summary of EMPA Speciation from adjacent Soils, for lead, arsenic, zinc, cadmium, and antimony.

		F%	RM-Pb	RM-As	RM-Zn	RM-Cd	RM-Sb
ADJ TO LOW RESOLUTION							
sc00017	Brass	6.1%	5.9%	0.0%	88.1%	0.0%	11.7%
	Fe Oxide	44.9%	94.1%	100.0%	11.9%	100.0%	88.3%
	Perlite	49.0%	0.0%	0.0%	0.0%	0.0%	0.0%
As = 9 ppm							
sc00035	As2O3	1.7%	0.0%	53.6%	0.0%	0.0%	0.3%
	Brass	1.5%	0.0%	0.0%	41.5%	0.0%	0.0%
ADJACENT TO HIGH RESOLUTION	Cu-Se	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%
	Fe Oxide	12.9%	0.4%	2.4%	6.4%	1.0%	0.4%
	Mn Oxide	26.9%	12.2%	6.3%	22.3%	10.5%	0.3%
	PbCrO4	9.2%	24.7%	0.0%	0.0%	0.0%	0.0%
	PbMO	8.8%	26.3%	24.4%	8.5%	85.9%	98.3%
	Perlite	15.4%	0.0%	0.0%	0.0%	0.0%	0.0%
As = 12 ppm	Phosphate	18.6%	36.4%	13.2%	5.2%	2.6%	0.7%
	SeMO	2.3%	0.0%	0.0%	0.0%	0.0%	0.0%
FOCAL = SC00046	ZnS	0.6%	0.0%	0.0%	16.0%	0.0%	0.0%
sc00048	Cerussite	0.2%	21.6%	0.0%	0.0%	0.0%	0.0%
ADJ TO HIGH RESOLUTION	Fe Oxide	3.6%	2.1%	28.6%	46.9%	22.6%	54.2%
	Fe Sulfate	0.2%	0.5%	0.1%	0.4%	0.7%	1.3%
	Mn Oxide	1.8%	14.5%	18.1%	39.6%	57.1%	10.7%
	Perlite	92.5%	0.0%	0.0%	0.0%	0.0%	0.0%
As = 35 ppm	Phosphate	1.8%	61.3%	53.3%	13.1%	19.7%	33.7%
FOCAL = SC00060							
sc00069	As2O3	26.6%	0.1%	96.2%	0.7%	0.9%	10.7%
	Cerussite	1.1%	19.3%	0.0%	0.0%	0.0%	0.0%
ADJ TO HIGH RESOLUTION	Cu-Se	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
	Fe Oxide	39.6%	3.3%	0.9%	43.9%	6.7%	2.9%
	Fe Sulfate	0.3%	0.1%	0.0%	0.0%	0.0%	0.0%
	Mn Oxide	25.2%	28.3%	0.7%	46.6%	21.2%	0.7%
	PbAsO	1.0%	11.4%	1.0%	0.2%	4.6%	0.2%
As = 13 ppm	PbMO	3.1%	23.1%	1.0%	6.7%	65.6%	85.3%
	Phosphate	3.0%	14.5%	0.2%	1.9%	0.9%	0.3%
FOCAL = SC00104							
sc00083	Fe Oxide	3.2%	1.0%	19.3%	0.2%	8.5%	2.2%
	Fe-Zn-S	18.3%	0.0%	0.0%	77.3%	0.0%	0.0%
ADJ TO HIGH RESOLUTION	Galena	0.7%	59.1%	0.0%	0.0%	0.0%	0.0%
	Mn Oxide	3.0%	12.7%	22.6%	0.4%	40.0%	0.8%
	PbAsO	0.2%	9.0%	55.2%	0.0%	15.4%	0.3%
	PbSbO	0.1%	3.1%	1.4%	0.0%	31.3%	82.9%
	Phosphate	0.1%	1.2%	1.5%	0.0%	0.3%	0.1%
As = 12 ppm	Se-In-Cu	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%
	Slag	73.7%	13.9%	0.0%	22.1%	4.5%	13.7%
FOCAL = SC00034							
sc00084	As2O3	0.6%	0.0%	34.2%	0.0%	0.1%	0.4%
	AsSbO	1.5%	0.4%	36.3%	0.1%	28.1%	74.0%
ADJ TO INT RESOLUTION							
As = 13 ppm							

TABLE 6. Summary of EMPA Speciation from adjacent Soils, for lead, arsenic, zinc, cadmium, and antimony.

		F%	RM-Pb	RM-As	RM-Zn	RM-Cd	RM-Sb
	Fe Oxide	37.9%	4.8%	12.6%	19.1%	23.0%	4.4%
	Mn Oxide	1.5%	2.5%	0.6%	1.2%	4.4%	0.1%
	PbMO	0.4%	4.7%	2.0%	0.4%	31.6%	18.5%
	Perlite	16.7%	0.0%	0.0%	0.0%	0.0%	0.0%
	Phosphate	11.5%	85.3%	14.3%	3.3%	12.2%	1.7%
	Slag	29.3%	2.3%	0.0%	58.3%	0.4%	0.9%
	ZnS	0.6%	0.0%	0.0%	17.6%	0.1%	0.0%
sc00101	Fe Oxide	8.8%	0.4%	4.4%	2.1%	3.0%	14.8%
	Mn Oxide	39.9%	22.4%	24.6%	15.9%	68.2%	26.1%
	Paint	26.3%	12.3%	0.0%	78.7%	2.7%	4.1%
	PbAsO	1.2%	7.2%	26.9%	0.1%	11.8%	4.8%
	Phosphate	23.9%	57.8%	44.2%	3.2%	14.3%	50.1%
sc00105	As2O3	23.4%	0.1%	97.2%	0.8%	5.3%	62.1%
	Fe Oxide	64.9%	8.7%	1.6%	90.1%	72.0%	30.9%
	Phosphate	11.7%	91.2%	1.1%	9.1%	22.7%	7.0%

Ads to low Res.
As = 10ppm

Ads to int. Res.
As = 21ppm
Focal = SC 000 5

TABLE 7. Summary of EMPA Speciation from Background Soils, for lead, arsenic, zinc, cadmium, and antimony.

		F%	RM-Pb	RM-As	RM-Zn	RM-Cd	RM-Sb
sc00065	Brass	9.5%	1.5%	0.0%	95.5%	0.0%	26.4%
	Chalcopyrite	6.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Fe Oxide	22.8%	7.6%	71.3%	4.2%	84.2%	64.9%
	PbCrO4	1.6%	43.4%	0.0%	0.0%	0.0%	0.0%
	Perlite	57.7%	0.0%	0.0%	0.0%	0.0%	0.0%
	Phosphate	2.4%	47.5%	28.7%	0.3%	15.8%	8.7%
sc00071	Fe Oxide	2.8%	0.1%	93.4%	0.4%	19.1%	2.2%
	Fe-Zn-S	7.6%	0.0%	0.0%	56.4%	0.0%	0.0%
	Galena	7.1%	96.9%	0.0%	0.0%	0.0%	0.0%
	PbSbO	0.1%	0.4%	6.6%	0.0%	68.0%	80.2%
	Se-In-Cu	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%
	Slag	82.2%	2.5%	0.0%	43.3%	12.9%	17.7%

TABLE 8. Summary of EMPA Speciation from High Lead Soils Soils, for lead, arsenic, zinc, cadmium, and antimony.

		F%	RM-Pb	RM-As	RM-Zn	RM-Cd	RM-Sb
3-2246B	Cerussite	4.9%	33.4%	0.0%	0.0%	0.0%	0.0%
	Clay	1.0%	0.1%	3.8%	0.0%	1.1%	0.4%
	Fe Oxide	9.6%	0.3%	11.9%	1.2%	13.8%	3.7%
	Mn Oxide	4.9%	2.1%	7.6%	1.0%	35.2%	0.7%
	Paint	54.8%	19.7%	0.0%	86.5%	23.6%	2.0%
	PbSiO4	13.4%	26.3%	32.2%	9.8%	2.0%	87.9%
	Phosphate	9.6%	17.9%	44.6%	0.7%	24.2%	4.6%
	Slag	1.6%	0.0%	0.0%	0.8%	0.1%	0.2%
	Solder	0.2%	0.2%	0.1%	0.0%	0.0%	0.4%
3-12151B	Fe Oxide	44.5%	2.6%	28.4%	30.6%	28.1%	52.0%
	Fe-Zn Sulfate	1.7%	0.0%	0.0%	3.9%	0.0%	0.0%
	Galena	0.1%	0.8%	0.0%	0.0%	0.0%	0.0%
	Mn Oxide	13.8%	10.8%	11.0%	15.8%	43.6%	6.3%
	Phosphate	25.4%	85.3%	60.6%	9.8%	28.0%	37.0%
	Slag	14.6%	0.5%	0.0%	39.8%	0.2%	4.7%
3-12040B	Anglesite	0.4%	1.9%	0.0%	0.0%	0.0%	0.0%
	Cerussite	12.8%	67.6%	0.0%	0.0%	0.0%	0.0%
	Fe Oxide	6.1%	0.2%	29.7%	1.0%	23.9%	32.2%
	Fe-Zn Sulfate	1.5%	0.0%	0.0%	0.9%	0.0%	0.0%
	Galena	1.9%	13.0%	0.0%	0.0%	0.0%	0.0%
	Paint	41.3%	11.5%	0.0%	87.5%	48.4%	20.4%
	Perlite	16.8%	0.0%	0.0%	0.0%	0.0%	0.0%
	Phosphate	3.9%	5.6%	70.3%	0.4%	26.4%	25.4%
	Slag	15.3%	0.2%	0.0%	10.2%	1.4%	22.0%
3-12039B	Cerussite	1.5%	12.4%	0.0%	0.0%	0.0%	0.0%
	Cu-Zn-SiO2	3.3%	0.0%	0.0%	17.8%	0.0%	0.0%
	Fe Oxide	32.2%	1.3%	20.6%	7.1%	27.5%	42.0%
	Fe Sulfate	2.0%	0.4%	0.0%	0.1%	0.9%	1.2%
	Mn Oxide	4.1%	2.2%	3.3%	1.5%	17.6%	2.1%
	Paint	25.3%	11.2%	0.0%	69.6%	6.5%	3.1%
	Phosphate	31.7%	72.6%	76.1%	3.9%	47.5%	51.7%
3-12035B	Cerussite	4.1%	33.7%	0.0%	0.0%	0.0%	0.0%
	Clay	5.6%	0.4%	17.9%	0.1%	5.5%	11.6%
	Fe Oxide	7.6%	0.3%	7.8%	1.5%	9.7%	16.2%
	Fe-Zn Sulfate	0.3%	0.0%	0.0%	0.2%	0.0%	0.0%
	Galena	0.1%	1.1%	0.0%	0.0%	0.0%	0.0%
	Mn Oxide	5.2%	2.7%	6.7%	1.7%	33.0%	4.3%
	Organic	4.8%	0.2%	0.0%	0.0%	0.0%	0.0%
	Paint	32.3%	14.1%	0.0%	77.9%	12.4%	6.5%
	Native Pb	0.4%	7.5%	0.0%	0.0%	0.0%	0.0%
	Phosphate	17.4%	39.3%	67.5%	1.9%	38.8%	46.5%
	Slag	22.1%	0.5%	0.0%	16.8%	0.6%	13.0%
	Solder	0.2%	0.2%	0.0%	0.0%	0.0%	1.9%

TABLE 8. Summary of EMPA Speciation from High Lead Soils Soils, for lead, arsenic, zinc, cadmium, and antimony.

		F%	RM-Pb	RM-As	RM-Zn	RM-Cd	RM-Sb
3-10319B	Fe Oxide	16.9%	0.9%	14.0%	6.7%	20.5%	25.7%
	Fe Sulfate	0.6%	0.2%	0.0%	0.0%	0.4%	0.4%
	Fe-Zn Sulfate	3.1%	0.0%	0.0%	4.1%	0.0%	0.0%
	Galena	1.1%	14.7%	0.0%	0.0%	0.0%	0.0%
	Mn Oxide	3.5%	2.5%	3.7%	2.3%	21.4%	2.1%
	Paint	1.4%	0.8%	0.0%	7.0%	0.5%	0.2%
	Phosphate	26.4%	79.2%	82.3%	5.9%	56.0%	50.2%
	Slag	46.9%	1.5%	0.0%	73.9%	1.3%	19.6%
	Solder	0.2%	0.3%	0.0%	0.0%	0.0%	1.8%

Table 9. Statistical Summary of In Vitro Bioavailability Results.

Source Media	Pb Bioavailability		As Bioavailability	
	Mean	Range	Mean	Range
Plant	66%	(58-74)	52%	(38-58)
ACME	40%	(40-41)	42%	(42-43)
PAX	50%	(41-60)	10%	(8-12)
Adjacent Soils	80%	(72-87)	47%	(22-74)
Focal Soils	81%	(71-96)	48%	(37-58)
Background Soils	78%	(72-85)	34%	(11-56)

BIOACCESSIBILITY

Table 10. Perlite Macroscopic Exam

Sample	Date	Particles at 10X		Microscopist
SC00114	6/13/00	2		Luiszer
SC00010	6/13/00	3		Luiszer
SC00027	6/13/00	0		Luiszer
SC00039	6/13/00	2		Luiszer
SC00038	6/13/00	2		Luiszer
SC00048	6/13/00	2		Luiszer
SC00077	6/13/00	23		Luiszer
SC00084	6/13/00	0		Luiszer
SC00070	6/13/00	8		Luiszer
SC00065	6/13/00	0		Luiszer
SC00043	6/13/00	0		Luiszer
SC00069	6/13/00	0		Luiszer
SC00101	6/13/00	1		Luiszer
SC00083	6/13/00	0		Luiszer
SC00011	6/13/00	4		Luiszer
SC00023	6/22/00	0		Drexler
SC00086	6/22/00	0		Drexler
SC00035	6/22/00	0		Drexler
SC00104	6/22/00	3		Drexler
SC00015	6/22/00	4		Drexler
SC00046	6/29/00	4		Drexler
SC00025	6/29/00	0		Drexler
SC00017	6/29/00	0		Drexler
SC00105	6/29/00	0		Drexler
SC00006	6/29/00	3		Drexler
SC00018	6/29/00	0		Drexler
3-02246-B	8/7/01	0		Drexler
3-10319-B	8/7/01	0		Drexler
3-12039-B	8/7/01	0		Drexler
3-12151-B	8/7/01	0		Drexler
3-12040-B	8/7/01	0		Drexler
3-12035-B	8/7/01	0		Drexler
SC0009	3/12/01	210	126	Drexler
315670-R	3/12/01	0	0	Drexler

TABLE 11. WDSXRF Results for VBI70 soils.

	Zn	As	Pb	Cd
SC-0006	493	1555	2110	21
SC-00017	116	28	91	13
MONT	2759	3696	1822	1426
SC-00038	304	43	224	9
SC-00071	349	20	194	13
SC-00114	226	38	122	9
SC-00101	432	18	144	8
SC-00069	173	27	201	9
SC-00018	2074	369509	4800	4654
SC-00025	293	36	171	10
SC-00104	352	2589	1290	14
MS-2711	373	104	1063	36

QA/QC

MS-2711	373	104	1063	36
Should be	350	105	1162	42
RPD	6	1	9	15

Values in red are exceed the linier calibration range for this instrument and can only be considered qualitative,

TABLE 11. WDSXRF Results for VBI70 soils.

	Zn	As	Pb	Cd
SC-00023	537	126758	4318	1723
SC-00070	2068	147069	4275	4532
MONT	2759	3696	1822	1426
SC-00065	339	15	189	11
SC-00084	275	137	248	21
SC-00077	2287	239035	5588	4613
SC-00046	756	3691	2035	30
SC-00086	207	311	287	15
SC-00035	413	21	250	12
SC-00048	524	62	310	12
SC-00043	183	186	173	9
MS-2711	370	108	1106	41

QA/QC

MS-2711	370	108	1106	41
Should be	350	105	1162	42
RPD	6	3	5	2

Values in red are exceed the linier calibration range for this instrument and can only be considered qualitative,

TABLE 11. WDSXRF Results for VBI70 soils.

	Zn	As	Pb	Cd
SC-00027	187	210	193	12
SC-00105	356	102	140	35
MONT	2759	3696	1822	1426
SC-00015	797	4058	2225	21
SC00039	228	55	126	15
SC-00083	458	37	214	12
SC-00010	527	231	505	18
SC-00011	2889	221953	4912	5805
SC-00035	417	15	256	7
SC-00048	530	58	325	11
SC-00043	183	194	175	13
MS-2710	6996	659	5204	18
QA/QC				
MS-2710	6996	659	5204	18
Should be	6952	626	5532	22
RPD	1	5	6	19

Values in red are exceed the linier calibration range for this instrument and can only be considered qualitative,

TABLE 11. WDSXRF Results for VBI70 soils.

	Zn	As	Pb	Cd
3-12035-B	685	43	1078	10
3-12151-B	776	310	645	14
3-10319-B	375	18	430	8
3-12040-B	285	34	236	10
3-02246-B	559	14	680	7
3-10319-B	784	28	1209	6

QA/QC

MS-2711	388	112	1096	40
Should be	350	105	1162	42
RPD	10	6	6	5
MS-2710	7065	695	5114	14
Should be	6952	626	5532	22
RPD	2	10	8	44

Table 11. WDSXRF results for PAX and ACME samples.

	RAW WDSXRF		Corrected for Starch		Quartz Dillution Factor	Final Concentration mg/kg	
	Pb	As	Pb	As		Pb	As
MS2710	3284.241	356.278	5482	563	0	5482	563
MS2711	815.529	60.653	1361	96	0	1361	96
Mont	1225.96	1277.123	2046	2018	0	2046	2018
SC-00099	1054.633	4780.149	1734	7181	45	78030	323145
3-15670R	7249.292	2513.062	13904	3558	48	667392	170784
25000 ppm	10618	13233.01	25624	25010	0	25624	25010
50000 ppm	15963.72	22101.84	49758	49996	0	49758	49996

QA/QC	Pb	As
MS2710	5482	563
Should be	5532	626
RPD	0.9	10.6
MS2711	1361	96
Should be	1162	105
RPD	15.8	9.0
25000 ppm	25624	25010
Should be	25000	25000
RPD	2.5	0.0
50000 ppm	49758	49996
Should be	50000	50000
RPD	0.5	0.0

APPENDIX I

TABLE 1A. EMPA Speciation Log

PROJECT: VBI70

Date: 08/29/01

ANALYST: Drexler

Pkcnt Sequence: Pb/As/Cd/Zn

Particle #	Date	Time	Sample Id	Phase	Pb	As	Cd	Sb	Zn
105	5/12/00	835	SC00011	fe	0.0049	0.1574			
60	5/12/00	1620	sc00015	fe	0.0281	0.0238			
387	5/13/00	919	sc00015	mn	0.0718	0.0542			
145	5/13/00	1108	sc00015b	phos	0.4027	0.0556			
110	5/15/00	845	sc0006	fe	0.0259	0.0728			
160	5/15/00	1305	sc0006	mn	0.0371	0.0081			
161	5/15/00	1318	sc0006	sulf	0.1129	0			
216	5/15/00	1623	sc0006	mn	0.1081	0.0403			
27	5/16/00	802	sc00023	asmo	0.007	0.3395	0.007	0.001	0
39	5/16/00	1018	sc00023	caso4	0.0046	0.0301			
40	5/16/00	1100	sc00023	asal	0.0048	0.9661	0.005	0.008	0.01
116	5/16/00	1501	sc00023	al	0.0261	0.1156	0.014	0.087	0
123	5/16/00	1634	sc00023	caso4	0.0238	0.0028	0.063	0	0
162	5/17/00	738	sc00023	PbMO	0.343	0.0447	0.003	0.368	0
216	5/17/00	949	sc00023	sbmo	0.3051	0.0271	0.005	0.411	0
6	5/17/00	1050	sc00038	mn	0.0705	0.0001	6E-04	0	0.01
11	5/17/00	1059	sc00038	pbmo	0.1972	0.0008	1E-05	0.012	0
18	5/17/00	1114	sc00038	mn	0.0585	0.0009	3E-04	0	0.01
19	5/17/00	1117	sc00038	fe	0	0.0022	0	0	0
23	5/17/00	1124	sc00038	slag	0.005	0	0	2E-04	0.07
8	5/17/00	1126	sc00039	mn	0.0233	0.0008	0	1E-04	0
25	5/18/00	1235	sc00039	phos	0.6318	0	0	0	0
40	5/18/00	1324	sc00018	caso4	0.0118	0.4712	0.029	0.013	0
161	5/18/00	1600	sc00018	asmo	0	0.901	0	0.006	0
180	5/18/00	922	sc00018	asmo	0.0479	0.5436	0.031	0.003	0
233	5/19/00	1159	sc00018	slag	0.0122	0	0	8E-05	0.07
245	5/19/00	1309	sc00018	asmo	0.0174	0.4065	0.019	0.015	0.01
252	5/19/00	1357	sc00018	asal	0.0058	0.8929	0.006	0.004	0.01
296	5/19/00	1451	sc00018	ascao		0.9348			
297	5/19/00	1504	sc00018	assbo	0.0291	0.1218	0.011	0.153	0
2	5/19/00	1549	sc000-10	fe	1E-05	0.0133	6E-06	9E-06	0
8	5/19/00	1559	sc000-10	mn	1E-05	0.0133	6E-06	9E-06	0
20	5/19/00	1628	sc000-10	phos	0.485	0	2E-04	0	0.01
37	5/20/00	745	sc000-10	slag	0.0016	0	4E-06	9E-04	0.03
20	5/25/00	808	sc00077	asmo	0.0354	0.4837	0.068	0.005	0.01
40	5/25/00	1001	sc00077	asfeo	0.0051	0.3294	0.035	0.001	0.01
69	5/25/00	1147	sc00077	ascdo	0.003	0.6512	0.356	0.001	0.05
83	5/25/00	1323	sc00077	asmo	0.0208	0.2832	0.031	0.05	0.01

TABLE 1A. EMPA Speciation Log

PROJECT: VBI70

Date: 08/29/01

ANALYST: Drexler

Pkcnt Sequence: Pb/As/Cd/Zn

Particle #	Date	Time	Sample Id	Phase	Pb	As	Cd	Sb	Zn
89	5/25/00	1355	sc00077	alsi	0	0.0147	1E-04	6E-04	0
101	5/25/00	1500	sc00077	asmo	0.0254	0.108	0.037	0.027	0.01
108	5/25/00	1523	sc00077	fe	0.0012	0.0404	2E-04	0	0
140	5/25/00	1624	sc00077	asfeo	0.0247	0.2135	0.026	0.003	0.04
175	5/26/00		sc00077	pbmo	0.3516	0.3439	0.042	0.004	0.01
4	5/27/00	743	sc00035	semo	0	0	0	0	0
6	5/27/00	804	sc00035	phos	0	0.3953	2E-04	0	0.01
16	5/27/00	1301	sc00035	pbmo	0.4449	0	6E-04	0	0.01
40	5/27/00	1445	sc00035	fe	0.0217	0	8E-04	2E-04	0.23
32	5/27/00	1602	sc00046	fe	0.0178	0.0471	2E-04	0	0.01
40	5/27/00	1635	sc00046	sulf	0	0	1E-04	1E-04	0
60	5/27/00	1710	sc00046	pbaso	0.4019	0.4054	7E-04	0.001	0
100	5/31/00	913	sc00046	cuznsi	0.0026	0	0	0	0.34
119	5/31/00	935	sc00046	slag	0.0009	0	0	0	0.03
248	5/31/00	1024	sc00046	fe	0.0033	0.0175	8E-05	2E-04	0
12	6/1/00	1410	SC00027	mn	0.0836	0.0079	0.003	3E-04	0.01
20	6/1/00	1444	SC00027	fe	0.0422	0.0362	2E-04	0	0.07
11	6/1/00	938	SC00065	phos	0.3919	0	2E-04	0	0.01
10	6/2/00	1217	SC00084	phos	0.1954	0	0	0	0
17	6/2/00	1336	SC00084	pbmo	0.3171	0.121	0.002	0.043	0.06
18	6/2/00	1338	SC00084	slag	0.0061	0	2E-05	0	0.07
2	6/2/00	1537	SC00069	mn	0.1051	0	2E-04	0	0.01
10	6/2/00	1031	SC00069	phos	0.4843	0.1428	0	0	0
30	6/3/00	1249	SC00069	pbmo	0.3858	0.2442	0.05	6E-05	0
25	6/5/00	1106	SC00114	mn	0.0558	0	0.002	5E-04	0.04
14	6/6/00	845	SC00025	phos	0.2189	0	3E-04	0	0.01
18	6/6/00	901	SC00025	fe	0.0008	0	3E-04	0	0.03
32	6/6/00	1122	SC00025	phos	0.5055	0.0046	2E-04	0.003	0
40	6/6/00	1154	SC00025	fe	1E-04	0	3E-04	0	0
42	6/6/00	1213	SC00025	pbsio4	0.3081	0	3E-05	3E-04	0.07
4	6/6/00	1311	SC00104	clay	0.0341	.1-8748	3E-04	4E-04	0
28	6/6/00	1431	SC00104	asfeo	0.2001	0.1287	5E-04	4E-04	0.02
62	6/6/00	1519	SC00104	sbmo	0.0322	0.2186	6E-04	0.12	0.02
84	6/6/00	1537	SC00104	phos	0.3814	0.0728	4E-04	0	0
108	6/6/00	1621	SC00104	SnMO	0.1112	0.0325	0	0	0.01
115	6/7/00	826	SC00104	phos	0.2143	0.0023	0	0.007	0.01
122	6/7/00	912	SC00104	fe	0.0041	0.0091	1E-04	0	0.01
123	6/7/00	924	SC00104	phos	0.2202	0.0183	7E-04	4E-04	0
140	6/7/00	952	SC00104	phos	0.1746	0.0454	2E-04	6E-04	0

TABLE 1A. EMPA Speciation Log

PROJECT: VBI70

Date: 08/29/01

ANALYST: Drexler

Pkcnt Sequence: Pb/As/Cd/Zn

Particle #	Date	Time	Sample Id	Phase	Pb	As	Cd	Sb	Zn
145	6/7/00	1020	SC00104	mn	0.1293	0.0287	7E-04	4E-05	0.01
146	6/7/00	1025	SC00104	fe	0.008	0.061	8E-05	0.013	0
163	6/7/00	1114	SC00104	phos	0.2132	0.0852	9E-05	0	0
189	6/7/00	1146	SC00104	fe	0.0239	0.057	1E-04	0	0
216	6/7/00	1215	SC00104	fe	0.0259	0.0504	8E-05	2E-04	0.02
208?	6/7/00	1313	SC00104	mn	0.1475	0.0305	1E-04	0	0
250	6/7/00	1352	SC00104	mn	0.1174	0.06	9E-05	6E-04	0
16	6/8/00	1025	sc00086	assbo	0.0005	1.8528	1E-04	0.12	0
17	6/8/00	1036	sc00086	fe	0.0326	0.0094	1E-04	1E-04	0
18	6/8/00	1042	sc00086	PbMO	0.4459	0.0019	1E-05	0.112	0
51	6/8/00	1227	sc00086	AsMO	0.1824	0.5862	0.001	0.004	0.11
60	6/8/00	1310	sc00086	fe	0.0036	0.0172	0	0	0.07
	6/8/00	1523	SC00048	fe	0.0074	0.0044	5E-05	1E-05	0
22	6/8/00	1558	SC00048	sulf	0.0026	0.001	1E-04	2E-04	0
191	6/9/00	817	SC00048	mn	0.0685	0.0017	5E-04	3E-04	0.01
14	6/9/00	1003	SC00043	mn	0.1239	0.008	0.001	5E-04	0.01
3	6/10/00	1423	SC00101	mn	0.0228	0	5E-04	1E-04	0.05
4	6/10/00	1452	SC00101	phos	0.2954	0	4E-04	0	0.01
8	6/10/00	1508	SC00101	phos	0.2432	0.0034	0	6E-05	0
4	6/10/00	1557	SC00101	phos	0.4493	4E-05	5E-04	0	0
61	6/13/00	857	SC00070	ascao	0.0006	0.7851	0.078	0	0
79	6/13/00	147	SC00070	asfeo	0	0.7471	0.002	0	0
103	6/13/00	1238	SC00070	asal	0.2114	0.5288	0.006	0.007	0.01
129	6/14/00	1235	SC00070	ascdca	0.0016	0.8324	0.09	0	0.01
139	6/14/00	1241	SC00070	slag	0.0012	0	0	0	0.15
160	6/14/00	1302	SC00070	asal	0	0.6994	0.005	2E-04	0
180	6/14/00	1344	SC00070	asal	0.1518	0.443	0.051	0.002	0.01
190	6/14/00	1357	SC00070	asmo	0.2605	0.2619	0.026	0.003	0.01
304	6/14/00		SC00070	pbsio4	0.2754	0.04	0	0.009	0.03
10?	6/14/00	1441	SC0071	slag	0.005	0	6E-05	0	0.05
20	6/14/00	149	SC0071	fezns	0	0	0	0	0.42
100	6/14/00	1601	SC0071	slag	0.0082	0	0	0	0.07
?	6/14/00	834	sc00083	slag	0.0003	0	0	0	0.03
77	6/14/00	843	sc00083	pbsbo	0.3716	0.0187	0.012	0.252	0
77	6/14/00		sc00083	pbaso	0.6377	0.3608	3E-04	1E-04	0
83	6/14/00	914	sc00083	mn	0.077	0	0.001	3E-05	0.03
100	6/14/00	1105	sc00083	slag	0.0043	0	0	2E-04	0.05
11	6/14/00	1421	SC00101	fe	0.0868	0.0057	4E-04	0.003	0.02
14	6/14/00	1445	SC00101	phos	0.3118	0	2E-05	0	0.01

TABLE 1A. EMPA Speciation Log

PROJECT: VBI70

Date: 08/29/01

ANALYST: Drexler

Pkcnt Sequence: Pb/As/Cd/Zn

Particle #	Date	Time	Sample Id	Phase	Pb	As	Cd	Sb	Zn
	6/15/00	857	SC00077	asal	0.0299	0.0514	0.042	0.008	0.01
	6/15/00	902	SC00077	ascdca	0.0347	0.1881	0.044	0.011	0.01
	6/15/00	906	SC00077	fe	0.0008	0.0322	9E-04	2E-04	0
	6/15/00	910	SC00077	ascdca	0.0547	0.7209	0.076	0.014	0.01
	6/15/00	915	SC00077	ascdca	0.0458	0.1298	0.066		
	6/15/00	923	SC00077	asal	0.0065	0.9829	0.008	0.008	0.01
	6/15/00	929	SC00077	ascao	0	0.9963	0.037	0	0.01
	6/15/00	932	SC00077	asfeo	0.0139	0.6321	0.026	0.002	0
	6/15/00	936	SC00077	asmo	0.0845	0.4371	0.059	0.01	0.01
	6/15/00	949	SC00077	asmo	0.0793	0.5741	0.06	0.028	0.01
	6/15/00	950	SC00077	accdca	0.0006	0.9253	0.11	0	0.03
	6/15/00	956	SC00027	fe	0.0002	0.0015	0	5E-04	0
	6/15/00	1004	SC00027	mn	0.0744	0.0032	0.002	0	0.01
	6/15/00	1013	SC00027	fe	0.0004	0.0004	2E-04	4E-04	0
	6/15/00	1023	SC00027	fe	0.0003	0.0003	0	0	0
	6/15/00	1030	SC00065	fe	0.005	0	0	8E-05	0.01
	6/15/00	1033	SC00065	fe	0.0121	0.0013	1E-04	0	0
	6/15/00	1045	SC00046	fe	0	0	2E-04	0	0.16
	6/15/00	1051	SC00046	as	0	2.3921	0	3E-04	0
	6/15/00	1057	SC00046	fe	0.002	0.0006	1E-04	1E-04	0
	6/15/00	1104	SC00046	phos	0.1737	0.219	5E-04	8E-05	0
	6/15/00	1110	SC00046	fe	0.0003	0.0006	0	0	0
	6/15/00	1115	SC00046	fe	0.0008	0	2E-04	2E-04	0
	6/15/00	1119	SC00046	phos	0.4667	0.1783	4E-04	0	0
	6/15/00	1123	SC00046	fe	0.0398	0.0294	3E-04	0	0
	6/15/00	1133	SC00046	as	0.0001	2.8523	1E-04	3E-04	0
	6/15/00	1136	SC00046	as	0	2.8185	0	0.007	0
	6/15/00	1141	SC00046	as	0.0004	2.5875	0	0.001	0
	6/15/00	1149	SC00046	as	0	2.7267	0	0.002	0
	6/15/00	1206	SC00086	fe	0	0	0	1E-04	0
	6/15/00	1215	SC00086	fe	0.0016	0.0056	8E-05	0	0
	6/15/00	1224	SC00086	fe	0.0009	0.009	3E-04	4E-04	0
	6/15/00	1230	SC00086	fe	0.0022	0.0011	0	3E-04	0
	6/15/00	1248	SC00048	fe	0.0102	0.0028	7E-05	0	0.01
	6/15/00	1254	SC00048	fe	0.0009	0	8E-05	6E-04	0
	6/15/00	1302	SC00048	mn	0.043	0.0003	2E-05	3E-04	0.01
	6/15/00	1308	SC00048	phos	0.2721	0.0229	4E-04	2E-04	0
	6/15/00	1319	SC00048	phos	0.0762	0.0519	3E-04	5E-04	0
	6/15/00	1334	SC00105	fe	0.0214	0	0.001	0	0.05

TABLE 1A. EMPA Speciation Log

PROJECT: VBI70

Date: 08/29/01

ANALYST: Drexler

Pkcnt Sequence: Pb/As/Cd/Zn

Particle #	Date	Time	Sample Id	Phase	Pb	As	Cd	Sb	Zn
	6/15/00	1339	SC00105	phos	0.5952	0	8E-04	0	0
	6/15/00	1359	SC00105	fe	0.0002	0	0	1E-04	0
	6/15/00	1415	SC00071	fe	0.0001	0	2E-04	1E-05	0
	6/15/00	1441	SC00071	fe	0.001	0.0019	0	0	0
	6/15/00	1517	SC00039	fe	0.0003	0.0004	0	0	0
	6/15/00	1524	SC00039	fe	0.0003	0.0011	0	3E-04	0
	6/15/00	1541	SC00025	fe	0.0003	0.0003	2E-04	0	0
	6/15/00	1559	SC00006	phos	0.2484	0.0474	4E-04	0	0
	6/15/00	1604	SC00006	pbaso	0.3054	0.4145	4E-04	6E-04	0
	6/15/00	1609	SC00006	pbaso	0.5846	0.2432	4E-04	9E-05	0
	6/15/00	1616	SC00006	as	0.0004	2.6925	3E-04	0.002	0
	6/16/00	803	SC00006	fe	0.0463	0.0021	1E-04	1E-04	0
	6/16/00	807	SC00006	pbaso	0.5409	0.2734	4E-04	0.002	0
	6/16/00	811	SC00006	pbaso	0.4989	0.2148	2E-05	8E-05	0
	6/16/00	818	SC00006	pbaso	0.6459	0.1799	1E-03	0	0
	6/16/00	822	SC00006	mn	0.1188	0.01	1E-04	2E-04	0
	6/16/00	825	SC00006	fe	0.0253	0.0155	2E-04	8E-04	0.01
	6/16/00	833	SC00006	phos	0.5022	0.0085	3E-04	0	0.02
	6/16/00	836	SC00006	fe	0.0026	0.0019	4E-06	2E-04	0.01
	6/16/00	842	SC00006	phos	0.4892	0.1456	4E-04	0	0
	6/16/00	849	SC00006	pbaso	0.5904	0.2222	3E-04	0	0
	6/16/00	856	SC00006	phos	0.0633	0.0861	8E-05	0	0.01
	6/16/00	904	SC00006	pbaso	0.4544	0.1303	5E-04	0	0
	6/16/00	908	SC00006	mn	0.064	0.0202	4E-05	0	0
	6/16/00	912	SC00038	fe	0.0006	0.001	0	0	0
	6/16/00	920	SC00038	mn	0.1365	0.0001	0.002	0	0.02
	6/16/00	925	SC00038	mn	0.1147	0	0.002	0	0.02
	6/16/00	933	SC00038	fe	0.0014	0	3E-04	1E-04	0
	6/16/00	937	SC00038	fe	0	0	0	0	0
	6/16/00	942	SC00038	fe	0.0085	0.0018	0	0	0.01
	6/16/00	1000	SC00011	pbaso	0.6044	0.4005	0.028	2E-04	0
	6/16/00	1005	SC00011	ascdca	0.0259	0.3957	0.057	0.015	0.01
	6/16/00	1010	SC00011	ascdo	0.0013	0.6844	0.302	0	0.02
	6/16/00	1014	SC00011	fe	0	0	3E-04	9E-05	0
	6/16/00	1019	SC00011	ascdo	0.0025	0.6816	0.333	0.003	0.02
	6/16/00	1025	SC00011	fe	0.0056	0.0699	0.006	0.003	0
	6/16/00	1031	SC00011	slag	0.0071	0	0	0	0.05
	6/16/00	1036	SC00011	pbaso	0.5792	0.2685	0.014	0.001	0.01
	6/16/00	1053	SC00114	fe	0.002	0.0018	0	0	0

TABLE 1A. EMPA Speciation Log

PROJECT: VBI70

Date: 08/29/01

ANALYST: Drexler

Pkcnt Sequence: Pb/As/Cd/Zn

Particle #	Date	Time	Sample Id	Phase	Pb	As	Cd	Sb	Zn
	6/16/00	1103	SC00114	fe	0	0.0005	1E-04	2E-04	0
	6/16/00	1111	SC00017	fe	0	0.0008	0	1E-04	0
	6/16/00	1120	SC00017	fe	0.0005	0	0	0	0
	6/16/00	1125	SC00018	as	0.0003	2.9255	0	5E-04	0
	6/16/00	1129	SC00018	as	0.0006	2.7893	0	5E-04	0
	6/16/00	1141	SC00018	ascdca	0.0062	0.6569	0.196	0	0.01
	6/16/00	1146	SC00018	ascao	0.0004	0.9831	0.039	0	0.01
	6/16/00	1150	SC00018	ascdca	0.0048	0.6343	0.269	0.002	0.01
	6/16/00	1158	SC00018	asal	0.008	1.1436	0.005	0.005	0.01
	6/16/00	1249	SC00015	pbaso	0.5385	0.4889	2E-04	0.002	0
	6/16/00	1253	SC00015	as	0.0007	2.1957	0	0.012	0
	6/16/00	1304	SC00015	as	0.0008	2.5444	1E-04	3E-04	0
	6/16/00	1309	SC00015	fe	0.0081	0.0152	2E-04	2E-05	0.01
	6/16/00	1313	SC00015	mn	0.0975	0.0067	6E-04	0	0.02
	6/16/00	1341	SC00015	as	0.0001	2.4556	5E-05	0.002	0
	6/16/00	1346	SC00104	fe	0.0074	0.0216	0	0	0.27
	6/16/00	1355	SC00104	pbaso	0.5204	0.4459	4E-04	7E-04	0
	6/16/00	1354	SC00104	as	o	2.4736	0	5E-04	0
	6/16/00	1402	SC00104	as	0	2.5008	0	0.002	0
	6/16/00	1407	SC00104	pbaso	0.6133	0.317	1E-04	0	0
	6/16/00	1419	SC00010	phos	0.4688	0	6E-04	0	0.02
	6/16/00	1443	SC00035	fe	0.0058	0.0002	4E-05	0	0
	6/16/00	1449	SC00035	fe	0.0012	0	0	0	0
	6/16/00	1454	SC00035	phos	0.6287	0	5E-04	0	0.01
	6/16/00	1501	SC00043	mn	0.063	0.0044	0.005	2E-04	0.03
	6/16/00	1514	SC00069	fe	0.0002	0	0	9E-05	0
	6/16/00	1518	SC00069	fe	0	0.0006	9E-05	3E-04	0
10	7/9/01	1005	3-12039b	fe	7E-05	0.0005	0	0	0
20	7/9/01	1323	3-12039b	paint	0.2223	0.0004	0	0	0
73	7/9/01	1554	3-12039b	fe	0.0658	0.0013	0	0	0
18	7/9/01	1640	3-10319b	slag	0.0006	0	0	0	0
27	7/10/01	803	3-10319b	lowpho	0.0469	0	0	0	0
40	7/10/01	934	3-10319b	fe	0.0138	0.0068	0	0	0
49	7/10/01	1034	3-10319b	phos	0.6396	0	0	0	0
60	7/10/01	1059	3-10319b	sold	0.0331	0.0006	0	0	0
100	7/10/01	1100	3-10319b	paint	0.1774	0	0	0	0
140	7/10/01	1235	3-10319b	slag	0.0009	0	0	0	0
23	7/10/01	1307	3-12035b	low-pho	0.0696	0	0	0	0
41	7/10/01	1411	3-12035b	slag	0.0027	0	0	0	0

TABLE 1A. EMPA Speciation Log

PROJECT: VBI70

Date: 08/29/01

ANALYST: Drexler

Pkcnt Sequence: Pb/As/Cd/Zn

Particle #	Date	Time	Sample Id	Phase	Pb	As	Cd	Sb	Zn
48	7/10/01	1523	3-12035b	org	0.0257	0	0	0	0
60	7/10/01	1558	3-12035b	fe	0.0091	0.0029	0	0	0
80	7/10/01	1645	3-12035b	mn	0.1548	0	0	0	0
40	7/13/01	945	3-02246b	pbsio4	0.2414	0	0	0	0
20	7/14/01	1159	3-12040b	feznso4	0.0657	0	0	0	0
1	7/16/01	807	3-12151b	mn	0.0323	0.0199	0	0	0
20	7/16/01	945	3-12151b	mn	0.079	0.0165	0	0	0.05
24	7/16/01	1023	3-12151b	fe	0.0108	0.026	0	0	0
40	7/16/01	1256	3-12151b	fe	0.0012	0.0077	0	0	0
50	7/16/01	1345	3-12151b	slag	0.0026	0	0	0	0.08
101	7/16/01	1557	3-12151b	slag	0.0025	0	0	0	0.06
107	7/16/01	1631	3-12151b	phos	0.3727	0.0116	0	0	0

TABLE 2A. Calibration Log

ANALYST: JWD **Reviewed By:** JWD **PROJECT** VBI70-99

Magnification Marker: 12/9/99 5/24/01 2/7/00 5/11/00 **Date:** 8/16/01

Standard Id	Date/Time	Known CF	Results	Acceptance Limits	Comments
As1	12/9/99-1217	0.258	0.25005	0.2451-0.2709	
Pb1	12/9/99-1217	0.8375	0.83798	0.7956-0.8793	
Cd1	12/9/99-1217	1	1.00134	0.95-1.05	
Zn1	12/9/99-1217	1	1.00001	0.95-1.05	
Tl1		1		0.95-1.05	
Se1		1		0.95-1.05	
Sb1		1		0.95-1.05	
Hg1		0.8326		0.7909-0.8742	
In1		0.5611		0.5330-0.5891	
O2	12/9/99-1217	0.0555	0.05475	0.0527-0.0582	
C1	12/9/99-1217	0.021	0.02152	0.0199-0.0220	
S4	12/9/99-1217	0.1554	0.15605	0.1476-0.1631	
As1	12/13/99-830	0.258	0.24592	0.2451-0.2709	
Pb1	12/13/99-830	0.8375	0.86933	0.7956-0.8793	
Cd1	12/13/99-830	1	0.999875	0.95-1.05	
Zn1	12/13/99-830	1	1.00123	0.95-1.05	
Tl1		1		0.95-1.05	
Se1		1		0.95-1.05	
Sb1		1		0.95-1.05	
Hg1		0.8326		0.7909-0.8742	
In1		0.5611		0.5330-0.5891	
O2	12/13/99-830	0.0555	0.05534	0.0527-0.0582	
C1	12/13/99-830	0.021	0.02016	0.0199-0.0220	
S4	12/13/99-830	0.1554	0.15565	0.1476-0.1631	
As1	12/15/99-1030	0.258	0.25997	0.2451-0.2709	
Pb1	12/15/99-1030	0.8375	0.86708	0.7956-0.8793	
Cd1	12/15/99-1030	1	1.00342	0.95-1.05	
Zn1	12/15/99-1030	1	0.989997	0.95-1.05	
Tl1		1		0.95-1.05	
Se1		1		0.95-1.05	
Sb1		1		0.95-1.05	
Hg1		0.8326		0.7909-0.8742	
In1		0.5611		0.5330-0.5891	
O2	12/15/99-1030	0.0555	0.05517	0.0527-0.0582	
C1	12/15/99-1030	0.021	0.0201	0.0199-0.0220	
S4	12/15/99-1030	0.1554	0.15649	0.1476-0.1631	
As1	2/7/00	0.258	0.25986	0.2451-0.2709	
Pb1	2/7/00	0.8375	0.86954	0.7956-0.8793	
Cd1	2/7/00	1	1.01092	0.95-1.05	
Zn1	2/7/00	1	1.02842	0.95-1.05	
Tl1	2/7/00	1	1.00342	0.95-1.05	
Se1	2/7/00	1	0.99185	0.95-1.05	
Sb1	2/7/00	1	1.00728	0.95-1.05	
Hg2	2/7/00	0.8326	0.83202	0.7909-0.8742	
In1	2/7/00	0.5611	0.56593	0.5330-0.5891	
O2	2/7/00	0.0555	0.05629	0.0527-0.0582	
C1	2/7/00	0.021	0.02087	0.0199-0.0220	
S4	2/7/00	0.1554	0.15752	0.1476-0.1631	

TABLE 2A. Calibration Log

ANALYST: JWD **Reviewed By:** JWD **PROJECT** VBI70-99

Magnification Marker: 12/9/99 5/24/01 2/7/00 5/11/00 **Date:** 8/16/01

Standard Id	Date/Time	Known CF	Results	Acceptance Limits	Comments
As1	2/28/00	1	0.98	0.95-1.05	
Pb1	2/28/00	1	0.98	0.95-1.05	
Cd1	2/28/00	1	1.00056	0.95-1.05	
Zn1	2/28/00	1	1.01111	0.95-1.05	
Tl1		1		0.95-1.05	
Se1		1		0.95-1.05	
Sb1		1		0.95-1.05	
Hg2		1		0.95-1.05	
In1		1		0.95-1.05	
O2	2/28/00	1	0.96	0.95-1.05	
C1	2/28/00	1	1.00568	0.95-1.05	
S4	2/28/00	1	1.001	0.95-1.05	
As1	3/1/00	1	1.002	0.95-1.05	
Pb1	3/1/00	1	0.9883	0.95-1.05	
Cd1	3/1/00	1	1.0032	0.95-1.05	
Zn1	3/1/00	1	0.9986	0.95-1.05	
Tl1		1		0.95-1.05	
Se1		1		0.95-1.05	
Sb1		1		0.95-1.05	
Hg2		1		0.95-1.05	
In1		1		0.95-1.05	
O2	3/1/00	1	0.99974	0.95-1.05	
C1	3/1/00	1	1.00256	0.95-1.05	
S4	3/1/00	1	0.998	0.95-1.05	
As1	5/11/00	1	0.99933	0.95-1.05	
Pb1	5/11/00	1	0.99428	0.95-1.05	
Cd1	5/11/00	1	0.9987	0.95-1.05	
Zn1	5/11/00	1	0.997088	0.95-1.05	
Tl1		1		0.95-1.05	
Se1	5/11/00	1	0.9991	0.95-1.05	
Sb1	5/11/00	1	1.0018	0.95-1.05	
Hg2		1		0.95-1.05	
In1	5/11/00	1	0.983795	0.95-1.05	
O2	5/11/00	1	1.018724	0.95-1.05	
C1	5/11/00	1	1.01237	0.95-1.05	
S4	5/11/00	1	0.9993	0.95-1.05	
As1	5/15/00	1	0.979011	0.95-1.05	
Pb1	5/15/00	1	1.010028	0.95-1.05	
Cd1	5/15/00	1	1.00591	0.95-1.05	
Zn1	5/15/00	1	0.983538	0.95-1.05	
Tl1		1		0.95-1.05	
Se1	5/15/00	1	0.98692	0.95-1.05	
Sb1	5/15/00	1	1.008506	0.95-1.05	
Hg2		1		0.95-1.05	
In1	5/15/00	1	0.983795	0.95-1.05	
O2	5/15/00	1	1.018724	0.95-1.05	
C1	5/15/00	1	0.99987	0.95-1.05	
S4	5/15/00	1	0.995595	0.95-1.05	

TABLE 2A. Calibration Log

ANALYST: JWD **Reviewed By: JWD** **PROJECT** VBI70-99

Magnification Marker: 12/9/99 5/24/01 2/7/00 5/11/00 **Date:** 8/16/01

Standard Id	Date/Time	Known CF	Results	Acceptance Limits	Comments
As1	5/18/00	1	0.988433	0.95-1.05	
Pb1	5/18/00	1	1.010101	0.95-1.05	
Cd1	5/18/00	1	0.995039	0.95-1.05	
Zn1	5/18/00	1	0.983538	0.95-1.05	
Tl1		1		0.95-1.05	
Se1	5/18/00	1	0.98692	0.95-1.05	
Sb1	5/18/00	1	0.996417	0.95-1.05	
Hg2		1		0.95-1.05	
In1	5/18/00	1	0.998586	0.95-1.05	
O2	5/18/00	1	1.010101	0.95-1.05	
C1	5/18/00	1	1.00056	0.95-1.05	
S4	5/18/00	1	0.99207	0.95-1.05	
As1	5/31/00	1	1.005363	0.95-1.05	
Pb1	5/31/00	1	1.021219	0.95-1.05	
Cd1	5/31/00	1	1.012252	0.95-1.05	
Zn1	5/31/00	1	1.101475	0.95-1.05	
Tl1		1		0.95-1.05	
Se1	5/31/00	1	0.99692	0.95-1.05	
Sb1	5/31/00	1	0.999507	0.95-1.05	
Hg2		1		0.95-1.05	
In1	5/31/00	1	0.993774	0.95-1.05	
O2	5/31/00	1	1.028994	0.95-1.05	
C1	5/31/00	1	1.01435	0.95-1.05	
S4	5/31/00	1	1.002561	0.95-1.05	
As1	6/5/00	1	1.008288	0.95-1.05	
Pb1	6/5/00	1	1.005469	0.95-1.05	
Cd1	6/5/00	1	1.006869	0.95-1.05	
Zn1	6/5/00	1	1.015897	0.95-1.05	
Tl1		1		0.95-1.05	
Se1	6/5/00	1	0.993675	0.95-1.05	
Sb1	6/5/00	1	1.005555	0.95-1.05	
Hg2		1		0.95-1.05	
In1	6/5/00	1	1.004443	0.95-1.05	
O2	6/5/00	1	1.012543	0.95-1.05	
C1	6/5/00	1	0.98675	0.95-1.05	
S4	6/5/00	1	0.985506	0.95-1.05	
As1	6/8/00	1	1.012175	0.95-1.05	
Pb1	6/8/00	1	0.987815	0.95-1.05	
Cd1	6/8/00	1	1.006516	0.95-1.05	
Zn1	6/8/00	1	0.98483	0.95-1.05	
Tl1		1		0.95-1.05	
Se1	6/8/00	1	1.006423	0.95-1.05	
Sb1	6/8/00	1	1.006738	0.95-1.05	
Hg2		1		0.95-1.05	
In1	6/8/00	1	0.984306	0.95-1.05	
O2	6/8/00	1	1.007395	0.95-1.05	
C1	6/8/00	1	1.00453	0.95-1.05	
S4	6/8/00	1	1.003128	0.95-1.05	

TABLE 2A. Calibration Log

ANALYST: JWD **Reviewed By:** JWD **PROJECT** VBI70-99

Magnification Marker: 12/9/99 5/24/01 2/7/00 5/11/00 **Date:** 8/16/01

Standard Id	Date/Time	Known CF	Results	Acceptance Limits	Comments
As1	6/12/00	1	0.981629	0.95-1.05	
Pb1	6/12/00	1	1.016025	0.95-1.05	
Cd1	6/12/00	1	1.005673	0.95-1.05	
Zn1	6/12/00	1	994673	0.95-1.05	
Tl1		1		0.95-1.05	
Se1	6/12/00	1	0.998384	0.95-1.05	
Sb1	6/12/00	1	1.005742	0.95-1.05	
Hg2		1		0.95-1.05	
In1	6/12/00	1	0.997486	0.95-1.05	
O2	6/12/00	1	0.995267	0.95-1.05	
C1	6/12/00	1	0.99976	0.95-1.05	
S4	6/12/00	1	1.015496	0.95-1.05	
As1	7/9/01	1	1.007098	0.95-1.05	
Pb	7/9/01	1	1.01913	0.95-1.05	
Cd1	7/9/01	1	0.998804	0.95-1.05	
Zn1	7/9/01	1	1.010023	0.95-1.05	
Tl1	7/9/01	1		0.95-1.05	
Se1	7/9/01	1	1.011528	0.95-1.05	
Sb1	7/9/01	1	0.988427	0.95-1.05	
Cu	7/9/01	1	1.003513	0.95-1.05	
In1	7/9/01	1	0.993805	0.95-1.05	
O2	7/9/01	1	1.017659	0.95-1.05	
C1	7/9/01	1		0.95-1.05	
S	7/9/01	1	0.998486	0.95-1.05	

TABLE 3A. PHOTOMICROGRAPH LOG

PROJECT: VBI70 **Reviewed By; JWD**
DATE: 8/16/01
ANALYST: JWD

Sample ID	Particle #	Photo #	EDS Spectra ID
sc00011	20-21	1	sc11-1
sc00011	40-41	2	sc11.2
sc00011	60	3	sc11.3
sc00011	80	4	sc11.4
sc00011	100	5	sc11.5
sc00011	120	6	sc11.6
sc00011	140	7	sc11.7
sc00011	160	8	sc11.8
sc00011	181	9	sc11.9
sc00011	200	10	sc11.10
sc00015	20	1	sc15.1
sc00015		2	sc15.2
sc00015	37	3	sc15.3
sc00015		4	sc15.4
sc00015		5	sc15.5
sc00015	80	6	sc15.6
sc00015	100	7	sc15.7
sc00015	121	8	sc15.8
sc00015	140	9	sc15.9
sc00015	150-209	10	sc15.10
sc00015		11	sc15.11
sc00015	384-387	12	sc15.12
sc00015	406-408	13	sc15.13
sc00015b	144-146	14	sc15.14
sc0006	20	1	sc6.1
sc0006	40	2	sc6-2
sc0006	60	3	sc6-3
sc0006	80	4	sc6-4
sc0006	100	5	sc6-5
sc0006	120	6	sc6-6
sc0006	140	7	sc6-7
sc0006	160	8	sc6-8
sc0006	181	9	sc6-9
sc0006	200	10	sc6-10
sc0006	219	11	sc6-11
sc0006	227	12	sc6-12
sc0006	20	1	sc23-1

TABLE 3A. PHOTOMICROGRAPH LOG

PROJECT: VBI70 Reviewed By; JWD
DATE: 8/16/01
ANALYST: JWD

Sample ID	Particle #	Photo #	EDS Spectra ID
sc0006	27	1	sc23-1
sc0006	40	2	sc23-2
sc0006	65	3	sc23-3
sc0006	80-100	4	sc23-4
sc0006	108	5	sc23-5
sc0006	120	6	sc23-6
sc0006	140	7	sc23-7
sc0006	161	8	sc23-8
sc0006	183	9	sc23-9
sc0006	205	10	sc23-10
sc0006	6	1	sc38-1
sc0006	10	2	sc38-2
sc0006	22	3	sc38-3
sc0006	23	4	sc38-4
sc00039	24	1	sc39-1
sc00018	20	1	sc18-1
sc00018	40-60	2	sc18-2
sc00018	80	3	sc18-3
sc00018	111	4	sc18-4
sc00018	125	5	sc18-5
sc00018	142	6	sc18-6
sc00018	161	7	sc18-7
sc00018	180	8	sc18-8
sc00018	233	9	sc18-9
sc00018	252	10	sc18-10
sc00018	307	11	sc18-11
sc00018	309	12	sc18-12
sc00010	20	1	sc10-1
sc00010	39	2	sc10-2
sc00010	55	3	sc10-3
sc00010	56	4	sc10-4
sc00010	60	5	sc10-5
sc00010	237	6	sc10-6
SC00077	20	1	sc77-1
SC00077	40	2	sc77-2
SC00077	69	3	sc77-3
SC00077	83	4	sc77-4
SC00077	101	5	sc77-5

TABLE 3A. PHOTOMICROGRAPH LOG

PROJECT: VBI70
DATE: 8/16/01
ANALYST: JWD

Reviewed By; JWD

Sample ID	Particle #	Photo #	EDS Spectra ID
SC00077	120	6	sc77-6
SC00077	140	7	sc77-7
SC00077		8	sc77-8
SC00077	175	9	sc77-9
SC00077	180	10	sc77-10
SC00017	4	1	sc17-1
SC00035	16	1	sc35-1
SC00035	40	2	sc35-2
SC00035	as203	3	sc35-3
SC00035	57	4	sc35-4
sc00046	20	1	sc46-1
sc00046	37	2	sc46-2
sc00046	40	3	sc46-3
sc00046	60	4	sc46-4
sc00046	100	5	sc46-5
sc00046	120	6	sc46-6
sc00046	200	7	sc46-7
sc00046	248	8	sc46-8
sc00046	250	9	sc46-9
sc00046	257	10	sc46-10
sc00046		1	sc27-1
sc00046	12	2	sc27-2
sc00046	20	3	sc27-3
sc00046	40	4	sc27-4
sc00046	43	5	sc27-5
sc00065	6	1	sc65-1
sc00065	11	2	sc65-2
sc00084	7	1	sc84-1
sc00084	10	2	sc84-2
sc00084	17	3	sc84-3
sc00084	2	1	sc69-1
sc00084	10	2	sc69-2
sc00084	24	3	sc69-3
sc00084	30	4	sc69-4
sc00114	13	1	sc114-1
sc00114	25	2	sc114-2
SC00025	14	1	sc25-1
SC00025	32	2	sc25-2

TABLE 3A. PHOTOMICROGRAPH LOG

PROJECT: VBI70
DATE: 8/16/01
ANALYST: JWD

Reviewed By; JWD

Sample ID	Particle #	Photo #	EDS Spectra ID
SC00025	40	3	sc25-3
SC00104	20	1	sc104-1
SC00104	28	2	sc104-2
SC00104	40	3	sc104-3
SC00104	62	4	sc104-4
SC00104	80	5	sc104-5
SC00104	108	6	sc104-6
SC00104	120	7	sc104-7
SC00104	140	8	sc104-8
SC00104	163	9	sc104-9
SC00104	181	10	sc104-10
SC00104	216	11	sc104-11
SC00086	16	1	sc86-1
SC00086	21	2	sc86-2
SC00086	40	3	sc86-3
SC00086	51	4	sc86-4
SC00086	60	5	sc86-5
SC00048	7	1	sc48-1
SC00048		2	sc48-2
SC00048	50	3	sc48-3
SC00048	191	4	sc48-4
SC00043	1	1	sc43-1
SC00043	14	2	sc43-2
SC00043	31	3	sc43-3
SC00101	8	1	sc101-1
SC00070	24	1	sc70-1
SC00070	42?	2	sc70-2
SC00070	61	3	sc70-3
SC00070	79	4	sc70-4
SC00070	103	5	sc70-5
SC00070	123	6	sc70-6
SC00070		7	sc70-7
SC00070	160	8	sc70-8
SC00070	180	9	sc70-9
SC00070	190	10	sc70-10
SC00071		1	sc71-1
SC00071	100	2	sc71-2
SC00071	104	3	sc71-3

TABLE 3A. PHOTOMICROGRAPH LOG

PROJECT: VBI70 Reviewed By; JWD
DATE: 8/16/01
ANALYST: JWD

Sample ID	Particle #	Photo #	EDS Spectra ID
SC00083	20,40,60	1	sc83-1
SC00083	77	2	sc83-2
SC00083	83	3	sc83-3
SC00083	100	4	sc83-4
SC00101	po4	1	sc101-1
SC00101	14	2	sc101-2
3-12039b	10	1	12039b-1
3-12039b	20	2	12039b-2
3-10319b	20	1	10319-1
3-12039b	40	2	10319-2
3-12039b	60	3	10319-3
3-12039b	80	4	10319-4
3-12039b	100	5	10319-5
3-12039b	120	6	10319b-6,7
3-12039b	140		10319b-6,7
3-12035b	20	1	12035b-1
3-12035b	41	2	12035b-2
3-12035b	60	3	12035b-3
3-12035b	80	4	12035b-4
3-02246b-1	20	1	2246b-1
3-02246b-1	40	2	2246b-2
3-12040b	20	1	12040b-1
3-12040b	40	2	12040b-2
3-12151b	20	1	12151b-1
3-12151b	40	2	12151b-2
3-12151b	60	3	12151b-3

TABLE 4A. Summary of Site-Specific phase parameters.

Phase	Specific Gravity	Compositions (ppm) Pb	As	Cd	Sb	Zn
As2O3	4	220	673865	42	2292	293
As-AlO	4	41347	166947	15921	14523	7348
AsCaO	4	274	357918	51425	0	8691
AsCdCaO	5	18252	187966	113550	6609	13578
AsCdO	5	1889	225520	330369	1726	29114
AsFeO	5	40826	195773	17900	1588	13855
AsMO	5	57917	213683	30671	15193	17060
AsSbO	5	12405	280183	5716	149861	1821
CaSO4	2	11193	43354	46219	6474	2399
Clay	3	14261	15922	212	474	1260
CuZnSiO4	4	2162	0	0	0	336653
Fe Oxide	4	7204	6513	215	478	14132
Fe Sulfate	4	32233	156	128	213	2338
FeZnCuS	5	0	0	0	0	357490
Organic	2	15000	0	0	0	0
Mn Oxide	5	65498	5502	1005	155	16137
Native Pb	11	1000000	0	0	0	0
PbAsO	8	449608	96535	3386	644	1456
PbMO	7	297376	33463	13954	84670	12696
PbSiO4	6	244326	5154	14	4509	46106
Phosphate	5	283111	14103	288	419	5485
SbMO	4	141233	39608	2946	265669	11310
Slag	4	3947	0	8	133	51595
SnMO	6	93137	12589	0	0	11402
CdO	8			875000		
As	6		1000000			
Se	5					
PbCrO4	6	300000				
Zns	4					670000
CdS	5			778000		
CdMO	8	50000	30000	790000	4000	1600
AsPbSO4	6	584000	100000			
AsSiO4	5		100000			
Brass	7	1700			2400	400000
Solder	7	100000	500		1300	

TABLE 5A. Summary of EMPA Speciation.

		F%	E%-95**	RM-Pb	RM-As	RM-Zn	RM-Cd	RM-Sb	RM-Se	RM-Tl	RM-Hg	RM-In
SC00010	Anglesite	0.4%	1.4%	17.1%	0.0%	0.0%	0.0%	0.0%				
Particles 87	As2O3	1.5%	2.6%	0.0%	86.3%	0.0%	0.5%	21.4%				
	Fe Oxide	16.1%	8.1%	4.0%	6.3%	10.0%	28.5%	45.6%				
	Galena	0.3%	1.2%	19.3%	0.0%	0.0%	0.0%	0.0%				
	Mn Oxide	7.6%	5.6%	22.7%	3.3%	7.0%	60.1%	7.5%				
	PbAsO	0.1%	0.5%	1.7%	0.9%	0.0%	2.5%	0.3%				
	Perlite	42.2%	10.4%	0.0%	0.0%	0.0%	0.0%	0.0%				
	Phosphate	2.5%	3.3%	31.9%	3.2%	0.8%	6.9%	7.9%				
	Slag	25.1%	9.1%	3.4%	0.0%	54.8%	0.9%	17.3%				
	ZnS	0.2%	0.8%	0.0%	0.0%	5.0%	0.1%	0.0%				
	ZnSO4	2.1%	3.0%	0.0%	0.0%	22.4%	0.7%	0.0%				
SC00011	Anglesite	1.2%	1.4%	15.9%	0.0%	0.0%	0.0%	0.0%				
Particles 235	As2O3	0.0%	0.2%	0.0%	0.2%	0.0%	0.0%	0.0%				
	AsCaO	0.8%	1.1%	0.0%	3.0%	0.2%	0.2%	0.0%				
	AsCdO	19.6%	5.1%	0.6%	65.7%	23.1%	68.6%	13.4%				
	AsFeO	5.1%	2.8%	1.2%	11.3%	2.5%	0.9%	3.4%				
	AsMO	3.3%	2.3%	2.5%	8.5%	2.0%	0.9%	16.8%				
	Cd metal	1.3%	1.5%	0.0%	0.0%	0.0%	22.5%	0.0%				
	CdMO	0.3%	0.7%	0.3%	0.2%	0.0%	3.6%	0.8%				
	CdMSiO4	0.4%	0.9%	0.0%	0.0%	0.0%	2.8%	0.5%				
	Fe Oxide	3.2%	2.3%	0.2%	0.1%	1.2%	0.0%	0.4%				
	Fe Sulfate	8.0%	3.5%	2.9%	0.0%	0.5%	0.0%	0.5%				
	FeCuZnS	0.2%	0.6%	0.0%	0.0%	3.3%	0.0%	0.0%				
	Galena	0.8%	1.1%	15.3%	0.0%	0.0%	0.0%	0.0%				
	PbAsO	5.2%	2.8%	54.2%	10.6%	0.4%	0.2%	1.7%				
	PbMO	0.7%	1.0%	4.3%	0.4%	0.5%	0.1%	34.2%				
	PbO	0.0%	0.2%	0.5%	0.0%	0.0%	0.0%	0.0%				
	Perlite	4.5%	2.7%	0.0%	0.0%	0.0%	0.0%	0.0%				
	SbO	0.1%	0.3%	0.0%	0.0%	0.0%	0.0%	26.7%				
	Se	1.8%	1.7%	0.0%	0.0%	0.0%	0.0%	0.0%	96%			
	SeHg	0.1%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	2.50%		100%	
	SeO	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	1.10%			
	Slag	43.2%	6.3%	1.9%	0.0%	62.6%	0.0%	1.6%				
	Tl	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%		100%		
	ZnS	0.2%	0.6%	0.0%	0.0%	4.0%	0.0%	0.0%				
SC00015	As2O3	10.8%	2.3%	0.0%	49.7%	0.3%	0.2%	16.8%				
Particles 706	AsSbO	0.4%	0.5%	0.0%	0.9%	0.1%	1.1%	49.4%				
	Brass	0.2%	0.3%	0.0%	0.0%	14.1%	0.0%	0.1%				
	Cu-Se	0.1%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	6%			
	Fe Oxide	11.4%	2.3%	0.2%	0.3%	15.3%	1.0%	3.2%				
	Mn Oxide	12.0%	2.4%	2.6%	0.4%	26.7%	5.1%	1.3%				
	PbasO	37.2%	3.6%	86.0%	47.5%	9.6%	90.9%	24.9%				
	Perlite	12.5%	2.4%	0.0%	0.0%	0.0%	0.0%	0.0%				
	Phosphate	12.0%	2.4%	11.2%	1.3%	9.0%	1.8%	4.2%				
	Se-Cu	0.3%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	29%			
	Se-Cu-In	0.7%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	62.40%			80%
	SeCuO	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	1.80%			
	Se-In	0.1%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	11.70%			20%
	Slag	1.9%	1.0%	0.0%	0.0%	10.3%	0.0%	0.1%				
	ZnS	0.2%	0.3%	0.0%	0.0%	14.5%	0.0%	0.0%				
SC00017	Brass	6.1%	19.2%	5.9%	0.0%	88.1%	0.0%	11.7%				
Particles 6	Fe Oxide	44.9%	39.8%	94.1%	100.0%	11.9%	100.0%	88.3%				
	Perlite	49.0%	40.0%	0.0%	0.0%	0.0%	0.0%	0.0%				

TABLE 5A. Summary of EMPA Speciation.

		F%	E%-95**	RM-Pb	RM-As	RM-Zn	RM-Cd	RM-Sb	RM-Se	RM-Tl	RM-Hg	RM-In
SC00016	As2O3	6.5%	2.6%	0.0%	26.9%	0.1%	0.0%	1.1%				
Particles 351	AsAlO	8.2%	2.9%	4.4%	8.6%	2.8%	1.6%	3.3%				
	AsCaO	4.0%	2.0%	0.0%	8.6%	1.2%	2.0%	0.0%				
	AsCdO	6.9%	2.6%	0.2%	13.0%	12.4%	38.8%	1.0%				
	AsFeO	1.0%	1.0%	0.3%	1.2%	0.7%	0.3%	0.1%				
	AsMO	22.1%	4.3%	18.3%	32.1%	20.3%	9.8%	24.7%				
	AsSbO	0.5%	0.7%	0.1%	0.9%	0.0%	0.0%	5.9%				
	CaSO4	9.9%	3.1%	0.8%	1.6%	0.4%	2.3%	1.8%				
	CdO	1.9%	1.4%	0.0%	0.0%	0.0%	44.6%	0.0%				
	Fe Oxide	0.8%	0.9%	0.1%	0.0%	0.4%	0.0%	0.0%				
	PbAsO	6.2%	2.5%	70.5%	7.2%	0.7%	0.5%	0.4%				
	SbMO	1.2%	1.1%	4.0%	0.1%	0.1%	0.1%	37.2%				
	SbO	0.3%	0.6%	0.0%	0.0%	0.0%	0.0%	24.2%				
	Se	3.1%	1.8%	0.0%	0.0%	0.0%	0.0%	0.0%	98.40%			
	SeHg	0.1%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	1.60%		100%	
	Slag	27.3%	4.7%	1.3%	0.0%	60.8%	0.0%	0.2%				
	Tl	0.2%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%		100%		
SC00023	As2O3	0.8%	1.1%	0.0%	3.1%	0.0%	0.0%	0.1%				
Particles 223	AsAlO	31.9%	6.1%	10.4%	32.2%	18.1%	6.2%	10.7%				
	AsCdO	4.4%	2.7%	0.1%	8.0%	13.1%	24.1%	0.5%				
	AsFeO	8.4%	3.6%	1.3%	10.1%	10.3%	2.4%	1.0%				
	AsMO	24.0%	5.6%	12.1%	33.6%	36.4%	10.4%	22.5%				
	AsPbSO4	0.4%	0.8%	2.8%	0.4%	0.0%	0.0%	0.0%				
	AsSbO	0.1%	0.5%	0.0%	0.3%	0.0%	0.0%	1.5%				
	CaSO4	8.4%	3.6%	0.4%	1.3%	0.6%	1.9%	1.3%				
	CdMO	2.2%	1.9%	1.8%	0.8%	0.6%	44.7%	1.1%				
	CdS	0.7%	1.1%	0.0%	0.0%	0.0%	8.9%	0.0%				
	Clay	0.6%	1.0%	0.1%	0.0%	0.0%	0.0%	0.0%				
	Fe Oxide	3.4%	2.4%	0.2%	0.1%	3.1%	0.0%	0.1%				
	PbAsO	8.4%	3.6%	58.0%	9.3%	1.5%	0.6%	0.5%				
	PbMO	2.2%	1.9%	9.5%	0.8%	4.0%	0.7%	21.2%				
	PbSIO4	0.1%	0.4%	0.2%	0.0%	0.4%	0.0%	0.0%				
	SbMO	1.5%	1.6%	3.1%	0.1%	0.2%	0.1%	39.2%				
	Se	2.2%	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	100%			
	ZnS	0.2%	0.6%	0.0%	0.0%	11.5%	0.0%	0.0%				
SC00025	Cerussite	11.7%	9.4%	78.6%	0.0%	0.0%	0.0%	0.0%				
Particles 45	Fe Oxide	57.8%	14.4%	1.8%	60.4%	55.8%	76.5%	68.1%				
	Fe Sulfate	0.8%	2.6%	0.1%	0.0%	0.1%	0.6%	0.4%				
	PbSIO4	0.7%	2.5%	1.4%	1.4%	4.0%	0.1%	14.2%				
	Perlite	10.2%	8.8%	0.0%	0.0%	0.0%	0.0%	0.0%				
	Phosphate	9.7%	8.7%	17.9%	38.2%	5.3%	22.6%	14.4%				
	Slag	9.1%	8.4%	0.2%	0.0%	34.9%	0.3%	2.9%				
SC00027	As2O3	1.1%	3.1%	0.0%	77.1%	0.0%	0.2%	10.8%				
Particles 44	Brass	1.3%	3.3%	0.2%	0.0%	19.5%	0.0%	2.2%				
	Fe Oxide	33.2%	13.9%	9.1%	14.3%	9.3%	28.7%	58.8%				
	Fe-Zn Sulfate	0.2%	1.3%	0.0%	0.0%	0.2%	0.0%	0.0%				
	Mn Oxide	15.7%	10.8%	58.6%	8.5%	7.3%	68.2%	10.9%				
	Paint	7.9%	8.0%	24.5%	0.0%	27.7%	2.1%	1.3%				
	PbFeO	0.6%	2.3%	0.6%	0.0%	0.2%	0.0%	0.0%				
	Perlite	6.4%	7.3%	0.0%	0.0%	0.0%	0.0%	0.0%				
	Phosphate	0.1%	0.9%	1.6%	0.2%	0.0%	0.2%	0.2%				
	Se-Cu	0.2%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	21.50%			
	Se-In-Cu	0.8%	2.6%	0.0%	0.0%	0.0%	0.0%	0.0%	78.50%			100%
	Slag	32.5%	13.8%	5.4%	0.0%	35.9%	0.6%	15.8%				

TABLE 5A. Summary of EMPA Speciation.

		F%	E%-95**	RM-Pb	RM-As	RM-Zn	RM-Cd	RM-Sb	RM-Se	RM-Tl	RM-Hg	RM-In
SC00035	As2O3	1.7%	3.2%	0.0%	53.6%	0.0%	0.0%	0.3%				
Particles 63	Brass	1.5%	3.0%	0.0%	0.0%	41.5%	0.0%	0.0%				
	Cu-Se	2.1%	3.6%	0.0%	0.0%	0.0%	0.0%	0.0%	60.30%			
	Fe Oxide	12.9%	8.3%	0.4%	2.4%	6.4%	1.0%	0.4%				
	Mn Oxide	26.9%	10.9%	12.2%	6.3%	22.3%	10.5%	0.3%				
	PbCrO4	9.2%	7.1%	24.7%	0.0%	0.0%	0.0%	0.0%				
	PbMO	8.8%	7.0%	26.3%	24.4%	8.5%	85.9%	98.3%				
	Perlite	15.4%	8.9%	0.0%	0.0%	0.0%	0.0%	0.0%				
	Phosphate	18.6%	9.6%	36.4%	13.2%	5.2%	2.6%	0.7%				
	SeMO	2.3%	3.7%	0.0%	0.0%	0.0%	0.0%	0.0%	39.70%			
	ZnS	0.6%	1.9%	0.0%	0.0%	16.0%	0.0%	0.0%				
SC00038	Fe Oxide	35.6%	17.1%	6.1%	44.6%	25.1%	16.7%	28.4%				
Particles 30	Mn Oxide	32.2%	16.7%	74.1%	50.3%	37.7%	75.4%	10.0%				
	PbMO	0.1%	1.3%	2.0%	2.4%	0.2%	7.7%	40.0%				
	PbSiO4	0.9%	3.4%	9.7%	2.3%	3.8%	0.0%	12.6%				
	Perlite	17.8%	13.7%	0.0%	0.0%	0.0%	0.0%	0.0%				
	Slag	12.0%	11.6%	1.2%	0.0%	33.3%	0.1%	2.6%				
	Solder	1.3%	4.1%	6.9%	0.4%	0.0%	0.0%	6.3%				
SC00039	Cu-Se-In	1.9%	4.8%	0.0%	0.0%	0.0%	0.0%	0.0%	100%			100%
Particles 31	Fe Oxide	59.2%	17.3%	6.6%	51.0%	73.1%	47.3%	75.9%				
	Mn Oxide	8.9%	10.0%	13.5%	9.6%	18.4%	35.6%	4.5%				
	Perlite	17.6%	13.5%	0.0%	0.0%	0.0%	0.0%	0.0%				
	Phosphate	12.2%	11.5%	79.8%	39.4%	8.5%	17.1%	19.6%				
SC00043	As2O3	6.3%	8.0%	0.0%	90.7%	0.1%	0.6%	33.2%				
Particles 35	Fe Oxide	54.0%	16.5%	7.8%	4.8%	37.0%	24.2%	51.2%				
	Mn Oxide	32.3%	15.5%	63.1%	3.6%	36.9%	72.5%	12.0%				
	Paint	2.9%	5.6%	4.7%	0.0%	24.8%	0.4%	0.3%				
	Phosphate	2.9%	5.6%	24.4%	1.0%	1.1%	2.3%	3.4%				
	Se-Cu-In	1.7%	4.3%	0.0%	0.0%	0.0%	0.0%	0.0%	100%			100%
SC00046	As2O3	4.3%	2.5%	0.0%	53.1%	0.1%	0.2%	33.7%				
Particles 260	Brass	1.0%	1.2%	0.0%	0.0%	40.1%	0.0%	1.3%				
	Cu-Zn-SiO2	2.1%	1.7%	0.0%	0.0%	38.7%	0.0%	0.0%				
	Fe Oxide	10.2%	3.7%	0.5%	0.8%	7.8%	2.5%	14.4%				
	Fe Sulfate	0.5%	0.8%	0.1%	0.0%	0.1%	0.1%	0.3%				
	Galena	0.1%	0.4%	1.3%	0.0%	0.0%	0.0%	0.0%				
	Mn Oxide	1.9%	1.7%	1.2%	0.2%	2.4%	2.3%	1.0%				
	PbAsO	13.1%	4.1%	89.3%	45.3%	1.9%	94.0%	44.5%				
	PbCrO4	0.5%	0.9%	1.9%	0.0%	0.0%	0.0%	0.0%				
	Perlite	60.8%	5.9%	0.0%	0.0%	0.0%	0.0%	0.0%				
	Phosphate	2.0%	1.7%	5.5%	0.6%	0.9%	0.9%	3.5%				
	Se	0.6%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	72.30%			
	Se-In-Cu	0.4%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	27.70%			100%
	Slag	2.7%	2.0%	0.1%	0.0%	8.1%	0.0%	1.0%				
SC00048	Cerussite	0.2%	0.6%	21.6%	0.0%	0.0%	0.0%	0.0%				
Particles 210	Fe Oxide	3.6%	2.5%	2.1%	28.6%	46.9%	22.6%	54.2%				
	Fe Sulfate	0.2%	0.6%	0.5%	0.1%	0.4%	0.7%	1.3%				
	Mn Oxide	1.8%	1.8%	14.5%	18.1%	39.6%	57.1%	10.7%				
	Perlite	92.5%	3.6%	0.0%	0.0%	0.0%	0.0%	0.0%				
	Phosphate	1.8%	1.8%	61.3%	53.3%	13.1%	19.7%	33.7%				

TABLE 5A. Summary of EMPA Speciation.

		F%	E%-95**	RM-Pb	RM-As	RM-Zn	RM-Cd	RM-Sb	RM-Se	RM-Tl	RM-Hg	RM-In
SC0006	As Metal	0.3%	0.6%	0.0%	6.7%	0.0%	0.0%	0.0%				
Particles 307	As2O3	2.9%	1.9%	0.0%	27.1%	0.1%	0.1%	13.8%				
	AsFeO	0.5%	0.8%	0.0%	1.3%	0.9%	6.0%	2.0%				
	Chalcopyrite	7.3%	2.9%	0.0%	0.0%	0.0%	0.0%	0.0%				
	Fe Oxide	24.7%	4.8%	0.6%	1.4%	37.5%	2.8%	21.0%				
	Fe Sulfate	1.2%	1.2%	0.1%	0.0%	0.3%	0.1%	0.5%				
	Galena	0.3%	0.6%	2.2%	0.0%	0.0%	0.0%	0.0%				
	Mn Oxide	19.4%	4.4%	6.5%	1.4%	49.0%	11.1%	6.4%				
	PbAsO	23.9%	4.8%	86.0%	61.6%	7.0%	79.3%	48.8%				
	PbSIO4	0.3%	0.6%	0.5%	0.0%	2.9%	0.0%	4.8%				
	Perlite	16.6%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%				
	Phosphate	2.7%	1.8%	3.9%	0.6%	2.3%	0.5%	2.8%				
SC00065	Brass	9.5%	15.3%	1.5%	0.0%	95.5%	0.0%	26.4%				
Particles 14	Chalcopyrite	6.0%	12.4%	0.0%	0.0%	0.0%	0.0%	0.0%				
	Fe Oxide	22.8%	22.0%	7.6%	71.3%	4.2%	84.2%	64.9%				
	PbCrO4	1.6%	6.6%	43.4%	0.0%	0.0%	0.0%	0.0%				
	Perlite	57.7%	25.9%	0.0%	0.0%	0.0%	0.0%	0.0%				
	Phosphate	2.4%	8.1%	47.5%	28.7%	0.3%	15.8%	8.7%				
SC00069	As2O3	26.6%	12.0%	0.1%	96.2%	0.7%	0.9%	10.7%				
Particles 52	Cerussite	1.1%	2.8%	19.3%	0.0%	0.0%	0.0%	0.0%				
	Cu-Se	0.1%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100%			
	Fe Oxide	39.6%	13.3%	3.3%	0.9%	43.9%	6.7%	2.9%				
	Fe Sulfate	0.3%	1.4%	0.1%	0.0%	0.0%	0.0%	0.0%				
	Mn Oxide	25.2%	11.8%	28.3%	0.7%	46.6%	21.2%	0.7%				
	PbAsO	1.0%	2.6%	11.4%	1.0%	0.2%	4.6%	0.2%				
	PbMO	3.1%	4.7%	23.1%	1.0%	6.7%	65.6%	85.3%				
	Phosphate	3.0%	4.6%	14.5%	0.2%	1.9%	0.9%	0.3%				
SC00070	AsAlO	9.8%	3.1%	5.2%	9.3%	2.7%	0.9%	10.4%				
Particles 359	AsCaO	4.9%	2.2%	0.0%	9.6%	1.2%	1.2%	0.0%				
	AsCdCaO	6.9%	2.6%	2.1%	7.8%	4.1%	5.5%	9.9%				
	AsCdO	34.6%	4.9%	1.1%	59.3%	49.7%	91.3%	13.6%				
	AsFeO	3.1%	1.8%	0.8%	3.5%	1.8%	0.4%	1.2%				
	AsMO	1.4%	1.2%	1.1%	1.8%	1.0%	0.3%	4.1%				
	AsSbO	0.6%	0.8%	0.1%	1.1%	0.0%	0.0%	21.1%				
	Clay	1.9%	1.4%	0.3%	0.1%	0.1%	0.0%	0.1%				
	Fe Oxide	6.3%	2.5%	0.5%	0.1%	2.8%	0.0%	0.5%				
	Fe Sulfate	0.1%	0.4%	0.1%	0.0%	0.0%	0.0%	0.0%				
	PbAsO	6.5%	2.5%	72.7%	6.8%	0.6%	0.2%	1.2%				
	PbMO	1.2%	1.1%	8.2%	0.4%	1.0%	0.2%	35.5%				
	PbSiO4	1.4%	1.2%	6.9%	0.1%	3.7%	0.0%	1.9%				
	Pyrite	0.8%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%				
	Se	2.0%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	83.00%			
	SeHg	0.6%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	11.90%			
	SeMO	0.2%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	4.90%			
	Slag	17.6%	3.9%	0.8%	0.0%	31.3%	0.0%	0.4%				
SC00071	Fe Oxide	2.8%	3.1%	0.1%	93.4%	0.4%	19.1%	2.2%				
Particles 106	Fe-Zn-S	7.6%	5.0%	0.0%	0.0%	56.4%	0.0%	0.0%				
	Galena	7.1%	4.9%	96.9%	0.0%	0.0%	0.0%	0.0%				
	PbSbO	0.1%	0.6%	0.4%	6.6%	0.0%	68.0%	80.2%				
	Se-In-Cu	0.3%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100%			100%
	Slag	82.2%	7.3%	2.5%	0.0%	43.3%	12.9%	17.7%				

TABLE 5A. Summary of EMPA Speciation.

		F%	E%-95**	RM-Pb	RM-As	RM-Zn	RM-Cd	RM-Sb	RM-Se	RM-Tl	RM-Hg	RM-In
SC00077	As2O3	7.3%	2.9%	0.0%	24.5%	0.1%	0.0%	1.6%				
Particles 303	AsAlO	10.7%	3.5%	6.9%	9.1%	5.6%	2.1%	5.7%				
	AsCaO	4.7%	2.4%	0.0%	8.1%	2.1%	2.3%	0.0%				
	AsCdO	14.8%	4.0%	0.6%	22.5%	40.3%	82.8%	2.9%				
	AsFeO	7.0%	2.9%	2.2%	7.0%	7.8%	2.0%	1.4%				
	AsMO	19.2%	4.4%	19.1%	22.4%	26.5%	8.5%	28.2%				
	AsSbO	0.7%	0.9%	0.1%	1.0%	0.1%	0.1%	11.2%				
	AsSiO4	0.4%	0.7%	0.0%	0.2%	0.0%	0.0%	0.0%				
	CaSO4	5.1%	2.5%	0.5%	0.6%	0.3%	1.1%	1.2%				
	Clay	2.6%	1.8%	0.4%	0.2%	0.2%	0.0%	0.1%				
	Fe Oxide	14.5%	4.0%	1.4%	0.3%	12.3%	0.0%	0.6%				
	Fe Sulfate	1.0%	1.1%	0.5%	0.0%	0.1%	0.0%	0.0%				
	PbAsO	3.5%	2.1%	47.1%	3.2%	0.6%	0.3%	0.3%				
	PbMO	2.4%	1.7%	20.0%	0.7%	3.9%	0.6%	35.4%				
	Perlite	1.0%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%				
	SbMO	0.3%	0.6%	1.1%	0.0%	0.0%	0.0%	11.4%				
	Se	4.7%	2.4%	0.0%	0.0%	0.0%	0.0%	0.0%	97.90%			
	SeHg	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.15%		100%	
	SeTl	0.2%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	1.90%	100%		
SC00083	Fe Oxide	3.2%	3.0%	1.0%	19.3%	0.2%	8.5%	2.2%				
Particles 134	Fe-Zn-S	18.3%	6.5%	0.0%	0.0%	77.3%	0.0%	0.0%				
	Galena	0.7%	1.4%	59.1%	0.0%	0.0%	0.0%	0.0%				
	Mn Oxide	3.0%	2.9%	12.7%	22.6%	0.4%	40.0%	0.8%				
	PbAsO	0.2%	0.8%	9.0%	55.2%	0.0%	15.4%	0.3%				
	PbSbO	0.1%	0.5%	3.1%	1.4%	0.0%	31.3%	82.9%				
	Phosphate	0.1%	0.4%	1.2%	1.5%	0.0%	0.3%	0.1%				
	Se-In-Cu	0.7%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	100%			100%
	Slag	73.7%	7.5%	13.9%	0.0%	22.1%	4.5%	13.7%				
SC00084	As2O3	0.6%	3.0%	0.0%	34.2%	0.0%	0.1%	0.4%				
Particles 27	AsSbO	1.5%	4.5%	0.4%	36.3%	0.1%	28.1%	74.0%				
	Fe Oxide	37.9%	18.3%	4.8%	12.6%	19.1%	23.0%	4.4%				
	Mn Oxide	1.5%	4.5%	2.5%	0.6%	1.2%	4.4%	0.1%				
	PbMO	0.4%	2.4%	4.7%	2.0%	0.4%	31.6%	18.5%				
	Perlite	16.7%	14.1%	0.0%	0.0%	0.0%	0.0%	0.0%				
	Phosphate	11.5%	12.0%	85.3%	14.3%	3.3%	12.2%	1.7%				
	Slag	29.3%	17.2%	2.3%	0.0%	58.3%	0.4%	0.9%				
	ZnS	0.6%	3.0%	0.0%	0.0%	17.6%	0.1%	0.0%				
SC00086	As2O3	11.9%	7.9%	0.1%	85.6%	0.4%	0.8%	4.2%				
Particles 65	AsMO	0.2%	1.1%	0.5%	0.5%	0.4%	11.0%	0.5%				
	AsSbO	3.2%	4.3%	1.7%	10.4%	0.7%	31.2%	87.4%				
	Fe Oxide	36.8%	11.7%	8.7%	1.6%	47.8%	11.4%	2.3%				
	Mn Oxide	23.1%	10.2%	73.5%	1.3%	49.9%	35.8%	0.6%				
	PbAsO	0.2%	1.1%	7.0%	0.4%	0.1%	1.8%	0.0%				
	PbMO	0.2%	1.1%	4.3%	0.1%	0.5%	7.9%	4.9%				
	Perlite	24.1%	10.4%	0.0%	0.0%	0.0%	0.0%	0.0%				
	Phosphate	0.3%	1.3%	4.2%	0.1%	0.2%	0.2%	0.0%				
SC00101	Fe Oxide	8.8%	14.4%	0.4%	4.4%	2.1%	3.0%	14.8%				
Particles 15	Mn Oxide	39.9%	24.8%	22.4%	24.6%	15.9%	68.2%	26.1%				
	Paint	26.3%	22.3%	12.3%	0.0%	78.7%	2.7%	4.1%				
	PbAsO	1.2%	5.5%	7.2%	26.9%	0.1%	11.8%	4.8%				
	Phosphate	23.9%	21.6%	57.8%	44.2%	3.2%	14.3%	50.1%				

TABLE 5A. Summary of EMPA Speciation.

		F%	E%-95**	RM-Pb	RM-As	RM-Zn	RM-Cd	RM-Sb	RM-Se	RM-Ti	RM-Hg	RM-In
SC00104	As2O3	10.5%	3.6%	0.0%	76.8%	0.2%	0.5%	10.8%				
Particles 285	AsFeO	0.7%	0.9%	0.1%	1.5%	0.6%	16.2%	0.6%				
	AsSbO	0.5%	0.8%	0.1%	1.8%	0.1%	3.6%	42.1%				
	Brass	1.5%	1.4%	0.0%	0.0%	50.0%	0.0%	0.3%				
	Cerussite	0.3%	0.6%	2.4%	0.0%	0.0%	0.0%	0.0%				
	Clay	4.6%	2.4%	0.3%	0.6%	0.2%	0.8%	0.8%				
	Fe Oxide	24.1%	5.0%	1.0%	1.1%	15.3%	5.2%	4.4%				
	Galena	0.1%	0.3%	0.8%	0.0%	0.0%	0.0%	0.0%				
	HgS	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%			100%	
	Mn Oxide	15.9%	4.2%	9.1%	0.9%	16.9%	17.3%	1.1%				
	Mo-Cu-Ga-In	1.3%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%				100%
	PbAsO	7.0%	3.0%	42.3%	14.2%	0.9%	43.8%	3.1%				
	PbMO	0.2%	0.5%	0.7%	0.1%	0.2%	5.4%	13.8%				
	Perlite	15.4%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%				
	Phosphate	17.6%	4.4%	43.0%	2.9%	6.3%	6.7%	4.1%				
	SbMO	0.1%	0.4%	0.2%	0.0%	0.0%	0.6%	18.8%				
	SnMO	0.1%	0.3%	0.1%	0.0%	0.1%	0.0%	0.0%				
	ZnS	0.3%	0.6%	0.0%	0.0%	9.4%	0.0%	0.0%				
SC00105	As2O3	23.4%	27.7%	0.1%	97.2%	0.8%	5.3%	62.1%				
Particles 9	Fe Oxide	64.9%	31.2%	8.7%	1.6%	90.1%	72.0%	30.9%				
	Phosphate	11.7%	21.0%	91.2%	1.1%	9.1%	22.7%	7.0%				
SC00114	Brass	7.4%	8.2%	0.6%	0.0%	69.9%	0.0%	10.7%				
Particles 39	Fe Oxide	43.7%	15.6%	8.1%	53.0%	7.6%	21.6%	64.9%				
	Mn Oxide	30.9%	14.5%	77.3%	46.8%	9.0%	77.1%	17.9%				
	Paint	4.9%	6.8%	10.3%	0.0%	10.8%	0.7%	0.7%				
	Perlite	12.3%	10.3%	0.0%	0.0%	0.0%	0.0%	0.0%				
	Solder	0.7%	2.5%	3.7%	0.2%	0.0%	0.0%	5.8%				
	ZnO	0.2%	1.3%	0.0%	0.0%	2.7%	0.3%	0.0%				
3-2246B	Cerussite	4.9%	6.1%	33.4%	0.0%	0.0%	0.0%	0.0%				
Particles 48	Clay	1.0%	2.8%	0.1%	3.8%	0.0%	1.1%	0.4%				
	Fe Oxide	9.6%	8.3%	0.3%	11.9%	1.2%	13.8%	3.7%				
	Mn Oxide	4.9%	6.1%	2.1%	7.6%	1.0%	35.2%	0.7%				
	Paint	54.6%	14.1%	19.7%	0.0%	86.5%	23.6%	2.0%				
	PbSIO4	13.4%	9.7%	26.3%	32.2%	9.6%	2.0%	87.9%				
	Phosphate	9.6%	8.3%	17.9%	44.6%	0.7%	24.2%	4.6%				
	Slag	1.6%	3.6%	0.0%	0.0%	0.6%	0.1%	0.2%				
	Solder	0.2%	1.3%	0.2%	0.1%	0.0%	0.0%	0.4%				
3-12151B	Fe Oxide	44.5%	9.4%	2.6%	28.4%	30.6%	28.1%	52.0%				
Particles 108	Fe-Zn Sulfate	1.7%	2.4%	0.0%	0.0%	3.9%	0.0%	0.0%				
	Galena	0.1%	0.4%	0.6%	0.0%	0.0%	0.0%	0.0%				
	Mn Oxide	13.8%	6.5%	10.8%	11.0%	15.8%	43.6%	6.3%				
	Phosphate	25.4%	8.2%	85.3%	60.6%	9.8%	28.0%	37.0%				
	Slag	14.6%	6.7%	0.5%	0.0%	39.8%	0.2%	4.7%				
3-12040B	Anglesite	0.4%	1.4%	1.9%	0.0%	0.0%	0.0%	0.0%				
Particles 78	Cerussite	12.8%	7.4%	67.6%	0.0%	0.0%	0.0%	0.0%				
	Fe Oxide	6.1%	5.3%	0.2%	29.7%	1.0%	23.9%	32.2%				
	Fe-Zn Sulfate	1.5%	2.7%	0.0%	0.0%	0.9%	0.0%	0.0%				
	Galena	1.9%	3.1%	13.0%	0.0%	0.0%	0.0%	0.0%				
	Paint	41.3%	10.9%	11.5%	0.0%	87.5%	48.4%	20.4%				
	Perlite	16.8%	8.3%	0.0%	0.0%	0.0%	0.0%	0.0%				

TABLE 5A. Summary of EMPA Speciation.

		F%	E%-95**	RM-Pb	RM-As	RM-Zn	RM-Cd	RM-Sb	RM-Se	RM-Tl	RM-Hg	RM-In
	Phosphate	3.9%	4.3%	5.6%	70.3%	0.4%	26.4%	25.4%				
	Slag	15.3%	8.0%	0.2%	0.0%	10.2%	1.4%	22.0%				
3-12039B	Cerussite	1.5%	2.7%	12.4%	0.0%	0.0%	0.0%	0.0%				
Particles 76	Cu-Zn-SiO2	3.3%	4.0%	0.0%	0.0%	17.8%	0.0%	0.0%				
	Fe Oxide	32.2%	10.5%	1.3%	20.6%	7.1%	27.5%	42.0%				
	Fe Sulfate	2.0%	3.1%	0.4%	0.0%	0.1%	0.9%	1.2%				
	Mn Oxide	4.1%	4.5%	2.2%	3.3%	1.5%	17.6%	2.1%				
	Paint	25.3%	9.8%	11.2%	0.0%	69.6%	6.5%	3.1%				
	Phosphate	31.7%	10.5%	72.6%	76.1%	3.9%	47.5%	51.7%				
3-12035B	Cerussite	4.1%	4.1%	33.7%	0.0%	0.0%	0.0%	0.0%				
Particles 91	Clay	5.6%	4.7%	0.4%	17.9%	0.1%	5.5%	11.6%				
	Fe Oxide	7.6%	5.4%	0.3%	7.8%	1.5%	9.7%	16.2%				
	Fe-Zn Sulfate	0.3%	1.1%	0.0%	0.0%	0.2%	0.0%	0.0%				
	Galena	0.1%	0.7%	1.1%	0.0%	0.0%	0.0%	0.0%				
	Mn Oxide	5.2%	4.6%	2.7%	6.7%	1.7%	33.0%	4.3%				
	Organic	4.8%	4.4%	0.2%	0.0%	0.0%	0.0%	0.0%				
	Paint	32.3%	9.6%	14.1%	0.0%	77.9%	12.4%	6.5%				
	Native Pb	0.4%	1.3%	7.5%	0.0%	0.0%	0.0%	0.0%				
	Phosphate	17.4%	7.8%	39.3%	67.5%	1.9%	38.8%	46.5%				
	Slag	22.1%	8.5%	0.5%	0.0%	16.8%	0.6%	13.0%				
	Solder	0.2%	0.8%	0.2%	0.0%	0.0%	0.0%	1.9%				
3-10319B	Fe Oxide	16.9%	6.0%	0.9%	14.0%	6.7%	20.5%	25.7%				
Particles 151	Fe Sulfate	0.6%	1.3%	0.2%	0.0%	0.0%	0.4%	0.4%				
	Fe-Zn Sulfate	3.1%	2.7%	0.0%	0.0%	4.1%	0.0%	0.0%				
	Galena	1.1%	1.6%	14.7%	0.0%	0.0%	0.0%	0.0%				
	Mn Oxide	3.5%	2.9%	2.5%	3.7%	2.3%	21.4%	2.1%				
	Paint	1.4%	1.9%	0.8%	0.0%	7.0%	0.5%	0.2%				
	Phosphate	26.4%	7.0%	79.2%	82.3%	5.9%	56.0%	50.2%				
	Slag	46.9%	8.0%	1.5%	0.0%	73.9%	1.3%	19.6%				
	Solder	0.2%	0.7%	0.3%	0.0%	0.0%	0.0%	1.8%				

** Counting error at 95% confidence limit.

Bioaccessibility

Table 6A. Bioavailability Estimates for VBI70 Samples.

Run at 1.5pH for 1 hr @ 39*c	As in bulk soil	mass soil (g)	calc As #1	ICP As (mg/l)	solution amt (l)	%As RBA	pH Stop
Plant							
SC-00018	41708	1.00217	41.80	221	0.1	53	1.565
SC-00011	28961	1.0037	29.07	167.54	0.1	58	1.603
SC-00023	15595	1.00279	15.64	59.12	0.1	38	1.572
SC-00070	21904	1.00818	22.08	118.35	0.1	54	1.601
SC00077	29323	1.00414	29.44	162.806	0.1	55	1.618
Focal Soils							
SC-00015	1788	1.00337	1.79	9.27	0.1	52	1.59
SC-00043	148	1.00902	0.15	0.803	0.1	54	1.57
SC-00027	148	1.00792	0.15	0.754	0.1	51	1.552
SC-00038	24	1.00354	0.02	0.09	0.1	37	1.558
SC-00086	212	1.00858	0.21	0.826	0.1	39	1.543
SC-00010	207	1.00402	0.21	0.99	0.1	48	1.549
SC-00046	1707	1.00031	1.71	9.13	0.1	53	1.571
SC-00083	9	1.00941	0.01	0.041	0.1	45	1.566
SC-00084	21	1.00386	0.02	0.105	0.1	50	1.567
SC00104	1221	1.00237	1.22	5.484	0.1	45	1.582
SC00039	28	1.00442	0.03	0.109	0.1	39	1.538
SC-0006	950	1.0041	0.95	5.485	0.1	58	1.575
Adjacent Soils							
SC-00114	38	1.00413	0.04	0.084	0.1	22	1.579
SC-00025	20	1.00297	0.02	0.113	0.1	56	1.588
SC-00017	8	1.00144	0.01	0.059	0.1	74	1.548
SC-00101	8	1.00698	0.01	0.019	0.1	24	1.561
SC-00069	13	1.00518	0.01	0.043	0.1	33	1.571
SC-00035	15	1.00705	0.02	0.07	0.1	46	1.538
SC00105	17	1.00656	0.02	0.08	0.1	47	1.551
SC00048	40	1.00261	0.04	0.285	0.1	71	1.57
Background Soils							
SC-00071	8	1.00335	0.01	0.045	0.1	56	1.556
SC00065	7	1.00326	0.01	0.008	0.1	11	1.576
PAX	220000	1.0019	220.42	1013	0.1	46	1.587
ACME	251300	1.00487	252.52	460	0.1	18	1.633
PAX	220000	0.40519	89.14	72.6	0.1	8	1.548

BIOACCESSIBILITY

Table 6A. Bioavailability Estimates for VBI70 Samples.

Run at 1.5pH for 1 hr @ 39°c	As in bulk soil	mass soil (g)	calc As #1	ICP As (mg/l)	solution amt (l)	%As RBA	pH Stop
ACME	251300	0.40068	100.69	418.4	0.1	42	1.544
PAX	220000	0.40953	90.10	105.1	0.1	12	1.571
ACME	251300	0.40177	100.96	431.3	0.1	43	1.572
QA/QC							
Blank-Spike	1			0.91			1.54
Reagent BLANK	0			0.00			1.568
Reagent BLANK	0			-0.005			1.57
Blank	0			0.01			1.52
Blank-Spike	1			1			1.53
Blank	0			0.022			1.547
SC-00025-PD	20	1.00559	0.02	0.106	0.1	53	1.562
SC-00017-AD	8	1.00144	0.01	0.038	0.1	47	1.548
SC-00018-PD	41708	1.00471	41.90	238.5	0.1	57	1.549
SC-00046-PD	1707	1.00014	1.71	9.17	0.1	54	1.54
SC-00011-PD	28961	1.0004	28.97	183.7	0.1	63	1.56
SC-00025-PD	20	1.00006	0.02	0.15	0.1	75	1.535
SC-00025-AD	20	1.00006	0.02	0.16	0.1	80	1.535
SC-00084-Spike		1.00682		1.05			1.556
SC-00048-Spike		0.99844		1.11			1.553
SC-00043-PD	148	1.00454	0.15	0.82	0.1	55	1.561
SC-00038-PD	24	1.00181	0.02	0.08	0.1	33	1.559
SC-00084-PD	21	0.99262	0.02	0.1	0.1	48	1.563
SC-00048-PD	40	1.0192	0.04	0.20	0.1	49	1.604
NIST-2710	626	1.0024	0.63	3.53	0.1	56	1.552
NIST-2711	105	1.0037	0.11	0.54	0.1	51	1.61

PD= Process duplicate
AD= Analytical duplicate

Table 6A. Bioavailability Estimates for VBI70 Samples.

Run at 1.5pH for 1 hr @ 39°c	Pb in bulk soil	mass soil (g)	calc Pb #1	ICP Pb (mg/l)	solution amt (l)	%Pb RBA	pH Stop
Plant							
SC-00018	9883	1.00217	9.90	63.53	0.1	64	1.565
SC-00011	7816	1.0037	7.84	51.67	0.1	66	1.603
SC-00023	4574	1.00279	4.59	34.163	0.1	74	1.572
SC-00070	5885	1.00818	5.93	39.916	0.1	67	1.601
SC00077	9038	1.00414	9.08	53.09	0.1	58	1.618
Adjacent Soils							
SC-00035	248	1.00705	0.25	1.923	0.1	77	1.538
SC-00101	135	1.00698	0.14	1.048	0.1	77	1.561
SC-00083	175	1.00941	0.18	1.507	0.1	85	1.566
SC-00084	230	1.00386	0.23	1.871	0.1	81	1.567
SC-00069	172	1.00518	0.17	1.507	0.1	87	1.571
SC-00017	54	1.00144	0.05	0.43	0.1	80	1.548
SC00048	307	1.00261	0.31	2.44	0.1	79	1.57
SC00105	107	1.00656	0.11	0.77	0.1	72	1.551
Focal Soils							
SC-00010	506	1.00402	0.51	3.975	0.1	78	1.549
SC-00086	262	1.00858	0.26	2.172	0.1	82	1.543
SC-00027	165	1.00792	0.17	1.222	0.1	73	1.552
SC-00038	212	1.00354	0.21	1.539	0.1	72	1.558
SC-00043	172	1.00902	0.17	1.252	0.1	72	1.57
SC-00015	2081	1.00337	2.09	20.026	0.1	96	1.59
SC-00114	112	1.00413	0.11	0.86	0.1	76	1.579
SC-0006	2014	1.0041	2.02	18.368	0.1	91	1.575
SC-00025	159	1.00297	0.16	1.264	0.1	79	1.588
SC-00046	2203	1.00031	2.20	20.69	0.1	94	1.571
SC00039	112	1.00442	0.11	0.80	0.1	71	1.538
SC00104	1333	1.00237	1.34	11.96	0.1	89	1.582
Background Soils							
SC-00071	162	1.00335	0.16	1.38	0.1	85	1.556
SC00065	175	1.00326	0.18	1.27	0.1	72	1.576

Table 6A. Bioavailability Estimates for VBI70 Samples.

Run at 1.5pH for 1 hr @ 39*c	Pb in bulk soil	mass soil (g)	calc Pb #1	ICP Pb (mg/l)	solution amt (l)	%Pb RBA	pH Stop
PAX	56000	1.0019	56.11	179.6	0.1	32	1.587
ACME	694600	1.00487	697.98	1247.9	0.1	18	1.633
PAX	56000	0.40519	22.69	94	0.1	41	1.548
ACME	694600	0.40068	278.31	1125	0.1	40	1.571
PAX	56000	0.40953	22.93	138.5	0.1	60	1.544
ACME	694600	0.40177	279.07	1107	0.1	40	1.572
QA/QC							
Blank-Spike	10			10.88			1.53
Blank-Spike	10			9.44			1.54
Reagent BLANK	0			0.001			1.568
Reagent BLANK	0			-0.002			1.567
BLANK	0			0.01			1.547
BLANK	0			0.03			1.52
SC-00025-PD	159	1.00559	0.16	1.32	0.1	83	1.562
SC-00017-AD	54	1.00144	0.05	0.43	0.1	80	1.548
SC-00018-PD	9883	1.00471	9.93	62.1	0.1	63	1.549
SC-00046-PD	2203	1.00014	2.20	18.34	0.1	83	1.54
SC-00011-PD	7816	1.0004	7.82	50.41	0.1	64	1.56
SC-00025-PD	159	1.00006	0.16	1.29	0.1	81	1.535
SC-00025-AD	159	1.00006	0.16	1.3	0.1	82	1.535
SC-00084-Spike		1.00682		11.119			1.556
SC-00048-Spike		0.99844		11.476			1.553
SC-00043-PD	172	1.00454	0.17	1.225	0.1	71	1.561
SC-00038-PD	212	1.00181	0.21	1.541	0.1	73	1.559
SC-00084-PD	230	0.99262	0.23	1.596	0.1	70	1.563
SC-00048-PD	307	1.0192	0.31	2.28	0.1	73	1.604
NIST-2710	5532	1.0024	5.55	41.07	0.1	74	1.552
NIST-2711	1162	1.0037	1.17	10.00	0.1	86	1.61

PD= Process duplicate

AD= Analytical duplicate

Laboratory of Environment and Geological Sciences, University of Colorado, Boulder

Project Name: VBI70 QA

Run #: | Date: 10/23/01 | OPERATOR: Drexler

Postion in rack	Sample name	Lab#	Wt. Grams	pH start	Starting time	Stopping time	pH stop
1	STD-2710		1.00235	1.555	10:48		1.552
2	STD-2711		1.00371	1.555	10:48		1.61
3	SC-00084-SPK		1.00682	1.555	10:48		1.556
4	SC-00048-SPK		0.99844	1.555	10:48		1.553
5	SC-00043-DUP		1.00454	1.555	10:48		1.561
6	SC-00038-DUP		1.00181	1.555	10:48		1.559
7	SC-00084-DUP		0.99262	1.555	10:48		1.563
8	SC-00048-DUP		1.01919	1.555	10:48		1.604
9	BLANK			1.555	10:48		1.568
10	BLANK-SPK			1.555	10:48		1.54

Project Name:

Run #: | Date: | Operater:

Postion in rack	Sample name	Lab#	Wt. Grams	pH start	Starting time	Stopping time	pH stop
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Laboratory of Environment and Geological Sciences, University of Colorado, Boulder

Project Name: VBI 70

Run #: 4 Date: 7/20/00 Operater: Valerie Morris

Postion in rack	Sample name	Lab#	Wt. Grams	pH start	Starting time	Stopping time	pH stop
1	VFW-2-R-30P		1.00103	1.519	2:00	3:00	1.494
2	VFW-1-B-30P		1.00568	1.519	2:00	3:00	1.522
3	SC-00018 dup		1.00471	1.519	2:00	3:00	1.549
4	SC-00011 dup		1.0004	1.519	2:00	3:00	1.56
5	SC-00046 dup		1.00014	1.519	2:00	3:00	1.54
6	SC-00025 dup		1.00006	1.519	2:00	3:00	1.535
7							
8							
9							
10							

Project Name:

Run #: Date: Operater:

Postion in rack	Sample name	Lab#	Wt. Grams	pH start	Starting time	Stopping time	pH stop
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Laboratory of Environment and Geological Sciences, University of Colorado, Boulder

Project Name: EPA - VBI - 70

Run #: 1 Date: 6/1/00 Operater: Valerie Morris

Postion in rack	Sample name	Lab#	Wt. Grams	pH start	Starting time	Stopping time	pH stop
1	SC-00018		1.00217	1.514	10:23	11:23	1.565
2	SC-00035		1.00705	1.514	10:23	11:23	1.538
3	SC-00010		1.00402	1.514	10:23	11:23	1.549
4	SC-00086		1.00858	1.514	10:23	11:23	1.543
5	SC-00027		1.00792	1.514	10:23	11:23	1.552
6	SC-00038		1.00354	1.514	10:23	11:23	1.558
7	S-00011		1.0037	1.514	10:23	11:23	1.603
8	SC-00023		1.00279	1.514	10:23	11:23	1.572
9	SC-00015		1.00337	1.514	10:23	11:23	1.59
10	SC-00070		1.00818	1.514	10:23	11:23	1.601

Project Name:

Run #: Date: Operater:

Postion in rack	Sample name	Lab#	Wt. Grams	pH start	Starting time	Stopping time	pH stop
1.57	SC-00043		1.00902	1.514	10:31	11:31	1.57
2	SC-00101		1.00698	1.514	10:31	11:31	1.561
3	SC-00083		1.00941	1.514	10:31	11:31	1.566
4	SC-00084		1.00386	1.514	10:31	11:31	1.567
5	SC-00069		1.00518	1.514	10:31	11:31	1.571
6	SC-00114		1.00413	1.514	10:31	11:31	1.579
7	SC-0006		1.0041	1.514	10:31	11:31	1.575
8	SC-00025		1.00297	1.514	10:31	11:31	1.588
9	SC-00025 DUP		1.00559	1.514	10:31	11:31	1.562
10	BLANK			1.514	10:31	11:31	1.567

Laboratory of Environment and Geological Sciences, University of Colorado, Boulder

Project Name: EPA - VBI - 70

Run #: 2 Date: 6/1/00 Operater: Valerie Morris

Postion in rack	Sample name	Lab#	Wt. Grams	pH start	Starting time	Stopping time	pH stop
1	SC-00039		1.00442	1.535	11:23	12:23	1.538
2	SC-00105		1.00656	1.535	11:23	12:23	1.551
3	SC-00065		1.00326	1.535	11:23	12:23	1.576
4	SC-00048		1.00261	1.535	11:23	12:23	1.57
5	SC-00104		1.00237	1.535	11:23	12:23	1.582
6	SC-00077		1.00414	1.535	11:23	12:23	1.618
7							
8							
9							
10							

Project Name: EPA - VBI-70

Run #: 3 Date: Operater:

Postion in rack	Sample name	Lab#	Wt. Grams	pH start	Starting time	Stopping time	pH stop
1	SC-00017		1.00144	1.523	2:57	3:57	1.548
2	SC-00046		1.00031	1.523	2:57		1.571
3	SC-00071		1.00335	1.523	2:57		1.556
4	Blank			1.523	2:57	4:24	1.547
5							
6							
7							
8							
9							

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Project Name: EPA/AFB

Run #: 1 Date: 12/6/00 Operator: Drexler

Postion in rack	Sample name	Lab#	Wt. Grams	pH start	Starting time	Stopping time	pH stop
1							
2							
3							
4							
5	3-15621-f		1.02879	1.544	10:40	11:40	1.739
6	3-15628-f		1.00481	1.544	10:40	11:40	1.74
7	3-15628-f-dup		1.00259	1.544	10:40	11:40	1.737
8							
9	Blk-1		-	1.544	10:40	11:40	1.606
10							

Project Name:

Run #: Date: Operator:

Postion in rack	Sample name	Lab#	Wt. Grams	pH start	Starting time	Stopping time	pH stop
1	Blk-Spk		-	1.49	12:30	1:30	
2							
3							
4							
5							
6							
7							
8							
9							
10							

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Project Name: VBI70

Run #: 1 Date: 3/12/01 Operator: DeBlieck

Postion in rack	Sample name	Lab#	Wt. Grams	pH start	Starting time	Stopping time	pH stop
1	SC-0099		1.00190	1.507	15:20	16:20	1.587
2	3-15670-R		1.00487	1.507	15:20	16:20	1.633
3	Blank		-	1.507	15:20	16:20	1.548

Project Name: -21

Run #: 2 Date: Operater:

Postion in rack	Sample name	Lab#	Wt. Grams	pH start	Starting time	Stopping time	pH stop
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

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Project Name: VBI70

Run #: 1 Date: 4/12/01 Val Morris

Postion in rack	Sample name	Lab#	Wt. Grams	pH start	Starting time	Stopping time	pH stop
1	sc-00099		0.40519	1.508	12:10	1:10	1.548
2	sc-00099 dup		0.40953	1.508	12:10	1:10	1.544
3	3-15670-r		0.40068	1.508	12:10	1:10	1.571
4	3-15670-r dup		0.40177	1.508	12:10	1:10	1.572
5	Blk Spk			1.508	12:10	1:10	1.518
6	Blk Spk			1.508	12:10	1:10	1.534
7							
8							
9							
10							

Project Name:

Run #: 2 Date: Operater:

Postion in rack	Sample name	Lab#	Wt. Grams	pH start	Starting time	Stopping time	pH stop
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

APPENDIX II

WDSXRF Detection Limits and Calibration Curves

	Replicate Analysis
Zn	
	366
	375
	372
	371
	370
	371
	371
Standard Deviation	2.7
IDL(3*SD)	8.0

Correct Concentration for MDL study?

Calibration Curve y= 2759.4x + 0 R2= 0.9999

As	
	4
	9
	9
	3
	-1
	11
	3
Standard Deviation	4.3
IDL(3*SD)	12.9

Calibration Curve Y=1623.4x^2 + 2072.1x + 0 R2= 0.9988

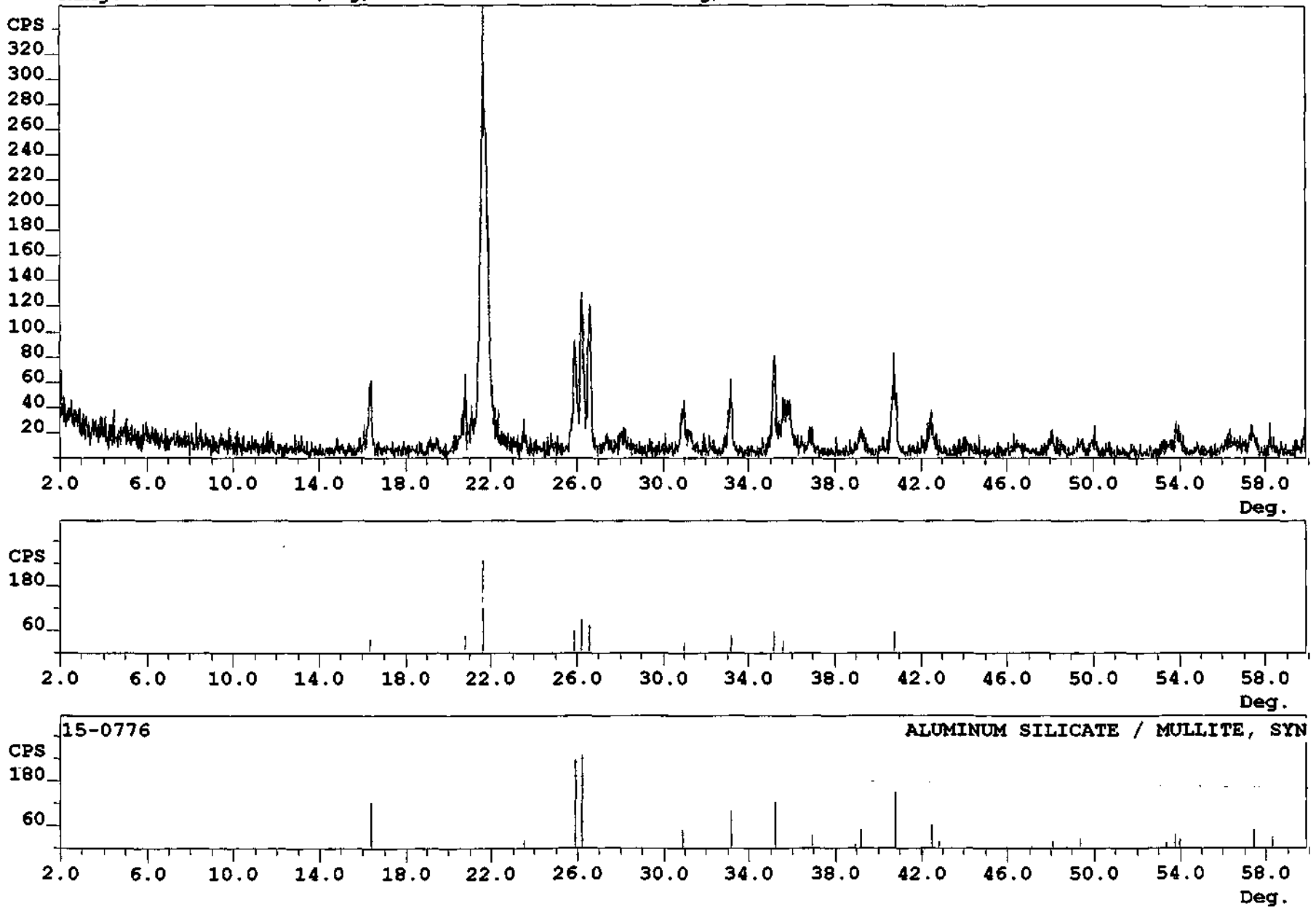
Pb	
	176
	177
	173
	167
	171
	165
	172
Standard Deviation	4.4
IDL(3*SD)	13.2

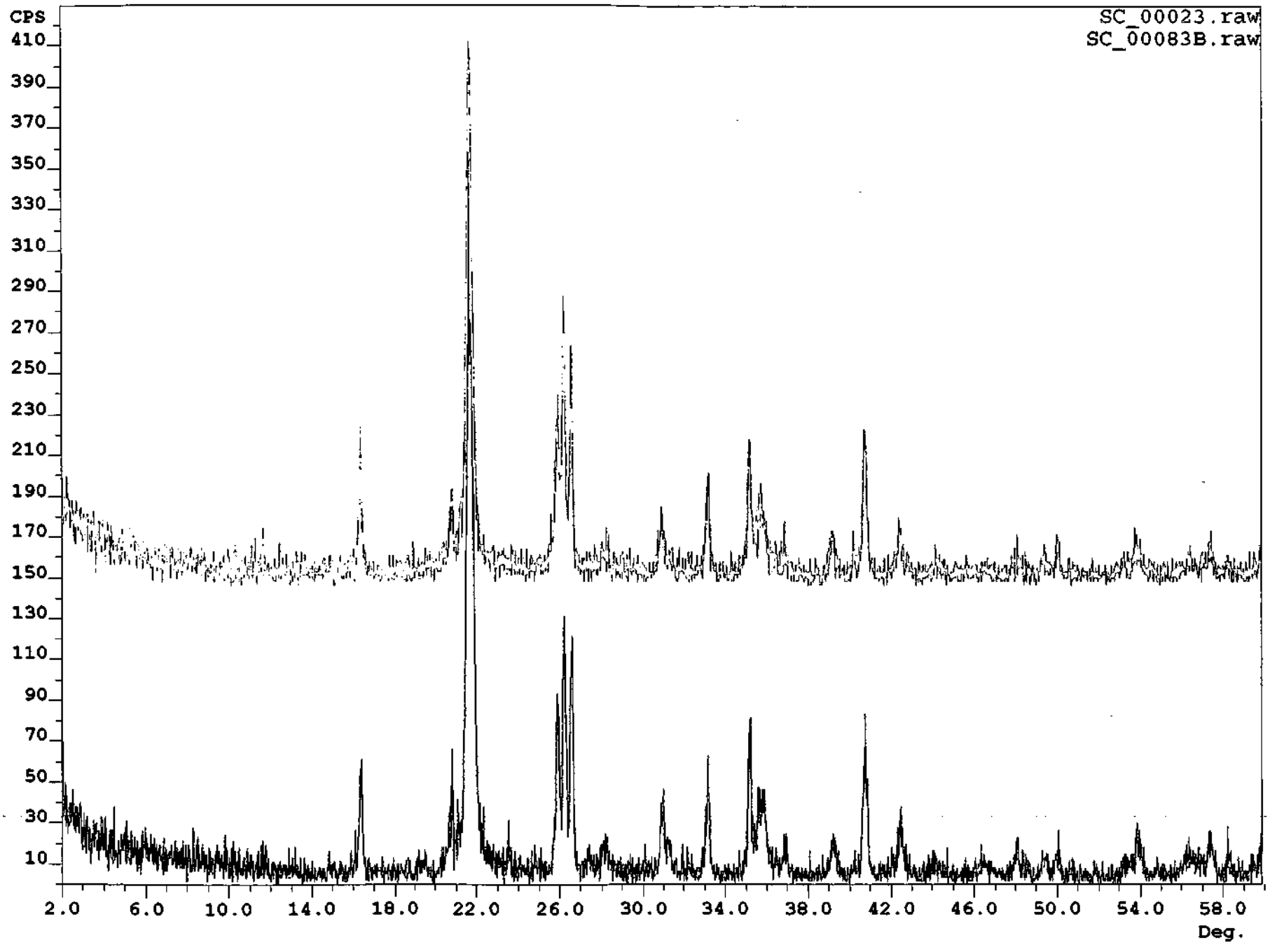
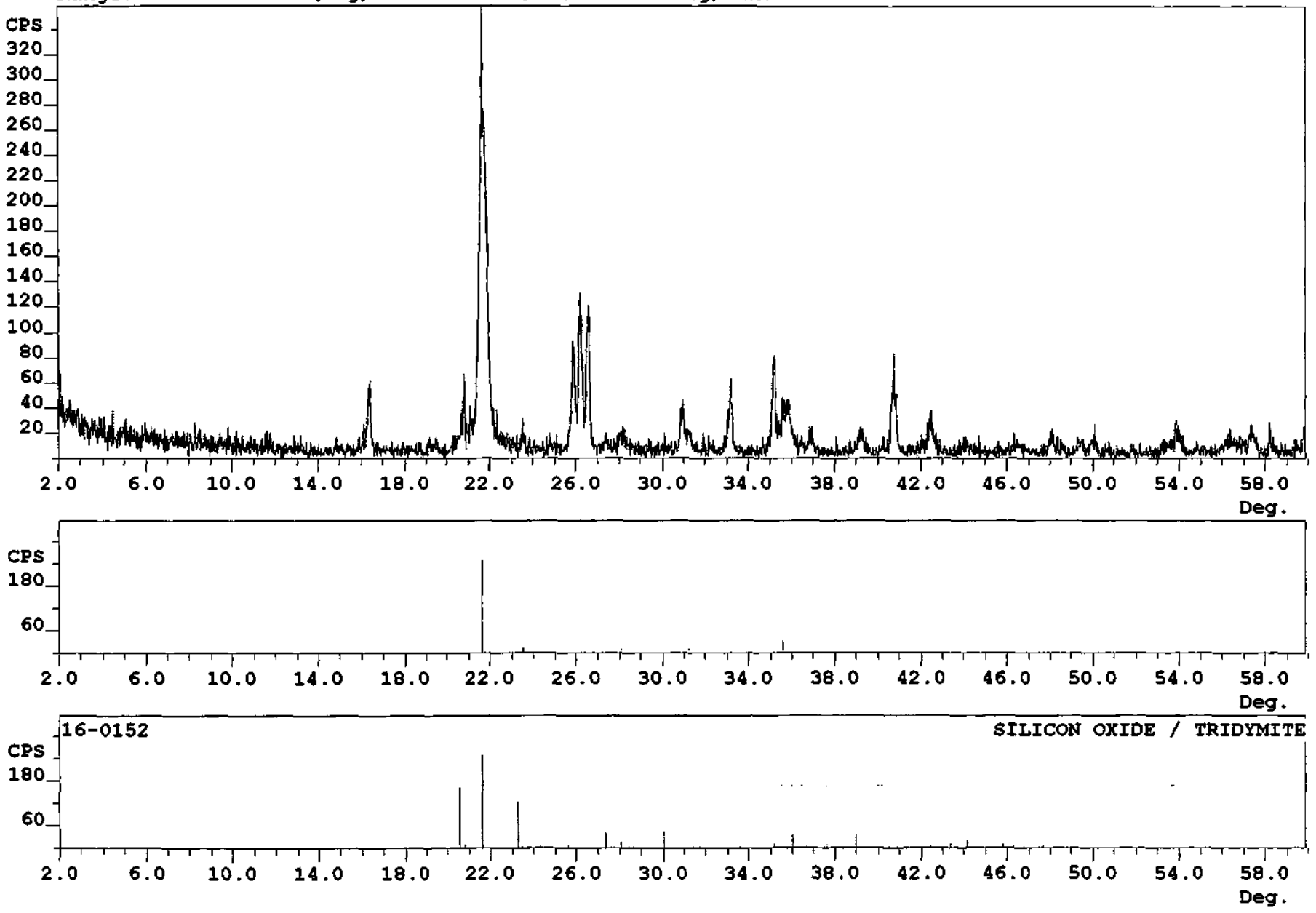
Calibration Curve Y=115.11x^2 + 1707.1x +0 R2 = 0.9999

Cd	
	36
	39
	38
	39
	33
	39
	36
Standard Deviation	2.3
IDL(3*SD)	6.8

Calibration Curve y=1511.6x - 85.246 R2= 0.9117

File: SC_00083B, ID: White grains
Date: 10/05/01 10:19 Step : 0.020° Cnt Time: 0.600 Sec.
Range: 2.00 - 60.00 (Deg) Cont. Scan Rate : 2.00 Deg/min.




CPS
410
390
370
350
330
310
290
270
250
230
210
190
170
150
130
110
90
70
50
30
10
SC_00023.raw
SC_00083B.raw
2.0
6.0
10.0
14.0
18.0
22.0
26.0
30.0
34.0
38.0
42.0
46.0
50.0
54.0
58.0
Deg.

File: SC_00083B, ID: White grains
Date: 10/05/01 10:19 Step : 0.020° Cnt Time: 0.600 Sec.
Range: 2.00 - 60.00 (Deg) Cont. Scan Rate : 2.00 Deg/min.