APPENDIX I

TCEQ Memorandum: Calculation of Tier 2 Residential Soil PCL for Arsenic under TRRP for the USEPA El Paso County Metals Site, May 2003

Texas Commission on Environmental Quality

INTEROFFICE MEMORANDUM

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To: **Jackie Hardee** **Date: May 5, 2003**
Director, Remediation Division
Office of Permitting, Remediation, and Registration

From: **J. Torin McCoy** JTM
Toxicology & Risk Assessment Section
Office of Permitting, Remediation, and Registration

Subject: **Calculation of a Tier 2 Residential Soil PCL for Arsenic under TRRP for the USEPA El Paso County Metals Site Response Action**

Summary:

USEPA is the lead agency in a response action to address unacceptable levels of arsenic and lead in soils within certain residential yards in El Paso (El Paso County Metals Site). As part of these efforts, USEPA commissioned a study to evaluate the bioavailability of arsenic in soils from the El Paso remediation area (lead was not addressed as part of this study). TCEQ Toxicology & Risk Assessment staff have reviewed these results and have incorporated them in the calculation of a Tier 2 site-specific protective concentration level (PCL) for arsenic in residential soil under the guidelines of the Texas Risk Reduction Program (TRRP). This Tier 2 soil PCL includes the exposure pathways that are combined in the ${}^{Tot}Soil_{Comb}$ expression (soil ingestion, dermal contact, inhalation, and ingestion of homegrown vegetables). The bioavailability adjustment affected the soil ingestion pathway (refinement to the assumed relative bioavailability factor, RBAF). In addition, given the site-specific nature of arsenic uptake into vegetables, Tier 2 refinement of the vegetable ingestion pathway was conducted (assumed soil-to-above ground plant biotransfer factor, Br_{Abg}). The potential for contaminant migration to groundwater, ecological risks, or other relevant pathways were not specifically addressed in this assessment.

A Tier 2 soil PCL (${}^{Tot}Soil_{Comb}$) for arsenic of **46 mg/kg** was calculated following these site-specific adjustments. Refer to TRRP (Figures 30 TAC §350.74(a) and §350.75(b)(1)) for default assumptions, equations, and other technical detail related to the calculation of a residential soil PCL for arsenic. Supporting information for the Tier 2 changes is briefly discussed in the following sections.

Soil Ingestion Pathway:

USEPA contracted with scientists from the College of Veterinary Medicine at the University of Missouri, Columbia to assess the relative bioavailability of arsenic in soil samples taken from El Paso. Two representative arsenic-containing soil samples were fed to juvenile swine to assess the bioavailability of arsenic in soil relative to soluble arsenic (the form of arsenic relevant to the critical studies upon which the toxicity factors for arsenic in TRRP are based). The bioavailability for the two soil samples were 37% and 44% relative to soluble arsenic. Since there did not appear to be a scientific rationale for exclusively utilizing results from one soil

sample or the other, an average relative bioavailability of 40% was selected (an approach that is also consistent with the reasonable maximum exposure approach taken in TRRP). This site-specific value was utilized in place of the TRRP Tier 1 default relative bioavailability factor (78%).

Ingestion of Homegrown Vegetables:

In assessing soil-to-plant transfers, certain site-specific considerations can significantly alter the appropriate soil PCL. TRRP requires that a soil-to-plant biotransfer factor be applied to model the transfer of arsenic from soil into above and below-ground vegetables. This factor varies based on soil conditions that influence the availability of arsenic for plant uptake (e.g., soil pH). It is important to note that the same factors that limited the oral availability of arsenic in soils (40% relative availability as described above) are likely to be somewhat applicable to the availability of arsenic to plants, although it is not possible to easily apply this bioavailability data quantitatively for this pathway.

In selecting a soil-to-plant uptake factor, it is critical to recognize that uptake rates differ among the various types of crops that might be grown in a home garden. This variability is especially pronounced with above-ground vegetables, due to the wide variety of vegetable types that are represented in this group (e.g., leafy vegetables, garden fruits, legumes). Leafy vegetables (e.g., lettuce) tend to have the greatest potential to accumulate arsenic. Toxicology & Risk Assessment staff contacted the El Paso County Extension Service for information about the types of vegetables most often grown in that area. Extension Service staff stated that the climate tended to limit extensive reliance on home gardens, but that tomatoes, peppers, and fruit trees were probably the most likely crops to be grown if gardens were present. These experts did not believe there was significant potential for extensive amounts of homegrown leafy vegetables.

The default Tier 1 above-ground soil-to-plant uptake factor for arsenic is heavily weighted toward leafy vegetables. Given local gardening habits in the El Paso area, a soil-to-above-ground plant uptake factor (Br_{Abg} of 0.002) that is more representative of uptake into the types of above-ground vegetables likely grown and consumed in home gardens in El Paso (e.g., tomatoes, garden fruits, peppers) was utilized in calculating a Tier 2 soil PCL for this pathway. This value is approximately five fold lower than the default Tier 1 soil-to-above-ground plant uptake factor in TRRP.

Tier 2 PCL determination:

Table 1 provides the individual pathway-specific soil PCLs after incorporation of these specific Tier 2 refinements for arsenic. Combining these individual pathways results in a Tier 2 soil PCL of 64 mg/kg based on carcinogenic effects and **46 mg/kg** based on non-carcinogenic effects. The lower of these values is applied as the final Tier 2 $^{Tot}Soil_{Comb}$ PCL for arsenic.

If you have questions regarding this evaluation, please feel free to contact me at (512) 239-1572.

Table 1: Individual pathway-specific soil PCLs following Tier 2 adjustments for arsenic.		
Carcinogenic Effects	Soil Ingestion	100 mg/kg
	Dermal Contact	460 mg/kg
	Inhalation (0.5 acre)	5300 mg/kg
	Vegetable Ingestion	310 mg/kg
Non-Carcinogenic Effects	Soil Ingestion	61 mg/kg
	Dermal Contact	360 mg/kg
	Inhalation (0.5 acre)	Not Applicable
	Vegetable Ingestion	370 mg/kg

El Paso Study- Pb RBA Calculation for Livers and Kidneys

This was an arsenic study but the soil also contained lead.

We analyzed Livers and Kidneys for Pb and then used a PbAc curve from Black and Veach to give a rough RBA calculation

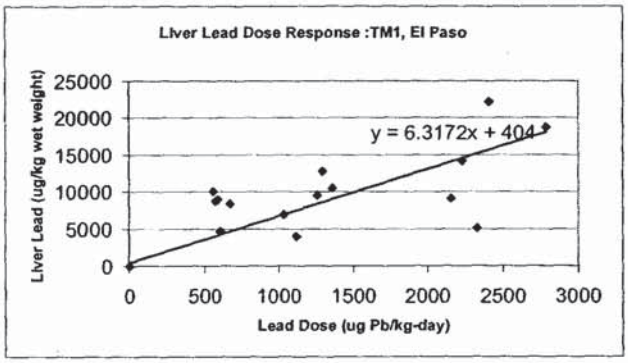
Material	As (mg/kg)	Pb (mg/kg)	Dose multiplication factor for converting As to Pb dosed
TM1	74	1100	14.86
TM2	73	1100	15.07

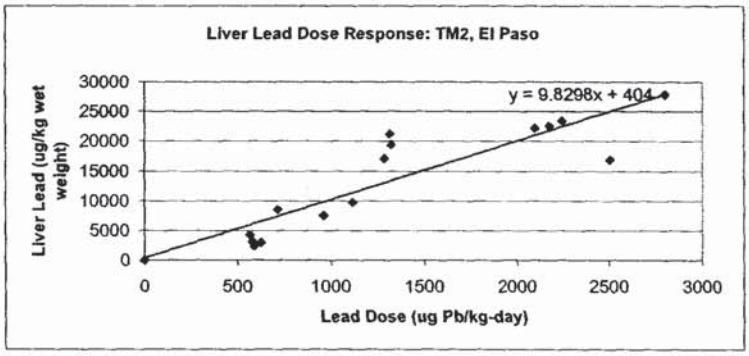
Lead RBA Results

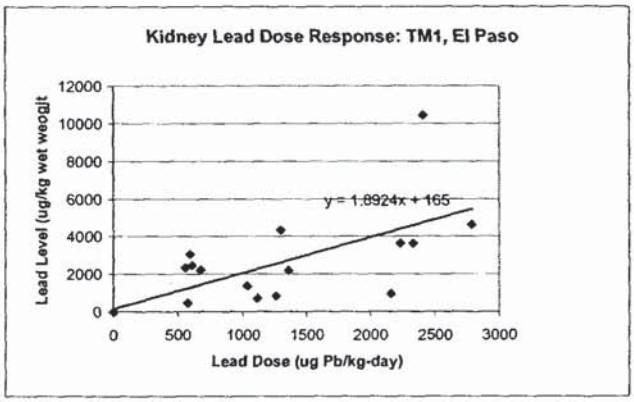
Material	Liver RBA	Kidney RBA
TM1	0.29	0.27
TM2	0.44	0.34

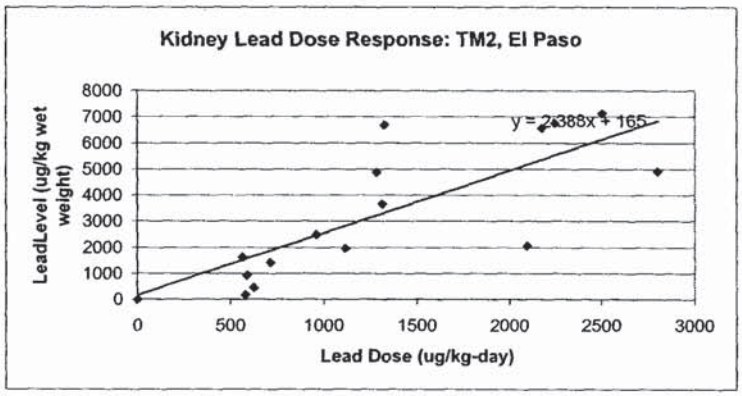
Lead RBA Calculations

Material	Liver RBA	Kidney RBA
TM1	6.3172/22.1	1.8924/7.0
TM2	9.8298/22.1	2.388/7.0









Research Toxicology Sample Report

DATE: May 7, 2003

Study:	El Paso-1, Arsenic	**Matrix:**	Liver, 1g tissue/10ml, 20%HNO3
Analyte:	Pb	**Detection Limit:**	1.0ppb
Method:	Furnace AA	**Spikes:**	within +/-15%
Data Set:	eplv4/28/03	**Analytical Duplicates:**	2-5ppb,<25%RPD; >5ppb,<10%RPD
Units:	ng/ml	**Perkin-Elmer Quality Control Std. 21@10 and 25ppb**	within +/-10%
Sample Value	Mean of 2 Replicates	**Sample Concentrations**	Have been adjusted for 1:10 prep dilution and any further dilutions

Dose (Pb in ug/kg-day)	Concentration ug/kg wet weight	Group	Sample I. D	Concentration	Adjusted for Prep Dilution	Detection Limit
0	5	1-Control	EP-84-L	<DL	<DL	1ppb
0	5	1-Control	EP-91-L	<DL	<DL	1ppb
0	5	1-Control	EP-1550-L	<DL	<DL	1ppb
592	8950	4-TM1-40	EP-64-L	89.5	895	2ppb
557	10120	4-TM1-40	EP-77-L	101.2	1012	2ppb
671	8380	4-TM1-40	EP-80-L	83.8	838	2ppb
575	8790	4-TM1-40	EP-92-L	87.9	879	2ppb
607	4690	4-TM1-40	EP-1548-L	46.9	469	1ppb
1361	10490	5-TM1-80	EP-87-L	104.9	1049	2ppb
1261	9520	5-TM1-80	EP-97-L	95.2	952	2ppb
1297	12810	5-TM1-80	EP-1543-L	128.1	1281	5ppb
1116	4020	5-TM1-80	EP-1553-L	40.2	402	1ppb
1034	7000	5-TM1-80	EP-1546-L	70	700	2ppb
2410	22160	6-TM1-160	EP-66-L	221.6	2216	5ppb
2330	5130	6-TM1-160	EP-68-L	51.3	513	1ppb
2787	18710	6-TM1-160	EP-86-L	187.1	1871	5ppb
2232	14180	6-TM1-160	EP-1545-L	141.8	1418	5ppb
2159	9100	6-TM1-160	EP-1561-L	91	910	2ppb
567	4280	7-TM2-40	EP-69-L	42.8	428	1ppb
590	2440	7-TM2-40	EP-75-L	24.4	244	1ppb
713	8590	7-TM2-40	EP-78-L	85.9	859	2ppb
626	3030	7-TM2-40	EP-98-L	30.3	303	1ppb
580	3210	7-TM2-40	EP-1564-L	32.1	321	1ppb
1281	17190	8-TM2-80	EP-88-L	171.9	1719	5ppb
957	7550	8-TM2-80	EP-89-L	75.5	755	2ppb
1310	21180	8-TM2-80	EP-99-L	211.8	2118	5ppb
1320	19440	8-TM2-80	EP-100-L	194.4	1944	5ppb
1112	9720	8-TM2-80	EP-1563-L	97.2	972	2ppb
2173	22580	9-TM2-160	EP-65-L	225.8	2258	5ppb
2502	16920	9-TM2-160	EP-82-L	169.2	1692	5ppb
2096	22260	9-TM2-160	EP-95-L	222.6	2226	5ppb
2244	23440	9-TM2-160	EP-1549-L	234.4	2344	5ppb
2797	27930	9-TM2-160	EP-1558-L	279.3	2793	10ppb
			EP-PREPBLANK-L	<DL	<DL	1ppb

Internal Calibration Verification

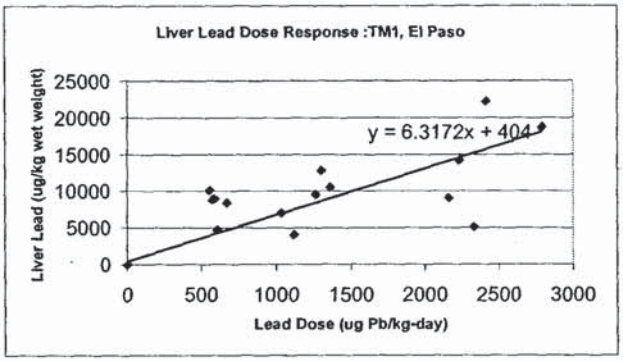
Sample I. D	Concentration	Acceptable Range
ICV-10	9.2	9.0-11.0
ICV-10	9.4	
ICV-10	9.2	
ICV-10	9.5	
ICV-10	9.4	
ICV-10	9.2	
ICV-10	9.2	
ICV-10	10	
ICV-25	23.4	22.5-27.5
ICV-25	23.7	
ICV-25	24.1	
ICV-25	24.4	
ICV-25	23.3	
ICV-25	23.8	
ICV-25	24	
ICV-25	23.6	

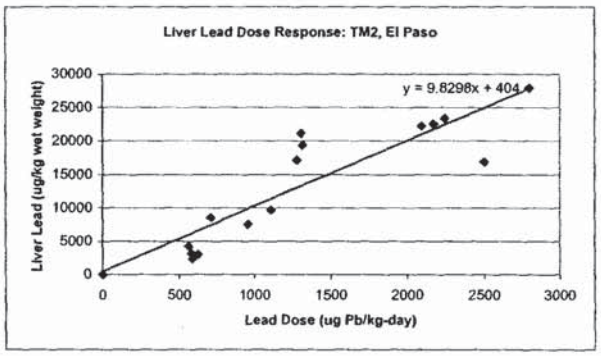
Analytical Duplicates

Sample I. D	Concentration 1, not adjusted for dilution	Concentration 2, not adjusted for dilution	RPD
EP-91-L	<DL	<DL	
EP-1564-L	32.2	32.6	-1%

Preparative Duplicates

EP-65-L	225.8	228.5	-1%
EP-80-L	83.9	74.9	11%
EP-100-L	194.4	195.7	-1%





Black & Veatch Lead Study: Tags for Liver Samples

matrix	index	group	pig number	day	date collected	sample number	[illegible]	[illegible]
liver	580	1	242	15	10/15/2002	BV-242-(15)-L	BV-01-0705	BV-01-0705-AS
liver	581	1	245	15	10/15/2002	BV-245-(15)-L	BV-01-0736	BV-01-0736-AS
liver	582	1	262	15	10/15/2002	BV-262-(15)-L	BV-01-0713	BV-01-0713-AS
liver	583	1	271	15	10/15/2002	BV-271-(15)-L	BV-01-0746	BV-01-0746-AS
liver	584	1	441	15	10/15/2002	BV-441-(15)-L	BV-01-0715	BV-01-0715-AS
liver	585	2	229	15	10/15/2002	BV-229-(15)-L	BV-01-0718	BV-01-0718-AS
liver	586	2	243	15	10/15/2002	BV-243-(15)-L	BV-01-0714	BV-01-0714-AS
liver	587	2	249	15	10/15/2002	BV-249-(15)-L	BV-01-0719	BV-01-0719-AS
liver	588	2	257	15	10/15/2002	BV-257-(15)-L	BV-01-0707	BV-01-0707-AS
liver	589	2	444	15	10/15/2002	BV-444-(15)-L	BV-01-0744	BV-01-0744-AS
liver	590	3	252	15	10/15/2002	BV-252-(15)-L	BV-01-0725	BV-01-0725-AS
liver	591	3	260	15	10/15/2002	BV-260-(15)-L	BV-01-0706	BV-01-0706-AS
liver	592	3	270	15	10/15/2002	BV-270-(15)-L	BV-01-0727	BV-01-0727-AS
liver	593	3	275	15	10/15/2002	BV-275-(15)-L	BV-01-0708	BV-01-0708-AS
liver	594	3	435	15	10/15/2002	BV-435-(15)-L	BV-01-0724	BV-01-0724-AS
liver	595	4	227	15	10/15/2002	BV-227-(15)-L	BV-01-0734	BV-01-0734-AS
liver	596	4	244	15	10/15/2002	BV-244-(15)-L	BV-01-0716	BV-01-0716-AS
liver	597	4	254	15	10/15/2002	BV-254-(15)-L	BV-01-0712	BV-01-0712-AS
liver	598	4	259	15	10/15/2002	BV-259-(15)-L	BV-01-0711	BV-01-0711-AS
liver	599	4	266	15	10/15/2002	BV-266-(15)-L	BV-01-0699	BV-01-0699-AS
liver	600	5	230	15	10/15/2002	BV-230-(15)-L	BV-01-0732	BV-01-0732-AS
liver	601	5	256	15	10/15/2002	BV-256-(15)-L	BV-01-0737	BV-01-0737-AS
liver	602	5	437	15	10/15/2002	BV-437-(15)-L	BV-01-0735	BV-01-0735-AS
liver	603	5	440	15	10/15/2002	BV-440-(15)-L	BV-01-0720	BV-01-0720-AS
liver	604	5	443	15	10/15/2002	BV-443-(15)-L	BV-01-0726	BV-01-0726-AS
liver	605	6	232	15	10/15/2002	BV-232-(15)-L	BV-01-0700	BV-01-0700-AS
liver	606	6	255	15	10/15/2002	BV-255-(15)-L	BV-01-0748	BV-01-0748-AS
liver	607	6	264	15	10/15/2002	BV-264-(15)-L	BV-01-0729	BV-01-0729-AS
liver	608	6	268	15	10/15/2002	BV-268-(15)-L	BV-01-0741	BV-01-0741-AS
liver	609	6	269	15	10/15/2002	BV-269-(15)-L	BV-01-0749	BV-01-0749-AS
liver	610	7	231	15	10/15/2002	BV-231-(15)-L	BV-01-0703	BV-01-0703-AS
liver	611	7	246	15	10/15/2002	BV-246-(15)-L	BV-01-0743	BV-01-0743-AS
liver	612	7	248	15	10/15/2002	BV-248-(15)-L	BV-01-0701	BV-01-0701-AS
liver	613	7	263	15	10/15/2002	BV-263-(15)-L	BV-01-0728	BV-01-0728-AS
liver	614	7	274	15	10/15/2002	BV-274-(15)-L	BV-01-0717	BV-01-0717-AS
liver	615	8	226	15	10/15/2002	BV-226-(15)-L	BV-01-0722	BV-01-0722-AS
liver	616	8	261	15	10/15/2002	BV-261-(15)-L	BV-01-0709	BV-01-0709-AS
liver	617	8	265	15	10/15/2002	BV-265-(15)-L	BV-01-0745	BV-01-0745-AS
liver	618	8	434	15	10/15/2002	BV-434-(15)-L	BV-01-0733	BV-01-0733-AS
liver	619	8	439	15	10/15/2002	BV-439-(15)-L	BV-01-0742	BV-01-0742-AS
liver	620	9	228	15	10/15/2002	BV-228-(15)-L	BV-01-0710	BV-01-0710-AS
liver	621	9	233	15	10/15/2002	BV-233-(15)-L	BV-01-0731	BV-01-0731-AS
liver	622	9	238	15	10/15/2002	BV-238-(15)-L	BV-01-0721	BV-01-0721-AS
liver	623	9	247	15	10/15/2002	BV-247-(15)-L	BV-01-0740	BV-01-0740-AS
liver	624	9	438	15	10/15/2002	BV-438-(15)-L	BV-01-0702	BV-01-0702-AS
liver	625	10	251	15	10/15/2002	BV-251-(15)-L	BV-01-0723	BV-01-0723-AS
liver	626	10	258	15	10/15/2002	BV-258-(15)-L	BV-01-0730	BV-01-0730-AS
liver	627	10	272	15	10/15/2002	BV-272-(15)-L	BV-01-0738	BV-01-0738-AS
liver	628	4	2244	15	10/15/2002	BV-2244-(15)-L	BV-01-0704	BV-01-0704-AS
liver	629	6	2264	15	10/15/2002	BV-2264-(15)-L	BV-01-0747	BV-01-0747-AS
liver	630	8	2434	15	10/15/2002	BV-2434-(15)-L	BV-01-0739	BV-01-0739-AS

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Research Toxicology Sample Report

DATE: March 4, 2003

Study:	Black and Veach #1	**Matrix:**	Liver, 1g tissue/10ml, 20%HNO3
Analyte:	Pb	**Detection Limit:**	1.0ppb
Method:	Furnace AA	**Spikes:**	within +/-15%
Data Set:	3/3/03lk	**Duplicates:**	2-5ppb,<25%RPD; >5ppb,<10%RPD
Units:	ng/ml	**Perkin-Elmer Quality Control Std. 21@10ppb**	within +/-10%
Sample Value	Mean of 2 Replicates	**Sample Concentrations**	Have been adjusted for 1:10 prep dilution and any further dilutions

Treatment | Lead Intake ug/kg/day

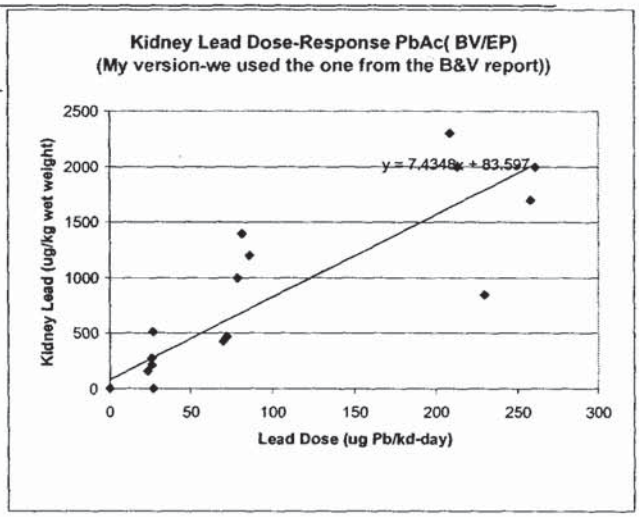
Sample I. D	Concentration	Detection Limit	Dilution	Matrix
Prep Blank Liver	2 ppb	1.0	1.0	Liver
699	210	1.0	1.0	Liver
700	950	2.0	2.0	Liver
701	220	1.0	1.0	Liver
702	670	2.0	2.0	Liver
703	120	1.0	1.0	Liver
704	140	1.0	1.0	Liver
705	100	1.0	1.0	Liver
706	410	1.0	1.0	Liver
707	200	1.0	1.0	Liver
708	1000	2.0	2.0	Liver
709	790	2.0	2.0	Liver
710	900	2.0	2.0	Liver
711	240	1.0	1.0	Liver
712	220	1.0	1.0	Liver
713	56	1.0	1.0	Liver
714	250	1.0	1.0	Liver
715	58	1.0	1.0	Liver
716	160	1.0	1.0	Liver
717	140	1.0	1.0	Liver
718	260	1.0	1.0	Liver
719	2000	5.0	5.0	Liver
720	1700	5.0	5.0	Liver
721	640	2.0	2.0	Liver
722	560	2.0	2.0	Liver
723	<DL	1.0	1.0	Liver
724	230	1.0	1.0	Liver
725	340	1.0	1.0	Liver
726	1000	2.0	2.0	Liver
727	790	2.0	2.0	Liver
728	180	5.0	5.0	Liver
729	1500	5.0	5.0	Liver
730	<DL	1.0	1.0	Liver
731	480	1.0	1.0	Liver
732	330	1.0	1.0	Liver
733	620	2.0	2.0	Liver
734	270	1.0	1.0	Liver
735	800	2.0	2.0	Liver
736	20	1.0	1.0	Liver
737	1400	5.0	5.0	Liver
738	18	1.0	1.0	Liver
739	560	2.0	2.0	Liver
740	740	2.0	2.0	Liver
741	1000	2.0	2.0	Liver
742	300	1.0	1.0	Liver
743	280	1.0	1.0	Liver
744	240	1.0	1.0	Liver
745	470	1.0	1.0	Liver
746	100	1.0	1.0	Liver
747	1700	5.0	5.0	Liver
748	980	2.0	2.0	Liver
749	650	2.0	2.0	Liver

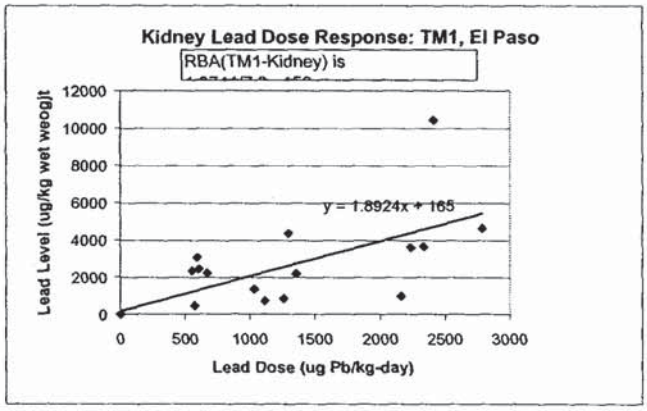
Research Toxicology Sample Report

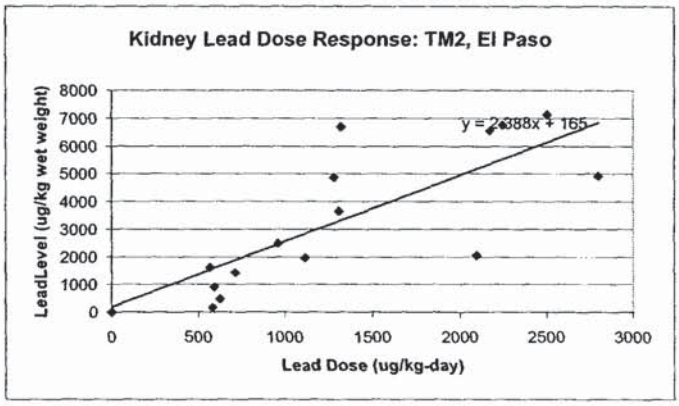
DATE: April 30,2003

Study:	El Paso-1, Arsenic	**Matrix:**	Kidney, 1g tissue/10ml, 20%HNO3
Analyte:	Pb	**Detection Limit:**	1.0ppb
Method:	Furnace AA	**Spikes:**	within +/-15%
Data Set:	EPKID4/29/03	**Analytical Duplicates:**	2-5ppb,<25%RPD; >5ppb,<10%RPD
Units:	ng/ml	**Perkin-Elmer Quality Control Std. 21@10 and 25ppb**	within +/-10%
Sample Value	Mean of 2 Replicates	**Sample Concentrations**	Have been adjusted for 1:10 prep dilution and any further dilutions

Group	Dose Pb ug/kg/d	Sample I. D	Concentration ug/kg of kidney
PbAc	0	EP-84-K	5
PbAc	0	EP-91-K	5
PbAc	0	EP-1550-K	5
PbAc	0	BV-01-0649	5
PbAc	0	BV-01-0675	5
PbAc	0	BV-01-0688	5
PbAc	25.59	BV-01-0650	280
PbAc	26.51	BV-01-0652	520
PbAc	25.59	BV-01-0677	220
PbAc	23.19	BV-01-0689	160
PbAc	26.94	BV-01-0697	5
PbAc	26.74	BV-01-0698	5
PbAc	78.71	BV-01-0648	1000
PbAc	71.88	BV-01-0656	470
PbAc	69.64	BV-01-0664	430
PbAc	81.62	BV-01-0667	1400
PbAc	85.86	BV-01-0687	1200
PbAc	229.83	BV-01-0659	850
PbAc	260.83	BV-01-0661	2000
PbAc	208.44	BV-01-0680	2300
PbAc	257.93	BV-01-0682	1700
PbAc	213.04	BV-01-0683	2000
TM1	592	EP-64-K	3080
TM1	557	EP-77-K	2360
TM1	671	EP-80-K	2220
TM1	575	EP-92-K	480
TM1	607	EP-1548-K	2460
TM1	1361	EP-87-K	2190
TM1	1261	EP-97-K	860
TM1	1297	EP-1543-K	4370
TM1	1116	EP-1546-K	730
TM1	1034	EP-1553-K	1370
TM1	2410	EP-66-K	10440
TM1	2330	EP-68-K	3640
TM1	2787	EP-86-K	4650
TM1	2232	EP-1545-K	3630
TM1	2159	EP-1561-K	980
TM2	567	EP-69-K	1630
TM2	590	EP-75-K	930
TM2	713	EP-78-K	1430
TM2	626	EP-98-K	460
TM2	580	EP-1564-K	170
TM2	1281	EP-88-K	4880
TM2	957	EP-89-K	2480
TM2	1310	EP-99-K	3660
TM2	1320	EP-100-K	6690
TM2	1112	EP-1563-K	1970
TM2	2173	EP-65-K	6570
TM2	2502	EP-82-K	7150
TM2	2096	EP-95-K	2060
TM2	2244	EP-1549-K	6760
TM2	2797	EP-1558-K	4920
		EP-PREP BLK-K	







Black & Veatch Lead Study: Tags for Kidney Samples

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
kidney	529	1	242	15	10/15/2002	BV-242-(15)-K	BV-01-0652	BV-01-0652-AS
kidney	530	1	245	15	10/15/2002	BV-245-(15)-K	BV-01-0677	BV-01-0677-AS
kidney	531	1	262	15	10/15/2002	BV-262-(15)-K	BV-01-0698	BV-01-0698-AS
kidney	532	1	271	15	10/15/2002	BV-271-(15)-K	BV-01-0689	BV-01-0689-AS
kidney	533	1	441	15	10/15/2002	BV-441-(15)-K	BV-01-0697	BV-01-0697-AS
kidney	534	2	229	15	10/15/2002	BV-229-(15)-K	BV-01-0656	BV-01-0656-AS
kidney	535	2	243	15	10/15/2002	BV-243-(15)-K	BV-01-0667	BV-01-0667-AS
kidney	536	2	249	15	10/15/2002	BV-249-(15)-K	BV-01-0648	BV-01-0648-AS
kidney	537	2	257	15	10/15/2002	BV-257-(15)-K	BV-01-0664	BV-01-0664-AS
kidney	538	2	444	15	10/15/2002	BV-444-(15)-K	BV-01-0687	BV-01-0687-AS
kidney	539	3	252	15	10/15/2002	BV-252-(15)-K	BV-01-0680	BV-01-0680-AS
kidney	540	3	260	15	10/15/2002	BV-260-(15)-K	BV-01-0659	BV-01-0659-AS
kidney	541	3	270	15	10/15/2002	BV-270-(15)-K	BV-01-0683	BV-01-0683-AS
kidney	542	3	275	15	10/15/2002	BV-275-(15)-K	BV-01-0661	BV-01-0661-AS
kidney	543	3	435	15	10/15/2002	BV-435-(15)-K	BV-01-0682	BV-01-0682-AS
kidney	544	4	227	15	10/15/2002	BV-227-(15)-K	BV-01-0662	BV-01-0662-AS
kidney	545	4	244	15	10/15/2002	BV-244-(15)-K	BV-01-0691	BV-01-0691-AS
kidney	546	4	254	15	10/15/2002	BV-254-(15)-K	BV-01-0695	BV-01-0695-AS
kidney	547	4	259	15	10/15/2002	BV-259-(15)-K	BV-01-0684	BV-01-0684-AS
kidney	548	4	266	15	10/15/2002	BV-266-(15)-K	BV-01-0692	BV-01-0692-AS
kidney	549	5	230	15	10/15/2002	BV-230-(15)-K	BV-01-0696	BV-01-0696-AS
kidney	550	5	256	15	10/15/2002	BV-256-(15)-K	BV-01-0668	BV-01-0668-AS
kidney	551	5	437	15	10/15/2002	BV-437-(15)-K	BV-01-0663	BV-01-0663-AS
kidney	552	5	440	15	10/15/2002	BV-440-(15)-K	BV-01-0685	BV-01-0685-AS
kidney	553	5	443	15	10/15/2002	BV-443-(15)-K	BV-01-0690	BV-01-0690-AS
kidney	554	6	232	15	10/15/2002	BV-232-(15)-K	BV-01-0666	BV-01-0666-AS
kidney	555	6	255	15	10/15/2002	BV-255-(15)-K	BV-01-0671	BV-01-0671-AS
kidney	556	6	264	15	10/15/2002	BV-264-(15)-K	BV-01-0657	BV-01-0657-AS
kidney	557	6	268	15	10/15/2002	BV-268-(15)-K	BV-01-0665	BV-01-0665-AS
kidney	558	6	269	15	10/15/2002	BV-269-(15)-K	BV-01-0655	BV-01-0655-AS
kidney	559	7	231	15	10/15/2002	BV-231-(15)-K	BV-01-0651	BV-01-0651-AS
kidney	560	7	246	15	10/15/2002	BV-246-(15)-K	BV-01-0660	BV-01-0660-AS
kidney	561	7	248	15	10/15/2002	BV-248-(15)-K	BV-01-0673	BV-01-0673-AS
kidney	562	7	263	15	10/15/2002	BV-263-(15)-K	BV-01-0653	BV-01-0653-AS
kidney	563	7	274	15	10/15/2002	BV-274-(15)-K	BV-01-0693	BV-01-0693-AS
kidney	564	8	226	15	10/15/2002	BV-226-(15)-K	BV-01-0654	BV-01-0654-AS
kidney	565	8	261	15	10/15/2002	BV-261-(15)-K	BV-01-0681	BV-01-0681-AS
kidney	566	8	265	15	10/15/2002	BV-265-(15)-K	BV-01-0676	BV-01-0676-AS
kidney	567	8	434	15	10/15/2002	BV-434-(15)-K	BV-01-0679	BV-01-0679-AS
kidney	568	8	439	15	10/15/2002	BV-439-(15)-K	BV-01-0674	BV-01-0674-AS
kidney	569	9	228	15	10/15/2002	BV-228-(15)-K	BV-01-0672	BV-01-0672-AS
kidney	570	9	233	15	10/15/2002	BV-233-(15)-K	BV-01-0678	BV-01-0678-AS
kidney	571	9	238	15	10/15/2002	BV-238-(15)-K	BV-01-0669	BV-01-0669-AS
kidney	572	9	247	15	10/15/2002	BV-247-(15)-K	BV-01-0670	BV-01-0670-AS
kidney	573	9	438	15	10/15/2002	BV-438-(15)-K	BV-01-0686	BV-01-0686-AS
kidney	574	10	251	15	10/15/2002	BV-251-(15)-K	BV-01-0675	BV-01-0675-AS
kidney	575	10	258	15	10/15/2002	BV-258-(15)-K	BV-01-0688	BV-01-0688-AS
kidney	576	10	272	15	10/15/2002	BV-272-(15)-K	BV-01-0649	BV-01-0649-AS
kidney	577	1	2245	15	10/15/2002	BV-2245-(15)-K	BV-01-0650	BV-01-0650-AS
kidney	578	6	2268	15	10/15/2002	BV-2268-(15)-K	BV-01-0694	BV-01-0694-AS
kidney	579	7	2274	15	10/15/2002	BV-2274-(15)-K	BV-01-0658	BV-01-0658-AS

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Data sorted by group

Research Toxicology Sample Report

DATE: March 5, 2003

Study:	Black and Veach #1	**Matrix:**	Kidney
Analyte:	Pb	**Detection Limit:**	1.0ppb
Method:	Furnace AA	**Spikes:**	within +/-15%
Data Set:	3/3/03lk,3/4/03lk	**Duplicates:**	2-5ppb,<25%RPD; >5ppb,<10%RPD
Units:	ng/ml	**Perkin-Elmer Quality Control Std. 21@10ppb**	within +/-10%
Sample Value	Mean of 2 Replicates	**Sample Concentrations**	Have been adjusted for 1:10 prep dilution and any further dilutions

Treatment	Lead Intake ug/kg/day	Group #	Pig #	Tag #	Sample I. D	Concentration	Detection Limit	Matrix
					Prep Blank Kidney	<DL	1.0	Kidney
PbAc	25.59	1	2245	BV-01-0650	650	28	1.0	Kidney
PbAc	26.51	1	242	BV-01-0652	652	52	1.0	Kidney
PbAc	25.59	1	245	BV-01-0677	677	22	1.0	Kidney
PbAc	23.19	1	271	BV-01-0689	689	16	1.0	Kidney
PbAc	26.94	1	441	BV-01-0697	697	<DL	1.0	Kidney
PbAc	26.74	1	262	BV-01-0698	698	<DL	1.0	Kidney
PbAc	78.71	2	249	BV-01-0648	648	100	1.0	Kidney
PbAc	71.88	2	229	BV-01-0656	656	47	1.0	Kidney
PbAc	69.64	2	257	BV-01-0664	664	43	1.0	Kidney
PbAc	81.62	2	243	BV-01-0667	667	140	1.0	Kidney
PbAc	85.86	2	444	BV-01-0687	687	120	1.0	Kidney
PbAc	229.83	3	260	BV-01-0659	659	85	1.0	Kidney
PbAc	260.83	3	275	BV-01-0661	661	200	1.0	Kidney
PbAc	208.44	3	252	BV-01-0680	680	230	1.0	Kidney
PbAc	257.93	3	435	BV-01-0682	682	170	1.0	Kidney
PbAc	213.04	3	270	BV-01-0683	683	200	1.0	Kidney
		4	227	BV-01-0662	662	150	1.0	Kidney
		4	259	BV-01-0684	684	59	1.0	Kidney
		4	244	BV-01-0691	691	76	1.0	Kidney
		4	266	BV-01-0692	692	31	1.0	Kidney
		4	254	BV-01-0695	695	83	1.0	Kidney
	225	5	437	BV-01-0663	663	150	1.0	Kidney
		5	256	BV-01-0668	668	370	1.0	Kidney
		5	440	BV-01-0685	685	330	1.0	Kidney
		5	443	BV-01-0690	690	280	1.0	Kidney
		5	230	BV-01-0696	696	130	1.0	Kidney
	400	6	269	BV-01-0655	655	220	1.0	Kidney
		6	264	BV-01-0657	657	300	1.0	Kidney
		6	268	BV-01-0665	665	300	1.0	Kidney
		6	232	BV-01-0666	666	320	1.0	Kidney
		6	255	BV-01-0671	671	500	1.0	Kidney
		6	2268	BV-01-0694	694	430	1.0	Kidney
	75	7	231	BV-01-0651	651	63	1.0	Kidney
		7	263	BV-01-0653	653	86	1.0	Kidney
		7	2274	BV-01-0658	658	35	1.0	Kidney
		7	246	BV-01-0660	660	56	1.0	Kidney
		7	248	BV-01-0673	673	100	1.0	Kidney
		7	274	BV-01-0693	693	27	1.0	Kidney
	225	8	226	BV-01-0654	654	400	1.0	Kidney
	225	8	439	BV-01-0674	674	92	1.0	Kidney
	225	8	265	BV-01-0676	676	110	1.0	Kidney
	225	8	434	BV-01-0679	679	150	1.0	Kidney
	225	8	261	BV-01-0681	681	130	1.0	Kidney
	400	9	238	BV-01-0669	669	190	1.0	Kidney
	400	9	247	BV-01-0670	670	260	1.0	Kidney
	400	9	228	BV-01-0672	672	310	1.0	Kidney
	400	9	233	BV-01-0678	678	210	1.0	Kidney
	400	9	438	BV-01-0686	686	220	1.0	Kidney
Control	0	10	272	BV-01-0649	649	<DL	1.0	Kidney
Control	0	10	251	BV-01-0675	675	<DL	1.0	Kidney
Control	0	10	258	BV-01-0688	688	<DL	1.0	Kidney

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