APPENDIX G-2

HYDROGEOLOGIC DATA

Appendix G-2

Explosive Residues from Munitions Used in Live-Fire Training

Studies performed by the US Army Corps of Engineers Cold Regions Experimentation Lab (CREL), which measured the amount of residue generated by detonations of selected munitions, provide an indication of the amount of explosive residue that may have resulted from past live-fire training exercises (Jenkins, no date; Jenkins et al. 2000). Several types of munitions, and different types of modes of detonation were evaluated. Both high-order detonations (where the munition item detonates as it was designed to do), and low-order detonations (where the munition item is exploded with an external charge (blown in place), were evaluated. Table G-1 summarizes the results of the studies.

The main components of the high explosive charge in the munitions, in order of their abundance in the residue, are RDX, HMX, and TNT. The 60mm mortars represent high-order detonations. The results for the 81mm mortar represent low-order detonations, where the mortar was placed on the ground (after removing the propellant, but leaving the high explosive charge) and blown up with an external charge of C4 plastic explosive.

The explosive charge in the 60mm (2-inch) mortar rounds contained about 0.95 pounds (0.43 kilograms) of Composition B. The high explosive charge in an 81mm (3-inch) mortar consists of about two pounds (0.91 kilograms) of Composition B. Composition B is composed of approximately 60 percent RDX (Royal Demolition Explosive or hexahydro-1,3,5-trinitro-1,3,5-triazine) and 39 percent TNT (2,4,6-trinitrotoluene) (Federation of American Scientists 2003).

C4 explosive contains about 91 percent RDX and the rest is polyisobutylene (butyl rubber, also used to make bicycle inner tubes). Military grade RDX typically contains about 10 percent HMX.

Both the initial weight of the high explosive charge, and the estimated initial weight of RDX, TNT, and HMX are shown in Table G-1. When the amount of HMX in RDX is taken into account, Composition B consists of about 54 percent RDX, 39 percent TNT, and about 6 percent HMX (Jenkins et al. 2000), while C4 contains about 82 percent RDX and 9 percent HMX. The remaining weight in the explosive charge is mostly inert material, such as wax and plastic.

Jenkins' studies also measured residues from detonation of M67 hand grenades. The hand grenades contained about one-quarter pound (100 grams) of RDX, about 0.15 pound (72 grams) of TNT, and one gram of

Table G-1
Residue Deposition from Selected Ordnance Items

Munition Type (High Explosive)	Total Weight of explosive charge [1]	Detonation Order [2]	Initial Weight of compound	Residue		Initial Weight of compound	Residue		Initial Weight of compound	Residue	
			RDX[3]			TNT			HMX [(4)]		
	kg		kg	µg	%	kg	µg	%	kg	µg	%
M67 hand grenade (Comp B)	0.17	H	0.100	26	0.00002	0.072	<1	-	0.011	<1	-
81mm mortar (Comp B)	0.91	L	0.49	35,000	0.007	0.35	240	0.00007	0.055	6,000	0.011
C4 alone (91% RDX)	.57	H	0.47	61,000	0.013	-	<1	-	0.052	26,000	0.050
M19 antitank mine	NR	L	-	280	-	-	<1	-	-	860	-
M15 antitank mine	NR	L	-	4,000	-	-	8	-	-	410	-
60mm mortar (Comp B)	0.43	H	0.23	630	0.00027	0.17	18	-	0.26	8	0.000003
60mm mortar (Comp B)	0.43	H	0.23	72	0.00003	0.17	14	-	0.26	19	0.000007
Claymore mine (C4, 91% RDX)	0.7 (est)	H	0.57	23,900	0.004	-	<1	-	0.06 (est)	17,400	0.03
Bangalore torpedo	NR	H	-	16,000	-		NR	-		2,300	-

Source: Jenkins, no date; Jenkins et al. 2000

Notes: [1]Total weight if reported, otherwise "NR" = not reported
[2]H=high order; L=low order
[3]RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine
[4]HMX - Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

HMX. Also shown are results of similar experiments with land mines and bangalore torpedoes. (The initial weight of the charges in these munitions was not reported, so they are not shown in the table).

The quantity of the explosive residue is given in micrograms in Table G-1. From this value it is possible to calculate the percentage of the initial weight of each explosive compound that the residue represents. Based on these data, the low-level detonations produce about 100 to 300 times more RDX residue than the high-level detonations.

The principal high explosives munitions used in a typical CALFEX live fire exercise at MMR include 60mm, 81mm, 84mm, 105mm, and 120mm rounds, claymore mines, and bangalore torpedoes. Each of these contains different quantities of high explosive. However, the maximum weight of high explosives that can be used in a CALFEX is limited to 300 lbs (136 kg).

For simplicity, we have assumed for purposes of this analysis, that on average, the high order detonation of the explosive yields residue representing 0.0001 percent of the initial weight of the explosive. Most of the high explosives used in the CALFEXs are Composition B. For purposes of estimation, it is assumed that on average, RDX accounts for 60 percent of the mass of the high explosives. Based on these assumptions, the total RDX residue that would result from detonation of 300 lbs (136 kg) of high explosives would be 82,000 micrograms (0.082 grams).

Further it can be expected that occasionally a mortar round will not detonate as planned, and will need to be blown in place by EOD personnel. For purposes of this estimate, it is assumed that on average, one unexploded 81mm mortar round will be blown in place in each live-fire exercise, and that these will be detonated with C4 explosive charges similar to those used in the studies by Jenkins et al., described above.

The use of C-4 explosive would add approximately 62,000 micrograms of RDX per live-fire exercise, and the low order detonation of an 81mm round would add an additional 65,000 micrograms. For purposes of this estimate, we can assume that the total RDX residue from each CALFEX would be the sum of these quantities, or approximately 0.21 grams of RDX.

The industrial soil PRG for RDX is 16,000 micrograms per kilogram. This concentration would result if all of the RDX residue

from a typical CALFEX described above were mixed with about 13 kilograms of soil.

Since the residues from detonation of explosives occurs over a relatively large area, what actually happens is that the explosives residues are dispersed in vastly larger quantities of soil than 13 kilograms. By way of illustration, one cubic yard of soil weighs approximately 1.3 tons (1,200 kg). There is one cubic yard of soil in a circular area with a radius of four feet and a depth of six inches. (Six inches is used in this example because many surface soil investigations are based on collecting samples from the upper six inches of soil). Therefore, assuming that the RDX were mixed evenly into the upper six inches of soil, it would require the residue from about 100 CALFEXs to contaminate one cubic yard of soil to a concentration that exceeded the industrial soil PRG, and it would require more than 80,000 CALFEXs to contaminate one acre of land to a depth of six inches in excess of the industrial soil PRG.

In fact, it is highly unlikely that detectable concentrations of RDX would be found if the residue is widely dispersed, or mixed into the upper six inches of soil. If the residue from 50 CALFEXs were distributed evenly over an area of 35 acres (the approximate size of the impact area where these detonations occur during live fire training exercises), the average concentration in the soil would be about 2 µg/kg. But the detection limit for the analytical method commonly used to detect RDX in soils is about 200 µg/kg, or about 100 times higher than the average concentration expected in the soil. Therefore, while localized detectable concentrations of RDX may occur, such as near the point of impact, or near where an unexploded round is blown in place, the concentrations overall would be too low to be detected.

Table G.2-1 Comparison of Metals Concentrations in Surface Soils to US EPA Region 9 PRGs

	Concentration (mg/kg)				PRGs		Occupational Risk	
Metal	Average	95% UCL	Hawai'i Background [1]	Onsite Background [2]	Non-Cancer	Cancer	Non-Cancer	Cancer
Aluminum [5]	48,589	52,013	60,000 to 80,000	40,573	100,000	-	0.52	-
Antimony	11.90	16.00	NA	6.00	409	-	0.039	-
Arsenic	3.50	4.10	0.02	0.30	256	1.59	0.016	2.58E-06
Barium	115	129	NA	97	66,577	-	0.0019	-
Beryllium	1.70	2.00	NA	0.90	1,900	1,941	0.0011	1.03E-09
Cadmium	2.80	4.30	0.12 to 0.13	0.40	450	-	0.0096	-
Chromium	199	217	254 to 586	171	100,000	448	0.0022	4.84E-07
Cobalt	64	71	54 to 59	38	13,000	-	0.0055	-
Copper	90	100	70 to 128	71	40,877	-	0.0024	-
Iron [5]	82,130	87,740	11,900 to 13,000	59,622	100,000	-	0.88	-
Lead	41	55	4.0 to 4.4	9.20	400	-	0.14	-
Manganese [5]	2,432	2,789	2,200 to 2,400	1,076	19,458	-	0.14	-
Mercury	0.13	0.15	NA	0.07	307	-	0.00049	-
Molybdenum	3.90	6.00	1	0.50	5,110	-	0.0012	-
Nickel	149	164	179 to 374	134	20,439	-	0.0080	-
Selenium	3.20	3.50	0.02 to 0.03	1.50	5,110	-	0.00068	-
Strontium	169	238	NA	95	100,000	-	0.0024	-
Thallium	0.17	0.19	NA	1.38	67	-	0.0028	-
Tin	1.18	1.77	NA	0.69	-	-	-	-
Vanadium	158	172	NA	138	7,154	-	0.024	-
Zinc	116	132	120 to 128	81	100,000	-	0.0013	-
Sum							**1.80**	**3.06E-06**

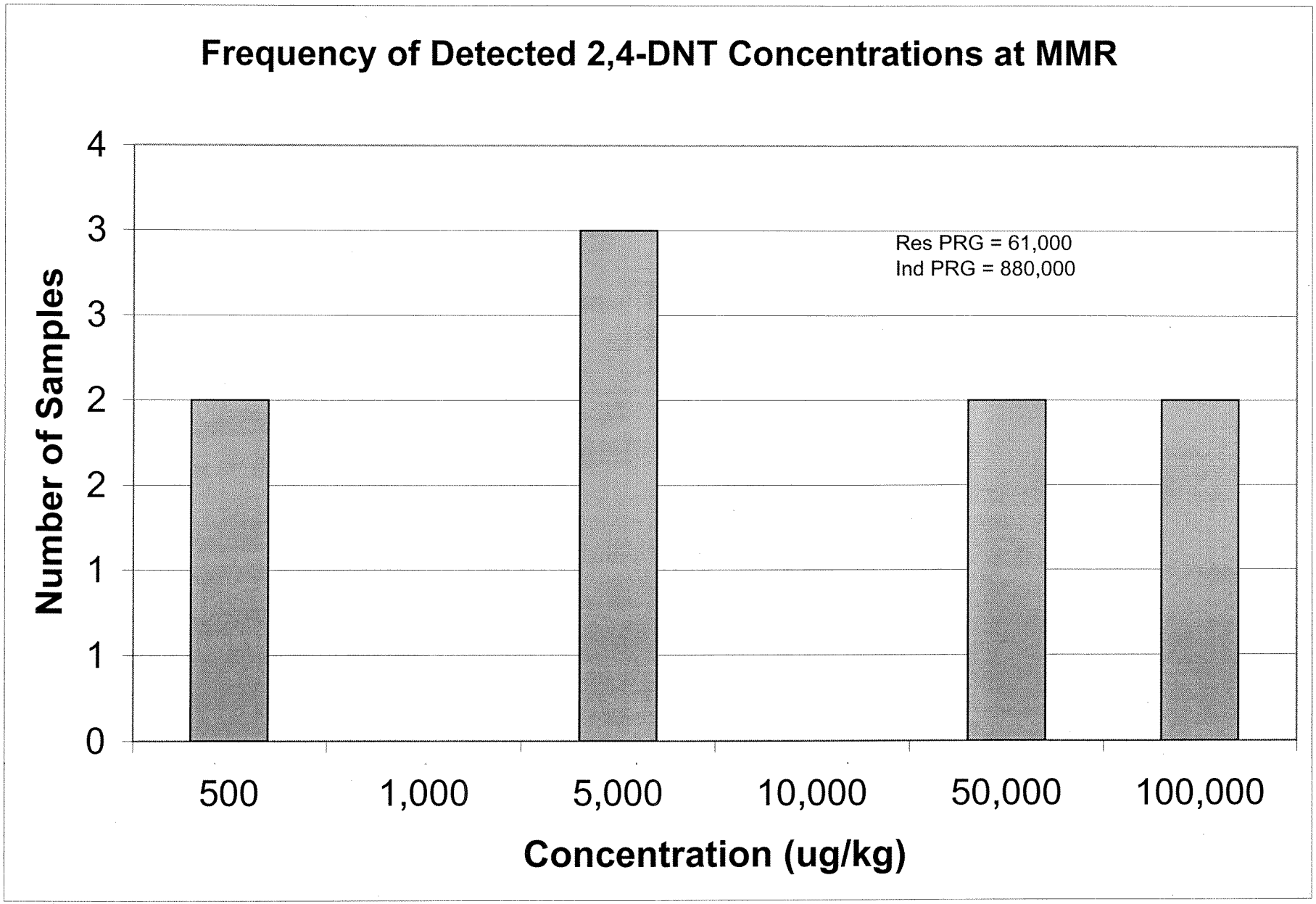
Notes: 1 - Background concentrations in Hawaiian soils from Halbig et al 1985

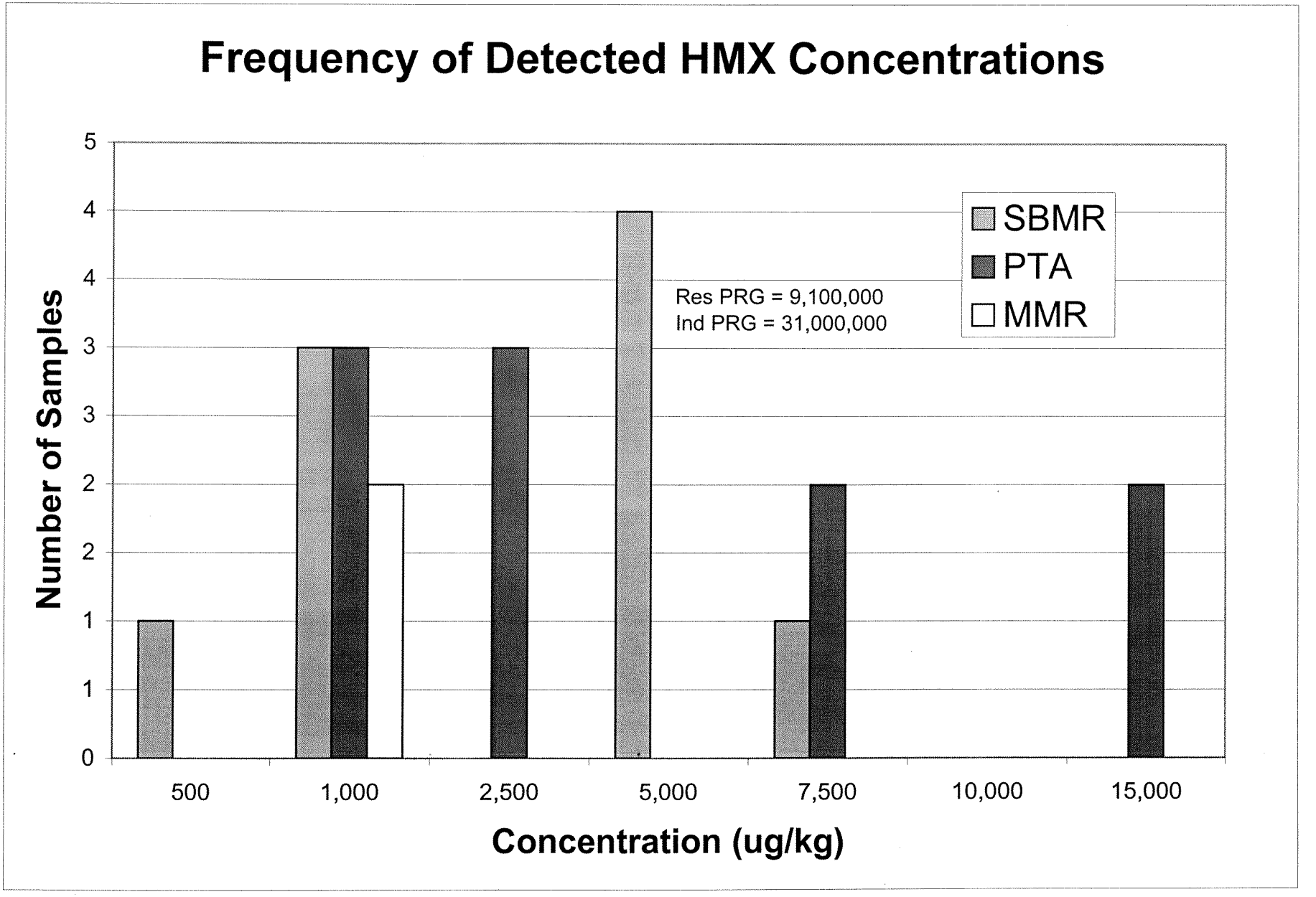
2 - Onsite background concentrations is 95% UCL for samples in areas of Makua Valley outside training area

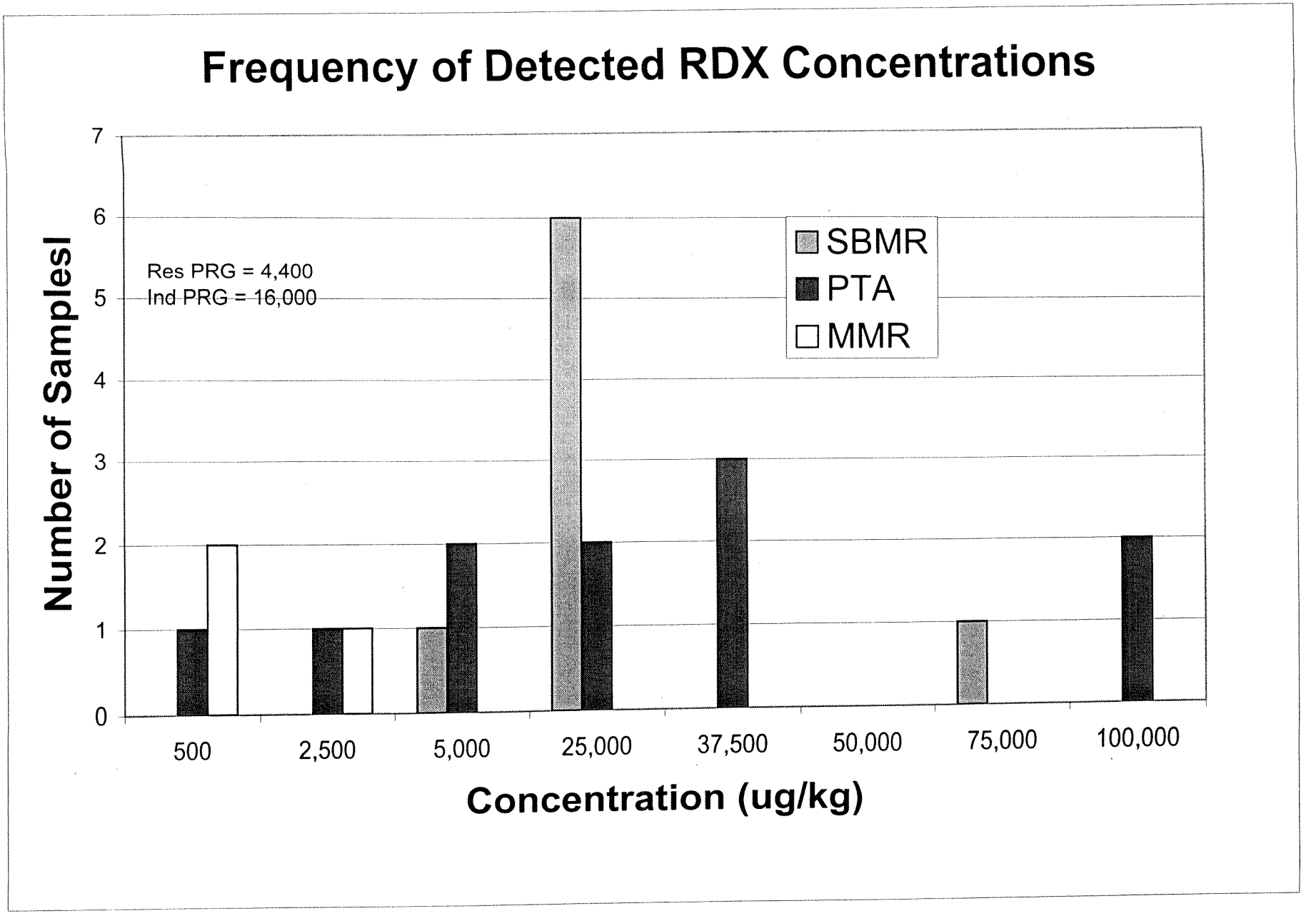
3 - US EPA Region 9 Preliminary Remediation Goals for Soils at Industrial sites (2002)

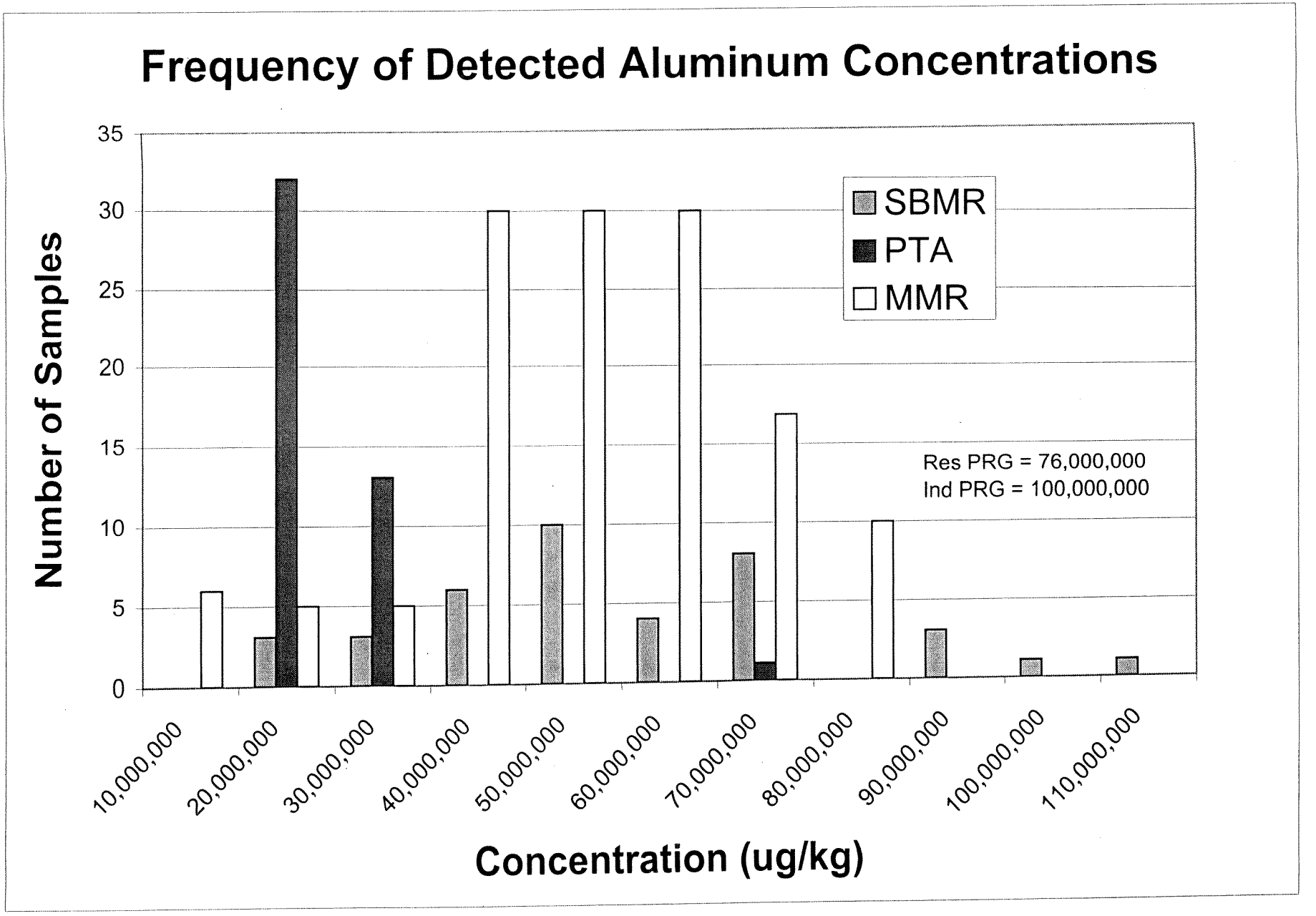
4 - Non-cancer risk = (95% UCL)/(non-cancer PRG); Cancer risk = (95% UCL)/(cancer PRG) x (10^{-6})

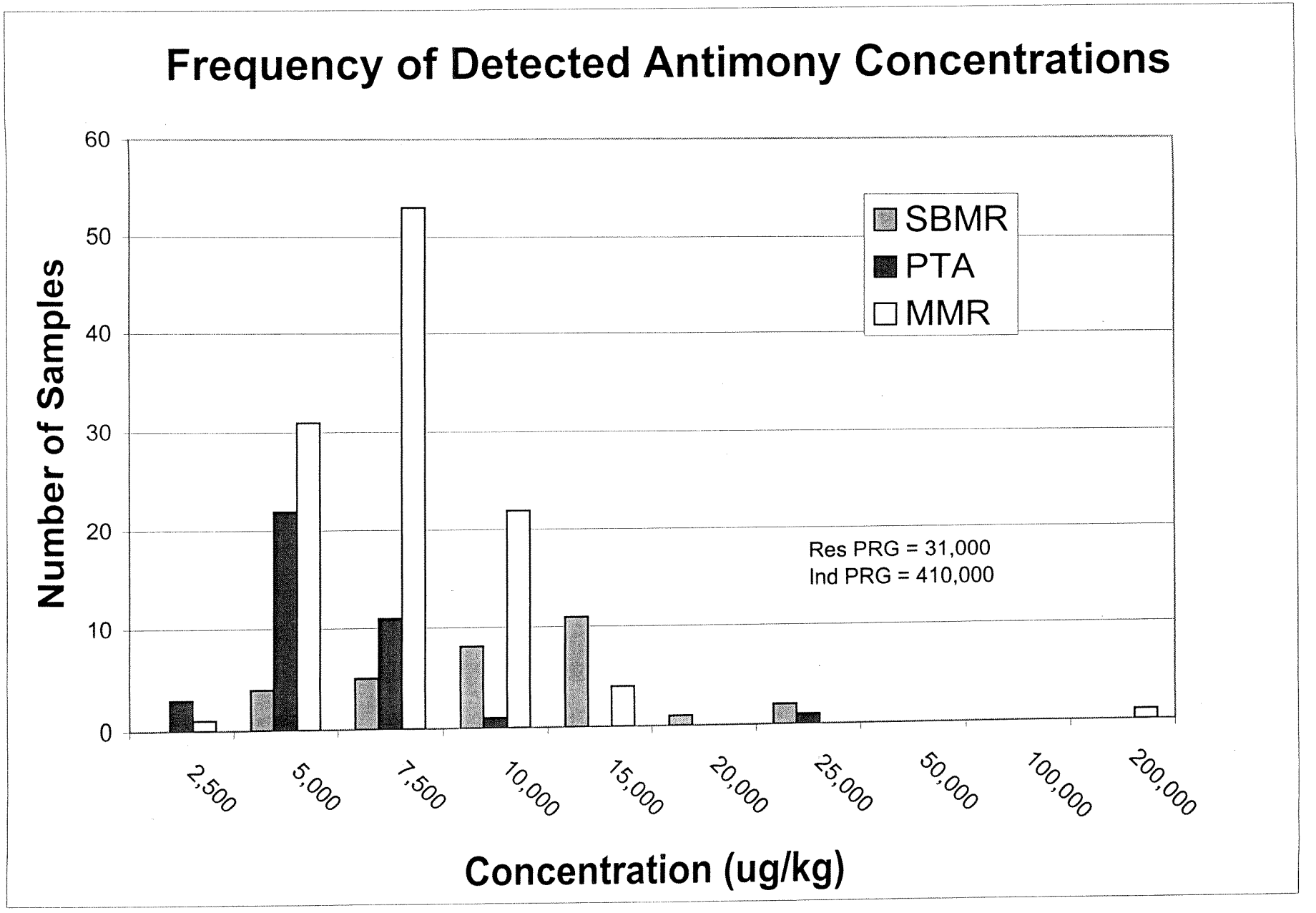
5 - Aluminum, Iron and Manganese contribute 85% of the combined non-cancer risk.


Frequency of Detected 2,4-DNT Concentrations at MMR
Number of Samples
4
3
3
2
2
1
1
0
Res PRG = 61,000
Ind PRG = 880,000
500
1,000
5,000
10,000
50,000
100,000
Concentration (ug/kg)

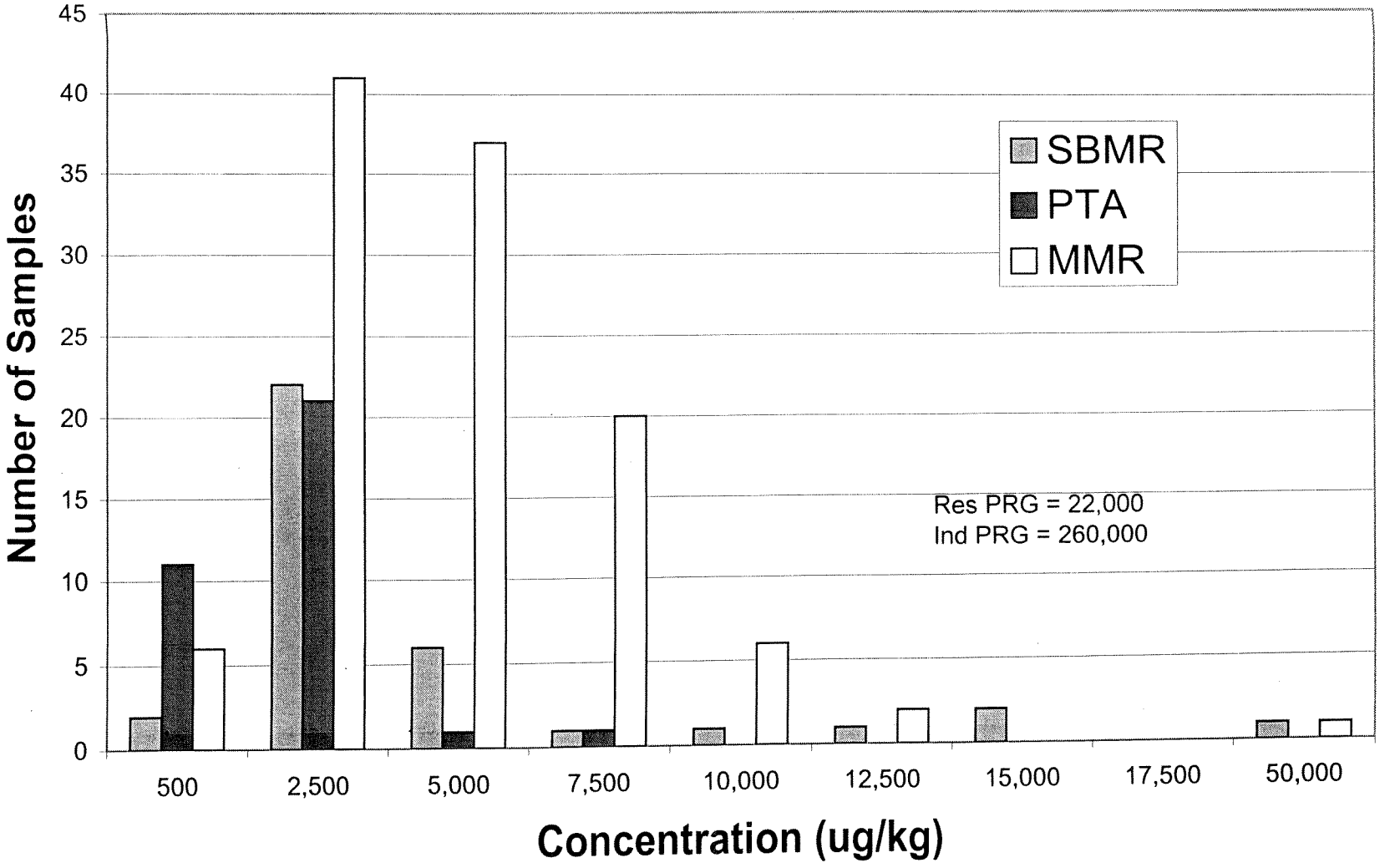

Frequency of Detected HMX Concentrations
Number of Samples
5
4
4
3
3
2
2
1
1
0
500
1,000
2,500
5,000
7,500
10,000
15,000
Concentration (ug/kg)
SBMR
PTA
MMR
Res PRG = 9,100,000
Ind PRG = 31,000,000

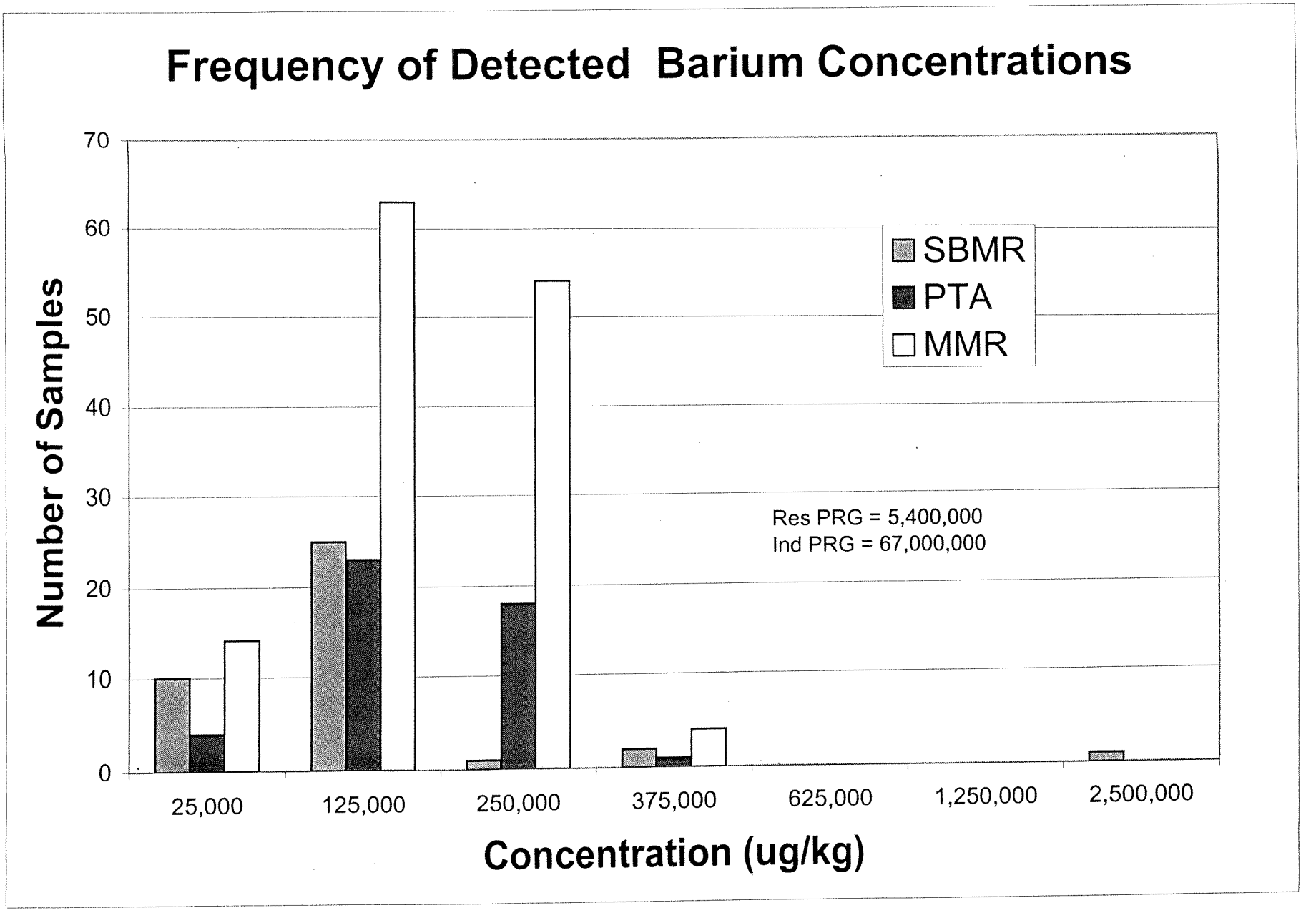

Frequency of Detected RDX Concentrations
Number of Samplesl
7
6
5
4
3
2
1
0
Res PRG = 4,400
Ind PRG = 16,000
SBMR
PTA
MMR
500
2,500
5,000
25,000
37,500
50,000
75,000
100,000
Concentration (ug/kg)

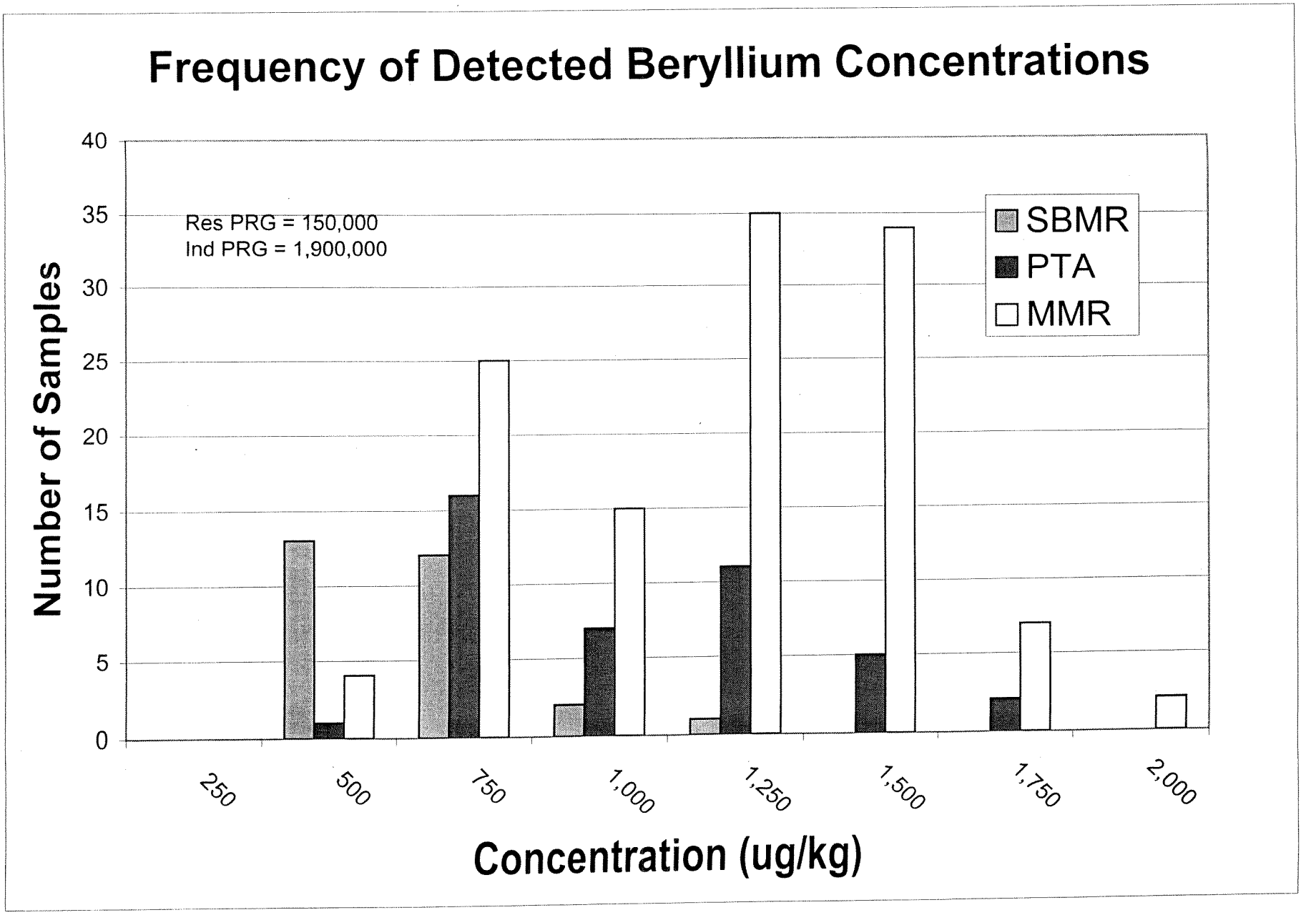

Frequency of Detected Aluminum Concentrations
Number of Samples
35
30
25
20
15
10
5
0
SBMR
PTA
MMR
Res PRG = 76,000,000
Ind PRG = 100,000,000
10,000,000
20,000,000
30,000,000
40,000,000
50,000,000
60,000,000
70,000,000
80,000,000
90,000,000
100,000,000
110,000,000
Concentration (ug/kg)


Frequency of Detected Antimony Concentrations
Number of Samples
60
50
40
30
20
10
0
SBMR
PTA
MMR
Res PRG = 31,000
Ind PRG = 410,000
2,500
5,000
7,500
10,000
15,000
20,000
25,000
50,000
100,000
200,000
Concentration (ug/kg)

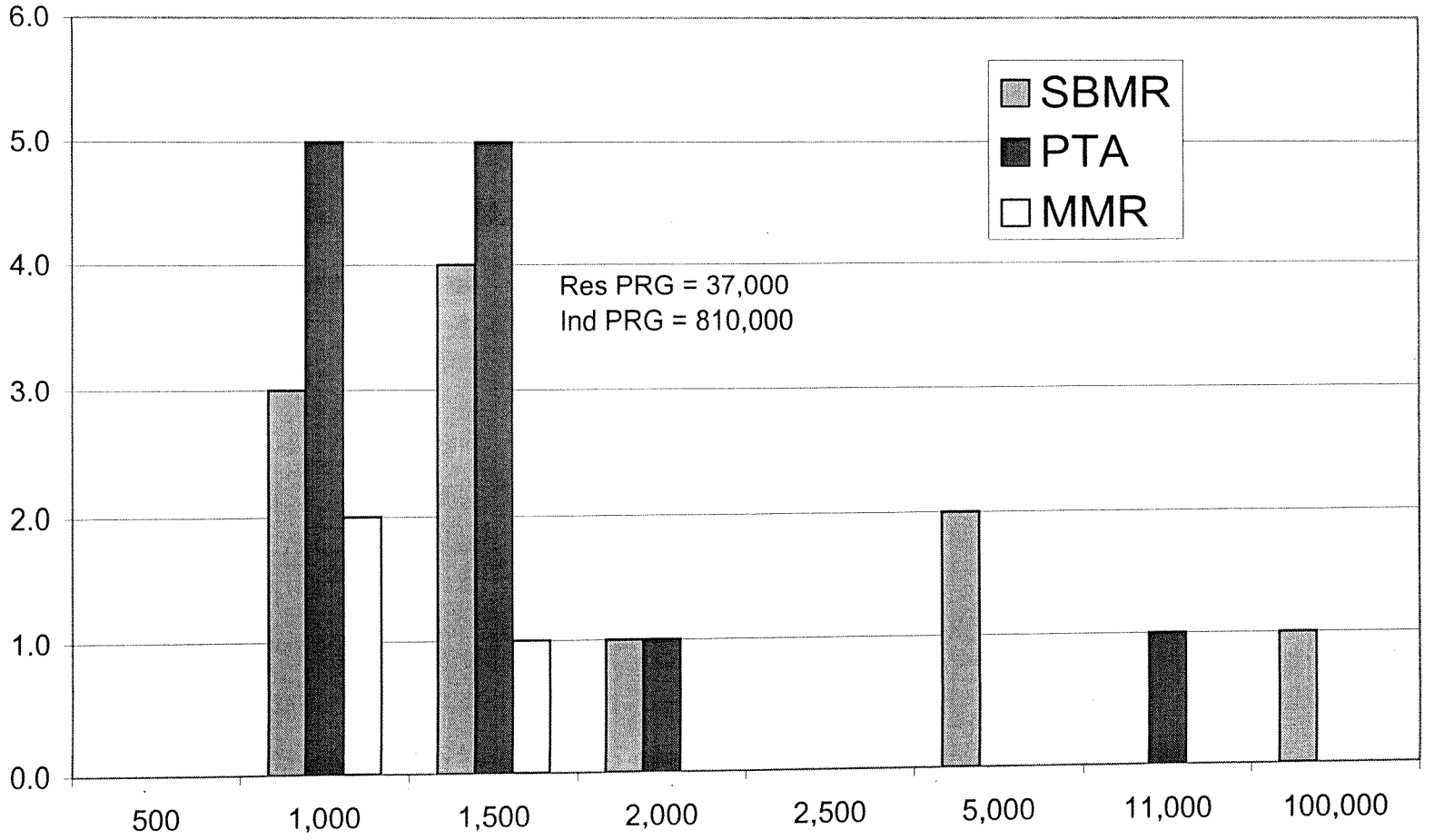
Frequency of Detected Arsenic Concentrations

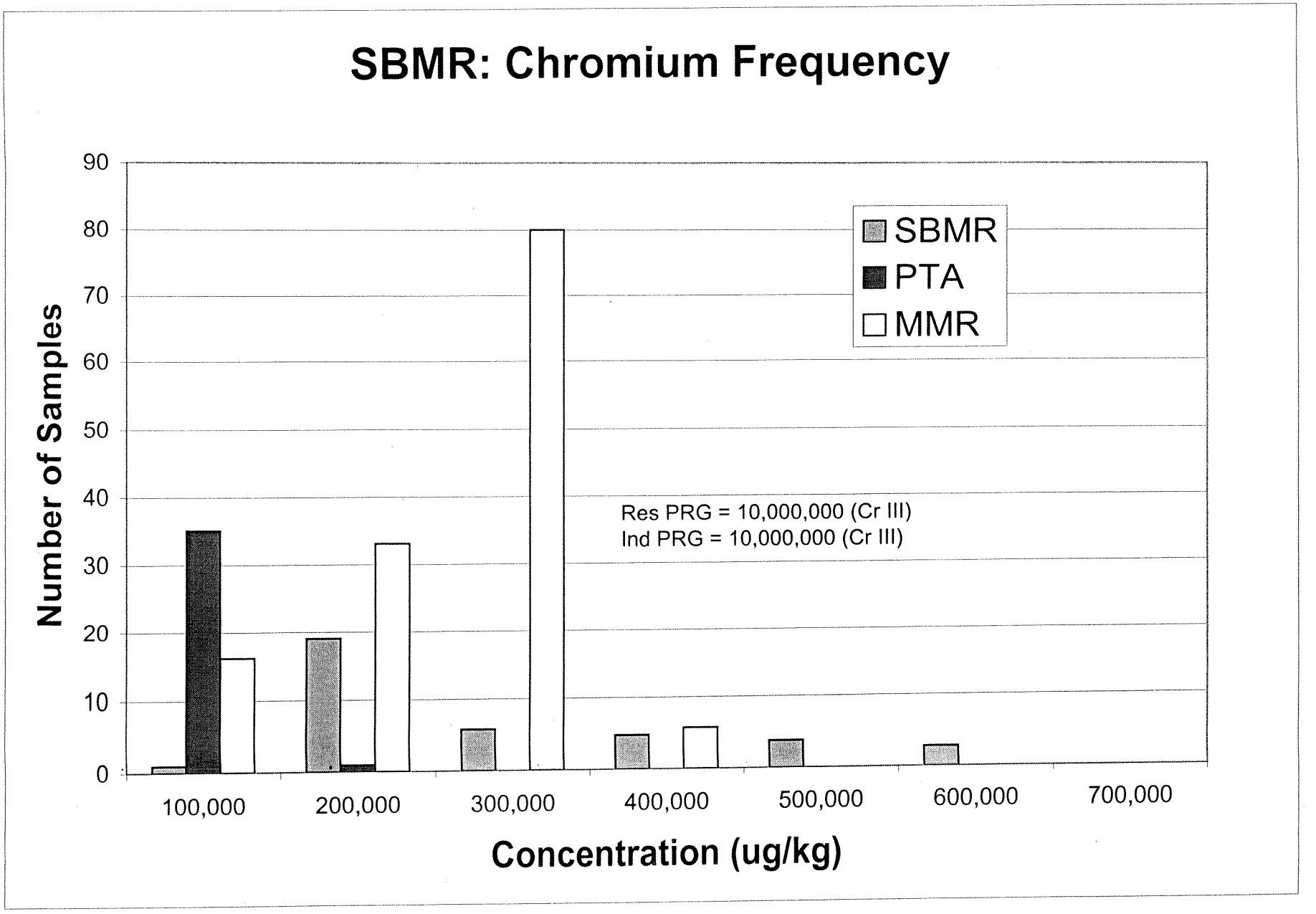



Frequency of Detected Barium Concentrations
Number of Samples
70
60
50
40
30
20
10
0
SBMR
PTA
MMR
Res PRG = 5,400,000
Ind PRG = 67,000,000
25,000
125,000
250,000
375,000
625,000
1,250,000
2,500,000
Concentration (ug/kg)

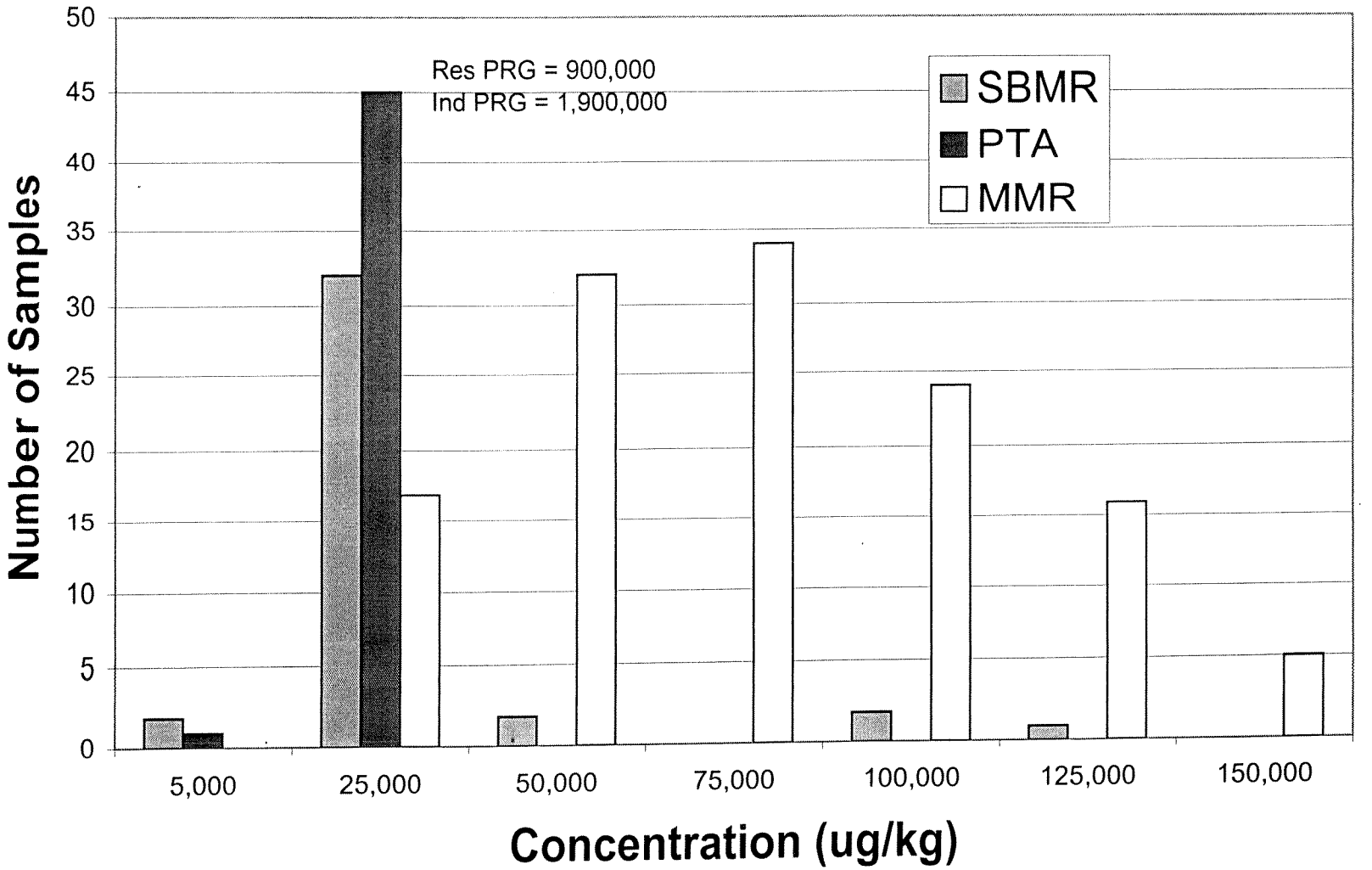

Frequency of Detected Beryllium Concentrations
Res PRG = 150,000
Ind PRG = 1,900,000
SBMR
PTA
MMR
Number of Samples
0
5
10
15
20
25
30
35
40
250
500
750
1,000
1,250
1,500
1,750
2,000
Concentration (ug/kg)

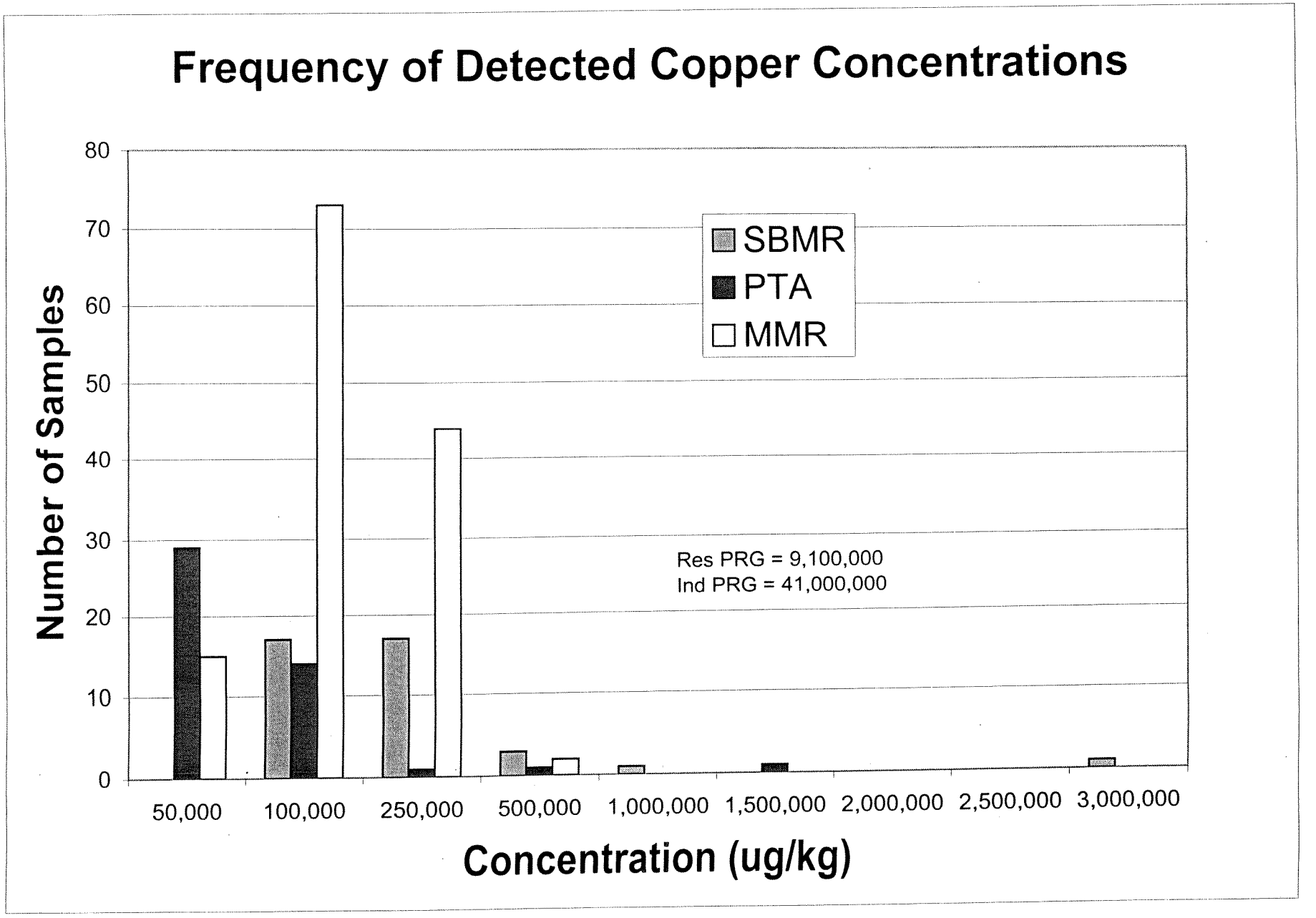
Frequency of Detected Cadmium Concentrations

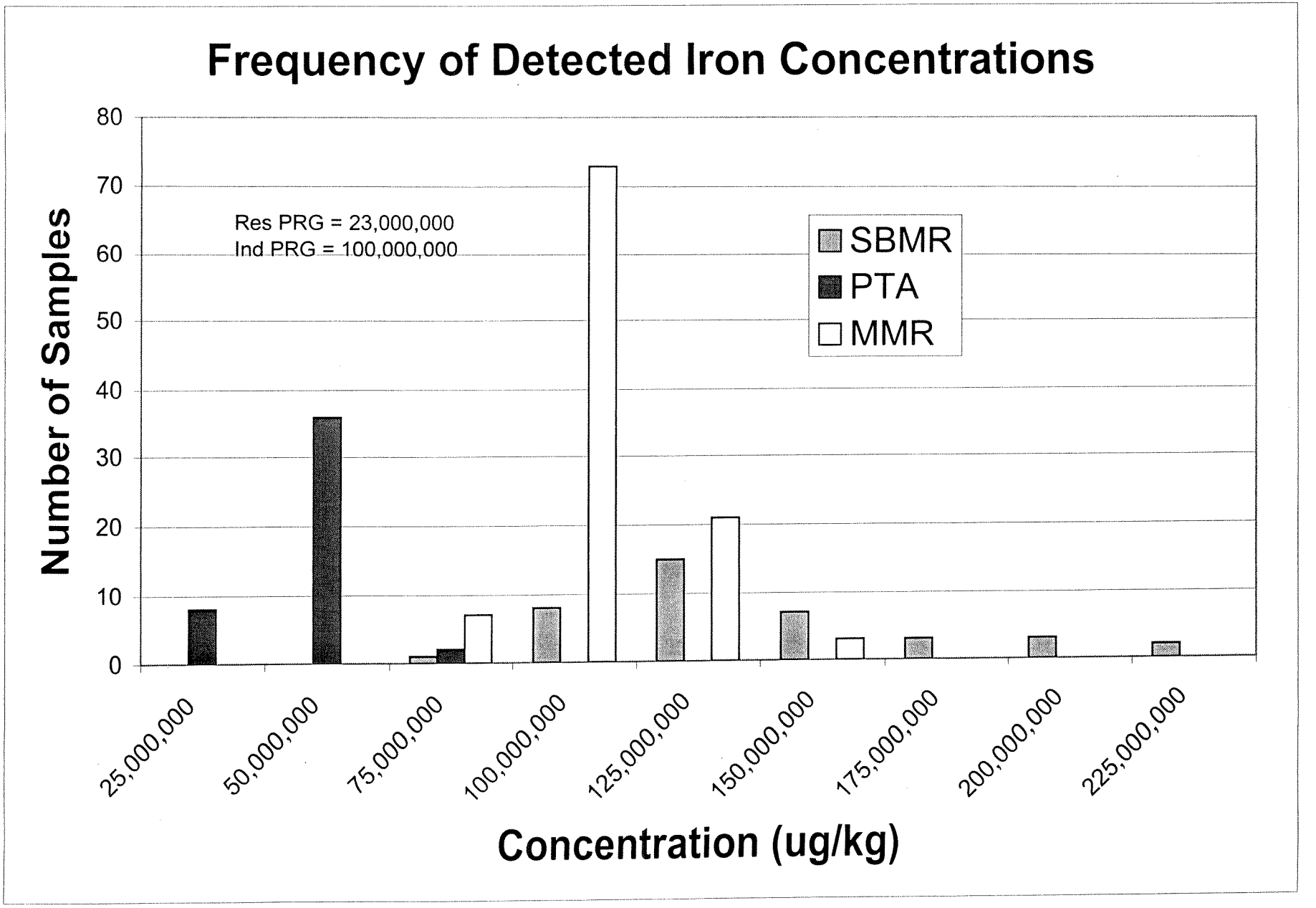


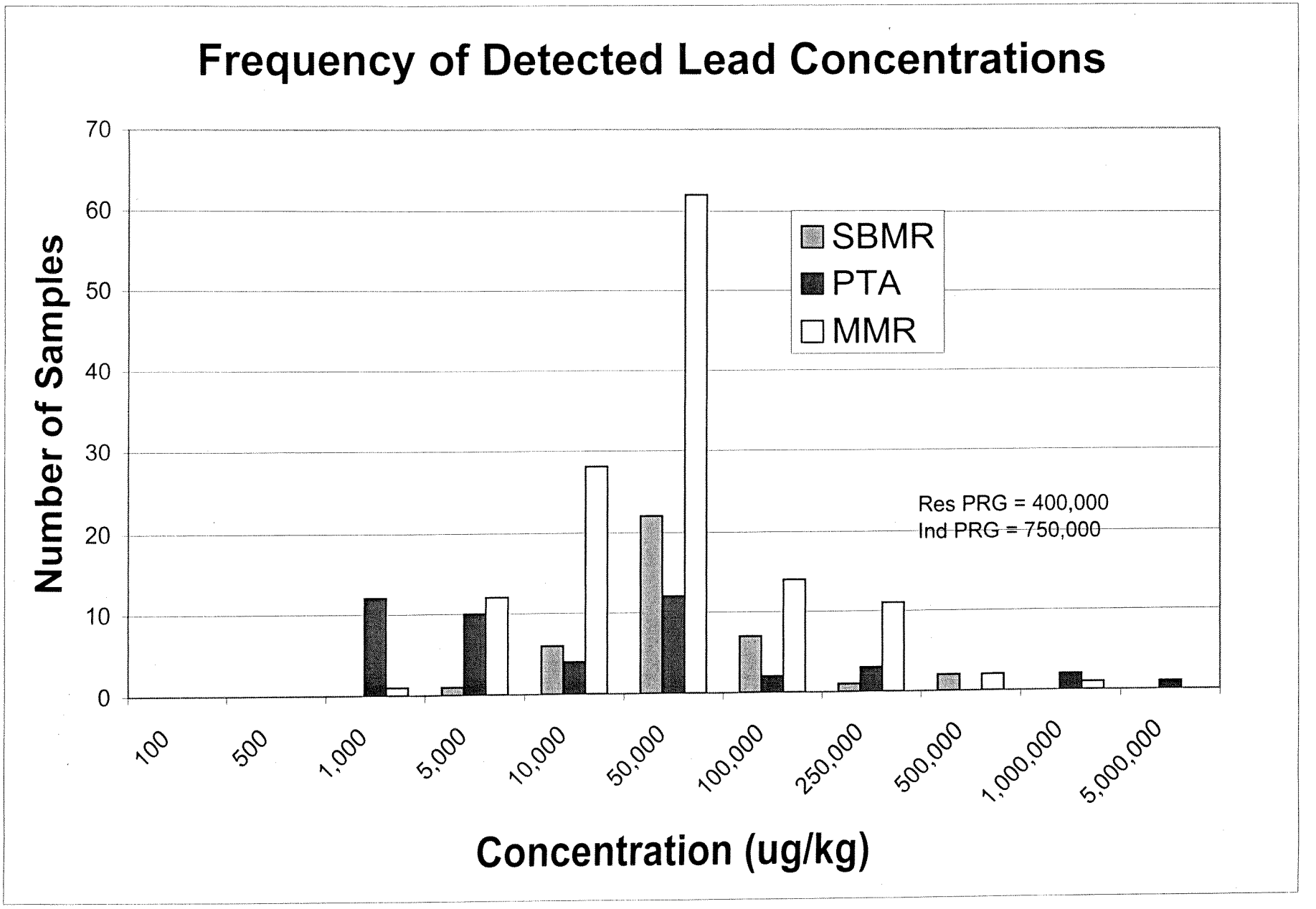

SBMR: Chromium Frequency
Number of Samples
90
80
70
60
50
40
30
20
10
0
SBMR
PTA
MMR
Res PRG = 10,000,000 (Cr III)
Ind PRG = 10,000,000 (Cr III)
100,000
200,000
300,000
400,000
500,000
600,000
700,000
Concentration (ug/kg)

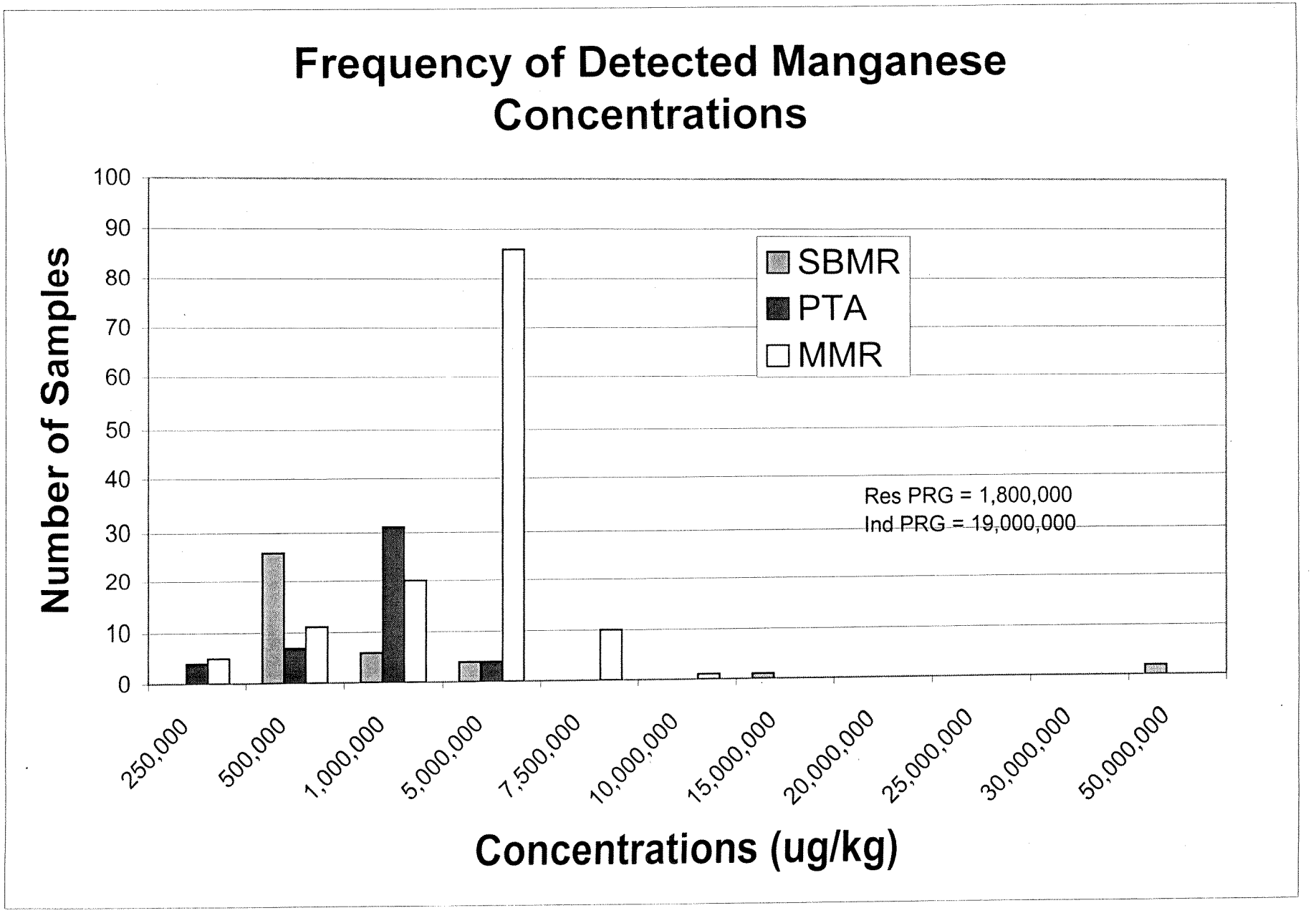
Frequency of Detected Cobalt Concentrations

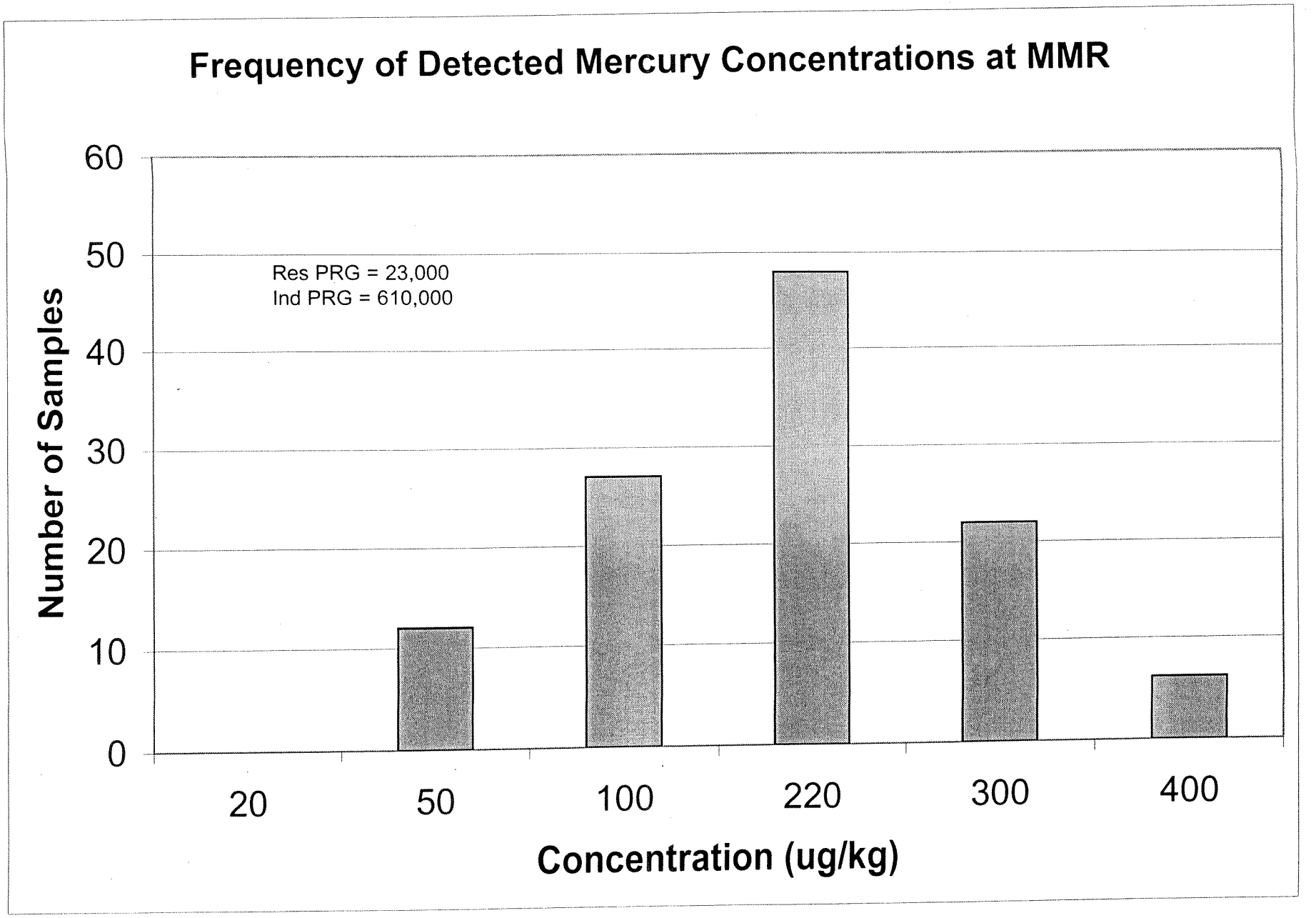


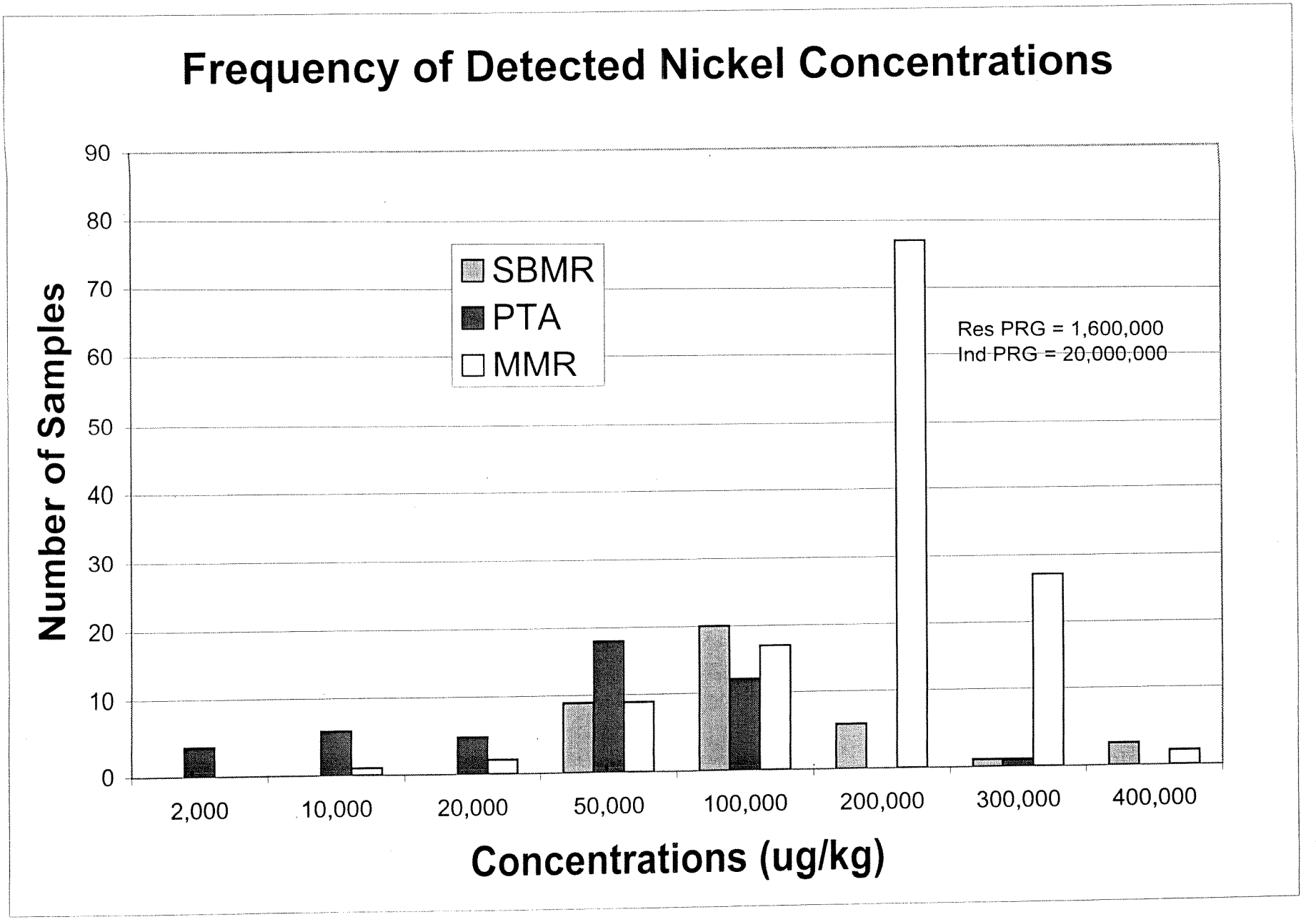

Frequency of Detected Copper Concentrations
Number of Samples
80
70
60
50
40
30
20
10
0
SBMR
PTA
MMR
Res PRG = 9,100,000
Ind PRG = 41,000,000
50,000
100,000
250,000
500,000
1,000,000
1,500,000
2,000,000
2,500,000
3,000,000
Concentration (ug/kg)

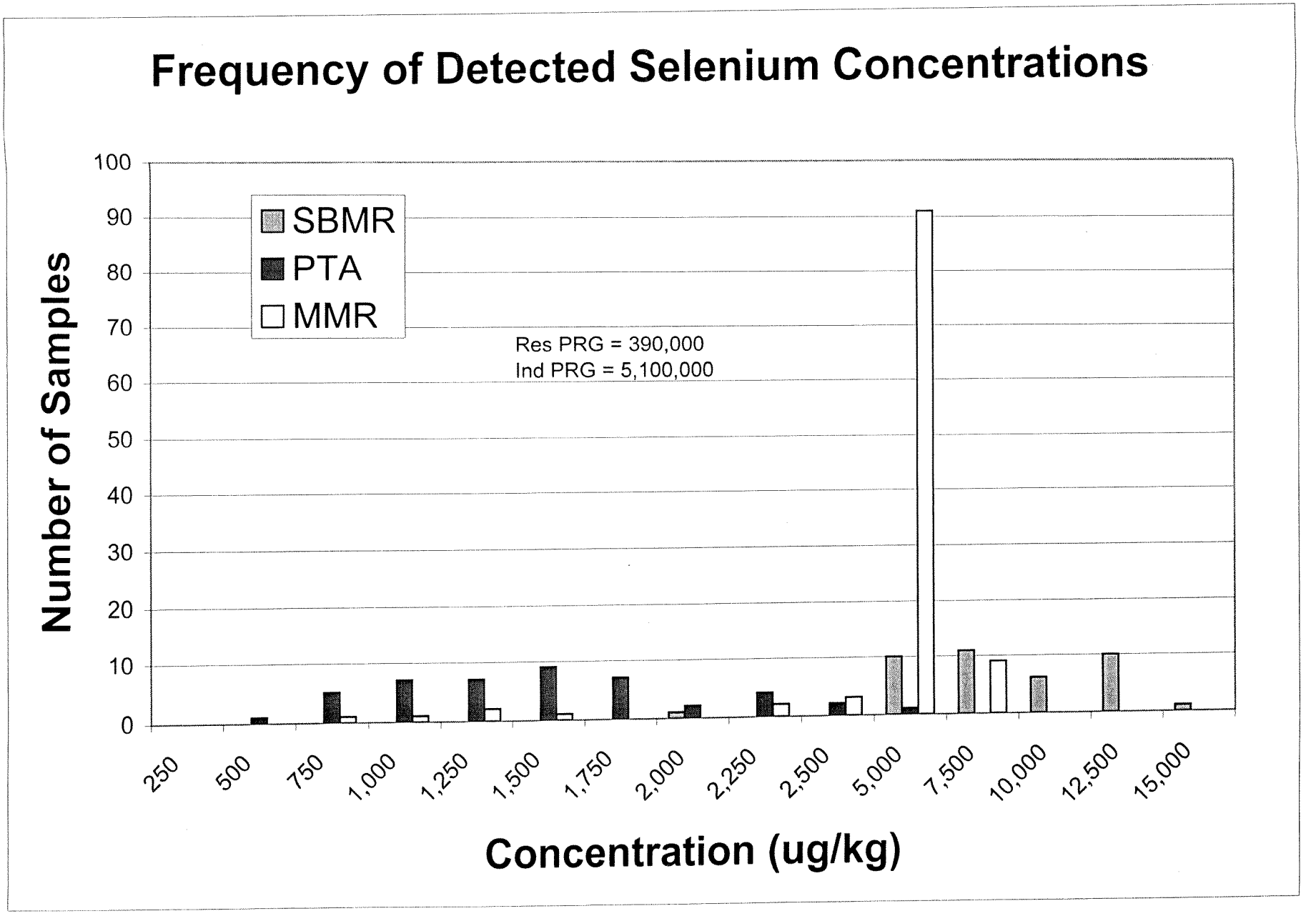

Frequency of Detected Iron Concentrations
Number of Samples
80
70
60
50
40
30
20
10
0
Res PRG = 23,000,000
Ind PRG = 100,000,000
SBMR
PTA
MMR
25,000,000
50,000,000
75,000,000
100,000,000
125,000,000
150,000,000
175,000,000
200,000,000
225,000,000
Concentration (ug/kg)

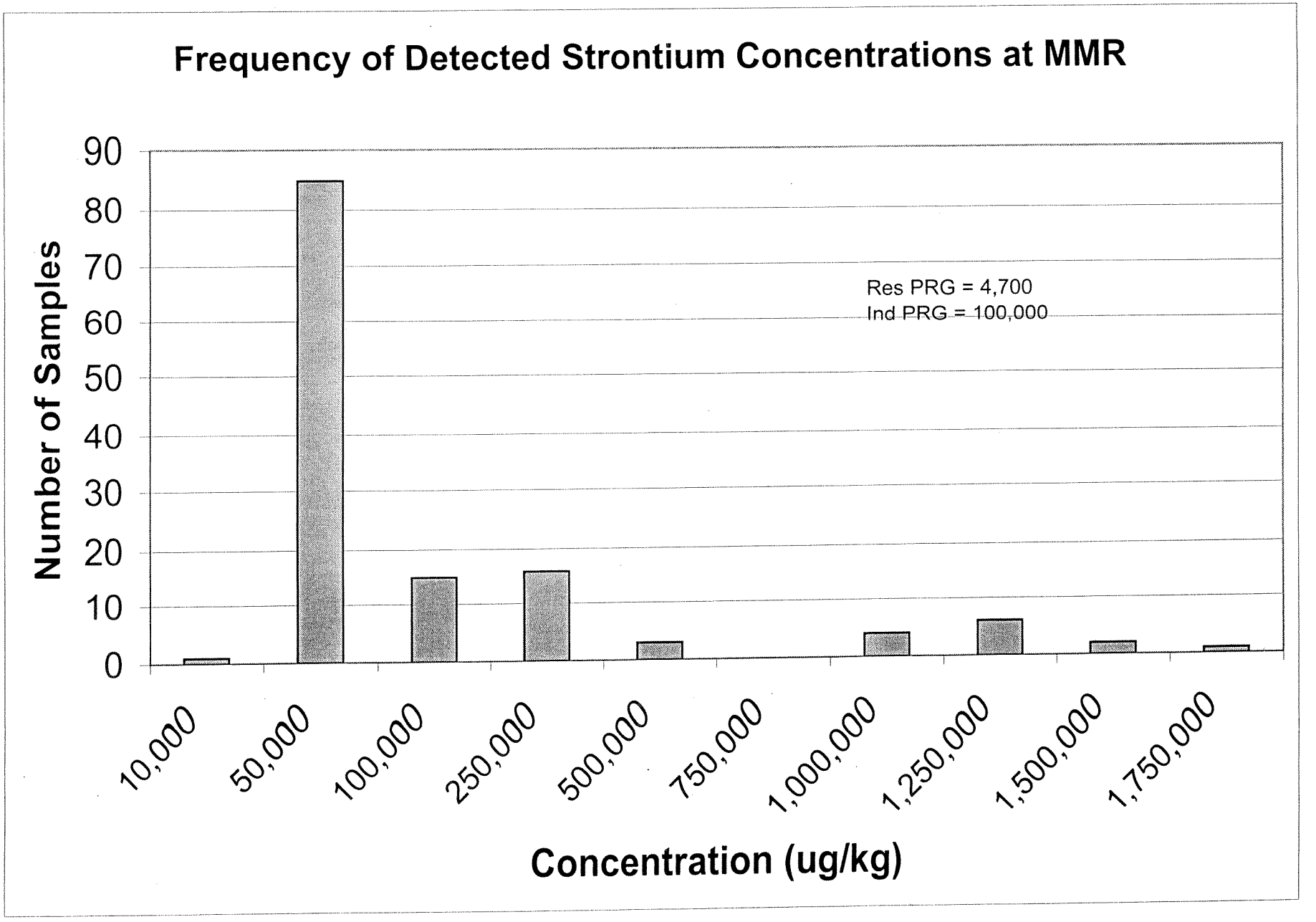

Frequency of Detected Lead Concentrations
Number of Samples
70
60
50
40
30
20
10
0
SBMR
PTA
MMR
Res PRG = 400,000
Ind PRG = 750,000
100
500
1,000
5,000
10,000
50,000
100,000
250,000
500,000
1,000,000
5,000,000
Concentration (ug/kg)

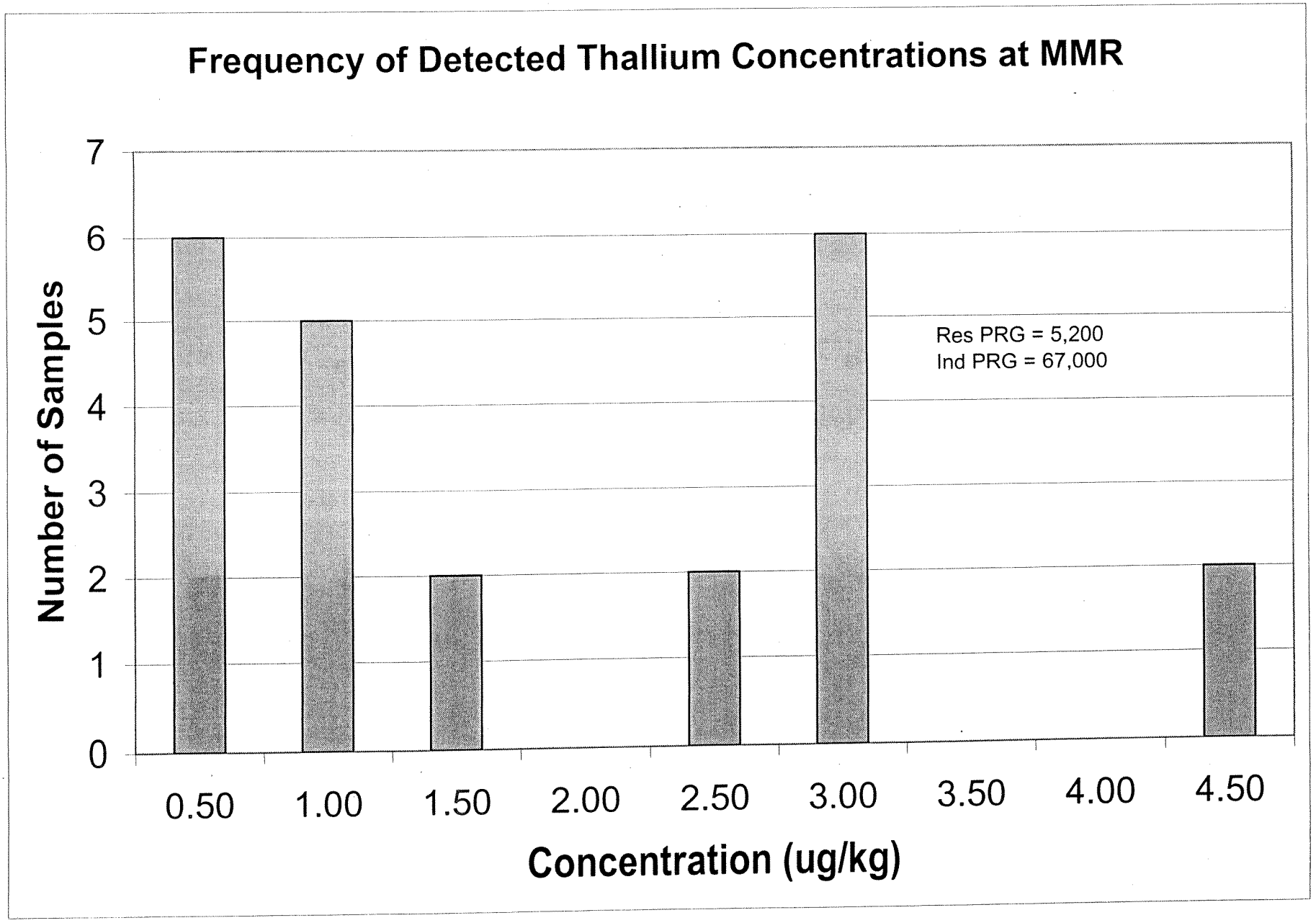

Frequency of Detected Manganese Concentrations
Number of Samples
100
90
80
70
60
50
40
30
20
10
0
SBMR
PTA
MMR
Res PRG = 1,800,000
Ind PRG = 19,000,000
250,000
500,000
1,000,000
5,000,000
7,500,000
10,000,000
15,000,000
20,000,000
25,000,000
30,000,000
50,000,000
Concentrations (ug/kg)

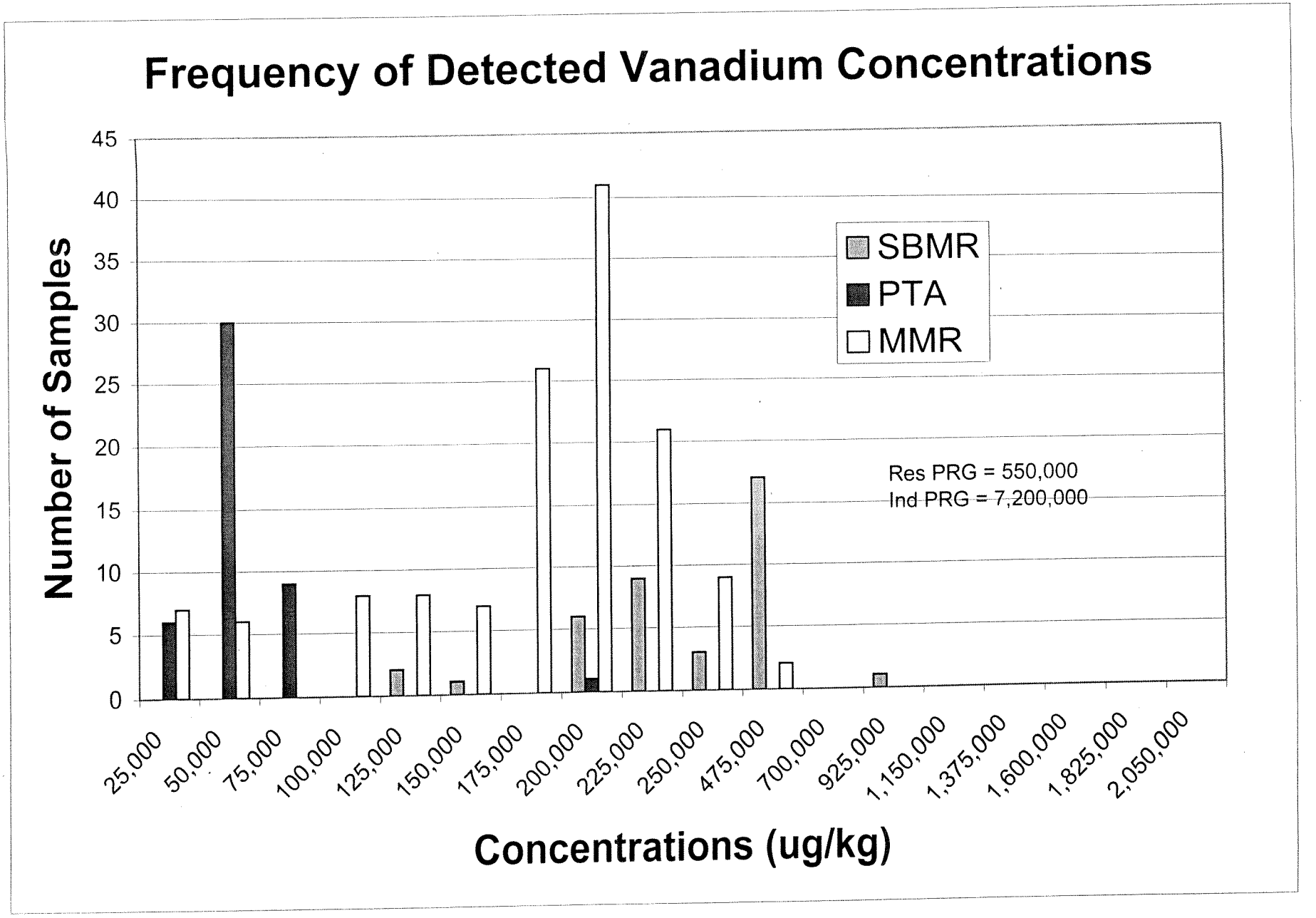

Frequency of Detected Mercury Concentrations at MMR
Number of Samples
60
50
40
30
20
10
0
Res PRG = 23,000
Ind PRG = 610,000
20
50
100
220
300
400
Concentration (ug/kg)

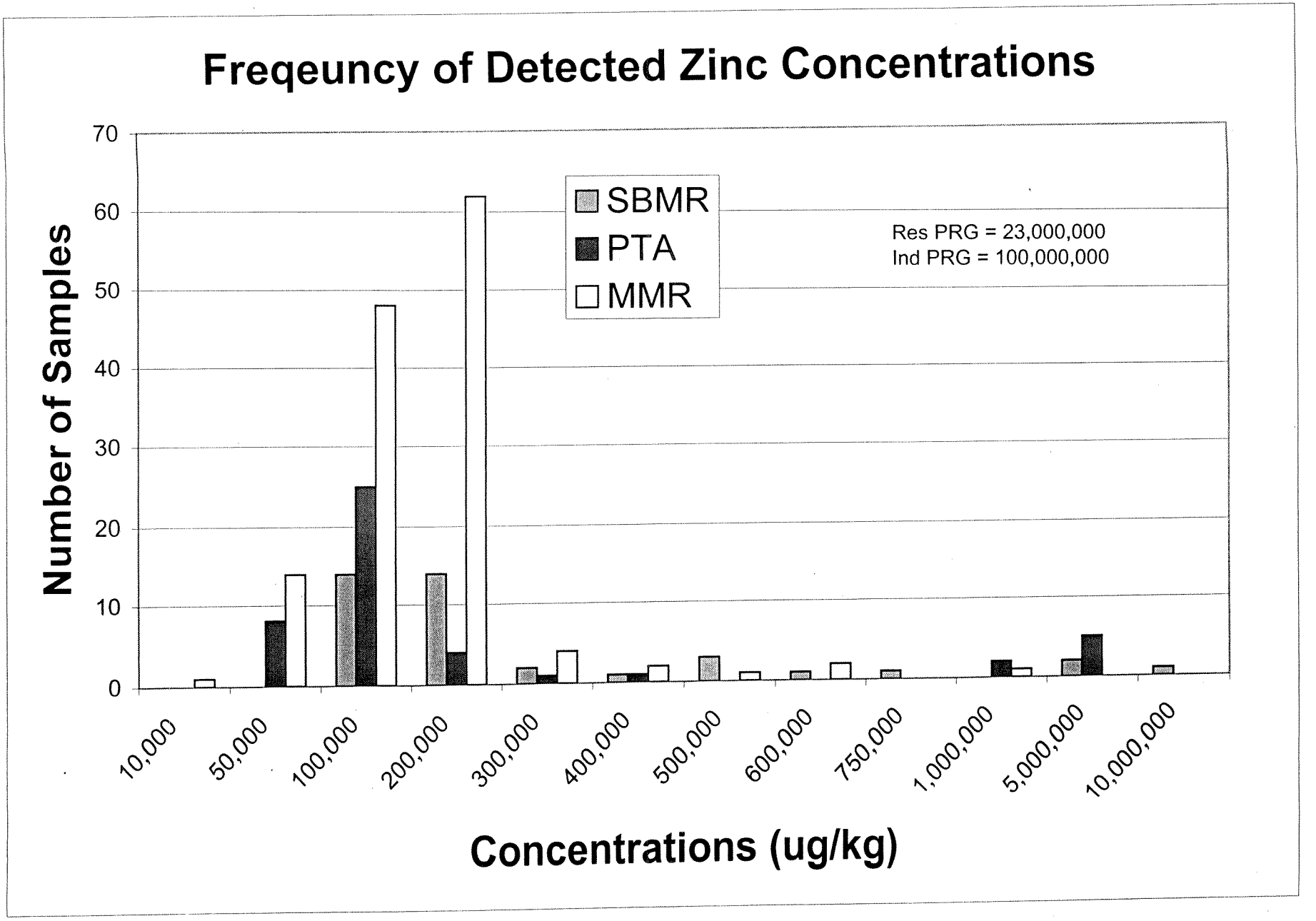

Frequency of Detected Nickel Concentrations
Number of Samples
90
80
70
60
50
40
30
20
10
0
SBMR
PTA
MMR
Res PRG = 1,600,000
Ind PRG = 20,000,000
2,000
10,000
20,000
50,000
100,000
200,000
300,000
400,000
Concentrations (ug/kg)


Frequency of Detected Selenium Concentrations
Number of Samples
100
90
80
70
60
50
40
30
20
10
0
SBMR
PTA
MMR
Res PRG = 390,000
Ind PRG = 5,100,000
250
500
750
1,000
1,250
1,500
1,750
2,000
2,250
2,500
5,000
7,500
10,000
12,500
15,000
Concentration (ug/kg)


Frequency of Detected Strontium Concentrations at MMR
Number of Samples
90
80
70
60
50
40
30
20
10
0
Res PRG = 4,700
Ind PRG = 100,000
10,000
50,000
100,000
250,000
500,000
750,000
1,000,000
1,250,000
1,500,000
1,750,000
Concentration (ug/kg)


Frequency of Detected Thallium Concentrations at MMR
Number of Samples
0
1
2
3
4
5
6
7
Res PRG = 5,200
Ind PRG = 67,000
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
Concentration (ug/kg)


Frequency of Detected Vanadium Concentrations
Number of Samples
45
40
35
30
25
20
15
10
5
0
SBMR
PTA
MMR
Res PRG = 550,000
Ind PRG = 7,200,000
25,000
50,000
75,000
100,000
125,000
150,000
175,000
200,000
225,000
250,000
475,000
700,000
925,000
1,150,000
1,375,000
1,600,000
1,825,000
2,050,000
Concentrations (ug/kg)


Freqeuncy of Detected Zinc Concentrations
Number of Samples
70
60
50
40
30
20
10
0
SBMR
PTA
MMR
Res PRG = 23,000,000
Ind PRG = 100,000,000
10,000
50,000
100,000
200,000
300,000
400,000
500,000
600,000
750,000
1,000,000
5,000,000
10,000,000
Concentrations (ug/kg)

Toxicity Equivalent Calculations for Individual Dioxin Isomers in Surface Soil Samples

SHORT_NAM	LOC_NAME	DATE_S	MATRIX	PARAMETER	RESULT	QUALIFIER		TCDD EQF	TCDD EQUIV	Res 12378 TCDD PRG	Ind 12378 TCDD PRG	Residential Cancer Risk	Industrial Cancer Risk
105-FA 1-01	105 Firing Area	10/03/02	SOIL	OCDD	0.20600		UG/KG	1.00E-04	2.06E-05	3.90E-03	1.60E-02	5.28E-09	1.29E-09
105-FA 1-02	105 Firing Area	10/03/02	SOIL	1,2,3,4,7,8,9-HpCDF	0.01000		UG/KG	1.00E-02	1.00E-04	3.90E-03	1.60E-02		
105-FA 1-02	105 Firing Area	10/03/02	SOIL	1,2,3,4,7,8-HxCDF	0.00900		UG/KG	1.00E-01	9.00E-04	3.90E-03	1.60E-02		
105-FA 1-02	105 Firing Area	10/03/02	SOIL	1,2,3,7,8,9-HxCDD	0.02600		UG/KG	1.00E-01	2.60E-03	3.90E-03	1.60E-02		
105-FA 1-02	105 Firing Area	10/03/02	SOIL	2,3,4,6,7,8-HxCDF	0.00900		UG/KG	1.00E-01	9.00E-04	3.90E-03	1.60E-02		
105-FA 1-02	105 Firing Area	10/03/02	SOIL	OCDD	0.04800		UG/KG	1.00E-04	4.80E-06	3.90E-03	1.60E-02		
105-FA 1-02	105 Firing Area	10/03/02	SOIL	Total HpCDD	4.79800		UG/KG		0.00E+00	3.90E-03	1.60E-02		
105-FA 1-02	105 Firing Area	10/03/02	SOIL	Total HpCDF	4.65800		UG/KG		0.00E+00	3.90E-03	1.60E-02		
105-FA 1-02	105 Firing Area	10/03/02	SOIL	Total HxCDD	5.03500		UG/KG		0.00E+00	3.90E-03	1.60E-02		
105-FA 1-02	105 Firing Area	10/03/02	SOIL	Total HxCDF	3.87500		UG/KG		0.00E+00	3.90E-03	1.60E-02		
105-FA 1-02	105 Firing Area	10/03/02	SOIL	Total PeCDD	5.12100		UG/KG		0.00E+00	3.90E-03	1.60E-02		
105-FA 1-02	105 Firing Area	10/03/02	SOIL	Total PeCDF	5.58100		UG/KG		0.00E+00	3.90E-03	1.60E-02		
105-FA 1-02	105 Firing Area	10/03/02	SOIL	Total TCDD	2.33500		UG/KG		0.00E+00	3.90E-03	1.60E-02		
105-FA 1-02	105 Firing Area	10/03/02	SOIL	Total TCDF	1.98200		UG/KG		0.00E+00	3.90E-03	1.60E-02		
Subtotal:									**4.50E-03**	**3.90E-03**	1.60E-02	1.16E-06	2.82E-07
BADGER 1-10	Badger	10/03/02	SOIL	OCDD	0.03200		UG/KG	1.00E-04	3.20E-06	3.90E-03	1.60E-02	8.21E-10	2.00E-10
BUFFALO 1-06	Buffalo	10/03/02	SOIL	OCDD	0.02600		UG/KG	1.00E-04	2.60E-06	3.90E-03	1.60E-02	6.67E-10	1.63E-10
CAA 1-01	Counter Attack Area	10/03/02	SOIL	OCDD	0.02200		UG/KG	1.00E-04	2.20E-06	3.90E-03	1.60E-02	5.64E-10	1.38E-10
CAA 1-07	Counter Attack Area	10/03/02	SOIL	OCDD	0.01600	X	UG/KG	1.00E-04	1.60E-06	3.90E-03	1.60E-02	4.10E-10	1.00E-10
COYOTE 1-02	Coyote	10/03/02	SOIL	OCDD	0.02300		UG/KG	1.00E-04	2.30E-06	3.90E-03	1.60E-02	5.90E-10	1.44E-10
DB 1-01	Deer Berms	10/03/02	SOIL	1,2,3,4,6,7,8-HpCDF	0.00300		UG/KG	1.00E-02	3.00E-05	3.90E-03	1.60E-02		
DB 1-01	Deer Berms	10/03/02	SOIL	OCDD	0.03700		UG/KG	1.00E-04	3.70E-06	3.90E-03	1.60E-02		
DB 1-01	Deer Berms	10/03/02	SOIL	Total HpCDF	0.00300		UG/KG		0.00E+00	3.90E-03	1.60E-02		
Subtotal:									3.37E-05	3.90E-03	1.60E-02	8.64E-09	2.11E-09
DEEDS 1-01	Deeds	10/03/02	SOIL	OCDD	0.05700		UG/KG	1.00E-04	5.70E-06	3.90E-03	1.60E-02		
DEEDS 1-01	Deeds	10/03/02	SOIL	OCDF	0.00800		UG/KG	1.00E-04	8.00E-07	3.90E-03	1.60E-02		
Subtotal:									6.50E-06	3.90E-03	1.60E-02	1.67E-09	4.06E-10
DEER 1-01	Deer	10/03/02	SOIL	1,2,3,4,6,7,8-HpCDD	0.03000		UG/KG	1.00E-02	3.00E-04	3.90E-03	1.60E-02		
DEER 1-01	Deer	10/03/02	SOIL	OCDD	0.34100		UG/KG	1.00E-04	3.41E-05	3.90E-03	1.60E-02		
DEER 1-01	Deer	10/03/02	SOIL	Total HpCDD	0.05500		UG/KG		0.00E+00	3.90E-03	1.60E-02		
Subtotal:									3.34E-04	3.90E-03	1.60E-02	8.57E-08	2.09E-08
DEMO-PIT 1-01	Demo Pit	10/03/02	SOIL	1,2,3,4,6,7,8-HpCDD	0.03700		UG/KG	1.00E-02	3.70E-04	3.90E-03	1.60E-02		
DEMO-PIT 1-01	Demo Pit	10/03/02	SOIL	1,2,3,6,7,8-HxCDF	0.00300	X	UG/KG	1.00E-01	3.00E-04	3.90E-03	1.60E-02		
DEMO-PIT 1-01	Demo Pit	10/03/02	SOIL	OCDD	0.74600		UG/KG	1.00E-04	7.46E-05	3.90E-03	1.60E-02		
DEMO-PIT 1-01	Demo Pit	10/03/02	SOIL	OCDF	0.00900		UG/KG	1.00E-04	9.00E-07	3.90E-03	1.60E-02		

Toxicity Equivalent Calculations for Individual Dioxin Isomers in Surface Soil Samples

SHORT_NAM	LOC_NAME	DATE_S	MATRIX	PARAMETER	RESULT	QUALIFIER		TCDD EQF	TCDD EQUIV	Res 12378 TCDD PRG	Ind 12378 TCDD PRG	Residential Cancer Risk	Industrial Cancer Risk
DEMO-PIT 1-01	Demo Pit	10/03/02	SOIL	Total HpCDD	0.06600		UG/KG		0.00E+00	3.90E-03	1.60E-02		
DEMO-PIT 1-01	Demo Pit	10/03/02	SOIL	Total HpCDF	0.00700		UG/KG		0.00E+00	3.90E-03	1.60E-02		
DEMO-PIT 1-01	Demo Pit	10/03/02	SOIL	Total HxCDF	0.00900		UG/KG		0.00E+00	3.90E-03	1.60E-02		
Subtotal:									7.46E-04	3.90E-03	1.60E-02	1.91E-07	4.66E-08
ELK 1-07	Elk	10/03/02	SOIL	OCDD	0.02200	X	UG/KG	1.00E-04	2.20E-06	3.90E-03	1.60E-02	5.64E-10	1.38E-10
FOX 1-03	Fox	10/03/02	SOIL	OCDD	0.02300		UG/KG	1.00E-04	2.30E-06	3.90E-03	1.60E-02	5.90E-10	1.44E-10
MSFA 1-01	Makua Stream Firing Area	10/07/02	SOIL	1,2,3,4,7,8,9-HpCDF	0.01200		UG/KG	1.00E-02	1.20E-04	3.90E-03	1.60E-02		
MSFA 1-01	Makua Stream Firing Area	10/07/02	SOIL	1,2,3,4,7,8-HxCDF	0.00700	X	UG/KG	1.00E-01	7.00E-04	3.90E-03	1.60E-02		
MSFA 1-01	Makua Stream Firing Area	10/07/02	SOIL	1,2,3,7,8,9-HxCDD	0.01600		UG/KG	1.00E-01	1.60E-03	3.90E-03	1.60E-02		
MSFA 1-01	Makua Stream Firing Area	10/07/02	SOIL	2,3,4,6,7,8-HxCDF	0.01100		UG/KG	1.00E-01	1.10E-03	3.90E-03	1.60E-02		
MSFA 1-01	Makua Stream Firing Area	10/07/02	SOIL	Total HpCDD	4.94800		UG/KG		0.00E+00	3.90E-03	1.60E-02		
MSFA 1-01	Makua Stream Firing Area	10/07/02	SOIL	Total HpCDF	4.87200		UG/KG		0.00E+00	3.90E-03	1.60E-02		
MSFA 1-01	Makua Stream Firing Area	10/07/02	SOIL	Total HxCDD	5.32200		UG/KG		0.00E+00	3.90E-03	1.60E-02		
MSFA 1-01	Makua Stream Firing Area	10/07/02	SOIL	Total HxCDF	4.16200		UG/KG		0.00E+00	3.90E-03	1.60E-02		
MSFA 1-01	Makua Stream Firing Area	10/07/02	SOIL	Total PeCDD	5.30500		UG/KG		0.00E+00	3.90E-03	1.60E-02		
MSFA 1-01	Makua Stream Firing Area	10/07/02	SOIL	Total PeCDF	5.48100		UG/KG		0.00E+00	3.90E-03	1.60E-02		
MSFA 1-01	Makua Stream Firing Area	10/07/02	SOIL	Total TCDD	2.43700		UG/KG		0.00E+00	3.90E-03	1.60E-02		
MSFA 1-01	Makua Stream Firing Area	10/07/02	SOIL	Total TCDF	2.10800		UG/KG		0.00E+00	3.90E-03	1.60E-02		
Subtotal:									3.52E-03	3.90E-03	1.60E-02	9.03E-07	2.20E-07
MSFA 1-03	Makua Stream Firing Area	10/08/02	SOIL	OCDD	0.07800		UG/KG	1.00E-04	7.80E-06	3.90E-03	1.60E-02	2.00E-09	4.88E-10
MTA 1-03	Misc Training Area	10/03/02	SOIL	1,2,3,7,8,9-HxCDD	0.01200	X	UG/KG	1.00E-01	1.20E-03	3.90E-03	1.60E-02	3.08E-07	7.50E-08
OB/OD 1-01	Open Burn Open Detontata	10/07/02	SOIL	1,2,3,4,6,7,8-HpCDD	0.10100		UG/KG	1.00E-02	1.01E-03	3.90E-03	1.60E-02		
OB/OD 1-01	Open Burn Open Detontata	10/07/02	SOIL	1,2,3,4,6,7,8-HpCDF	0.01500		UG/KG	1.00E-02	1.50E-04	3.90E-03	1.60E-02		
OB/OD 1-01	Open Burn Open Detontata	10/07/02	SOIL	1,2,3,4,7,8-HxCDD	0.00800		UG/KG	1.00E-01	8.00E-04	3.90E-03	1.60E-02		
OB/OD 1-01	Open Burn Open Detontata	10/07/02	SOIL	1,2,3,7,8,9-HxCDD	0.01000		UG/KG	1.00E-01	1.00E-03	3.90E-03	1.60E-02		
OB/OD 1-01	Open Burn Open Detontata	10/07/02	SOIL	1,2,3,7,8-PeCDD	0.24000	X	UG/KG	1.00E+00	**2.40E-01**	**3.90E-03**	**1.60E-02**		
OB/OD 1-01	Open Burn Open Detontata	10/07/02	SOIL	2,3,7,8-TCDD	0.03000	X	UG/KG	1.00E-01	3.00E-03	3.90E-03	1.60E-02		
OB/OD 1-01	Open Burn Open Detontata	10/07/02	SOIL	OCDD	0.87500		UG/KG	1.00E-04	8.75E-05	3.90E-03	1.60E-02		
OB/OD 1-01	Open Burn Open Detontata	10/07/02	SOIL	OCDF	0.04000		UG/KG	1.00E-04	4.00E-06	3.90E-03	1.60E-02		
OB/OD 1-01	Open Burn Open Detontata	10/07/02	SOIL	Total HpCDD	0.10100		UG/KG		0.00E+00	3.90E-03	1.60E-02		
OB/OD 1-01	Open Burn Open Detontata	10/07/02	SOIL	Total HpCDF	0.05300		UG/KG		0.00E+00	3.90E-03	1.60E-02		
OB/OD 1-01	Open Burn Open Detontata	10/07/02	SOIL	Total HxCDD	0.04000		UG/KG		0.00E+00	3.90E-03	1.60E-02		
OB/OD 1-01	Open Burn Open Detontata	10/07/02	SOIL	Total HxCDF	0.03500		UG/KG		0.00E+00	3.90E-03	1.60E-02		
Subtotal:									**2.46E-01**	**3.90E-03**	**1.60E-02**	6.31E-05	1.54E-05
OB/OD 1-02	Open Burn Open Detontata	10/07/02	SOIL	1,2,3,4,6,7,8-HpCDD	0.01600		UG/KG	1.00E-02	1.60E-04	3.90E-03	1.60E-02		
OB/OD 1-02	Open Burn Open Detontata	10/07/02	SOIL	1,2,3,7,8,9-HxCDD	0.01000		UG/KG	1.00E-01	1.00E-03	3.90E-03	1.60E-02		
OB/OD 1-02	Open Burn Open Detontata	10/07/02	SOIL	OCDD	0.12000		UG/KG	1.00E-04	1.20E-05	3.90E-03	1.60E-02		
OB/OD 1-02	Open Burn Open Detontata	10/07/02	SOIL	Total HpCDD	0.01600		UG/KG		0.00E+00	3.90E-03	1.60E-02		

Toxicity Equivalent Calculations for Individual Dioxin Isomers in Surface Soil Samples

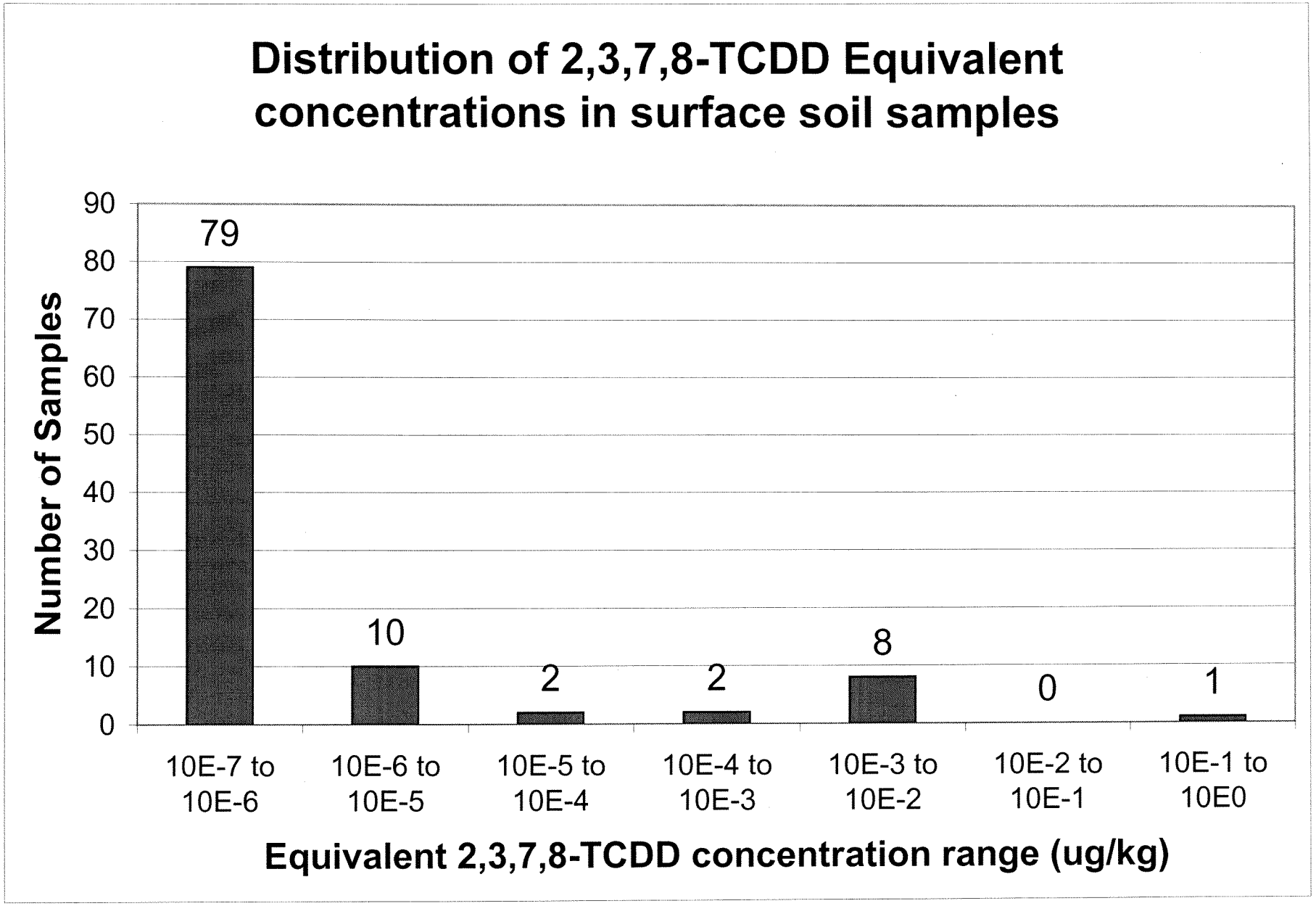
SHORT_NAM	LOC_NAME	DATE_S	MATRIX	PARAMETER	RESULT	QUALIFIER		TCDD EQF	TCDD EQUIV	Res 12378 TCDD PRG	Ind 12378 TCDD PRG	Residential Cancer Risk	Industrial Cancer Risk
OB/OD 1-02	Open Burn Open Detontata	10/07/02	SOIL	Total HpCDF	0.01600		UG/KG		0.00E+00	3.90E-03	1.60E-02		
OB/OD 1-02	Open Burn Open Detontata	10/07/02	SOIL	Total HxCDD	0.01000		UG/KG		0.00E+00	3.90E-03	1.60E-02		
Subtotal:									1.17E-03	3.90E-03	1.60E-02	3.01E-07	7.33E-08
OB/OD 1-03	Open Burn Open Detontata	10/07/02	SOIL	1,2,3,4,6,7,8-HpCDD	0.02000	X	UG/KG	1.00E-02	2.00E-04	3.90E-03	1.60E-02		
OB/OD 1-03	Open Burn Open Detontata	10/07/02	SOIL	OCDD	0.19400		UG/KG	1.00E-04	1.94E-05	3.90E-03	1.60E-02		
OB/OD 1-03	Open Burn Open Detontata	10/07/02	SOIL	Total HpCDD	0.01900		UG/KG		0.00E+00	3.90E-03	1.60E-02		
OB/OD 1-03	Open Burn Open Detontata	10/07/02	SOIL	Total HpCDF	0.00700		UG/KG		0.00E+00	3.90E-03	1.60E-02		
Subtotal:									2.19E-04	3.90E-03	1.60E-02	5.63E-08	1.37E-08
OB/OD 1-04	Open Burn Open Detontata	10/07/02	SOIL	1,2,3,4,6,7,8-HpCDD	0.09000		UG/KG	1.00E-02	9.00E-04	3.90E-03	1.60E-02		
OB/OD 1-04	Open Burn Open Detontata	10/07/02	SOIL	1,2,3,4,6,7,8-HpCDF	0.01100		UG/KG	1.00E-02	1.10E-04	3.90E-03	1.60E-02		
OB/OD 1-04	Open Burn Open Detontata	10/07/02	SOIL	OCDD	1.22200		UG/KG	1.00E-04	1.22E-04	3.90E-03	1.60E-02		
OB/OD 1-04	Open Burn Open Detontata	10/07/02	SOIL	OCDF	0.07600		UG/KG	1.00E-04	7.60E-06	3.90E-03	1.60E-02		
OB/OD 1-04	Open Burn Open Detontata	10/07/02	SOIL	Total HpCDD	0.15600		UG/KG		0.00E+00	3.90E-03	1.60E-02		
OB/OD 1-04	Open Burn Open Detontata	10/07/02	SOIL	Total HpCDF	0.04700		UG/KG		0.00E+00	3.90E-03	1.60E-02		
OB/OD 1-04	Open Burn Open Detontata	10/07/02	SOIL	Total HxCDF	0.00800		UG/KG		0.00E+00	3.90E-03	1.60E-02		
Subtotal:									1.14E-03	3.90E-03	1.60E-02	2.92E-07	7.12E-08
OB/OD 1-05	Open Burn Open Detontata	10/07/02	SOIL	1,2,3,4,6,7,8-HpCDD	0.09900		UG/KG	1.00E-02	9.90E-04	3.90E-03	1.60E-02		
OB/OD 1-05	Open Burn Open Detontata	10/07/02	SOIL	1,2,3,4,6,7,8-HpCDF	0.01400		UG/KG	1.00E-02	1.40E-04	3.90E-03	1.60E-02		
OB/OD 1-05	Open Burn Open Detontata	10/07/02	SOIL	1,2,3,6,7,8-HxCDF	0.00700		UG/KG	1.00E-01	7.00E-04	3.90E-03	1.60E-02		
OB/OD 1-05	Open Burn Open Detontata	10/07/02	SOIL	1,2,3,7,8,9-HxCDD	0.03200	X	UG/KG	1.00E-01	3.20E-03	3.90E-03	1.60E-02		
OB/OD 1-05	Open Burn Open Detontata	10/07/02	SOIL	OCDD	1.03600		UG/KG	1.00E-04	1.04E-04	3.90E-03	1.60E-02		
OB/OD 1-05	Open Burn Open Detontata	10/07/02	SOIL	OCDF	0.03600		UG/KG	1.00E-04	3.60E-06	3.90E-03	1.60E-02		
OB/OD 1-05	Open Burn Open Detontata	10/07/02	SOIL	Total HpCDD	0.17900		UG/KG		0.00E+00	3.90E-03	1.60E-02		
OB/OD 1-05	Open Burn Open Detontata	10/07/02	SOIL	Total HpCDF	0.04600		UG/KG		0.00E+00	3.90E-03	1.60E-02		
OB/OD 1-05	Open Burn Open Detontata	10/07/02	SOIL	Total HxCDD	0.01600		UG/KG		0.00E+00	3.90E-03	1.60E-02		
OB/OD 1-05	Open Burn Open Detontata	10/07/02	SOIL	Total HxCDF	0.02700		UG/KG		0.00E+00	3.90E-03	1.60E-02		
Subtotal:									**5.14E-03**	**3.90E-03**	1.60E-02	1.32E-06	3.21E-07
PBP 1-01	Propose Burn Pit	10/03/02	SOIL	1,2,3,6,7,8-HxCDD	0.01100		UG/KG	1.00E-01	1.10E-03	3.90E-03	1.60E-02		
PBP 1-01	Propose Burn Pit	10/03/02	SOIL	1,2,3,7,8,9-HxCDD	0.01700		UG/KG	1.00E-01	1.70E-03	3.90E-03	1.60E-02		
PBP 1-01	Propose Burn Pit	10/03/02	SOIL	Total HxCDD	0.02800		UG/KG		0.00E+00	3.90E-03	1.60E-02		
Subtotal:									2.80E-03	3.90E-03	1.60E-02	7.18E-07	1.75E-07
WSBP 1-01	Wheather Station Burn Pa	10/03/02	SOIL	OCDD	0.03700		UG/KG	1.00E-04	3.70E-06	3.90E-03	1.60E-02	9.49E-10	2.31E-10

Risk Calculation
for Dioxinx in Surface Soils

MATRIX	PARAMETER	RESULT	QUALIFIER		TCDD EQF	TCDD EQUIV	Res 12378 TCDD PRG	Ind 12378 TCDD PRG	Residential Cancer Risk	Industrial Cancer Risk
	Total dioxin					**2.46E-01**	**3.90E-03**	**1.60E-02**	**6.31E-05**	**1.54E-05**
	Total dioxin					**5.14E-03**	**3.90E-03**	1.60E-02	**1.32E-06**	3.21E-07
	Total dioxin					**4.50E-03**	**3.90E-03**	1.60E-02	**1.16E-06**	2.82E-07
	Total dioxin					3.52E-03	3.90E-03	1.60E-02	9.03E-07	2.20E-07
	Total dioxin					2.80E-03	3.90E-03	1.60E-02	7.18E-07	1.75E-07
	Total dioxin					1.71E-03	3.90E-03	1.60E-02	4.37E-07	1.07E-07
SOIL	1,2,3,7,8,9-HxCDD	0.01200	X	UG/KG	1.00E-01	1.20E-03	3.90E-03	1.60E-02	3.08E-07	7.50E-08
	Total dioxin					1.17E-03	3.90E-03	1.60E-02	3.01E-07	7.33E-08
	Total dioxin					1.14E-03	3.90E-03	1.60E-02	2.92E-07	7.12E-08
	DEER 1-01					5.84E-04	3.90E-03	1.60E-02	1.50E-07	3.65E-08
	Total dioxin					2.19E-04	3.90E-03	1.60E-02	5.63E-08	1.37E-08
	Total dioxin					3.37E-05	3.90E-03	1.60E-02	8.64E-09	2.11E-09
SOIL	OCDD	0.20600		UG/KG	1.00E-04	2.06E-05	3.90E-03	1.60E-02	5.28E-09	1.29E-09
SOIL	OCDD	0.07800		UG/KG	1.00E-04	7.80E-06	3.90E-03	1.60E-02	2.00E-09	4.88E-10
	Total dioxin					6.50E-06	3.90E-03	1.60E-02	1.67E-09	4.06E-10
SOIL	OCDD	0.03700		UG/KG	1.00E-04	3.70E-06	3.90E-03	1.60E-02	9.49E-10	2.31E-10
SOIL	OCDD	0.03200		UG/KG	1.00E-04	3.20E-06	3.90E-03	1.60E-02	8.21E-10	2.00E-10
SOIL	OCDD	0.02600		UG/KG	1.00E-04	2.60E-06	3.90E-03	1.60E-02	6.67E-10	1.63E-10
SOIL	OCDD	0.02300		UG/KG	1.00E-04	2.30E-06	3.90E-03	1.60E-02	5.90E-10	1.44E-10
SOIL	OCDD	0.02300		UG/KG	1.00E-04	2.30E-06	3.90E-03	1.60E-02	5.90E-10	1.44E-10
SOIL	OCDD	0.02200		UG/KG	1.00E-04	2.20E-06	3.90E-03	1.60E-02	5.64E-10	1.38E-10
SOIL	OCDD	0.02200	X	UG/KG	1.00E-04	2.20E-06	3.90E-03	1.60E-02	5.64E-10	1.38E-10
SOIL	OCDD	0.01600	X	UG/KG	1.00E-04	1.60E-06	3.90E-03	1.60E-02	4.10E-10	1.00E-10
						8.00E-07				
						8.00E-07				
						8.00E-07				
						8.00E-07				
						8.00E-07				
						8.00E-07				
						8.00E-07				
						8.00E-07				
						8.00E-07				
						8.00E-07				
						8.00E-07				
						8.00E-07				

Carcinogenic Risk Calculation

	Count	
	102	
Residential Risk	**95% Conf**	
1.89E-06	4.73E-03	
Occupational Risk	**95% UCL**	
4.60E-07	7.36E-03	
	Mean	**Std Dev**
	2.63E-03	2.44E-02


Distribution of 2,3,7,8-TCDD Equivalent concentrations in surface soil samples
Number of Samples
90
80
70
60
50
40
30
20
10
0
79
10
2
2
8
0
1
10E-7 to 10E-6
10E-6 to 10E-5
10E-5 to 10E-4
10E-4 to 10E-3
10E-3 to 10E-2
10E-2 to 10E-1
10E-1 to 10E0
Equivalent 2,3,7,8-TCDD concentration range (ug/kg)

Detections of Dioxins and Perchlorate in Borehole Samples

SHORT_NAME	ANAL_MED	DATE_S	PARAMETER	RESULT	QUALIFIER	UNITS	TCDD EQF	TCDD EQ		PRG_RES	PRG_IND	IND_UNIT
BHSS1-2	E300.0	02/07/03	CHLORIDE-CL	158.0000		MG/KG				-999.0000	-999.0000	MG/KG
BHSS2-1	E300.0	02/11/03	CHLORIDE-CL	239.0000		MG/KG				-999.0000	-999.0000	MG/KG
BHSS2-3	E300.0	02/11/03	CHLORIDE-CL	126.0000		MG/KG				-999.0000	-999.0000	MG/KG
BHSS3-1	E300.0	02/12/03	CHLORIDE-CL	28.3000		MG/KG				-999.0000	-999.0000	MG/KG
BHSS3-1	E300.0	02/12/03	CHLORIDE-CL	28.6000		MG/KG				-999.0000	-999.0000	MG/KG
BHSS1-2	E300.0	02/07/03	FLUORIDE-F	9.2900		MG/KG				3700.0000	53000.0000	MG/KG
BHSS2-1	E300.0	02/11/03	FLUORIDE-F	3.7300		MG/KG				3700.0000	53000.0000	MG/KG
BHSS2-3	E300.0	02/11/03	FLUORIDE-F	7.1800		MG/KG				3700.0000	53000.0000	MG/KG
BHSS3-1	E300.0	02/12/03	FLUORIDE-F	3.7700		MG/KG				3700.0000	53000.0000	MG/KG
BHSS3-1	E300.0	02/12/03	FLUORIDE-F	4.0700		MG/KG				3700.0000	53000.0000	MG/KG
BHSS1-2	E300.0	02/07/03	NITRATE-N	1.2100	J	MG/KG				-999.0000	-999.0000	MG/KG
BHSS2-1	E300.0	02/11/03	NITRATE-N	2.8000		MG/KG				-999.0000	-999.0000	MG/KG
BHSS2-3	E300.0	02/11/03	NITRATE-N	2.4000		MG/KG				-999.0000	-999.0000	MG/KG
BHSS3-1	E300.0	02/12/03	NITRATE-N	1.2700		MG/KG				-999.0000	-999.0000	MG/KG
BHSS3-1	E300.0	02/12/03	NITRATE-N	1.3100		MG/KG				-999.0000	-999.0000	MG/KG
BHSS1-2	E300.0	02/07/03	PERCHLORATE	1670.0000		UG/KG				7820.0000	102199.0000	UG/KG
BHSS2-3	E300.0	02/11/03	PERCHLORATE	120.0000	J	UG/KG				7820.0000	102199.0000	UG/KG
BHSS1-2	E300.0	02/07/03	SULFATE	63.6000		MG/KG				-999.0000	-999.0000	MG/KG
BHSS2-1	E300.0	02/11/03	SULFATE	474.0000		MG/KG				-999.0000	-999.0000	MG/KG
BHSS2-3	E300.0	02/11/03	SULFATE	47.0000		MG/KG				-999.0000	-999.0000	MG/KG
BHSS3-1	E300.0	02/12/03	SULFATE	15.2000		MG/KG				-999.0000	-999.0000	MG/KG
BHSS3-1	E300.0	02/12/03	SULFATE	16.6000		MG/KG				-999.0000	-999.0000	MG/KG
BHSS1-2	SW 8280	02/07/03	OCDD	0.0600		ug/Kg	1.00E-04	6.00E-06		3.90E-09	1.60E-08	ug/Kg
BHSS2-1	SW 8280	02/11/03	OCDD	0.0310		ug/Kg	1.00E-04	3.10E-06		3.90E-09	1.60E-08	ug/Kg
BHSS2-3	SW 8280	02/11/03	OCDD	0.0300		ug/Kg	1.00E-04	3.00E-06		3.90E-09	1.60E-08	ug/Kg
BHSS3-1	SW 8280	02/12/02	OCDD	0.0850		ug/Kg	1.00E-04	8.50E-06		3.90E-09	1.60E-08	ug/Kg
BHSS1-1	SW6010B	02/07/03	ALUMINUM	63800.0000		MG/KG				3700.0000	53000.0000	MG/KG
BHSS1-2	SW6010B	02/07/03	ALUMINUM	85500.0000		MG/KG				3700.0000	53000.0000	MG/KG
BHSS1-3	SW6010B	02/07/03	ALUMINUM	48200.0000		MG/KG				3700.0000	53000.0000	MG/KG
BHSS1-4	SW6010B	02/07/03	ALUMINUM	67900.0000		MG/KG				3700.0000	53000.0000	MG/KG
BHSS1-5	SW6010B	02/07/03	ALUMINUM	61400.0000		MG/KG				3700.0000	53000.0000	MG/KG
BHSS1-6	SW6010B	02/07/03	ALUMINUM	51300.0000		MG/KG				3700.0000	53000.0000	MG/KG
BHSS1-7	SW6010B	02/07/03	ALUMINUM	65300.0000		MG/KG				3700.0000	53000.0000	MG/KG
BHSS1-8	SW6010B	02/07/03	ALUMINUM	62800.0000		MG/KG				3700.0000	53000.0000	MG/KG
BHSS2-1	SW6010B	02/11/03	ALUMINUM	90900.0000		MG/KG				3700.0000	53000.0000	MG/KG
BHSS2-2	SW6010B	02/11/03	ALUMINUM	76100.0000		MG/KG				3700.0000	53000.0000	MG/KG
BHSS2-3	SW6010B	02/11/03	ALUMINUM	82300.0000		MG/KG				3700.0000	53000.0000	MG/KG
BHSS2-4	SW6010B	02/11/03	ALUMINUM	77400.0000		MG/KG				3700.0000	53000.0000	MG/KG
BHSS2-5	SW6010B	02/11/03	ALUMINUM	73800.0000		MG/KG				3700.0000	53000.0000	MG/KG
BHSS2-6	SW6010B	02/11/03	ALUMINUM	62500.0000		MG/KG				3700.0000	53000.0000	MG/KG
BHSS2-7	SW6010B	02/11/03	ALUMINUM	63200.0000		MG/KG				3700.0000	53000.0000	MG/KG
BHSS2-8	SW6010B	02/11/03	ALUMINUM	34600.0000		MG/KG				3700.0000	53000.0000	MG/KG
BHSS3-1	SW6010B	02/12/03	ALUMINUM	48400.0000		MG/KG				3700.0000	53000.0000	MG/KG
BHSS3-2	SW6010B	02/12/03	ALUMINUM	53500.0000		MG/KG				3700.0000	53000.0000	MG/KG
BHSS1-2	SW6010B	02/07/03	ANTIMONY	5.1600	J	MG/KG				31.0000	820.0000	MG/KG
BHSS1-3	SW6010B	02/07/03	ANTIMONY	4.6800	J	MG/KG				31.0000	820.0000	MG/KG
BHSS1-4	SW6010B	02/07/03	ANTIMONY	9.2700	J	MG/KG				31.0000	820.0000	MG/KG

Summary of Dioxin Equivalent Toxicity Calculations for Surface Water Samples

CLIENT_SAM	LOC_NAME	DATE_S	CASE_NUM	PARAMETER	RESULT	QUALIFIER	UNITS	2,3,7,8-TCDD EQF	TCDD EQIV	TCDD PRG	Cancer Risk	DET_LIM	REP_LIO
MMRKASSW-R1	Kaluakauila Stream	02/14/03	35822-46-9	1,2,3,4,6,7,8-HpCDD	4.92E-06		ug/L	1.00E-02	4.92E-08	4.50E-07	1.09E-07	1.546	5.62
MMRKASSW-R1	Kaluakauila Stream	02/14/03	67562-39-4	1,2,3,4,6,7,8-HpCDF	1.12E-05		ug/L	1.00E-02	1.12E-07	4.50E-07	2.49E-07	1.002	2.36
MMRKASSW-R1	Kaluakauila Stream	02/14/03	3268-87-9	OCDD	2.22E-05	B	ug/L	1.00E-04	2.22E-09	4.50E-07	4.92E-09	2.170	52.54
MMRKASSW-R1	Kaluakauila Stream	02/14/03	39001-02-0	OCDF	1.36E-05	X	ug/L	1.00E-04	1.36E-09	4.50E-07	3.03E-09	1.825	5.87
MMRKASSW-R1	Kaluakauila Stream	02/14/03	37871-00-4	Total HpCDD	4.92E-06		ug/L		0.00E+00	4.50E-07		1.546	0
MMRKASSW-R1	Kaluakauila Stream	02/14/03	38998-75-3	Total HpCDF	1.12E-05		ug/L		0.00E+00	4.50E-07		1.002	0
Subtotal:									1.65E-07	4.50E-07	3.67E-07		
MMRKSSW-R1	Koiahi Gulch	02/14/03	35822-46-9	1,2,3,4,6,7,8-HpCDD	9.48E-05		ug/L	1.00E-02	**9.48E-07**	4.50E-07	2.11E-06	2.784	5.62
MMRKSSW-R1	Koiahi Gulch	02/14/03	67562-39-4	1,2,3,4,6,7,8-HpCDF	5.25E-05		ug/L	1.00E-02	**5.25E-07**	4.50E-07	1.17E-06	1.286	2.36
MMRKSSW-R1	Koiahi Gulch	02/14/03	57117-44-9	1,2,3,6,7,8-HxCDF	8.87E-06	I	ug/L	1.00E-01	**8.87E-07**	4.50E-07	1.97E-06	1.172	2.58
MMRKSSW-R1	Koiahi Gulch	02/14/03	3268-87-9	OCDD	8.34E-04	B	ug/L	1.00E-04	**8.34E-08**	4.50E-07	1.85E-07	3.051	52.54
MMRKSSW-R1	Koiahi Gulch	02/14/03	39001-02-0	OCDF	1.71E-04		ug/L	1.00E-04	1.71E-08	4.50E-07	3.79E-08	2.464	5.87
MMRKSSW-R1	Koiahi Gulch	02/14/03	37871-00-4	Total HpCDD	1.63E-04		ug/L		0.00E+00	4.50E-07		2.784	0
MMRKSSW-R1	Koiahi Gulch	02/14/03	38998-75-3	Total HpCDF	5.25E-05		ug/L		0.00E+00	4.50E-07		1.286	0
MMRKSSW-R1	Koiahi Gulch	02/14/03	55684-94-1	Total HxCDF	3.60E-05		ug/L		0.00E+00	4.50E-07		1.172	0
Subtotal:									**2.46E-06**	4.50E-07	5.47E-06		
MMRMSSW-R1	Makua Stream	02/14/03	35822-46-9	1,2,3,4,6,7,8-HpCDD	5.16E-06	X	ug/L	1.00E-02	5.16E-08	4.50E-07	1.15E-07	1.764	5.62
MMRMSSW-R1	Makua Stream	02/14/03	3268-87-9	OCDD	2.82E-05	B	ug/L	1.00E-04	2.82E-09	4.50E-07	6.26E-09	2.097	52.54
Subtotal:									5.45E-08	4.50E-07	1.21E-07		
MMRPSSW-R1	Punapohaku Stream	02/14/03	35822-46-9	1,2,3,4,6,7,8-HpCDD	5.30E-06	X	ug/L	1.00E-02	5.30E-08	4.50E-07	1.18E-07	1.761	5.62
MMRPSSW-R1	Punapohaku Stream	02/14/03	3268-87-9	OCDD	2.60E-05	B	ug/L	1.00E-04	2.60E-09	4.50E-07	5.78E-09	2.179	52.54
Subtotal:									5.56E-08	4.50E-07	1.24E-07		

Calculation of 2,3,,7,8-TCDD Equivalents for Dioxin Isomers Detected in Groundwater Samples

Dioxin Compounds									TCDD
MMRMW1-R1	WELL 01	SW8290	12/12/20	1,2,3,4,6,7,8-HpCDD	0.000004	ug/l	1.00E-02	3.95E-08	4.50E-07
MMRMW1-R1	WELL 01	SW8290	12/12/20	1,2,3,4,6,7,8-HpCDF	0.000004 X	ug/l	1.00E-02	3.87E-08	4.50E-07
MMRMW1-R1	WELL 01	SW8290	12/12/20	OCDD	0.000025 B	ug/l	1.00E-04	2.51E-09	4.50E-07
MMRMW1-R1	WELL 01	SW8290	12/12/20	OCDF	0.000005	ug/l	1.00E-04	4.67E-10	4.50E-07
MMRMW1-R1	WELL 01	SW8290	12/12/20	Total HpCDD	0.000004	ug/l		0.00E+00	4.50E-07
Subtotal:								8.12E-08	4.50E-07
MMRMW2-R1	WELL 02	SW8290	12/13/20	1,2,3,4,6,7,8-HpCDD	0.000005	ug/l	1.00E-02	5.30E-08	4.50E-07
MMRMW2-R1	WELL 02	SW8290	12/13/20	1,2,3,4,6,7,8-HpCDF	0.000002 X	ug/l	1.00E-02	2.30E-08	4.50E-07
MMRMW2-R1	WELL 02	SW8290	12/13/20	OCDD	0.000018 B	ug/l	1.00E-04	1.80E-09	4.50E-07
MMRMW2-R1	WELL 02	SW8290	12/13/20	OCDF	0.000006	ug/l	1.00E-04	5.64E-10	4.50E-07
MMRMW2-R1	WELL 02	SW8290	12/13/20	Total HpCDD	0.000008	ug/l		0.00E+00	4.50E-07
MMRMW2-R1	WELL 02	SW8290	12/13/20	Total HpCDF	0.000004	ug/l		0.00E+00	4.50E-07
Subtotal:								7.83E-08	4.50E-07
MMRMW3A-R1	WELL 03A	SW8290	12/13/20	1,2,3,4,6,7,8-HpCDD	0.000002	ug/l	1.00E-02	1.61E-08	4.50E-07
MMRMW3A-R1	WELL 03A	SW8290	12/13/20	OCDD	0.000011 B	ug/l	1.00E-04	1.12E-09	4.50E-07
MMRMW3A-R1	WELL 03A	SW8290	12/13/20	OCDF	0.000002	ug/l	1.00E-04	1.55E-10	4.50E-07
MMRMW3A-R1	WELL 03A	SW8290	12/13/20	Total HpCDD	0.000002	ug/l		0.00E+00	4.50E-07
Subtotal:								1.74E-08	4.50E-07
MMRMW-3B	WELL 03B	SW8290	12/18/20	1,2,3,4,6,7,8-HpCDF	0.000001 X	ug/l	1.00E-02	1.43E-08	4.50E-07
MMRMW-3B	WELL 03B	SW8290	12/18/20	OCDD	0.000007 B	ug/l	1.00E-04	7.13E-10	4.50E-07
Subtotal:								1.50E-08	4.50E-07
MMRMW4A-R1	WELL 04A	SW8290	12/16/20	1,2,3,4,6,7,8-HpCDD	0.000003	ug/l	1.00E-02	2.78E-08	4.50E-07
MMRMW4A-R1	WELL 04A	SW8290	12/16/20	OCDD	0.000020 B	ug/l	1.00E-04	2.03E-09	4.50E-07
MMRMW4A-R1	WELL 04A	SW8290	12/16/20	Total HpCDD	0.000003	ug/l		0.00E+00	4.50E-07
Subtotal:								2.99E-08	4.50E-07
MMRMW-4B	WELL 04B	SW8290	12/16/20	1,2,3,4,6,7,8-HpCDD	0.000004	ug/l	1.00E-02	3.95E-08	4.50E-07
MMRMW-4B	WELL 04B	SW8290	12/16/20	1,2,3,4,6,7,8-HpCDF	0.000006 X	ug/l	1.00E-02	6.08E-08	4.50E-07
MMRMW-4B	WELL 04B	SW8290	12/16/20	OCDD	0.000020 B	ug/l	1.00E-04	1.99E-09	4.50E-07
MMRMW-4B	WELL 04B	SW8290	12/16/20	OCDF	0.000005 X	ug/l	1.00E-04	4.71E-10	4.50E-07
MMRMW-4B	WELL 04B	SW8290	12/16/20	Total HpCDD	0.000004	ug/l		0.00E+00	4.50E-07
MMRMW-4B	WELL 04B	SW8290	12/16/20	Total HpCDF	0.000002	ug/l		0.00E+00	4.50E-07
Subtotal:								1.03E-07	4.50E-07
MMRMW-4C	WELL 04C	SW8290	12/18/20	1,2,3,4,6,7,8-HpCDF	0.000002 X	ug/l	1.00E-02	2.06E-08	4.50E-07
MMRMW-4C	WELL 04C	SW8290	12/18/20	OCDD	0.000009 B	ug/l	1.00E-04	9.35E-10	4.50E-07
Subtotal:								2.16E-08	4.50E-07

MMRMW5-R2	WELL 05	SW8290	02/13/03	1,2,3,4,6,7,8-HpCDD	**0.000059**	ug/l	1.00E-02	**5.86E-07**	4.50E-07
MMRMW5-R2	WELL 05	SW8290	02/13/03	1,2,3,4,6,7,8-HpCDF	0.000015	ug/l	1.00E-02	1.46E-07	4.50E-07
MMRMW5-R2	WELL 05	SW8290	02/13/03	1,2,3,6,7,8-HxCDD	0.000003	ug/l	1.00E-01	3.09E-07	4.50E-07
MMRMW5-R2	WELL 05	SW8290	02/13/03	1,2,3,6,7,8-HxCDF	0.000003 I	ug/l	1.00E-01	2.75E-07	4.50E-07
MMRMW5-R2	WELL 05	SW8290	02/13/03	1,2,3,7,8,9-HxCDD	0.000002	ug/l	1.00E-01	2.47E-07	4.50E-07
MMRMW5-R2	WELL 05	SW8290	02/13/03	OCDD	0.000333 B	ug/l	1.00E-04	3.33E-08	4.50E-07
MMRMW5-R2	WELL 05	SW8290	02/13/03	OCDF	0.000076	ug/l	1.00E-04	7.62E-09	4.50E-07
MMRMW5-R2	WELL 05	SW8290	02/13/03	Total HpCDD	0.000095	ug/l		0.00E+00	4.50E-07
MMRMW5-R2	WELL 05	SW8290	02/13/03	Total HpCDF	0.000049	ug/l		0.00E+00	4.50E-07
MMRMW5-R2	WELL 05	SW8290	02/13/03	Total HxCDD	0.000011	ug/l		0.00E+00	4.50E-07
MMRMW5-R2	WELL 05	SW8290	02/13/03	Total HxCDF	0.000008	ug/l		0.00E+00	4.50E-07
Subtotal:								**1.60E-06**	**4.50E-07**
MMRSP-7	WELL SP07	SW8290	12/18/20	OCDD	0.000015 B	ug/l	1.00E-04	1.54E-09	4.50E-07
MMRSP-7	WELL SP07	SW8290	12/18/20	OCDF	0.000004	ug/l	1.00E-04	3.66E-10	4.50E-07
Subtotal:								1.90E-09	4.50E-07