APPENDIX D

Worksheets

Stream flow calculations
Radionuclide background reference calculations
Isotopic ratios
Descriptive statistics and correlations
Source area volume and mass calculations
ADEC Method 3 on-line calculator output

WORKSHEET 1

Stream flow calculations

Stream Flow Estimates

Fish Creek

USGS Station - 19010102

Water shed area = 32.10 square miles

Monthly average flow (June 1915 to Sept 2003)

Jan	356 CFS
Feb	316
Mar	262
Apr	353
May	503
Jun	471
Jul	334
Aug	333
Sep	449
~~Oct~~	694
~~Dec~~ Nov	567
Dec	421
mean	422 CFS

$R_{Gauge} = 422 \text{ CFS} / 32.1 \text{ miles}^2$

$= 13.1 \text{ CFS/mile}^2$

Stanley Creek

USGS Station 19010103

Watershed area = 50.6 mile^2

Monthly average flow (Sept 1989 - Sept 2003)

Jan	463
Feb	386
Mar	338
Apr	296
May	231
Jun	120
Jul	94
Aug	198
Sep	485
Oct	659
Nov	557
Dec	592
mean	368

R_{Gauge} = 368 cfs / 50.6 mile^2

= 7.3 cfs/mile^2

Flow > 7,000 cfs

Number of events = 15

~~Qmean / 7,000 cfs = 19~~ Event average = 11,800

Q_{peak} / Qmean = ~~7000 cfs / 368 cfs = 19~~

11800 cfs / 368 cfs = 32

Harding River (some glacier contribution)

USGS Station 19010101

Watershed area = 67.40 miles^2

Monthly average flow (Aug 1951 to Sep 2002)

Jan	253
Feb	236
Mar	202
Apr	359
May	918
Jun	1389
Jul	1344
Aug	1145
Sep	1147
Oct	1079
Nov	496
Dec	338
mean	742

$$R_{Gauge} = 742 \text{ cfs} / 67.4 \text{ mile}^2$$
$$= 11.0 \text{ cfs/mile}^2$$

$$R_{Region} = \frac{13.1 + 7.3 + 11.0}{3} = 10.5 \text{ cfs/mile}^2$$

Peak events n=30 since 1970

Crest average flow = 7100 cfs

Q_{Peaks}/Q_{mean} = 7100 cfs/742 cfs = 9.6

Harding River

Date	Crest CFS
9/25/1974	4140
9/23/1986	4140
9/11/1973	4300
9/25/1985	4400
9/2/2001	4640
10/11/1977	5000
10/3/1990	5700
10/10/1982	5740
9/26/1996	5960
10/29/1970	6050
9/11/1995	6190
8/25/1984	6360
9/20/1997	6460
9/28/1992	6560
9/20/1989	6770
9/23/1993	6770
10/18/1979	6890
10/9/1980	7060
9/26/1987	7160
5/24/1999	7250
9/1/1988	7320
9/26/1970	7900
11/5/1982	8050
9/24/1991	8220
8/28/1998	8620
10/21/1999	9120
9/15/1976	9260
9/30/1972	9960
10/8/1974	11700
10/26/1993	15300
Crest mean =	7100
Annual mean =	742
Ratio =	9.6

Staney Creek

Date	Crest CFS
10/26/1993	19800
12/6/1990	18000
10/21/1999	16200
1/29/1993	14400
4/2/1997	13200
10/26/2003	12000
10/30/2001	11100
9/30/2001	11100
11/27/1989	11200
8/28/1998	10300
11/10/1994	9300
5/3/1992	8740
1/10/1996	7230
10/18/1998	7180
9/21/2002	7130
Crest mean =	11792
Annual mean =	368
Ratio =	32

WORKSHEET 2

Radionuclide background calculations

WORKSHEET
BACKGROUND RADIONUCLIDE REFERENCES
ROSS ADAMS

GRANITE BACKGROUND

Analyte	GR-01	GR-02	GR-03	GR-04	GR-05	GR-06	GR-07	GR-08	GR-09	GR-10	Mean	SD	Mean + 2SD
Bi-212	8.1	7.7	2.6	6.4	1.7	4	1.1	3.3	2.3	2.5	3.97	2.53	9.0
Bi-214	4.45	3.03	1.81	13.6	2.57	2.54	1.9	2.94	4.6	2.89	4.033	3.49	11.0
Ra-226	0.66	2.01	1.02	11.4	0.81	0.71	0.64	0.49	0.85	0.93	1.952	3.35	8.6
Ra-228	9.7	2.46	1.3	7.3	1.53	2.93	1.61	1.46	2.66	1.97	3.292	2.85	9.0
Pb-212	8.1	3.47	1.93	8	1.95	2.56	1.9	2	3.13	2.31	3.535	2.44	8.4
Pb-214	4.95	3.47	2.17	15.4	3.09	2.8	2.22	2.94	5.4	2.86	4.53	3.97	12.5
Th-227	8	-1	0.16	-3	-0.17	-6	0.15	-0.06	-0.9	-5	-0.782	3.80	6.8
Th-228	8.7	2.41	1.73	7.5	1.37	2.68	1.54	1.88	3.08	2.14	3.303	2.60	8.5
Th-230	4.64	3.24	2.34	16.8	2.23	2.39	1.21	1.07	2.13	2.29	3.834	4.66	13.2
Th-232	6.8	2.19	1.39	7.5	1.07	2.85	1.58	1.32	2.54	2.32	2.956	2.29	7.5
Th-234	10.2	4.3	2.3	16.9	5	4.4	2.7	3	4.4	5	5.82	4.47	14.8
U-234	4.75	2.91	1.22	16.5	1.35	2.09	1.16	0.84	1.68	1.99	3.449	4.72	12.9
U-235	--	--	0.01	1.21	-0.34	0.11	0.2	-0.22	0.48	0.43			
U-235	0.59	-0.3	--	--	--	--	--	--	--	--	0.2011	0.38	1.0
U-235	0.193	0.163	0.083	0.94	0.048	0.064	0.097	0.067	0.067	0.13			
U-238	5	3.34	1.44	17.3	1.73	2.37	1.4	1.03	1.98	2.71	3.83	4.87	13.6

U
Tl

SD = STANDARD DEVIATION

QUARTZ MONZONITE BACKGROUND

Analyte	Units	QM-01	QM-02	QM-03	Mean	SD	Mean + 2 SD
Bi-212	pCi/g	0.65	0	0.08	0.24	0.35	0.95
Bi-214	pCi/g	0.44	0.57	0.46	0.49	0.07	0.63
Pb-212	pCi/g	0.62	0.53	0.52	0.56	0.06	0.67
Pb-214	pCi/g	0.56	0.6	0.42	0.53	0.09	0.72
Ra-226	pCi/g	1.07	0.46	0.36	0.63	0.38	1.40
Ra-228	pCi/g	0.64	0.66	0.71	0.67	0.04	0.74
Th-227	pCi/g	-0.09	0.19	-0.2	-0.03	0.20	0.37
Th-228	pCi/g	0.7	0.82	0.66	0.73	0.08	0.89
Th-230	pCi/g	0.72	0.84	0.58	0.71	0.13	0.97
Th-232	pCi/g	0.6	0.91	0.77	0.76	0.16	1.07
Th-234	pCi/g	0.52	0.19	0.58	0.43	0.21	0.85
U-234	pCi/g	0.49	0.45	0.49	0.48	0.02	0.52
U-235	pCi/g	-0.03	-0.15	-0.1	-0.03	0.08	0.12
U-235	pCi/g	0.025	0.017	0.046			
U-238	pCi/g	0.42	0.44	0.43	0.43	0.01	0.45

non-detect

WORKSHEET
BACKGROUND RADIONUCLIDE REFERENCES
ROSS ADAMS

OSA Soil BACKGROUND

Analyte	SOIL-01	SOIL-02	Mean	SD	Mean + 2SD
Bi-212	12.4	15.1	13.75	1.91	17.6
Bi-214	12.5	9	10.75	2.47	15.7
Pb-212	14.8	11	12.9	2.69	18.3
Pb-214	14	10.2	12.1	2.69	17.5
Ra-226	11.7	12.7	12.2	0.71	13.6
Ra-228	15.4	9.6	12.5	4.10	20.7
Th-227	7	13	10	4.24	18.5
Th-228	15.2	10.5	12.85	3.32	19.5
Th-230	28.1	18.2	23.15	7.00	37.2
Th-232	18	11.1	14.55	4.88	24.3
Th-234	30.4	20.3	25.35	7.14	39.6
U-234	20.1	13.6	16.85	4.60	26.0
U-235	1.2	1.1	1.15	0.07	1.3
U-235	1.09	0.77	0.93	0.23	1.4
U-238	20.6	14	17.3	4.67	26.6

non-detect SD = STANDARD DEVIATION

STREAM SEDIMENT BACKGROUND

Analyte	Units	SSED-01	SSED-02	Mean	SD	Mean + 2 SD
Bi-212	pCi/g	2.6	0.83	1.72	1.25	4.22
Bi-214	pCi/g	1.86	1.1	1.48	0.54	2.55
Pb-212	pCi/g	1.55	0.8	1.18	0.53	2.24
Pb-214	pCi/g	2.35	1.2	1.78	0.81	3.40
Ra-226	pCi/g	1.99	0.67	1.33	0.93	3.20
Ra-228	pCi/g	2.27	0.76	1.515	1.07	3.65
Th-227	pCi/g	-0.25	0.12	-0.07	0.26	0.46
Th-228	pCi/g	1.32	1	1.16	0.23	1.61
Th-230	pCi/g	1.85	1.65	1.75	0.14	2.03
Th-232	pCi/g	1.3	1.83	1.57	0.37	2.31
Th-234	pCi/g	1.8	2.25	2.03	0.32	2.66
U-234	pCi/g	1.43	1.25	1.34	0.13	1.59
U-235	pCi/g	0.31	0.121	0.14	0.12	0.38
U-235	pCi/g	0.07	0.042			
U-238	pCi/g	1.55	1.17	1.36	0.27	1.90

non-detect SD = STANDARD DEVIATION

SURFACE WATER BACKGROUND

Analyte	SW-01	SW-02	Mean	SD	Mean + 2SD
Gross Alph	0.86	1.26	1.06	0.28	1.63
Gross Beta	0.35	1.74	1.045	0.98	3.01
Ra-226	0.03	0.07	0.05	0.03	0.11
Ra-228	0.17	0.36	0.265	0.13	0.53

non-detect SD = STANDARD DEVIATION

WORKSHEET
BACKGROUND RADIONUCLIDE REFERENCES
ROSS ADAMS

MARINE SEDIMENT BACKGROUND

Analyte	MSED-01	MSED-02	MSED-03	Mean	SD	Mean + 2 SD
Bi-212	0.41	0.45	0.3	0.39	0.08	0.54
Bi-214	0.14	0.23	-0.01	0.12	0.12	0.36
Pb-212	0.111	0.208	0.159	0.16	0.05	0.26
Pb-214	0.14	0.339	0.197	0.23	0.10	0.43
Ra-226	0.38	0.137	0.17	0.23	0.13	0.49
Ra-228	0.25	0.164	0.3	0.238	0.07	0.38
Th-227	-0.37	0.3	0.37	0.10	0.41	0.92
Th-228	0.065 U	0.157	0.14	0.15	0.01	0.17
Th-230	0.211	0.284	0.3	0.27	0.05	0.36
Th-232	0.133	0.137	0.18	0.15	0.03	0.20
Th-234	0.53	1.36	0.63	0.86	0.43	1.73
U-234	0.48	1.06	0.56	0.70	0.31	1.33
U-235	0.04	0.13	0.03	0.05	0.04	0.14
U-235	0.037	0.069	0.011			
U-238	0.427	1.06	0.57	0.69	0.33	1.35

TI

non-detect

SD = STANDARD DEVIATION

WORKSHEET 3

Secular equilibrium evaluation

WORKSHEET

RAD RATIOS

ROSS ADAMS

CONCENTRATIONS

	QM Sources			Granite Sources										
alyt	**300-01**	**300-02**	**HR-01**	**700-01**	**700-02**	**700-03**	**700-04**	**900-01**	**900-02**	**900-03**	**900-04**	**900-05**	**MR-01**	**MR-02**
Th-232	175	57	136	212	244	218	61	63	252	69	119	116	60	60
Ra-228	950	50.4	130	1150	249	1220	191	156	810	200	124	115	68	96
Th-228	208	59	142	225	248	292	75	76	292	82	120	124	61	65
Pb-212	512	48.2	128	612	235	671	146	126	538	124	109	101	57	72
Bi-212	450	54.3	125	750	264	680	50	130	530	260	116	117	94	100
U-238	2350	41.8	207	3220	420	3390	660	452	2880	462	171	138	326	190
Th-234	960	81	264	1830	469	1230	360	250	1050	300	200	154	180	-80
U-234	2280	39.9	196	3220	422	3390	650	415	2800	470	163	137	321	185
Th-230	347	69	315	472	491	473	159	202	740	169	225	214	135	105
Ra-226	1550	53.5	223	1960	368	2210	447	481	1470	274	131	160	234	179
Pb-214	830	46.7	201	1060	342	1190	256	279	990	157	127	104	91	88
Bi-214	660	42.3	182	950	323	970	232	242	920	161	113	97	72	52
Pb-210	--	--	--	3220	--	3040	--	520	--	--	--	--	--	--

RATIOS

				AVG RATIO	**MAX**	**MIN**												**AVG RATIO**	**MAX**	**MIN**
Th-232:Th-232	1.00	1.00	1.00	**1.00**	**1.00**	**1.00**	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	**1.00**	**1.00**	**1.00**
Ra-228:Th-232	5.43	0.88	0.96	**2.42**	**5.43**	**0.88**	5.42	1.02	5.60	3.13	2.48	3.21	2.90	1.04	0.99	1.13	1.60	**1.37**	**1.60**	**1.13**
Th-228:Th-232	1.19	1.04	1.04	**1.09**	**1.19**	**1.04**	1.06	1.02	1.34	1.23	1.21	1.16	1.19	1.01	1.07	1.02	1.08	**1.05**	**1.08**	**1.02**
Pb-212:Th-232	2.93	0.85	0.94	**1.57**	**2.93**	**0.85**	2.89	0.96	3.08	2.39	2.00	2.13	1.80	0.92	0.87	0.95	1.20	**1.08**	**1.20**	**0.95**
Bi-212:Th-232	2.57	0.95	0.92	**1.48**	**2.57**	**0.92**	3.54	1.08	3.12	0.82	2.06	2.10	3.77	0.97	1.01	1.57	1.67	**1.62**	**1.67**	**1.57**
U-238:U-238	1.00	1.00	1.00	**1.00**	**1.00**	**1.00**	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	**1.00**	**1.00**	**1.00**
Th-234:U-238	0.41	1.94	1.28	**1.21**	**1.94**	**0.41**	0.57	1.12	0.36	0.55	0.55	0.36	0.65	1.17	1.12	0.55	-0.42	**0.07**	**0.55**	**-0.42**
U-234:U-238	0.97	0.95	0.95	**0.96**	**0.97**	**0.95**	1.00	1.00	1.00	0.98	0.92	0.97	1.02	0.95	0.99	0.98	0.97	**0.98**	**0.98**	**0.97**
Th-230:U-238	0.15	1.65	1.52	**1.11**	**1.65**	**0.15**	0.15	1.17	0.14	0.24	0.45	0.26	0.37	1.32	1.55	0.41	0.55	**0.48**	**0.55**	**0.41**
Ra-226:U-238	0.66	1.28	1.08	**1.01**	**1.28**	**0.66**	0.61	0.88	0.65	0.68	1.06	0.51	0.59	0.77	1.16	0.72	0.94	**0.83**	**0.94**	**0.72**
Pb-214:U-238	0.35	1.12	0.97	**0.81**	**1.12**	**0.35**	0.33	0.81	0.35	0.39	0.62	0.34	0.34	0.74	0.75	0.28	0.46	**0.37**	**0.46**	**0.28**
Bi-214:U-238	0.28	1.01	0.88	**0.72**	**1.01**	**0.28**	0.30	0.77	0.29	0.35	0.54	0.32	0.35	0.66	0.70	0.22	0.27	**0.25**	**0.27**	**0.22**
Pb-210:U-238	--	--	--				1.00	--	0.90	--	1.15	--	--	--	--	--	--			

Tentative ID

Non-detect

WORKSHEET
RAD RATIOS
ROSS ADAMS

CONCENTRATIONS

	QM Soil Source	Granite Background									
alyt	**GEN-02**	**GR-01**	**GR-02**	**GR-03**	**GR-04**	**GR-05**	**GR-06**	**GR-07**	**GR-08**	**GR-09**	**GR-10**
Th-232	4.38	6.8	2.19	1.39	7.5	1.07	2.85	1.58	1.32	2.54	2.32
Ra-228	6.6	9.7	2.46	1.3	7.3	1.53	2.93	1.61	1.46	2.66	1.97
Th-228	4.41	8.7	2.41	1.73	7.5	1.37	2.68	1.54	1.88	3.08	2.14
Pb-212	6.71	8.1	3.47	1.93	8	1.95	2.56	1.9	2	3.13	2.31
Bi-212	5.4	8.1	7.7	2.8	6.4	1.7	4	1.1	3.3	2.3	2.5
U-238	6.4	5	3.34	1.44	17.3	1.73	2.37	1.4	1.03	1.98	2.71
Th-234	13.6	10.2	4.3	2.3	16.9	5	4.4	2.7	3	4.4	5
U-234	6.2	4.75	2.91	1.22	16.5	1.35	2.09	1.16	0.84	1.68	1.99
Th-230	9	4.64	3.24	2.34	16.8	2.23	2.39	1.21	1.07	2.13	2.29
Ra-226	5.7	0.66	2.01	1.02	11.4	0.81	0.71	0.64	0.49	0.85	0.93
Pb-214	10.5	4.95	3.47	2.17	15.4	3.09	2.8	2.22	2.94	5.4	2.86
Bi-214	8.7	4.45	3.03	1.81	13.6	2.57	2.54	1.9	2.94	4.6	2.89
Pb-210	--	--	--	--	--	--	--	--	--	--	--

RATIOS

												AVG RATIO	MAX	MIN
Th-232:Th-232	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	**1.00**	**1.00**	**1.00**
Ra-228:Th-232	1.51	1.43	1.12	0.94	0.97	1.43	1.03	1.02	1.11	1.05	0.85	**0.95**	**1.05**	**0.85**
Th-228:Th-232	1.01	1.28	1.10	1.24	1.00	1.28	0.94	0.97	1.42	1.21	0.92	**1.07**	**1.21**	**0.92**
Pb-212:Th-232	1.53	1.19	1.58	1.39	1.07	1.82	0.90	1.20	1.52	1.23	1.00	**1.11**	**1.23**	**1.00**
Bi-212:Th-232	1.23	1.19	3.52	1.87	0.85	1.59	1.40	0.70	2.50	0.91	1.08	**0.99**	**1.08**	**0.91**
U-238:U-238	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	**1.00**	**1.00**	**1.00**
Th-234:U-238	2.13	2.04	1.29	1.60	0.98	2.89	1.86	1.93	2.91	2.22	1.85	**2.03**	**2.22**	**1.85**
U-234:U-238	0.97	0.95	0.87	0.85	0.95	0.78	0.88	0.83	0.82	0.85	0.73	**0.79**	**0.85**	**0.73**
Th-230:U-238	1.41	0.93	0.97	1.63	0.97	1.29	1.01	0.86	1.04	1.08	0.85	**0.96**	**1.08**	**0.85**
Ra-226:U-238	0.89	0.13	0.60	0.71	0.66	0.47	0.30	0.46	0.48	0.43	0.34	**0.39**	**0.43**	**0.34**
Pb-214:U-238	1.64	0.99	1.04	1.51	0.89	1.79	1.18	1.59	2.85	2.73	1.06	**1.89**	**2.73**	**1.06**
Bi-214:U-238	1.36	0.89	0.91	1.26	0.79	1.49	1.07	1.36	2.85	2.32	1.07	**1.69**	**2.32**	**1.07**
Pb-210:U-238	--	--	--	--	--	--	--	--	--	--	--			

Tentative ID
Non-detect

WORKSHEET
RAD RATIOS
ROSS ADAMS

CONCENTRATIONS

	MSED Background			MSED Target						
alyt	**MSED-01**	**MSED-02**	**MSED-03**	**MSED-04**	**MSED-05**	**MSED-06**	**MSED-07**	**MSED-08**	**MSED-09**	**MSED-10**
Th-232	0.133	0.137	0.18	2.25	4.32	0.65	79	117	20.2	34.6
Ra-228	0.25	0.164	0.3	1.74	3.44	0.77	32.6	2.84	17	45.4
Th-228	0.065	0.157	0.14	2.19	2.72	0.46	75	123	17.1	30
Pb-212	0.111	0.208	0.159	2.23	4.26	0.81	34.9	3.54	15.8	48.3
Bi-212	0.41	0.45	0.3	2.41	5	1.4	41	3.7	13.4	46.3
U-238	0.427	1.06	0.57	2.83	4.1	0.44	137	86	25.9	28.6
Th-234	0.59	1.36	0.63	3.16	8	0.73	63	4.6	29.7	121
U-234	0.48	1.06	0.56	2.8	4.32	0.45	132	84	25.3	26.8
Th-230	0.211	0.284	0.3	3.16	6.2	0.59	149	222	33.7	64
Ra-226	0.38	0.137	0.17	2.15	2.71	0.19	52.4	64	16.1	17.7
Pb-214	0.14	0.339	0.197	2.48	3.94	0.78	36.5	3.57	18.3	82
Bi-214	0.14	0.23	-0.01	2.26	3.4	0.63	31.1	2.97	15.8	75.2
Pb-210	--	--	--	3.23	--	--	--	--	--	--

RATIOS

				AVG RATIO	**MAX**	**MIN**								**AVG RATIO**	**MAX**	**MIN**
Th-232:Th-232	1.00	1.00	1.00	**1.00**	**1.00**	**1.00**	1.00	1.00	1.00	1.00	1.00	1.00	1.00	**1.00**	**1.00**	**1.00**
Ra-228:Th-232	1.88	1.20	1.67	**1.43**	**1.67**	**1.20**	0.77	0.80	1.18	0.41	0.02	0.84	1.31	**1.08**	**1.31**	**0.84**
Th-228:Th-232	0.49	1.15	0.78	**0.96**	**1.15**	**0.78**	0.97	0.63	0.71	0.95	1.05	0.85	0.87	**0.86**	**0.87**	**0.85**
Pb-212:Th-232	0.83	1.52	0.88	**1.20**	**1.52**	**0.88**	0.99	0.99	1.25	0.44	0.03	0.78	1.40	**1.09**	**1.40**	**0.78**
Bi-212:Th-232	3.08	3.28	1.67	**2.48**	**3.28**	**1.67**	1.07	1.16	2.15	0.52	0.03	0.66	1.34	**1.00**	**1.34**	**0.66**
U-238:U-238	1.00	1.00	1.00	**1.00**	**1.00**	**1.00**	1.00	1.00	1.00	1.00	1.00	1.00	1.00	**1.00**	**1.00**	**1.00**
Th-234:U-238	1.38	1.28	1.11	**1.19**	**1.28**	**1.11**	1.12	1.95	1.66	0.46	0.05	1.15	4.23	**2.69**	**4.23**	**1.15**
U-234:U-238	1.12	1.00	0.98	**0.99**	**1.00**	**0.98**	0.99	1.05	1.02	0.96	0.98	0.98	0.94	**0.96**	**0.98**	**0.94**
Th-230:U-238	0.49	0.27	0.53	**0.40**	**0.53**	**0.27**	1.12	1.51	1.34	1.09	2.58	1.30	2.24	**1.77**	**2.24**	**1.30**
Ra-226:U-238	0.89	0.13	0.30	**0.21**	**0.30**	**0.13**	0.76	0.66	0.43	0.38	0.74	0.62	0.62	**0.62**	**0.62**	**0.62**
Pb-214:U-238	0.33	0.32	0.35	**0.33**	**0.35**	**0.32**	0.88	0.96	1.77	0.27	0.04	0.71	2.87	**1.79**	**2.87**	**0.71**
Bi-214:U-238	0.33	0.22		**0.22**	**0.22**	**0.22**	0.80	0.83	1.43	0.23	0.03	0.61	2.63	**1.62**	**2.63**	**0.61**
Pb-210:U-238	--	--	--				1.14	--	--	--	--	--	--			

Tentative ID
Non-detect

WORKSHEET
RAD RATIOS
ROSS ADAMS

CONCENTRATIONS

	OSA Source			QM Background			Soil Background	
alyt	**OSA-01**	**OSA-02**	**OSA-03**	**QM-01**	**QM-02**	**QM-03**	**SOIL-01**	**SOIL-02**
Th-232	158	64	39.9	0.6	0.91	0.77	18	11.1
Ra-228	1040	299	262	0.64	0.66	0.71	15.4	9.6
Th-228	192	72	55	0.7	0.82	0.66	15.2	10.5
Pb-212	527	142	128	0.62	0.53	0.52	14.8	11
Bi-212	440	20	260	0.65	0	0.08	12.4	15.1
U-238	2280	670	630	0.42	0.44	0.43	20.6	14
Th-234	910	450	370	0.52	0.19	0.58	30.4	20.3
U-234	2370	650	630	0.49	0.45	0.49	20.1	13.6
Th-230	328	126	93	0.72	0.84	0.58	28.1	18.2
Ra-226	1650	498	482	1.07	0.46	0.36	11.7	12.7
Pb-214	970	314	287	0.56	0.6	0.42	14	10.2
Bi-214	890	285	267	0.44	0.57	0.46	12.5	9
Pb-210	2620	--	--	--	--	--	--	--

RATIOS

				AVG RATIO	**MAX**	**MIN**				**AVG RATIO**	**MAX**	**MIN**			**AVG RATIO**	**MAX**	**MIN**
Th-232:Th-232	1.00	1.00	1.00	**1.00**	**1.00**	**1.00**	1.00	1.00	1.00	**1.00**	**1.00**	**1.00**	1.00	1.00	**1.00**	**1.00**	**1.00**
Ra-228:Th-232	6.58	4.67	6.57	**5.62**	**6.57**	**4.67**	1.07	0.73	0.92	**0.82**	**0.92**	**0.73**	0.86	0.86	**0.86**	**0.86**	**0.86**
Th-228:Th-232	1.22	1.13	1.38	**1.25**	**1.38**	**1.13**	1.17	0.90	0.86	**0.88**	**0.90**	**0.86**	0.84	0.95	**0.90**	**0.95**	**0.84**
Pb-212:Th-232	3.34	2.22	3.21	**2.71**	**3.21**	**2.22**	1.03	0.58	0.68	**0.63**	**0.68**	**0.58**	0.82	0.99	**0.91**	**0.99**	**0.82**
Bi-212:Th-232	2.78	0.31		**0.31**	**0.31**	**0.31**		0.00	0.10	**0.05**	**0.10**	**0.00**	0.69	1.36	**1.02**	**1.36**	**0.69**
U-238:U-238	1.00	1.00	1.00	**1.00**	**1.00**	**1.00**	1.00	1.00	1.00	**1.00**	**1.00**	**1.00**	1.00	1.00	**1.00**	**1.00**	**1.00**
Th-234:U-238	0.40	0.67	0.59	**0.63**	**0.67**	**0.59**	1.24	0.43	1.35	**0.89**	**1.35**	**0.43**	1.48	1.45	**1.46**	**1.48**	**1.45**
U-234:U-238	1.04	0.97	1.00	**0.99**	**1.00**	**0.97**	1.17	1.02	1.14	**1.08**	**1.14**	**1.02**	0.98	0.97	**0.97**	**0.98**	**0.97**
Th-230:U-238	0.14	0.19	0.15	**0.17**	**0.19**	**0.15**	1.71	1.91	1.35	**1.63**	**1.91**	**1.35**	1.36	1.30	**1.33**	**1.36**	**1.30**
Ra-226:U-238	0.72	0.74	0.77	**0.75**	**0.77**	**0.74**	2.55	1.05	0.84	**0.94**	**1.05**	**0.84**	0.57	0.91	**0.74**	**0.91**	**0.57**
Pb-214:U-238	0.43	0.47	0.46	**0.46**	**0.47**	**0.46**	1.33	1.36	0.98	**1.17**	**1.36**	**0.98**	0.68	0.73	**0.70**	**0.73**	**0.68**
Bi-214:U-238	0.39	0.43	0.42	**0.42**	**0.43**	**0.42**	1.05	1.30	1.07	**1.18**	**1.30**	**1.07**	0.61	0.64	**0.62**	**0.64**	**0.61**
Pb-210:U-238	1.15	--	--				--	--	--				--	--			

Tentative ID
Non-detect

WORKSHEET
RAD RATIOS
ROSS ADAMS

CONCENTRATIONS

	OSA Soil		Granite Soil Source				SSED Background	
alyt	**SOIL-04**	**SOIL-05**	**SOIL-07**	**SOIL-08**	**SOIL-09**	**SOIL-10**	**SSED-01**	**SSED-02**
Th-232	84	20.3	8.3	68	6.9	120	1.3	1.83
Ra-228	82	53.3	12.8	65	9.1	122	2.27	0.76
Th-228	100	24.3	9.6	71	8.2	111	1.32	1
Pb-212	94	60.6	12.8	67.2	10	125	1.55	0.8
Bi-212	82	51	14.1	66	7.8	127	2.6	0.83
U-238	557	36.4	4.83	278	4.27	176	1.55	1.17
Th-234	527	127	10.6	309	12.5	107	1.8	2.25
U-234	562	37	4.35	295	4.15	164	1.43	1.25
Th-230	223	30.9	5.6	138	5.08	240	1.85	1.65
Ra-226	122	25	3.93	126	5.3	221	1.99	0.67
Pb-214	159	63.8	6.18	102	7.24	166	2.35	1.2
Bi-214	138	61.5	5.66	93	6.6	152	1.86	1.1
Pb-210	--	--	--	--	--	--	--	--

RATIOS

			AVG RATIO	**MAX**	**MIN**					**AVG RATIO**	**MAX**	**MIN**			**AVG RATIO**	**MAX**	**MIN**
Th-232:Th-232	1.00	1.00	**1.00**	**1.00**	**1.00**	1.00	1.00	1.00	1.00	**1.00**	**1.00**	**1.00**	1.00	1.00	**1.00**	**1.00**	**1.00**
Ra-228:Th-232	0.98	2.63	**1.80**	**2.63**	**0.98**	1.54	0.96	1.32	1.02	**1.17**	**1.32**	**1.02**	1.75	0.42	**1.08**	**1.75**	**0.42**
Th-228:Th-232	1.19	1.20	**1.19**	**1.20**	**1.19**	1.16	1.04	1.19	0.93	**1.06**	**1.19**	**0.93**	1.02	0.55	**0.78**	**1.02**	**0.55**
Pb-212:Th-232	1.12	2.99	**2.05**	**2.99**	**1.12**	1.54	0.99	1.45	1.04	**1.25**	**1.45**	**1.04**	1.19	0.44	**0.81**	**1.19**	**0.44**
Bi-212:Th-232	0.98	2.51	**1.74**	**2.51**	**0.98**	1.70	0.97	1.13	1.06	**1.09**	**1.13**	**1.06**	2.00	0.45	**1.23**	**2.00**	**0.45**
U-238:U-238	1.00	1.00	**1.00**	**1.00**	**1.00**	1.00	1.00	1.00	1.00	**1.00**	**1.00**	**1.00**	1.00	1.00	**1.00**	**1.00**	**1.00**
Th-234:U-238	0.95	3.49	**2.22**	**3.49**	**0.95**	2.19	1.11	2.93	0.61	**1.77**	**2.93**	**0.61**	1.16	1.92	**1.54**	**1.92**	**1.16**
U-234:U-238	1.01	1.02	**1.01**	**1.02**	**1.01**	0.90	1.06	0.97	0.93	**0.95**	**0.97**	**0.93**	0.92	1.07	**1.00**	**1.07**	**0.92**
Th-230:U-238	0.40	0.85	**0.62**	**0.85**	**0.40**	1.16	0.50	1.19	1.36	**1.28**	**1.36**	**1.19**	1.19	1.41	**1.30**	**1.41**	**1.19**
Ra-226:U-238	0.22	0.69	**0.45**	**0.69**	**0.22**	0.81	0.45	1.24	1.26	**1.25**	**1.26**	**1.24**	1.28	0.57	**0.93**	**1.28**	**0.57**
Pb-214:U-238	0.29	1.75	**1.02**	**1.75**	**0.29**	1.28	0.37	1.70	0.94	**1.32**	**1.70**	**0.94**	1.52	1.03	**1.27**	**1.52**	**1.03**
Bi-214:U-238	0.25	1.69	**0.97**	**1.69**	**0.25**	1.17	0.33	1.55	0.86	**1.20**	**1.55**	**0.86**	1.20	0.94	**1.07**	**1.20**	**0.94**
Pb-210:U-238	--	--				--	--	--	--				--	--			

Tentative ID
Non-detect

WORKSHEET
RAD RATIOS
ROSS ADAMS

CONCENTRATIONS

	SSED Target							
alyt	**SSED-03**	**SSED-04**	**SSED-05**	**SSED-06**	**SSED-07**	**SSED-08**	**SSED-09**	**SSED-10**
Th-232	0.75	0.59	2.23	0.74	1.25	33.2	6	5.2
Ra-228	0.99	0.96	1.03	2	2.1	34.1	5.96	1.73
Th-228	0.83	0.88	2.36	1.09	1.6	26.9	4.16	5.7
Pb-212	1.27	1.25	1.2	1.65	2.06	26.8	5.46	1.96
Bi-212	1.2	1.6	1.6	0.6	1.8	32.7	7.2	1.6
U-238	0.86	1.17	4.15	1.08	2.3	60.8	7.1	5.42
Th-234	1.4	1.9	0.6	1.5	3.8	59.8	11.2	3.2
U-234	1.16	1.07	3.93	1.27	2.55	56.8	5.97	5.18
Th-230	4.63	0.96	4.04	0.98	1.99	70	11	7.8
Ra-226	1.49	1.6	4.5	0.78	1.44	67	7.5	5.7
Pb-214	2.16	1.82	1.57	2.4	3.39	43.2	6.36	2.87
Bi-214	2.04	1.37	1.38	2.01	2.73	39.1	5.62	2.33
Pb-210	--	--	--	--	--	--	--	--

RATIOS

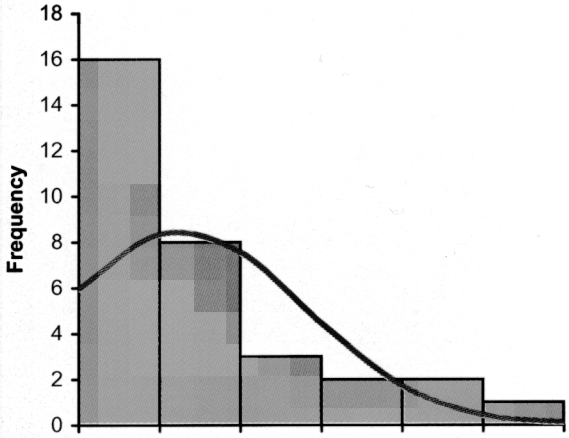
									AVG RATIO	**MAX**	**MIN**
Th-232:Th-232	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	**1.00**	**1.00**	**1.00**
Ra-228:Th-232	1.32	1.63	0.46	2.70	1.68	1.03	0.99	0.33	**1.27**	**2.70**	**0.33**
Th-228:Th-232	1.11	1.49	1.06	1.47	1.28	0.81	0.69	1.10	**1.13**	**1.49**	**0.69**
Pb-212:Th-232	1.69	2.12	0.54	2.23	1.65	0.81	0.91	0.38	**1.29**	**2.23**	**0.38**
Bi-212:Th-232	1.60	2.71	0.72	0.81	1.44	0.98	1.20	0.31	**1.22**	**2.71**	**0.31**
U-238:U-238	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	**1.00**	**1.00**	**1.00**
Th-234:U-238	1.63	1.62	0.14	1.39	1.65	0.98	1.58	0.59	**1.20**	**1.65**	**0.14**
U-234:U-238	1.35	0.91	0.95	1.18	1.11	0.93	0.84	0.96	**1.03**	**1.35**	**0.84**
Th-230:U-238	5.38	0.82	0.97	0.91	0.87	1.15	1.55	1.44	**1.64**	**5.38**	**0.82**
Ra-226:U-238	1.73	1.37	1.08	0.72	0.63	1.10	1.06	1.05	**1.09**	**1.73**	**0.63**
Pb-214:U-238	2.51	1.56	0.38	2.22	1.47	0.71	0.90	0.53	**1.28**	**2.51**	**0.38**
Bi-214:U-238	2.37	1.17	0.33	1.86	1.19	0.64	0.79	0.43	**1.10**	**2.37**	**0.33**
Pb-210:U-238	--	--	--	--	--	--	--	--			

Tentative ID
Non-detect

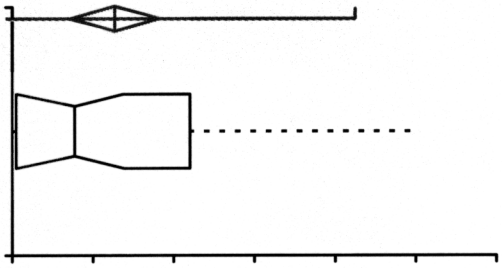
WORKSHEET 4

Descriptive statistics and correlations

Test	**Continuous summary descriptives**
Variable	Th-232 - Values
Performed by	csullivan
Date	14 October 2004

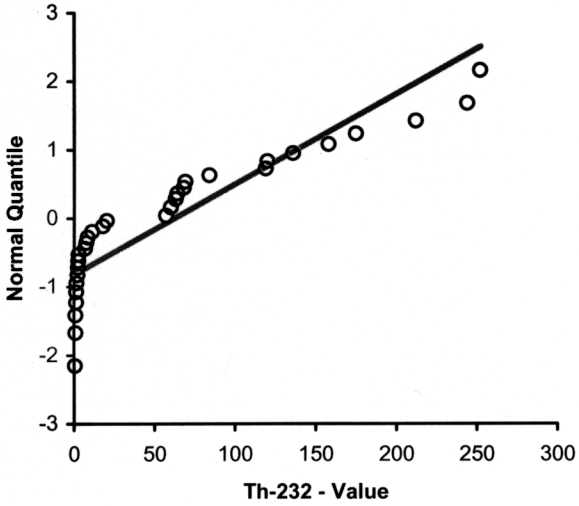


n	32 (cases excluded: 1 due to mis
Mean	63.430
95% CI	36.118 to 90.743
Variance	5738.7094
SD	75.7543
SE	13.3916
CV	119%



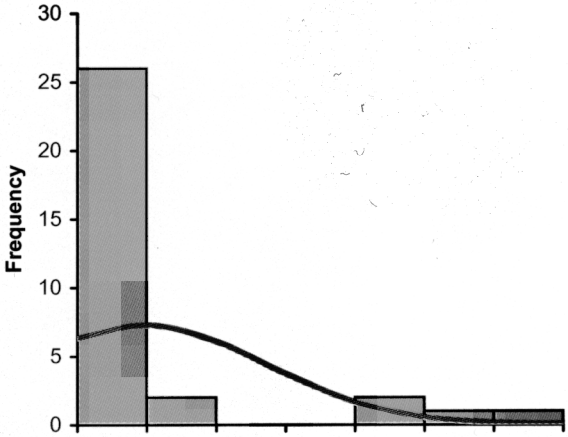
Median	38.650
98.0% CI	2.850 to 69.000
Range	251.4
IQR	107.765

Percentile	
2.5th	-
25th	2.485
50th	38.650
75th	110.250
97.5th	-

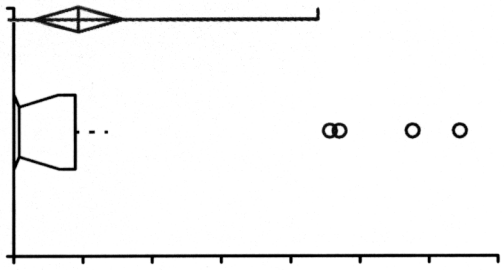


	Coefficient	p
Shapiro-Wilk	0.8037	<0.0001
Skewness	1.2389	0.0059
Kurtosis	0.5947	0.3628

Test	**Continuous summary descriptives**
Variable	U-238 - Values
Performed by	csullivan
Date	14 October 2004

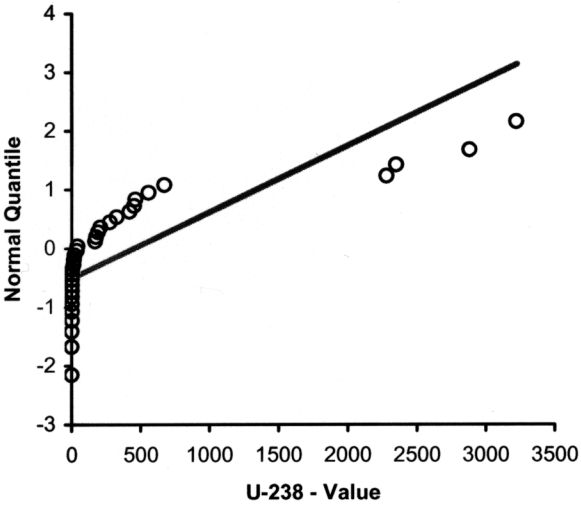


n	32
Mean	462.368
95% CI	143.669 to 781.068
Variance	781377.2055
SD	883.9554
SE	156.2627
CV	191%



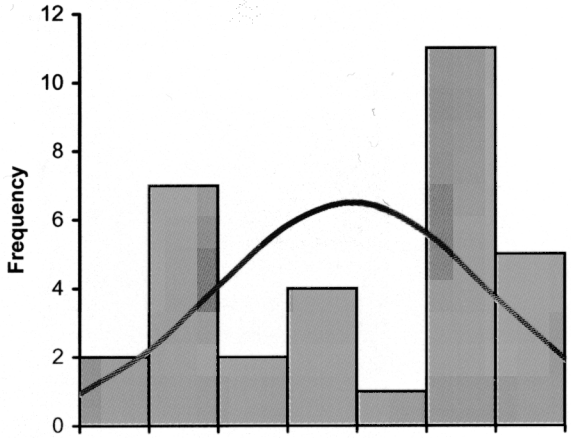
Median	39.100
98.0% CI	3.340 to 326.000
Range	3219.58
IQR	441.375

Percentile	
2.5th	-
25th	2.625
50th	39.100
75th	444.000
97.5th	-

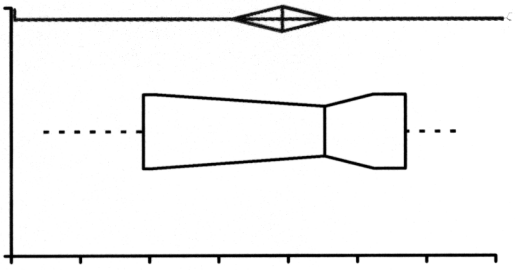


	Coefficient	p
Shapiro-Wilk	0.5702	<0.0001
Skewness	2.2997	<0.0001
Kurtosis	4.1478	0.0042

Test	**Continuous summary descriptives**
Variable	Th-232 - Log Values
Performed by	csullivan
Date	14 October 2004

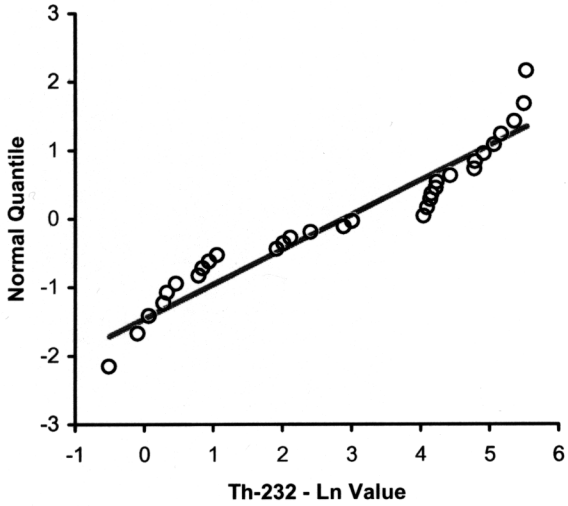


n	32 (cases excluded: 1 due to mis
Mean	2.906
95% CI	2.195 to 3.617
Variance	3.8874
SD	1.9717
SE	0.3485
CV	68%



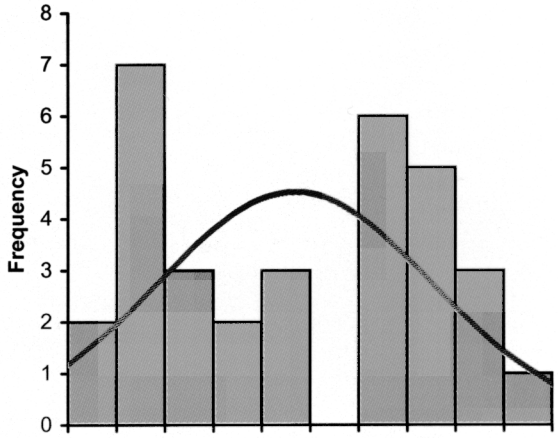
Median	3.527
98.0% CI	1.047 to 4.234
Range	6.040254711
IQR	3.782531962

Percentile	
2.5th	-
25th	0.910
50th	3.527
75th	4.692
97.5th	-

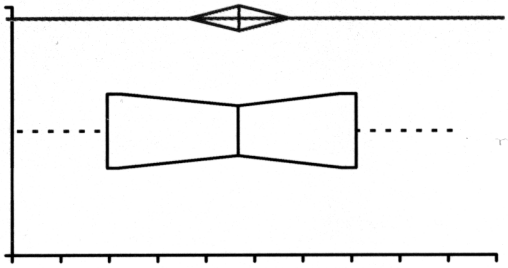


	Coefficient	p
Shapiro-Wilk	0.9011	0.0066
Skewness	-0.2902	0.4626
Kurtosis	-1.4566	0.0003

Test	**Continuous summary descriptives**
Variable	U-238 - Log Values
Performed by	csullivan
Date	14 October 2004

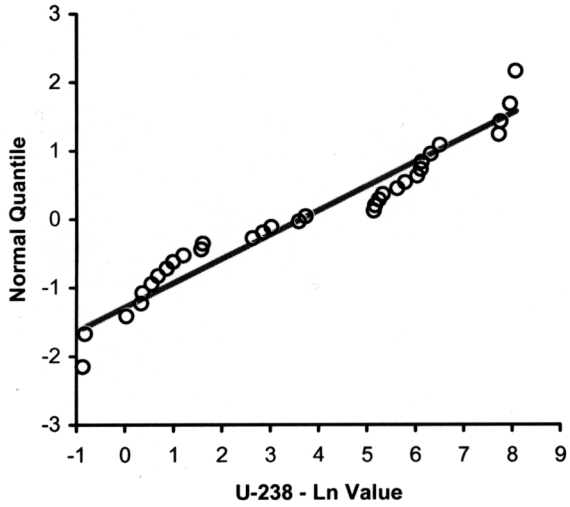


n	32
Mean	3.667
95% CI	2.646 to 4.687
Variance	8.0150
SD	2.8311
SE	0.5005
CV	77%



Median	3.664
98.0% CI	1.206 to 5.787
Range	8.94
IQR	5.13

Percentile	
2.5th	-
25th	0.963
50th	3.664
75th	6.095
97.5th	-



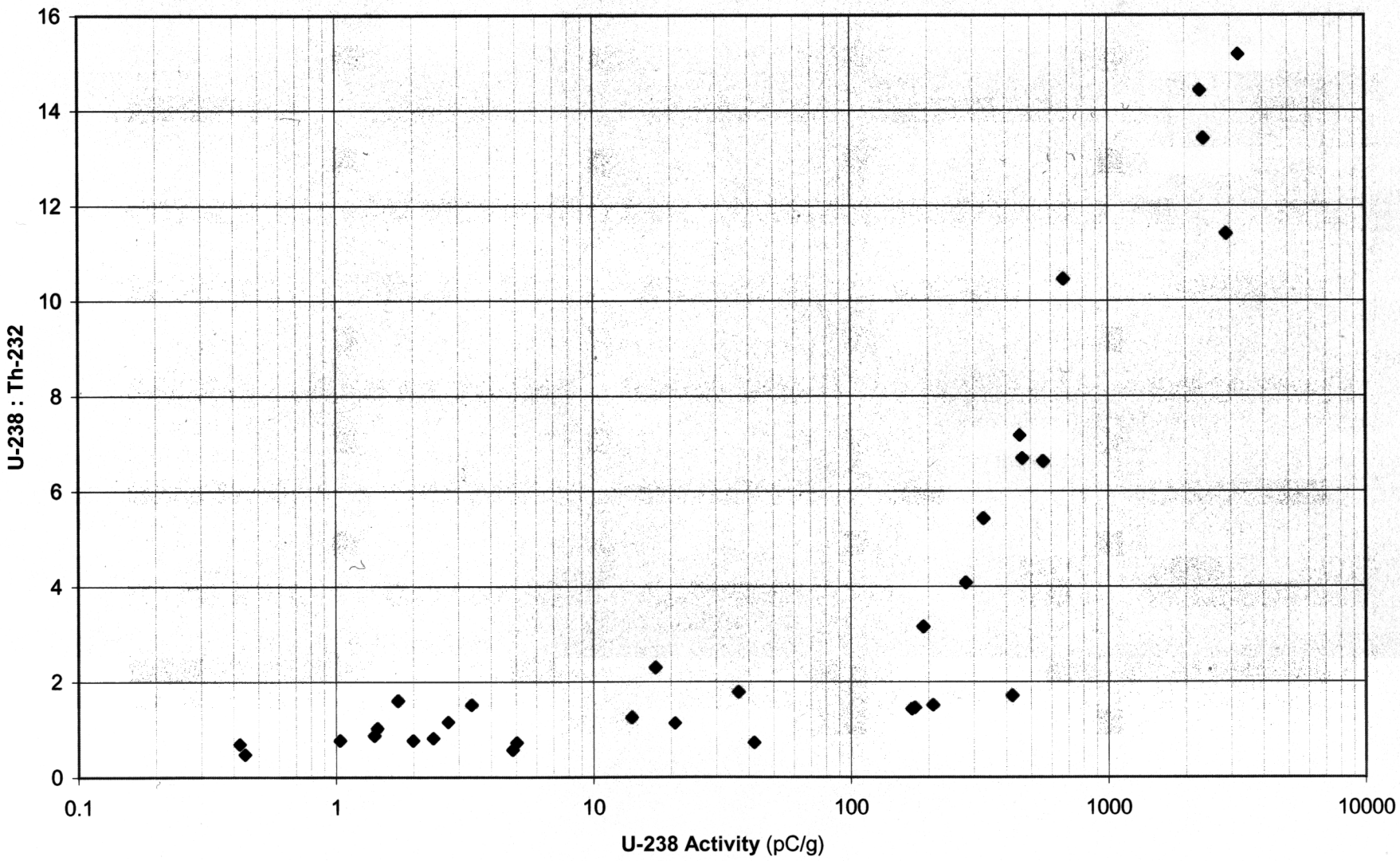
	Coefficient	p
Shapiro-Wilk	0.9267	0.0317
Skewness	-0.0289	0.9411
Kurtosis	-1.3879	0.0010

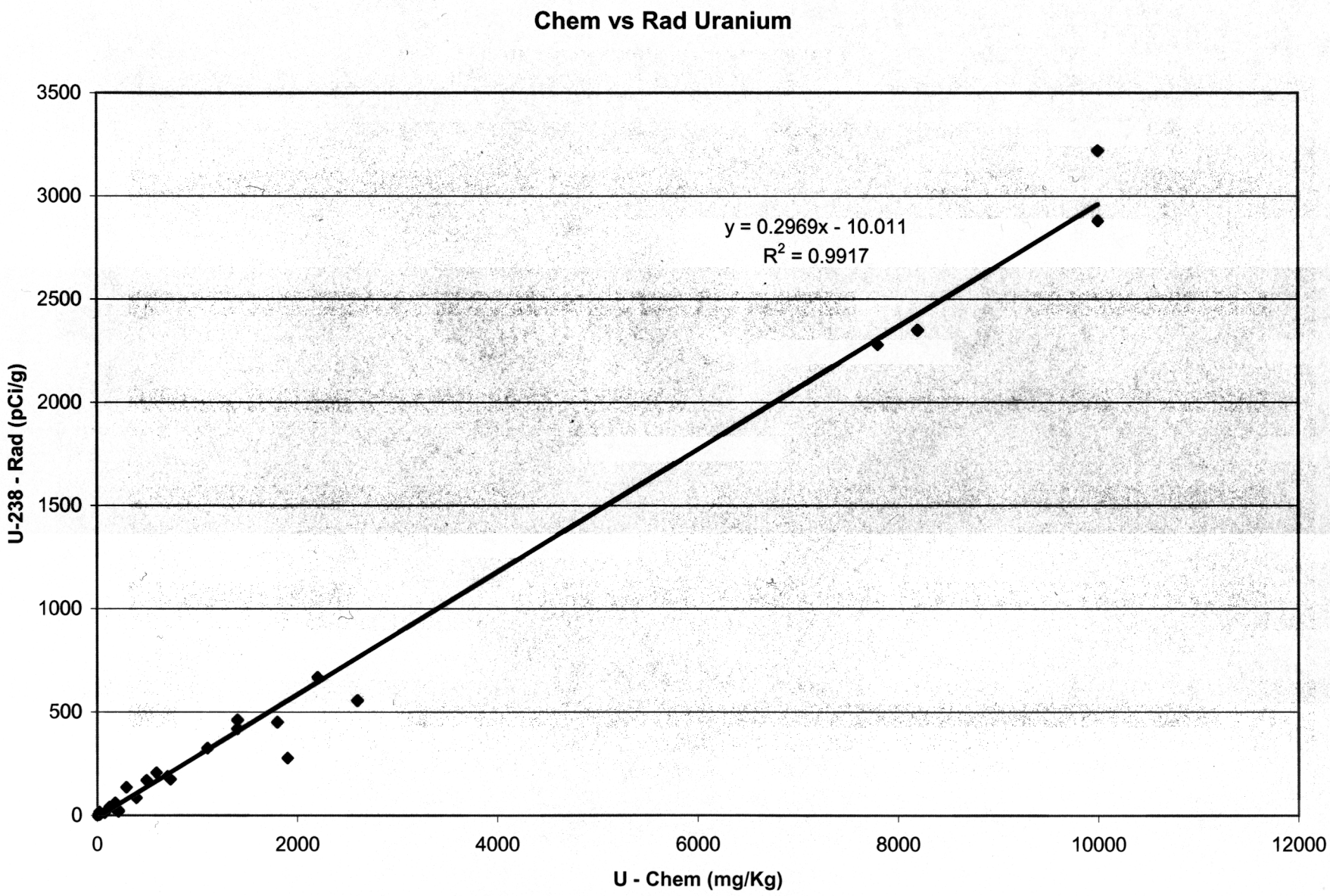
WORKSHEET

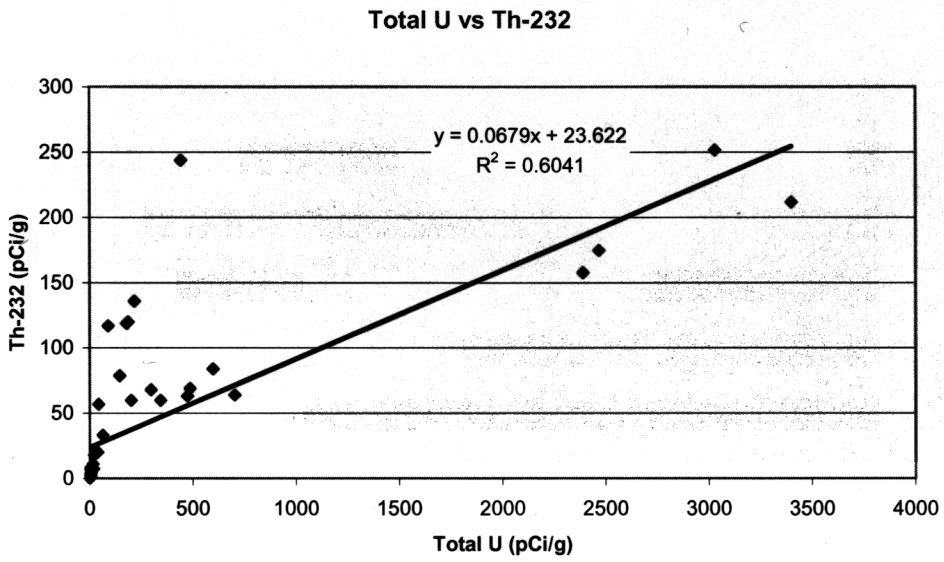
Analyte and Gamma Correlations

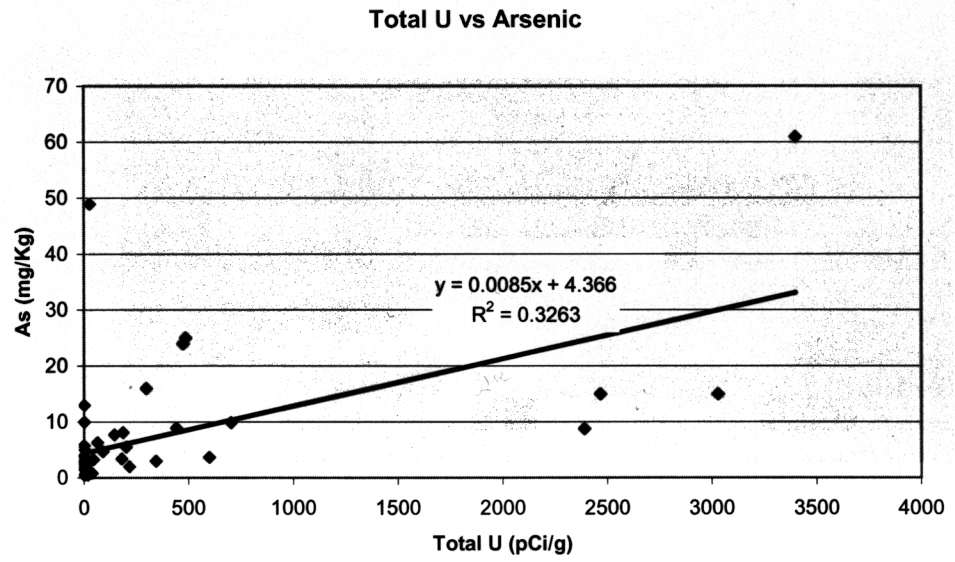
Sample No	U (chem)	Q	U-238	Q	U-235	Q	Total U	Th-232	Q	U + Th	As	Q	Pb	Q	Gamma 3 Ft	Gamma bag
QM-01	0.4	J	0.42		0.025		0.445	0.6		1	0.5	U	0.94		6	10
MSED-01	1	E	0.427		0.037		0.464	0.133		1	3.9		2.2	U		20
MSED-06	1		0.44		0.022	U	0.462	0.65		1	1.6		1.6			8
QM-02	1	J	0.44		0.017		0.457	0.91		1	0.5	U	1.9		4	15
MSED-03	2		0.57		0.011		0.581	0.18		1	5.8		2.5			20
SSED-03	3		0.86		0.034		0.894	0.75		2	2.3		6.7			15
GR-08	1	J	1.03		0.067		1.097	1.32		2	2.6		11		16	25
MSED-02	5		1.06		0.069		1.129	0.137		1	13		4.2			15
SSED-06	3	J	1.08	J	0.073		1.153	0.74	J	2	2		6	J		18
SSED-04	2		1.17		0.045	J	1.215	0.59		2	1.9		5.7			13
SSED-02	3		1.17		0.042		1.212	1.83		3	10		9.8			17
GR-07	1	J	1.4		0.097		1.497	1.58		3	0.5	U	3.2		21	25
GR-03	4	J	1.44		0.083		1.523	1.39		3	0.5	U	8.7		40	15
SSED-01	3		1.55		0.07	U	1.62	1.3		3	1.9		16			12
GR-05	5	J	1.73		0.048	U	1.778	1.07		3	0.5	U	19		160	15
GR-09	5	J	1.98		0.067		2.047	2.54		5	2.8		18		24	25
SSED-07	11		2.3		0.121	J	2.421	1.25		4	3.2		14			10
GR-06	4	J	2.37		0.064	U	2.434	2.85		5	0.5	U	8		32	30
GR-10	6	J	2.71		0.13		2.84	2.32		5	1.8		24		28	20
MSED-04	5		2.83		0.125		2.955	2.25		5	2.5		9.7			17
GR-02	7	J	3.34		0.163		3.503	2.19		6	2.1		14		32	11
MSED-05	17		4.1		0.226		4.326	4.32		9	5		20			12
SSED-05	14		4.15		0.201		4.351	2.23		7	1.8		7.6			15
SOIL-07	11	J	4.83		0.33		5.16	8.3		13	1.7		28	J	90	20
GR-01	9	J	5		0.193		5.193	6.8		12	0.5	U	22		37	25
SSED-10	23	J	5.42	J	0.265		5.685	5.2	J	11	2.4		9.1	J		15
GEN-02	22	J	6.4		0.245		6.645	4.38		11	2.1		15	J	40	20
SSED-09	24		7.1		0.31		7.41	6		13	2.2		16			15
SOIL-02	73	J	14		0.77		14.77	11.1		26	0.95	U	19	J	30	17
GR-04	19	J	17.3		0.94		18.24	7.5		26	0.5	U	3.2		185	12
SOIL-01	210	J	20.6		1.09		21.69	18		40	3.1	U	31	J	30	15
MSED-09	210		25.9		1.53		27.43	20.2		48	49		43			112
SOIL-05	170	J	36.4		1.65		38.05	20.3		58	0.85	U	23	J	100	23
300-02	120	J	41.8		1.92		43.72	57	J	101	3.3		62		206	45
SSED-08	180		60.8		3.04		63.84	33.2		97	6.3		48			25
MSED-08	390	J	86	J	4.18	J	90.18	117	J	207	4.7	J	14	J		42
MSED-07	290		137		8.7		145.7	79		225	7.7		20			28
900-04	490	J	171		9		180	119	J	299	3.4		62		478	95
SOIL-10	730	J	176		9.8		185.8	120		306	8.1		110	J	125	20
MR-02	700	J	190		11		201	60		261	5.5		82	J	800	85
HR-01	590	J	207		10.3		217.3	136	J	353	2		300	J	480	130
SOIL-08	1900	J	278		19.7		297.7	68		366	16		290	J	110	42
MR-01	1100	J	326		18		344	60		404	3		78	J	750	70
700-02	1400	J	420	J	22	J	442	244	J	686	8.9		190		1,074	250
900-01	1800	J	452		21.7		473.7	63		537	24		110		2,200	120
900-03	1400	J	462		24		486	69		555	25		110		1,600	300
SOIL-04	2600	J	557		41		598	84		682	3.7		87	J	100	25
OSA-02	2200	J	670		32.2	U	702.2	64	J	766	9.9	J	240	J	1,145	15
OSA-01	7800	J	2280		110	U	2390	158		2548	8.8		470		5,000	1,167
300-01	8200	J	2350		117		2467	175		2642	15		330		2,200	1,000
900-02	10000	J	2880		149		3029	252		3281	15		470		1,350	1,400
700-01	10000	J	3220		180		3400	212		3612	61		410		5,000	1,017

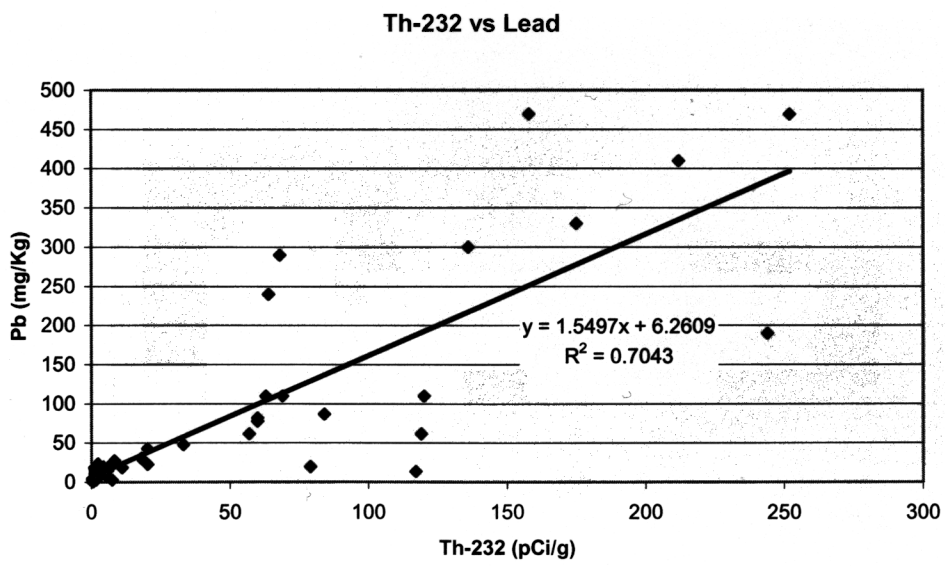
U:Th Ratio as a Function of U-238 Activity

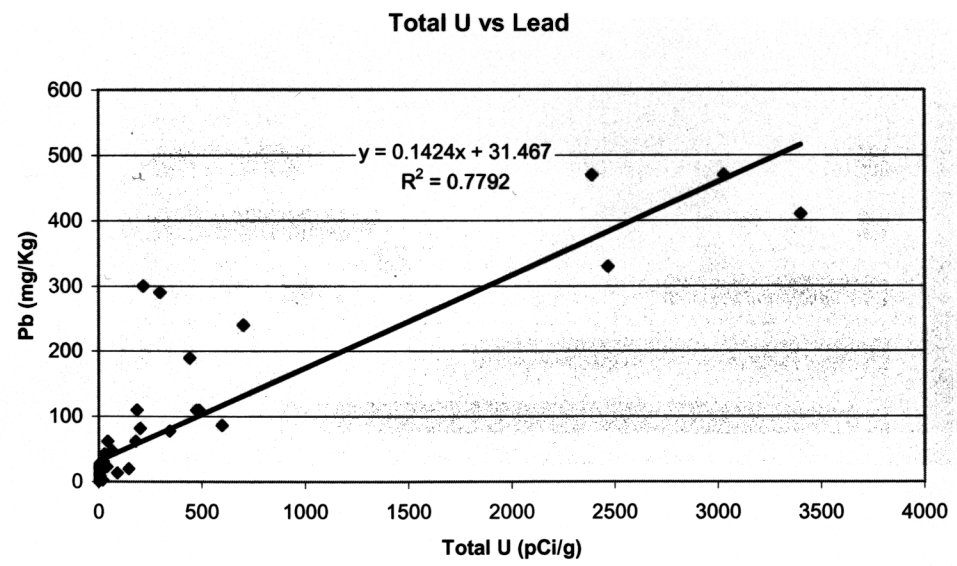



Chem vs Rad Uranium
y = 0.2969x - 10.011
R2 = 0.9917
U-238 - Rad (pCi/g)
U - Chem (mg/Kg)
0
500
1000
1500
2000
2500
3000
3500
0
2000
4000
6000
8000
10000
12000

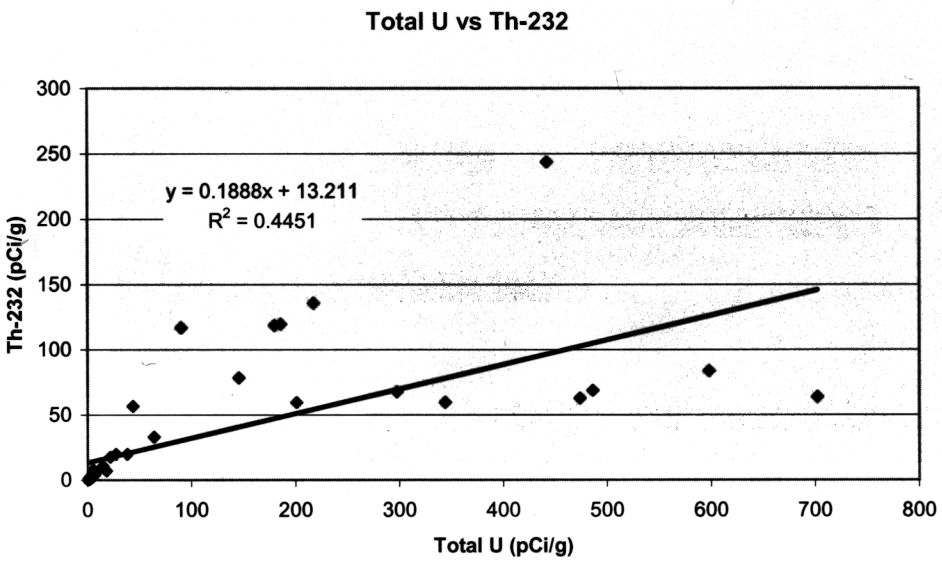


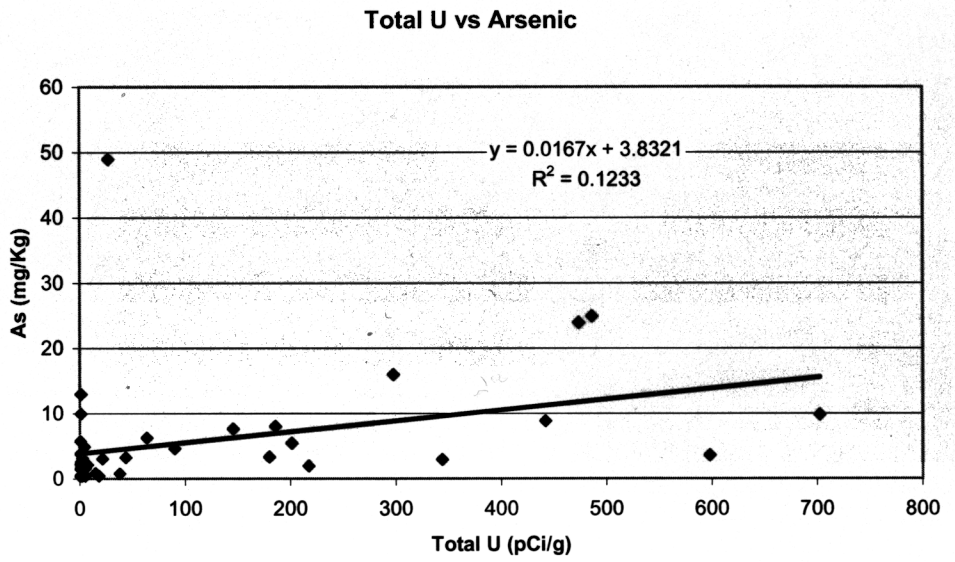


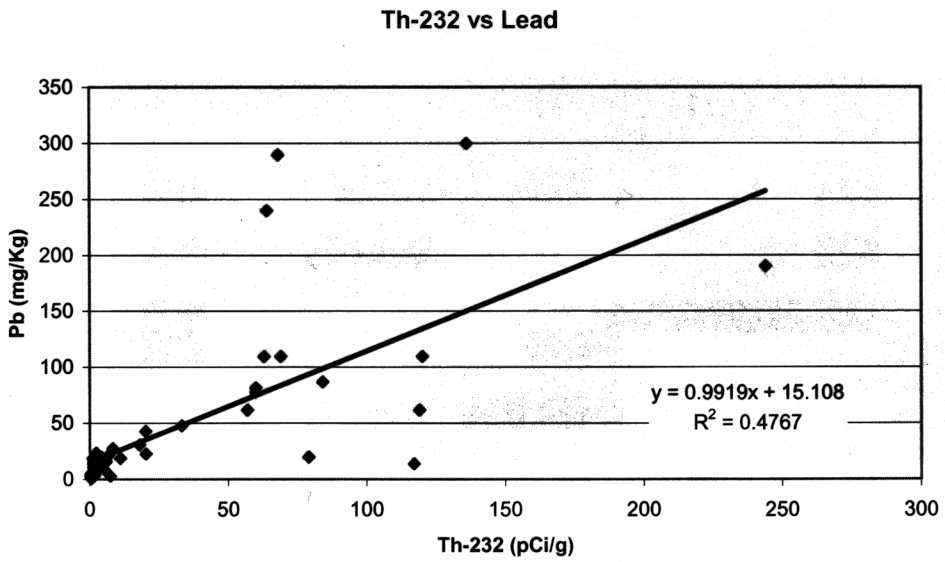


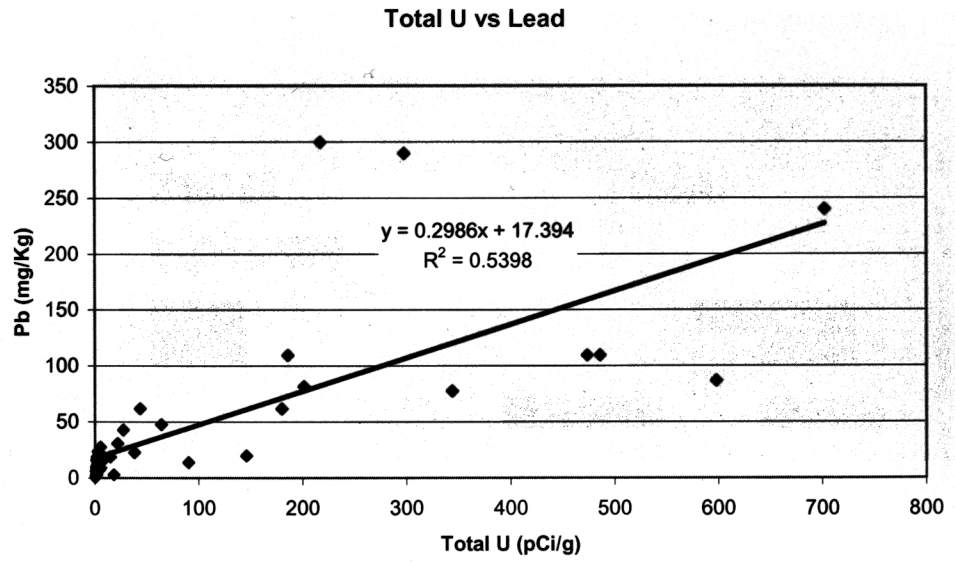


Analyte Correlations

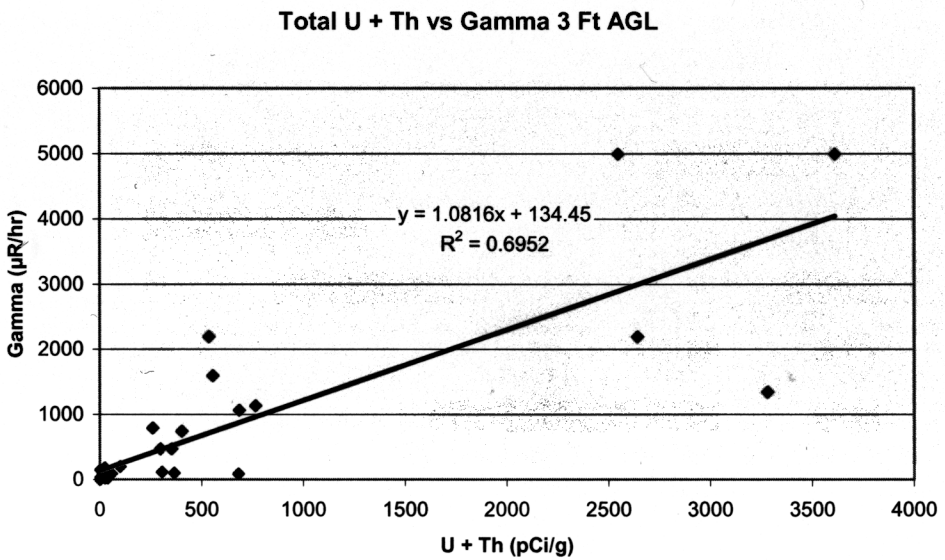


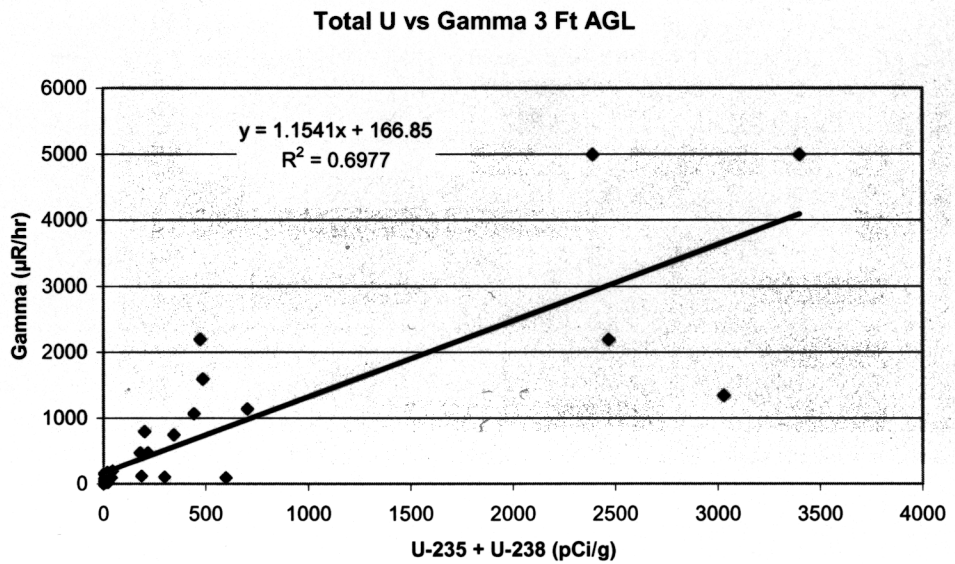


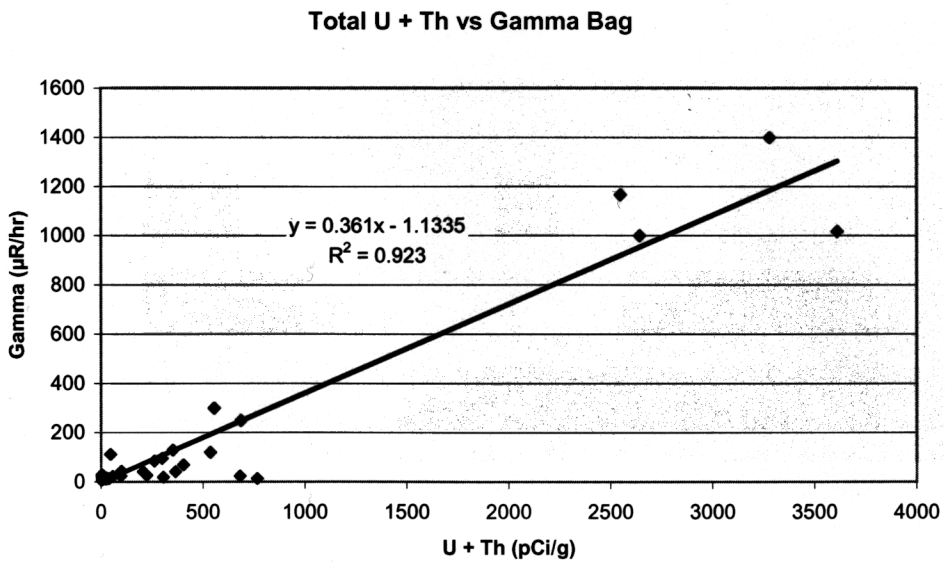


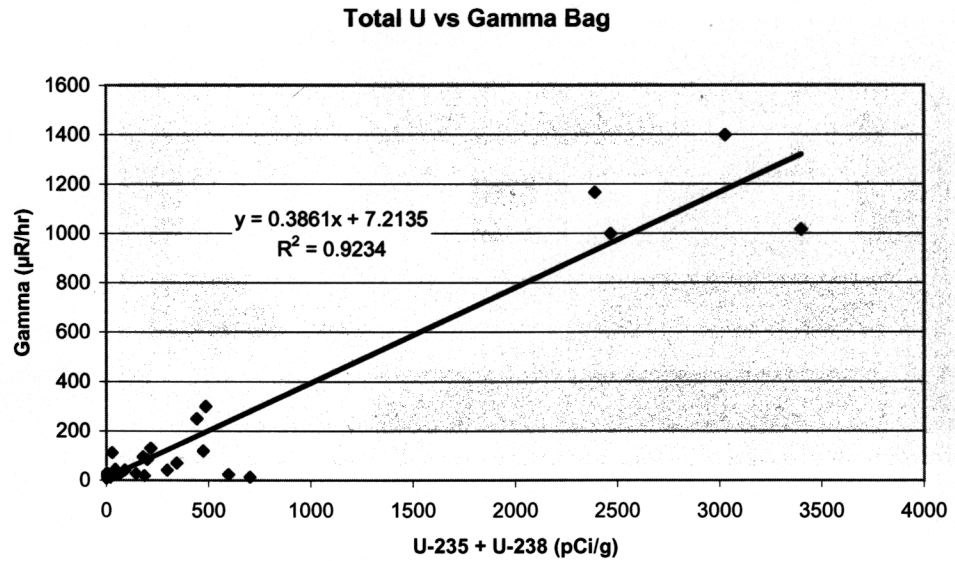


Analyte Correlations (subset)

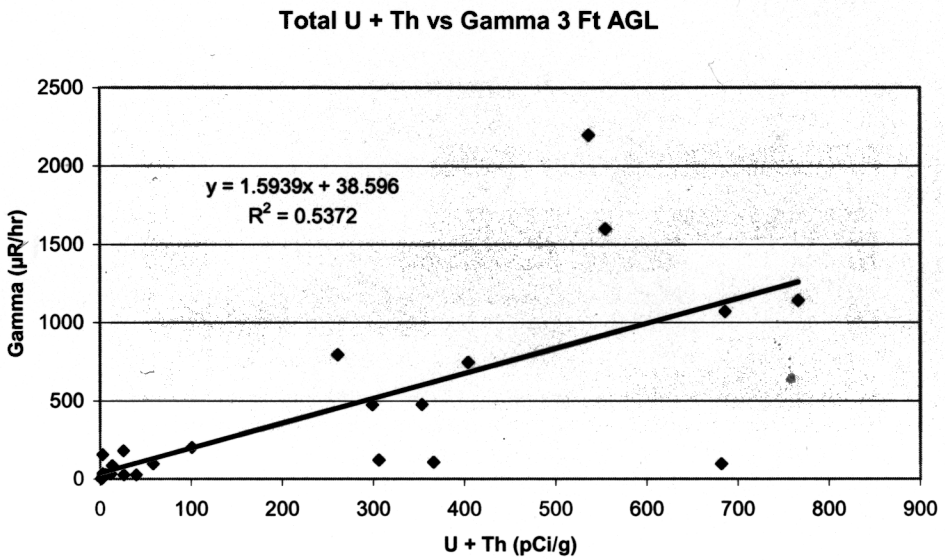


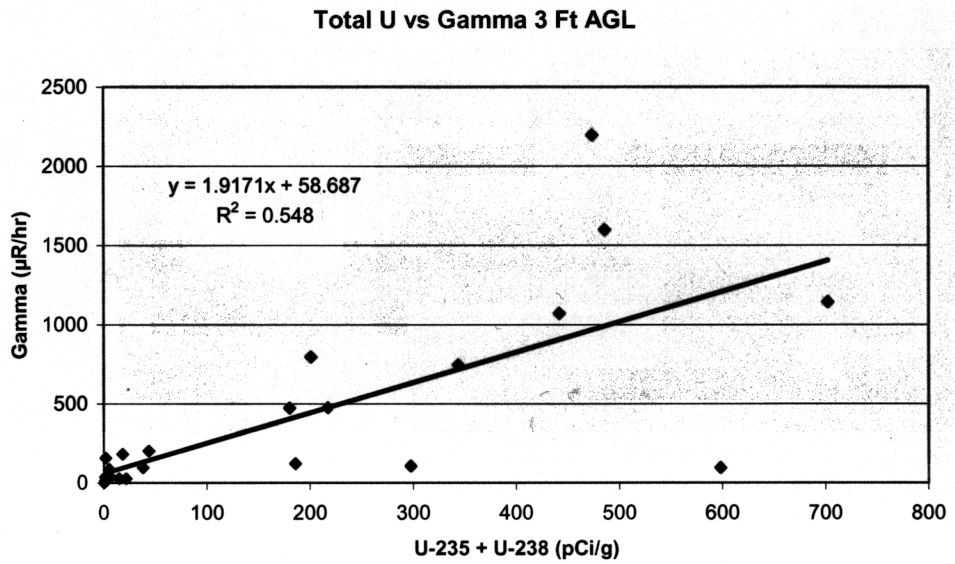


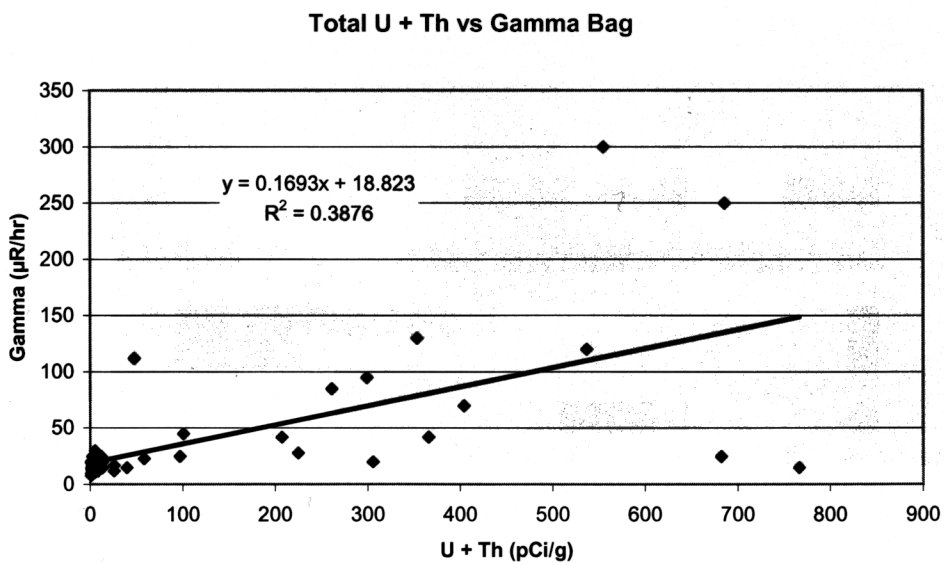


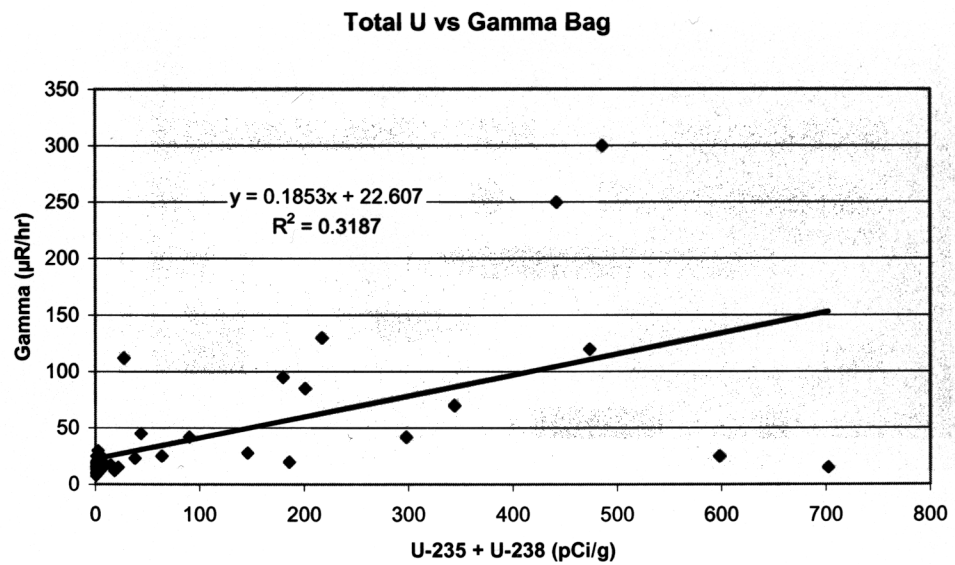


Gamma Correlations









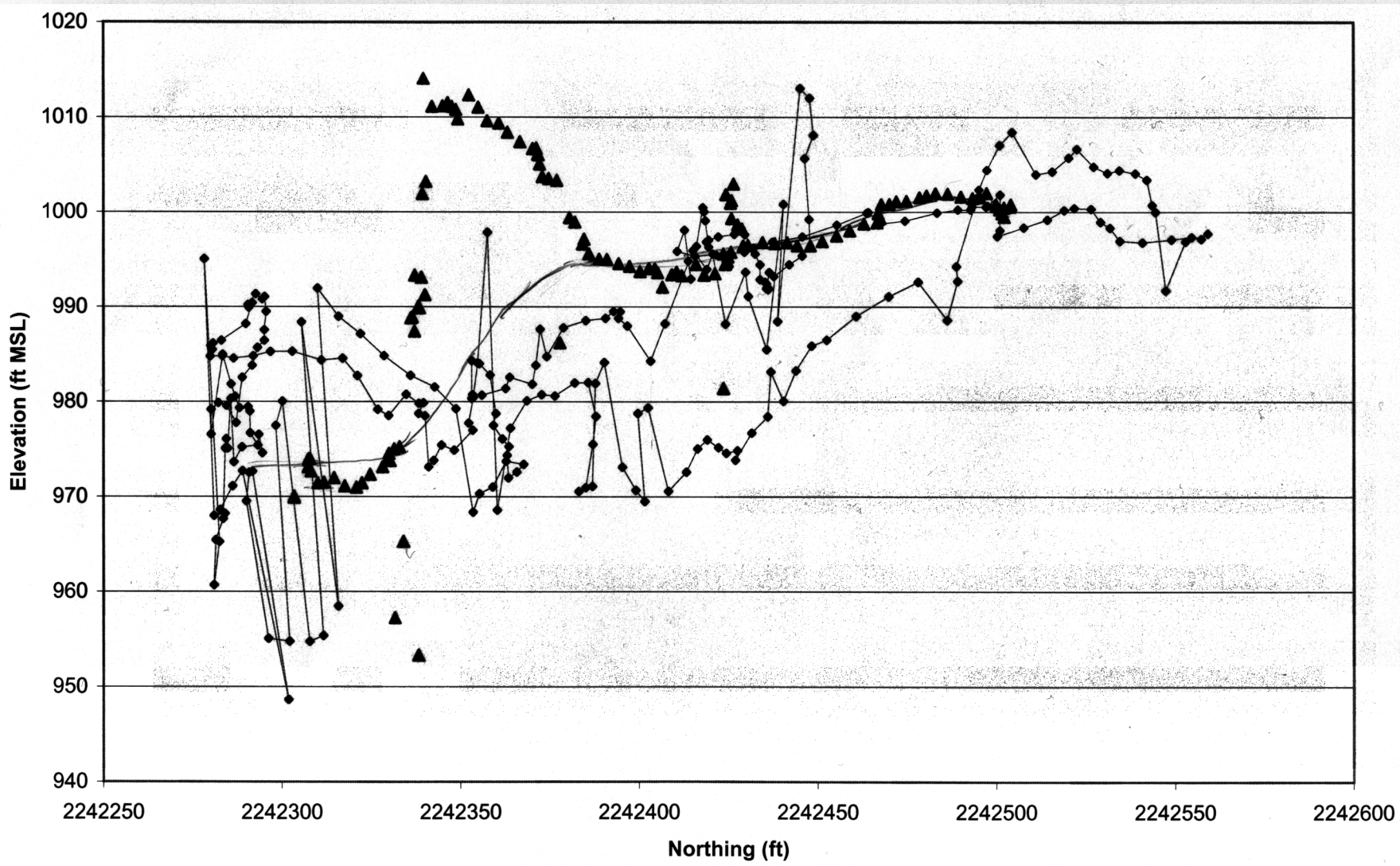
Gamma Correlations (subset)

WORKSHEET 5

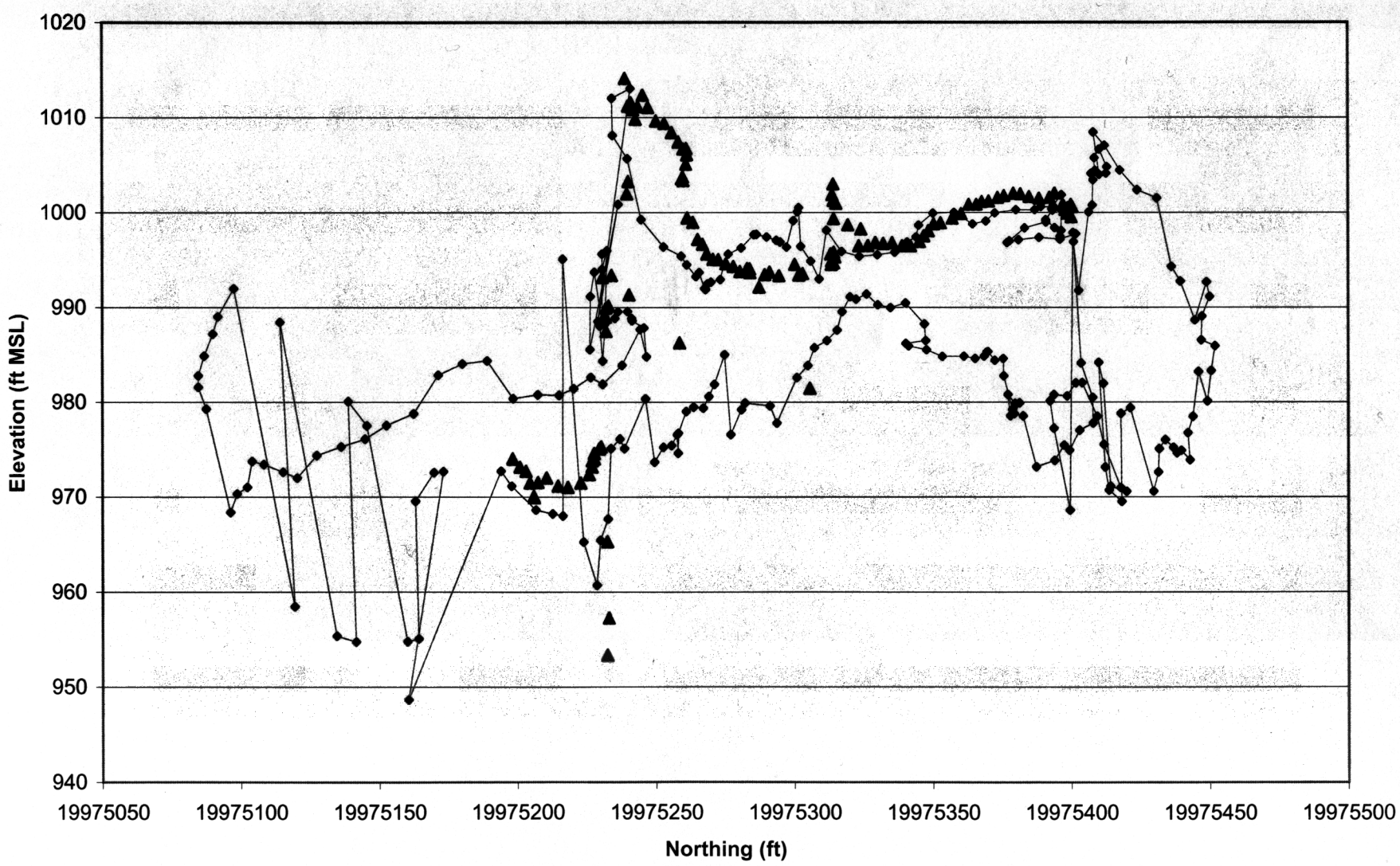
Source area volume and mass calculations

CRS
8/18

900 Level Profile (East-West)

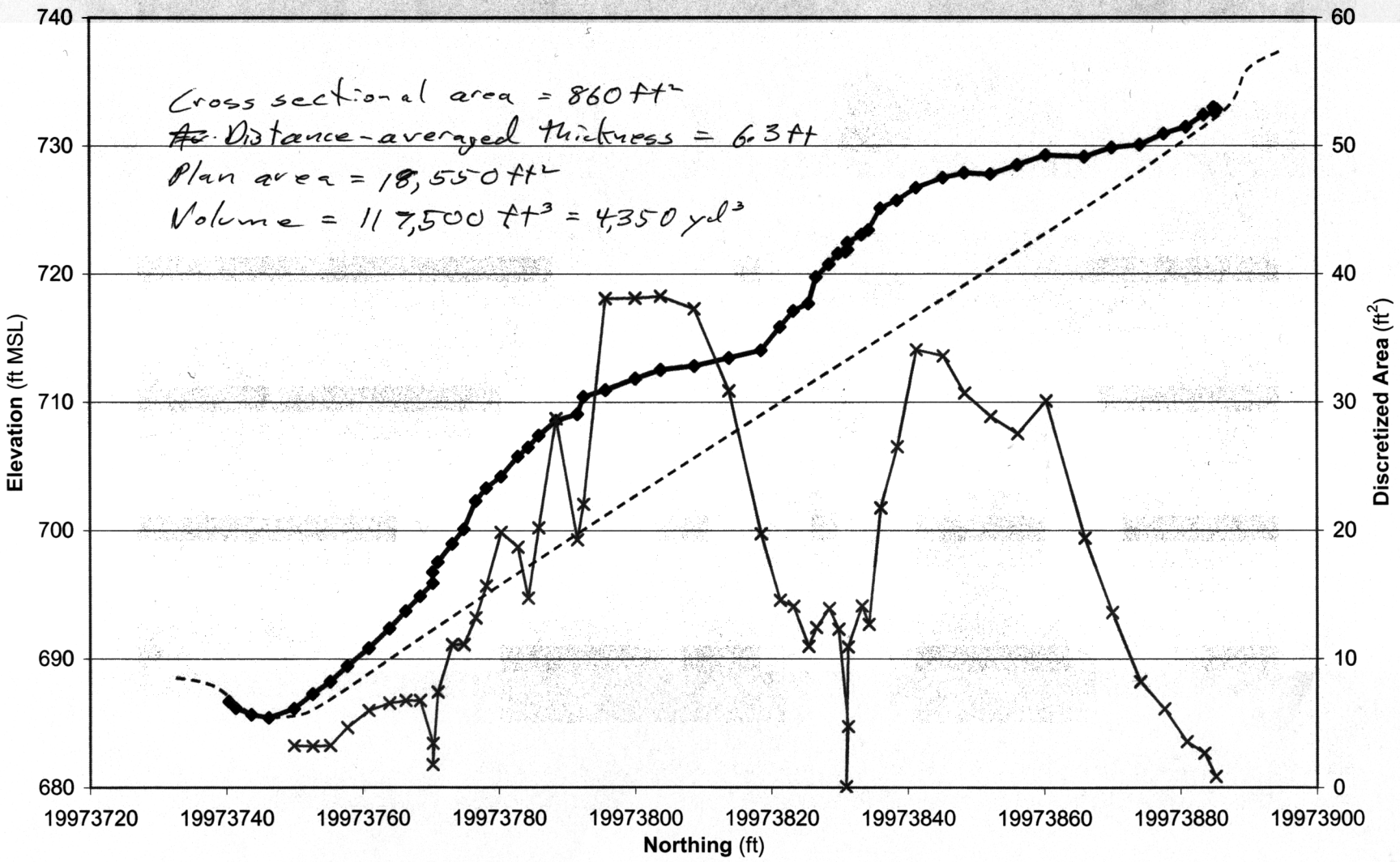


900 Level Profile (North-South)



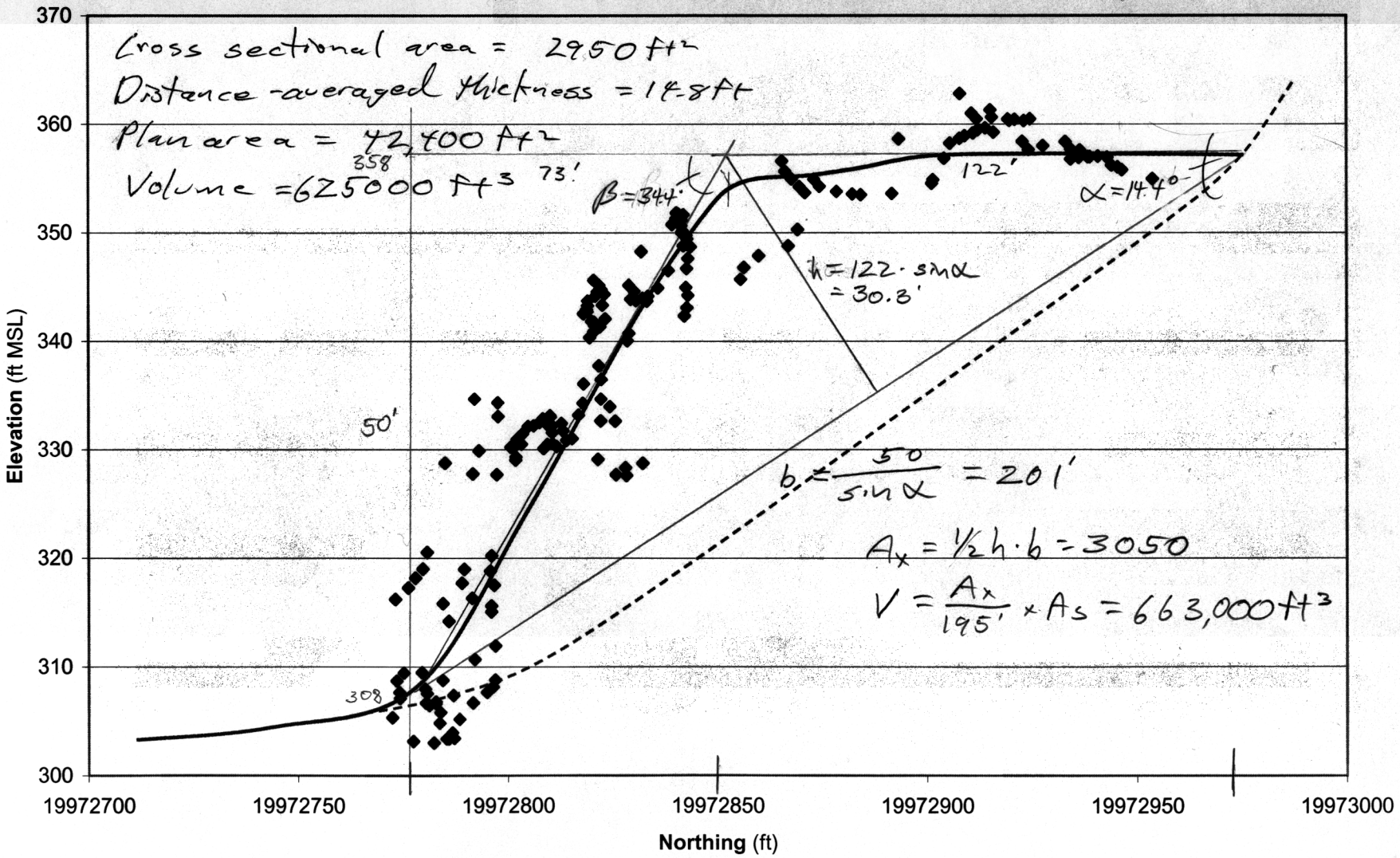
CRS
8/19

700 Level Dump Profile



CRS
8/19

300 Level Dump Profile



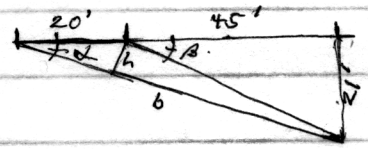
CRS
8/16

Mine road fill volume calculations

Fill area (I):

Surface area = 570 m² = 6135 ft²

Length = 160 ft



$\beta = 25.0°$

$\tan\alpha = \frac{21}{65}$ $\qquad h = 20 \cdot \sin\alpha = 6.1\,ft$

$\alpha = 17.9°$ $\qquad b = \cancel{68.3\,ft}\ \frac{21}{\sin\alpha} = 68.3\,ft$

$A_x = \frac{1}{2} b \cdot h = 210\,ft^2$

Shape factor $\equiv 0.6$

$V = 160\,ft \times 210\,ft^2 \times 0.6$

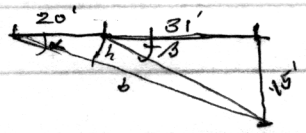
$= 20000\,ft^3 = 750\,yd^3 = 570\,m^3$

Alternative: $V = \frac{A_x}{65} \cdot$ Surface area $= \cancel{19800\,ft^3}\ 19800\,ft^3$

Fill area (II):

Surface area = 250 m² = 2690 ft² (A_s)

Length = 30.5 m = 100 ft



$\beta = 25.8°$

$\tan\alpha = \cancel{\frac{21}{55}}\ \frac{15}{51}$ $\qquad h = 20 \cdot \sin\alpha = 5.6\,ft$

$\alpha = 16.4°$ $\qquad b = \frac{15}{\sin\alpha} = 53.1\,ft$

$A_x = \frac{1}{2} b \cdot h = 150\,ft^2$

Shape factor $\equiv 0.5$

$V = 100\,ft \times 150\,ft^2 \times 0.5$

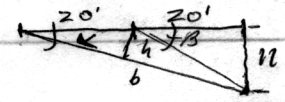
$= 7500\,ft^3 = 280\,yd^3 = 210\,m^3$

Alt: $V = \frac{A_x}{51} \cdot A_s = \cancel{7600\,ft^3}\ 7900\,ft^3$

Fill area (III)

Surface area (A_s) = 410 m^2 = 4410 ft^2

Length = 59 m = 194 ft



$\beta = 28.8°$

$\tan\alpha = \frac{11}{40}$ $\qquad h = 20 \cdot \sin\alpha = 5.3$ ft

$\alpha = 15.4°$ $\qquad b = \frac{11}{\sin\alpha} = 41.4$ ft

$A_x = \frac{1}{2} b \cdot h = 110$ ft^2

Shape factor $\equiv 0.7$

$V = 194$ ft $\times$ 110 ft^2 $\times$ 0.7

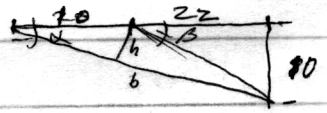
$= 15000$ ft^3 $= 550$ yd^3 $= 420$ m^3

Alt: $V = \frac{A_x}{40} \cdot A_s$ = ~~11,200 ft³~~ 12,100 ft^3

Fill area (IV)

A_s = 350 m^2 = 3770 ft^2

Length = 56 m = 188 ft



$\beta = 24.4°$

$\tan\alpha = \frac{10}{32}$ $\qquad h = 10 \cdot \sin\alpha = 3.0$ ft

$\alpha = 17.4°$ $\qquad b = \frac{10}{\sin\alpha} = 33.4$ ft

$A_x = \frac{1}{2} b \cdot h = 50$ ft^2

Shape factor $\equiv 0.7$

$V = 183$ ft $\times$ 50 ft^2 $\times$ 0.7

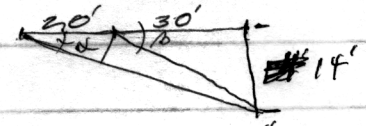
$= 6400$ ft^3 $= 240$ yd^3 $= 180$ m^3

Alt: $V = \frac{A_x}{32} \cdot A_s = 5{,}900$ ft^3

Fill area (V)

Surface area (A_s) = 240 m^2 = 2583 ft^2

Length = 31.6 m = 103.7 ft



$\beta = 25.0°$

$\tan\alpha = \frac{14}{50}$ $\qquad h = 20 \cdot \sin\alpha = 5.4\,ft$

$\alpha = 15.6°$ $\qquad b = \frac{14}{\sin\alpha} = 52.0\,ft$

$A_x = \frac{1}{2} b \cdot h = 140\,ft^2$

Shape factor $\equiv 0.5$

$V = 104\,ft \times 140\,ft^2 \times 0.5$

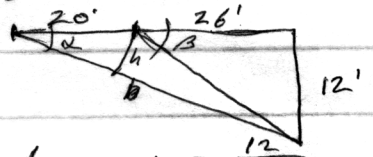
$= 7300\,ft^3 = 270\,yd^3 = 210\,m^3$

Alt: $V = \frac{A_x}{50} \cdot A_s = 7200\,ft^3$

Fill area (VI)

$A_s = 410\,m^2 = 4413\,ft^2$

Length = 51 m = 167 ft



$\beta = 24.8°$

$\tan\alpha = \frac{12}{46}$ $\qquad h = 20 \cdot \sin\alpha = 5.0\,ft$

$\alpha = 14.6°$ $\qquad b = \frac{12}{\sin\alpha} = 47.6\,ft$

$A_x = \frac{1}{2} b \cdot h = 120\,ft^2$

Shape factor = 0.5

$V = 167\,ft \times 120\,ft^2 \cdot 0.5$

$= 10000\,ft^3 = 370\,yd^3 = 280\,m^3$

Alt: $V = \frac{A_x}{46} \cdot A_s = 11500\,ft^3$

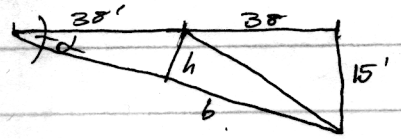
Total volume $\approx 2400\,yd^3$

CRS
8/19

900 level south dump volume calculation

$A_s = 467 m^2 = 5027 ft^2$

Length (E-W) = 31 m = 102 ft



$\beta = 21.5°$

$\alpha = \text{atan}\frac{15}{26} = 11.2°$ $\quad h = 38 \sin\alpha = 7.4 ft$

$b = \frac{15}{\sin\alpha} = 77.2 ft$

$A_x = \frac{1}{2} b \cdot h = \cancel{570 ft^2}\ 286 ft^2$

shape factor = 0.5

$V = 102 ft \times \cancel{570} 286 ft^2 \times 0.5$

$= \cancel{29000} 14600 ft^3 = \cancel{1080} 540 yd^3 = \cancel{820} 413 m^3$

<u>OR</u>

$V = \frac{A_x}{26} \times A_s = \cancel{37700} 18900 ft^3 =$

$= \cancel{1400} 700 yd^3$

$= 540 m^3$

WORKSHEET 6

ADEC Method 3 calculations

Alaska Department of Environmental Conservation • Spill Prevention and Response

Contaminated Sites Remediation Program

STEP 4:

The following are the calculated cleanup levels for each chemical and pathway. Where values are provided for more than one pathway, the lowest of the values should be used as the soil cleanup level. All cleanup levels are in units of mg/kg. Any other chemical-specific requirements that must be considered follow the table of cleanup levels.

Chemical Name	Chemical Type	Ingestion	Inhalation	Migration to GW
DRO (Total)	Petroleum	8300	12500	1700
RRO (Total)	Petroleum	8300	22000	22000

Chemical	Notes
DRO (Total)	The Maximum Allowable DRO concentration is 12500 mg/kg.
RRO (Total)	The Maximum Allowable RRO concentration is 22000 mg/kg.

These cleanup levels should be printed. To print, please select the print function on your web browser. This page may also be saved and emailed for documentation of the calculated cleanup levels. For best results, save the page as a "Web Archive for email" file (.mht) if your browser supports this; in Internet Explorer 5 choose "Save as..." from the file menu and change the "Save as type" to "Web Archive for email". Other browsers should have a similar choice.

For reference, the parameters used to calculate these levels are as follows (with defaults that have been changed listed in parentheses):

Volatilization Pathway:

ρ_b: Dry soil bulk density (g/cm^3):	1.5	(Default: 1.5)
n: Total soil porosity (L_{pore}/L_{soil}):	0.434	(Default: 0.434)
Θ_w: Water-filled soil porosity (L_{water}/L_{soil}):	0.15	(Default: 0.15)
Θ_a: Air-filled soil porosity (L_{air}/L_{soil}):	0.284	(Default: 0.284)
w: average soil moisture content (g_{water}/g_{soil}):	0.1	(Default: 0.1)
f_{oc}: organic carbon content of soil (g/g):	0.0076	(Default: 0.001)

Groundwater Pathway:

Θ_w: Water-filled soil porosity (L_{water}/L_{soil}):	0.3	(Default: 0.3)
Θ_a: Air-filled soil porosity (L_{air}/L_{soil}):	0.13	(Default: 0.13)
w: average soil moisture content (g_{water}/g_{soil}):	0.2	(Default: 0.2)
K: aquifer hydraulic conductivity (m/yr):	876	(Default: 876)

i: hydraulic gradient (m/m):	0.002	(Default: 0.002)
L: source length parallel to groundwater flow (m):	32	(Default: 32)
I: infiltration rate (m/yr):	0.6	(Default: 0.6)
d_a: aquifer thickness (m):	10	(Default: 10)

The exposure scenario and zone for this project: Over 40-inch Zone - Residential Exposures
Today's date: 9/27/04
Enter site name to view on printout: Ross Adams Gen Bldg

If you wish to calculate cumulative risks based on concentrations that have been entered for the site, select the "continue" button below. If you do not wish to complete this step, please note that you must demonstrate that the calculated cleanup levels will not produce unacceptable cumulative risks before they will be accepted. If cumulative risks are above the benchmarks, the cleanup levels should be modified downwards. See the Guidance on Cleanup Standards Equations and Input Parameters for details.

Continue

Alternatively, to return to the first step to rerun the calculator or change parameters, click here.