Vegetative Sampling Results Summary

In Support of Health and Safety Plan

For Vegetation Clearing and Grubbing

West Lake Landfill Operable Unit 1, Bridgeton, Missouri

Prepared for: Engineering Management Support, Inc.

7220 West Jefferson Ave., Suite 406

Lakewood, Colorado 80235

Prepared by: TA Woodford and Associates, LLC

5315 Precious Stone Drive

St. Charles, Missouri 63304

March 30, 2009

Table of Contents

1 Introduction.....1
2 Purpose and Objectives.....1
3 Sample Locations.....2
4 Data Summary/Conclusion.....2
5 References.....3

List of Tables

1 Vegetative Sampling Results

List of Figures

1 Sample Locations in Areas 1 and 2
2 Background Sample Locations
3 Ra-226 in Vegetation
4 Th-228 in Vegetation
5 Th-230 in Vegetation
6 Th-232 in Vegetation
7 U-234 in Vegetation
8 U-235 in Vegetation
9 U-238 in Vegetation

WLLFOIA4312 - 004 - 0081647

1 Introduction

T. A. Woodford & Associates as a subcontractor to Engineering Management Support, Inc. (EMSI) is part of the Remedial Design team for Operable Unit 1 at the West Lake Landfill. A Remedial Design Work Plan (EMSI et al., 2008) for performance of design investigations and preparation of the remedial design in accordance with Amendment 2 to the Administrative Order on Consent for Operable Unit 1 was previously prepared and submitted to the U.S. Environmental Protection Agency (USEPA) and the Missouri Department of Natural Resources (MDNR).

In support of the Remedial Design activities, a new topographic survey needs to be prepared for Areas 1 and 2 of Operable Unit 1 at the West Lake Landfill. Before the survey can be performed, existing vegetation needs to be cleared from Areas 1 and 2 to allow access for performance of the topographic survey.

It is anticipated that clearing and grubbing of the vegetation will be performed using a skid-steer loader (e.g., Bobcat) with a cutter/grinder attachment. Based on the costs required for mobilization of the equipment and training of the crews, it is more cost effective to clear all of Areas 1 and 2 at one time. Therefore, with the exception of trees with trunk diameters of 6-inches or more, all vegetation will be cleared from Areas 1 and 2 as part of this effort. Topographic surveying can be performed around the larger trees. These trees will be removed at a later date as part of the implementation of the remedial action for the Site.

Cutting and grinding of the vegetation may result in generation of debris that could contain radionuclides. The radiological data contained in this report and its attachments show that no significant radiological uptake has taken place in the vegetation.

2 Purpose and Objectives

The purpose of this effort was to determine the level (if any) of radium 226, isotopic uranium, and isotopic thorium in the vegetation that is slated for removal/grinding. The objective of this effort was to obtain representative samples of the different types of vegetation slated for removal/grinding. These activities are described in greater detail in the Vegetation Sampling Plan dated March 9, 2009. Samples were collected from areas that have previously been identified as having greater than twice gross gamma background (> 25 uR/hr) when possible. Some areas of the site were not accessible due to the overgrowth of vegetation. The balance of the samples were collected from areas with lower gross gamma radiation.

WLLFOIA4312 - 004 - 0081648

3 Sample Locations

The vegetation sample locations were determined by the presence of vegetation and gross gamma measurements. These locations in Areas 1 and 2 are identified on Figure 1. The gross gamma radiological measurements were performed utilizing a Ludlum Model 12 Micro R Meter. Radiological screening and vegetation sampling focused on areas with greater than twice gross gamma background (> 25 uR/hr), when possible.

A total of seven vegetation samples were collected from the approximately 10 acres to be cleared in Area 1 and 13 vegetation samples were taken from the approximately 30 acres to be cleared in Area 2. A duplicate sample was obtained in each area for quality control purposes. All samples were given a unique sample identification number.

In addition to the collection of samples from areas with low gamma values within Areas 1 and 2, two vegetation background samples were taken from outside of Areas 1 and 2. Figure 2 shows the background sample locations in relation to the West Lake Landfill site. These background samples are numbered 8 and 9 on Table 1 (Vegetative Sampling Results). The background samples were collected along the Missouri River at the end of St. Charles Rock Road.

Samples were collected in the manner described in the Vegetation Sampling Plan (Woodford and Associates, 2009).

4 Data Summary/Conclusion

The data collected as a result of this sampling effort can be found in Table 1. Results reported in picocuries per gram (pCi/g) are provided for each of the various nuclides for each sample. Figures 3 through 9 show the activity concentrations and uncertainties for each of the samples for Radium-226, Thorium-228, Thorium-230, Thorium-232, Uranium-234, Uranium-235, and Uranium-238, respectively.

The highest activity concentration from the vegetation sampling effort is 1.38 pCi/g for Ra-226 from sample location 13 (Figures 1 and 3). All other results for Ra-226 were less than 0.33 pCi/g. This activity concentration of 1.38 pCi/g for Ra-226 found in one vegetation sample is only slightly higher than the background level of 1.3 pCi/g for Ra-226 in soil discussed in the Remedial Investigation (EMSI, 2000) and significantly less than the 5 pCi/g plus background soil cleanup level for Ra-226 contained in the Record of Decision (USEPA, 2008) for the Buffer Zone/Crossroad Property.

WLLFOIA4312 - 004 - 0081649

While the activity results from the vegetation sampling effort cannot be directly compared to the background and cleanup levels for soil, the vegetative debris generated during the clearing/grubbing effort will be much less of a respiratory hazard than that of soil due to particle size. Also, the vegetation material slated for removal has very high moisture content (as noted during sampling) and therefore will not readily become airborne. Therefore, there will be no increased risk associated with contact with the vegetation debris during the clearing/grubbing effort and no special handling measures need be taken with respect to the vegetation debris that will be left in-place. In addition, although not necessary based on the results of the vegetation sampling effort discussed in this report, the equipment to be utilized for the vegetation clearing/grubbing effort will be one closed-cab skid steer (Bobcat) that is equipped with a filtered air intake for the operator.

Based on the data and the above considerations, we are of the belief that clearing and grubbing can proceed without the need for respiratory protection. All other Health and Safety considerations will apply including but not limited to: Thermoluminescent Dosemeter (TLD) monitoring, Radiological Scanning, and Training.

5 References

EMSI, 2000, Remedial Investigation Report, West Lake Landfill OU-1, April 10.

EMSI et al., 2008, Remedial Design Work Plan, West Lake Landfill OU-1, Bridgeton, MO, November 25.

USEPA, 2008, Record of Decision, West Lake Landfill Site, Bridgeton, MO, OU-1, CERCLIS ID Number MOD079900932, May.

Woodford and Associates (2009), Vegetation Sampling Plan in Support of Health and Safety Plan for Vegetation Clearing and Grubbing, West Lake Landfill OU-1, Bridgeton, MO, March 9.

WLLFOIA4312 - 004 - 0081650

Table 1 - Vegetative Sampling Results

Area	North	West	uR/h	SampleType	Sample Location	Description	ReportUnits	Ra-226	Ra-226unc	Ra-226MDA	Th-228	Th-228unc	Th-228MDA	Th-230	Th-230unc	Th-230MDA
1	38˚46.233	90˚26.601	50	DUP	1	1LD	pCi/g	0.0228	0.0201	0.0285	0.0372	0.0279	0.0321	0.2385	0.0846	0.0296
1	38˚46.233	90˚26.601	50	DO	1	1	pCi/g	0.0004	0.0088	0.0384	0.0737	0.0622	0.0276	0.1561	0.1005	0.0667
1	38˚46.233	90˚26.601	50	TRG	2	1FQA	pCi/g	0.2708	0.0999	0.0642	0.0079	0.0156	0.0326	0.3854	0.1193	0.0267
1	38˚46.226	90˚26.608	12	TRG	3	3	pCi/g	0.3290	0.0943	0.0547	0.0266	0.0221	0.0251	0.5375	0.1548	0.0195
1	38˚46.230	90˚26.576	30	TRG	4	4	pCi/g	0.1386	0.0648	0.0501	0.0314	0.0294	0.0376	0.1556	0.0708	0.0275
1	38˚46.198	90˚26.628	10	TRG	5	5	pCi/g	0.0387	0.0279	0.0369	0.0361	0.0252	0.0318	0.0259	0.0196	0.0229
1	38˚46.182	90˚26.642	10	TRG	6	6	pCi/g	0.0197	0.0248	0.0386	0.0272	0.0242	0.0335	0.0314	0.0235	0.0223
1	38˚46.228	90˚26.562	10	TRG	7	7	pCi/g	0.1469	0.0797	0.0489	0.0321	0.0231	0.0218	0.0139	0.0155	0.0234
Background	38˚46.905	90˚28.163	8	TRG	8	8	pCi/g	0.0647	0.0365	0.0338	0.0095	0.0161	0.0318	0.0369	0.0255	0.0174
Background	38˚47.282	90˚27.917	7	TRG	9	9	pCi/g	0.0273	0.0202	0.0192	0.0132	0.0171	0.0304	0.0118	0.0151	0.0265
2	38˚46.286	90˚26.898	25	TRG	10	10	pCi/g	0.2895	0.0831	0.0338	0.0331	0.0181	0.0140	0.4877	0.1125	0.0131
2	38˚46.311	90˚26.942	10	TRG	11	11	pCi/g	0.0984	0.0410	0.0359	0.0364	0.0232	0.0204	0.0316	0.0206	0.0135
2	38˚46.294	90˚26.891	1,200	DUP	12	12LD	pCi/g	0.1080	0.0677	0.0710	0.0095	0.0096	0.0143	0.5294	0.1140	0.0102
2	38˚46.294	90˚26.891	1,200	DO	12	12	pCi/g	0.2621	0.1055	0.0907	0.0236	0.0170	0.0213	0.6819	0.1558	0.0100
2	38˚46.398	90˚26.889	80	TRG	13	13	pCi/g	1.3780	0.3022	0.1103	0.0132	0.0130	0.0174	0.2698	0.0763	0.0163
2	38˚46.424	90˚26.903	50	TRG	14	14	pCi/g	0.0695	0.0380	0.0427	0.0108	0.0120	0.0177	0.0414	0.0227	0.0166
2	38˚46.424	90˚26.903	50	TRG	15	14FQA	pCi/g	0.0670	0.0441	0.0485	0.0080	0.0094	0.0070	0.0164	0.0143	0.0170
2	38˚46.436	90˚26.721	10	TRG	16	16	pCi/g	0.0305	0.0359	0.0755	0.0045	0.0075	0.0143	0.0300	0.0169	0.0111
2	38˚46.420	90˚26.744	12	TRG	17	17	pCi/g	0.0390	0.0304	0.0310	0.0041	0.0072	0.0132	0.0040	0.0070	0.0132
2	38˚46.380	90˚26.966	10	TRG	18	18	pCi/g	0.1744	0.0812	0.0427	0.0232	0.0244	0.0374	0.0420	0.0291	0.0198
2	38˚46.400	90˚27.024	12	TRG	19	19	pCi/g	0.0436	0.0379	0.0539	0.0252	0.0198	0.0245	0.0111	0.0119	0.0134
2	38˚46.454	90˚26.985	10	TRG	20	20	pCi/g	0.1122	0.0870	0.0887	0.0092	0.0136	0.0249	0.0346	0.0238	0.0250
2	38˚46.474	90˚26.957	12	TRG	21	21	pCi/g	0.1177	0.0858	0.0910	0.0116	0.0155	0.0275	0.0141	0.0151	0.0213
2	38˚46.503	90˚26.902	9	TRG	22	22	pCi/g	0.0383	0.0519	0.1161	0.0168	0.0197	0.0305	0.0371	0.0264	0.0112

Notes:
uR/h = micro Roentgen per hour, the gamma rate at the sample location measured with a Ludlum Model 12 MicroR field meter.
pCi/g = picocuries per gram
DUP = laboratory duplicate sample
DO = duplicate original field sample (i.e., Sample locations 1 and 2 are in the same location, as are Sample locations 14 and 15)
TRG = original field sample
LD = laboratory duplicate
FQA = field quality assurance
unc = uncertainty
MDA = minimum detectable activity

WLLFOIA4312 - 004 - 0081651

Table 1 - Vegetative Sampling Results

Area	North	West	uR/h	SampleType	Sample Location	Description	ReportUnits	Th-232	Th-232unc	Th-232MDA	U-234	U-234unc	U-234MDA	U-235	U-235unc	U-235MDA
1	38˚46.233	90˚26.601	50	DUP	1	1LD	pCi/g	0.0012	0.0080	0.0248	0.0772	0.0287	0.0194	0.0053	0.0075	0.0071
1	38˚46.233	90˚26.601	50	DO	1	1	pCi/g	0.0084	0.0209	0.0471	0.0751	0.0264	0.0089	0.0072	0.0083	0.0065
1	38˚46.233	90˚26.601	50	TRG	2	1FQA	pCi/g	0.0047	0.0105	0.0235	0.2390	0.0569	0.0177	0.0167	0.0139	0.0155
1	38˚46.226	90˚26.608	12	TRG	3	3	pCi/g	0.0137	0.0148	0.0166	0.0317	0.0178	0.0106	0.0113	0.0114	0.0077
1	38˚46.230	90˚26.576	30	TRG	4	4	pCi/g	0.0126	0.0181	0.0306	0.0280	0.0161	0.0125	0.0064	0.0090	0.0154
1	38˚46.198	90˚26.628	10	TRG	5	5	pCi/g	0.0092	0.0121	0.0205	0.0152	0.0123	0.0149	0.0070	0.0092	0.0142
1	38˚46.182	90˚26.642	10	TRG	6	6	pCi/g	0.0018	0.0077	0.0222	0.0072	0.0093	0.0159	-0.0010	0.0014	0.0152
1	38˚46.228	90˚26.562	10	TRG	7	7	pCi/g	0.0055	0.0097	0.0181	0.0251	0.0159	0.0107	0.0048	0.0082	0.0155
Background	38˚46.905	90˚28.163	8	TRG	8	8	pCi/g	-0.0013	0.0018	0.0203	0.0076	0.0099	0.0169	0.0044	0.0086	0.0180
Background	38˚47.282	90˚27.917	7	TRG	9	9	pCi/g	-0.0001	0.0070	0.0241	0.0113	0.0158	0.0299	-0.0021	0.0025	0.0254
2	38˚46.286	90˚26.898	25	TRG	10	10	pCi/g	0.0080	0.0081	0.0054	0.0275	0.0164	0.0133	0.0023	0.0055	0.0126
2	38˚46.311	90˚26.942	10	TRG	11	11	pCi/g	0.0019	0.0060	0.0158	0.2169	0.0536	0.0129	0.0281	0.0180	0.0143
2	38˚46.294	90˚26.891	1,200	DUP	12	12LD	pCi/g	0.0104	0.0092	0.0118	0.3258	0.0687	0.0090	0.0261	0.0164	0.0112
2	38˚46.294	90˚26.891	1,200	DO	12	12	pCi/g	0.0169	0.0127	0.0100	0.2937	0.0622	0.0050	0.0132	0.0113	0.0105
2	38˚46.398	90˚26.889	80	TRG	13	13	pCi/g	0.0091	0.0102	0.0135	0.2211	0.0537	0.0057	0.0103	0.0104	0.0070
2	38˚46.424	90˚26.903	50	TRG	14	14	pCi/g	0.0021	0.0052	0.0117	0.0288	0.0158	0.0106	0.0024	0.0049	0.0066
2	38˚46.424	90˚26.903	50	TRG	15	14FQA	pCi/g	0.0000	0.0000	0.0070	0.0120	0.0099	0.0054	0.0025	0.0049	0.0067
2	38˚46.436	90˚26.721	10	TRG	16	16	pCi/g	0.0017	0.0042	0.0094	0.0161	0.0124	0.0130	0.0017	0.0055	0.0144
2	38˚46.420	90˚26.744	12	TRG	17	17	pCi/g	0.0024	0.0049	0.0066	0.0010	0.0042	0.0122	-0.0025	0.0021	0.0184
2	38˚46.380	90˚26.966	10	TRG	18	18	pCi/g	0.0042	0.0126	0.0316	0.0220	0.0168	0.0229	-0.0031	0.0026	0.0224
2	38˚46.400	90˚27.024	12	TRG	19	19	pCi/g	-0.0015	0.0017	0.0175	0.0234	0.0134	0.0105	-0.0007	0.0010	0.0116
2	38˚46.454	90˚26.985	10	TRG	20	20	pCi/g	0.0080	0.0114	0.0193	0.0098	0.0089	0.0108	-0.0004	0.0048	0.0171
2	38˚46.474	90˚26.957	12	TRG	21	21	pCi/g	0.0070	0.0116	0.0228	0.0104	0.0117	0.0196	0.0014	0.0060	0.0173
2	38˚46.503	90˚26.902	9	TRG	22	22	pCi/g	0.0074	0.0148	0.0320	0.0214	0.0137	0.0109	-0.0004	0.0008	0.0115

Notes:
uR/h = micro Roentgen per hour, the gamma rate at the sample location measured with a Ludlum Model 12 MicroR field meter.
pCi/g = picocuries per gram
DUP = laboratory duplicate sample
DO = duplicate original field sample (i.e., Sample locations 1 and 2 are in the same location, as are Sample locations 14 and 15)
TRG = original field sample
LD = laboratory duplicate
FQA = field quality assurance
unc = uncertainty
MDA = minimum detectable activity

WLLFOIA4312 - 004 - 0081652

Table 1 - Vegetative Sampling Results

Area	North	West	uR/h	SampleType	Sample Location	Description	ReportUnits	U-238	U-238unc	U-238MDA
1	38˚46.233	90˚26.601	50	DUP	1	1LD	pCi/g	0.0829	0.0296	0.0158
1	38˚46.233	90˚26.601	50	DO	1	1	pCi/g	0.0892	0.0293	0.0126
1	38˚46.233	90˚26.601	50	TRG	2	1FQA	pCi/g	0.2331	0.0558	0.0146
1	38˚46.226	90˚26.608	12	TRG	3	3	pCi/g	0.0433	0.0209	0.0062
1	38˚46.230	90˚26.576	30	TRG	4	4	pCi/g	0.0192	0.0134	0.0135
1	38˚46.198	90˚26.628	10	TRG	5	5	pCi/g	0.0180	0.0130	0.0128
1	38˚46.182	90˚26.642	10	TRG	6	6	pCi/g	0.0011	0.0047	0.0136
1	38˚46.228	90˚26.562	10	TRG	7	7	pCi/g	0.0339	0.0186	0.0125
Background	38˚46.905	90˚28.163	8	TRG	8	8	pCi/g	0.0084	0.0098	0.0145
Background	38˚47.282	90˚27.917	7	TRG	9	9	pCi/g	0.0198	0.0170	0.0157
2	38˚46.286	90˚26.898	25	TRG	10	10	pCi/g	0.0278	0.0164	0.0119
2	38˚46.311	90˚26.942	10	TRG	11	11	pCi/g	0.2053	0.0516	0.0128
2	38˚46.294	90˚26.891	1,200	DUP	12	12LD	pCi/g	0.3092	0.0660	0.0053
2	38˚46.294	90˚26.891	1,200	DO	12	12	pCi/g	0.2376	0.0535	0.0050
2	38˚46.398	90˚26.889	80	TRG	13	13	pCi/g	0.2264	0.0545	0.0056
2	38˚46.424	90˚26.903	50	TRG	14	14	pCi/g	0.0176	0.0120	0.0053
2	38˚46.424	90˚26.903	50	TRG	15	14FQA	pCi/g	0.0089	0.0090	0.0120
2	38˚46.436	90˚26.721	10	TRG	16	16	pCi/g	0.0057	0.0075	0.0116
2	38˚46.420	90˚26.744	12	TRG	17	17	pCi/g	0.0094	0.0091	0.0109
2	38˚46.380	90˚26.966	10	TRG	18	18	pCi/g	0.0052	0.0102	0.0221
2	38˚46.400	90˚27.024	12	TRG	19	19	pCi/g	0.0101	0.0086	0.0080
2	38˚46.454	90˚26.985	10	TRG	20	20	pCi/g	0.0083	0.0081	0.0096
2	38˚46.474	90˚26.957	12	TRG	21	21	pCi/g	0.0211	0.0150	0.0162
2	38˚46.503	90˚26.902	9	TRG	22	22	pCi/g	0.0073	0.0081	0.0109

Notes:
uR/h = micro Roentgen per hour, the gamma rate at the sample location measured with a Ludlum Model 12 MicroR field meter.
pCi/g = picocuries per gram
DUP = laboratory duplicate sample
DO = duplicate original field sample (i.e., Sample locations 1 and 2 are in the same location, as are Sample locations 14 and 15)
TRG = original field sample
LD = laboratory duplicate
FQA = field quality assurance
unc = uncertainty
MDA = minimum detectable activity

WLLFOIA4312 - 004 - 0081653

Figure 1

Vegetative Sampling Results Summary
In Support of Health and Safety Plan
For Vegetation Clearing and Grubbing
West lake Landfill Operable Unit 1,
Bridgeton, Missouri

LEGEND

- N 786,000 — GRID COORDINATES
- EXISTING TOPO
- LIMITS OF REGRADING AREA
- EXISTING SHRUB
- EXISTING TREE LINE
- VEGETATION SAMPLE LOCATION

Prepared for: Engineering Management Support, Inc.
7220 West Jefferson Ave. Suite 406
Lakewood, Co. 80235

Prepared by: TA Woodford and Associates, LLC
5315 Precious Stone Drive
St. Charles, Missouri 63304

March 30, 2009

GRAPHIC SCALE

Figure 2

Vegetative Sampling Results Summary
In Support of Health and Safety Plan
For Vegetation Clearing and Grubbing
West lake Landfill Operable Unit 1,
Bridgeton, Missouri

LEGEND

Approximate Landfill Boundary

Vegetation Sample Location

Prepared for: Engineering Management Support, Inc.
7220 West Jefferson Ave. Suite 406
Lakewood, Co. 80235

Prepared by: TA Woodford and Associates, LLC
5315 Precious Stone Drive
St. Charles, Missouri 63304

March 30, 2009

N

1500 0 1500

SCALE IN FEET

Source: St. Charles, MO USGS 7.5' Quadrangle, 1994

M:\CLIENTS\EMS\WESTLAKE\2009\WL-ECO-OFFSITE-SAMPLES.DWG-LAYOUT1 04/03/2009 5:27PM

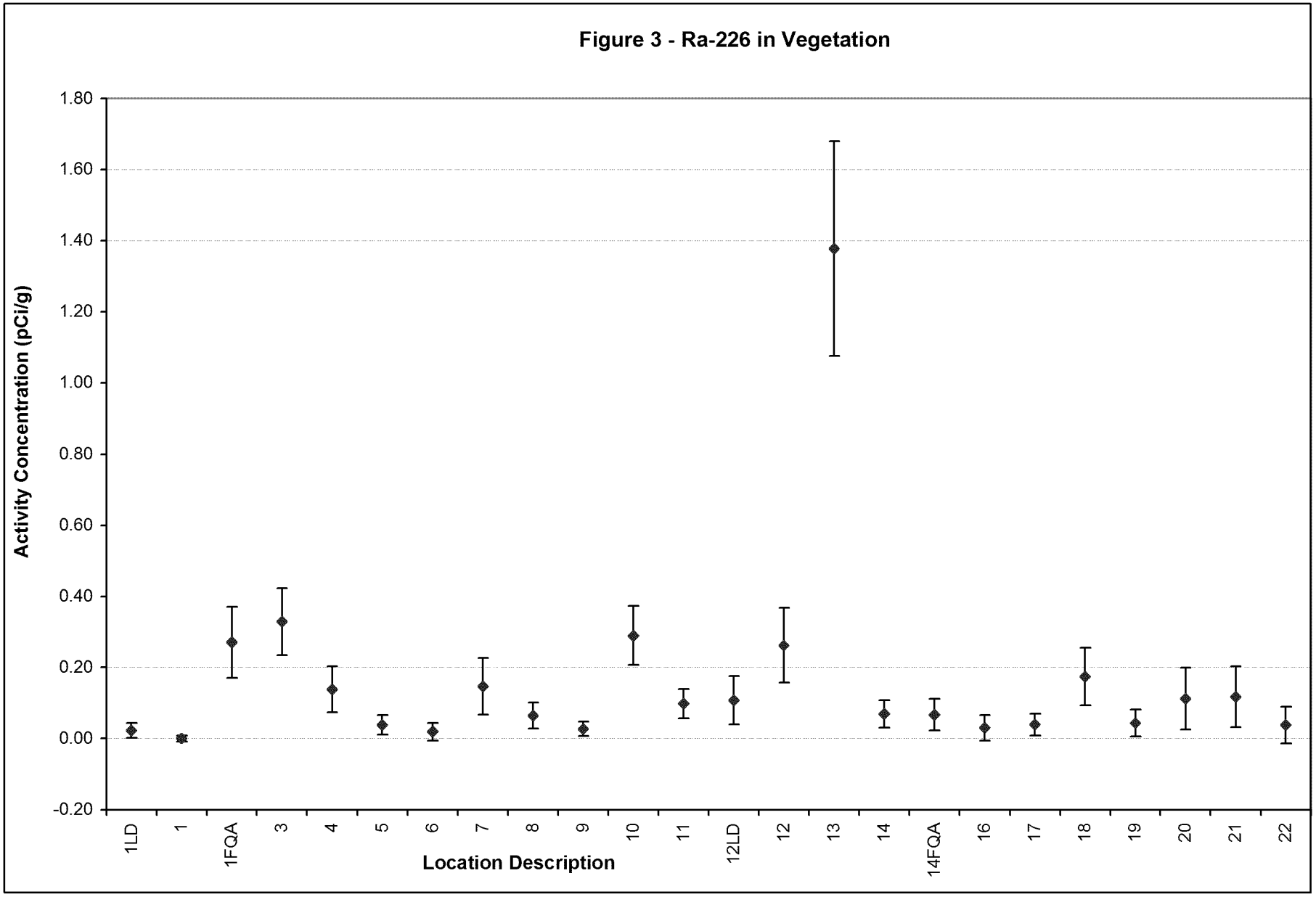
Figure 3 - Ra-226 in Vegetation
Activity Concentration (pCi/g)
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
1LD
1
1FQA
3
4
5
6
7
8
9
10
11
12LD
12
13
14
14FQA
16
17
18
19
20
21
22
Location Description

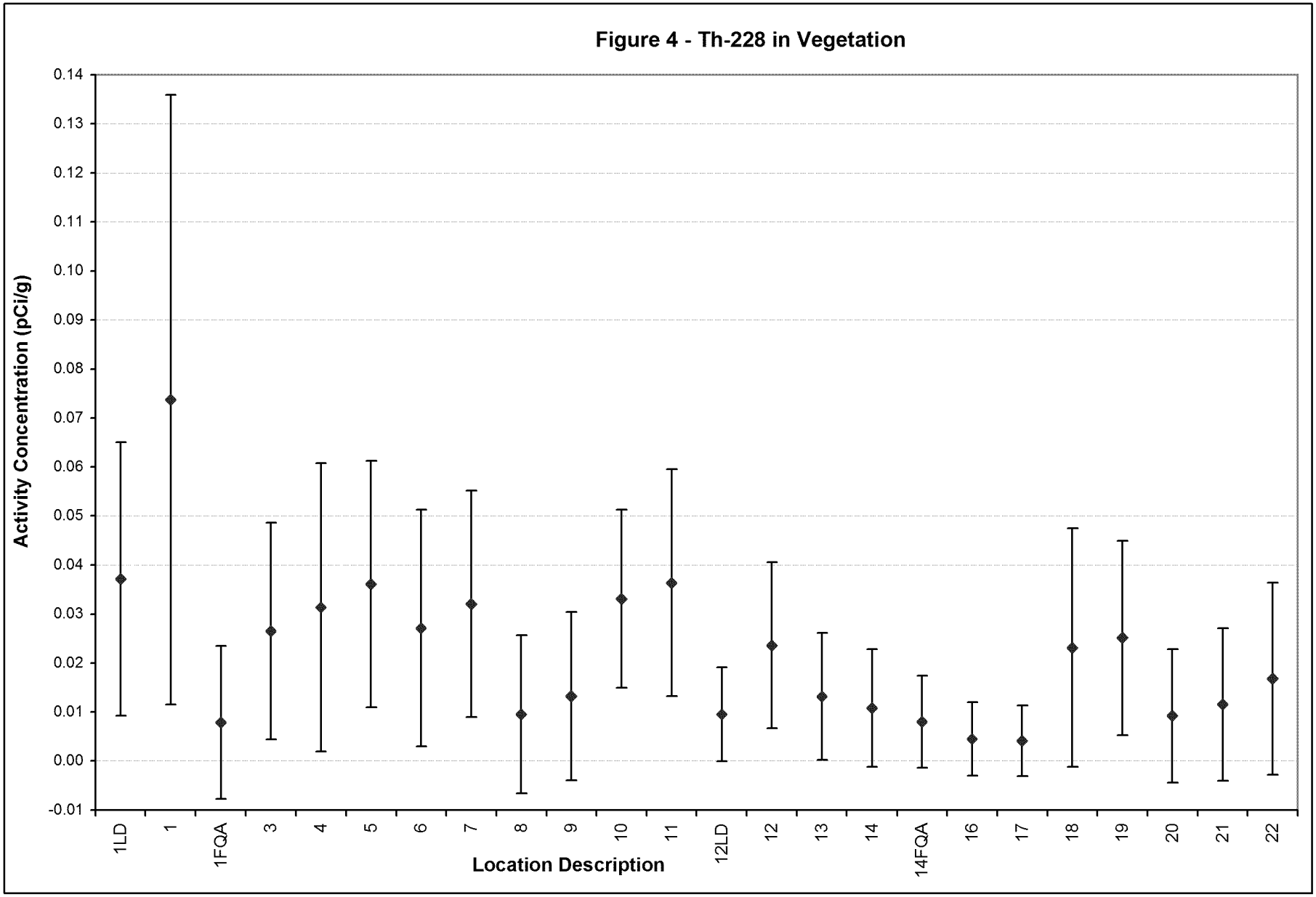
Figure 4 - Th-228 in Vegetation
Activity Concentration (pCi/g)
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
-0.01
1LD
1
1FQA
3
4
5
6
7
8
9
10
11
12LD
12
13
14
14FQA
16
17
18
19
20
21
22
Location Description

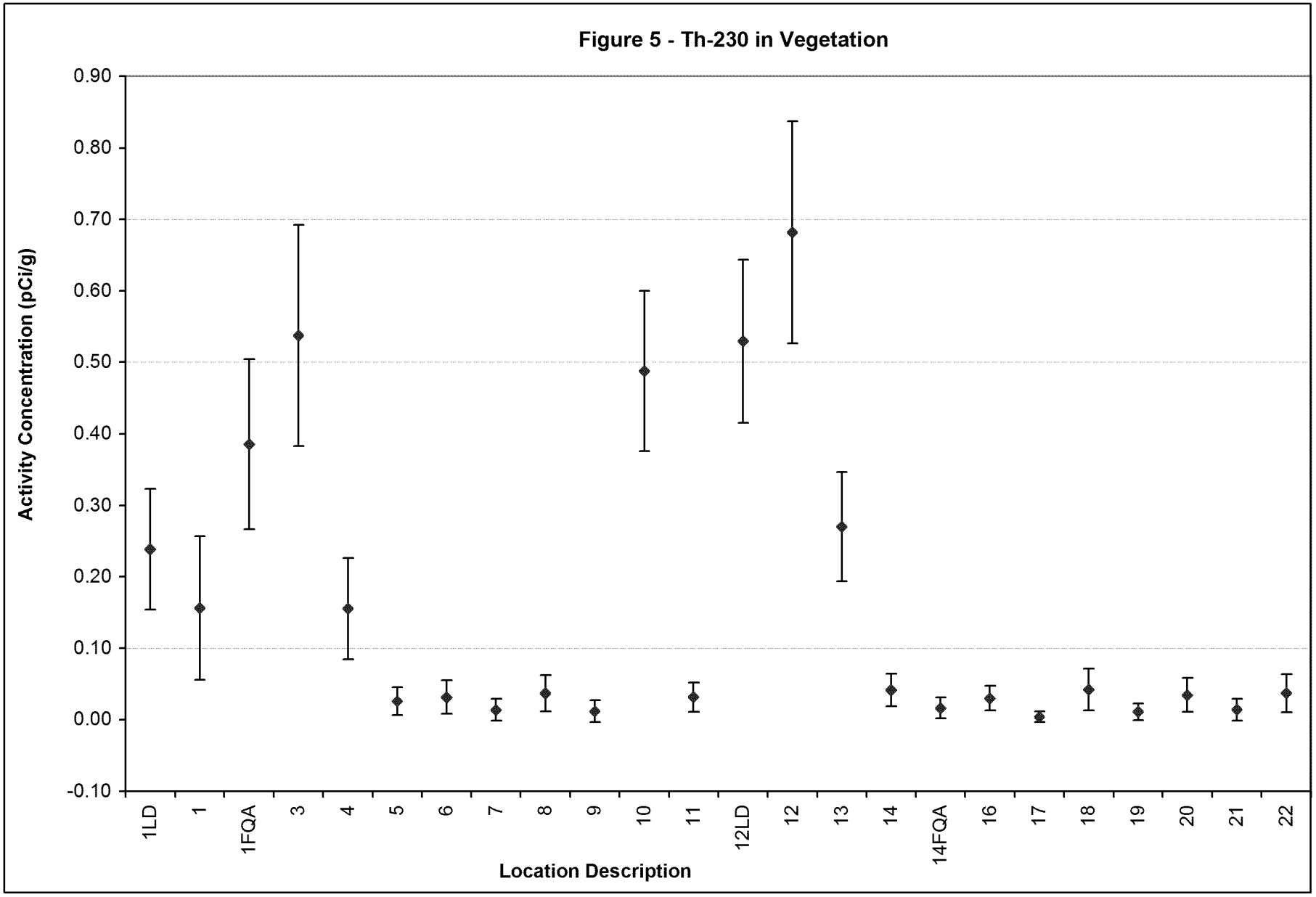
Figure 5 - Th-230 in Vegetation
Activity Concentration (pCi/g)
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
1LD
1
1FQA
3
4
5
6
7
8
9
10
11
12LD
12
13
14
14FQA
16
17
18
19
20
21
22
Location Description

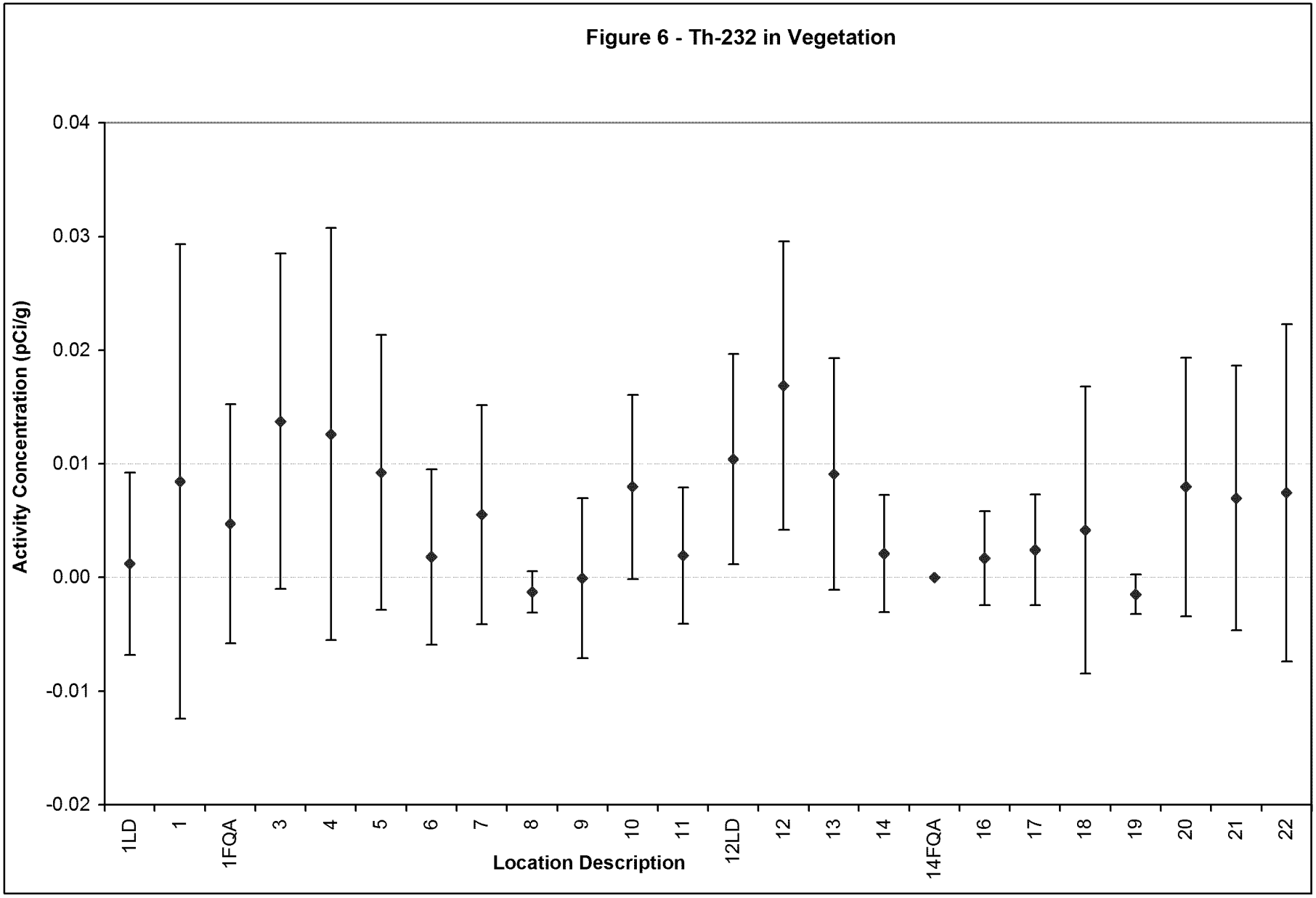
Figure 6 - Th-232 in Vegetation
Activity Concentration (pCi/g)
0.04
0.03
0.02
0.01
0.00
-0.01
-0.02
1LD
1
1FQA
3
4
5
6
7
8
9
10
11
12LD
12
13
14
14FQA
16
17
18
19
20
21
22
Location Description

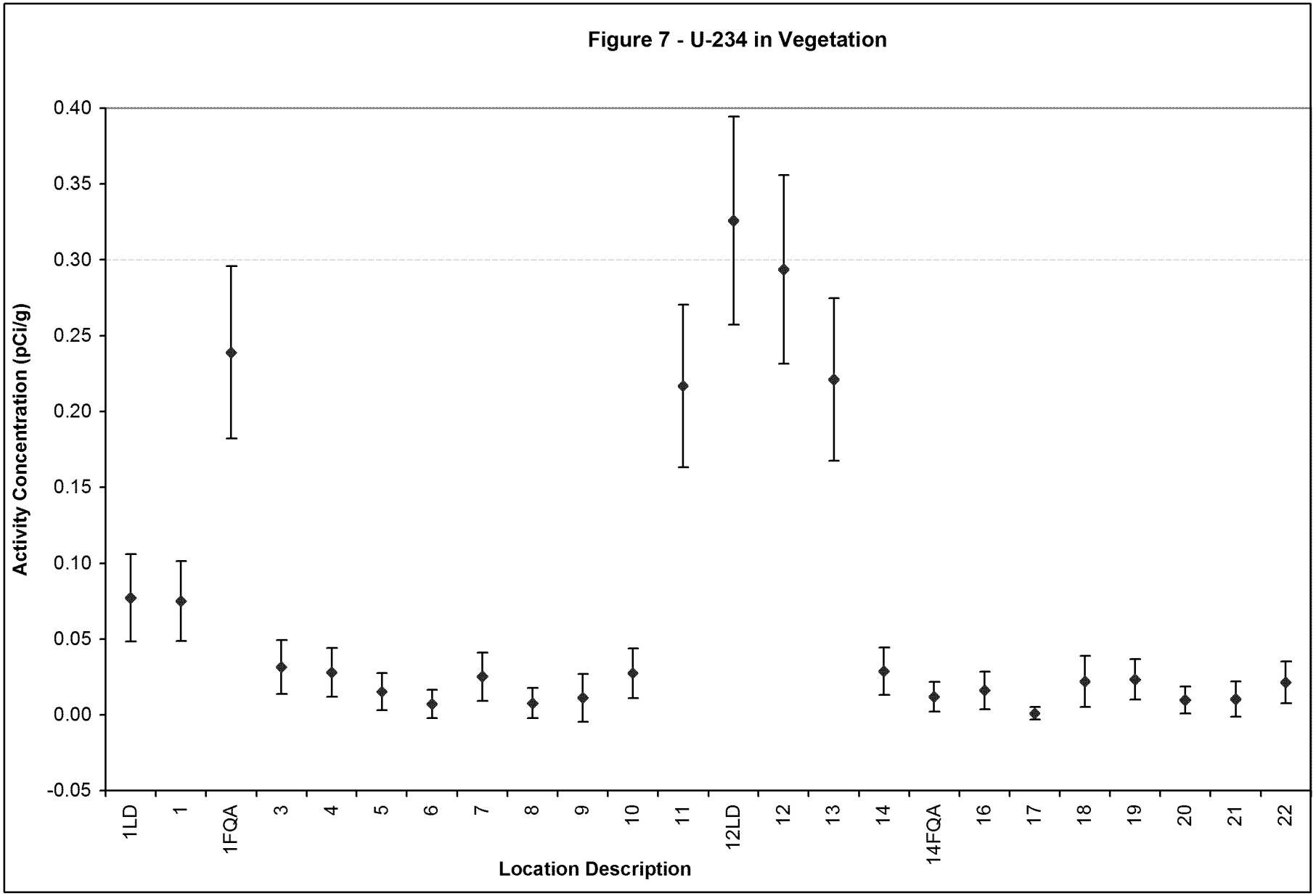
Figure 7 - U-234 in Vegetation
Activity Concentration (pCi/g)
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
1LD
1
1FQA
3
4
5
6
7
8
9
10
11
12LD
12
13
14
14FQA
16
17
18
19
20
21
22
Location Description

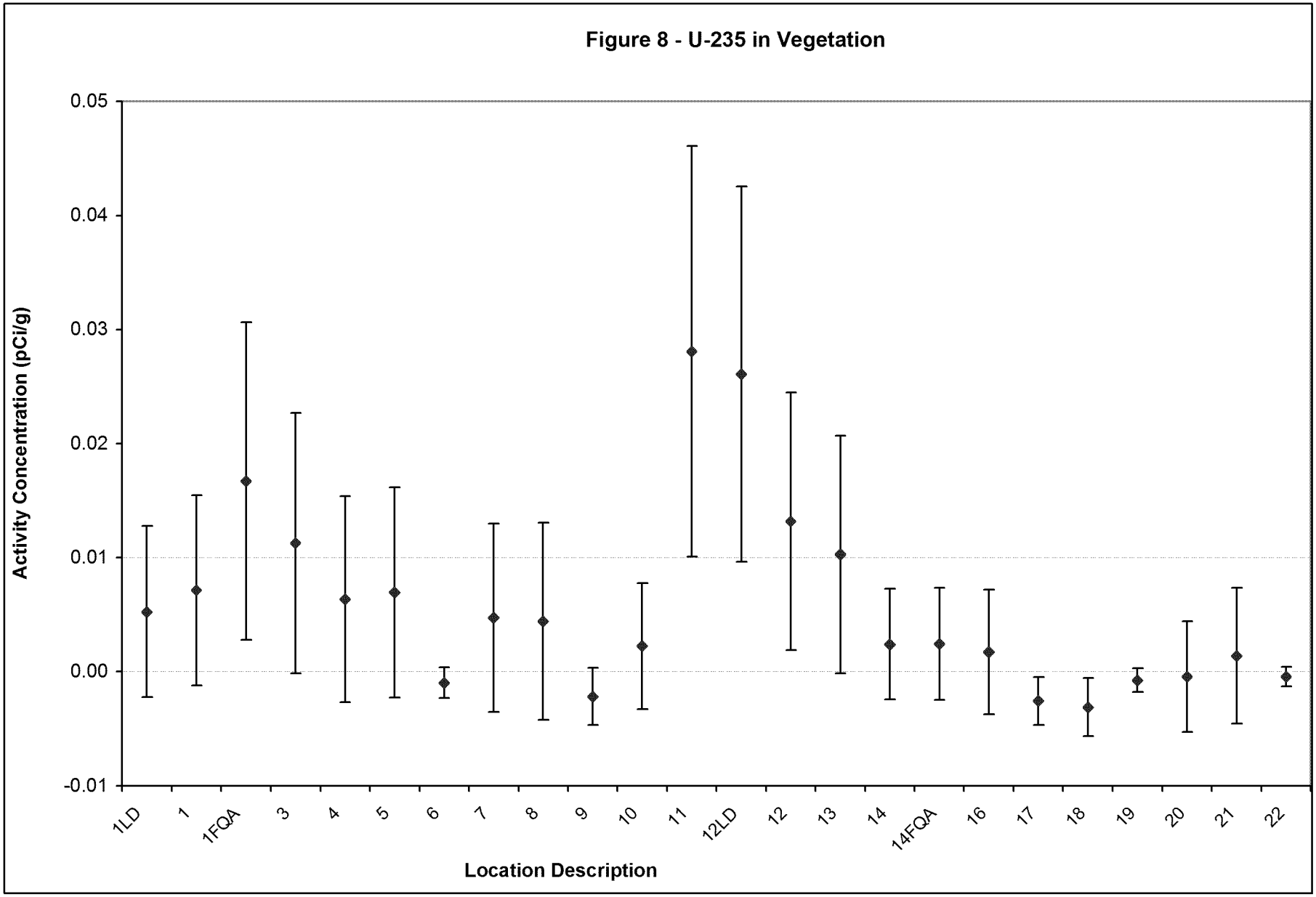
Figure 8 - U-235 in Vegetation
Activity Concentration (pCi/g)
0.05
0.04
0.03
0.02
0.01
0.00
-0.01
1LD
1
1FQA
3
4
5
6
7
8
9
10
11
12LD
12
13
14
14FQA
16
17
18
19
20
21
22
Location Description

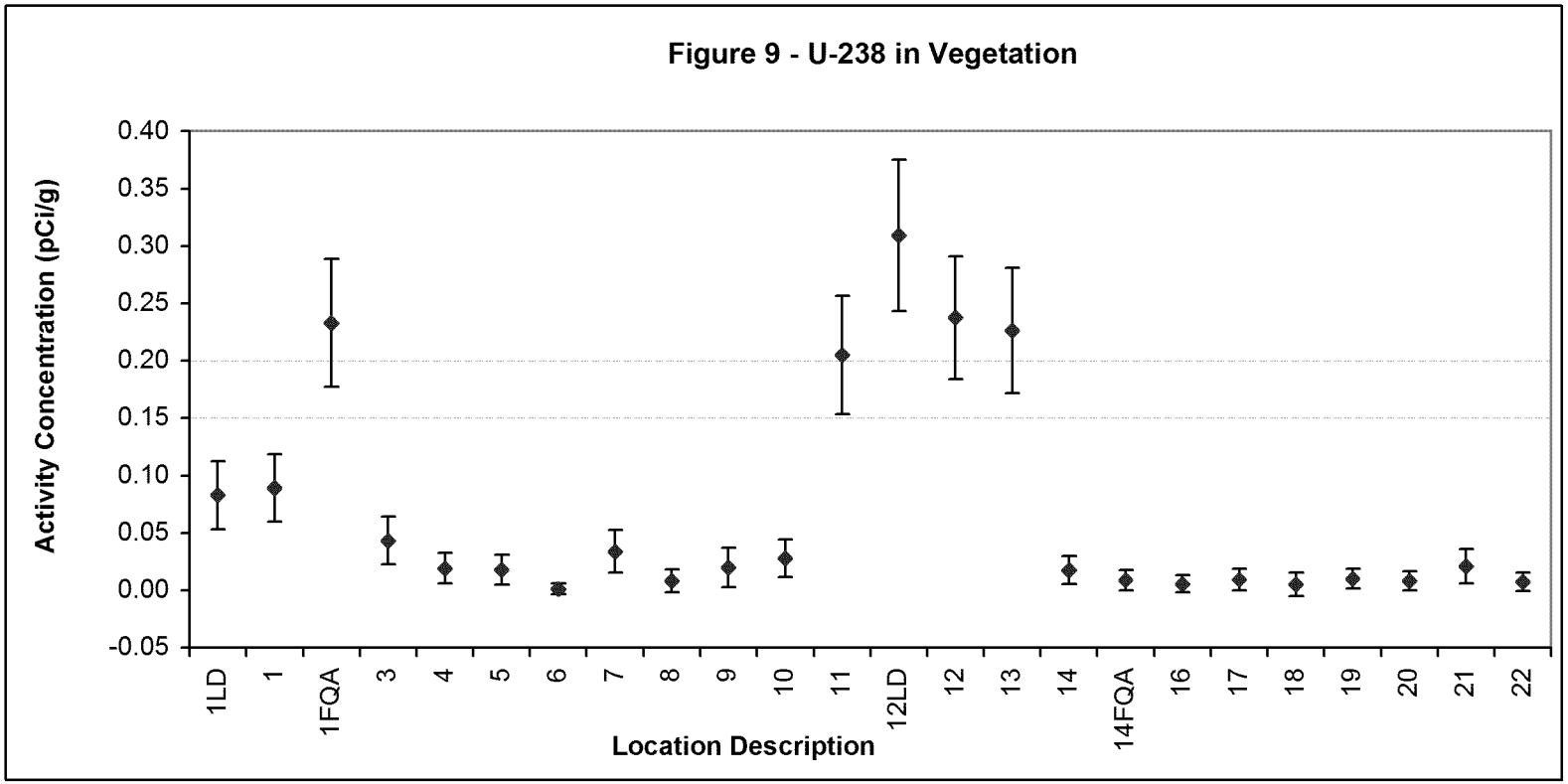
Figure 9 - U-238 in Vegetation
Activity Concentration (pCi/g)
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
1LD
1
1FQA
3
4
5
6
7
8
9
10
11
12LD
12
13
14
14FQA
16
17
18
19
20
21
22
Location Description