Clean Harbors Deer Trail, LLC
108555 East Highway 36
Deer Trail, Colorado 80105

2012 Annual Report

Colorado Department of Public Health and Environment
Radioactive Materials License Number 1102-01

Approvals:

John Kehoe, MS, Facility General Manager

Clyde E. Christman, RRPT, Radiation Safety Officer

Executive Summary

Clean Harbors Deer Trail, LLC (CHDT, or facility) is the holder of Colorado Department of Public Health and Environment (CDPHE) Radioactive Materials License 1102-01, Amendment 13. Condition 15(J) of the License is to provide an annual report to the CDPHE with details pertaining to environmental and occupational monitoring, disposal activities, anticipated activities for the next year, and an evaluation of the decommissioning warranty and funding plan. This report is written to satisfy Condition 15(J) of the License.

Results of the environmental monitoring program are consistent with the baseline sampling results. The L-4 wells and cell leachate results indicate the highest variability, while L-3 appears to have the lowest water quality. The L-5 wells are the more stable wells, with the highest water quality. No treated or surface water was released off-site that came into contact with radiologically impacted materials. Air monitoring results indicate radiological concentrations below CDPHE airborne limits. Area exposure rates are consistent with baseline values. Results of the routine monthly clean area contamination surveys did not indicate any release of radioactive materials from site operations to unrestricted surface areas.

The calculated effective dose equivalent to the maximally exposed individual of the general public residing approximately 3500 meters north of the facility is 1.47E-04 mrem/yr. The effective dose equivalent calculated for the nearest resident is 6.4E-05 mrem/yr. Both doses are well within the general public dose limit of 100 mrem/yr.

Occupational monitoring results indicated worker exposure to radioactive materials was well within ALARA goals. Lapel air sampling was conducted in the Treatment Building and Disposal Cell to more accurately reflect radionuclide concentrations in the worker breathing zone. The results were used to calculate the internal portion of the effective dose equivalent.

The decommissioning warranty was updated for inflation and reported separately in September, 2012 to comply with State regulations. Review of the decommissioning funding plan indicates that a total of $781,367 has been accumulated towards decommissioning as of December 31, 2012. (Funding financial modeling was adjusted during 2012 to allocate site closure and post closure costs over additional probable air-space to be built.) Continued contributions toward the funding plan should provide adequate funding for decommissioning.

The License was renewed on December 21, 2010. The License was amended in December of 2012. This License amendment (13) incorporated modifications to the waste acceptance procedure negotiated for the Adams County Amended CD. Modifications included clarification of terminology, reporting procedures and dispute resolution. The scope of the License remains unchanged. All other procedures approved during the License renewal were considered adequate and remained unchanged during 2012.

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STATE OF COLORADO

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Christopher E. Urbina, MD, MPH
Executive Director and Chief Medical Officer

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of Public Health
and Environment

MAY 2 1 2013

Clean Harbors Deer Trail, LLC
108555 East Highway 36
Deer Trail, Colorado 80105

Attention: Clyde Christman, Radiation Safety Officer

Re: 2011 Annual Report
Colorado Radioactive Materials License Number Colo. 1102-01

This letter acknowledges receipt of the 2012 Annual Report dated March 29, 2013. The Department has reviewed the report and deems it acceptable for fulfilling the requirements of License Condition 15.J of Radioactive Materials License 1102-01.

If you have any questions regarding this letter or your license please contact Phillip Peterson at (303) 692-3402 or phillip.peterson@state.co.us. Additional questions or comments can be directed to me at (303) 692-3403 or jennifer.opila@state.co.us.

Jennifer T. Opila, Unit Leader
Radioactive Materials Unit
Hazardous Materials and Waste Management Division

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1.0 INTRODUCTION

Clean Harbors Deer Trail, LLC (CHDT, or facility) is the holder of Colorado Department of Public Health and Environment (CDPHE) Radioactive Materials License 1102-01 (License). Condition 15(J) of the License is to provide an annual report to the CDPHE. This report is written to satisfy condition 15(J) of the License. Specifically, this condition of the license requires details pertaining to the following items:

A. Specification of each quantity of radioactive contaminants released to unrestricted areas in liquid and in airborne effluents;

B. The results of the environmental monitoring program;

C. A summary of licensee disposal unit radiation survey and maintenance activities;

D. A summary of activities and quantities of radionuclides disposed of;

E. Any instances in which the observed site characteristics were significantly different from those described in the application for a license;

F. Estimated doses to members of the public from the licensee's activities. This includes TEDE (total effective dose equivalent) and TODE (total organ dose equivalent) for both the nearest resident and the maximally exposed member of the public (if they are not the same person). The calculation of public doses shall be in accordance with Department approved methods, sampling frequencies, and dose modeling assumptions. Dose estimates shall be accompanied by appropriate supporting data including an electronic copy of the lab results, spreadsheets, computer model inputs, and modeling results/outputs;

G. A summary of Occupational Doses (total effective dose equivalent (TEDE), committed effective dose equivalent (CEDE), and deep dose equivalent (DDE));

H. A copy of the annual ALARA program audit;

I. A summary of anticipated activities for the coming year;

J. An evaluation of the existing decommissioning warranty to ensure that the available funds are sufficient to account for inflation, current site conditions, and projected activities for the coming year; and

K. An evaluation of the existing decommissioning funding plan to ensure that the licensee will have sufficient funds for the licensee to complete site decommissioning activities.

CHDT is also a permitted hazardous waste treatment and disposal facility. The facility is located in eastern Colorado (Figure 1), and currently has two closed and one active disposal cells. CHDT has multiple buildings that are utilized for various functions, such as laboratory, water treatment, and maintenance activities. A map of CHDT is presented as Figure 2.

2.0 ENVIRONMENTAL MONITORING

Environmental monitoring is performed at CHDT for various pathways and contaminants. Airborne particulate monitoring, radon monitoring, and external exposure monitoring are performed at various locations throughout the facility.

2.1 Radioactive Contaminants Released to Unrestricted Areas

Potential radioactive contaminants present in liquid or airborne particulate forms are monitored for the potential impact to offsite property and personnel. Results of the air monitoring program are compared directly to the limits for airborne effluents listed in Table 4B2, Column 2 of Appendix 4B of 6 Colorado Code of Regulations (CCR) 1007-1 Part 4, Standards for Protection Against Radiation. Routine monthly clean area survey results did not indicate any release of radioactive materials to unrestricted surface areas.

2.2 Airborne Effluents

Airborne effluents are monitored in accordance with the CHDT SOP 15.OPS.15, Air Monitoring for Radioactive Materials. Airborne effluents are monitored utilizing four fixed monitoring stations located at the facility as shown in Figure 3. Filters are collected monthly and sent off-site for analyses. The reported activities from the filter analyses are used along with the sample collection time and recorded flow rates to calculate airborne concentration levels for the month.

The monitors were operated during daylight hours to reflect emissions during operational hours. The following table presents a summary of the results in units of microcuries per milliliter (µCi/ml) for the airborne monitoring. The attached Table 1 of this report presents the full monthly results for the airborne monitoring.

As shown by the summary table, none of the air concentrations exceed the Table 4B2 air effluent limit, Column 2 of Appendix 4B of 6 Colorado Code of Regulations (CCR) 1007-1 Part 4, Standards for Protection Against Radiation.

Analysis	Station A		Station B		Station C		Station D		Table 4B2 Air Effluent Limit (mCi/ml)
	Average (mCi/ml)	Maximum (mCi/ml)	Average (mCi/ml)	Maximum (mCi/ml)	Average (mCi/ml)	Maximum (mCi/ml)	Average (mCi/ml)	Maximum (mCi/ml)	
Gross Alpha	4.7E-15	2.3E-14	1.9E-15	4.1E-15	1.9E-15	5.5E-15	1.3E-15	3.2E-15	N/A
Gross Beta	5.6E-14	1.8E-13	2.9E-14	8.4E-14	3.1E-14	9.1E-14	2.4E-14	7.4E-14	N/A
Th-232	1.1E-16	5.6E-16	3.1E-17	8.6E-17	5.1E-17	2.0E-16	8.9E-17	2.8E-16	4.0E-15
Th-230	4.3E-16	1.2E-15	1.8E-16	4.9E-16	3.2E-16	7.1E-16	3.4E-16	1.1E-15	2.0E-14
Th-228	1.9E-16	7.2E-16	1.1E-16	5.4E-16	1.9E-16	6.0E-16	2.1E-16	6.1E-16	2.0E-14
U-238	1.2E-16	6.8E-16	5.1E-17	1.9E-16	7.6E-17	2.4E-16	8.3E-17	2.4E-16	5.0E-14
U-235	2.8E-17	1.2E-16	1.5E-17	6.6E-17	1.2E-17	5.9E-17	1.2E-17	9.0E-17	6.0E-14
U-234	6.8E-17	1.7E-16	3.1E-17	8.7E-17	1.3E-16	4.2E-16	6.8E-17	2.9E-16	6.0E-14
Ra-226	7.3E-16	3.3E-15	1.3E-16	2.5E-16	3.1E-16	1.4E-15	4.3E-16	1.4E-15	9.0E-13

2.3 Liquid Effluents

No liquid effluents, including surface or treated water, that came into contact with radioactive materials were released off the facility property or outside the permitted area in 2012. All treated water was recycled and reused in plant operations. Water discharges to recycle tanks in 2012 are presented in Table 2.

2.4 Groundwater Monitoring

Groundwater monitoring is performed quarterly at CHDT. The wells are sampled utilizing low-flow sampling techniques. The samples are collected from the cell leachate and collection sumps, and from the various geologic strata of CHDT.

The results of the sampling indicate a continuation of the past sampling events. The L-4 and cell leachate results indicate the highest variability, while L-3 appears to have the lowest water quality. The L-5 wells are the more stable wells, with the highest water quality. Figures 4 through 30 present a visual representation of the data as compared to the baseline sampling events. Tables 3 through 7 present the data for the sampling events.

In summary, the groundwater monitoring data from 2012 present no indications of verifiable waste release to groundwater from facility operations.

2.5 Radon Monitoring

Radon monitoring at CHDT is performed at ten locations throughout the facility. Locations of the radon monitors are presented in Figure 31. Radon is detected utilizing passive alpha track radon detectors. The detectors are exchanged and analyzed by Landauer, Inc. on a quarterly frequency. Results of the radon monitoring are summarized in the table below, with all results presented in Table 8. The results do not indicate any significant impacts from radon emanation originating from radioactive materials disposed at the facility.

Location Number	Location Description	Average (pCi/L)	Maximum (pCi/L)
1	Disposal Cell A	1.1	1.7
2	Disposal Cell B	1.4	1.6
3	Treatment Bldg N	0.8	1.0
4	Treatment Bldg. S	0.8	1.0
5	South Air Sampler B	1.4	1.9
6	North Air Sampler A	1.4	1.7
7	N. Perimeter Fence	1.0	1.4
8	E. Perimeter Fence	1.2	1.6
9	Gate 8	1.0	1.4
10	W. Perimeter fence	1.0	1.7

2.6 External Dose

External dose is measured at 16 locations at the facility using environmental thermoluminescent dosimeters (TLDs). Locations of the TLDs are presented in Figure 32. The TLDs are exchanged and analyzed by Landauer, Inc., on a quarterly basis. The total annual dose in millirem (mrem) and equivalent dose rate in microrem per hour (µrem/hr) from the environmental TLD monitoring are summarized in the table below, with all quarterly results presented in Table 9.

Location Number	Location Description	Total (mrem)	Equivlent Dose Rate (μrem/hr)
N/A	Deploy Control	178.2	20.3
1	Admin Bldg	164.0	18.7
2	Scale	152.8	17.4
3	West Fence	167.7	19.1
4	Gate 8	156.6	17.9
5	East Fence	164.9	18.8
6	North Fence	165.0	18.8
7	Gate 4	151.7	17.3
8	Lunch Room	157.4	18.0
9	Laboratory	138.3	15.8
10	Sample Bay	154.9	17.7
11	Maintenance	165.5	18.9
12	Treatment Building	148.1	16.9
13	Haul Road	164.9	18.8
14	South Air Sampler	185.8	21.2
15	Disposal Cell	140.0	16.0
16	North Air Sampler	158.7	18.1

2.7 Dose to Members of the Public

Estimated doses to members of the public from the secure cell disposal operations were determined utilizing the USEPA CAP-88PC30 computer model. This includes total effective dose equivalent (TEDE) and total organ dose equivalent (TODE) for both the nearest resident and the maximally exposed member of the public. The computer model estimates dose and risk from radionuclide emissions to the air from various sources.

A population file specific to the facility was created for the assessment using Figure 5.8.2, *Housing Units and Population Count within a Ten Mile Radius of Site,* from the initial citing of the facility. Clean Harbors personnel verified the current status of the resident locations. Table 10 presents the residencies for each of the assessed locations.

The Stapleton Airport wind file data (23062) from the CAP-88PC program was selected for the assessment. The annual precipitation was input as 35.6 centimeters per year, with an annual ambient temperature of 10 degrees Celsius. The height of lid was input as 10,000 meters and the absolute humidity was left as the default value. The food source scenario selected was rural.

The source evaluated was a 1,000 square meter area which was one meter high. This represents a conservative daily disposal operation. Further conservatism is built into the assessment in that the disposal area is covered daily to prevent dust emission.

The radionuclide source term was created by multiplying the tons of materials received by the maximum waste concentration to obtain a total curie content per generator. The source term was then adjusted for fugitive emissions utilizing dumping operations as described in the facility air permit. Table 11 presents the source term evaluated in the assessment.

The CAP-88PC model calculated an effective dose equivalent of 1.47E-04 mrem/yr to the maximally exposed individual residing approximately 3500 meters north of the facility. The effective dose equivalent calculated for the nearest resident is 6.4E-05 mrem/yr. Both calculated doses are well within the general public dose limit of 100 mrem/yr.

3.0 SITE CHARACTERISTICS AND DISPOSAL ACTIVITIES

3.1 Disposal Unit Survey and Maintenance Activities

The disposal area for radiologically impacted materials is surveyed prior to and after the placement of the daily cover to assure proper cover. No maintenance activities were required for the secure cell itself except for routine removal of leachate water collected in the sump of the cell in order to prevent leachate headspace from exceeding regulatory limits.

3.2 Disposal Quantities

The following presents the quantities and generators of radioactive materials containing NORM or TENORM that were disposed of at the facility in 2012.

Generator	Total (Tons)
In Compact	
Redhill Forest POMWACA, Fairplay, CO - NORM impacted soil from water treatment plant clean-up	282.14
U.S. Navy DRI Site, Aurora, CO - NORM impacted soil from former Air Force Base	2.76
Colorado Springs Utilities, Colorado Springs, CO - NORM/TENORM water treatment filter media	29.24
PSCO-Comanche Station, Pueblo, CO - Junk circuit breakers	30.13
Mojave Generating Station, Laughlin, NV - TENORM scale (from Coal Slurry Pipeline)	1.40
In Compact Subtotal	**345.67**
Out of Compact	
Tervita Corporation, Alexander, ND - TENORM Filter Cake from oil processing	19678.56
AFRPA Western Region, McClellan, CA - Contaminated soil from former Air Force Base	3239.41
Honeywell, Geismar, LA - NORM fluorogypsum pipe scale	153.22
U.S. DOE for RMOTC, Casper, WY - NORM impacted polyethylene debris	20.28
Oneok Hydrocarbon L.P., Bushton, KS - Refractory brick	1.69
EOG Resources, Stanley, ND - TENORM filter socks	38.28
Duratherm, Inc., San Leon, TX - NORM/TENORM desorber solids	100.77
Denbury Onshore, LLC, Ruth, MS - TENORM waste water filters	1.66
OWL, LLC, Culbertson, MT - TENORM filter socks from petroleum production	8.94
Out of Compact Subtotal	**23242.81**
Total for 2012	**23588.48**

3.3 Site Characteristics

No observed site characteristics were significantly different than those presented in the license application and the renewal application.

4.0 OCCUPATIONAL DOSE AND ALARA

4.1 Deep Dose Equivalent

Workers wear TLDs to measure occupational external exposure to radioactive materials while at CHDT. The TLDs are exchanged on a quarterly frequency and are analyzed by Landauer, Inc. Results of the personnel monitoring are summarized in the table below in units of millirem (mrem), with all results presented in Table 12. The detection limit was 1 mrem.

Participant ID	Deep Dose Equivalent (mrem)
00002	0
00004	1
00012	0
00013	0
00014	0
00020	0
00025	0
00029	0
00030	0
00034	0
00035	0
00036	0
00038	0
00039	0
00040	1
00049	1
00059	0
00060	0

4.2 Committed Effective Dose Equivalent

The committed effective dose equivalent (CEDE) is calculated at CDHT in accordance with CHDT *Standard Operating Procedure (SOP) 15.RPP.05, Estimation of Inhalation Dose* and *SOP 15.OPS.15, Air Monitoring for Radioactive Materials*. Lapel breathing zone air sampling within the treatment building and the active disposal cell was conducted during peak disposal activities to better estimate actual inhalation dose to exposed employees. Lapel air samples were inadvertently run by the wrong laboratory method resulting in higher than optimal detection limits but ALARA goals were still met. Analytical results from the lapel sampling were used to determine intake and CEDE for Site workers. The use of full-face, air-purifying respirators with an assigned protection factor of 50 was factored into the dose calculations. Since respiratory protection is required at all times within the disposal cell, a wear frequency of 100% was incorporated into the calculation process. Based on these premises and analytical results, the CEDE assigned to full-time employees working the entire year is 15.7 millirem.

4.3 As Low As Reasonably Achievable Program

A copy of the annual as low as reasonably achievable (ALARA) program audit is attached in Appendix 1.

5.0 DECOMMISSIONING WARRANTY AND FUNDING PLAN

In 2012, CHDT made adjustments to the funding mechanism for the Decommissioning Warranty and the Long-Term Care Warranty insurance policies, which are also integrated into the RCRA Permit Closure and Post-Closure financial assurance. The funding amounts were adjusted for inflation. The inflated closure and post-closure cost estimates were calculated by multiplying the current cost estimate by the current annual inflation factor (1.02141). This inflation factor was calculated by dividing the current annual Implicit Price Deflator (IPD) for Gross National Product (GNP) for 2011 (113.347) by the annual IPD for GNP for 2010 (110.971). These IPDs were obtained from the U.S. Department of Commerce's Bureau of Economic Analysis and are the values that existed on July 11, 2012.

The current Closure warranty is $5,329,221.34. The current Post Closure warranty is $5,514,287.63. CHDT feels that these amounts are sufficient to cover projected activities for 2013 and to complete site decommissioning activities.

CHDT also accrues funding for decommissioning costs that increases in two ways: one is based on accruing an amount per cubic yard on monthly units of consumption; the other is based on accreting the cumulative balance at the weighted average discount rate. The per cubic yard accrual is based upon a financial estimate of closure of the individual landfill cell, closure of the site, and post-closure care of the site. The rate at which the costs of site closure and post-closure are allocated depends on the cubic yards of probable landfill airspace at the time the site is closed. The estimate of probable airspace was adjusted during 2012 to include all seven permitted landfills on site. (Previous financial models had only included four landfill cells.) Adjustments were then made to the site closure accruals. Overall, this resulted in Cell 3 closure funding increasing per the amount of waste disposed in it and site closure and post-closure funding decreasing as these costs are now allocated over more landfill space.

Following are the accrued balances as of December 31, 2012:

Cell 3 Closure	$751,451
Site Closure	$14,634
Post Closure	$15,282
Total	$781,367

Continued accrual of funds at current rates should be sufficient to pay for site decommissioning and post closure care at the time of projected facility closure.

6.0 2013 ANTICIPATED ACTIVITIES

No changes or additions to any facilities other than maintenance or information technology upgrades are anticipated in 2013.

Figures

Figure 1 - CHDT Location

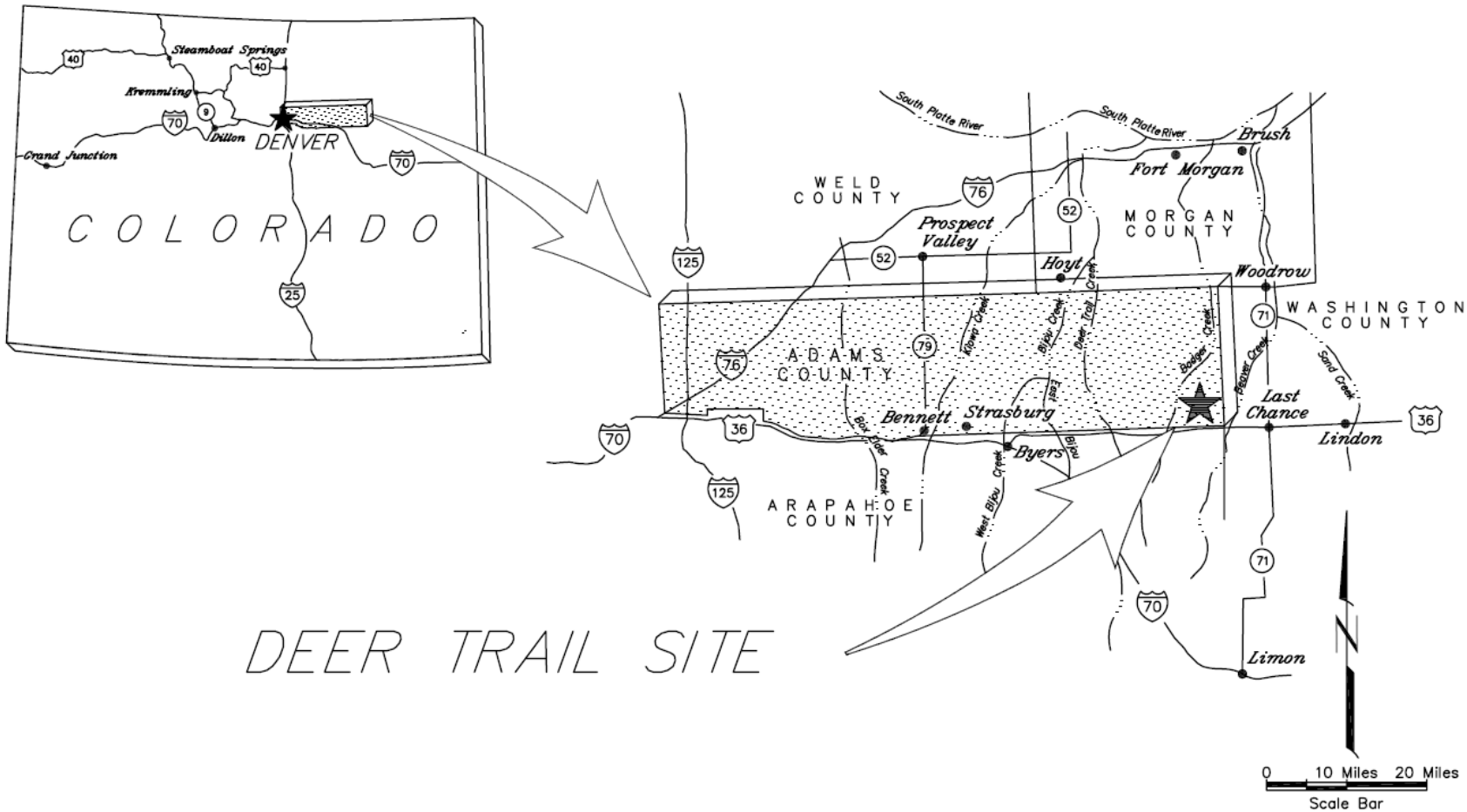


Figure 2 - CHDT Facility Layout

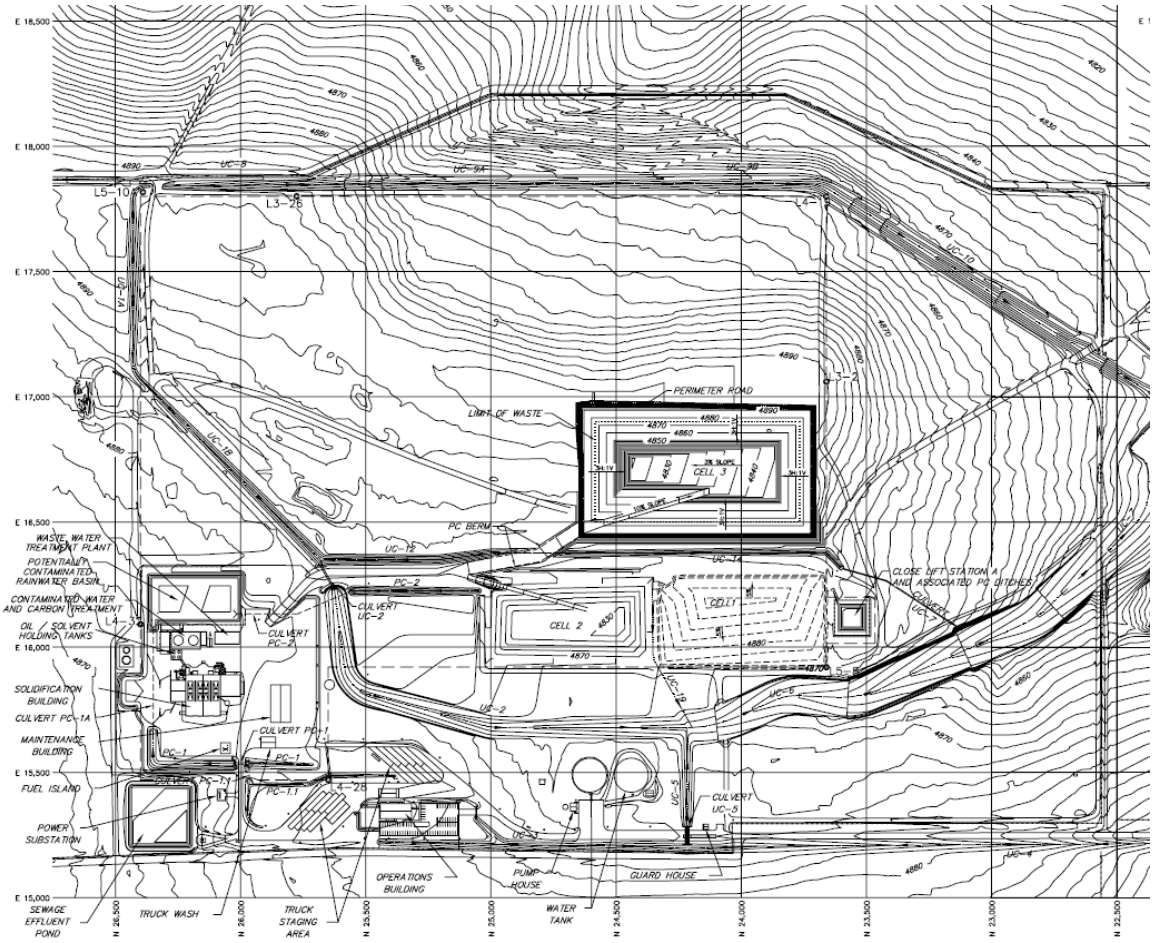
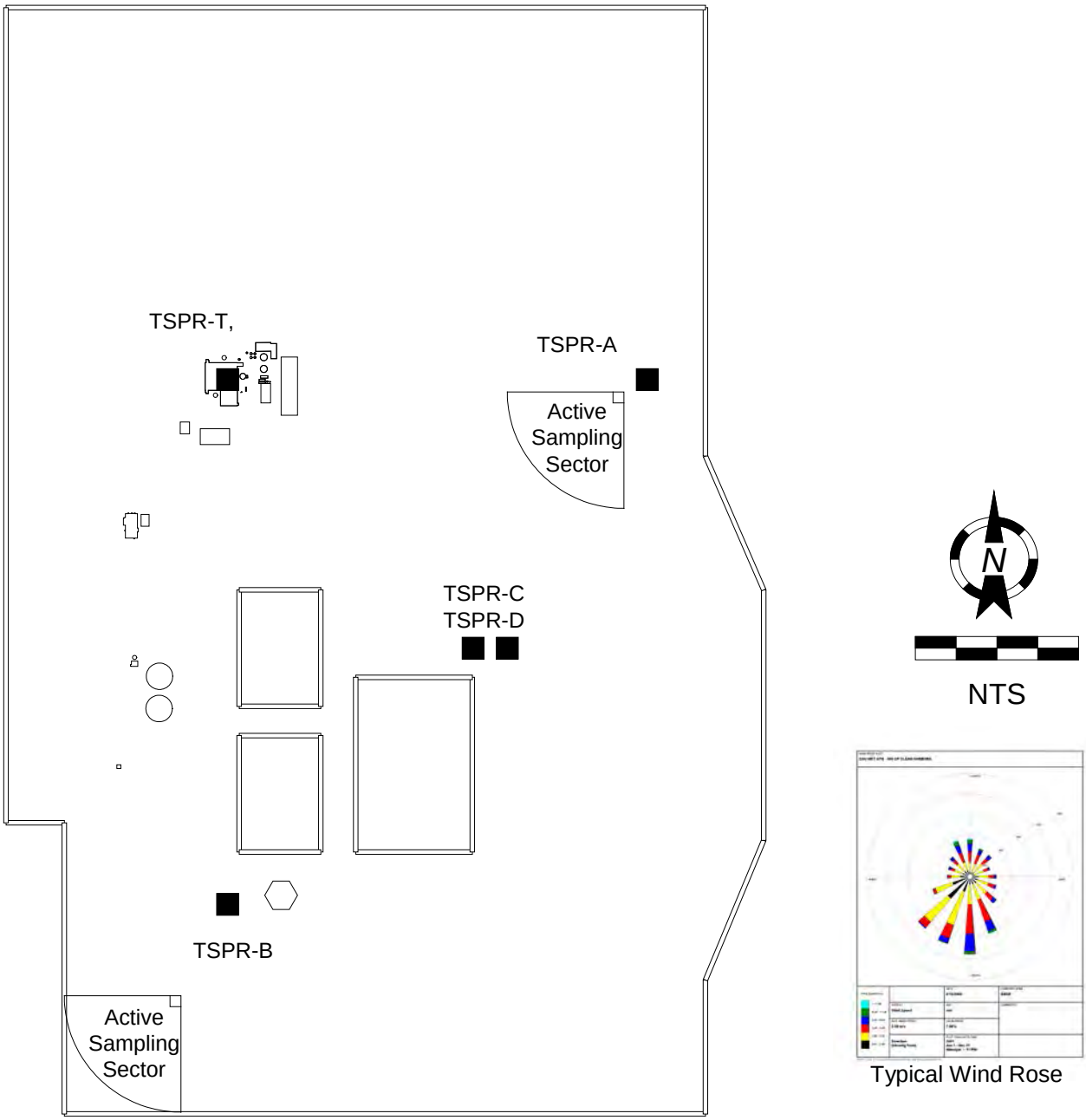


Figure 3 - CHDT Air Monitoring Stations



TSPR-A is the designated primary sampler used for data statistical analysis

TSPR-B is the sampler designated to measure background concentrations

TSPR-C is the sampler designated to the active secure cell area

TSPR-D is the designated collocated sampler used to measure the precision and accuracy of the samplers

TSPR-T is the sampler designated to the Treatment Building

Figure 4 – Groundwater Trending Results – Cell 1 LCS

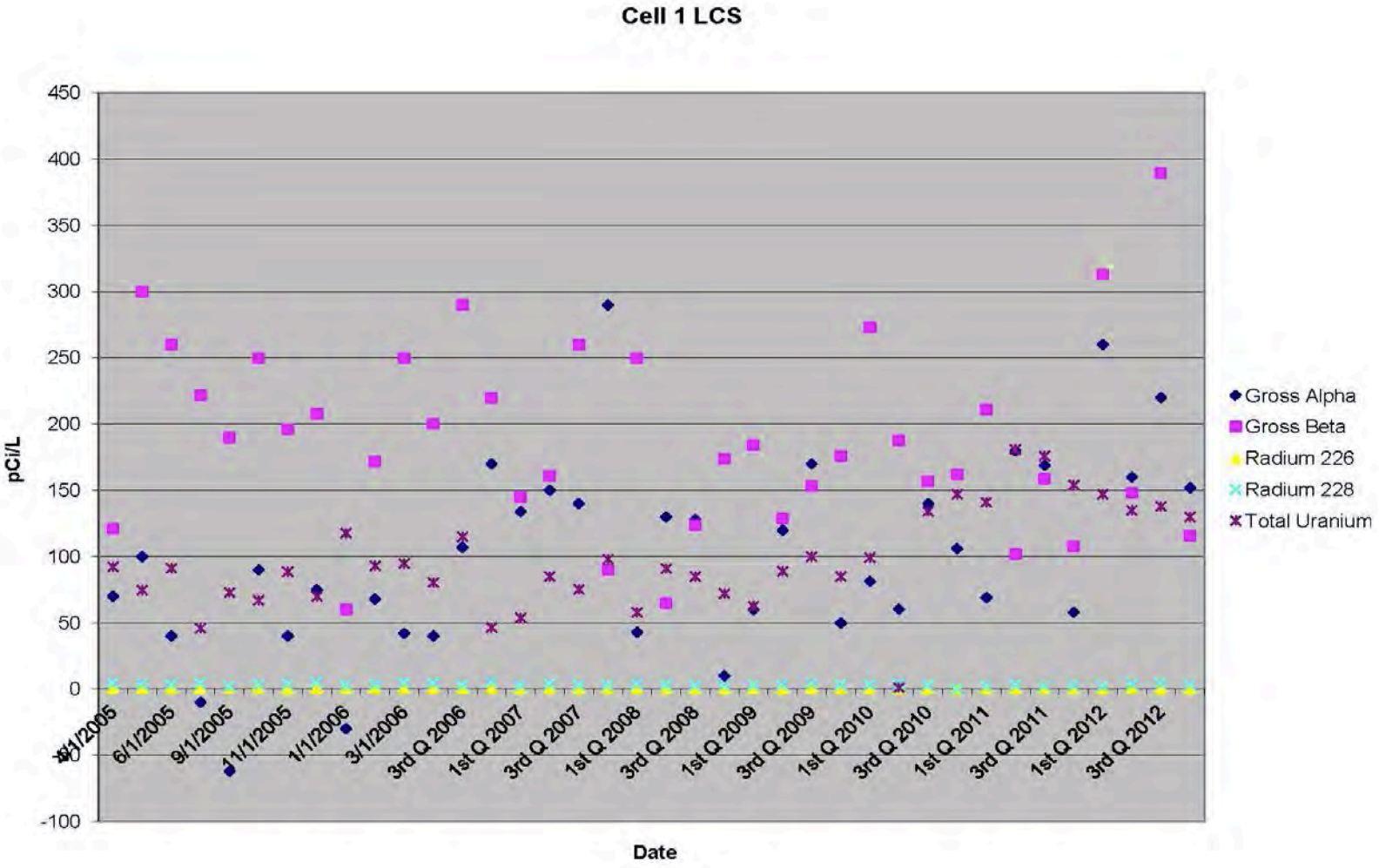


Figure 5 - Groundwater Trending Results – Cell 1 LDS

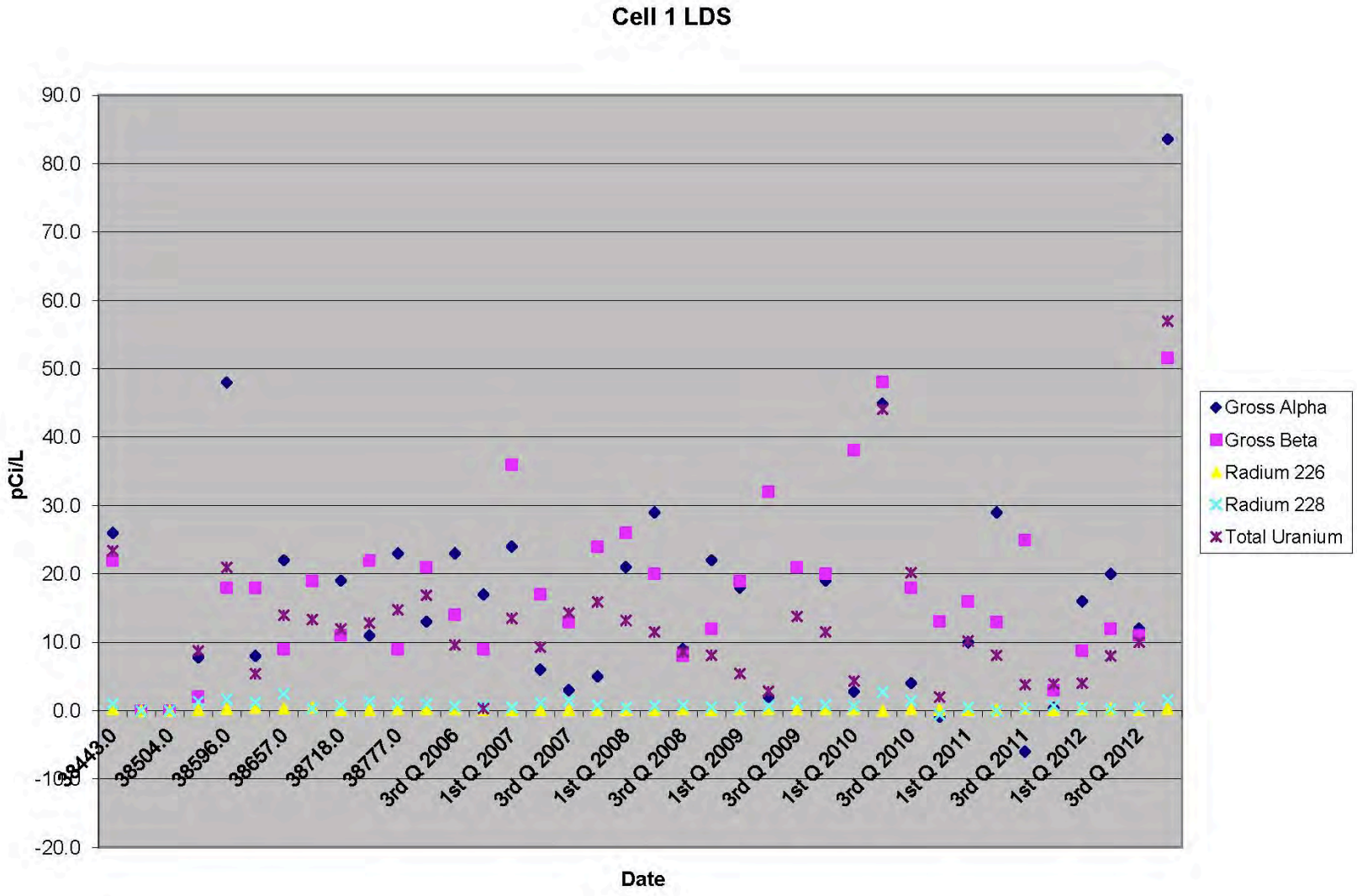


Figure 6 - Groundwater Trending Results – Cell 1 PS

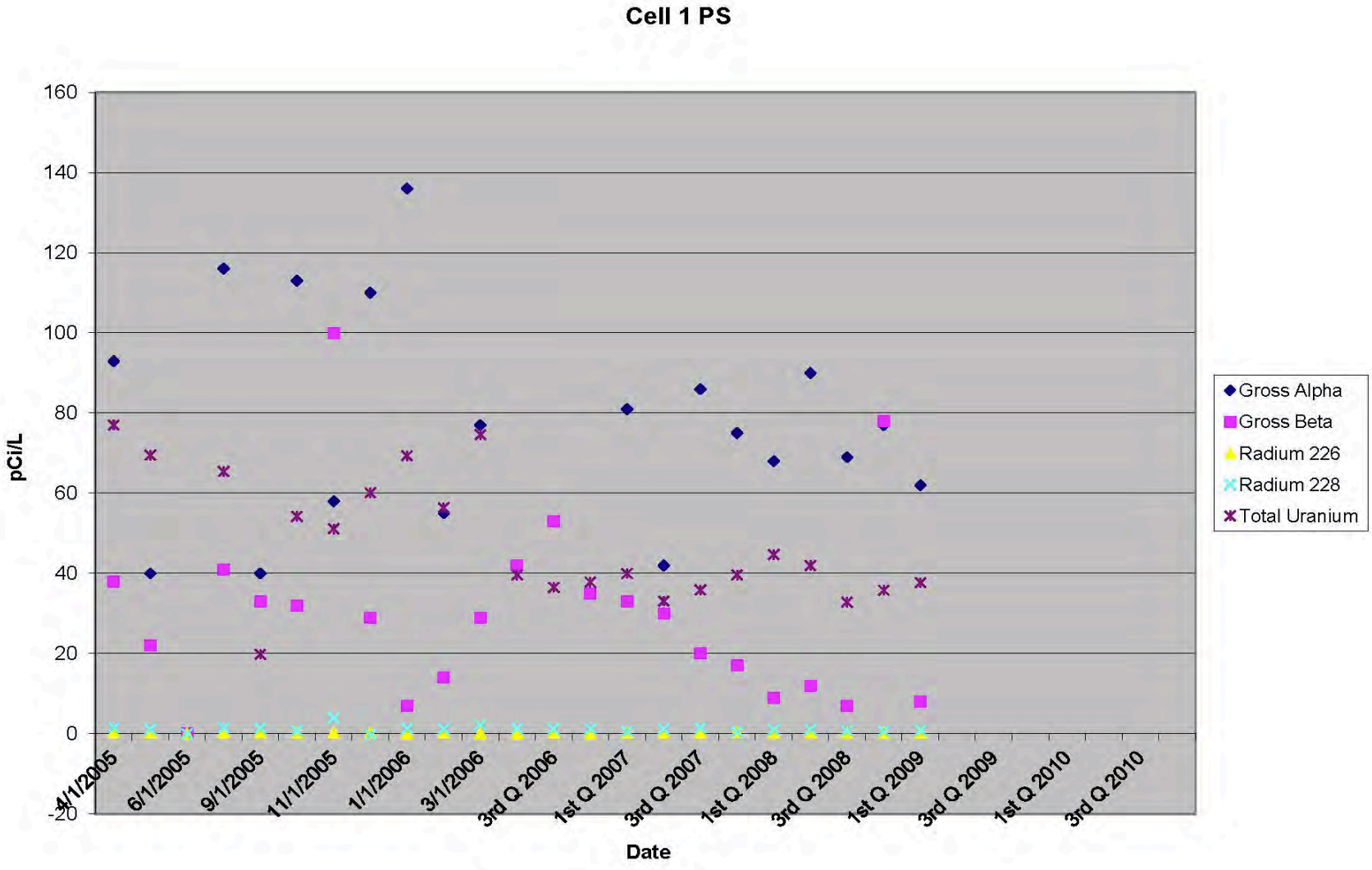


Figure 7 - Groundwater Trending Results – Cell 2 LCS

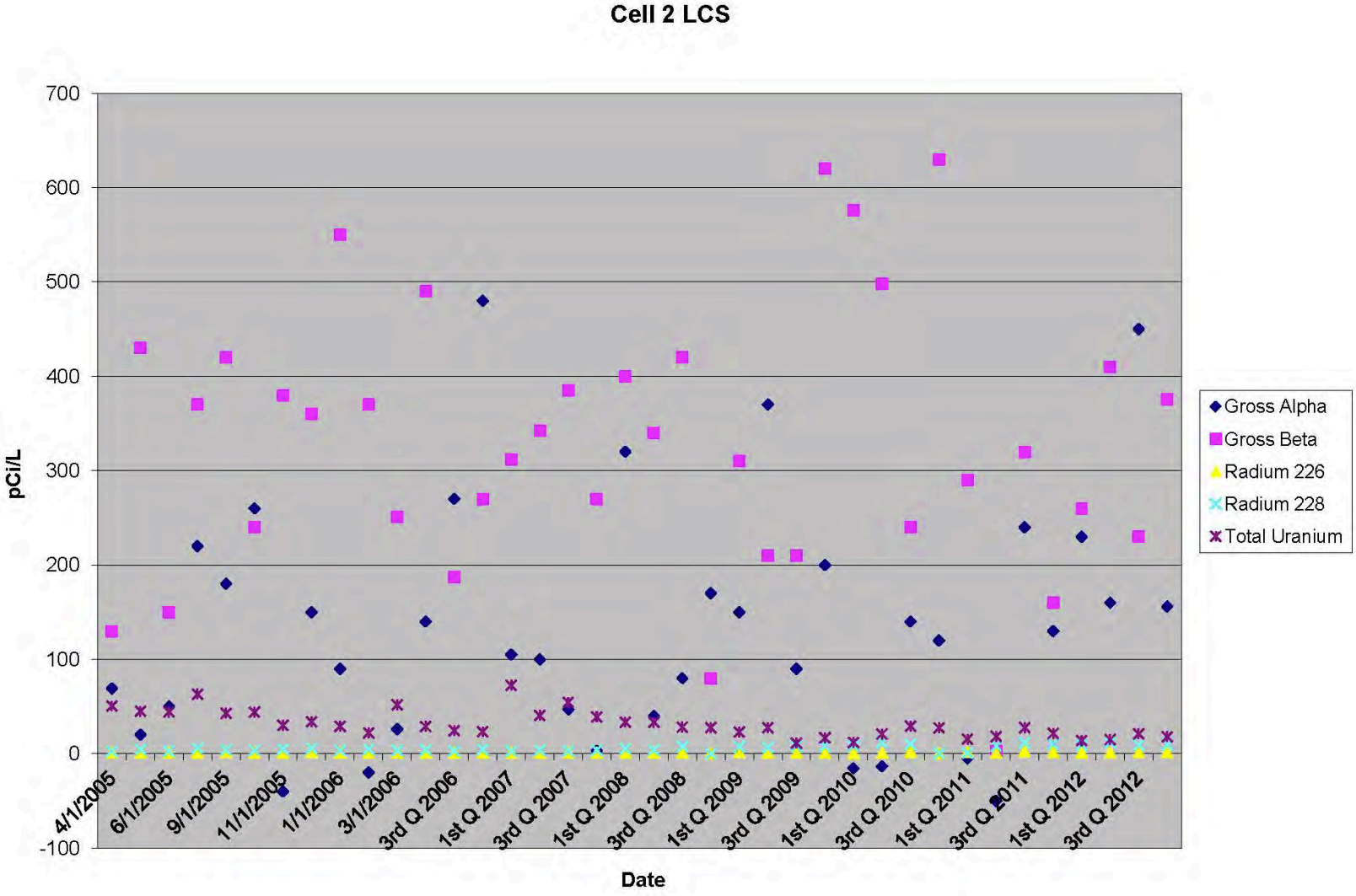


Figure 8 - Groundwater Trending Results – Cell 2 LDS

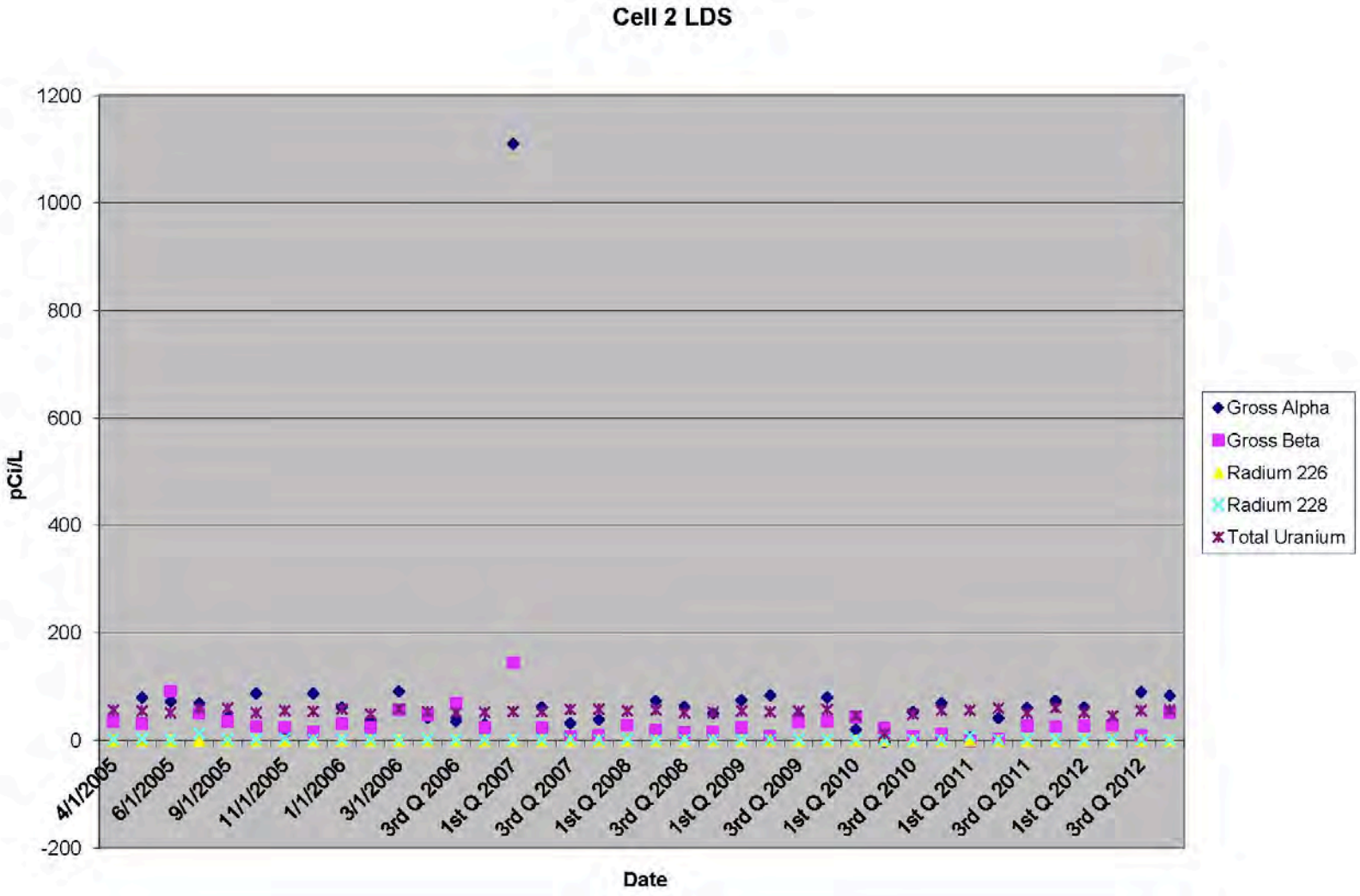


Figure 9 - Groundwater Trending Results – TRB LDS

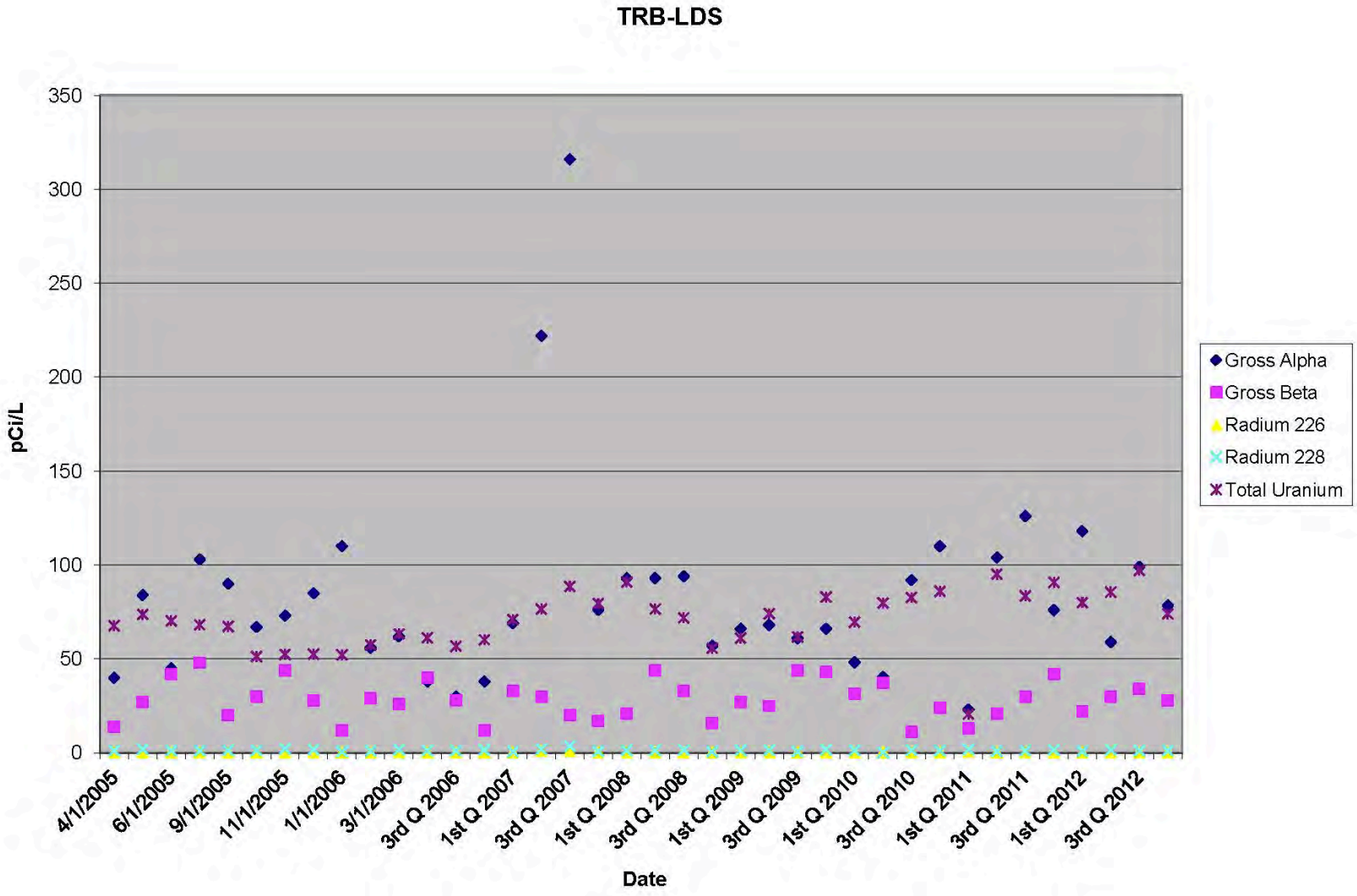


Figure 10 - Groundwater Trending Results – Cell 3 LCS

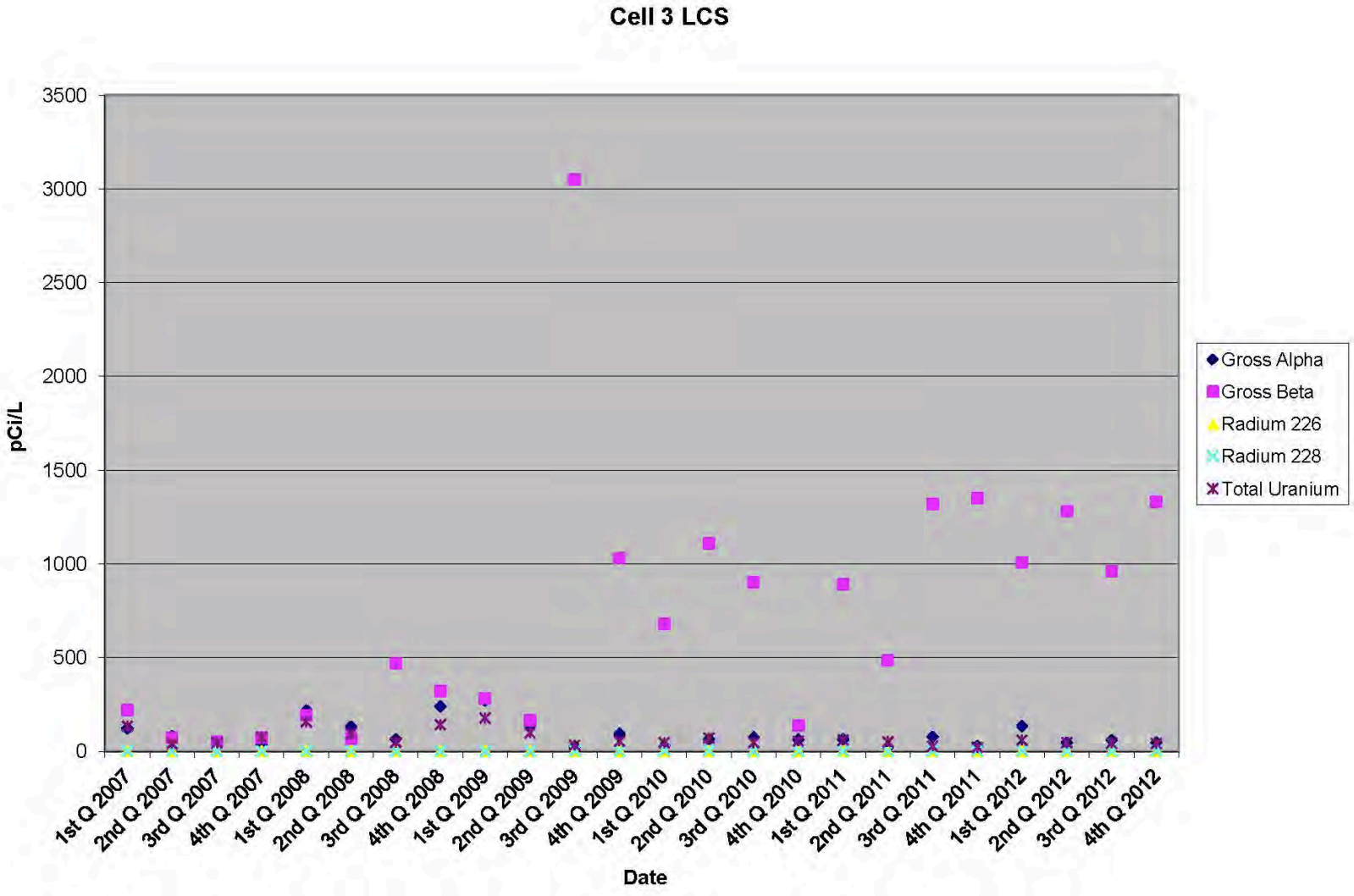


Figure 11 - Groundwater Trending Results – Cell 3 LDS

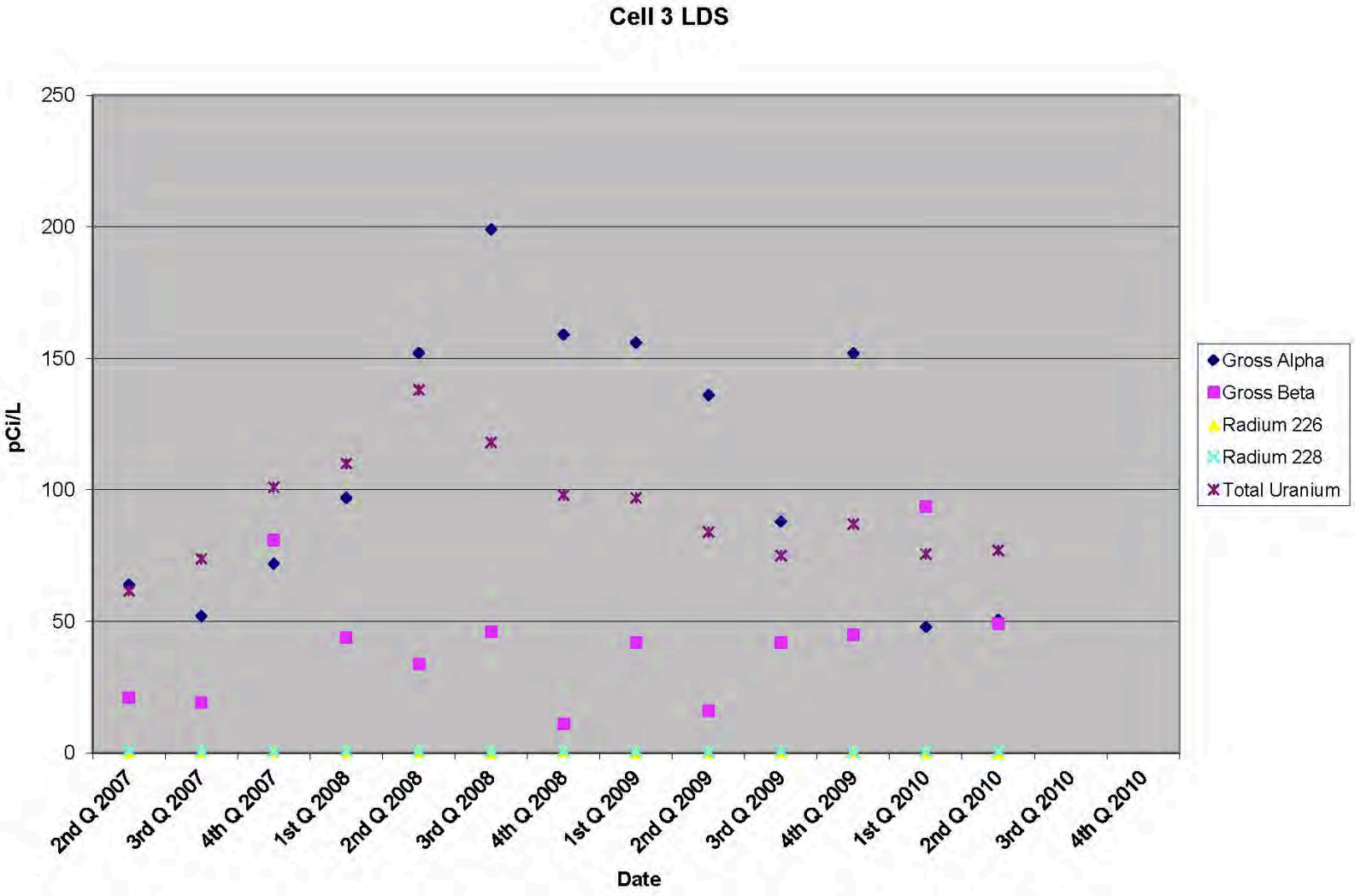


Figure 12 - Groundwater Trending Results – Well L3-42

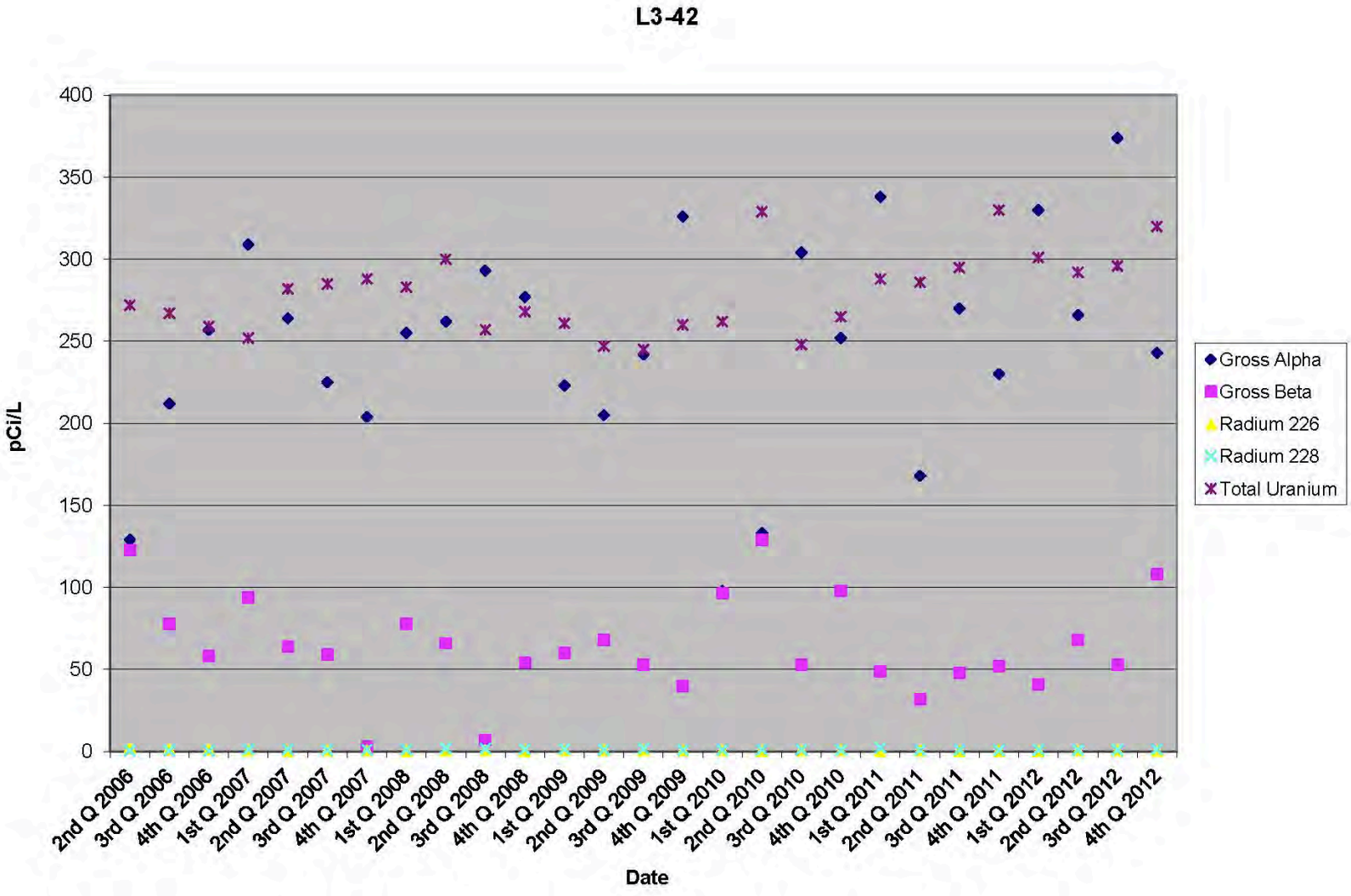


Figure 13 - Groundwater Trending Results – Well L4-16

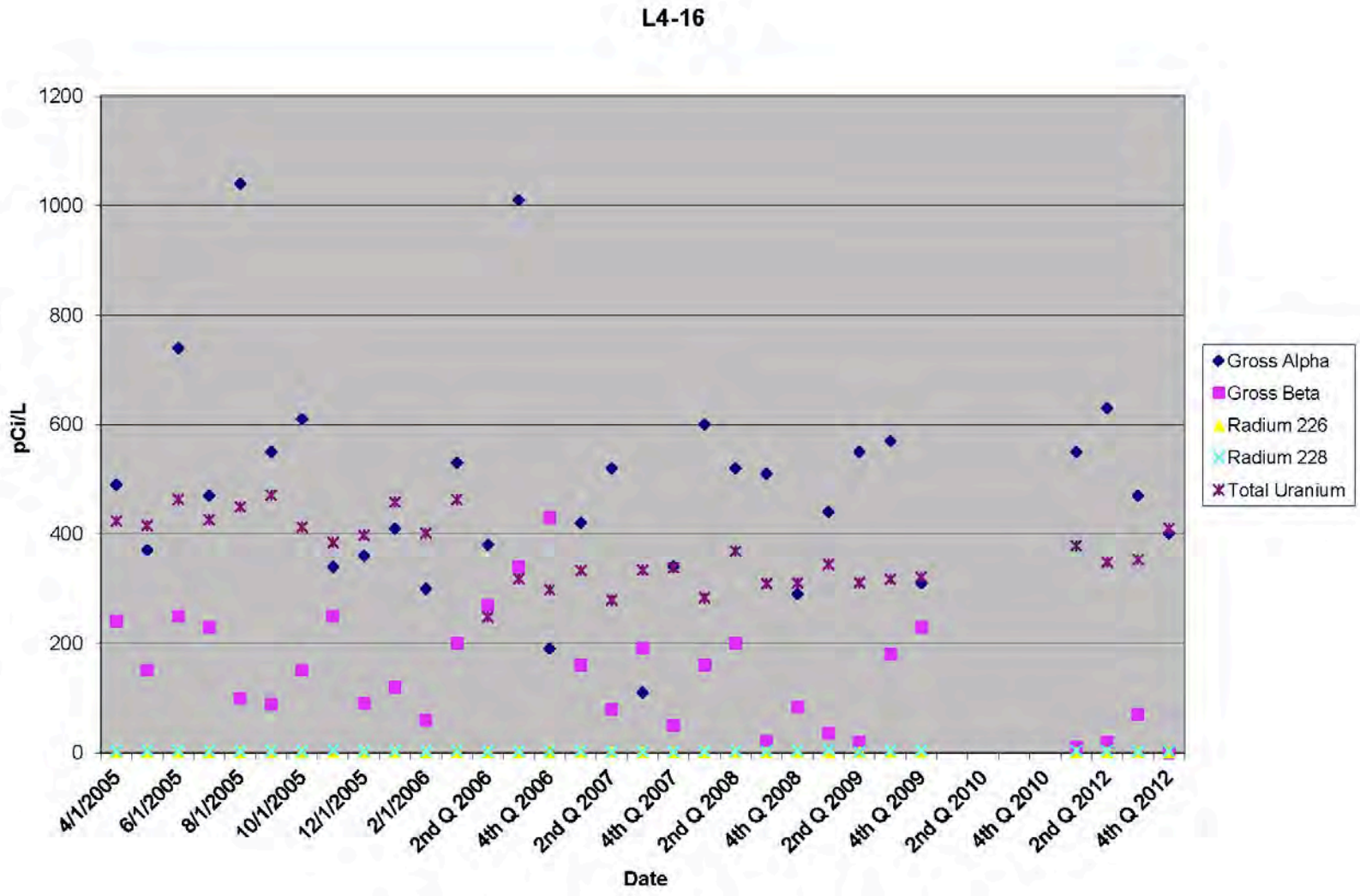


Figure 14 - Groundwater Trending Results – Well L4-32A

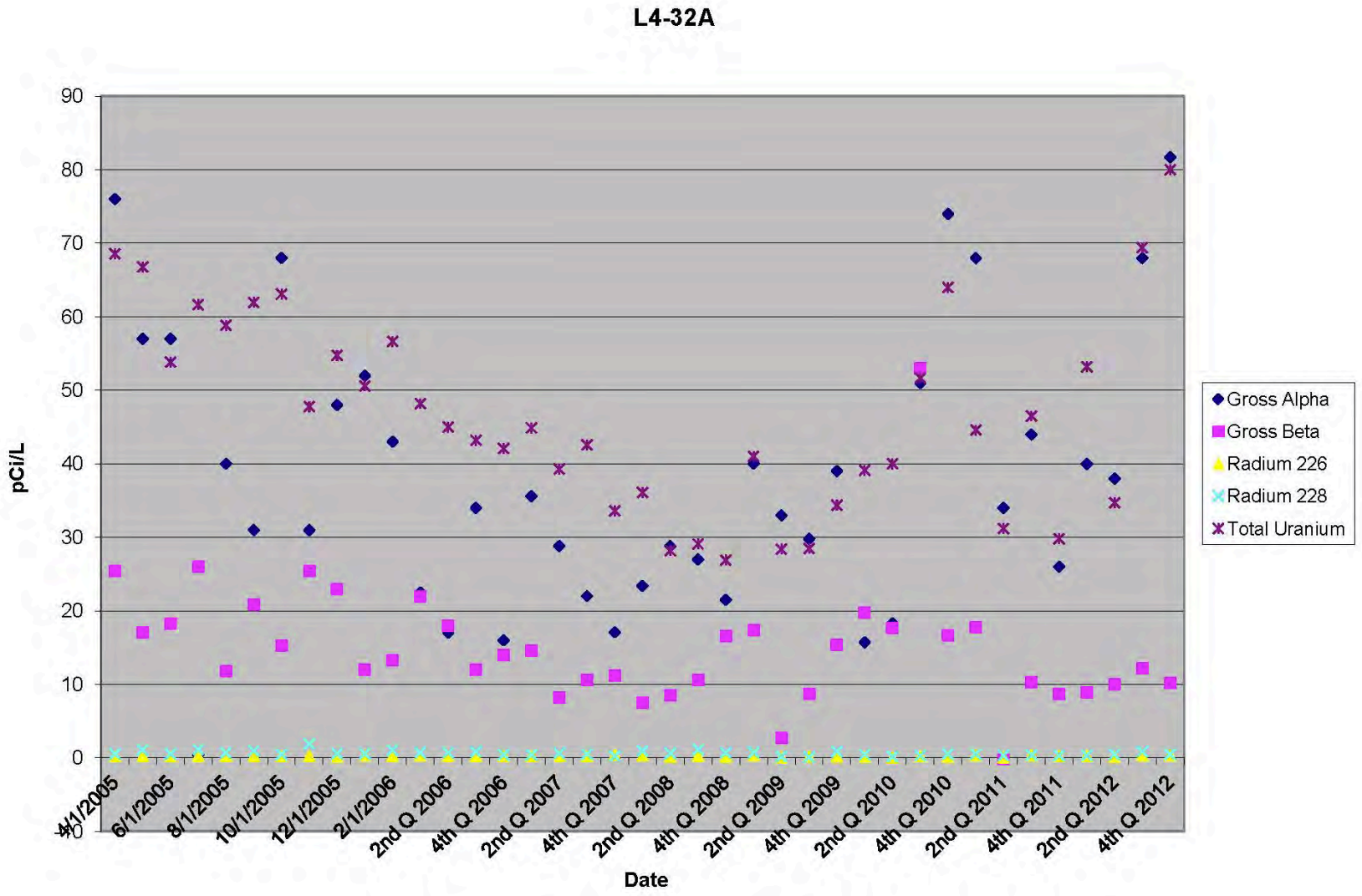


Figure 15 - Groundwater Trending Results – Well L4-32WA

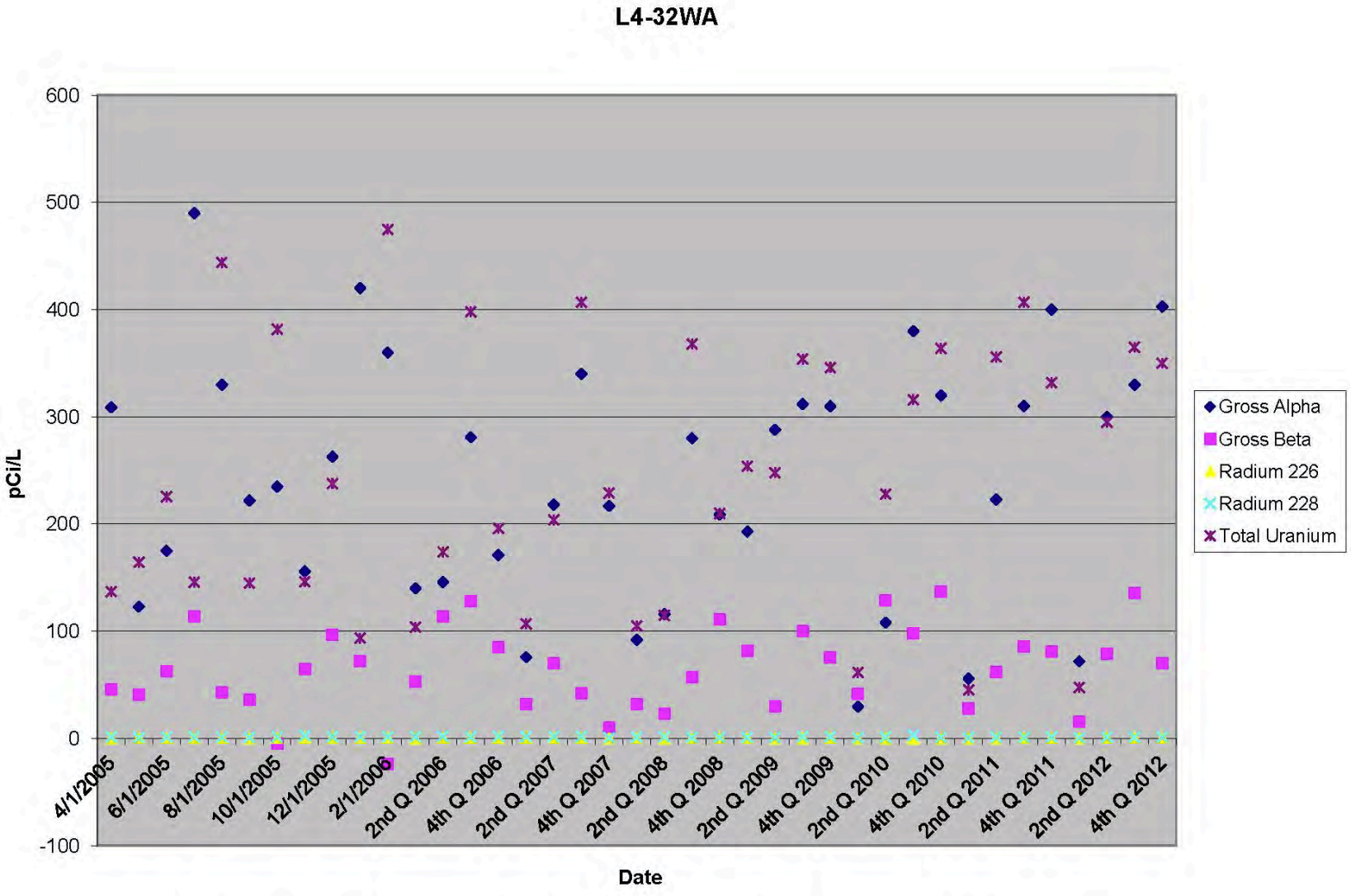


Figure 16 - Groundwater Trending Results – Well L4-33

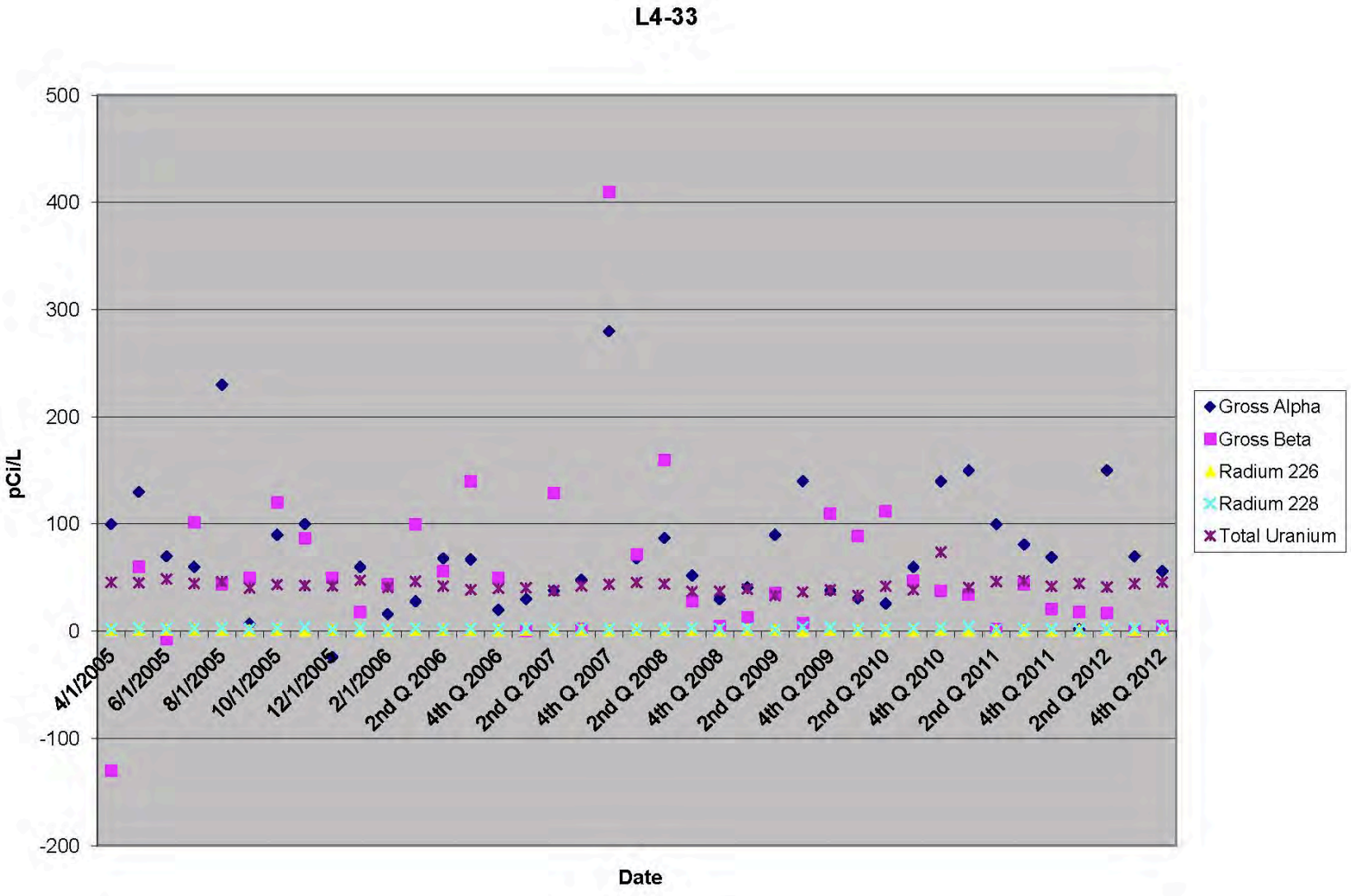


Figure 17 - Groundwater Trending Results – Well L4-41

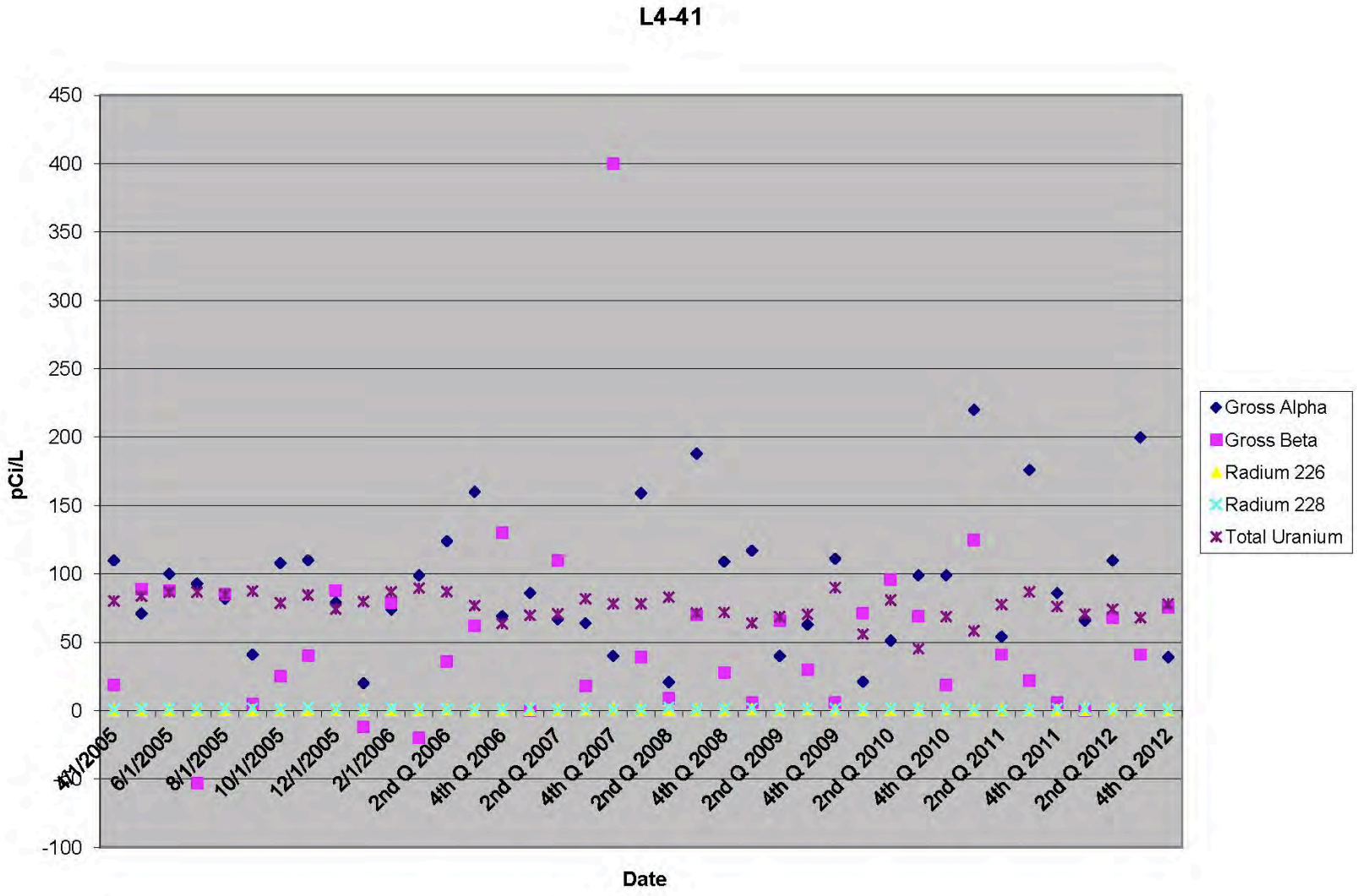


Figure 18 - Groundwater Trending Results – Well L4-8

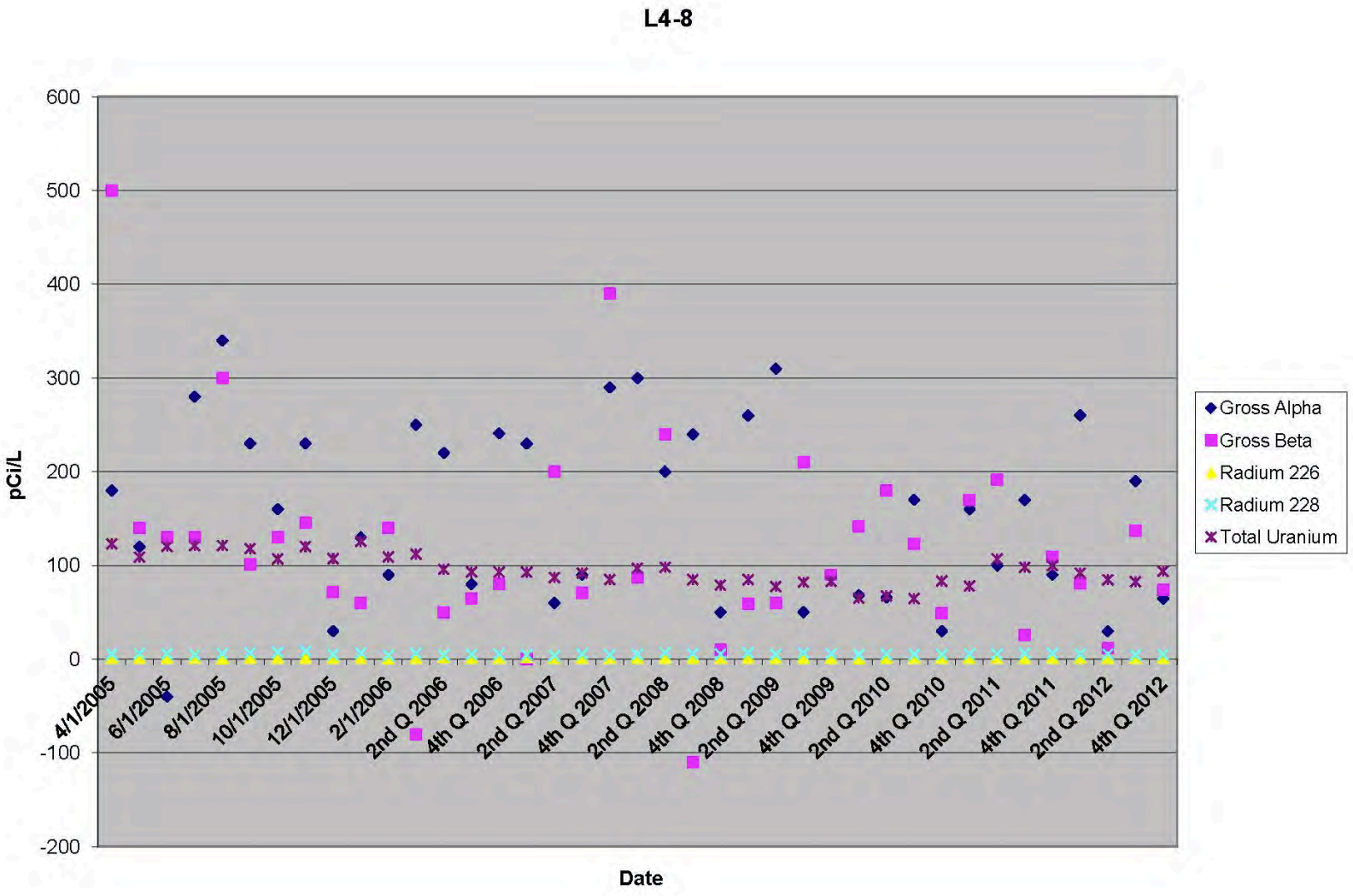


Figure 19 - Groundwater Trending Results – Well L4-8N

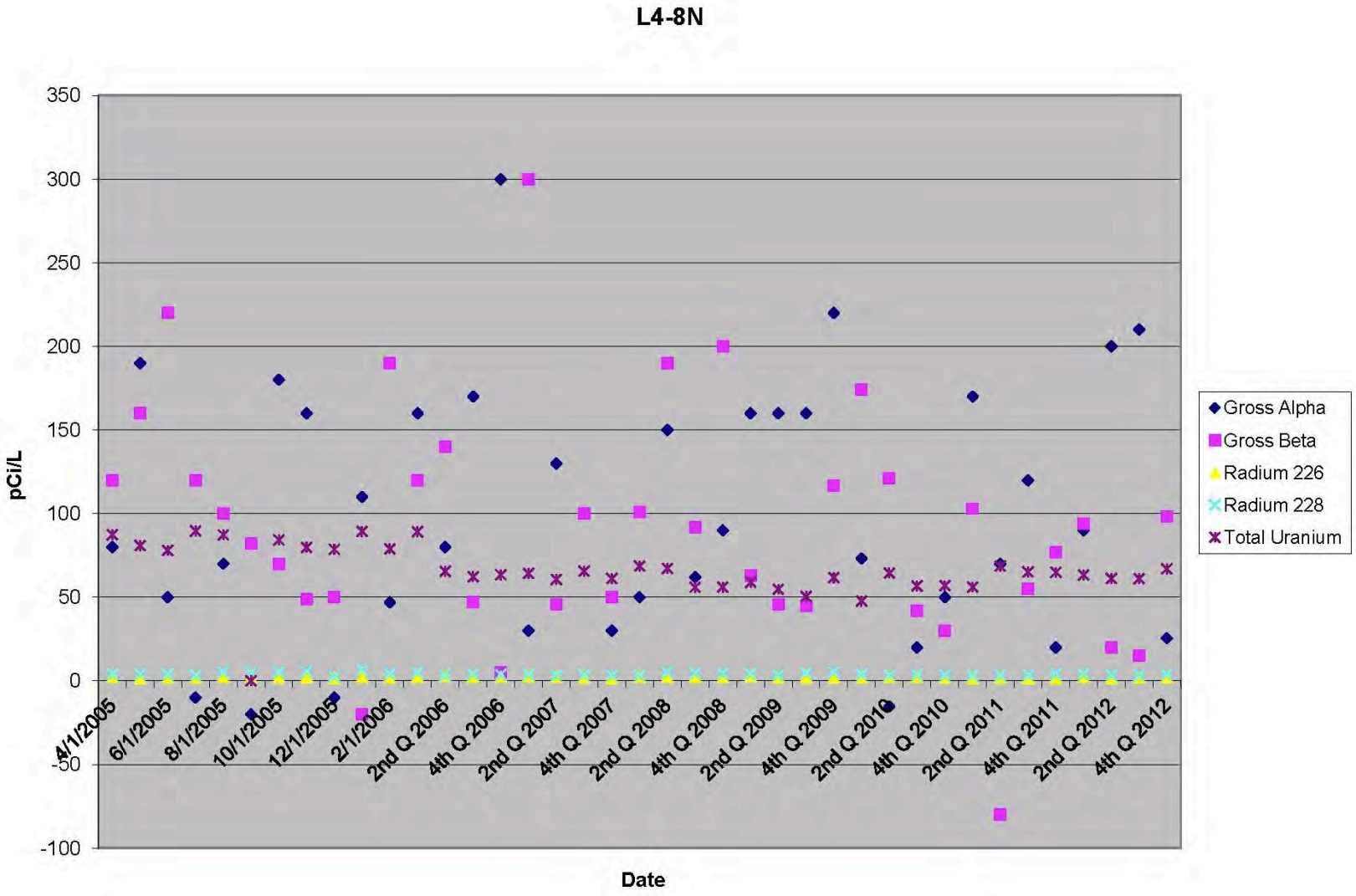


Figure 20 - Groundwater Trending Results – Well L4-9N

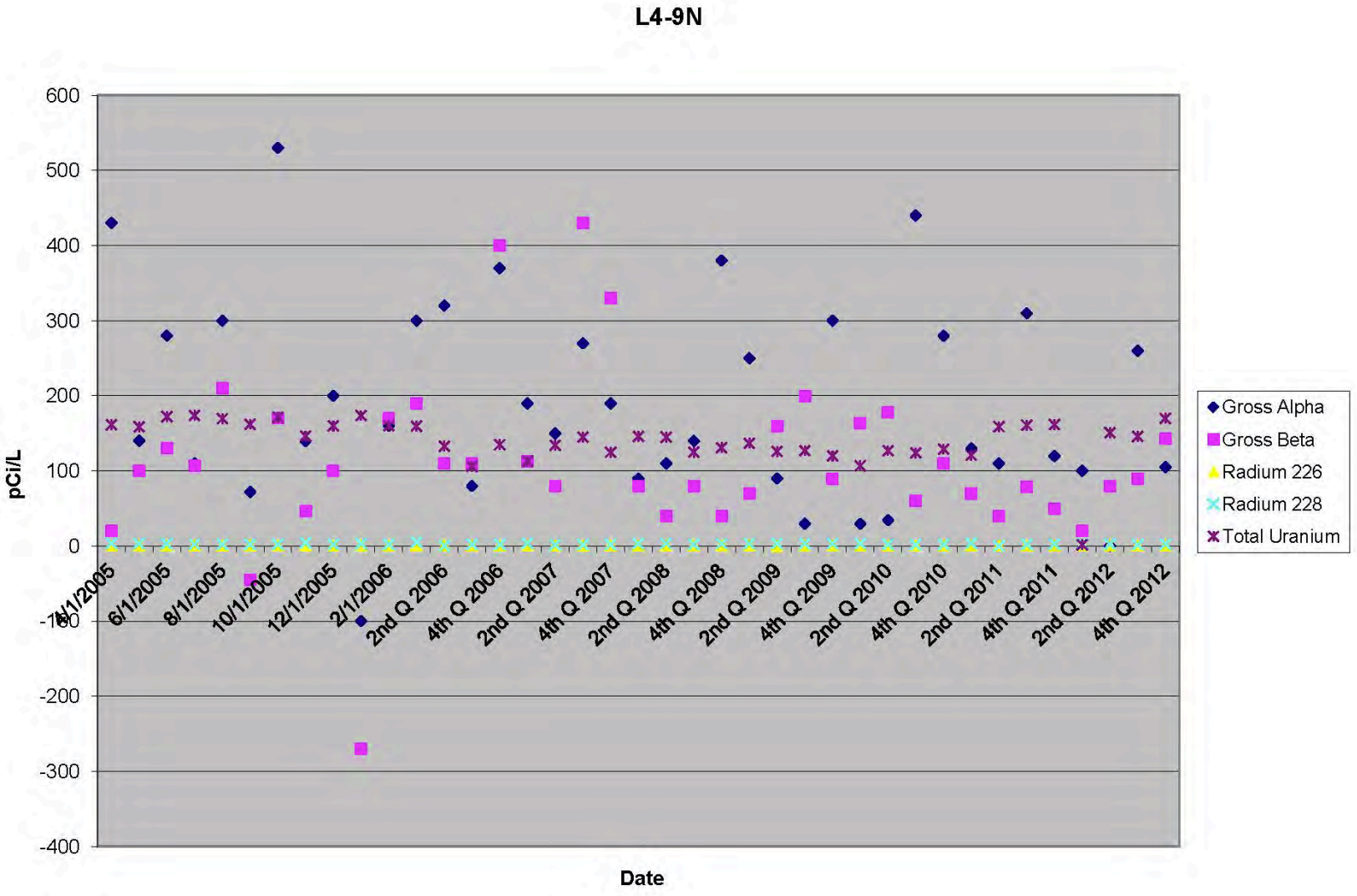


Figure 21-Groundwater Trending Results–Well L4-9W

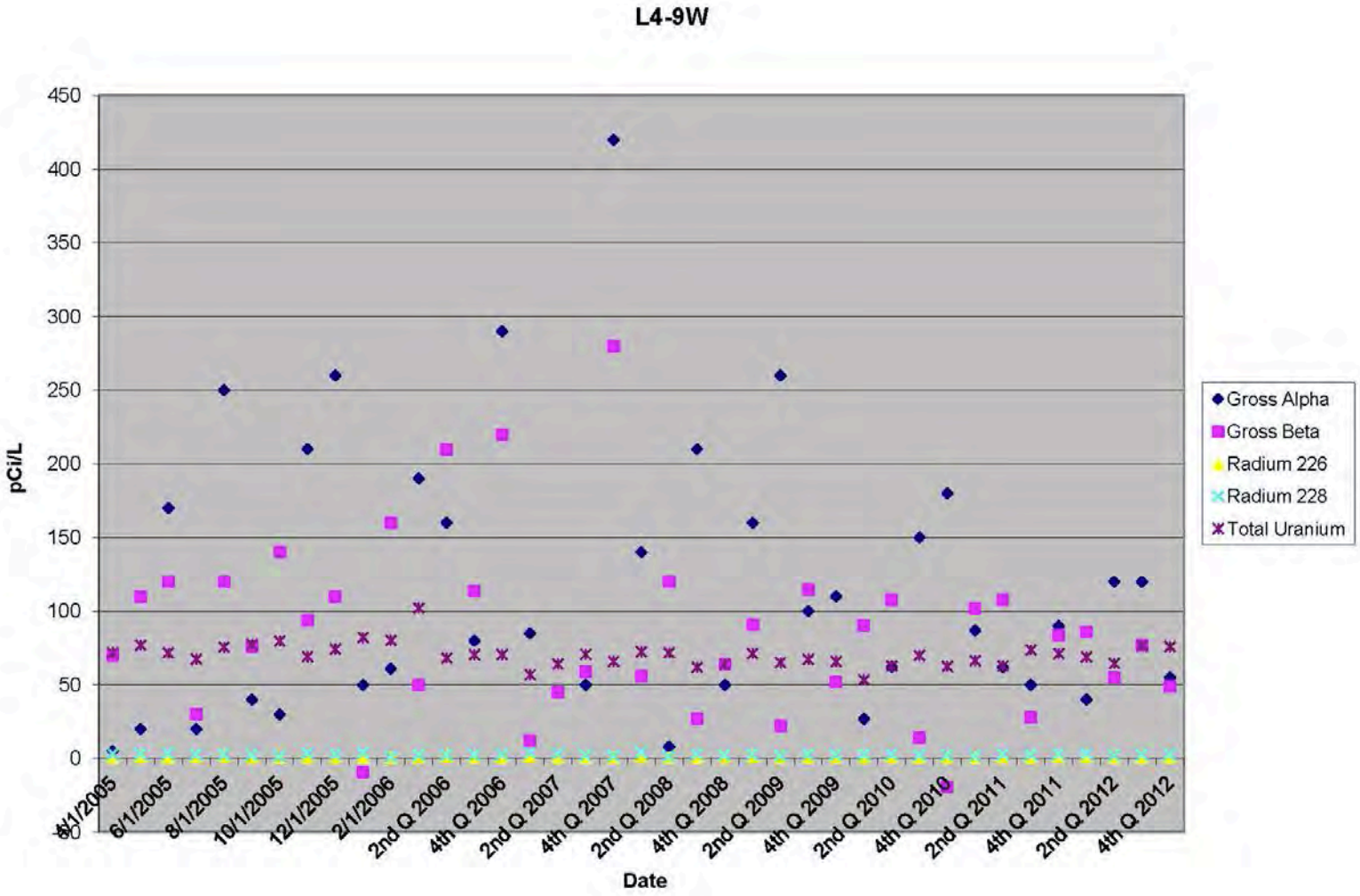


Figure 22 - Groundwater Trending Results – Well L4-28

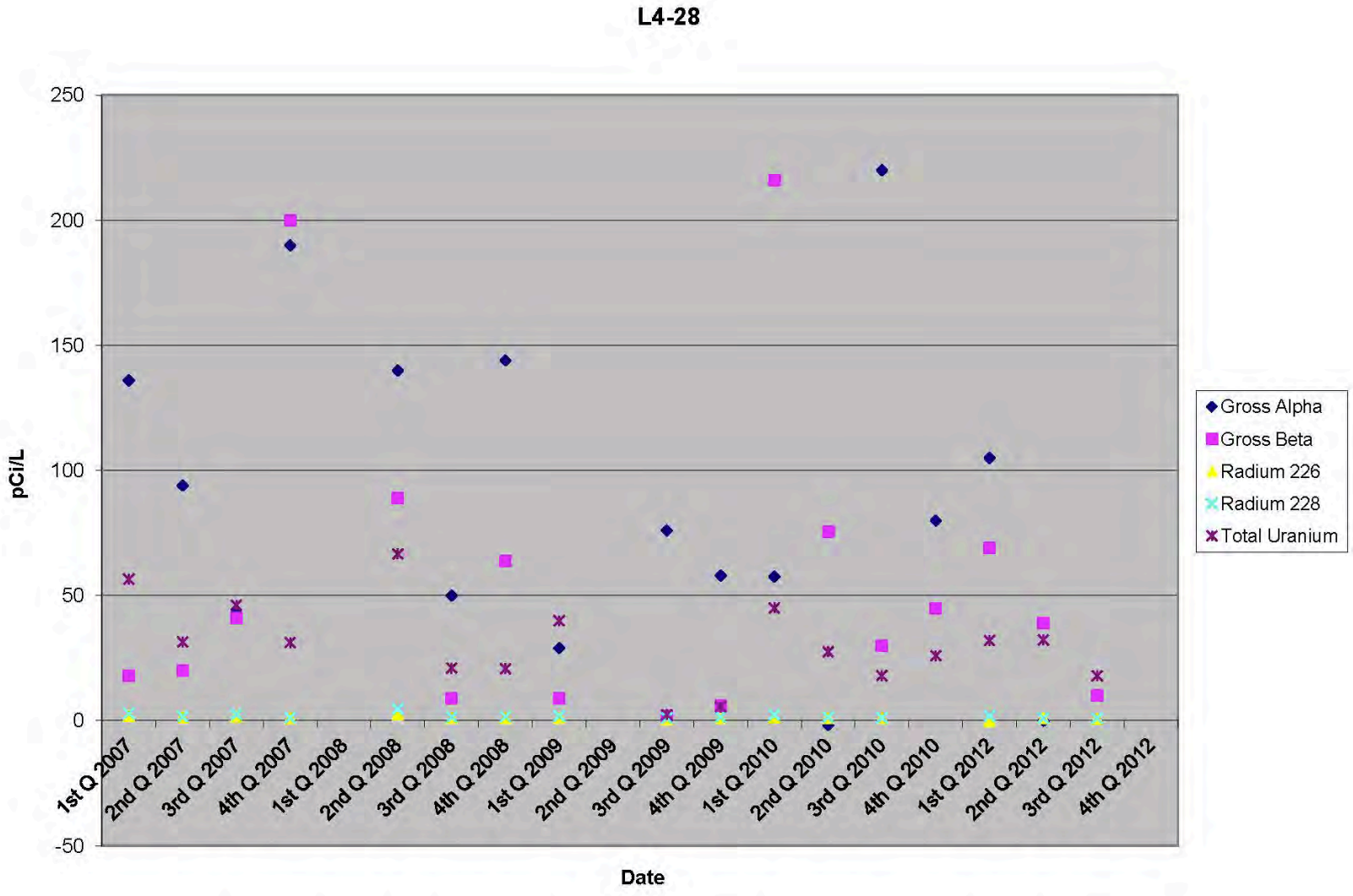


Figure 23 - Groundwater Trending Results Well L5-10A

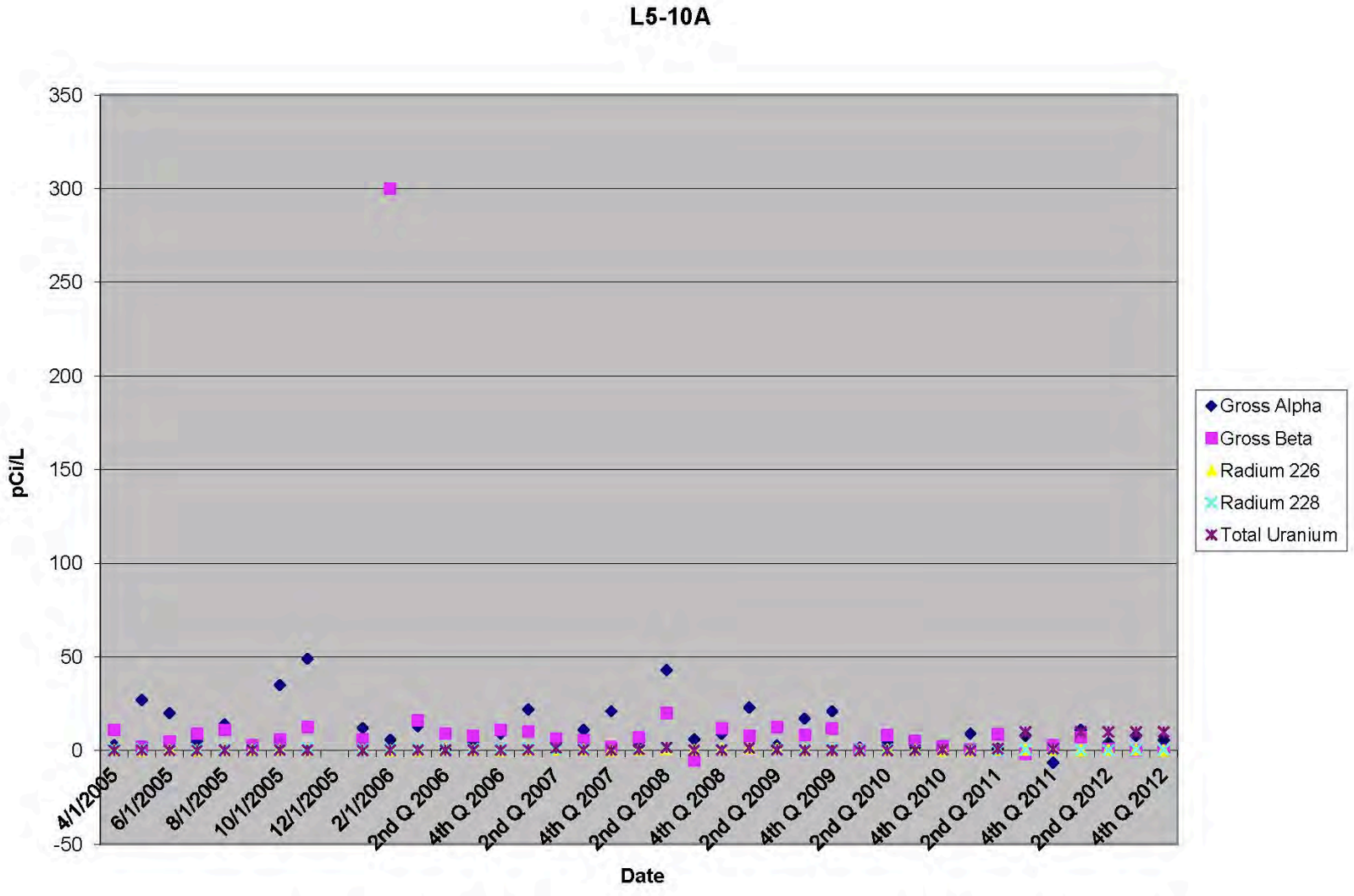


Figure 24 - Groundwater Trending Results – Well L5-4

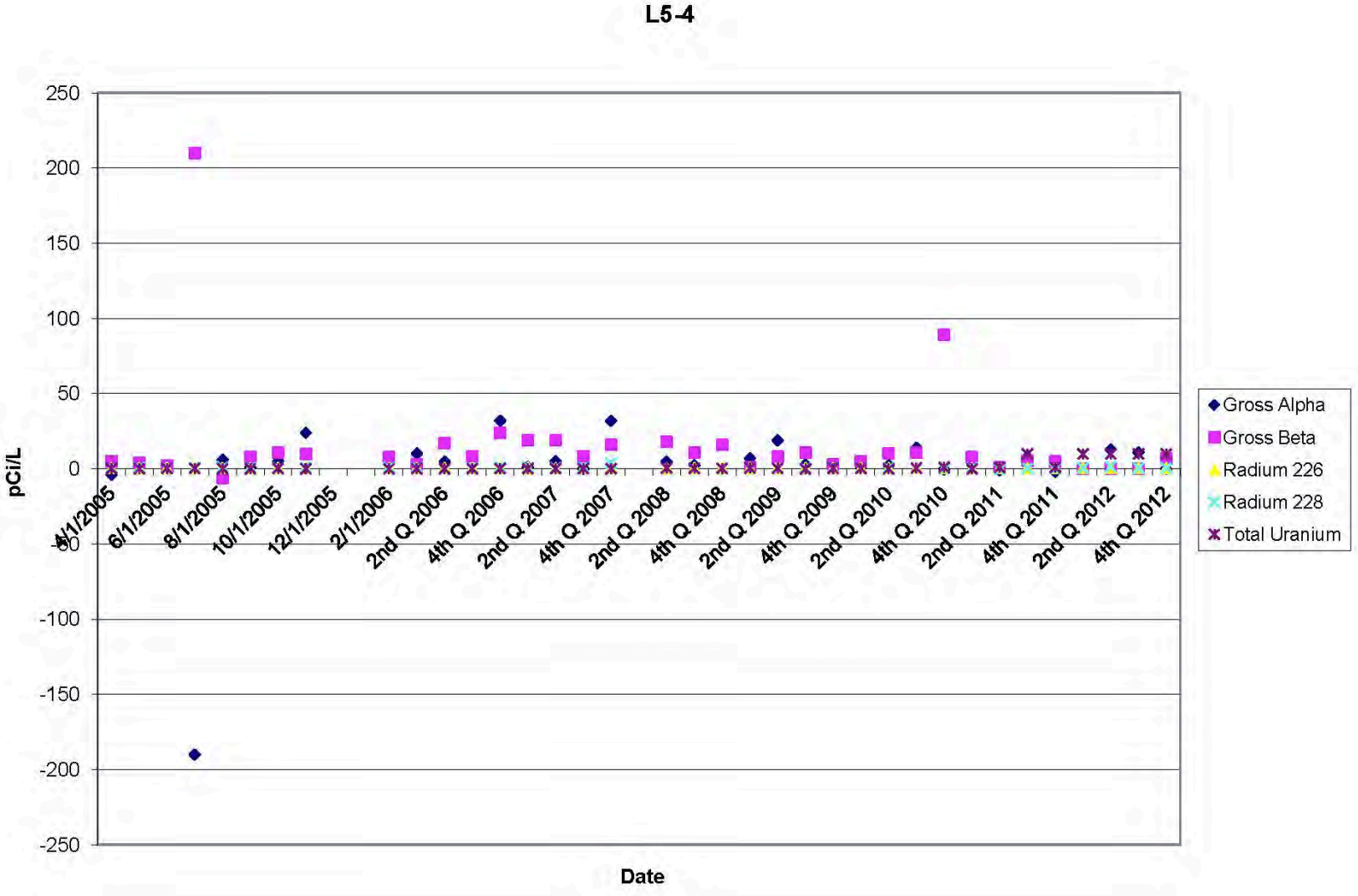


Figure 25 - Groundwater Trending Results – Well L5-5

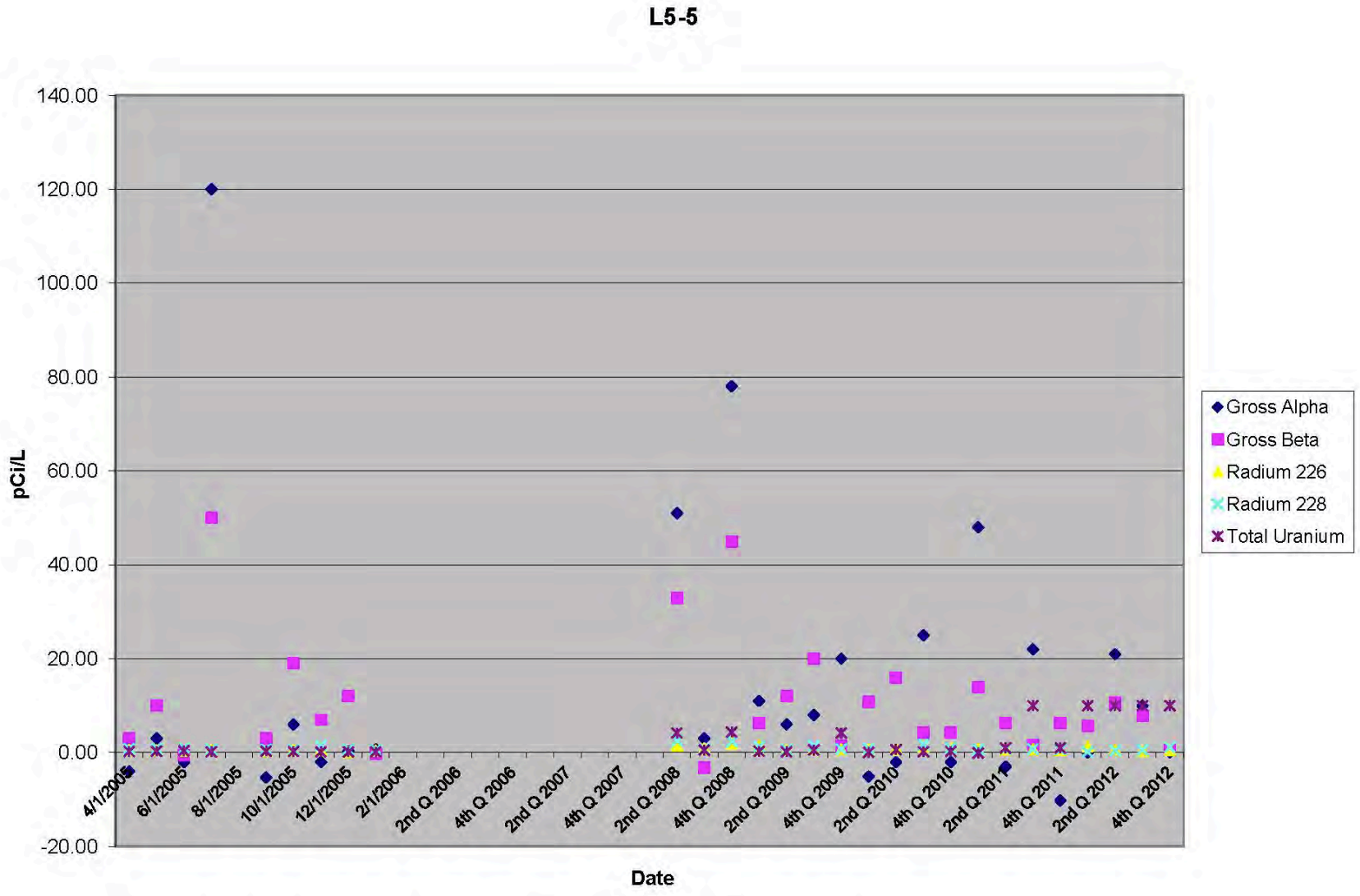


Figure 26 - Groundwater Trending Results – Well L5-6

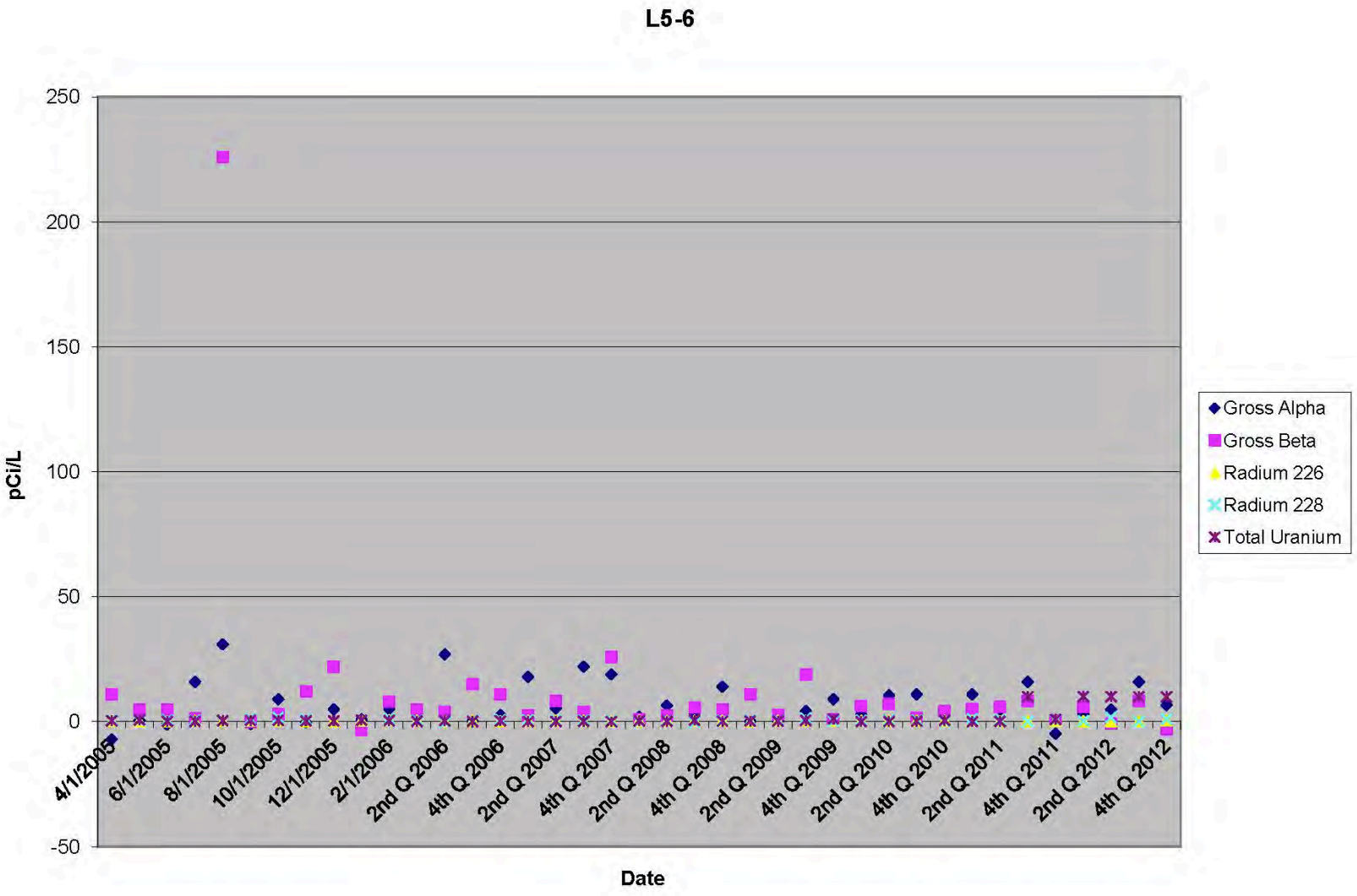


Figure 27 - Groundwater Trending Results – Well L5-7

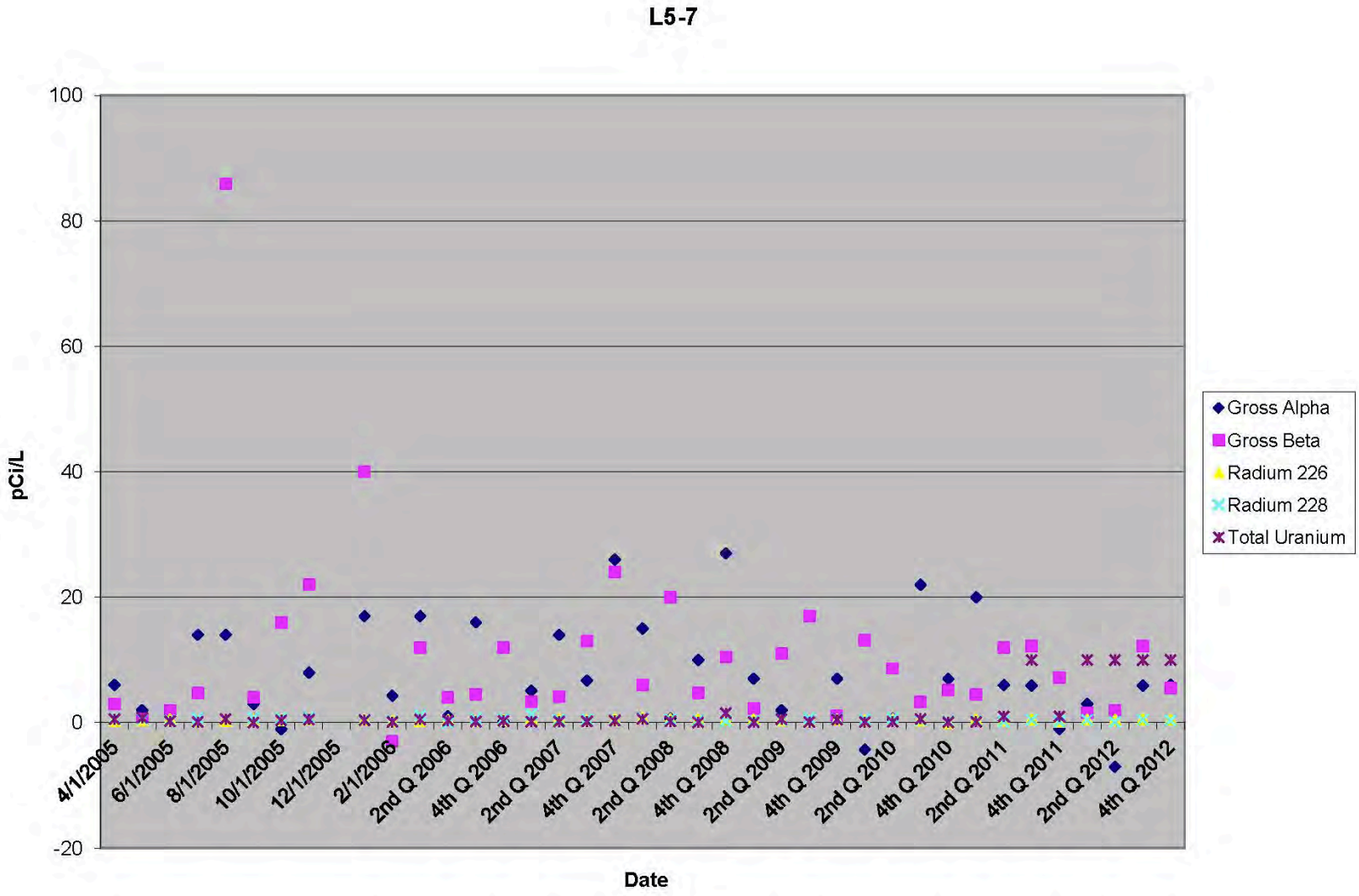


Figure 28 - Groundwater Trending Results – Well L5-8

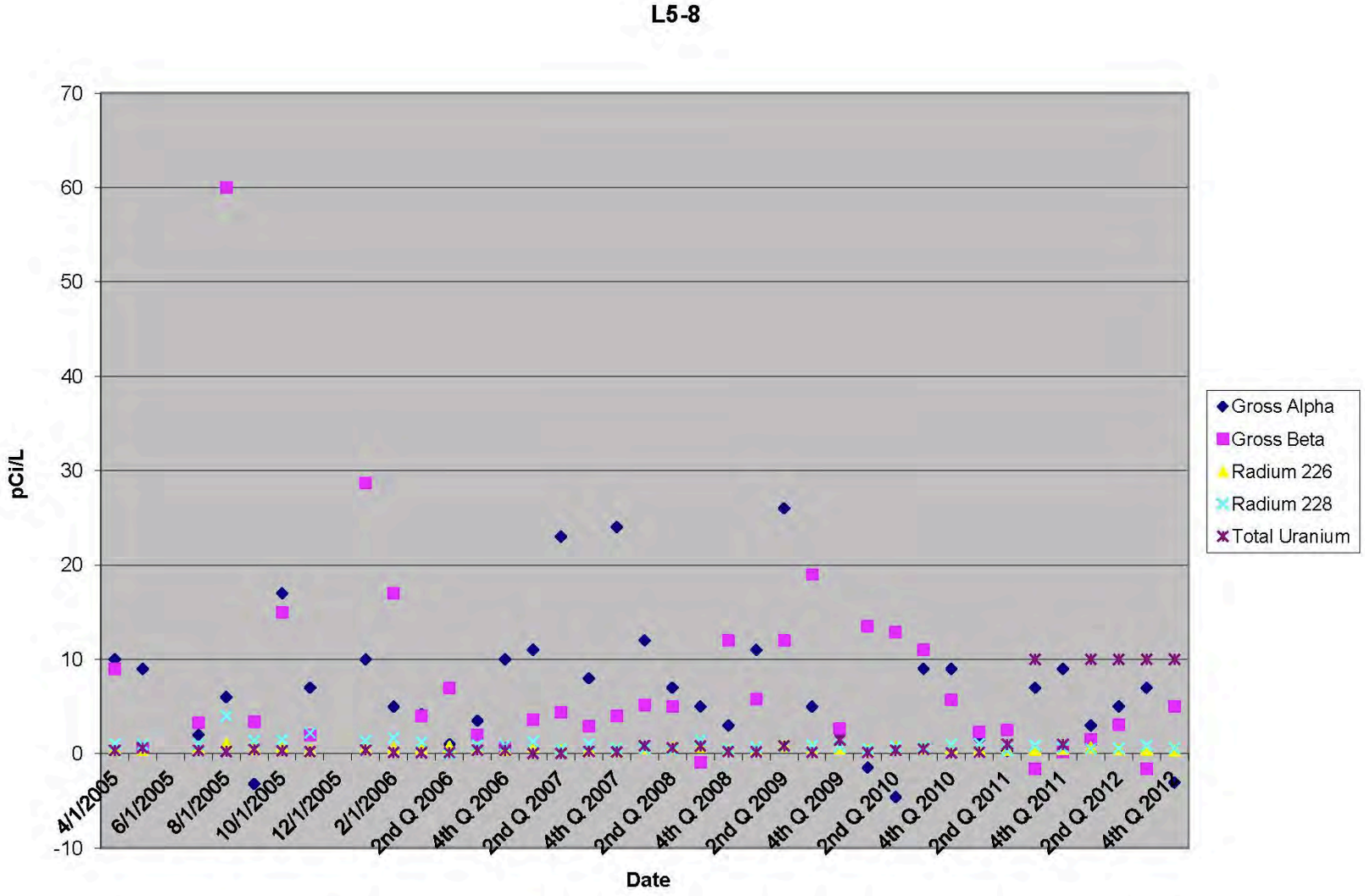


Figure 29 - Groundwater Trending Results – Well L5-9

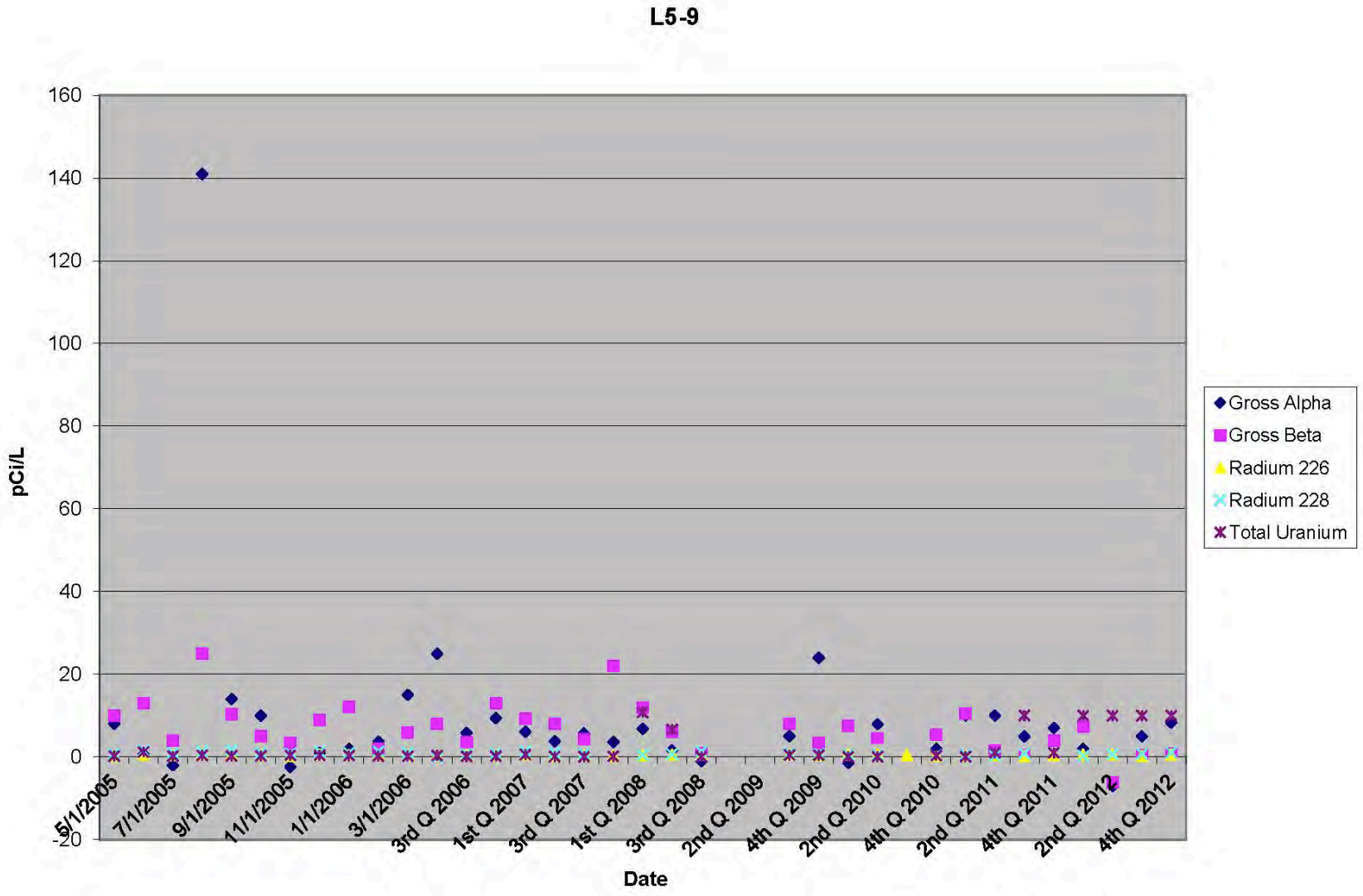


Figure 30 - Groundwater Trending Results – Well L6-3A

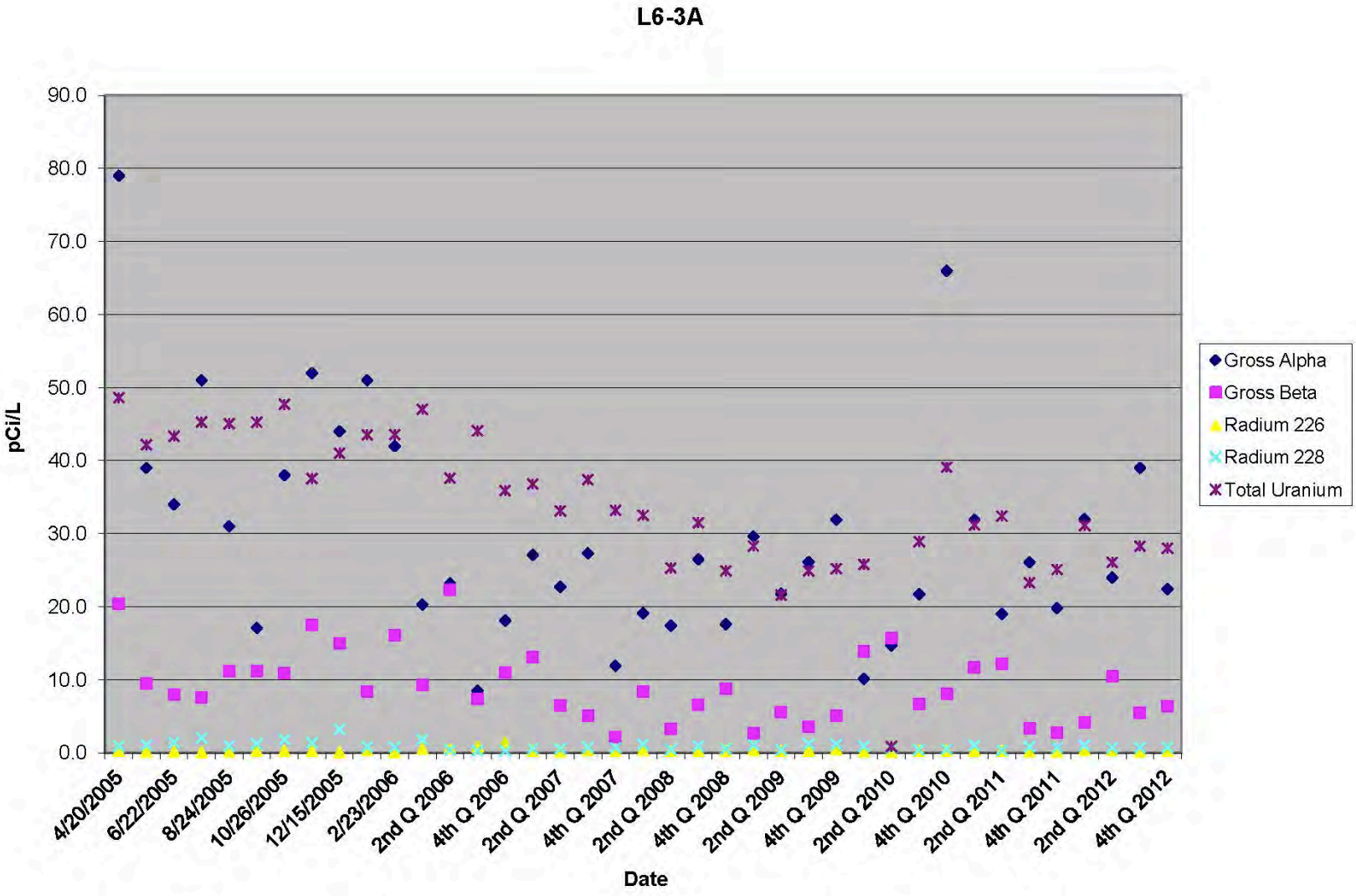


Figure 31 - CHDT Radon Monitoring Stations

Location Description
Disposal Cell A
Disposal Cell B
Treatment Building North
Treatment Building South
South Air Sampler (B)
North Air Sampler (A)
North Perimeter Fence
East Perimeter Fence
Gate 8
West Perimeter Fence

Figure 32 - CHDT Thermoluminescent Dosimeter Monitoring Stations

Location Number	Location Description	Total (mrem)	Equivalent Dose Rate (μrem/hr)
N/A	Deploy Control	178.2	20.3
1	Admin Bldg	164.0	18.7
2	Scale	152.8	17.4
3	West Fence	167.7	19.1
4	Gate 8	156.6	17.9
5	East Fence	164.9	18.8
6	North Fence	165.0	18.8
7	Gate 4	151.7	17.3
8	Lunch Room	157.4	18.0
9	Laboratory	138.3	15.8
10	Sample Bay	154.9	17.7
11	Maintenance	165.5	18.9
12	Treatment Building	148.1	16.9
13	Haul Road	164.9	18.8
14	South Air Sampler	185.8	21.2
15	Disposal Cell	140.0	16.0
16	North Air Sampler	158.7	18.1

Tables

Table 1 – 2012 CHDT Airborne Monitoring Results (uCi/ml)

Air Station A	January	February	March	April	May	June	July	August	September	October	November	December	Average	Maximum
Air (ml)	1.09E+09	1.80E+09	2.52E+09	4.17E+08	1.09E+09	3.16E+09	2.01E+09	2.10E+09	6.21E+08	2.68E+08	1.02E+09	3.61E+08	1.37E+09	3.16E+09
Gross Alpha	1.64E-15	1.66E-15	9.69E-16	4.80E-15	1.64E-15	1.18E-15	3.38E-15	3.24E-15	6.10E-15	2.31E-14	2.46E-15	6.79E-15	4.75E-15	2.31E-14
Gross Beta	1.51E-14	2.56E-14	1.80E-14	8.21E-14	2.73E-14	1.94E-14	3.15E-14	3.00E-14	1.07E-13	1.76E-13	5.25E-14	8.73E-14	5.60E-14	1.76E-13
Th-232	6.44E-17	5.01E-17	4.76E-17	5.64E-16	3.02E-17	4.11E-17	1.69E-17	6.19E-17	2.42E-16	-9.38E-17	2.26E-17	2.66E-16	1.09E-16	5.64E-16
Th-230	6.16E-16	6.12E-17	5.95E-17	1.17E-15	2.47E-16	1.77E-16	2.19E-16	2.57E-16	5.80E-16	1.00E-15	3.11E-16	4.46E-16	4.29E-16	1.17E-15
Th-228	1.38E-16	6.12E-17	2.42E-16	2.59E-16	1.74E-16	1.68E-16	9.95E-18	9.53E-18	1.77E-16	7.25E-16	1.15E-16	2.08E-16	1.91E-16	7.25E-16
U-238	1.10E-16	6.68E-17	8.34E-18	6.82E-16	-6.40E-18	1.58E-17	5.92E-17	2.00E-17	2.26E-16	8.67E-17	8.30E-17	1.13E-16	1.22E-16	6.82E-16
U-235	5.52E-17	-1.00E-17	1.55E-17	1.07E-16	0.00E+00	-2.85E-18	0.00E+00	2.38E-17	6.44E-18	0.00E+00	2.07E-17	1.21E-16	2.81E-17	1.21E-16
U-234	1.75E-16	6.12E-17	4.76E-17	6.63E-17	7.31E-17	4.75E-17	-4.48E-18	8.58E-17	1.11E-16	0.00E+00	5.96E-17	9.31E-17	6.80E-17	1.75E-16
Ra-226	3.50E-16	4.12E-16	0.00E+00	1.10E-15	1.46E-16	1.99E-16	2.29E-16	4.91E-16	6.77E-16	3.25E-15	2.82E-16	1.63E-15	7.31E-16	3.25E-15
Air Station B	January	February	March	April	May	June	July	August	September	October	November	December	Average	Maximum
Air (ml)	2.77E+09	2.91E+09	4.23E+09	3.28E+09	1.79E+09	5.20E+09	3.96E+09	3.61E+09	3.90E+09	8.90E+08	2.24E+09	1.02E+09	2.98E+09	5.20E+09
Gross Alpha	1.75E-15	1.67E-15	7.53E-16	8.48E-16	1.27E-15	5.62E-16	1.56E-15	9.57E-16	2.13E-15	4.01E-15	4.06E-15	2.88E-15	1.87E-15	4.06E-15
Gross Beta	1.36E-14	2.52E-14	1.52E-14	1.54E-14	2.84E-14	1.33E-14	2.07E-14	1.93E-14	2.15E-14	8.42E-14	3.91E-14	4.97E-14	2.88E-14	8.42E-14
Th-232	1.15E-17	8.60E-17	3.54E-17	1.60E-17	-1.23E-17	2.69E-17	4.29E-17	3.88E-17	1.77E-17	7.00E-17	3.50E-17	3.81E-18	3.10E-17	8.60E-17
Th-230	1.44E-16	1.13E-16	6.38E-17	1.23E-16	2.18E-16	1.15E-16	5.04E-17	6.93E-17	1.64E-16	3.54E-16	2.02E-16	4.86E-16	1.75E-16	4.86E-16
Th-228	7.57E-17	3.44E-17	1.51E-16	6.98E-17	1.18E-16	3.65E-17	3.03E-17	2.50E-17	4.61E-17	5.35E-16	4.70E-17	1.62E-16	1.11E-16	5.35E-16
U-238	4.33E-17	2.41E-17	1.89E-17	4.82E-17	1.06E-16	2.31E-17	2.12E-17	8.32E-18	3.59E-17	1.87E-16	4.74E-17	4.49E-17	5.07E-17	1.87E-16
U-235	-1.05E-17	-9.63E-18	1.68E-17	0.00E+00	2.24E-17	1.92E-17	1.11E-17	0.00E+00	5.64E-18	6.63E-17	1.97E-17	4.34E-17	1.54E-17	6.63E-17
U-234	1.01E-17	-7.56E-18	1.61E-17	6.40E-17	1.85E-17	4.81E-17	2.52E-17	3.05E-17	2.77E-17	0.00E+00	8.68E-17	5.37E-17	3.11E-17	8.68E-17
Ra-226	1.01E-16	1.75E-16	0.00E+00	9.76E-17	8.96E-17	2.50E-17	1.84E-16	1.08E-16	1.36E-16	1.90E-16	2.55E-16	2.19E-16	1.32E-16	2.55E-16
Air Station C	January	February	March	April	May	June	July	August	September	October	November	December	Average	Maximum
Air (ml)	1.55E+09	*1.95E+09*	2.36E+09	1.77E+09	9.30E+08	*1.37E+09*	1.81E+09	2.31E+09	1.68E+09	4.16E+08	1.24E+09	7.71E+08	1.51E+09	2.36E+09
Gross Alpha	1.21E-15	*1.08E-15*	9.52E-16	9.37E-16	2.09E-15	*1.56E-15*	1.03E-15	1.11E-15	1.70E-15	5.49E-15	3.62E-15	2.05E-15	1.90E-15	5.49E-15
Gross Beta	1.42E-14	*1.53E-14*	1.65E-14	1.68E-14	2.93E-14	*2.78E-14*	2.62E-14	2.54E-14	3.58E-14	9.12E-14	3.64E-14	3.31E-14	3.07E-14	9.12E-14
Th-232	-5.17E-19	*1.46E-17*	2.96E-17	3.11E-17	3.44E-17	*3.95E-17*	4.46E-17	8.21E-18	8.94E-17	2.05E-16	4.02E-17	7.80E-17	5.11E-17	2.05E-16
Th-230	1.62E-16	*2.20E-16*	2.79E-16	3.66E-17	3.33E-16	*2.88E-16*	2.42E-16	2.12E-16	3.64E-16	7.10E-16	4.06E-16	6.37E-16	3.24E-16	7.10E-16
Th-228	9.05E-17	*2.42E-16*	3.94E-16	2.72E-17	1.40E-16	*1.25E-16*	1.10E-16	7.34E-17	1.49E-16	5.97E-16	1.71E-16	1.32E-16	1.88E-16	5.97E-16
U-238	7.11E-17	*6.31E-17*	5.50E-17	-4.23E-18	2.36E-16	*1.43E-16*	5.01E-17	9.51E-17	7.75E-17	-9.63E-17	9.87E-17	1.22E-16	7.60E-17	2.36E-16
U-235	-3.17E-17	*-3.56E-18*	2.45E-17	3.52E-17	-1.07E-17	*-8.13E-18*	-5.51E-18	0.00E+00	1.37E-17	4.79E-17	1.87E-17	5.89E-17	1.16E-17	5.89E-17
U-234	5.17E-18	*3.79E-17*	7.07E-17	5.23E-17	1.50E-16	*1.28E-16*	1.05E-16	1.04E-16	1.19E-16	4.24E-16	1.50E-16	1.60E-16	1.25E-16	4.24E-16
Ra-226	2.52E-16	*1.26E-16*	0.00E+00	-1.13E-17	7.52E-17	*2.44E-16*	4.13E-16	1.68E-16	2.86E-16	1.45E-15	4.11E-16	3.20E-16	3.11E-16	1.45E-15
Air Station D	January	February	March	April	May	June	July	August	September	October	November	December	Average	Maximum
Air (ml)	9.60E+08	4.22E+08	2.02E+09	3.54E+09	1.72E+09	4.78E+09	3.78E+09	3.97E+09	3.58E+09	8.66E+08	2.70E+09	6.38E+08	2.41E+09	4.78E+09
Gross Alpha	1.46E-16	2.84E-15	9.78E-16	7.26E-16	1.08E-15	8.12E-16	6.61E-16	5.47E-16	1.18E-15	3.24E-15	8.01E-16	2.34E-15	1.28E-15	3.24E-15
Gross Beta	1.65E-15	2.39E-14	1.75E-14	1.36E-14	2.32E-14	1.20E-14	1.71E-14	1.20E-14	2.03E-14	7.43E-14	2.63E-14	5.17E-14	2.45E-14	7.43E-14
Th-232	2.81E-17	2.84E-16	8.90E-18	1.87E-17	2.44E-17	1.47E-17	6.35E-17	1.76E-17	5.30E-17	2.63E-16	2.59E-17	2.71E-16	8.95E-17	2.84E-16
Th-230	3.33E-16	1.11E-15	3.56E-16	1.23E-16	2.67E-16	1.32E-16	1.03E-16	-7.56E-19	1.37E-16	4.21E-16	2.51E-16	8.86E-16	3.43E-16	1.11E-15
Th-228	1.56E-16	4.50E-16	5.88E-16	8.47E-17	2.32E-17	1.47E-17	7.14E-17	4.03E-17	7.81E-17	6.07E-16	1.23E-16	2.27E-16	2.05E-16	6.07E-16
U-238	1.46E-16	2.37E-16	6.67E-17	2.75E-17	8.71E-17	1.68E-17	3.97E-17	3.02E-17	6.98E-17	8.53E-17	6.15E-17	1.26E-16	8.28E-17	2.37E-16
U-235	-1.87E-17	-4.50E-17	1.19E-17	-2.64E-18	2.32E-17	6.28E-18	9.52E-18	0.00E+00	2.29E-17	4.25E-17	0.00E+00	9.00E-17	1.17E-17	9.00E-17
U-234	2.08E-17	4.27E-17	4.30E-17	9.89E-18	1.39E-16	5.44E-17	4.50E-17	1.51E-17	3.63E-17	2.56E-17	9.60E-17	2.85E-16	6.78E-17	2.85E-16
Ra-226	7.81E-16	1.40E-15	0.00E+00	1.86E-16	1.10E-16	0.00E+00	2.49E-16	1.81E-16	2.06E-16	9.36E-16	1.31E-16	1.01E-15	4.32E-16	1.40E-15

Table 2 – CHDT 2012 Wastewater Discharge Monitoring Results
(All Discharged Water Was Recycled for Plant Use)

	January	February	March	April	May	June	July	August	September	October	November	December	Average *	Total
Gallons	0	0	0	224000	0	0	0	0	552400	0	0	0		776400
Gross Alpha (pCi/L)	-	-	-	2.70	-	-	-	-	2.10	-	-	-	2.27	
Gross Beta (pCi/L)	-	-	-	15.70	-	-	-	-	22.10	-	-	-	20.25	
Ra-226 (pCi/L)	-	-	-	0.24	-	-	-	-	0.13	-	-	-	0.16	
Ra-228 (pCi/L)	-	-	-	0.18	-	-	-	-	0.21	-	-	-	0.20	
(* weighted average)														

Table 3 - CHDT Groundwater Monitoring Results – Cell Group

							1st Quarter 2012				
Parameter	Method	GW Standard	Units	Cell 1-LCS	Cell 2-LCS	Cell 3-LCS	Cell 1-LDS	Cell 2-LDS	Cell 3-LDS	TRB-LDS	Cell 1-PS
Gross Alpha [1]	9310 MOD	15	pCi/L	260	230U	135	16U	62		118	
Gross Beta [2]	9310 MOD	50	pCi/L	313	260	1010	8.8U	28		22U	
Radium 226 [3]	9315 MOD	5	pCi/L	0.45	1.45	1.93	0.25	0.27		0.26	
Radium 228 [3]	9320 MOD	5	pCi/L	2.53	9.1	3.8	0.49	1.82		0.89	
Uranium	D5174-91	30	ug/L	147	13.9	60.1	4	52.1		80	
							2nd Quarter 2012				
Parameter	Method	GW Standard	Units	Cell 1-LCS	Cell 2-LCS	Cell 3-LCS	Cell 1-LDS	Cell 2-LDS	Cell 3-LDS	TRB-LDS	Cell 1-PS
Gross Alpha [1]	9310 MOD	15	pCi/L	160U	160U	46U	20U	34U		59U	
Gross Beta [2]	9310 MOD	50	pCi/L	148	410	1280	12U	29U		30	
Radium 226 [3]	9315 MOD	5	pCi/L	0.61	1.34	1.59	.27	0.4		0.27	
Radium 228 [3]	9320 MOD	5	pCi/L	3.87	11.6	5.7	0.29U	2.74		1.77	
Uranium	D5174-91	30	ug/L	135	15.1	46.5	8	45.8		85.6	
							3rd Quarter 2012				
Parameter	Method	GW Standard	Units	Cell 1-LCS	Cell 2-LCS	Cell 3-LCS	Cell 1-LDS	Cell 2-LDS	Cell 3-LDS	TRB-LDS	Cell 1-PS
Gross Alpha [1]	9310 MOD	15	pCi/L	220U	450U	61U	12U	90		99	
Gross Beta [2]	9310 MOD	50	pCi/L	390	230U	960	11U	10U		34	
Radium 226 [3]	9315 MOD	5	pCi/L	0.55	1.62	1.39	0.15U	0.4		0.14U	
Radium 228 [3]	9320 MOD	5	pCi/L	4.45	9.4	3.65	0.43	2.26		1.11	
Uranium	D5174-91	30	ug/L	138	21.2	44.2	10U	56.1		97.1	
							4th Quarter 2012				
Parameter	Method	GW Standard	Units	Cell 1-LCS	Cell 2-LCS	Cell 3-LCS	Cell 1-LDS	Cell 2-LDS	Cell 3-LDS	TRB-LDS	Cell 1-PS
Gross Alpha [1]	9310 MOD	15	pCi/L	152	156U	47.6U	32.3	83.6		78.5	
Gross Beta [2]	9310 MOD	50	pCi/L	116	376	1330	12U	51.6		27.8	
Radium 226 [3]	9315 MOD	5	pCi/L	0.574	2.09	2.61	.112U	0.273		0.181	
Radium 228 [3]	9320 MOD	5	pCi/L	3.29	9.45	4.34	.645	1.59		1.3	
Uranium	D5174-91	30	ug/L	130	18	43	8.9	57		74	

Notes: [1] CDPHE GW standard for Gross Alpha excludes U and Rn.
[2] CDPHE GW standard for Gross Beta is a screening level.
[3] CDPHE GW standard for Radium 226 and 228 is a combined value of 5 pc/l.

Units: pCi/L picocuries per liter; ug/L micrograms per liter

Lab Flags: J result is greater than the sample detection limit but less than the stated reporting limit; U result is less than the sample detection limit

Table 4 - CHDT Groundwater Monitoring Results – L3-42

Parameter	Method	CDPHE GW Standard	Units	1st Q 2012	1st Q 2012	2nd Q 2012	2nd Q 2012	3rd Q 2012	3rd Q 2012	4th Q 2012	4th Q 2012
				L3-42	L3-42 Duplicate	L3-42	L3-42 Duplicate	L3-42	L3-42 Duplicate	L3-42	L3-42 Duplicate
Gross Alpha [1]	9310 MOD	15	pCi/L	330	335	266	355	374	306	243	223
Gross Beta [2]	9310 MOD	50	pCi/L	41	43	68	90	53	38	108	90.4
Radium 226 [3]	9315 MOD	5	pCi/L	0.44	0.4	0.55	0.35	0.55	0.46	0.477	0.556
Radium 228 [3]	9320 MOD	5	pCi/L	0.92	0.66	0.96	0.83	1.12	1.06	1.43	1.17
Uranium	D5174	30	ug/L	301	289	292	298	296	307	320	320

Notes:
[1] CDPHE GW standard for Gross Alpha excludes U and Rn.
[2] CDPHE GW standard for Gross Beta is a screening level.
[3] CDPHE GW standard for Radium 226 and 228 is a combined value of 5 pc/l.

Units	pCi/L	picocuries per liter
	ug/L	micrograms per liter
Lab Flags	J	result is greater than the sample detection limit but less than the stated reporting limit
	U	result is less than the sample detection limit

Table 5 - CHDT Groundwater Monitoring Results – L4 Group

Method	GW Stnd.	Units	L4-32A	L4-32A Duplicate	L4-32EA	L4-32WA	L4-33	L4-33WA	L4-41	L4-8	L4-8N	L4-9N	L4-9W	L4-9W Duplicate	L4-16	L4-28
1st Quarter 2012																
9310 MOD	15	pCi/L	40	37	107	72	2U	75	66U	260	90U	100U	40U		550	105U
9310 MOD	50	pCi/L	8.9U	6U	27	15.5	18U	33	-50U	81U	94U	20U	86U		10U	69U
9315 MOD	5	pCi/L	0.28	0.31	0.3	0.29	1.06	0.59	0.7	1.35	2.24	0.87	1.05		0.89	-0.136U
9320 MOD	5	pCi/L	0.35U	0.72	0.74	0.58	1.74	1.29	1.55	5.44	4.13	2.74	3.25		3.83	1.96
D5174-91	30	ug/L	53.2	44	113	47.6	44.5	121	70.6	91.7	63.3	157	68.9		378	32.1
2nd Quarter 2012																
Method	GW Stnd.	Units	L4-32A	L4-32A Duplicate	L4-32EA	L4-32WA	L4-33	L4-33WA	L4-41	L4-8	L4-8N	L4-9N	L4-9W	L4-9W Duplicate	L4-16	L4-28
9310 MOD	15	pCi/L	38		115	300	150U	96	110U	30U	200U	-40U	120U	810	630	-30U
9310 MOD	50	pCi/L	10		29	79	17U	21	68U	12U	20U	80U	55U	650	20U	39U
9315 MOD	5	pCi/L	0.11U		0.28	0.43	1.59	0.53	0.91	1.36	1.65	0.56	0.77	0.77	0.93	1.06
9320 MOD	5	pCi/L	0.49		28.8	1.29	2.65	1.03	1.08	5.26	3.6	2.79	2.24	2.56	4.2	1.04
D5174-91	30	ug/L	34.7		110	295	41.3	81.8	74.2	84.7	61.3	151	64.6	65.1	348	32.3
3rd Quarter 2012																
Method	GW Stnd.	Units	L4-32A	L4-32A Duplicate	L4-32EA	L4-32WA	L4-33	L4-33WA	L4-41	L4-8	L4-8N	L4-9N	L4-9W	L4-9W Duplicate	L4-16	L4-28
9310 MOD	15	pCi/L	68	76	188	330	70U	119	200	190U	210U	260U	120U		470	10U
9310 MOD	50	pCi/L	12.2U	21.3	29	136	-7U	18	41U	137	15U	90U	77U		70U	10U
9315 MOD	5	pCi/L	0.35	0.28	0.32	0.57	1.26	0.38	0.48	1.44	1.94	0.59	0.87		0.88	0.85
9320 MOD	5	pCi/L	0.88	0.69	0.58	1.14	2.92	0.78	1.2	4.47	3.31	2.23	2.6		2.83	0.92
D5174-91	30	ug/L	69.4	60.9	146	365	44.3	122	68.1	82.7	61.1	146	76.3		353	17.9
4th Quarter 2012																
Method	GW Stnd.	Units	L4-32A	L4-32A Duplicate	L4-32EA	L4-32WA	L4-33	L4-33WA	L4-41	L4-8	L4-8N	L4-9N	L4-9W	L4-9W Duplicate	L4-16	L4-28
9310 MOD	15	pCi/L	81.7		175	403	56.1U	94.1	39.1U	64.8U	25.5U	105U	54.9U	111U	401	
9310 MOD	50	pCi/L	10.2U		31.1	70.2	4.76U	21.6	75.6U	73.9U	98.5U	143U	48.9U	75.9U	-38.4U	
9315 MOD	5	pCi/L	0.334		0.384	0.495	1.51	0.582	0.652	1.58	1.9	0.54	0.847	0.794	0.91	
9320 MOD	5	pCi/L	0.499		1.35	1.51	2.48	0.973	1.36	5.02	3.98	2.67	2.93	3.1	3.4	
D5174-91	30	ug/L	80		170	350	46	120	78	94	67	170	76	80	410	

[1] CDPHE GW standard for Gross Alpha excludes U and Rn.
[2] CDPHE GW standard for Gross Beta is a screening level.
[3] CDPHE GW standard for Radium 226 and 228 is a combined value of 5 pc/l.

pCi/L	picocuries per liter
ug/L	micrograms per liter
J	result is greater than the sample detection limit but less than the stated reporting limit
U	result is less than the sample detection limit
NS	not sampled due to insufficient volume

Table 6 - CHDT Groundwater Monitoring Results – L5 Group

1st Quarter 2012

Parameter	Method	CDPHE GW Standard	Units	L5-3	L5-4	L5-5	L5-6	L5-7	L5-8	L5-9	L5-10A	L5-10A Duplicate
Gross Alpha [1]	9310 MOD	15	pCi/L	-12U	-1U	-0.3U	3U	3U	3U	2U	11U	2.5U
Gross Beta [2]	9310 MOD	50	pCi/L	0.8U	9.5U	5.7U	6.1U	1.6U	1.5U	7.3U	7U	8.8U
Radium 226 [3]	9315 MOD	5	pCi/L	0.38	0.74	1.32	0.32U	0.52	0.67	0.6	0.31	0.4
Radium 228 [3]	9320 MOD	5	pCi/L	0.4U	0.73	0.19U	0.42U	0.48	0.54	0.27U	0.31U	0.4
Uranium	D5174-91	30	ug/L	10U	10U	10U	10U	10U	10U	10U	10U	10U

2nd Quarter 2012

Parameter	Method	CDPHE GW Standard	Units	L5-3	L5-4	L5-4 Duplicate	L5-5	L5-6	L5-7	L5-8	L5-9	L5-10A	L5-10A Duplicate
Gross Alpha [1]	9310 MOD	15	pCi/L	7U	13U	3U	21U	5U	-7U	5U	-7U	4U	
Gross Beta [2]	9310 MOD	50	pCi/L	5.20U	-4.5U	0.3U	10.7U	-0.8U	2U	3.1U	-6.2U	1U	
Radium 226 [3]	9315 MOD	5	pCi/L	0.26	0.67	0.63	0.62	0.27	0.47	0.49	0.56	0.38	
Radium 228 [3]	9320 MOD	5	pCi/L	.95	1.55	0.3U	0.46	1.79	0.13U	0.61	0.75	0.29U	
Uranium	D5174-91	30	ug/L	10U	10U	10U	10U	10U	10U	10U	10U	10U	

3rd Quarter 2012

Parameter	Method	CDPHE GW Standard	Units	L5-3	L5-4	L5-5	L5-6	L5-7	L5-8	L5-9	L5-10A	L5-10A Duplicate
Gross Alpha [1]	9310 MOD	15	pCi/L	10U	11U	10U	16	5.90 U	7 U	5 U	8 U	
Gross Beta [2]	9310 MOD	50	pCi/L	8.1U	-27.3U	7.8U	8.50 U	12.2	-1.60 U	0.500 U	-1.80 U	
Radium 226 [3]	9315 MOD	5	pCi/L	0.21	0.5	0.4	0.31	0.56	0.46	0.3	0.4	
Radium 228 [3]	9320 MOD	5	pCi/L	0.39	0.48	0.66	0.0700 U	0.47	0.87	0.8	0.51	
Uranium	D5174-91	30	ug/L	10U	10U	10U	10 U	10 U	10 U	10 U	10 U	

4th Quarter 2012

Parameter	Method	CDPHE GW Standard	Units	L5-3	L5-4	L5-4 Duplicate	L5-5	L5-5 Duplicate	L5-6	L5-7	L5-8	L5-9	L5-10A
Gross Alpha [1]	9310 MOD	15	pCi/L	6.51U	.247U	1.34U	-3.02U		6.7U	6.06U	-3.05U	8.31U	5.63U
Gross Beta [2]	9310 MOD	50	pCi/L	8.27U	6.88U	3.94U	.534U		-3.13U	5.52U	5.02U	.825U	-3.1U
Radium 226 [3]	9315 MOD	5	pCi/L	0.312	0.669	0.641	0.598		0.502	0.498	0.371	0.618	0.274
Radium 228 [3]	9320 MOD	5	pCi/L	.849	0.654	0.508	1.21		1.11	.361U	0.605	1.09	0.458
Uranium	D5174-91	30	ug/L	10U	10U	10U	10U		10U	10U	10U	10U	10U

Notes: [1] CDPHE GW standard for Gross Alpha excludes U and Rn.
[2] CDPHE GW standard for Gross Beta is a screening level.
[3] CDPHE GW standard for Radium 226 and 228 is a combined value of 5 pc/l.

Units: pCi/L picocuries per liter; ug/L micrograms per liter

Lab Flags: J result is greater than the sample detection limit but less than the stated reporting limit; U result is less than the sample detection limit

Table 7 - CHDT Groundwater Monitoring Results – L6-3A

Parameter	Method	CDPHE GW Standard	Units	1st Q 2012 L6-3A	2nd Q 2012 L6-3A	3rd Q 2012 L6-3A	4th Q 2012 L6-3A
Gross Alpha [1]	9310 MOD	15	pCi/L	32	24	39	22.4
Gross Beta [2]	9310 MOD	50	pCi/L	4.2U	10.5	5.5	6.42
Radium 226 [3]	9315 MOD	5	pCi/L	0.4	0.35	0.21	0.241
Radium 228 [3]	9320 MOD	5	pCi/L	1.02	0.68	0.71	0.74
Uranium	D5174	30	ug/L	31.1	26.1	28.3	28

Notes:
[1] CDPHE GW standard for Gross Alpha excludes U and Rn.
[2] CDPHE GW standard for Gross Beta is a screening level.
[3] CDPHE GW standard for Radium 226 and 228 is a combined value of 5 pc/l.

Units
pCi/L picocuries per liter
ug/L micrograms per liter

Lab Flags
J result is greater than the sample detection limit but less than the stated reporting limit
U result is less than the sample detection limit

Table 8 - CHDT 2012 Radon Monitoring Results

Reported Radon Concentration (pCi/l)							
Location	ID Number	Q1 - 2012	Q2 - 2012	Q3 - 2012	Q4 - 2012	Average (pCi/L)	Maximum (pCi/L
Disposal Cell A	1	1.5	1.2	1.7	0.0	1.1	1.7
Disposal Cell B	2	1.4	1.0	1.6	1.6	1.4	1.6
Treatment Bldg North	3	0.8	0.3	0.9	1.0	0.8	1.0
Treatment Bldg. South	4	1.0	0.3	0.9	0.8	0.8	1.0
South Air Sampler (B)	5	1.2	1.0	1.5	1.9	1.4	1.9
North Air Sampler (A)	6	1.3	1.1	1.7	1.5	1.4	1.7
North Perimeter Fence	7	0.6	1.1	0.9	1.4	1.0	1.4
East Perimeter Fence	8	0.7	1.2	1.1	1.6	1.2	1.6
Gate 8	9	0.5	1.1	0.8	1.4	1.0	1.4
West Perimeter Fence	10	0.6	0.9	0.8	1.7	1.0	1.7

Table 9 - CHDT 2012 Environmental Dosimeter Monitoring Results

Gross (millirem)						
Location	Id Number	Q1 - 2012	Q2 - 2012	Q3 - 2012	Q4 - 2012	Total
Deploy Control	X9	44.2	45.2	45.2	43.6	178.2
Admin Bldg	1	39.1	40.5	44.2	40.2	164
Scale	2	39.5	40.9	37.7	34.7	152.8
West Fence	3	39.7	44.1	43.9	40	167.7
Gate 8	4	35.4	40.3	42.3	38.6	156.6
East Fence	5	41.1	42.4	44.4	37	164.9
North Fence	6	36.4	40.5	46.4	41.7	165
Gate 4	7	35.3	38.2	40.3	37.9	151.7
Lunch Room	8	40.3	38.5	40.1	38.5	157.4
Laboratory	9	33.5	32.8	37.2	34.8	138.3
Sample Bay	10	37.8	37.8	40.9	38.4	154.9
Maintenance	11	40.8	41	43.2	40.5	165.5
Treatment Building	12	35.9	35.2	40.5	36.5	148.1
Haul Road	13	41.4	43.5	42.4	37.6	164.9
South Air Sampler	14	38.3	39.9	39.1	68.5[1]	185.8
Disposal Cell	15	33.3	35.8	36.5	34.4	140
North Air Sampler	16	34.7	44	41.3	38.7	158.7
Net (millirem)						
Location	Id Number	Q1 - 2012	Q2 - 2012	Q3 - 2012	Q4 - 2012	Average
Admin Bldg	1	-5.1	-4.7	-0.9	-3.4	-3.5
Scale	2	-4.7	-4.3	-7.5	-8.9	-6.4
West Fence	3	-4.5	-1.1	-1.3	-3.6	-2.6
Gate 8	4	-8.7	-1.2	-2.9	-5	-4.5
East Fence	5	-3.1	-2.8	-0.8	-6.6	-3.3
North Fence	6	-7.8	-4.6	1.2	-1.9	-3.3
Gate 4	7	-8.9	-7	-4.9	-5.7	-6.6
Lunch Room	8	-3.9	-6.7	-5.1	-5.1	-5.2
Laboratory	9	-10.7	-12.4	-8	-8.8	-10.0
Sample Bay	10	-6.4	-7.4	-4.3	-5.2	-5.8
Maintenance	11	-3.4	-4.2	-2	-3.1	-3.2
Treatment Building	12	-8.3	-10	-4.7	-7.1	-7.5
Haul Road	13	-2.8	-1.7	-2.8	-6	-3.3
South Air Sampler	14	-5.9	-5.3	-3.8	-0.7	-3.9
Disposal Cell	15	-10.9	-9.3	-8.6	-9.2	-9.5
North Air Sampler	16	-9.5	-1.6	-3.9	-4.9	-5.0

[1]This dosimeter was left in place for two quarters.

Table 10 - CHDT Site-Specific CAP-88PC Population File

	Distance (meters)												
Direction	50	100	150	250	350	450	750	1500	2500	3500	4500	5500	7000
N	0	0	0	0	0	0	0	0	0	1	2	2	0
NNW	0	0	0	0	0	0	0	0	0	1	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	3	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	4
NE	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 11 - CHDT 2012 CAP-88PC Source Term

Uranium Series	Air Emission Activity (Ci)
U-238	8.47563E-08
Th-234	8.47563E-08
Pa-234m	8.47563E-08
U-234	8.47563E-08
Th-230	8.47563E-08
Ra-226	4.04106E-06
Rn-222	4.04106E-06
Po-218	4.04106E-06
Pb-214	4.04106E-06
Bi-214	4.04106E-06
Po-214	4.04106E-06
Pb-210	4.29697E-06
Bi-210	4.29697E-06
Po-210	4.29697E-06
Thorium Series	
Th-232	8.81212E-08
Ra-228	1.87962E-06
Ac-228	1.87962E-06
Th-228	1.87962E-06
Ra-224	1.87962E-06
Rn-220	1.87962E-06
Po-216	1.87962E-06
Pb-212	1.87962E-06
Bi-212	1.87962E-06
Po-212	1.20427E-06
Tl-208	6.75347E-07

Table 12 - CHDT 2012 Occupational Thermoluminescent Dosimetry Results

	Exposure in millirem					
Participant ID	**Q1**	**Q2**	**Q3**	**Q4**	**Average**	**DDE**
00002	0	0	0	0	0	0
00004	0	1	0		0.33	1
00012	0	0	0	0	0	0
00013	0	0	0	0	0	0
00014	0	0	0	0	0	0
00020	0	0	0	0	0	0
00025	0	0	0	0	0	0
00029	0	0	0	0	0	0
00030	0	0	0	0	0	0
00034	0	0	0	0	0	0
00035	0				0	0
00036	0				0	0
00038	0	0	0	0	0	0
00039		0	0	0	0	0
00040	0	0	0	1	0.25	1
00049	0	0	0	1	0.25	1
00059			0	0	0	0
00060			0	0	0	0

Table 13 – CHDT 2012 CEDE Calculations

2012 internal dose calculations for workers were determined using the results of lapel airsampling in the treatment building and active disposal cell work face during peak disposal activities. Lapel air samples were inadvertently run by the wrong laboratory method (EPA 901 instead of 903) for Radium-226 resulting in higher than optimal detection limits but ALARA goals were still met.

Worker 1

Radionuclide	Total (pCi)	Total - Accounting for respirator use (APF = 50) (pCi)	DCF (mrem/pCi)	CEDE (mrem)
U-234	0.0	0.0	1.32E-01	0.0
U-238	0.0	0.0	1.18E-01	0.0
Th-228	0.0	0.0	3.42E-01	0.0
Th-230	833.9	16.7	3.26E-01	5.4
Th-232	0.0	0.0	1.64E+00	0.0
Ra-226	0.0	0.0	8.58E-03	0.0
			Total	5.4

Worker 2

Radionuclide	Total (pCi)	Total - Accounting for respirator use (APF = 50) (pCi)	DCF (mrem/pCi)	CEDE (mrem)
U-234	0.0	0.0	1.32E-01	0.0
U-238	0.0	0.0	1.18E-01	0.0
Th-228	0.0	0.0	3.42E-01	0.0
Th-230	543.2	10.9	3.26E-01	3.5
Th-232	0.0	0.0	1.64E+00	0.0
Ra-226	71473.7	1429.5	8.53E-03	12.2
			Total	15.7

7.0 APPENDIX 1 – ALARA PROGRAM AUDIT

2012 ALARA Program Audit and 2013 ALARA Goals

Approvals

Clyde E. Christman, RRPT, Clean Harbors RSO

John Kehoe, Clean Harbors General Manager

Clean Harbors Deer Trail, LLC (CHDT) performs an annual program audit of the As Low As Reasonably Achievable (ALARA) Program as a condition of the Colorado Department of Public Health and Environment (CDPHE) Radioactive Materials License number CO 1102-01. The audit consists of a review of operations of the past year and the establishment of the facility ALARA goals for the upcoming year.

A stand-alone procedure, *SOP 15.RPP.07, ALARA, Revision 1* was developed and implemented as part of the Radioactive Materials License renewal process. The new procedure requires an ALARA Review whenever predetermined thresholds are exceeded or are anticipated to be exceeded.

REVIEW OF THE 2012 OPERATIONS

CHDT received and disposed of over 23,000 tons of radioactive materials in 2012. The materials were dispositioned by both direct burial and through treatment prior to burial.

2012 Occupational Exposure ALARA Goal

The ALARA goal for occupational exposure at CHDT is 25 millirem (mrem) per year. The highest occupational exposure for 2012 was 15.7mrem. This goal was met.

Personnel Contamination Events

The CHDT ALARA goal for personnel contaminations in 2012 was zero (0). This goal was met.

Spills

The CHDT ALARA goal for spills in 2012 was zero (0). This goal was met.

2013 OPERATIONS

No changes or additions to any facilities other than maintenance or information technology upgrades are anticipated in 2013. Radioactive materials containing NORM and TENORM are expected to continue as a portion of the overall waste acceptance at CHDT.

2013 ALARA Goals

Occupational Exposure

The 2013 ALARA goal for occupational exposure is unchanged from 2012 and remains 25 mrem for any personnel.

Personnel Contamination Events

The CHDT ALARA goal for personnel contaminations in 2013 is zero (0). Personnel requiring decontamination in accordance with Section 5.2 of *Standard Operating Procedure (SOP) 15.OPS.12, Personnel Contamination Surveys, Revision 2* defines personnel contaminations.

Spills

The CHDT ALARA goal for spills in 2013 is zero (0). Spill events, surveys and responses are defined in *SOP 15.Ops.14, Spill Surveys, Revision 1*

8.0 APPENDIX 2 – 2012 CAP-88PC REPORT