Rio Algom Mining LLC

January 23, 2017

Mr. Jeffrey A. Whited
Nuclear Regulatory Commission
Two White Flint, Mail Stop T8F5
11545 Rockville Pike
Rockville, MD 20852
Docket Number: 40-8905

Re: **Ambrosia Lake Facility**
License SUA-1473, Docket No. 40-8905
License Condition #34
2nd Half 2016 Groundwater Stability Monitoring Report

Dear Mr. Whited:

Pursuant to license condition #34 for License SUA-1473, attached is the Semi-Annual Groundwater Stability Monitoring Report for the Second Half of 2016. This report describes the results associated with the groundwater stability monitoring plan established by Amendment #56.

A digital copy of the report is also included in the package.

If you have any questions or need additional information, please call me at (209)736-4803.

Sincerely,

Rio Algom Mining LLC

Theresa Ballaine
Manager

Attachment: As stated

cc: NRC – Document Control (certified mail)
NMED, Kurt Vollbrecht (email)
DOE, Rich Bush (email)
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RIO ALGOM LLC
AMBROSIA LAKE FACILITY

License SUA-1473 Docket 40-8905

Groundwater Stability Monitoring Report

Second Half 2016

January 23, 2017

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ACRONYMS AND ABBREVIATIONS

ACL	alternate concentration limit
AOD	Assurance of Discontinuance
CAP	corrective action program
GPS	groundwater protection standard
KD	Dakota Sandstone
LTSM	long-term surveillance and maintenance boundary
mg/L	milligrams per liter
NMED	New Mexico Environment Department
NRC	Nuclear Regulatory Commission
pCi/L	picocuries per liter
POC	point of compliance
POE	point of exposure
RAML	Rio Algom Mining LLC
Site	Rio Algom Mining LLC – Ambrosia Lake Facility
SOP	standard operating procedure
TRA	Tres Hermanos A
TRB	Tres Hermanos B

RIO ALGOM MINING LLC
AMBROSIA LAKE FACILITY
GROUNDWATER STABILITY MONITORING REPORT – FIRST HALF 2016

Nuclear Regulatory Commission (NRC) source material license SUA-1473, Condition #34(D), requires Rio Algom Mining LLC (RAML) to submit semiannual groundwater monitoring reports associated with the facility's groundwater stability monitoring plan established by Amendment 56. Condition 34.D states:

> *Submit, by February 1 and August 1 of each year groundwater monitoring reports to include a minimum of the following: potentiometric surface maps for each aquifer; time vs. concentration plots for all parameters for which ACLs have been issued, hydrographs for the downgradient most trend well or POE well in each aquifer, hydraulic gradient calculations, and tabulated analytical data for each ACL parameter for each well.*

1.0 BACKGROUND

RAML's Ambrosia Lake facility (Site) is located in McKinley County, approximately 24 miles due north of Grants, New Mexico, in the Ambrosia Lake valley. Uranium milling activities started at the Site in 1957. The waste management structures were Tailings Impoundments 1 and 2, Decantation Pond 3, and Evaporation Ponds 4 through 10. Tailings Impoundments 1 and 2 were built in 1958, along with Pond 3 at the eastern toe of Tailings Impoundment 1, to accept decanted tailings liquids. Tailings were first produced at the Site in November 1958. In 1976, RAML diverted the natural course of the Arroyo del Puerto east of Ponds 4, 5, and 6, and lined Ponds 9 and 10. The solids fraction of the tailings was disposed through a slurry transfer system to the tailings impoundments, while the liquids fraction was transferred to the evaporation ponds. Evaporation Pond residues from Ponds 3, 4, 5, 6, 7, and 8 were placed in Tailings Impoundments 1 and 2 prior to final reclamation. All the aforementioned tailings impoundments and ponds were unlined. Seepage from the tailings impoundments and Evaporation Ponds 3 through 6, along with seepage from unrelated mining and milling operations, saturated and impacted the alluvium of the Arroyo del Puerto. Seepage from the tailings impoundments and Evaporation Ponds 7 and 8 recharged and impacted the Tres Hermanos B sandstones within the Mancos Formation shale, and the Dakota Sandstone, which underlies the Mancos Formation.

Consequently, in 1983, RAML entered into an Assurance of Discontinuance (AOD) with the State of New Mexico Environmental Improvement Division (currently the New Mexico Environment Department [NMED]) to minimize the future impact of mill tailings solutions seepage on groundwater. The approved AOD remedial action required the construction and maintenance of an interceptor trench (IT-1) and the cessation of discharges to unlined Ponds 4 through 8. These

ponds were taken out of service in 1983. In the late 1990s, RAML added interceptor trenches IT-2, IT-3, and IT-4 south of Pond 10 to collect seepage potentially missed by IT-1.

In 1986, after the State of New Mexico relinquished its licensing authority over uranium mill activities, NRC reasserted jurisdiction at the Site and required that the Site begin a groundwater detection monitoring program. Data from this program were the basis for the groundwater protection standards (GPSs) established for the Site by NRC, and a corrective action program (CAP) for the groundwater was developed based on this information. The CAP required pumping, treating, and discharging treated groundwater into the Arroyo del Puerto. The treated groundwater would sweep through the alluvium, creating a hydraulic barrier between the tailings ponds and the Arroyo del Puerto while flushing existing impacts toward the interceptor trench where it was captured and disposed of into tailings impoundment 1. RAML implemented the CAP beginning in the mid-1980s, however, the CAP and its requirements to pump and treat were removed when the alternate concentration limit (ACL) petition was granted by the NRC in 2006.

Mining and milling operations in the area have had two notable hydrologic effects: creation and maintenance of a saturated zone at the base of the alluvium, and creation of a cone of depression in bedrock aquifers due to dewatering of underground mines. The saturated zone in the alluvium has continued to decrease since the mine dewatering, milling processes, and CAP was terminated.

2.0 SECOND HALF 2016 ACTIVITIES

Activities associated with the groundwater monitoring program at the mill facility during the second half of 2016 consisted of performing sampling pursuant to SUA-1473. The well network was designed to track and assess groundwater impacts between the tailings impoundment and the point of exposure (POE) which is the long-term surveillance and maintenance boundary (LTSM) in the alluvium, Tres Hermanos A, Tres Hermanos B, and the Dakota Sandstone. The ACLs for the Site are presented in **Table 1** below.

Table 1. Rio Algom Mining – Ambrosia Lake Operation Alternate Concentration Limits

Parameter	Dakota	Tres Hermanos A	Tres Hermanos B	Alluvium
U-nat (mg/L)	1.6	No ACL	1.6	23
Th-230 (pCi/L)	945	945	945	13,627
Ra-226 and -228 (pCi/L)	218	218	218	3,167
Pb-210 (pCi/L)	88	88	88	1,274
Gross Alpha (pCi/L)	No ACL	No ACL	No ACL	8,402
Molybdenum (mg/L)	No ACL	No ACL	No ACL	176
Nickel (mg/L)	6.8	No ACL	6.8	98
Selenium (mg/L)	No ACL	No ACL	No ACL	49
Chloride (mg/L)	3,200	1,070	2,810	7,110
Nitrate (mg/L)	22.8	9.2	7.7	351
Sulfate (mg/L)	6,480	2,584	4,760	12,000
Total Dissolved Solids (mg/L)	14,100	6,400	11,700	26,100

mg/L = milligrams per liter
pCi/L = picocuries per liter

Appendix 1 of this report contains the analytical data for the Dakota, Tres Hermanos A, Tres Hermanos B, and alluvial units. **Appendix 2** contains the time versus concentration plots for the ACL parameters for the Dakota, Tres Hermanos A, Tres Hermanos B, and alluvial units.

Appendix 3 contains the hydrographs for the most downgradient monitoring well for the Dakota, Tres Hermanos A, Tres Hermanos B, and alluvial units. The most notable observation in the data is that the potentiometric surface in the alluvium continues to decline. For example, RAML has observed a decline of over 30 feet at monitoring well 32-69 since February of 2005. This drop is attributable to the discontinuance of the alluvial CAP, which was maintaining the artificial water mound in the vicinity of the Site. RAML's groundwater flow model projected a 65- to 100-year period for the alluvium to dewater following cessation of the CAP. This water table drop acts to slow the lateral migration rate of milling-related seepage.

RAML determined the hydraulic gradients by calculating the difference in groundwater elevation between the most upgradient point of compliance (POC) well in each unit and the farthest downgradient well in the same unit. That value was then divided by the distance along a flow path between the two wells. Results of these calculations are summarized below:

- Dakota Sandstone – 0.035 foot per foot
- Tres Hermanos A Sandstone – 0.002 foot per foot
- Tres Hermanos B Sandstone – 0.016 foot per foot
- Alluvium – 0.008 foot per foot

Appendix 4 contains monitoring well network and potentiometric surface maps for the Dakota, Tres Hermanos A, Tres Hermanos B, and alluvial units.

3.0 IMPROVEMENTS TO THE MONITORING PROGRAM

Improvements to the groundwater monitoring program include replacing monitoring wells where measured total depth varied from total depth on construction logs, or wells with visible or suspected damage. The ACL wells that have been replaced are alluvial wells 5-03, 5-08, and 5-73; Dakota wells 30-48 KD and 32-45 KD; Tres Hermanos A well 31-01 TRA; and Tres Hermanos B well 31-02 TRB. The well-replacement program was completed in 2013. Analytical data and time-concentration plots for the replacement wells are included in **Appendices 1** and **2**, respectively, and sampling results are discussed in Section 4.0.

Dedicated pumps have been installed in 17 of the NRC groundwater monitoring network wells including 5-03 ALL-R, 5-08 ALL-R, 5-73 ALL-R, 30-48 KD-R, 31-02 TRB-R, 32-45 KD-R, 32-50 TRB-R, 36-06 KD, 33-01 TRA, 19-77 TRB, 31-67 TRB, 36-02 TRB, 32-59 ALL, 31-61 ALL, 31-65 ALL, and 5-04 ALL. A dedicated electric submersible pump was installed in 17-01 KD due to its depth.

3.1 Wells Requiring Further Investigation

Monitoring wells 30-02 KD and 30-01 TRA have not contained sufficient water to collect a sample since 2012 and 2009, respectively. Review of the well construction diagrams for 30-02 KD and 30-01 TRA revealed 20 feet of solid casing (or sump) below the bottom of the screened interval in each well.

Desaturation of the alluvium and upper bedrock units is expected at the Site due to the termination of surface water discharge associated with the groundwater CAP in 2006. The unusual well construction of 30-02 KD and 30-01 TRA (20-foot sump) creates uncertainty in groundwater elevation measurements, since the water level in those wells is below the screened interval. 30-02 KD is one of six monitoring wells in the Dakota aquifer. According to available screen depth and depth-to-water measurements, the last sample collected from within the screened interval of 30-02 KD was in 1988. Similarly, a representative groundwater sample from within the screened interval for 30-01 TRA was last collected in 1998. Collecting a sample from the screened interval of these monitoring wells ensures that the sample is representative of formation groundwater, however, since the water levels are below the screened interval, the water in the sumps is likely stagnant water. For these reasons, RAML proposes to review historical data for these wells and present justification for plugging and abandoning these wells in a request for a license amendment.

4.0 DATA EVALUATION

As a component of the ACL approval process, NRC not only established ACLs for specific parameters, but also maintained the GPSs for those constituents for which ACLs were not proposed. Data collected during the second half of 2016 were compared to ACLs and GPSs. Notable results are described in detail in the following sections.

4.1 Dakota Sandstone

Analytical results from groundwater samples collected from the Dakota well network are tabulated in **Appendix 1** and presented in time series plots for the ACL parameters in **Appendix 2.** Dakota monitoring wells 36-06 KD and 32-45 KD-R have been monitored monthly due to exceedances of GPSs for beryllium, cadmium, and gross alpha in 36-06 KD and molybdenum in 32-45 KD-R. The results of monthly monitoring are discussed below. Groundwater sampling results from Dakota monitoring wells 17-01 KD and 30-48 KD-R did not reveal any exceedances of ACLs or GPSs in the second half of 2016. Lead-210 (pb-201) results for second half 2016 were reported at higher activities in many KD wells (**Appendix 2**); however, these results did not exceed ACLs. Monitoring wells 5-02 KD and 30-02 KD did not contain enough water for sample collection.

4.1.1 36-06 KD

Monitoring well 36-06 KD has been monitored monthly for beryllium, cadmium, gross alpha, and uranium. RAML's interpretation, as previously discussed with NRC, is that fluctuations in groundwater quality in 36-06 KD appear to be linked to surface reclamation work.

4.1.1.1 Beryllium and Cadmium

Elevated beryllium concentrations were identified in 2006 in Dakota POC monitoring well 36-06 KD. As a result of this condition, RAML submitted a proposed CAP on January 15, 2007, to address the beryllium concentrations present within monitoring well 36-06 KD. This CAP was approved by NRC on April 30, 2007.

The initial increasing trend in beryllium concentrations (2001-2007) correlated with surface field work in the vicinity of the well. The increasing trend in beryllium has stabilized, and concentrations trended downward after 2007. RAML proposed to continue monthly monitoring of well 36-06 KD for beryllium so that additional data would be available. Although the beryllium concentration in groundwater samples from monitoring well 36-06 KD continues to exceed the GPS of 0.01 mg/L, it appears to be relatively stable between 0.015 and 0.0225 mg/L since 2014 (**Table 2** and **Figure 1**).

Table 2. Second Half 2016 Analytical Summary for Beryllium and Cadmium in Monitoring Well 36-06 KD

Date	Beryllium (mg/L)	Cadmium (mg/L)
GPS (mg/L)	**0.01**	**0.01**
7/18/2016	**0.0217**	**0.0114**
8/10/2016	**0.01587**	**0.0105**
9/20/2016	**0.01534**	0.0073
10/10/2016	**0.01239**	0.0065
11/22/2016	**0.0133**	0.0075
12/14/2016	**0.0124**	**0.0156**

*Bold values indicate an exceedance of the KD GPS.

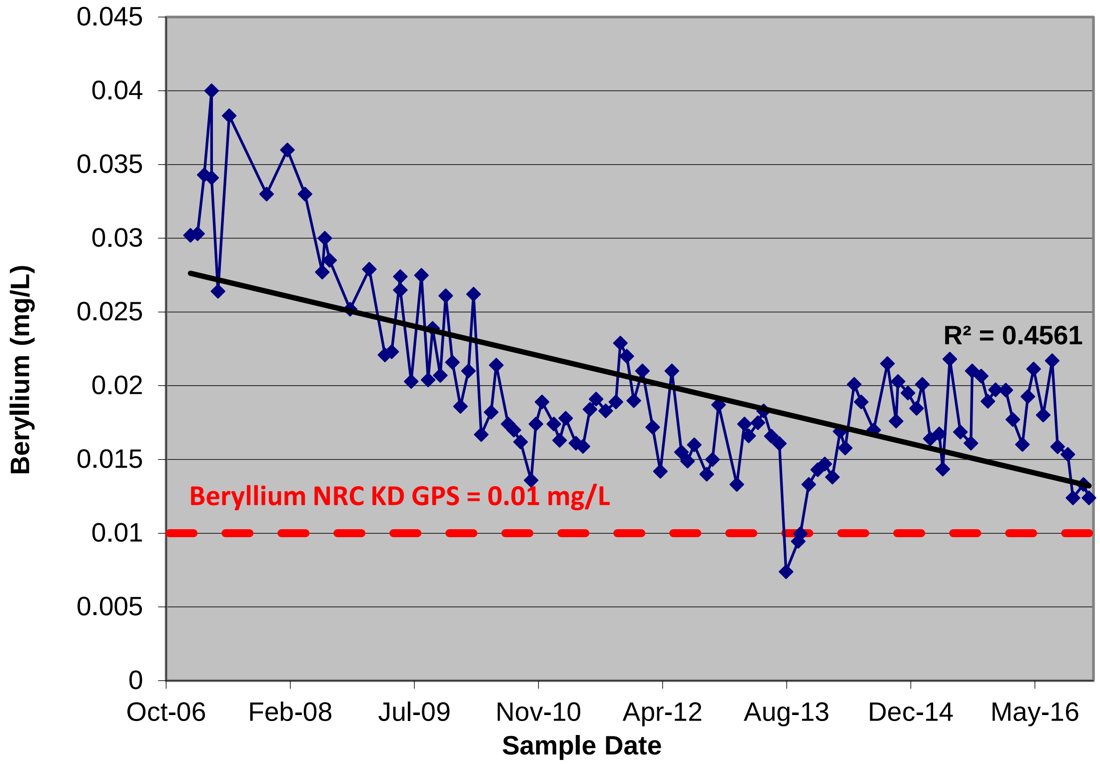


Figure 1. Beryllium Concentrations in Dakota Monitoring Well 36-06 KD

In 2009 RAML instituted a policy of third-party review of laboratory data within five working days of receipt of data. As a result of this policy, RAML was made aware that cadmium concentrations in the samples of groundwater from monitoring well 36-06 KD had exceeded the GPS of 0.01 mg/L during several sampling rounds beginning in November 2007 (**Figure 2**).

Cadmium concentrations in monitoring well 36-06 KD follow a pattern that is very similar to both uranium and beryllium concentrations in the same well. These constituents increase when pH decreases and decrease when pH increases. As with uranium and beryllium, cadmium concentrations continue to exhibit an overall decreasing trend and were below the GPS in samples collected during the February, April, and June sampling events for monitoring well 36-06 KD (**Table 2** and **Figure 2**).

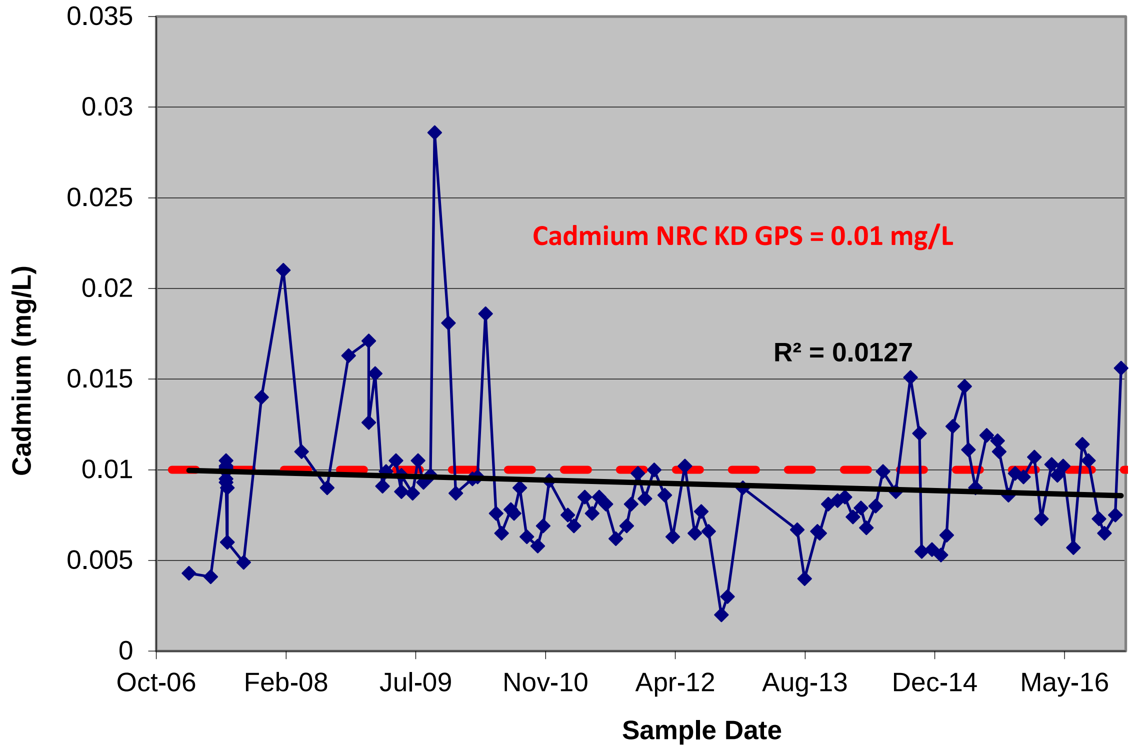


Figure 2. Cadmium Concentrations in Dakota Monitoring Well 36-06 KD

4.1.1.2 Gross Alpha and Uranium

At the time of the Bedrock ACL application (AVM and AHA, 2000), gross alpha, among other constituents, was in exceedance of the GPS in the Dakota aquifer. Since ACLs were being proposed for alpha emitters Th-230 and Ra-226, an ACL for gross alpha was deemed unnecessary and duplicative. The Bedrock ACL application proposed that the GPS for gross alpha be removed from the license as a hazardous constituent in bedrock aquifers and noted that a GPS for gross alpha is unnecessary since the alpha activity hazard is addressed by ACLs for uranium, Th-230, Ra-226, and Pb-210 (which decays to Po-210). Additionally, the Proposed Groundwater Stability Monitoring Plan (included in the December 7, 2005, Response to RAIs Accession number ML053480214 [RAML, 2005]) does not list gross alpha as a monitoring constituent for any of the bedrock units. In the Technical Evaluation Report, which was prepared by the NRC (NRC, 2006)

to document its review of the of the various submittals during the six-year ACL application process, NRC acknowledges that gross alpha was evaluated as a constituent of concern and that the proposed ACLs (including ACLs for radiologic constituents) are appropriate and protective of human health and the environment; however, an ACL for gross alpha was never proposed by RAML, likely because the ACLs for the major alpha-emitting constituents were proposed instead and because the GPS for gross alpha was requested to be removed from the license.

In order to evaluate the gross alpha counts in water from 36-06 KD, factors including alpha-emitting constituents, laboratory uncertainty, and alpha-emitter compliance standards were considered. Semiannual samples collected in 36-06 KD are also analyzed for alpha emitters Th-230 and Ra-226. The monthly samples are analyzed for gross alpha and uranium. **Table 3** shows the results of the alpha emitters, the calculated gross alpha based on these results, the measured gross alpha minus uranium, and the corresponding ACL/GPSs from 2014 to the present. It is important to note that alpha emitters in the Dakota Sandstone are subject to ACLs, while gross alpha has a more conservative GPS. The sum of the ACLs for the major alpha emitters (Th-230 and Ra-226) is 1,163 pCi/L, which is 20 times greater than the gross alpha GPS of 56 pCi/L.

Table 3. Summary of the Effects of Gross Alpha Calculation Methods in Monitoring Well 36-06 KD.

Date Sampled	Ra-226 (pCi/L)	Th-230 (pCi/L)	Gross Alpha[A] (Summed Isotopes) (pCi/L)	Gross Alpha (U Corrected) (pCi/L)
GPS/ACL	**218 (ACL)**	**945 (ACL)**	**56 (GPS)**	**56 (GPS)**
6/10/2014	9.2	29	38.2	55.5
9/24/2014	10	25	35	-122
11/6/2014	15	13	28	**68.9**
2/11/2015	12	30	42	-39.4
8/26/2015	11	13	24	-66.1
2/11/2016	16	11	27	-18
7/18/2016	19	84	**103**	34

*Bold values indicate an exceedance of the KD gross alpha GPS of 56 pCi/L.

[A]Gross Alpha (Summed Isotopes) is calculated from the sum of Ra-226 and Th-230 activities. Isotopes selected for the Gross Alpha summation have long half lives, are alpha emitters, and are sourced from either U-238 or Th-232, the most abundant isotopes of each element.

The gross alpha analysis is performed in accordance with EPA Method 900.0. This method is a commonly used gross alpha screening method for groundwater. The corrected gross alpha values are presented in **Table 4.** One out of six of the corrected gross alpha values (gross alpha – gross alpha derived from uranium) were greater than the GPS of 56 pCi/L in the second half of 2016. **Figure 3** shows gross alpha results over time with error bars signifying the range of possible

results. Monthly sampling and analysis will continue for gross alpha and uranium in 36-06 KD pending preparation of a license amendment with proposed modifications to the gross alpha standards in the upper bedrock units.

Table 4. Second Half 2016 Analytical Summary for Gross Alpha and Uranium in Monitoring Well 36-06 KD

Date	Corrected Gross Alpha Value (pCi/L)	Uranium (mg/L)
GPS/ACL	**56 (GPS)**	**1.6 (ACL)**
7/18/2016	34	0.9195
8/10/2016	**130**	0.5229
9/20/2016	-69	0.7450
10/10/2016	**58**	0.6604
11/22/2016	22	0.5786
12/14/2016	-46	0.636

*Bold values indicate an exceedance of the KD GPS or ACL.

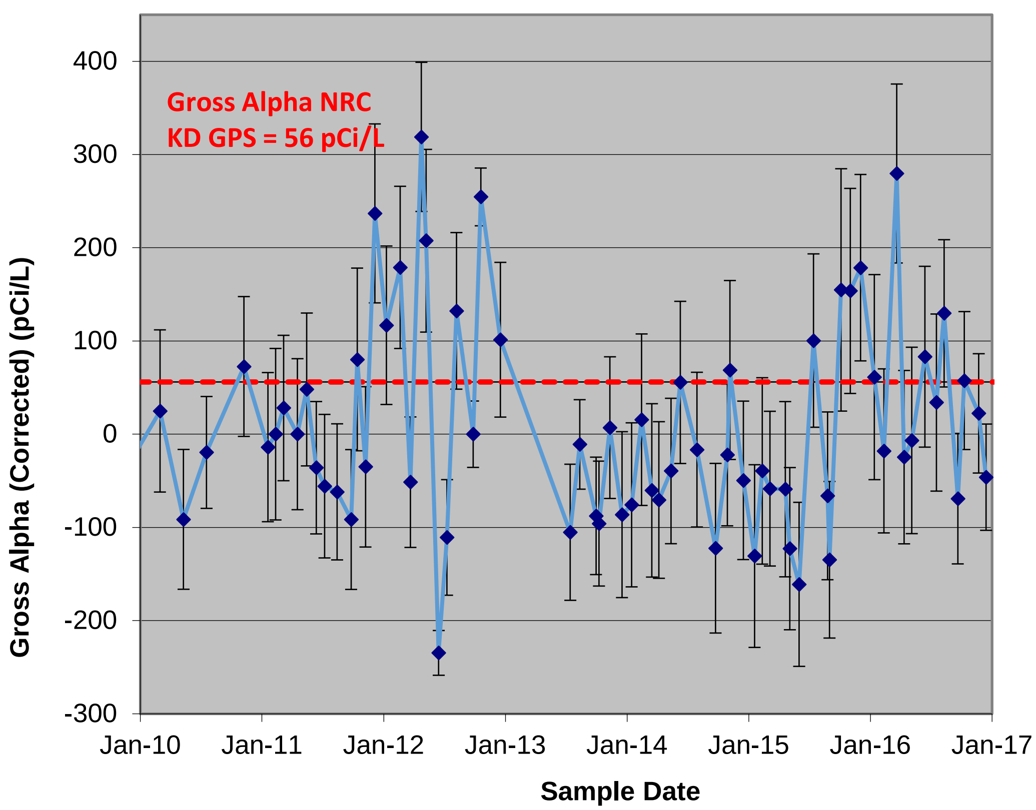


Figure 3. Gross Alpha Activities in Dakota Monitoring Well 36-06 KD

Uncertainties in gross alpha analysis are due to application of an analytical method for drinking water (EPA method 900.0) to waters with high dissolved solids. In an effort to find a more appropriate method that could minimize interference with dissolved solids, split samples collected May 5, 2016 were analyzed by ACZ Laboratories using EPA method 600/00-02. The primary difference between EPA methods 900.0 and EPA method 600/00-02 is that EPA method 900 is based on evaporation of the sample, therefore increasing interference from solids content. EPA method 600/00-02 is based on precipitation of a barium-radium sulfate and iron oxy-hydroxides, which should sorb most common alpha emitters. However, this method can have interferences from high barium and/or calcium contents. The results of the split sampling are summarized in **Table 5**. Analysis by EPA method 600/00-02 did not result in more precise results for the samples tested.

Table 5. Comparison of EPA Methods for Gross Alpha Analysis

Location	Uncorrected Gross Alpha	Uncertainty	Uncorrected Gross Alpha & Beta	Uncertainty
EPA Method	**900.0 (Evaporation)**	**900.0 (Evaporation)**	**600/00-02 (co-precipitation)**	**600/00-02 (co-precipitation)**
31-02 TRB-R	41	33	50	40
36-06 KD	**670**	100	390	90

4.1.2 32-45 KD-R

Pursuant to Condition 34.F and Criterion 5D of 10 CFR part 40 Appendix A, RAML proposed a CAP to address the exceedances of nitrate and molybdenum in 32-45 KD-R in the *Groundwater Stability Monitoring Report, Second Half 2014* (RAML, 2015a). Since 32-45 KD-R is a replacement well, RAML proposed the continuation of monthly monitoring for these parameters to gather more information as the well continues to stabilize. Nitrate concentrations in monitoring well 32-45 KD-R have continued to decrease and have remained below the ACL of 22.8 mg/L since April 2015. RAML ceased monthly analysis of nitrate in 32-45 KD-R after the February 2016 event as described in the *Groundwater Stability Monitoring Report, Second Half 2015* (RAML, 2016). Nitrate in 32-45 KD-R will continue to be analyzed on a semiannual basis.

4.1.2.1 Molybdenum

Molybdenum in 32-45 KD-R reached a maximum concentration of 0.505 mg/L in March of 2015. Although concentrations have been decreasing, they continue to exceed the GPS of 0.06 mg/L (**Figure 4**). **Table 6** presents molybdenum concentrations in monitoring well 32-45 KD-R during the second half of 2016. Time series plots for molybdenum (**Figure 4**) in 32-45 KD-R show that concentrations during the second half of 2016 appear to follow a generally decreasing trend. While molybdenum remains above the GPS of 0.06 mg/L, the concentrations appear to be stabilizing.

Table 6. Second Half 2016 Analytical Result Summary for Molybdenum in Monitoring Well 32-45 KD-R

Sample Date	Molybdenum (mg/L)
GPS/ACL	**0.06 (GPS)**
7/18/2016	**0.3073**
8/11/2016	**0.241**
9/20/2016	**0.2724**
10/10/2016	**0.2564**
11/22/2016	**0.2382**
12/14/16	**0.239**

*Bold values indicate an exceedance of the KD GPS or ACL.

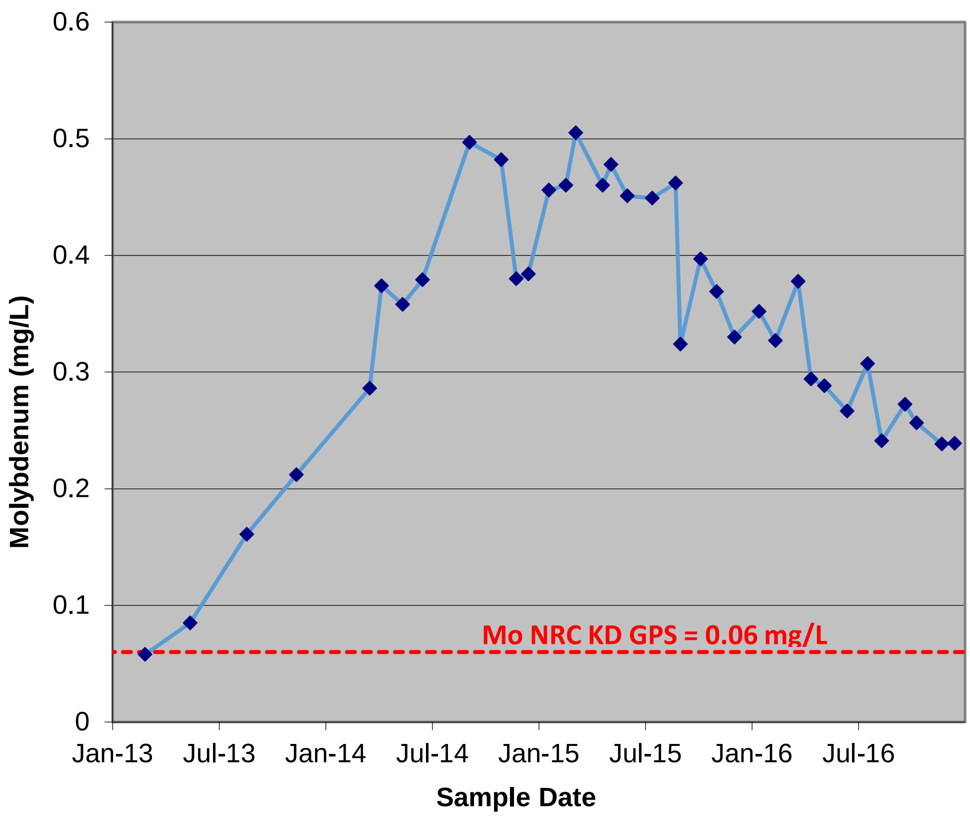


Figure 4. Molybdenum Concentration in Dakota Monitoring Well 32-45 KD-R

Molybdenum is known to occur naturally near uranium deposits (Guilbert & Park, 1986). Molybdenum is not included in primary or secondary EPA Maximum Contaminant Levels for

drinking water; however, NMED has a molybdenum standard for irrigation, which is 1.0 mg/L, and concentrations of molybdenum in this well are less than that standard.

Monthly sampling and analysis for molybdenum will continue pending preparation of a License amendment, which may include a proposed GPS modification or an ACL for molybdenum in the Dakota aquifer.

4.2 Tres Hermanos A

Analytical results from Tres Hermanos A wells are tabulated in **Appendix 1** and presented graphically as time series plots in **Appendix 2**. As discussed in Section 3.1, well 30-01 TRA did not contain enough water to collect a sample. Groundwater from Tres Hermanos A well 33-01 TRA did not exceed ACLs or GPSs. Groundwater from well 31-01 TRA-R exceeded the Tres Hermanos A GPS for molybdenum (0.03 mg/L) in the sample collected on July 26, 2016 with a value of 0.0439 mg/L. The well was resampled on August 29, 2016, within seven days of the lab reported exceedance, with a result of 0.0261 mg/L, which is below the GPS for molybdenum.

4.3 Tres Hermanos B

Analytical results from Tres Hermanos B wells are tabulated in **Appendix 1** and presented graphically as time series plots in **Appendix 2**. Second half 2016 results for Pb-210 were reported in activities higher than normal for many TRB wells (**Appendix 2**), however the ACLs were not exceeded. Well 36-01 TRB was last sampled in 2009, and has not contained enough water for a sample since then. Groundwater collected from Tres Hermanos B wells 19-77 TRB, 31-02 TRB-R, 31-67 TRB, and 36-02 TRB did not exceed ACLs or GPSs in the second half of 2016.

4.3.1 31-02 TRB-R

Uranium concentrations in groundwater samples collected from former monitoring well 31-02 TRB from July through November of 2011 exceeded the ACL of 1.6 mg/L. RAML continued monthly sampling, and uranium concentrations were observed below the ACL throughout 2012. As part of the Site-wide well-replacement program, monitoring well 31-02 TRB was identified for replacement and a new well (31-02 TRB-R) was installed on December 14, 2012. Monthly sampling and analysis for uranium and gross alpha in well 31-02 TRB-R continued and results are provided below.

4.3.1.1 Uranium and Gross Alpha

Results from groundwater sampling for the second half of 2016 are presented in **Table 7.** Gross alpha over time is shown in **Figure 5**. Uranium concentrations in this replacement well have never exceeded the ACL. Gross alpha activity was above the GPS of 21 pCi/L in September and October 2016 (**Table 7**).

Table 7. Second Half 2016 Analytical Summary for Uranium and Gross Alpha in Monitoring Well 31-02 TRB-R

Date	Uranium (mg/L)	Gross Alpha Corrected (pCi/L)
ACL/GPS	**1.6 (ACL)**	**21 (GPS)**
7/18/2016	0.0045	4.7
8/11/2016	0.0041	9.3
9/20/2016	0.005	**43**
10/10/2016	0.0043	**29**
11/22/2016	0.0042	5
12/14/2016	0.0048	20

*Bold values indicate an exceedance of the TRB GPS.

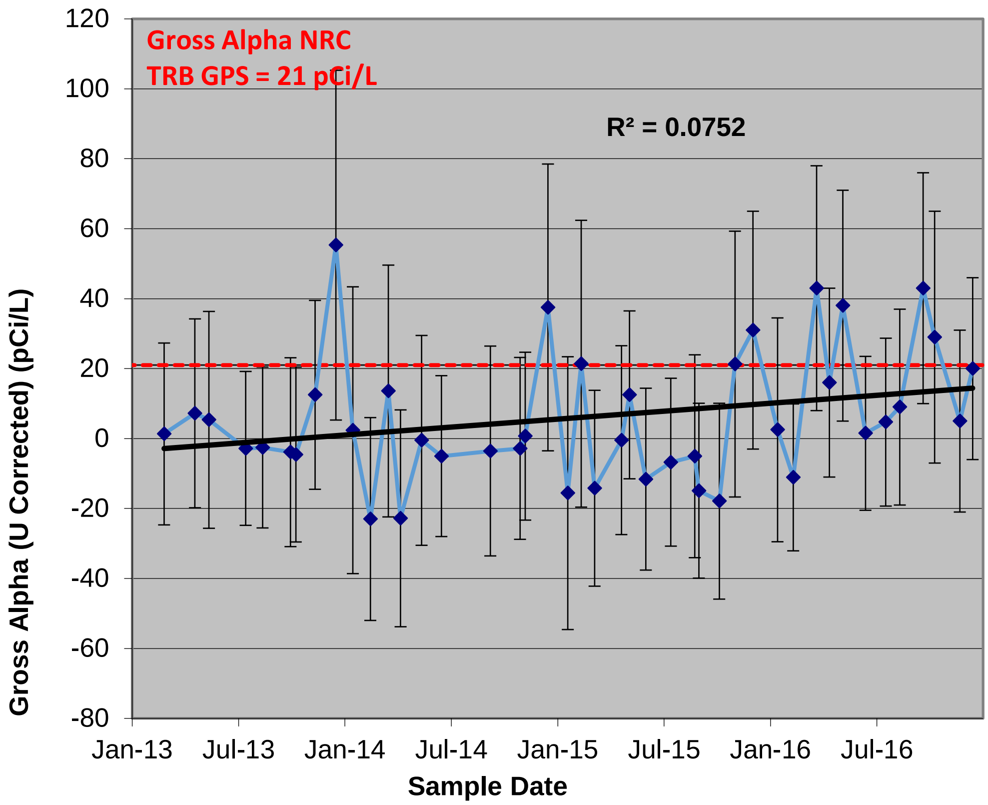


Figure 5. Gross Alpha (U Corrected) Activities in Tres Hermanos B Monitoring Well 31-02 TRB-R

As with the gross alpha results in 36-06 KD described in Section 4.1.1.2, the Tres Hermanos B does not have an ACL for gross alpha, but does have ACLs for the other alpha emitters. Monthly

sampling and analysis will continue for gross alpha and uranium in 31-02 TRB-R, pending preparation of a license amendment with proposed modifications to the gross alpha standards in the upper bedrock units.

4.4 Alluvium

Analytical results from the alluvial well network are tabulated in **Appendix 1** and presented graphically as time series plots in **Appendix 2**. As with Pb-210 in the KD and TRB, some results for the second half of 2016 were reported in activities that are higher than normal. No Pb-210 activities exceeded ACLs. MW-24 ALL did not contain enough water to collect a sample. Groundwater from all other alluvial wells did not exceed ACLs.

4.5 Pb-210

All measured activities of Pb-210 from samples collected during the 2nd Half 2016 sampling event were atypically high compared to historic results. The cause of these elevated results is due to dilution of the samples by the analytical laboratory in order to minimize the effects of matrix interferences. However, due to the naturally low Pb-210 activities, when the sample was diluted the effects of the instrument background were magnified, resulting in reported values that are greater than normal. No exceedances of ACLs occurred. Future samples will not be diluted.

Any remaining samples from the 2nd Half of 2016 will be reanalyzed for Pb-210 using undiluted aliquots. The results will be submitted with the 1st Half 2017 semi-annual report. There is no remaining sample volume from wells 36-06 KD, 5-73 ALL-R, 5-03 ALL-R, and 31-61 ALL; it will not be possible to re-run Pb-210 analysis on these samples.

5.0 CONCLUSIONS

Table 8 summarizes the notable results from the second half of 2016 groundwater monitoring and provides path forward recommendations.

**Table 8. Rio Algom Mining – Ambrosia Lake
Second Half 2016 Summary and Path Forward**

Well	Summary	Status	Path Forward
36-06 KD	Beryllium, cadmium, and gross alpha above GPSs	CAP submitted for beryllium 2007; monthly monitoring (plus uranium)	Continue with monthly monitoring until development and approval of ACLs or GPS modification for gross alpha for License Amendment.
32-45 KD-R	Molybdenum above GPS	Replacement well stabilizing, monthly monitoring	Continue with monthly monitoring and quarterly reporting for molybdenum until concentrations drop below the GPS; consider revision of GPS for molybdenum in upcoming License Amendment.
31-02 TRB-R	Gross alpha above GPS	Replacement well stabilizing; monthly monitoring	Continue monthly monitoring and quarterly reporting until well stabilizes; consider revision of GPS or ACLs for License Amendment.

RAML proposes to continue monthly sampling of constituents exceeding their GPS. Replacement wells that are in the process of stabilization will also be sampled monthly for constituents exceeding GPSs or ACLs. If exceedances continue to occur after wells have stabilized, a CAP will be proposed and submitted to NRC. Wells with construction specifications that allow for collection of samples that may not be representative of formation conditions will be monitored for total depth and depth to water, and sampled if the water level is sufficient.

Monitoring of the well network is required on a semiannual basis, with the exception of the wells involved in accelerated monthly sampling. RAML will continue to conduct monthly and semiannual monitoring in accordance with the requirements in Condition #34 of the License.

6.0 REFERENCES

AVM Environmental Services, Inc., and Applied Hydrology Associates, Inc. (AVM and AHA), 2000. *Corrective Action Program and Alternate Concentration Limits Petition for Upper Most Bedrock Units Ambrosia Lake Uranium Mill Facility Near Grants, New Mexico*.

Guilbert, J.M. and C.F. Park, 1986. *The Geology of Ore Deposits*. Waveland Press, IL.

Rio Algom Mining LLC (RAML), 2005. Response to Request for Additional Information. Rio Algom Mining LLC License Amendment for Alternate Concentration Limits Non-Hazardous Constituents. December 2005. ML053480214, Dec. 7.

———, 2015a. *Rio Algom LLC Ambrosia Lake Facility, License SUA-1473 Docket 40-8905, Groundwater Stability Monitoring Report, Second Half 2014.*

———, 2015b. *Groundwater Monitoring Standard Operating Procedure.*

———, 2016. *Rio Algom LLC Ambrosia Lake Facility, License SUA-1473 Docket 40-8905, Groundwater Stability Monitoring Report, First Half 2016.*

U.S. Nuclear Regulatory Commission (NRC), 2006. *Technical Evaluation Report Alternate Concentration Limits Application, Rio Algom Mining, LLC. Ambrosia Lake Uranium Mill Facility, New Mexico*.

APPENDIX 1

Stability Monitoring Plan
Analytical Results

RIO ALGOM MINING LLC
2nd HALF 2016
DAKOTA WELL RESULTS - ACL PARAMETERS

Well	Date		Depth To Water	Total Depth	Specific Conductivity	Temp (°C)	pH s.u.	Chloride (mg/L)	Nitrate (mg/L)	T.D.S. (mg/L)	Sulfate (mg/L)
17-01 KD	7/26/2016	Q3 2016	-	-	1567	22.76	8.82	15.8	<0.02	1080	716
30-02 KD	7/28/2016	Q3 2016	308.15	313.25				Insufficient Water			
30-48 KD-R	7/26/2016	Q3 2016	326.45	-	5040	14.70	6.79	538	<0.02	4350	2250
32-45 KD-R	7/18/2016	Q3 2016	257.66	278.65	2274	14.04	6.72	108	1.27	1810	849
36-06 KD	7/18/2016	Q3 2016	187.11	196.40	8627	14.67	3.32	1300	<0.02	7710	4440
5-02 KD	7/29/2016	Q3 2016	188.05	190.31				Insufficient Water			
ACL								**3200**	**22.8**	**14100**	**6480**

Well	Date		Ni (mg/L)	U-nat (mg/L)	Th-230 (pCi/L)	Pb-210 (pCi/L)	Ra-226+Ra-228 (pCi/L)
17-01 KD	7/26/2016	Q3 2016	<0.0006	<0.0001	-0.09	70	2.19 y
30-02 KD	7/28/2016	Q3 2016			Insufficient Water		
30-48 KD-R	7/26/2016	Q3 2016	<0.003	<0.0005	-0.04	52	8 y
32-45 KD-R	7/18/2016	Q3 2016	0.0026 B	0.08	2.4	63	1.9 y
36-06 KD	7/18/2016	Q3 2016	0.22	0.92	84	48	27 y
5-02 KD	7/29/2016	Q3 2016			Insufficient Water		
ACL			**6.8**	**1.6**	**945**	**88**	**218**

Total depth could not be measured at 17-01 KD and 32-45 KD-R.
Monitoring Wells 30-02 KD and 5-02 KD contained insufficient water for sample collection.
< = constituent was not detected above the method detection limit.
'y' indicates the value is calculated from analytical results.
'B' indicates that the analyte was detected in both the blank and sample.

RIO ALGOM MINING LLC
2nd HALF 2016
TRA WELL RESULTS - ACL PARAMETERS

Well	Date		Depth To Water	Total Depth	Specific Conductivity	Temp (°C)	pH s.u.	Chloride (mg/L)	Nitrate (mg/L)	T.D.S. (mg/L)	Sulfate (mg/L)
30-01 TRA	7/28/2016	Q3 2016	204.66	207.55			Insufficient Water				
31-01 TRA-R	7/26/2016	Q3 2016	204.87	213.55	2054	14.19	7.26	38.7	0.1	1710	1070
33-01 TRA	7/25/2016	Q3 2016	118.57	172.40	3466	13.42	7.80	32.2	0.02 B	2710	1880
ACL								**1070**	**9.2**	**6400**	**2584**

Well	Date		Th-230 (pCi/L)	Pb-210 (pCi/L)	Ra-226+Ra-228 (pCi/L)
30-01 TRA	7/28/2016	Q3 2016		Insufficient Water	
31-01 TRA-R	7/26/2016	Q3 2016	-0.40	40	3.72 y
33-01 TRA	7/25/2016	Q3 2016	0.05	37	3.91 y
ACL			**945**	**88**	**218**

< = constituent was not detected above the method detection limit.
Well 30-01 TRA contained insufficient water for sample collection.
'y' indicates the value is calculated from analytical results.
'B' indicates that the analyte was detected in both the blank and sample.

RIO ALGOM MINING LLC
2nd HALF 2016
TRB WELL RESULTS - ACL PARAMETERS

Well	Date		Depth To Water	Total Depth	Specific Conductivity	Temp (°C)	pH s.u.	Chloride (mg/L)	Nitrate (mg/L)	T.D.S. (mg/L)	Sulfate (mg/L)
19-77 TRB	7/25/2016	Q3 2016	272.27	288.49	4406	14.60	7.71	15.7	0.35	3330	2030
31-02 TRB-R	7/18/2016	Q3 2016	96.78	128.34	8857	13.47	6.20	1130	<0.02	7770	3760
31-67 TRB	7/28/2016	Q3 2016	35.49	96.23	7317	12.30	6.41	1080	<0.02	7380	3430
36-01 TRB	7/28/2016	Q3 2016	-	58.50			Dry				
36-02 TRB	7/26/2016	Q3 2016	51.01	57.50	10553	13.74	6.74	2200	<0.02	8510	3200
ACL								**2810**	**7.7**	**11700**	**4760**

Well	Date		Ni (mg/L)	U-nat (mg/L)	Th-230 (pCi/L)	Pb-210 (pCi/L)	Ra-226+Ra-228 (pCi/L)
19-77 TRB	7/25/2016	Q3 2016	0.003 B	0.0083	-0.44	60	1.89 y
31-02 TRB-R	7/18/2016	Q3 2016	<0.003	0.0045	0.24	72	10.6 y
31-67 TRB	7/28/2016	Q3 2016	0.006 B	0.0129	-0.21	67	11.3 y
36-01 TRB	7/28/2016	Q3 2016			Dry		
36-02 TRB	7/26/2016	Q3 2016	0.004 B	0.0031	0.28	50	0.94 y
ACL			**6.8**	**1.6**	**945**	**88**	**218**

< = constituent was not detected above the method detection limit.
Monitoring Well 36-01 TRB was dry and therefore not sampled.
'y' indicates the value is calculated from analytical results.
'B' indicates that the analyte was detected in both the blank and sample.

RIO ALGOM MINING LLC
2nd HALF 2016
ALLUVIAL WELL RESULTS - ACL PARAMETERS

Well	Date		Depth To Water	Total Depth	Specific Conductivity	Temp (°C)	pH s.u.	Chloride (mg/L)	Nitrate (mg/L)	T.D.S. (mg/L)	Sulfate (mg/L)
5-73 ALL-R	7/28/2016	Q3 2016	21.83	35.67	6642	11.80	6.86	1180	0.64	5720	2440
5-03 ALL-R	7/28/2016	Q3 2016	26.82	55.82	4679	12.60	7.00	543	0.41	4490	2310
5-04 ALL	7/27/2016	Q3 2016	24.39	60.15	5919	12.57	8.18*	890	<0.02	5120	2790
5-08 ALL-R	7/27/2016	Q3 2016	37.31	76.52	4167	13.00	7.23	223	15	3880	2200
31-61 ALL	7/28/2016	Q3 2016	16.57	29.10	14451	12.20	6.23	2360	2.93	13800	6750
31-65 ALL	7/28/2016	Q3 2016	13.75	41.49	15180	10.70	6.16	2630	<0.02	15700	7660
32-59 ALL	7/28/2016	Q3 2016	21.96	28.19	4995	12.20	7.45	539	2.06	4910	2640
MW-24 ALL	7/28/2016	Q3 2016	50.15	50.35			Insufficient Water				
ACL								**7110**	**351**	**26100**	**12000**

RIO ALGOM MINING LLC
2nd HALF 2016
ALLUVIAL WELL RESULTS - ACL PARAMETERS

Well	Date		Mo (mg/L)	Ni (mg/L)	Se (mg/L)	U-nat (mg/L)	Th-230 (pCi/L)	Pb-210 (pCi/L)	Ra-226+Ra-228 (pCi/L)	Gross Alpha (pCi/L)
5-73 ALL-R	7/28/2016	Q3 2016	0.007 B	0.016 B	0.254	1.23	0.29	56	1.08 y	-314 y
5-03 ALL-R	7/28/2016	Q3 2016	<0.003	<0.003	0.0008 B	0.1019	-0.14	53	0.84 y	-21 y
5-04 ALL	7/27/2016	Q3 2016	<0.003	<0.003	<0.0005	<0.0005	-0.02	54	0.6 y	-16 y
5-08 ALL-R	7/27/2016	Q3 2016	0.005	0.002 B	0.0031	0.0249	0.32	38	0.38 y	-10.8 y
31-61 ALL	7/28/2016	Q3 2016	<0.005	0.053	0.007	0.642	0.28	52	2.08 y	-220 y
31-65 ALL	7/28/2016	Q3 2016	<0.005	0.13	0.004	0.086	0.14	41	0.44 y	-52.1 y
32-59 ALL	7/28/2016	Q3 2016	0.005 B	<0.003	0.022	0.1706	-0.24	21	0.7 y	-30 y
MW-24 ALL	7/28/2016	Q3 2016				Insufficient Water				
ACL			**176**	**98**	**49**	**23**	**13627**	**1274**	**3167**	**8402**

* value was recorded 8/24/2015
< = constituent was not detected above the method detection limit.
'y' indicates the value is calculated from analytical results.
'B' indicates that the analyte was detected in both the blank and sample.

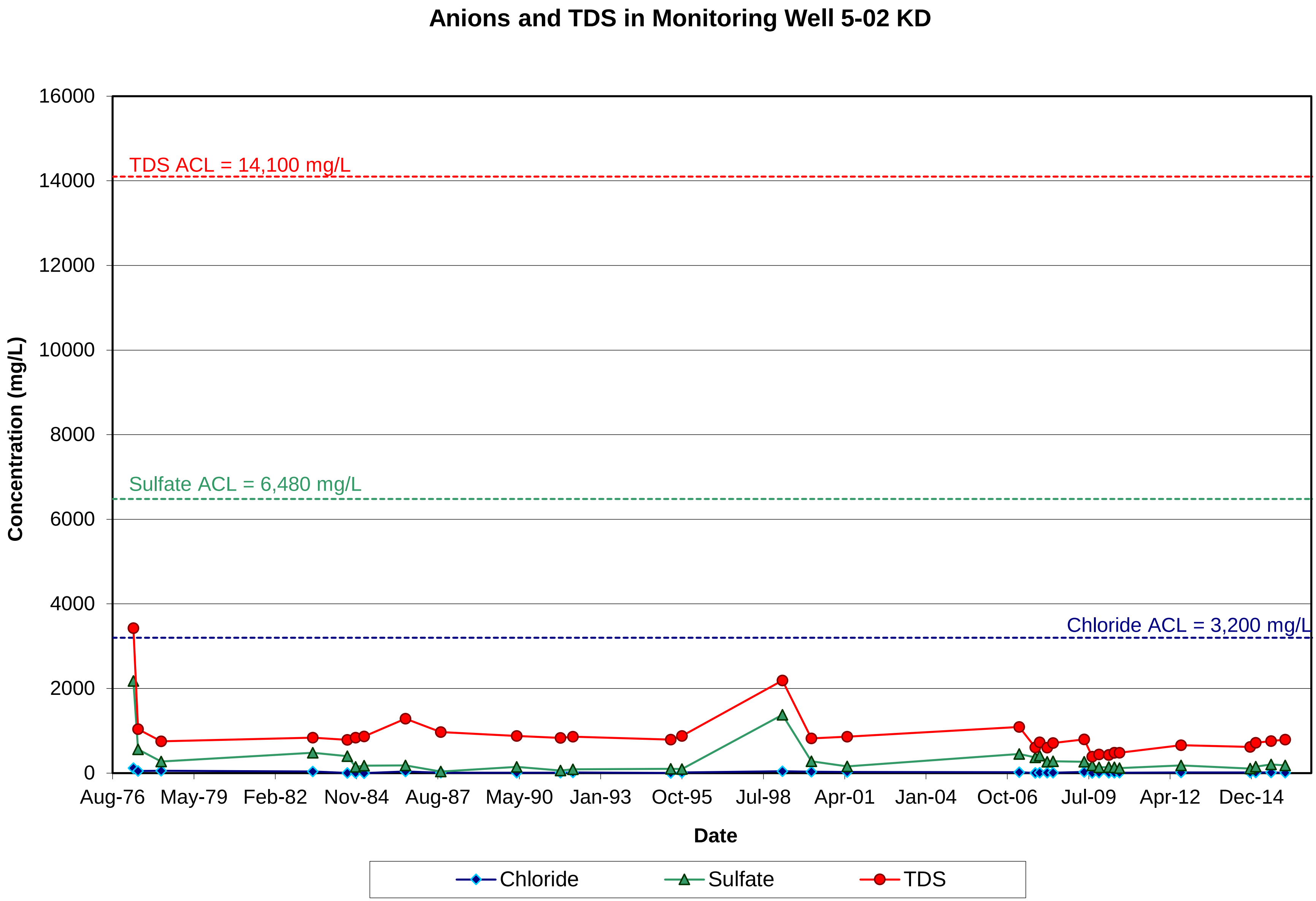
INTERA

APPENDIX 2

Stability Monitoring Plan
Time Versus Concentration Plots

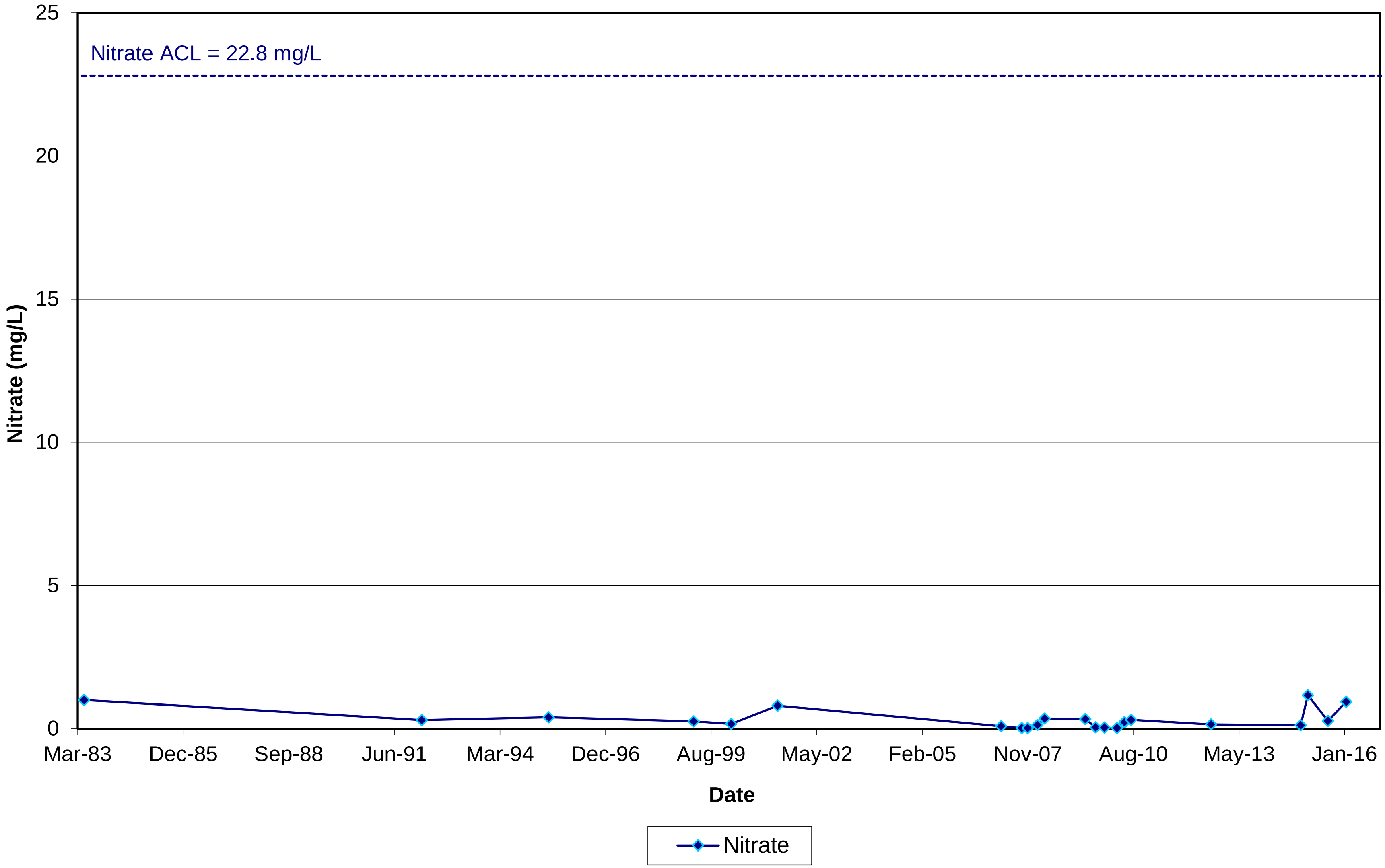
Stability Monitoring Plan
Time Versus Concentration Plots

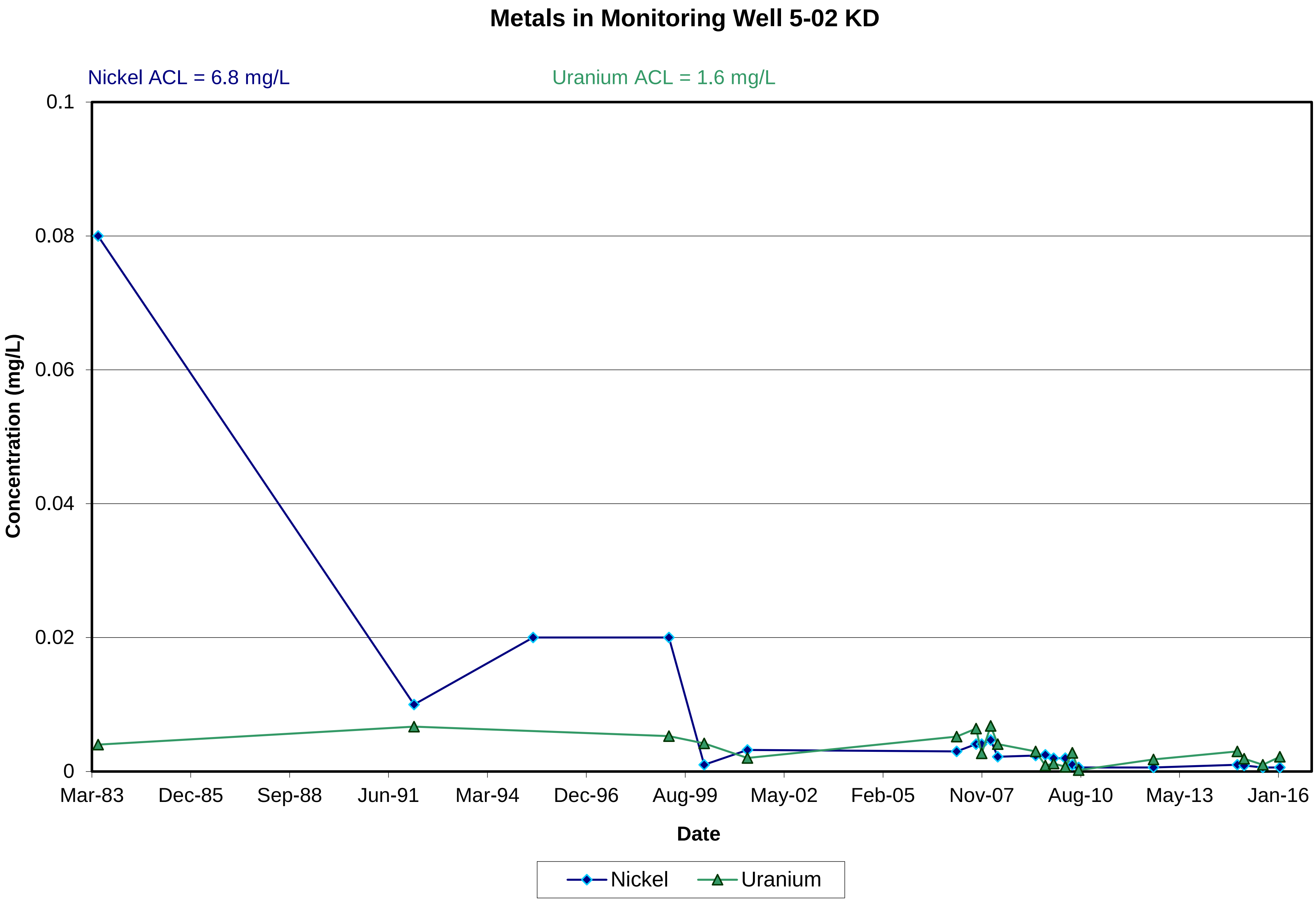
Dakota



Anions and TDS in Monitoring Well 5-02 KD
Concentration (mg/L)
16000
14000
12000
10000
8000
6000
4000
2000
0
TDS ACL = 14,100 mg/L
Sulfate ACL = 6,480 mg/L
Chloride ACL = 3,200 mg/L
Aug-76
May-79
Feb-82
Nov-84
Aug-87
May-90
Jan-93
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Date
Chloride
Sulfate
TDS

Nitrate in Monitoring Well 5-02 KD





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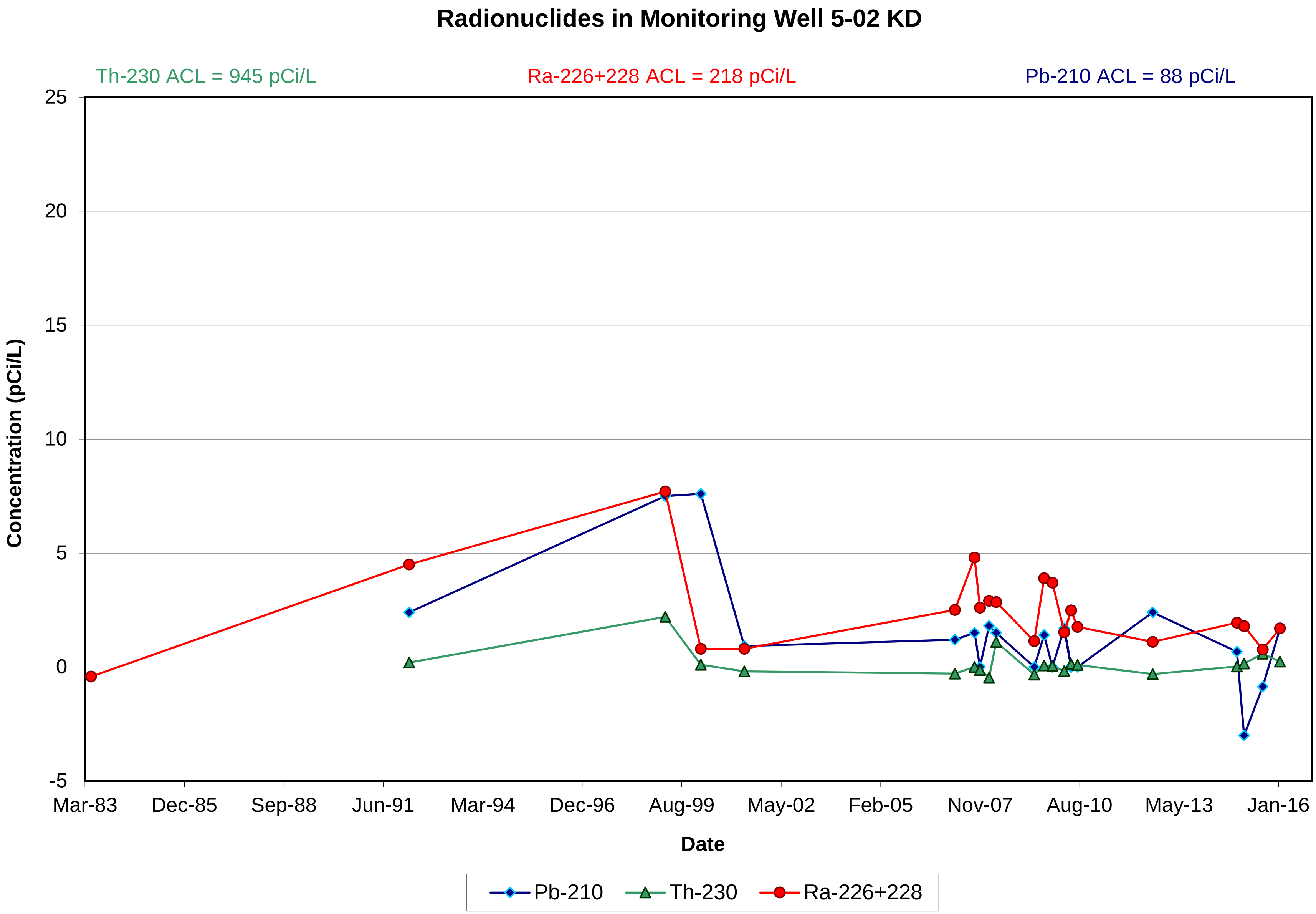
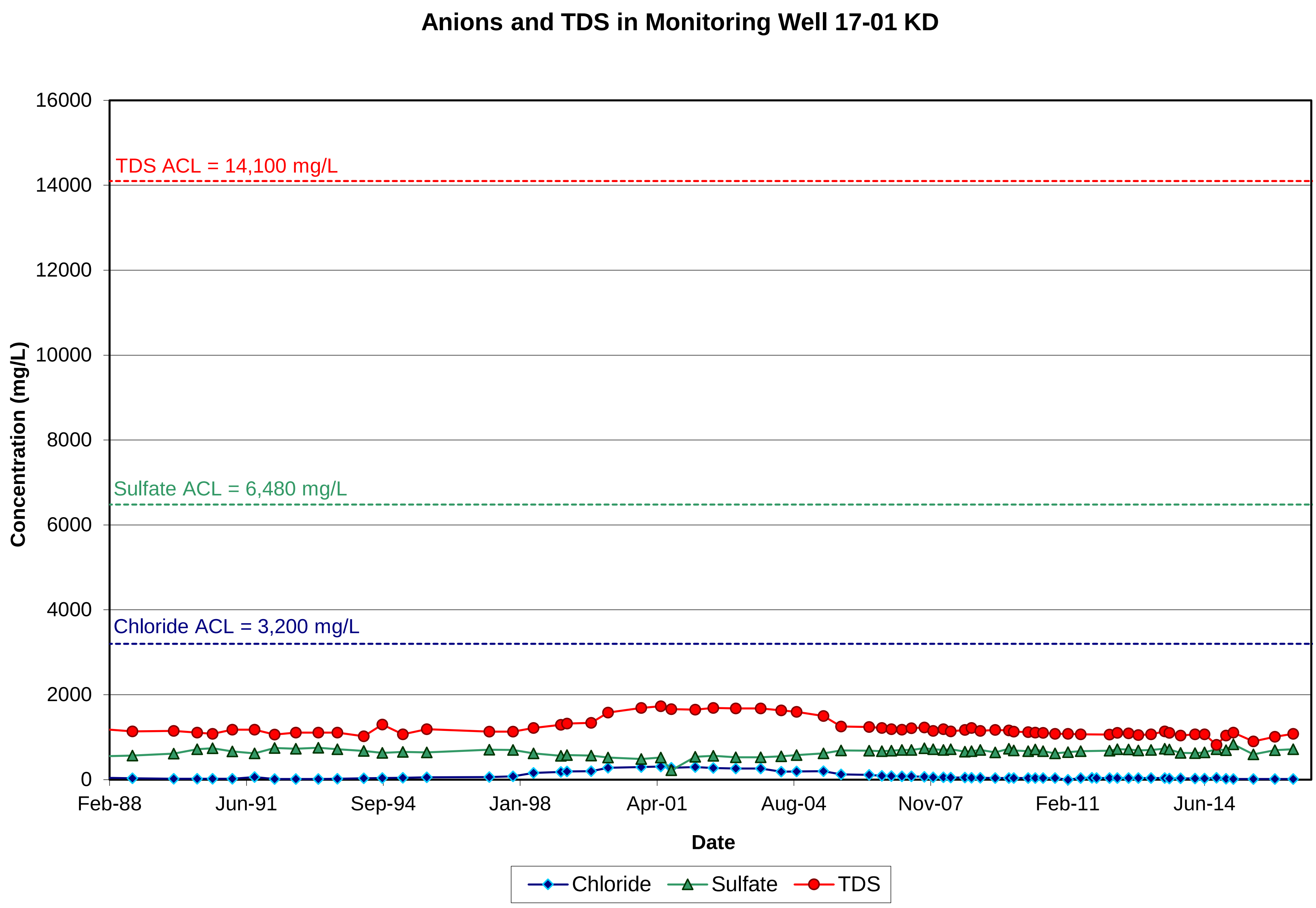

Radionuclides in Monitoring Well 5-02 KD
Th-230 ACL = 945 pCi/L
Ra-226+228 ACL = 218 pCi/L
Pb-210 ACL = 88 pCi/L
Concentration (pCi/L)
25
20
15
10
5
0
-5
Mar-83
Dec-85
Sep-88
Jun-91
Mar-94
Dec-96
Aug-99
May-02
Feb-05
Nov-07
Aug-10
May-13
Jan-16
Date
Pb-210
Th-230
Ra-226+228



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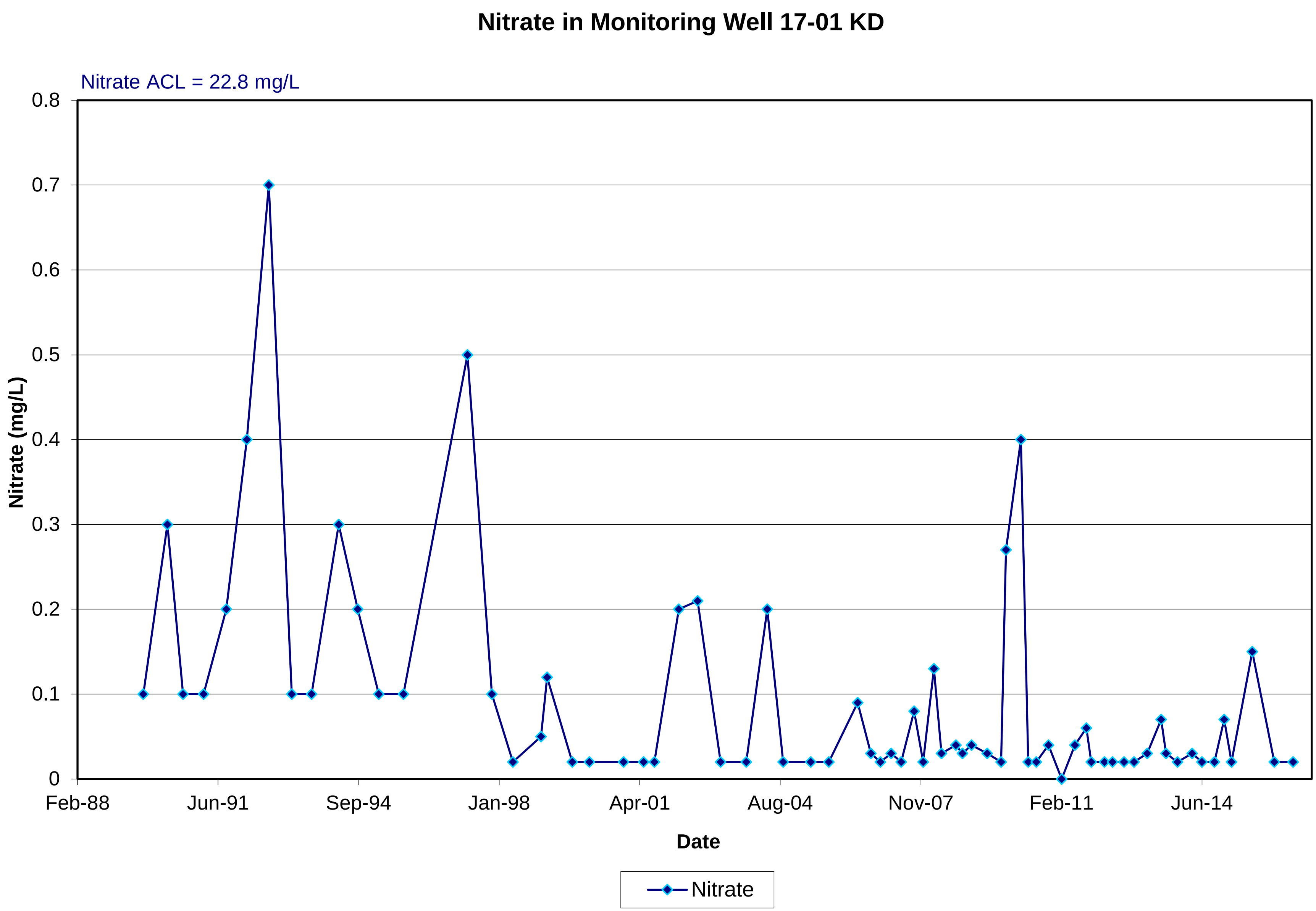
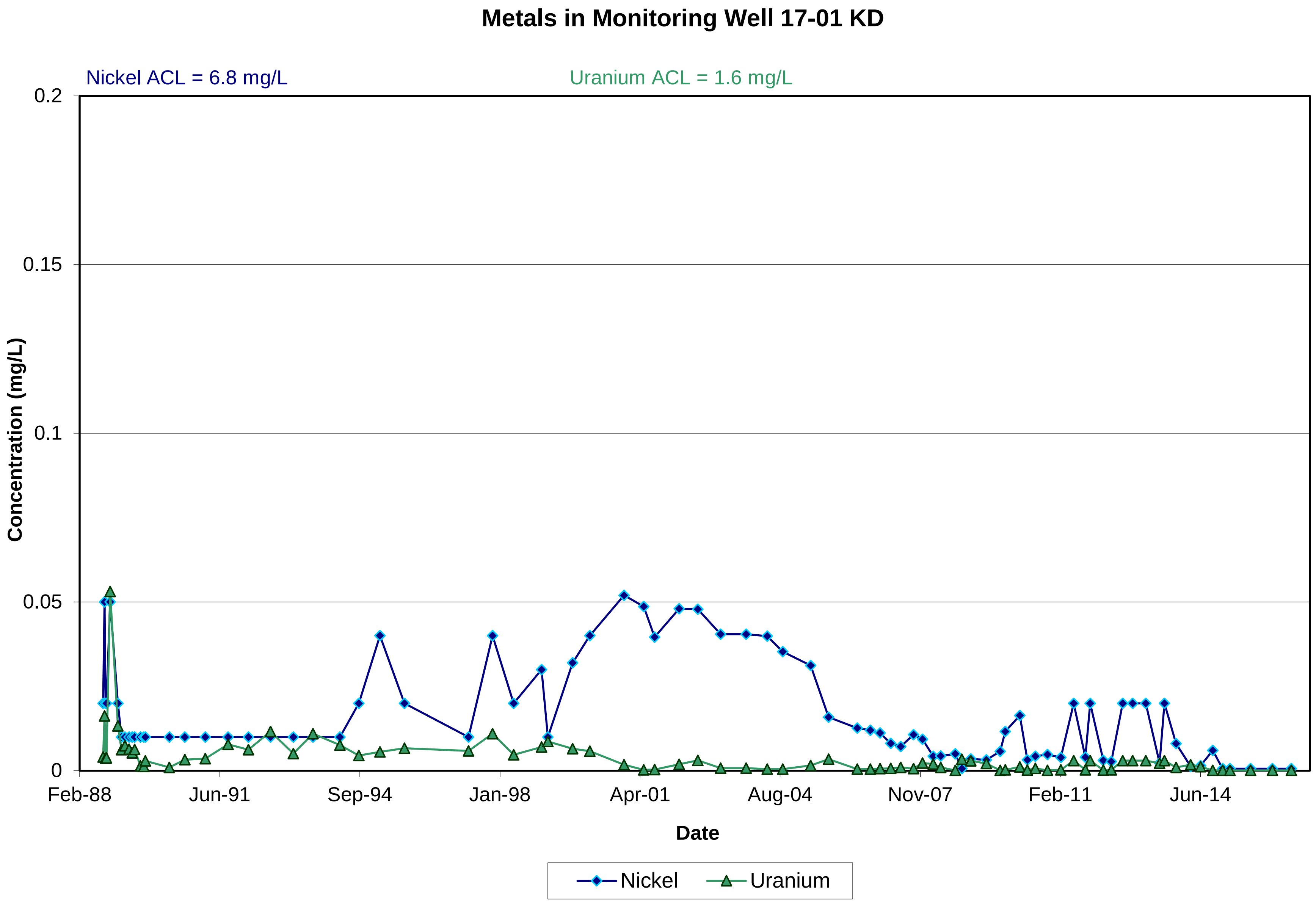
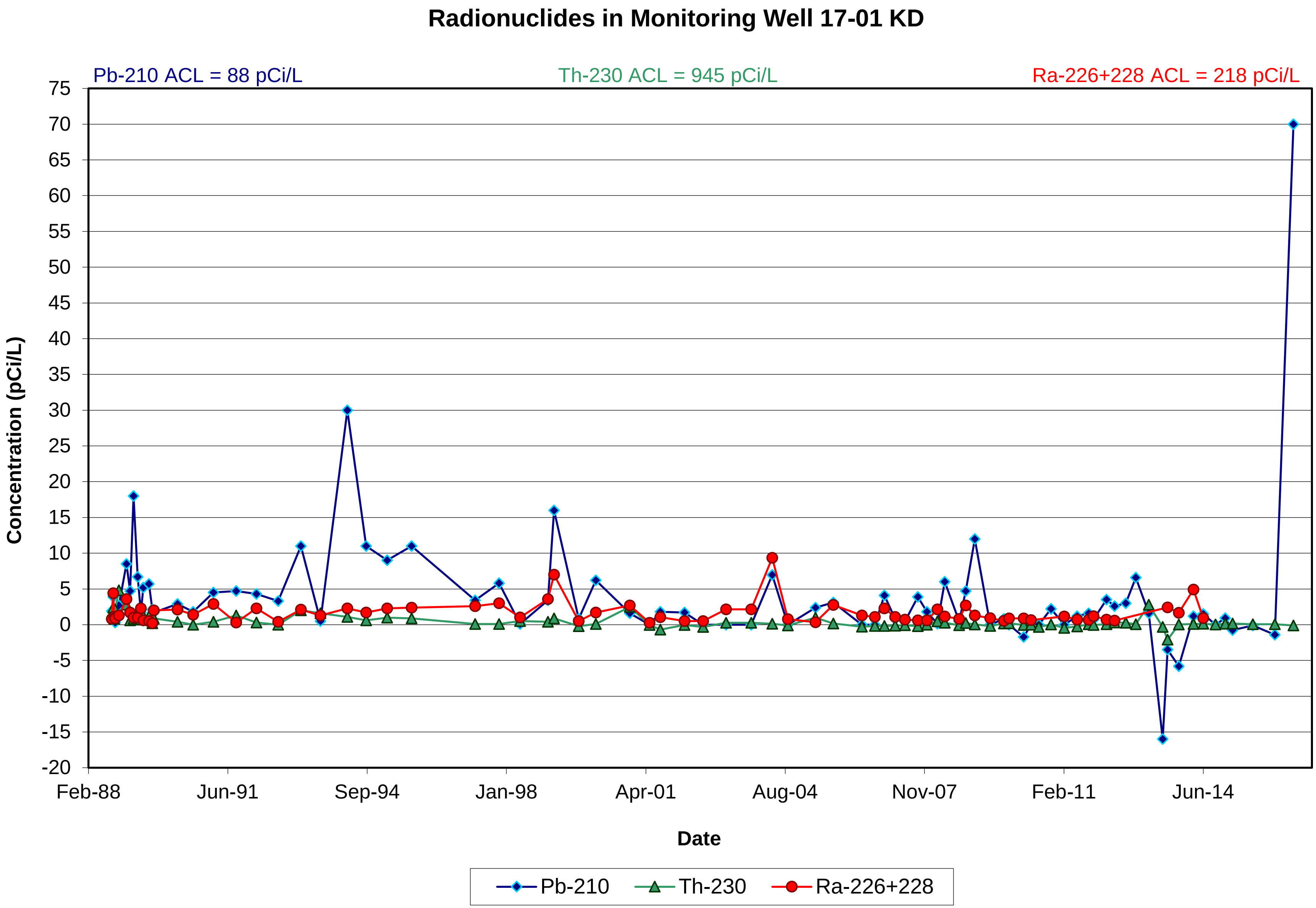
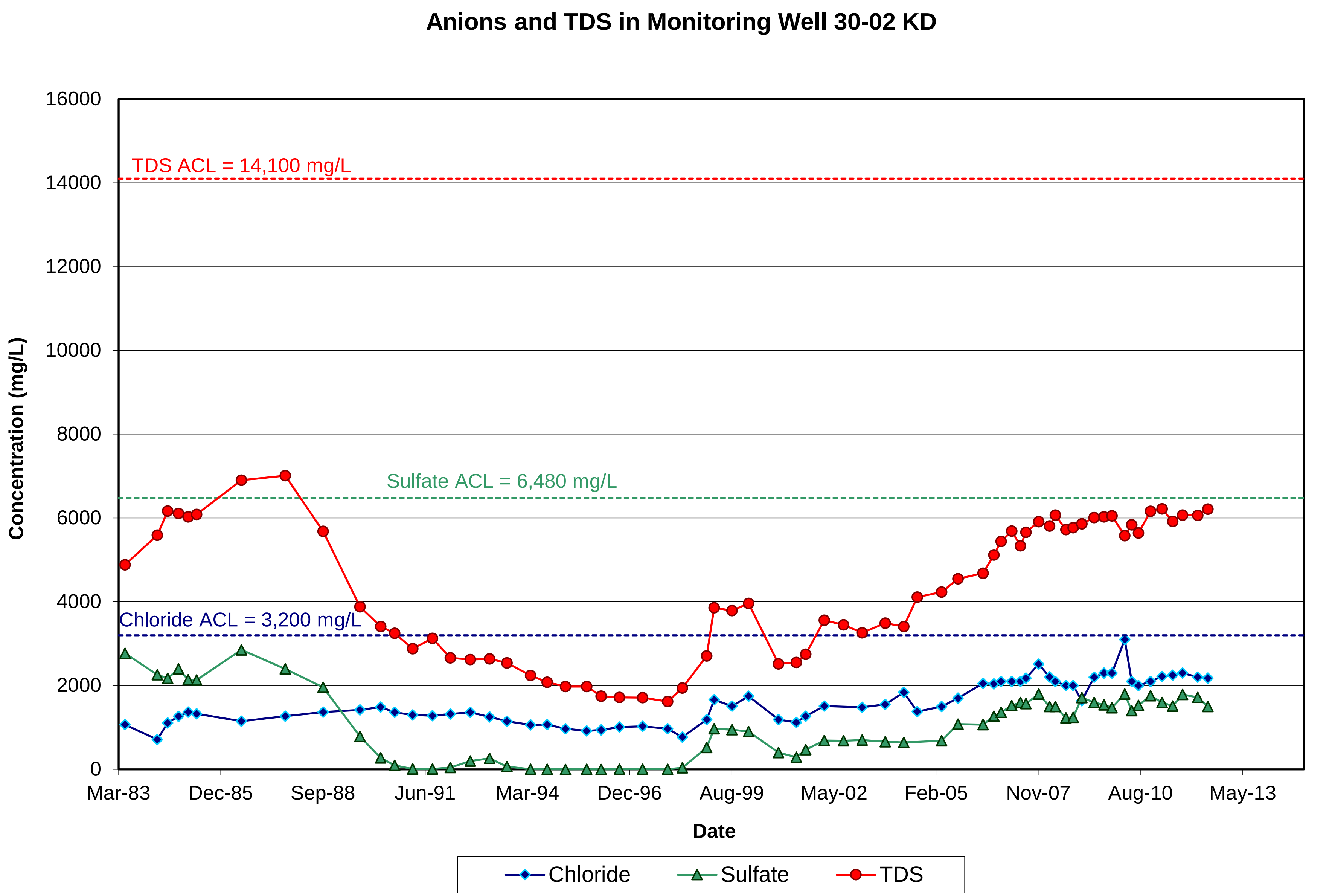


Nitrate in Monitoring Well 17-01 KD
Nitrate ACL = 22.8 mg/L
Nitrate (mg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Feb-88
Jun-91
Sep-94
Jan-98
Apr-01
Aug-04
Nov-07
Feb-11
Jun-14
Date
Nitrate


Metals in Monitoring Well 17-01 KD
Nickel ACL = 6.8 mg/L
Uranium ACL = 1.6 mg/L
Concentration (mg/L)
0.2
0.15
0.1
0.05
0
Feb-88
Jun-91
Sep-94
Jan-98
Apr-01
Aug-04
Nov-07
Feb-11
Jun-14
Date
Nickel
Uranium

INTERA


Radionuclides in Monitoring Well 17-01 KD
Pb-210 ACL = 88 pCi/L
Th-230 ACL = 945 pCi/L
Ra-226+228 ACL = 218 pCi/L
Concentration (pCi/L)
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
Feb-88
Jun-91
Sep-94
Jan-98
Apr-01
Aug-04
Nov-07
Feb-11
Jun-14
Date
Pb-210
Th-230
Ra-226+228



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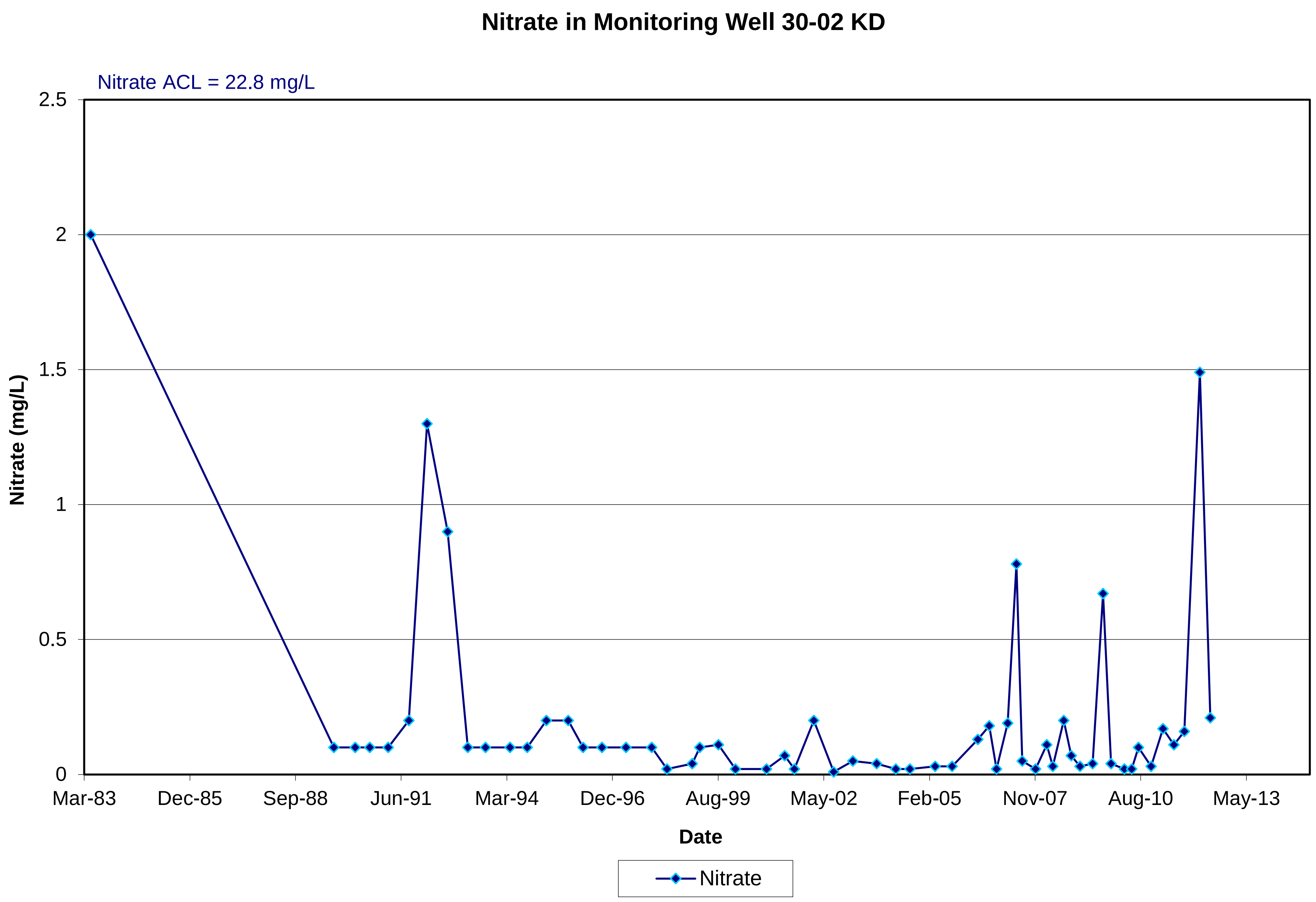

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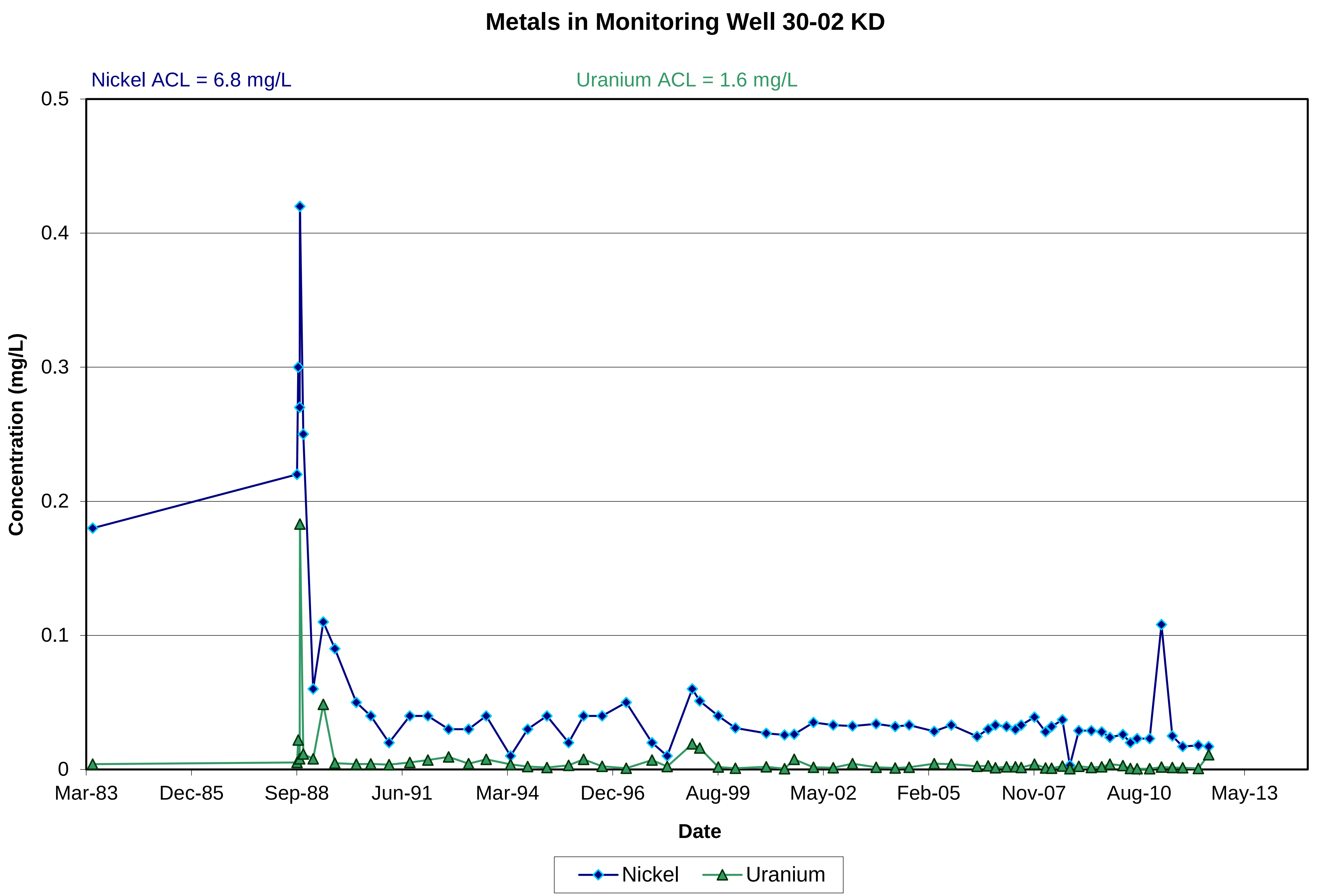
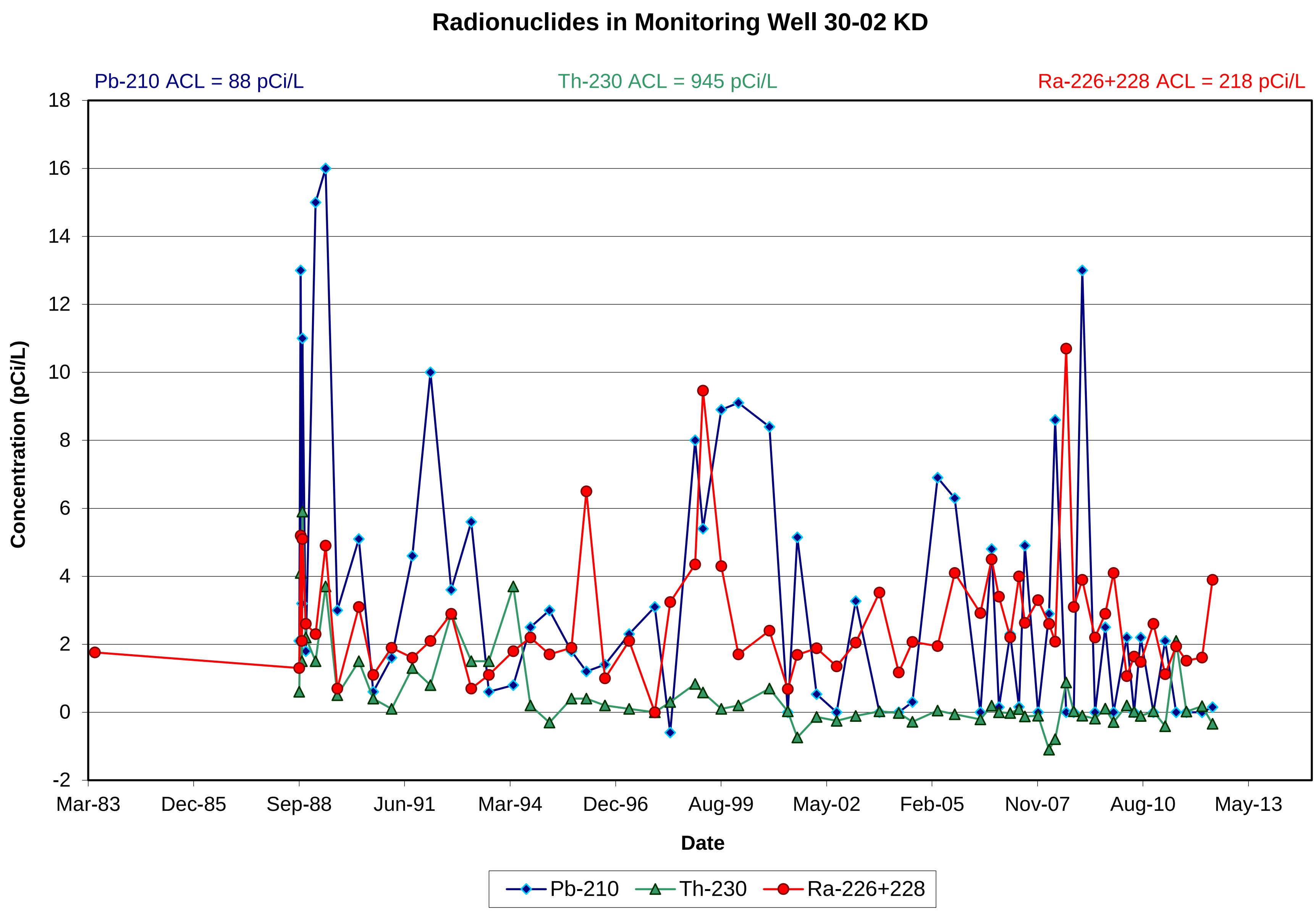
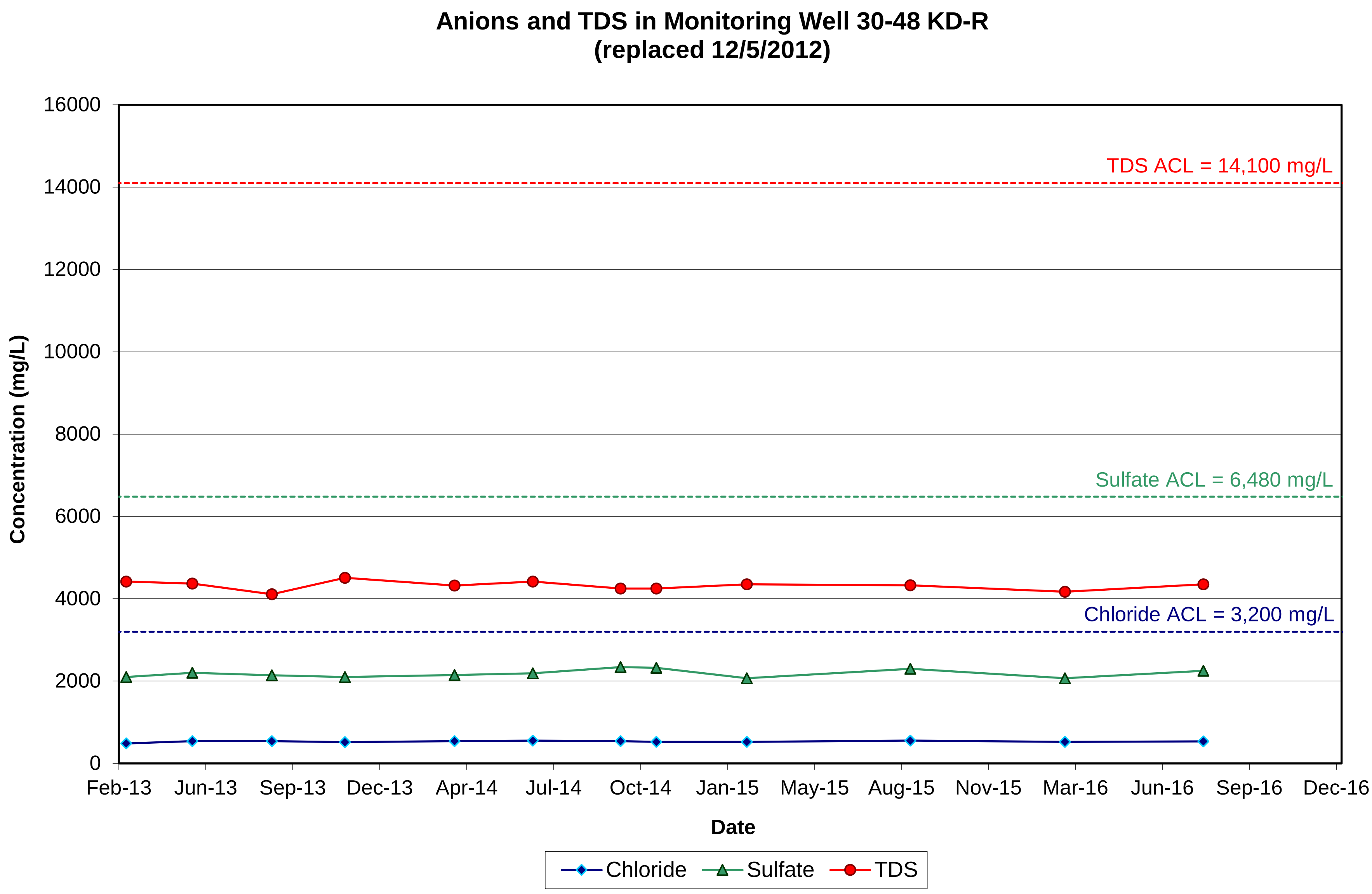

Metals in Monitoring Well 30-02 KD
Nickel ACL = 6.8 mg/L
Uranium ACL = 1.6 mg/L
Concentration (mg/L)
0.5
0.4
0.3
0.2
0.1
0
Mar-83
Dec-85
Sep-88
Jun-91
Mar-94
Dec-96
Aug-99
May-02
Feb-05
Nov-07
Aug-10
May-13
Date
Nickel
Uranium



Radionuclides in Monitoring Well 30-02 KD
Pb-210 ACL = 88 pCi/L
Th-230 ACL = 945 pCi/L
Ra-226+228 ACL = 218 pCi/L
Concentration (pCi/L)
18
16
14
12
10
8
6
4
2
0
-2
Mar-83
Dec-85
Sep-88
Jun-91
Mar-94
Dec-96
Aug-99
May-02
Feb-05
Nov-07
Aug-10
May-13
Date
Pb-210
Th-230
Ra-226+228



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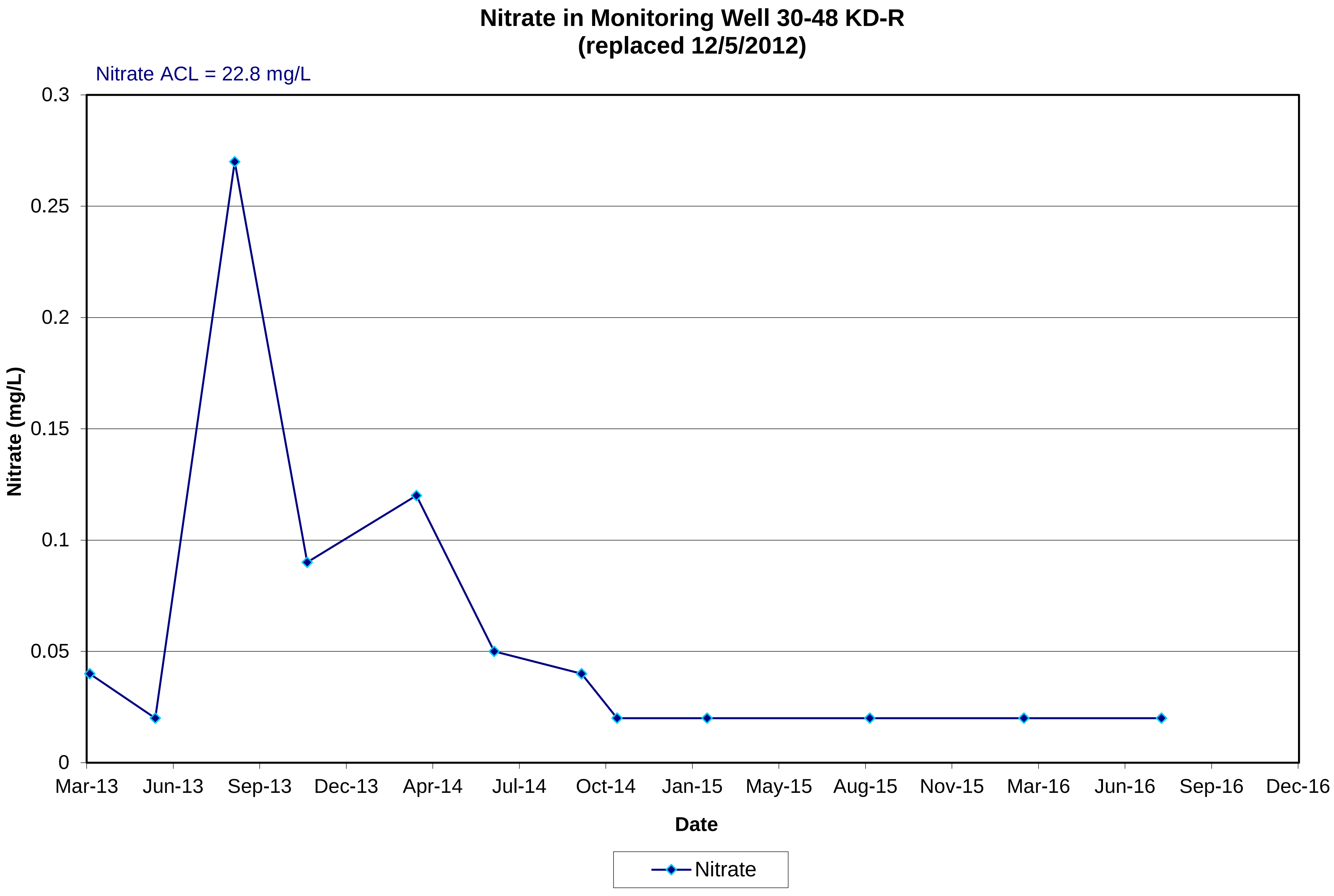

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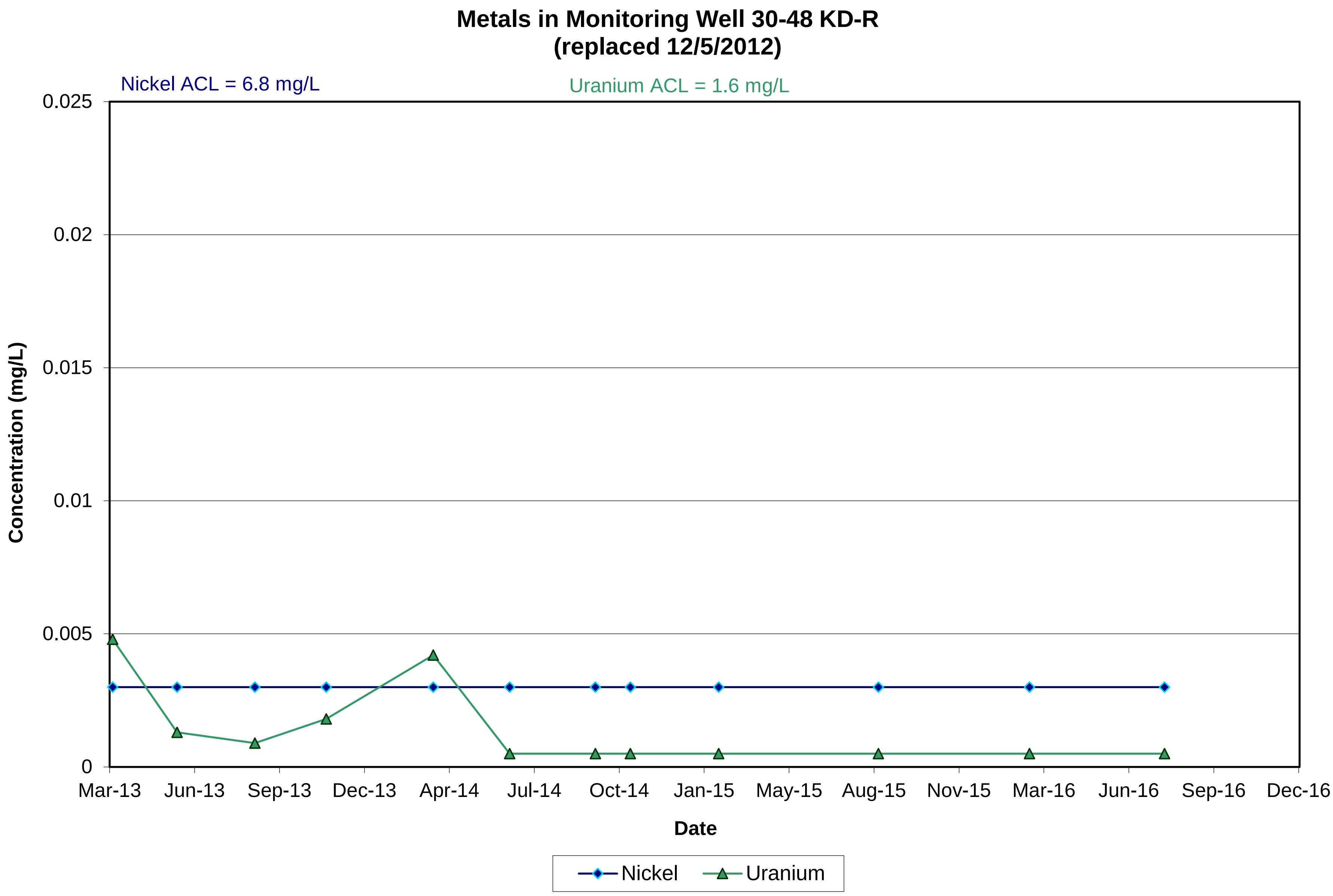
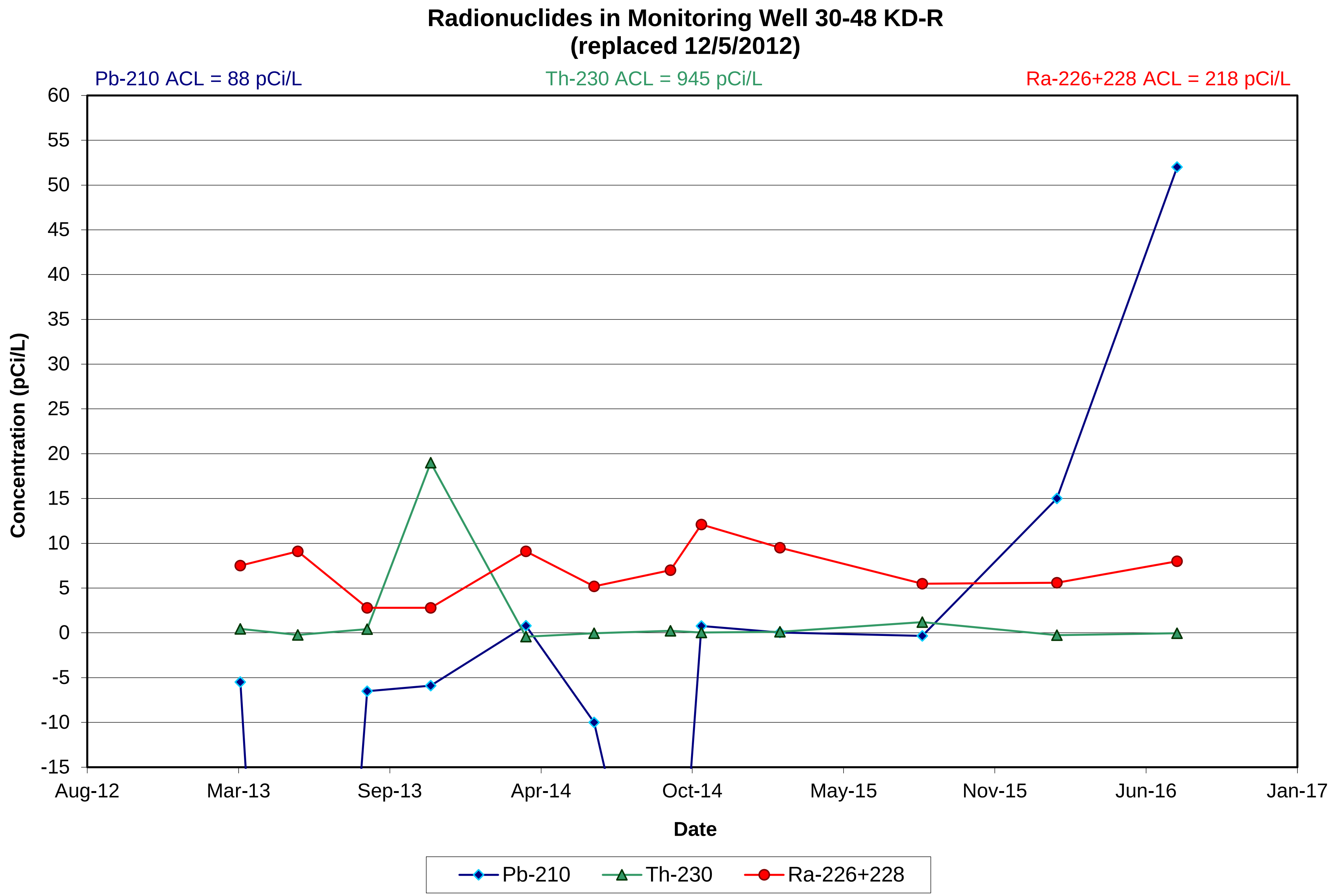

Metals in Monitoring Well 30-48 KD-R
(replaced 12/5/2012)
Nickel ACL = 6.8 mg/L
Uranium ACL = 1.6 mg/L
Concentration (mg/L)
0.025
0.02
0.015
0.01
0.005
0
Mar-13
Jun-13
Sep-13
Dec-13
Apr-14
Jul-14
Oct-14
Jan-15
May-15
Aug-15
Nov-15
Mar-16
Jun-16
Sep-16
Dec-16
Date
Nickel
Uranium



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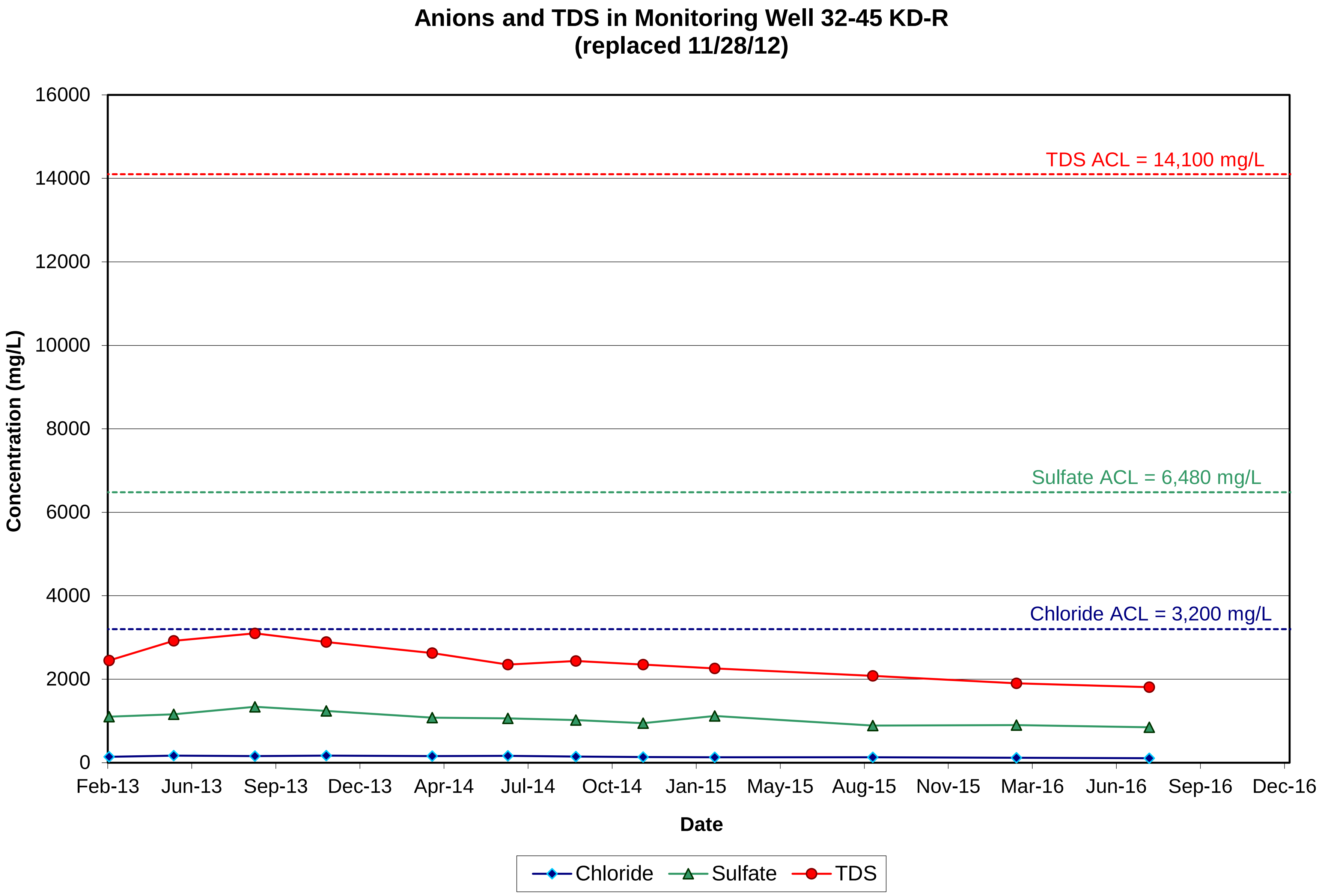

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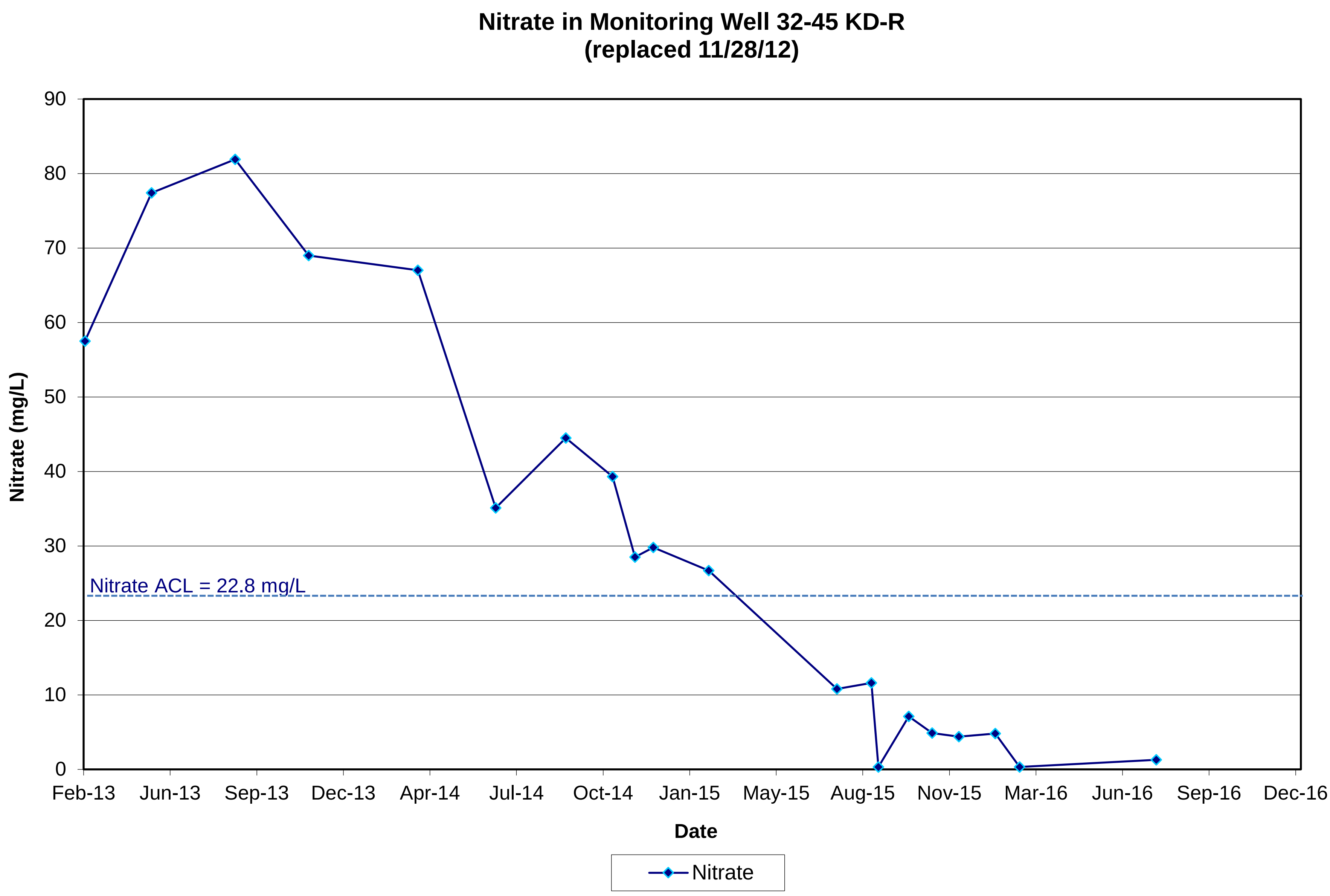
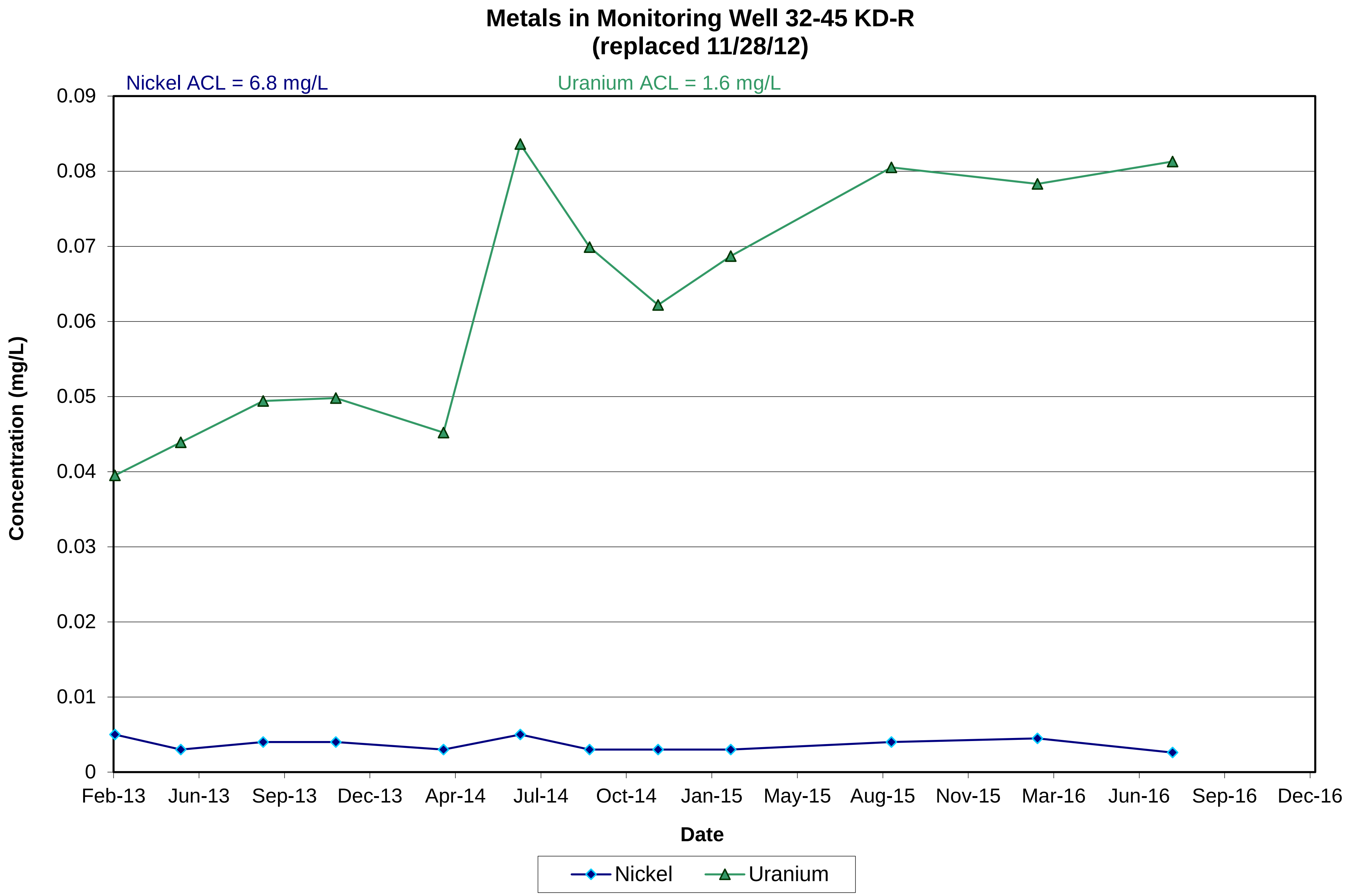
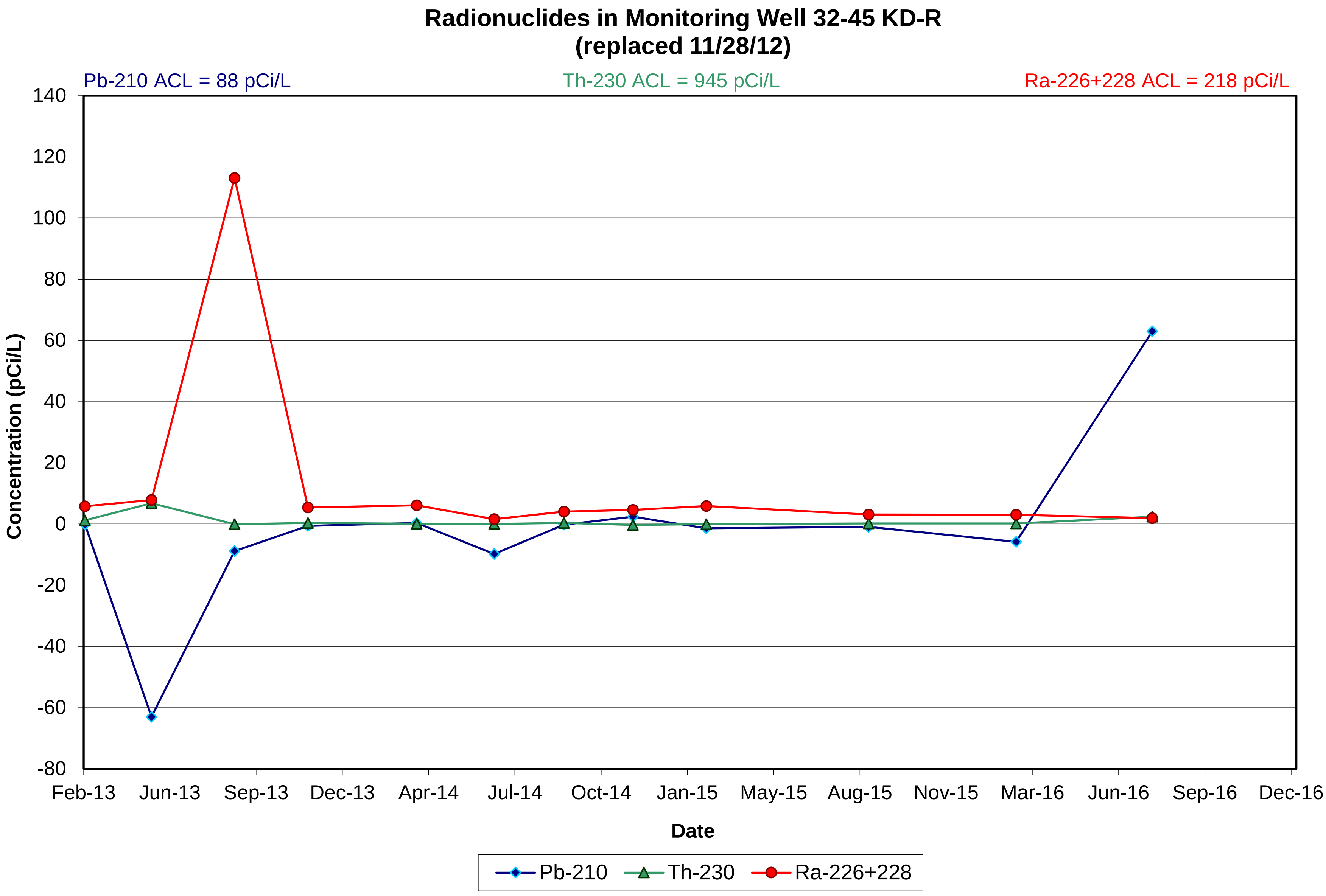
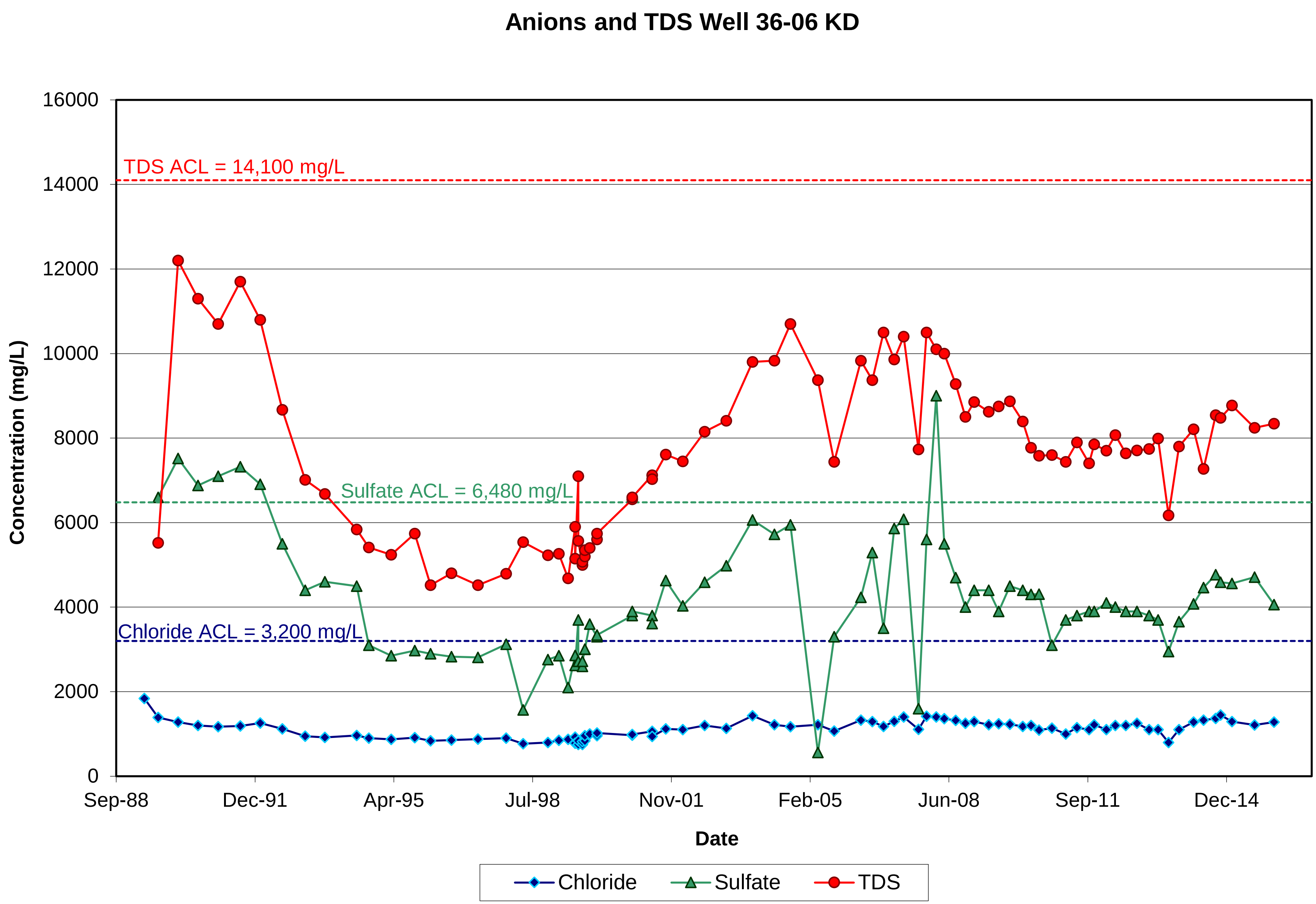


Nitrate in Monitoring Well 32-45 KD-R
(replaced 11/28/12)
90
80
70
60
50
40
30
20
10
0
Nitrate (mg/L)
Nitrate ACL = 22.8 mg/L
Feb-13
Jun-13
Sep-13
Dec-13
Apr-14
Jul-14
Oct-14
Jan-15
May-15
Aug-15
Nov-15
Mar-16
Jun-16
Sep-16
Dec-16
Date
Nitrate



Metals in Monitoring Well 32-45 KD-R
(replaced 11/28/12)
Nickel ACL = 6.8 mg/L
Uranium ACL = 1.6 mg/L
Concentration (mg/L)
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Feb-13
Jun-13
Sep-13
Dec-13
Apr-14
Jul-14
Oct-14
Jan-15
May-15
Aug-15
Nov-15
Mar-16
Jun-16
Sep-16
Dec-16
Date
Nickel
Uranium


Radionuclides in Monitoring Well 32-45 KD-R
(replaced 11/28/12)
Pb-210 ACL = 88 pCi/L
Th-230 ACL = 945 pCi/L
Ra-226+228 ACL = 218 pCi/L
Concentration (pCi/L)
140
120
100
80
60
40
20
0
-20
-40
-60
-80
Feb-13
Jun-13
Sep-13
Dec-13
Apr-14
Jul-14
Oct-14
Jan-15
May-15
Aug-15
Nov-15
Mar-16
Jun-16
Sep-16
Dec-16
Date
Pb-210
Th-230
Ra-226+228



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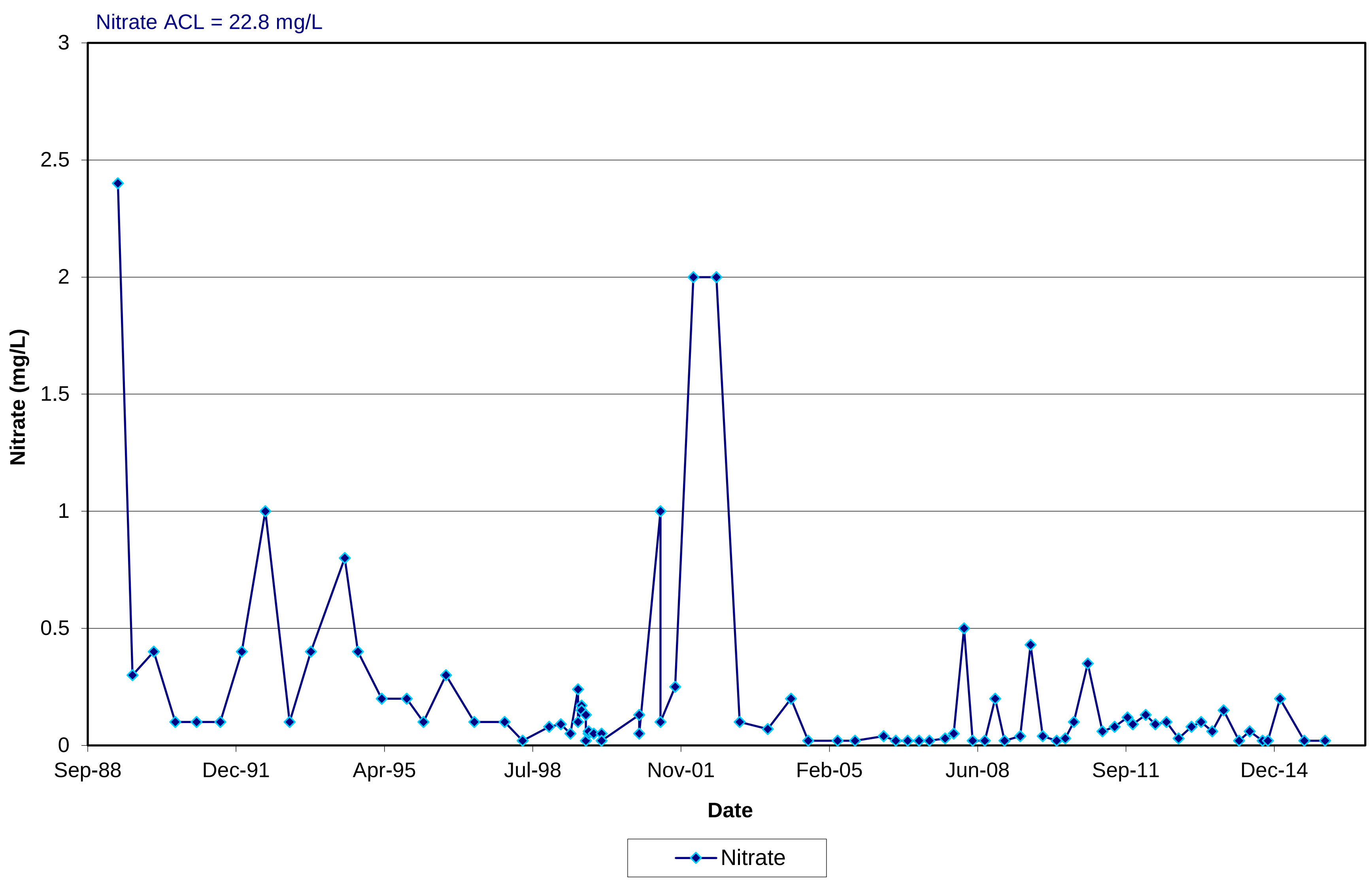
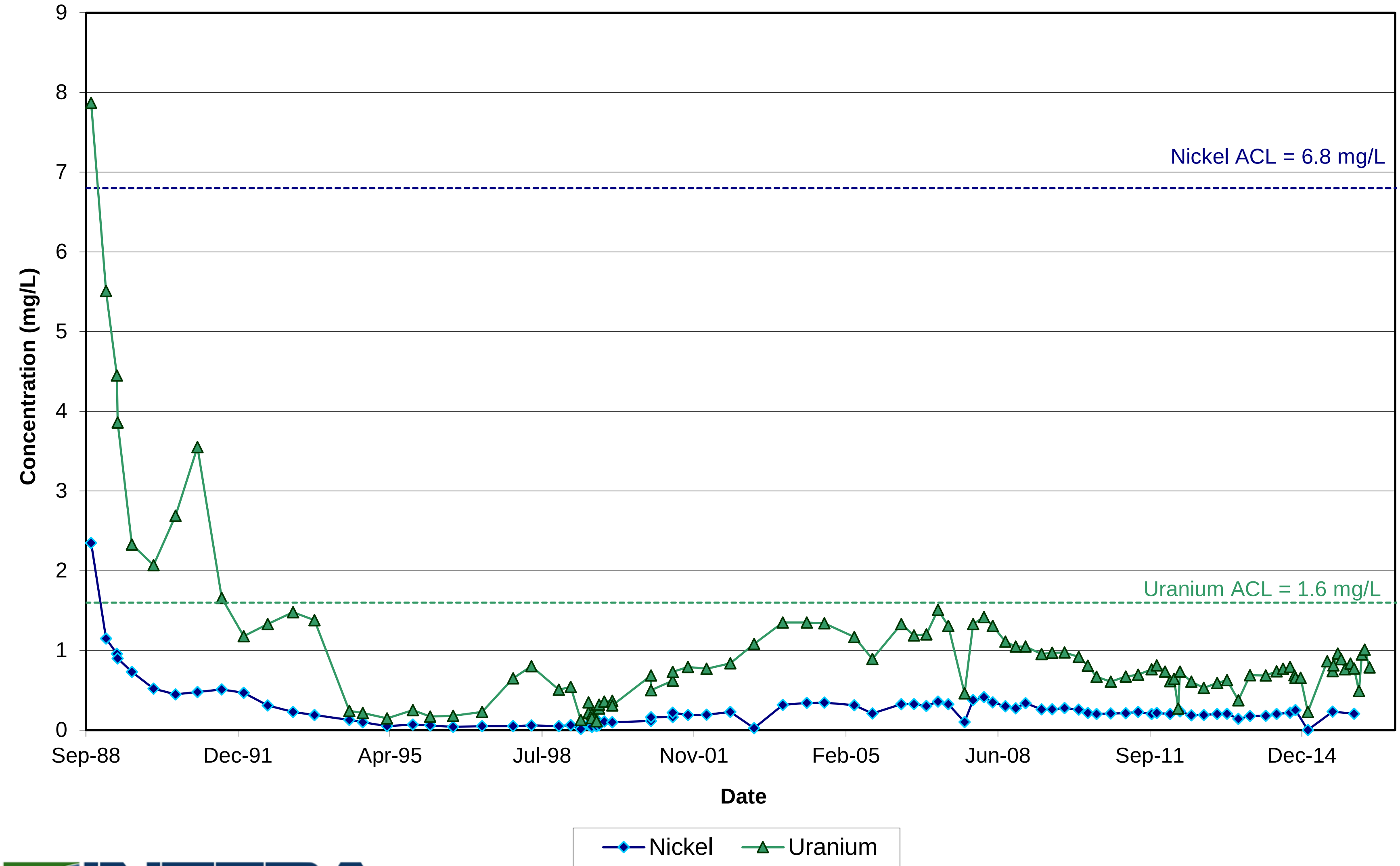
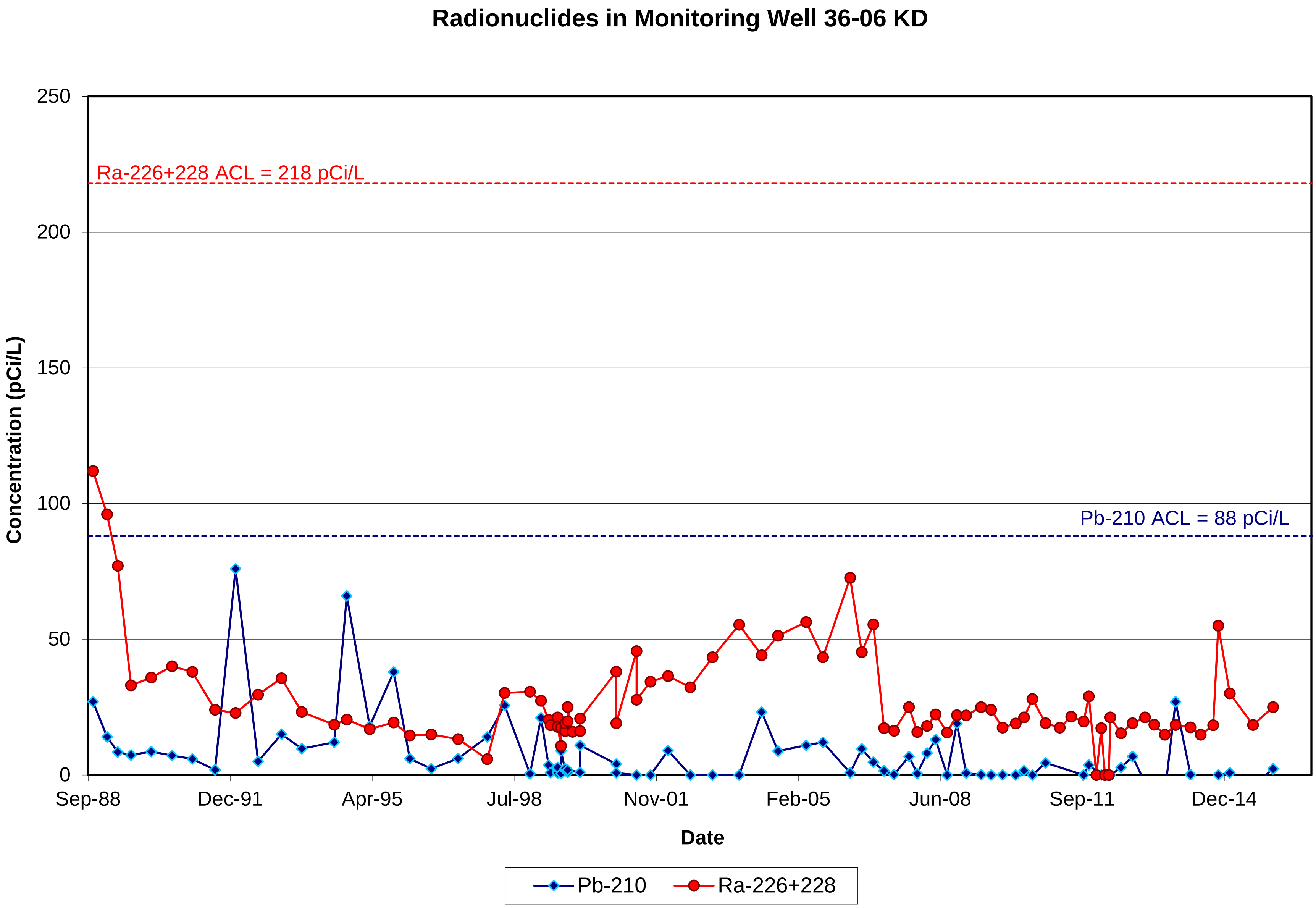
Nitrate in Monitoring Well 36-06 KD



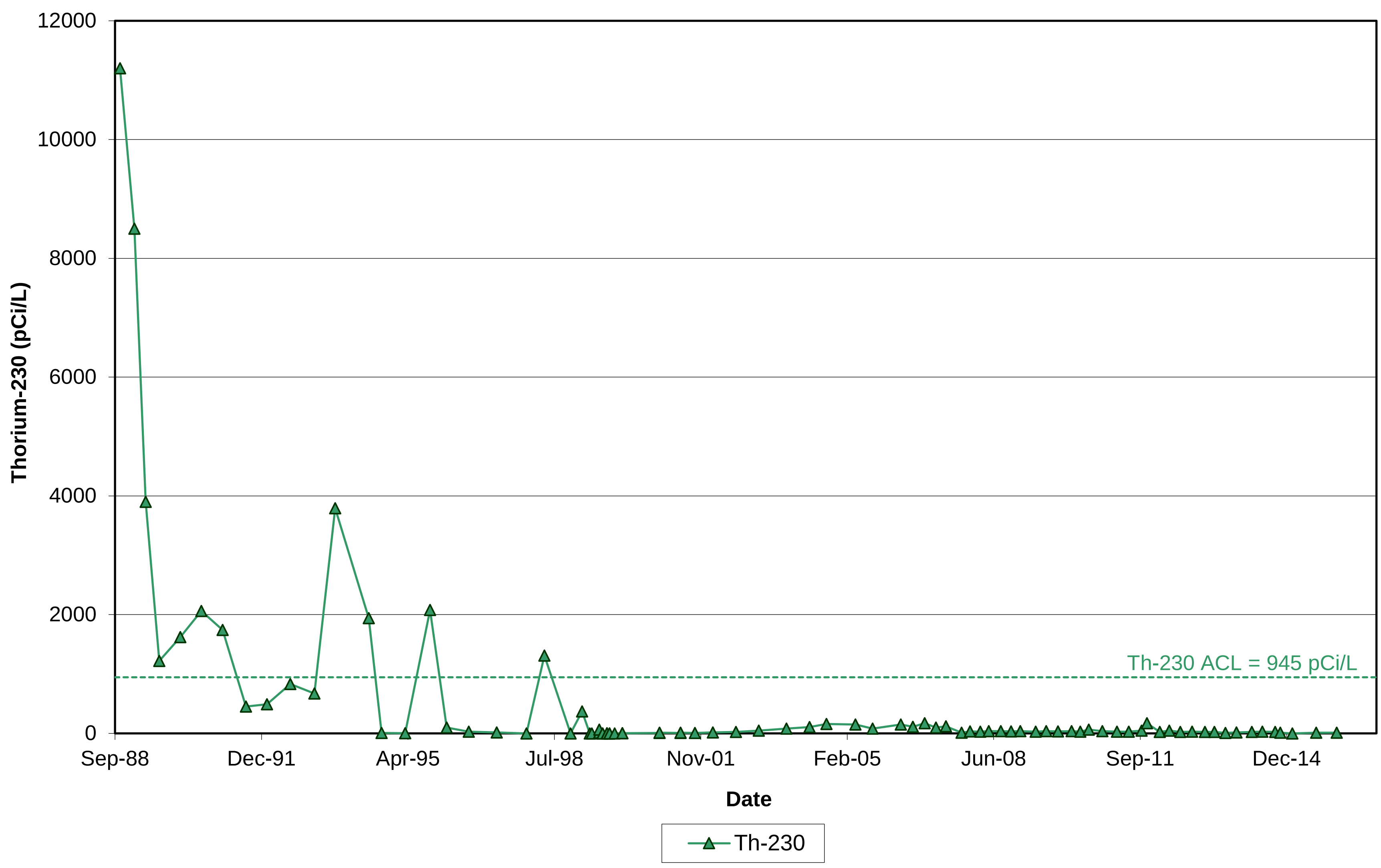
Metals in Monitoring Well 36-06 KD



INTERA

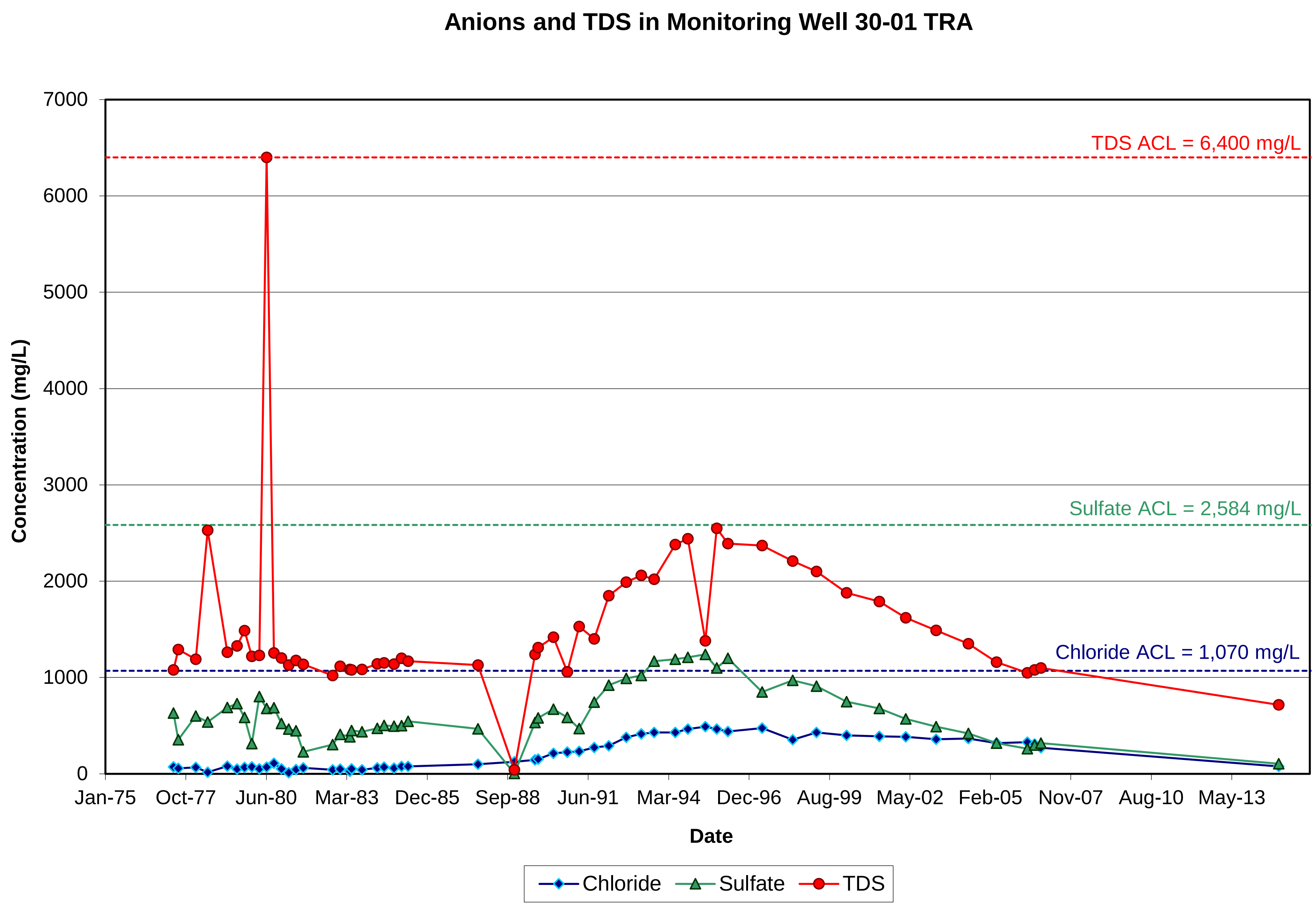

Radionuclides in Monitoring Well 36-06 KD
250
200
150
100
50
0
Ra-226+228 ACL = 218 pCi/L
Pb-210 ACL = 88 pCi/L
Concentration (pCi/L)
Sep-88
Dec-91
Apr-95
Jul-98
Nov-01
Feb-05
Jun-08
Sep-11
Dec-14
Date
Pb-210
Ra-226+228

Thorium-230 in Monitoring Well 36-06 KD

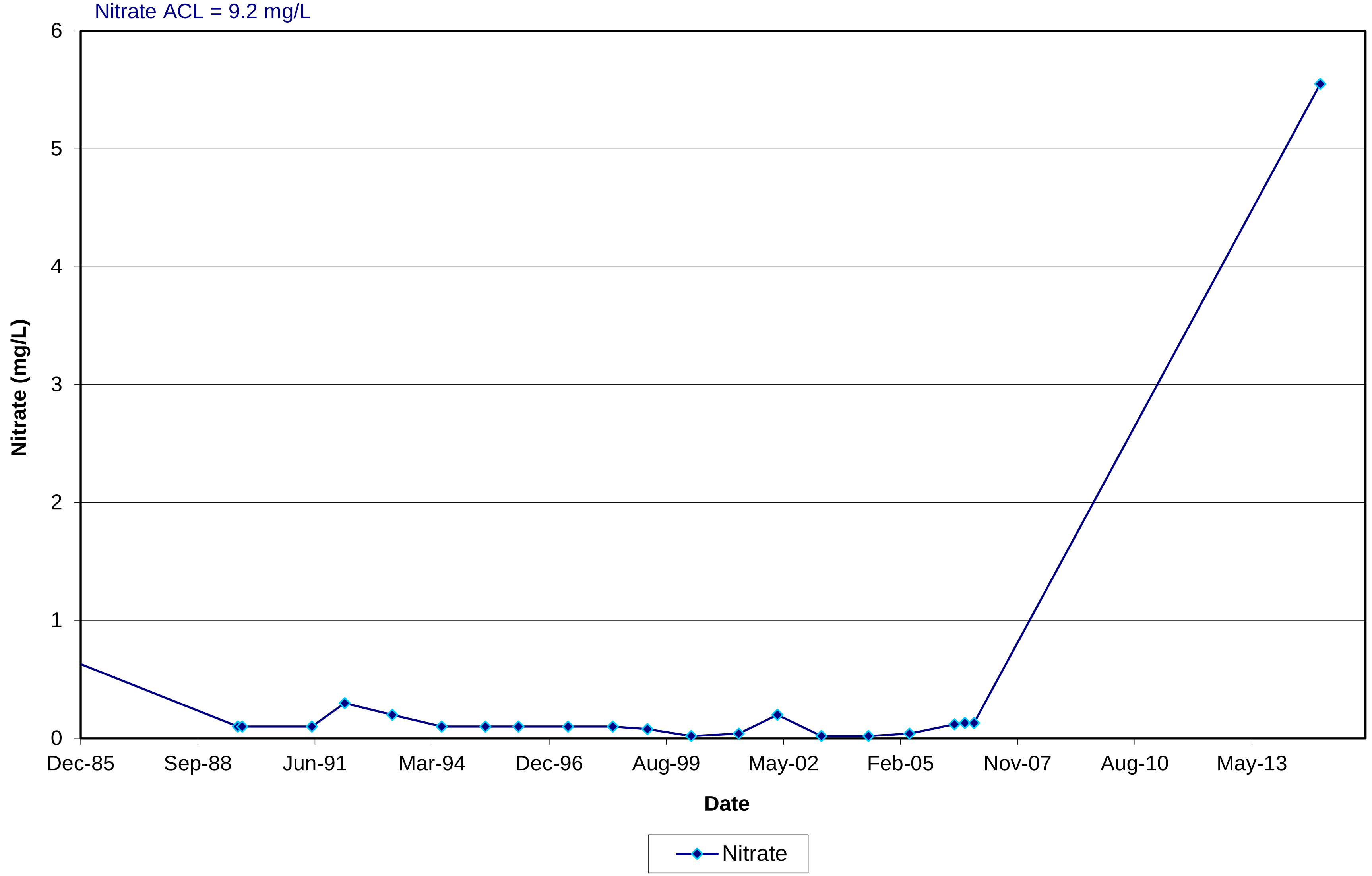


Stability Monitoring Plan
Time Versus Concentration Plots

Tres Hermanos A


Anions and TDS in Monitoring Well 30-01 TRA
Concentration (mg/L)
7000
6000
5000
4000
3000
2000
1000
0
TDS ACL = 6,400 mg/L
Sulfate ACL = 2,584 mg/L
Chloride ACL = 1,070 mg/L
Jan-75
Oct-77
Jun-80
Mar-83
Dec-85
Sep-88
Jun-91
Mar-94
Dec-96
Aug-99
May-02
Feb-05
Nov-07
Aug-10
May-13
Date
Chloride
Sulfate
TDS

Nitrate in Monitoring Well 30-01 TRA



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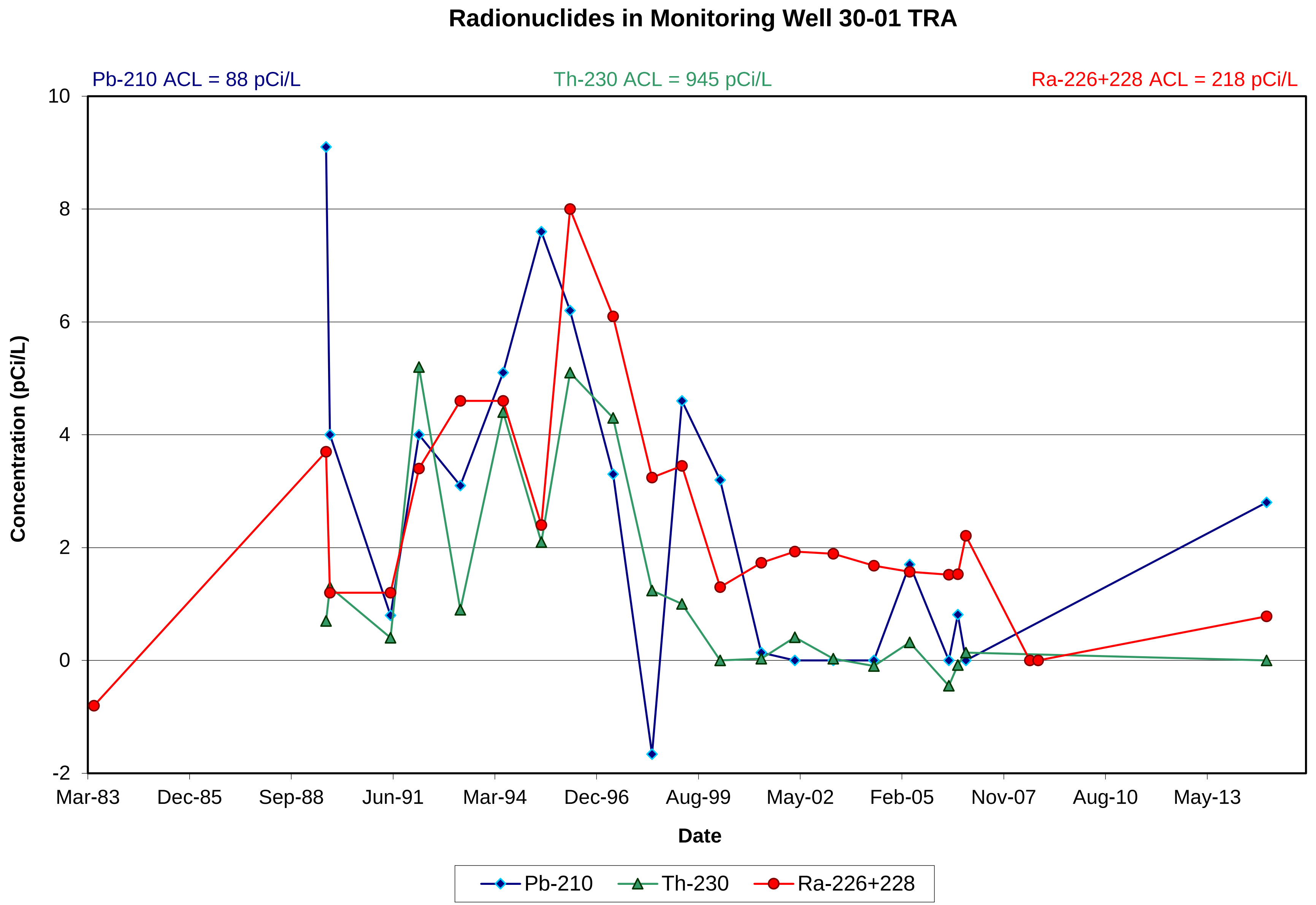

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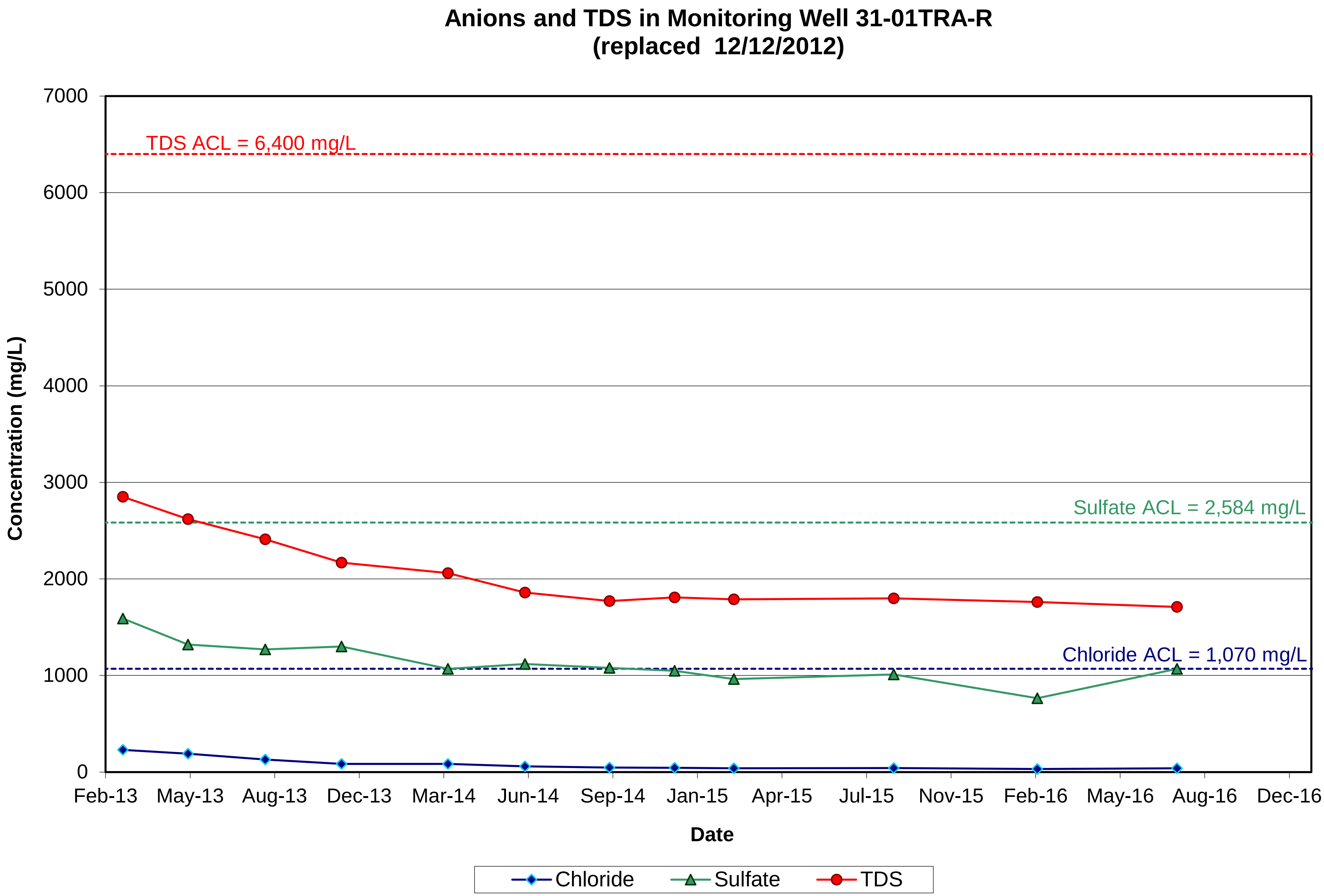
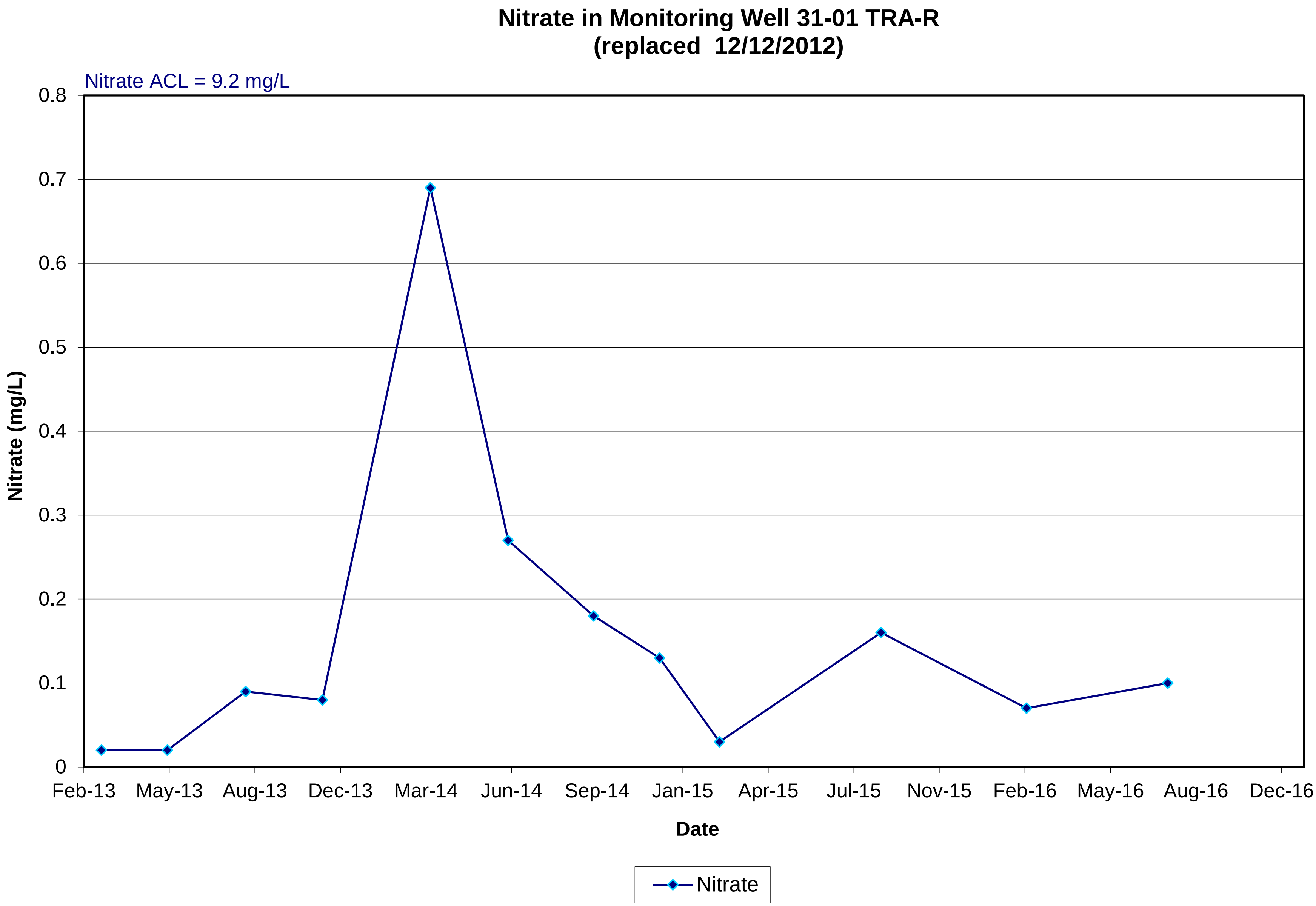
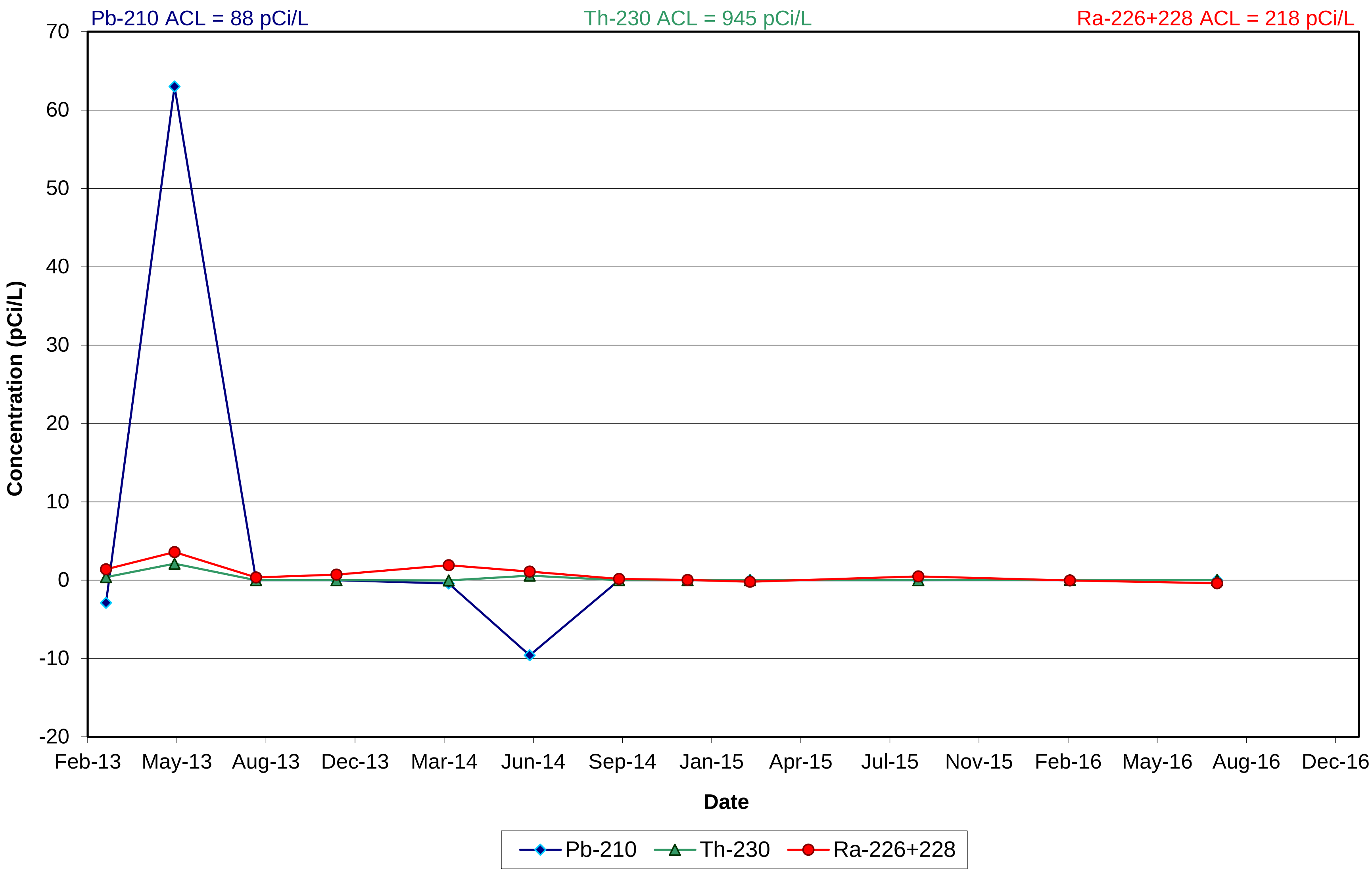

Anions and TDS in Monitoring Well 31-01TRA-R
(replaced 12/12/2012)
TDS ACL = 6,400 mg/L
Sulfate ACL = 2,584 mg/L
Chloride ACL = 1,070 mg/L
Concentration (mg/L)
7000
6000
5000
4000
3000
2000
1000
0
Feb-13
May-13
Aug-13
Dec-13
Mar-14
Jun-14
Sep-14
Jan-15
Apr-15
Jul-15
Nov-15
Feb-16
May-16
Aug-16
Dec-16
Date
Chloride
Sulfate
TDS

INTERA


Nitrate in Monitoring Well 31-01 TRA-R
(replaced 12/12/2012)
Nitrate ACL = 9.2 mg/L
Nitrate (mg/L)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Feb-13
May-13
Aug-13
Dec-13
Mar-14
Jun-14
Sep-14
Jan-15
Apr-15
Jul-15
Nov-15
Feb-16
May-16
Aug-16
Dec-16
Date
Nitrate

Radionuclides in Well 31-01 TRA-R (replaced 12/12/2012)



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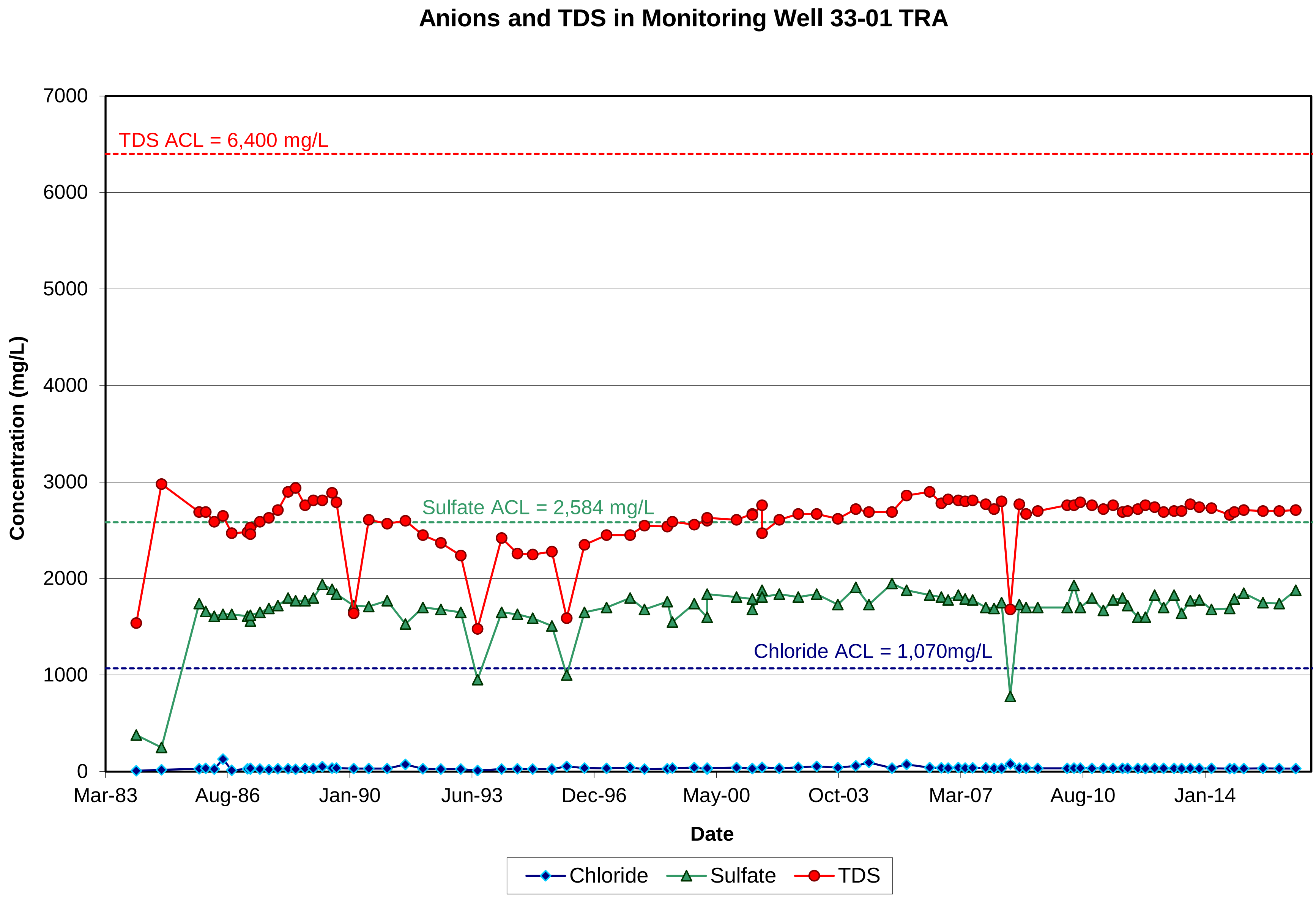
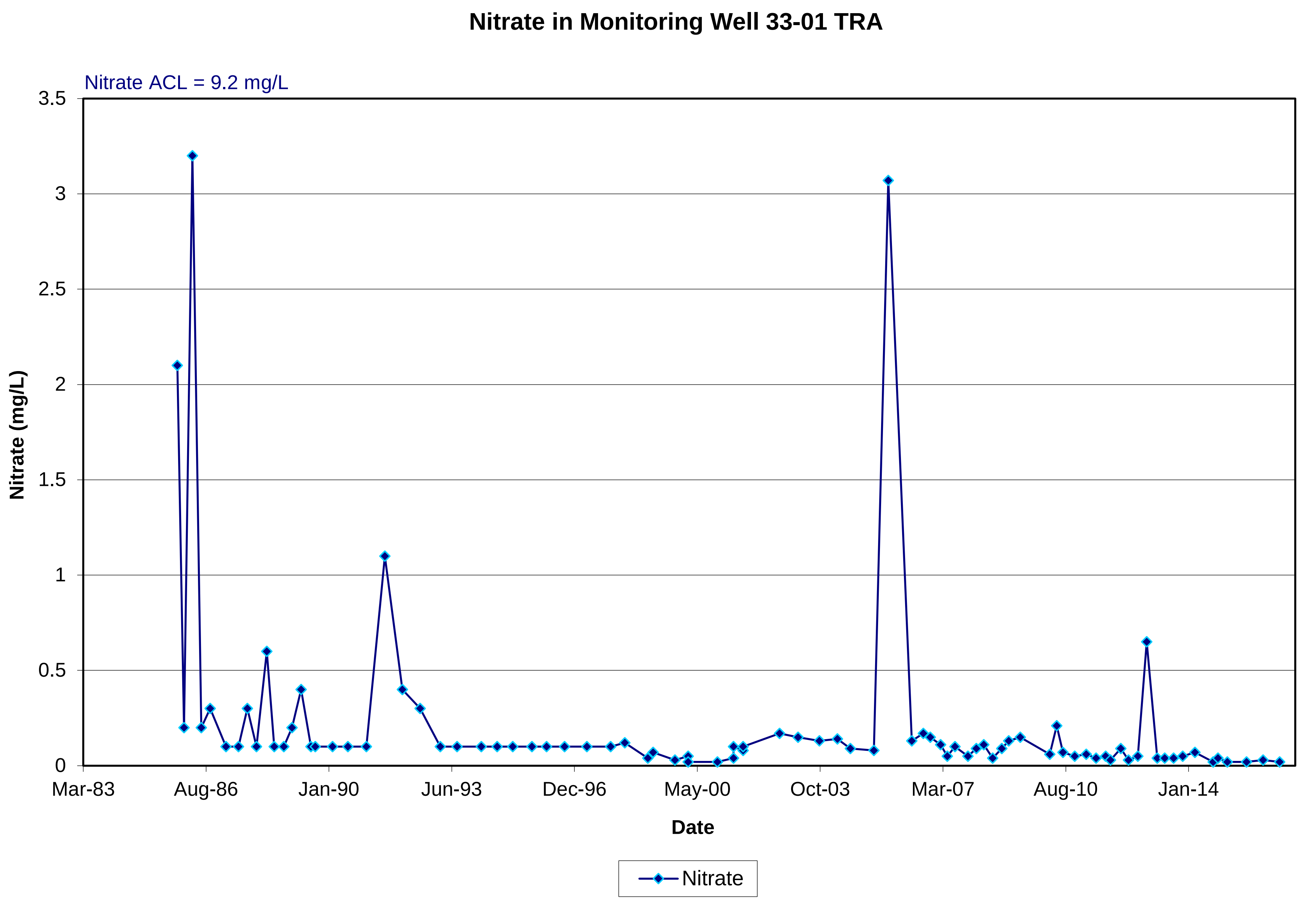


Anions and TDS in Monitoring Well 33-01 TRA
Concentration (mg/L)
7000
6000
5000
4000
3000
2000
1000
0
TDS ACL = 6,400 mg/L
Sulfate ACL = 2,584 mg/L
Chloride ACL = 1,070mg/L
Mar-83
Aug-86
Jan-90
Jun-93
Dec-96
May-00
Oct-03
Mar-07
Aug-10
Jan-14
Date
Chloride
Sulfate
TDS



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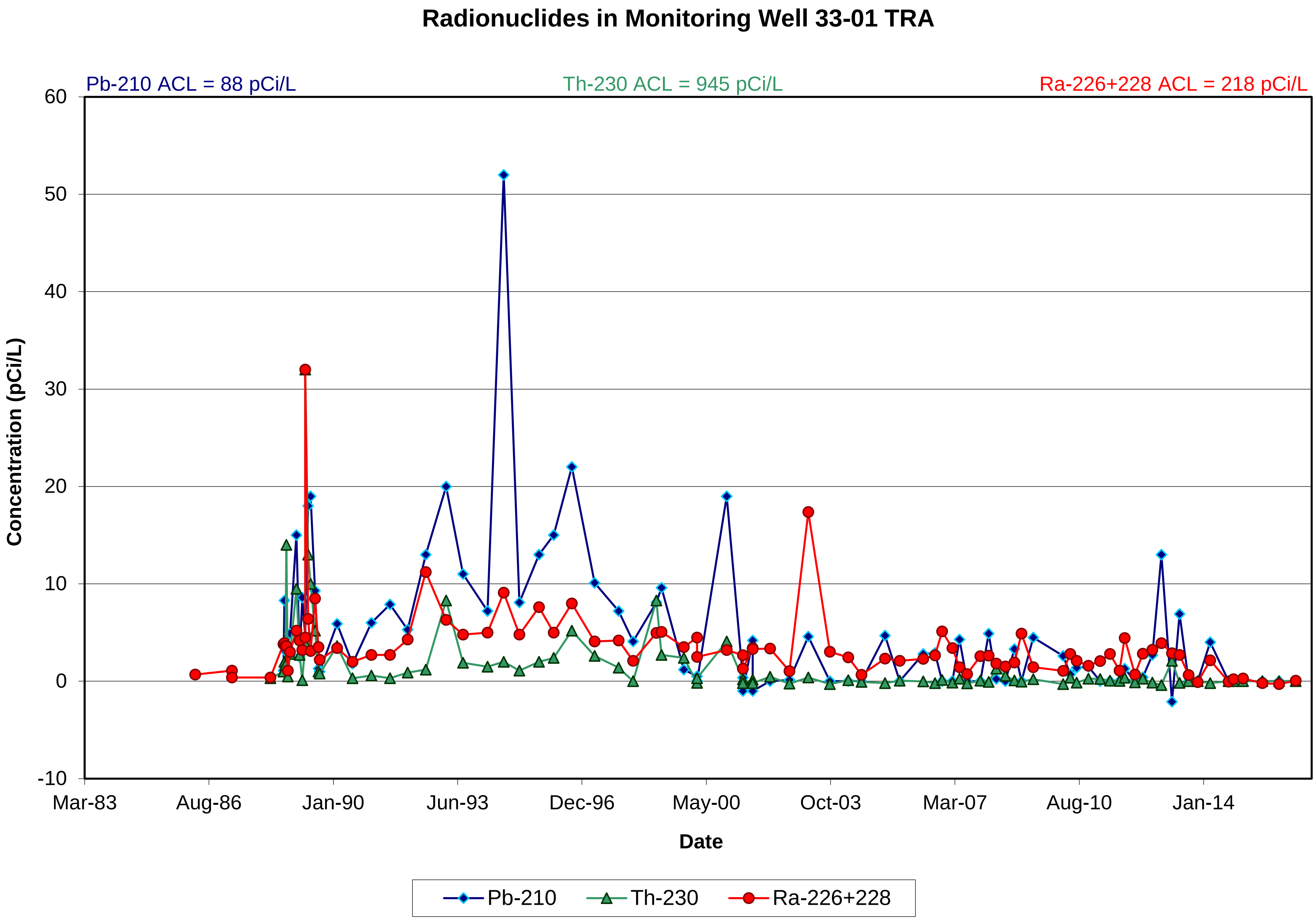

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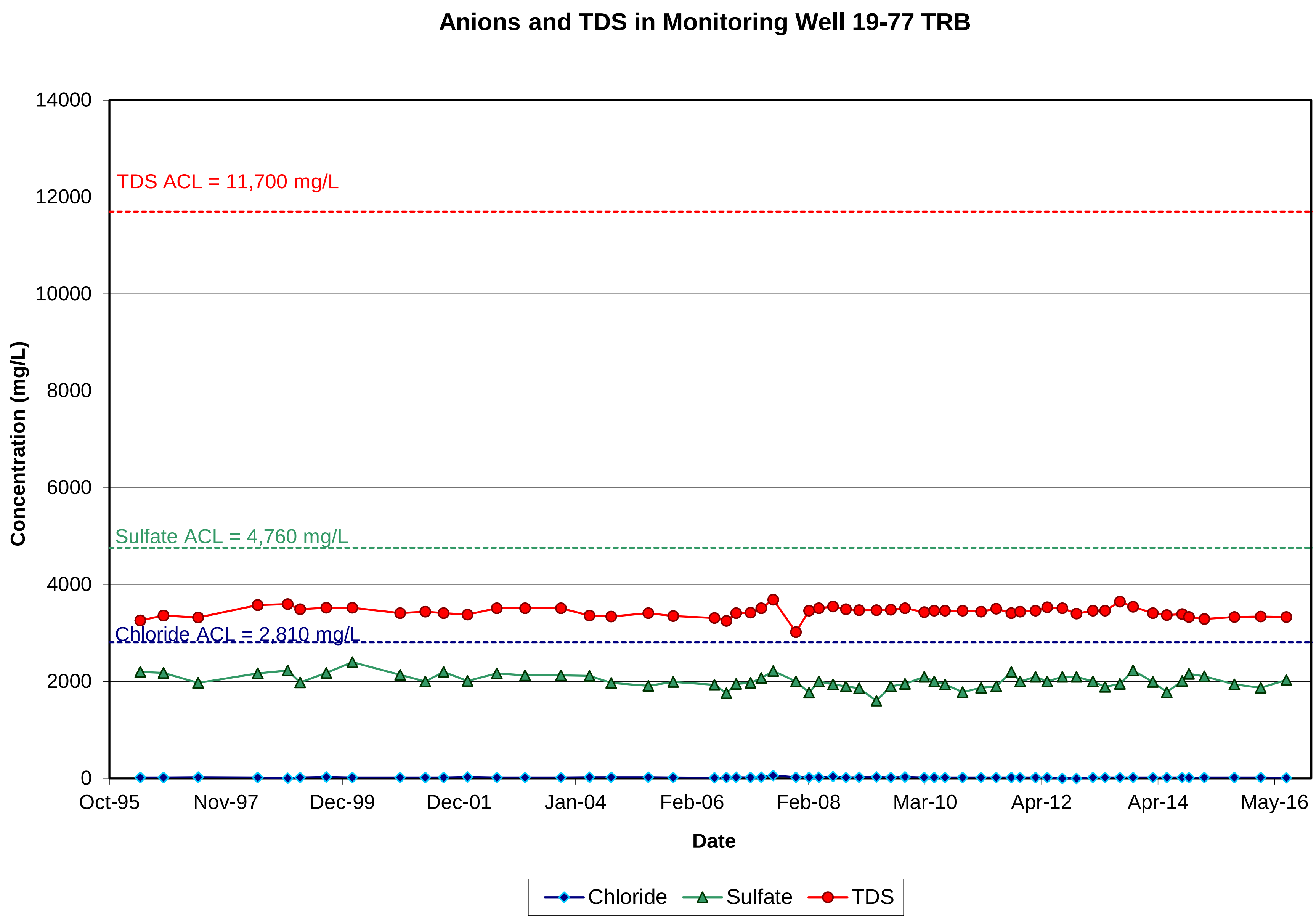
Stability Monitoring Plan
Time Versus Concentration Plots

Tres Hermanos B



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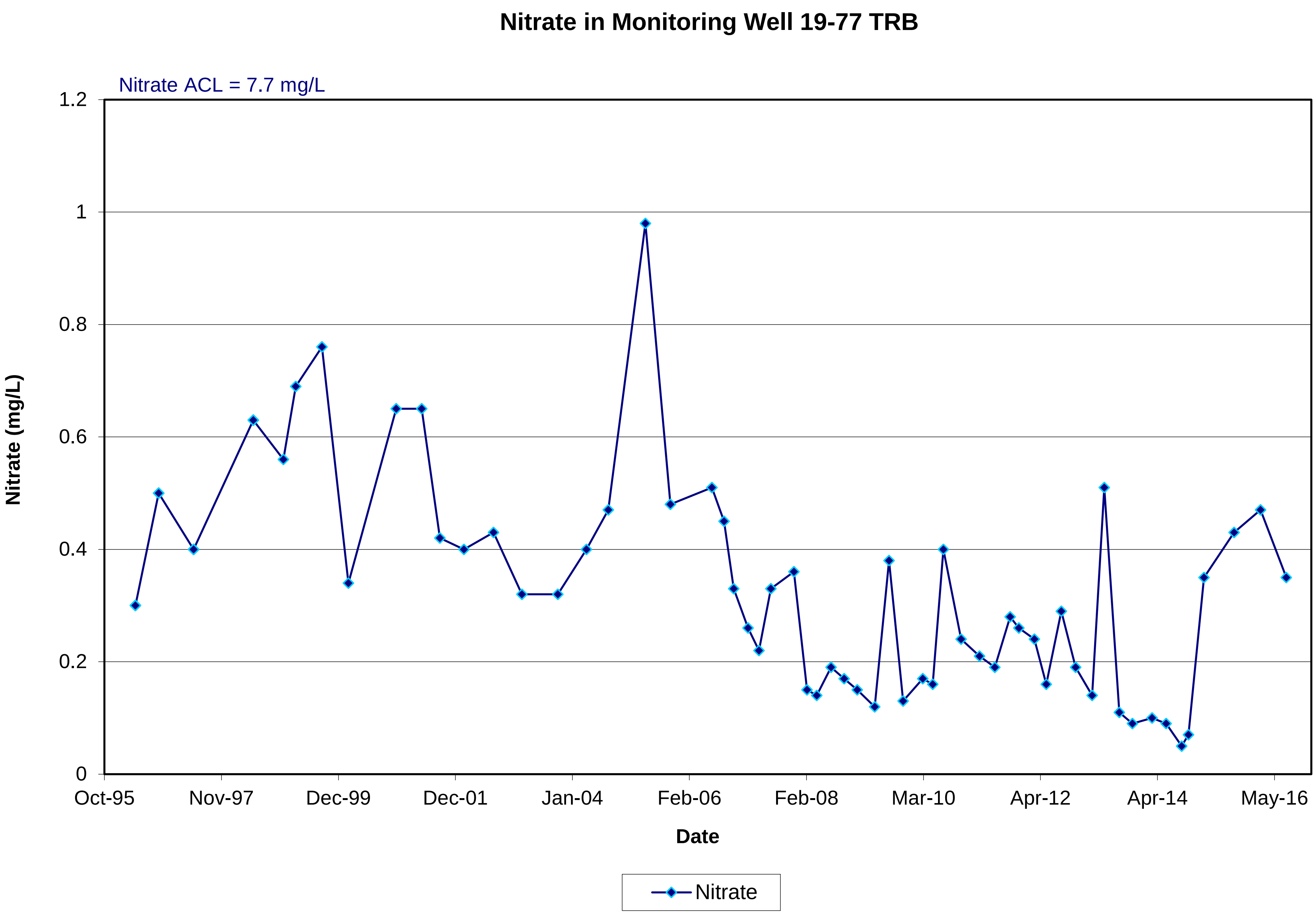

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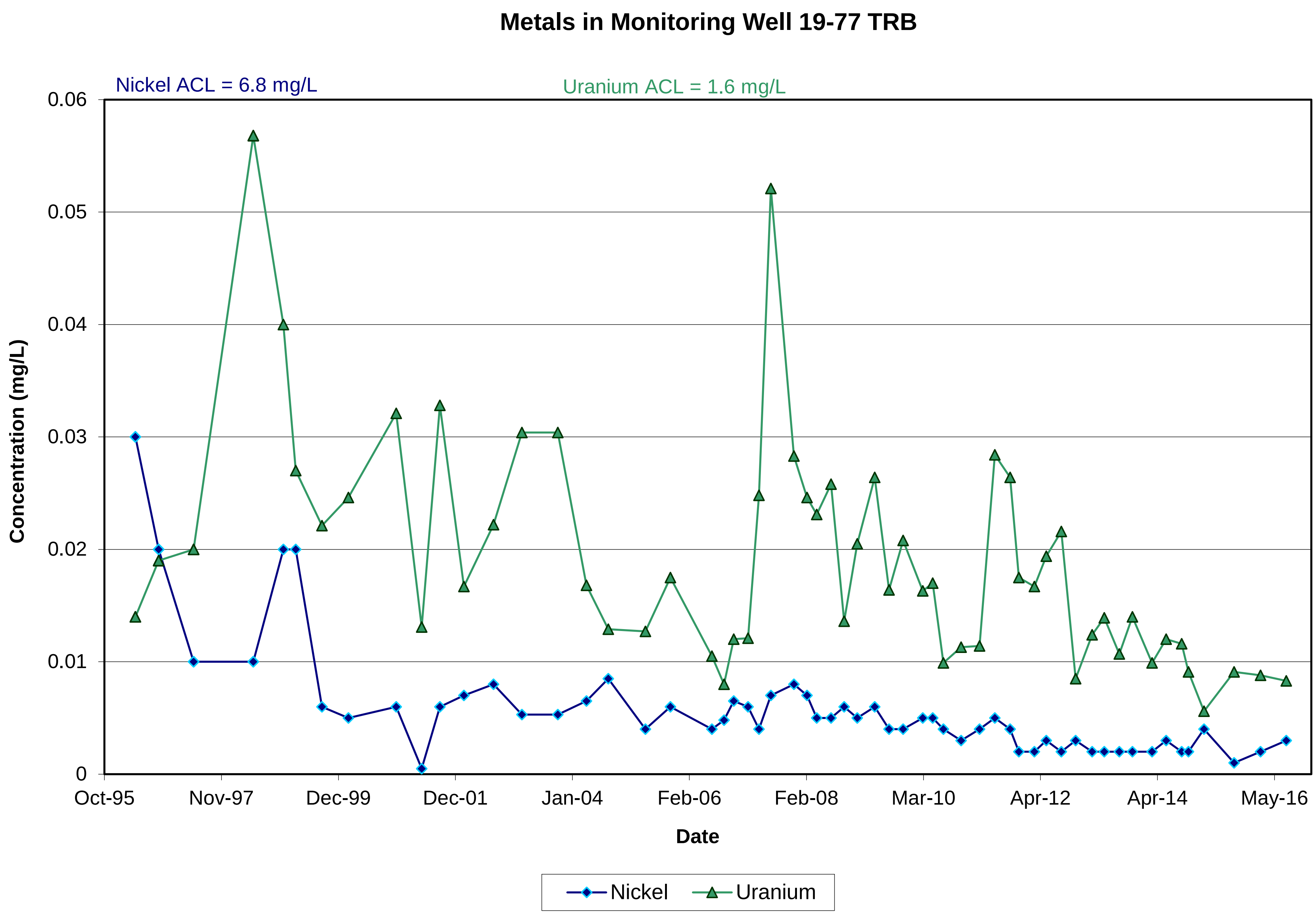

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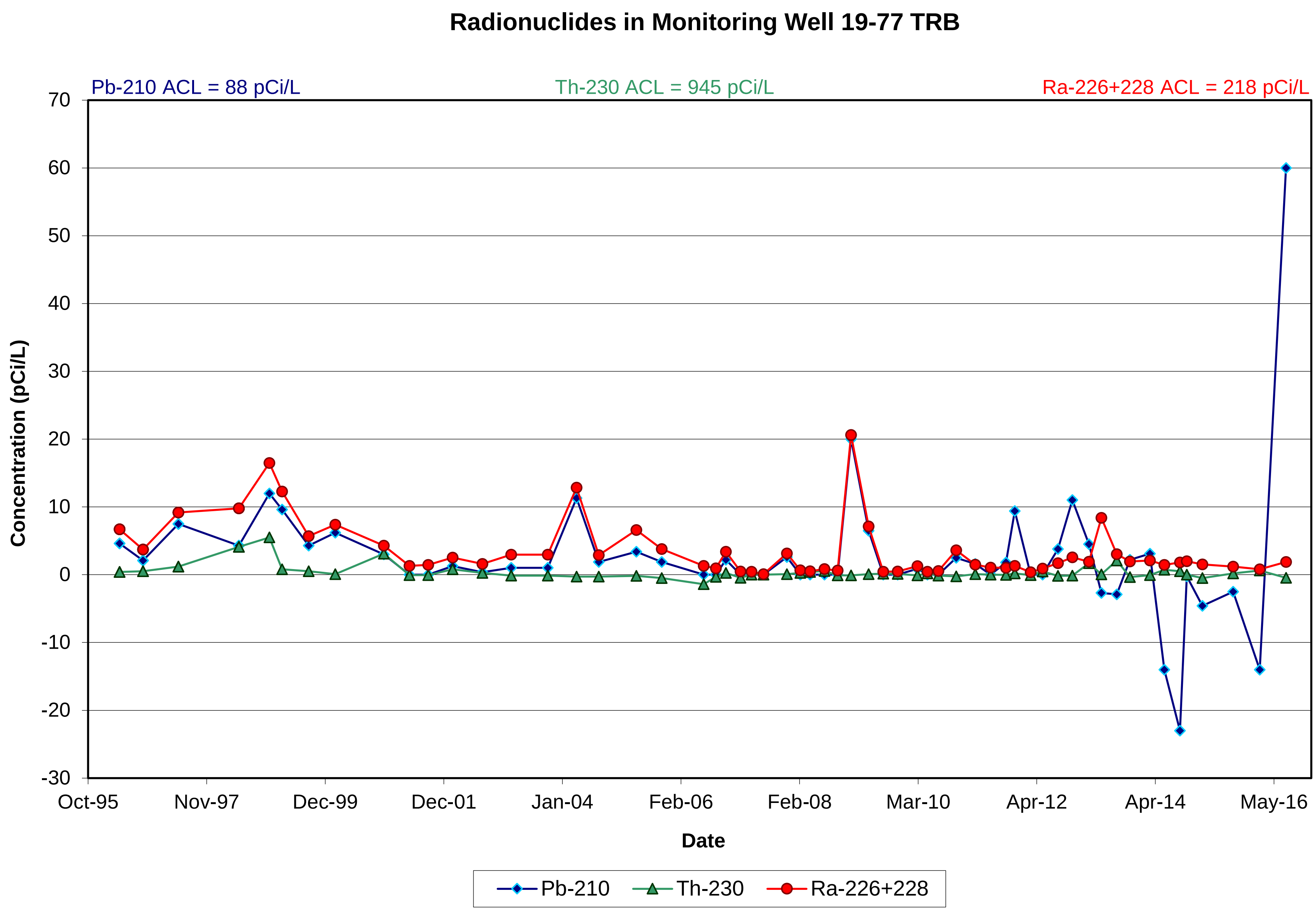
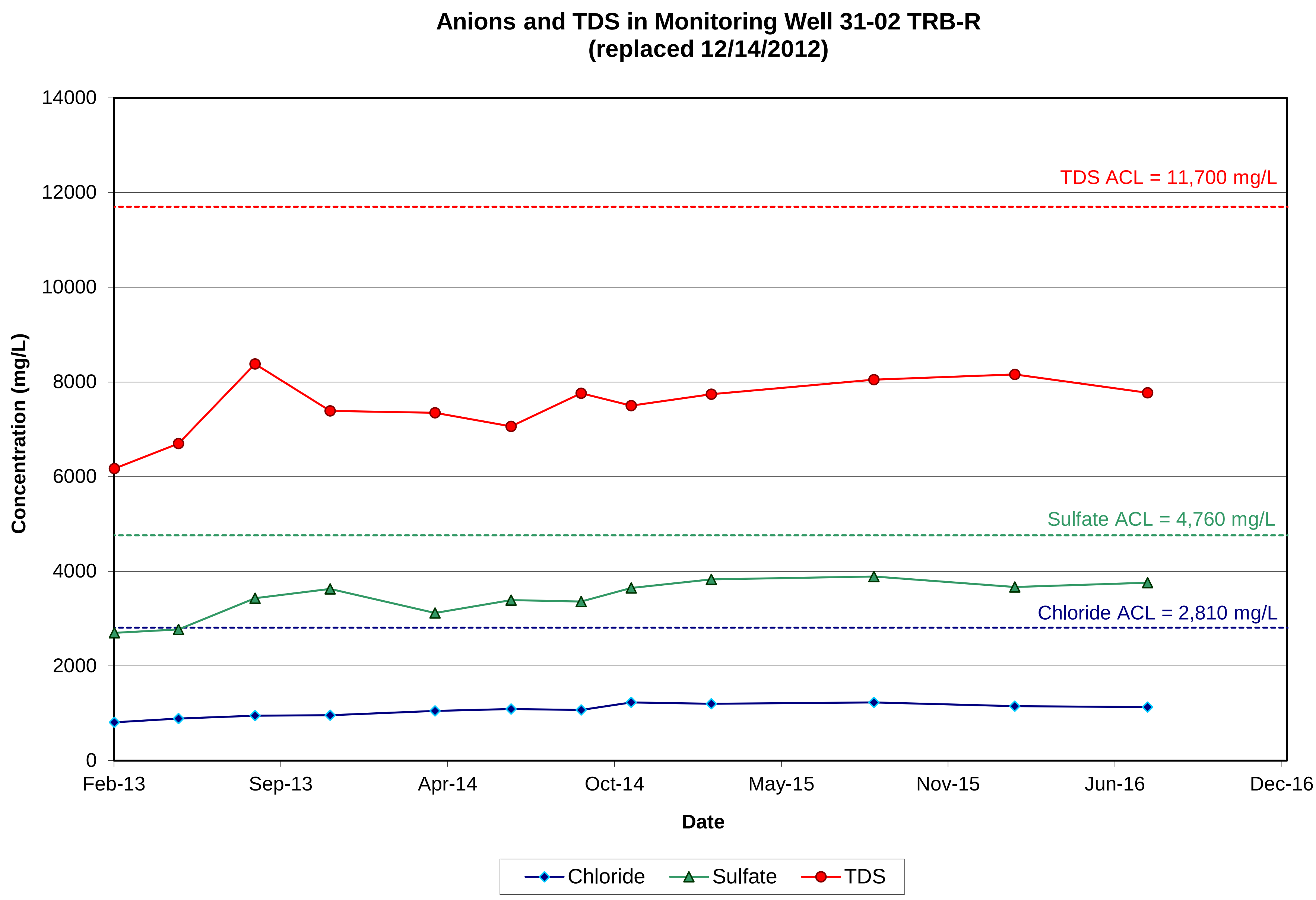
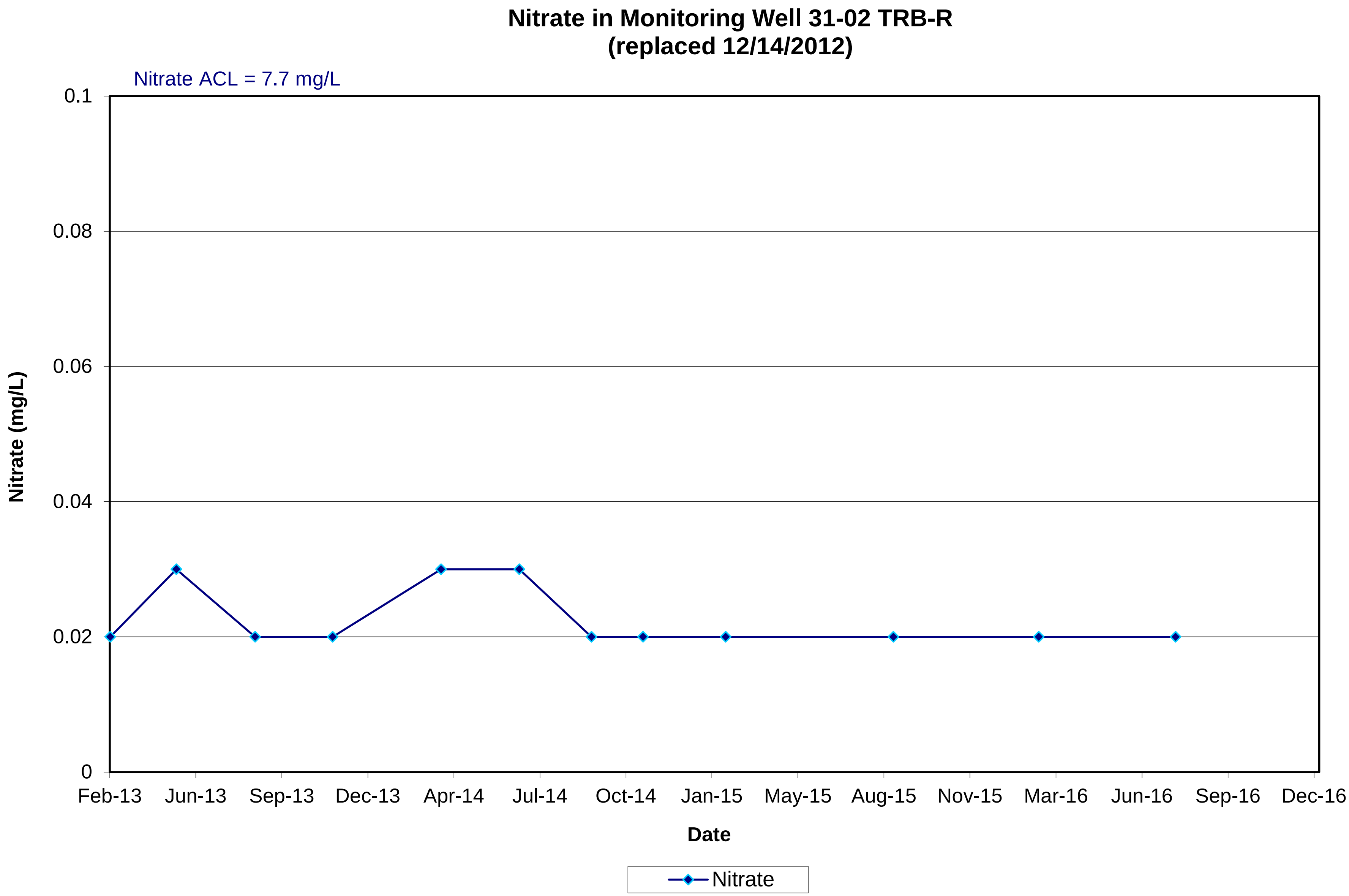


Radionuclides in Monitoring Well 19-77 TRB
Pb-210 ACL = 88 pCi/L
Th-230 ACL = 945 pCi/L
Ra-226+228 ACL = 218 pCi/L
Concentration (pCi/L)
70
60
50
40
30
20
10
0
-10
-20
-30
Oct-95
Nov-97
Dec-99
Dec-01
Jan-04
Feb-06
Feb-08
Mar-10
Apr-12
Apr-14
May-16
Date
Pb-210
Th-230
Ra-226+228

INTERA



Anions and TDS in Monitoring Well 31-02 TRB-R
(replaced 12/14/2012)
Concentration (mg/L)
14000
12000
10000
8000
6000
4000
2000
0
TDS ACL = 11,700 mg/L
Sulfate ACL = 4,760 mg/L
Chloride ACL = 2,810 mg/L
Feb-13
Sep-13
Apr-14
Oct-14
May-15
Nov-15
Jun-16
Dec-16
Date
Chloride
Sulfate
TDS



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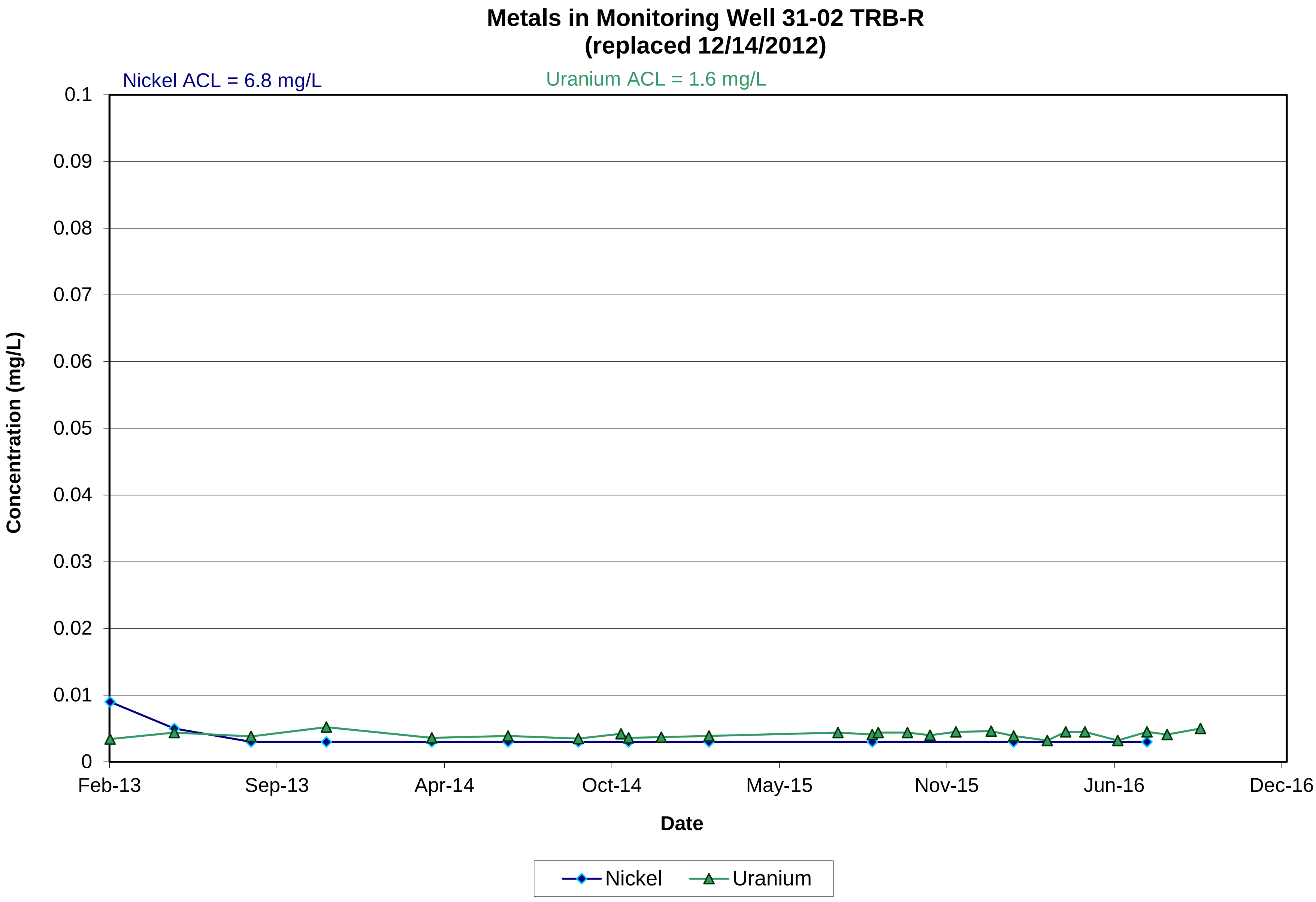
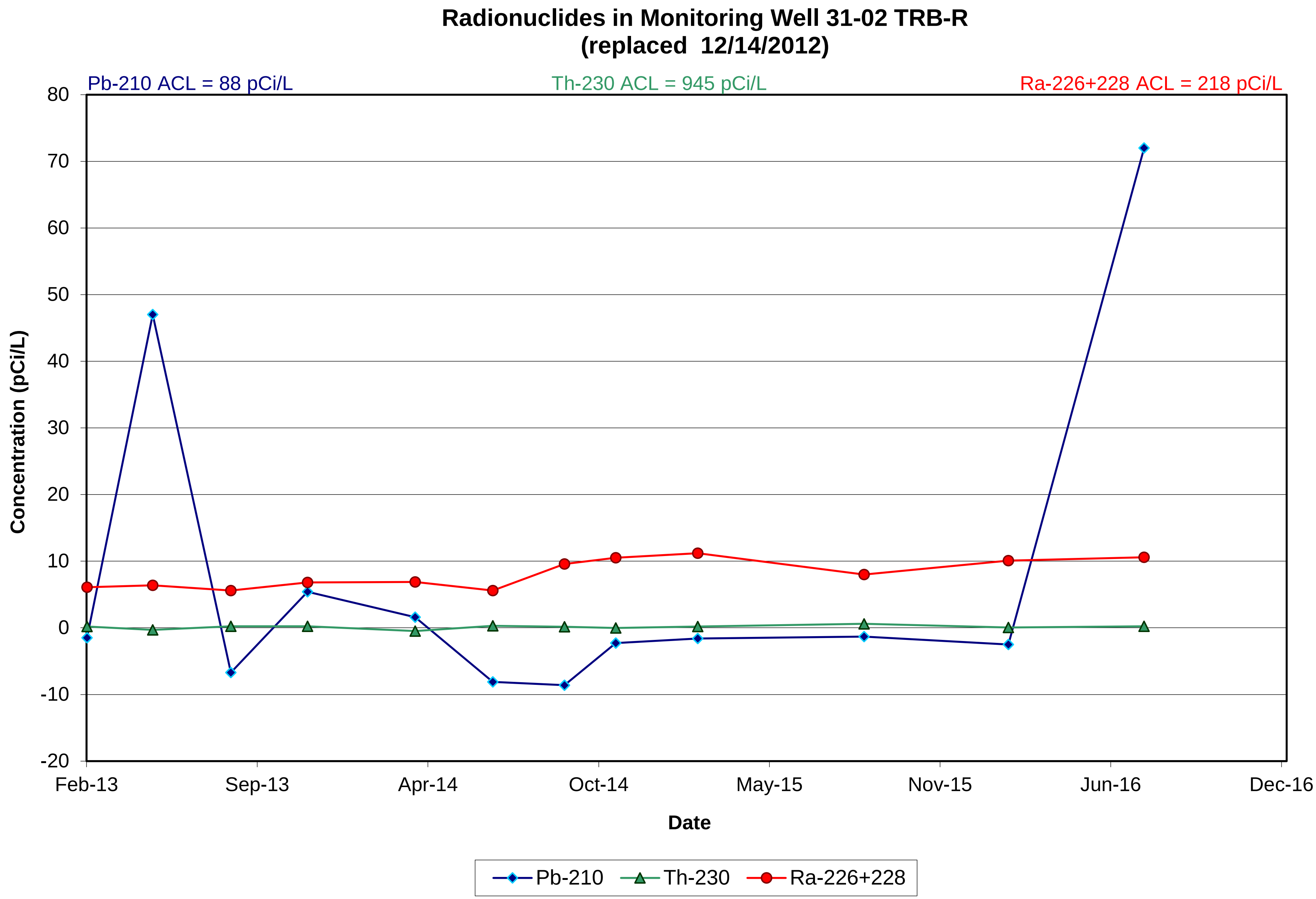


Metals in Monitoring Well 31-02 TRB-R
(replaced 12/14/2012)
Nickel ACL = 6.8 mg/L
Uranium ACL = 1.6 mg/L
Concentration (mg/L)
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Feb-13
Sep-13
Apr-14
Oct-14
May-15
Nov-15
Jun-16
Dec-16
Date
Nickel
Uranium



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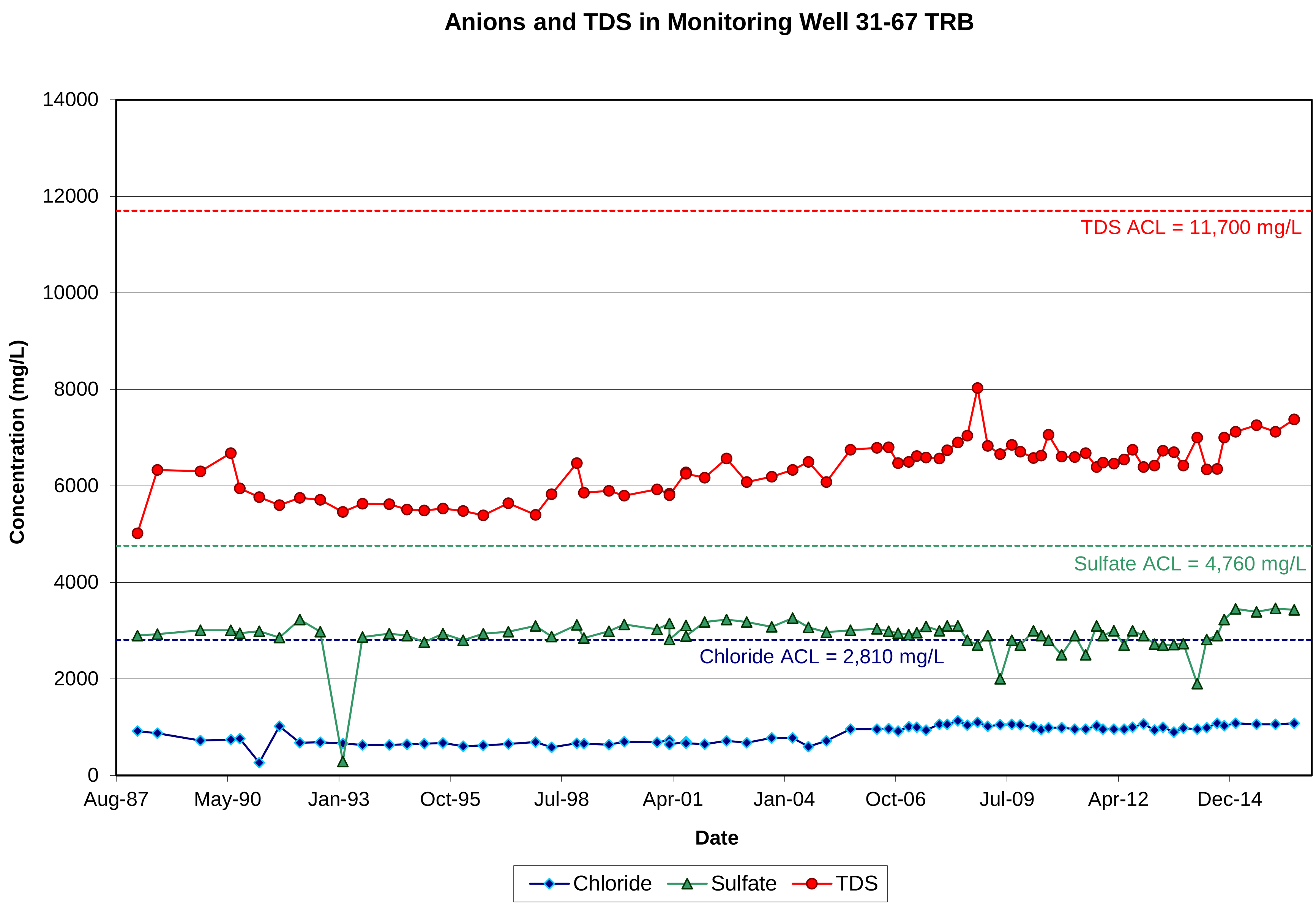
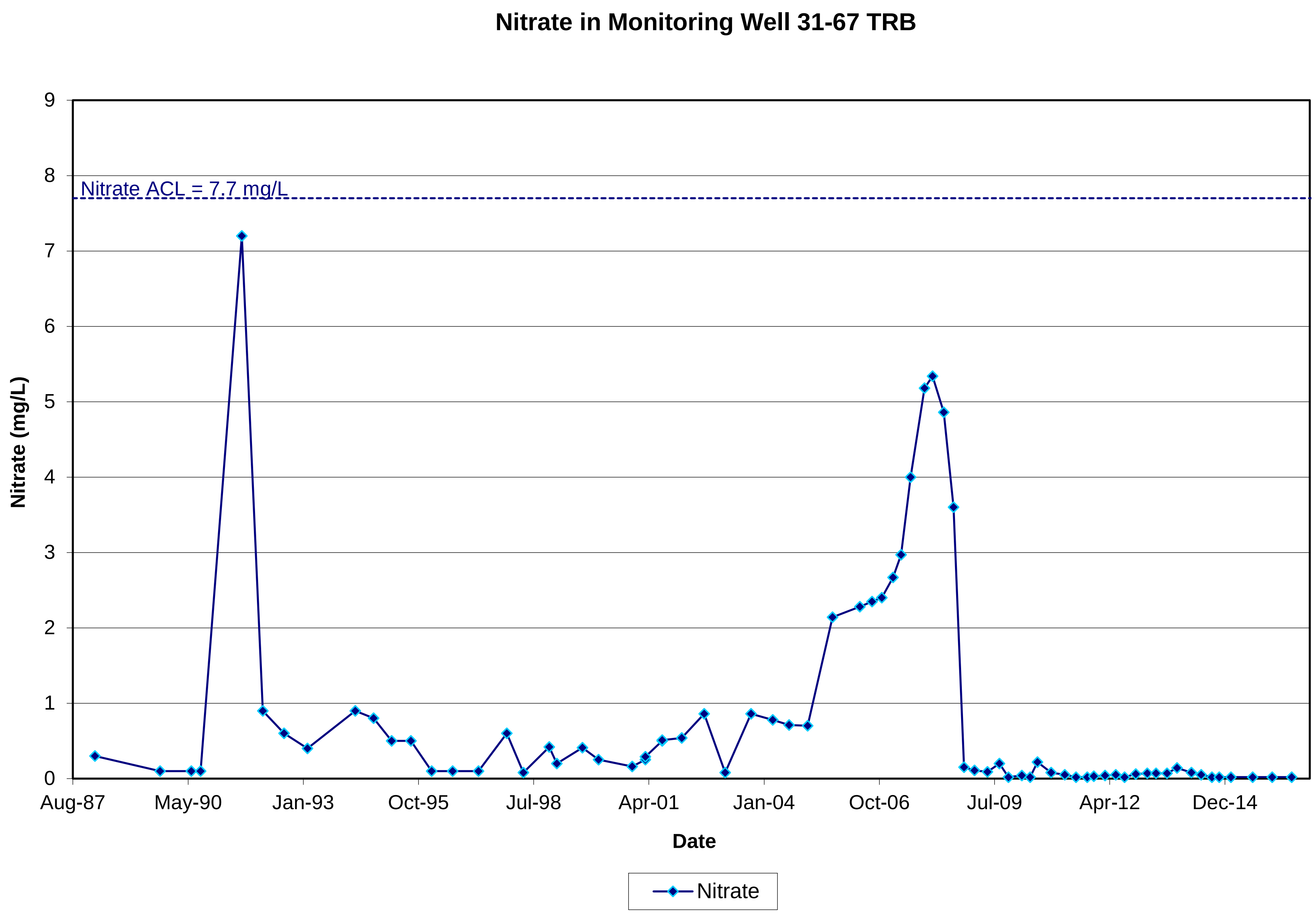
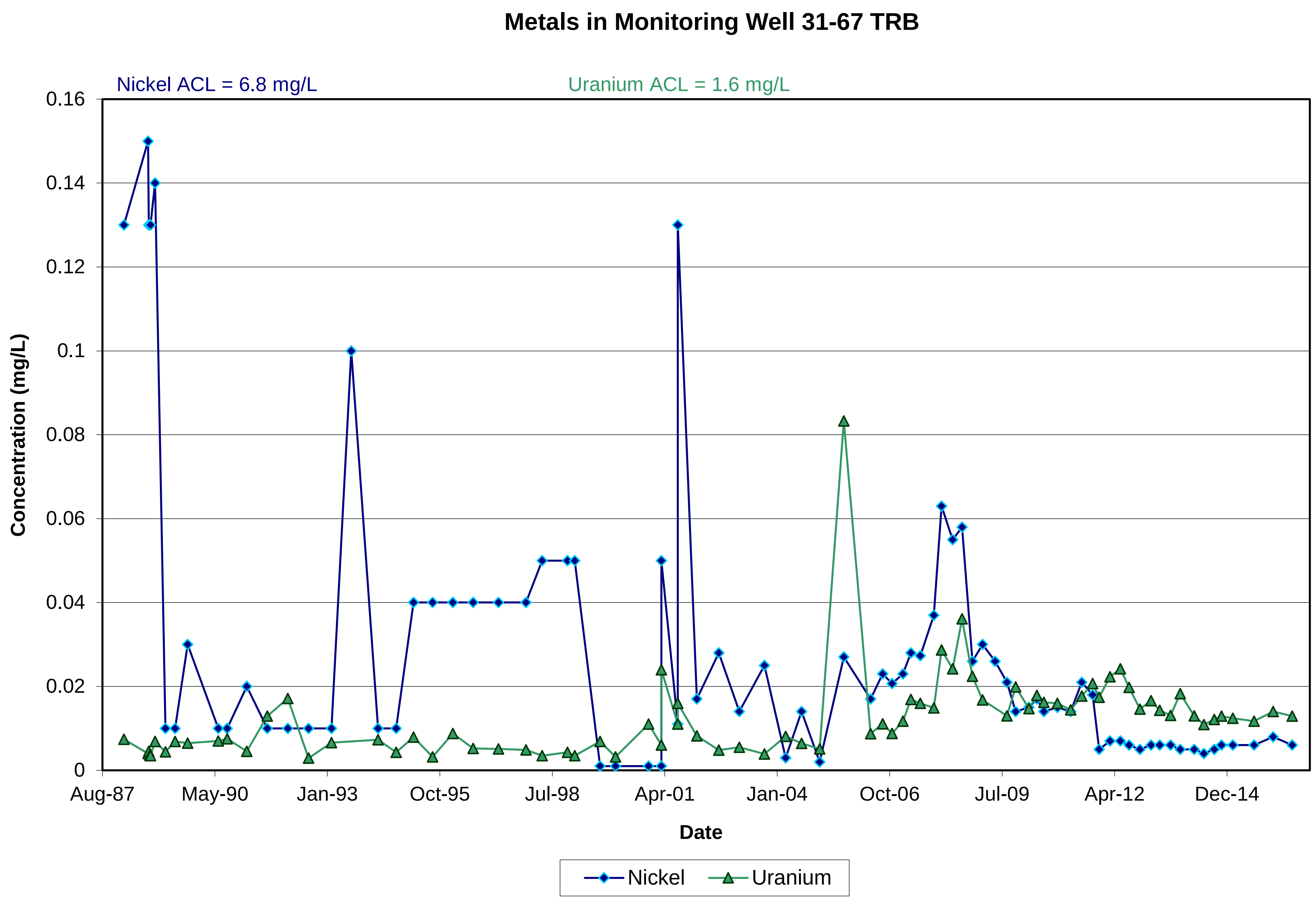
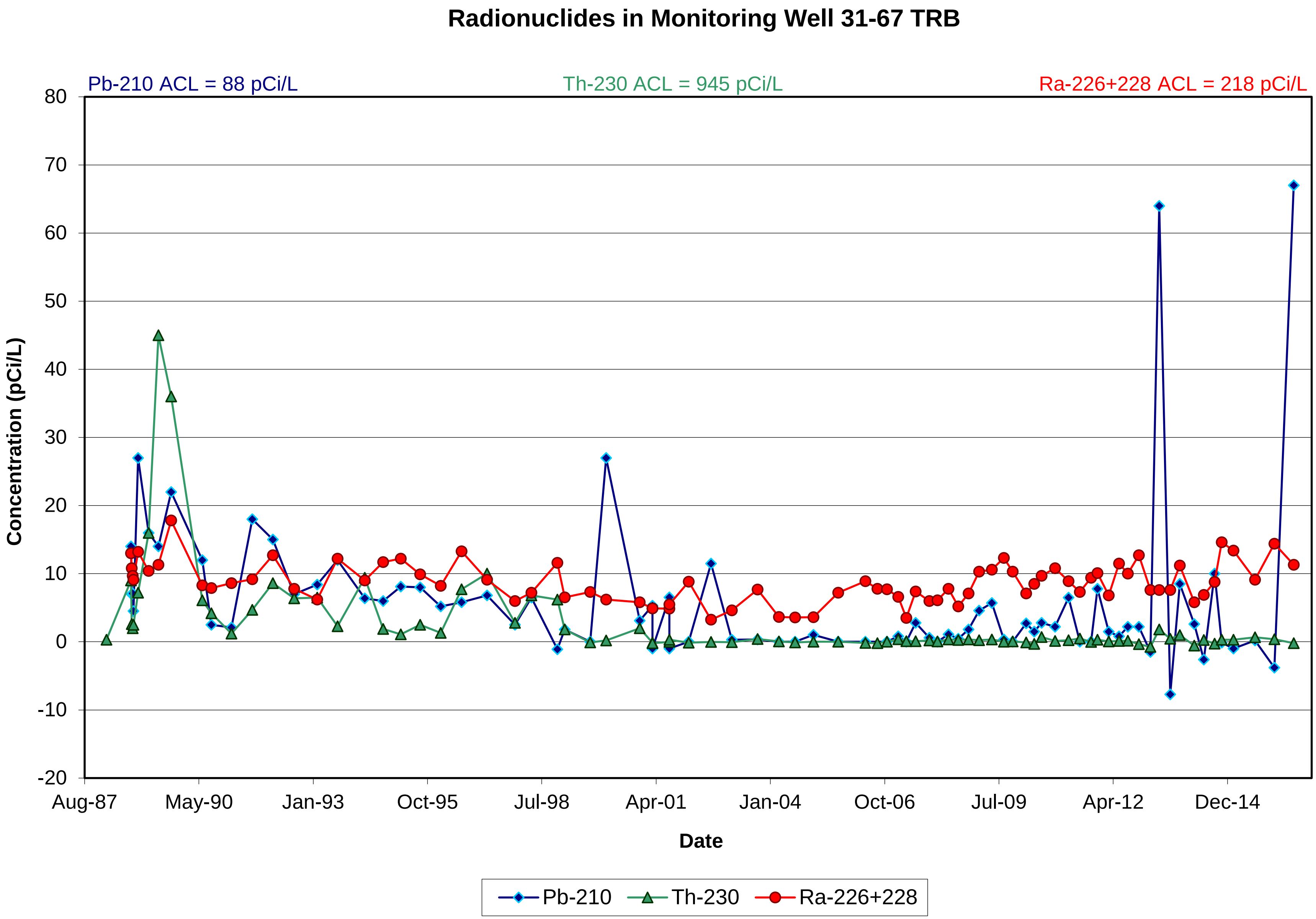

Anions and TDS in Monitoring Well 31-67 TRB
Concentration (mg/L)
14000
12000
10000
8000
6000
4000
2000
0
TDS ACL = 11,700 mg/L
Sulfate ACL = 4,760 mg/L
Chloride ACL = 2,810 mg/L
Aug-87
May-90
Jan-93
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Date
Chloride
Sulfate
TDS



Nitrate in Monitoring Well 31-67 TRB
Nitrate ACL = 7.7 mg/L
Nitrate (mg/L)
9
8
7
6
5
4
3
2
1
0
Aug-87
May-90
Jan-93
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Date
Nitrate



Metals in Monitoring Well 31-67 TRB
Nickel ACL = 6.8 mg/L
Uranium ACL = 1.6 mg/L
Concentration (mg/L)
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Aug-87
May-90
Jan-93
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Date
Nickel
Uranium



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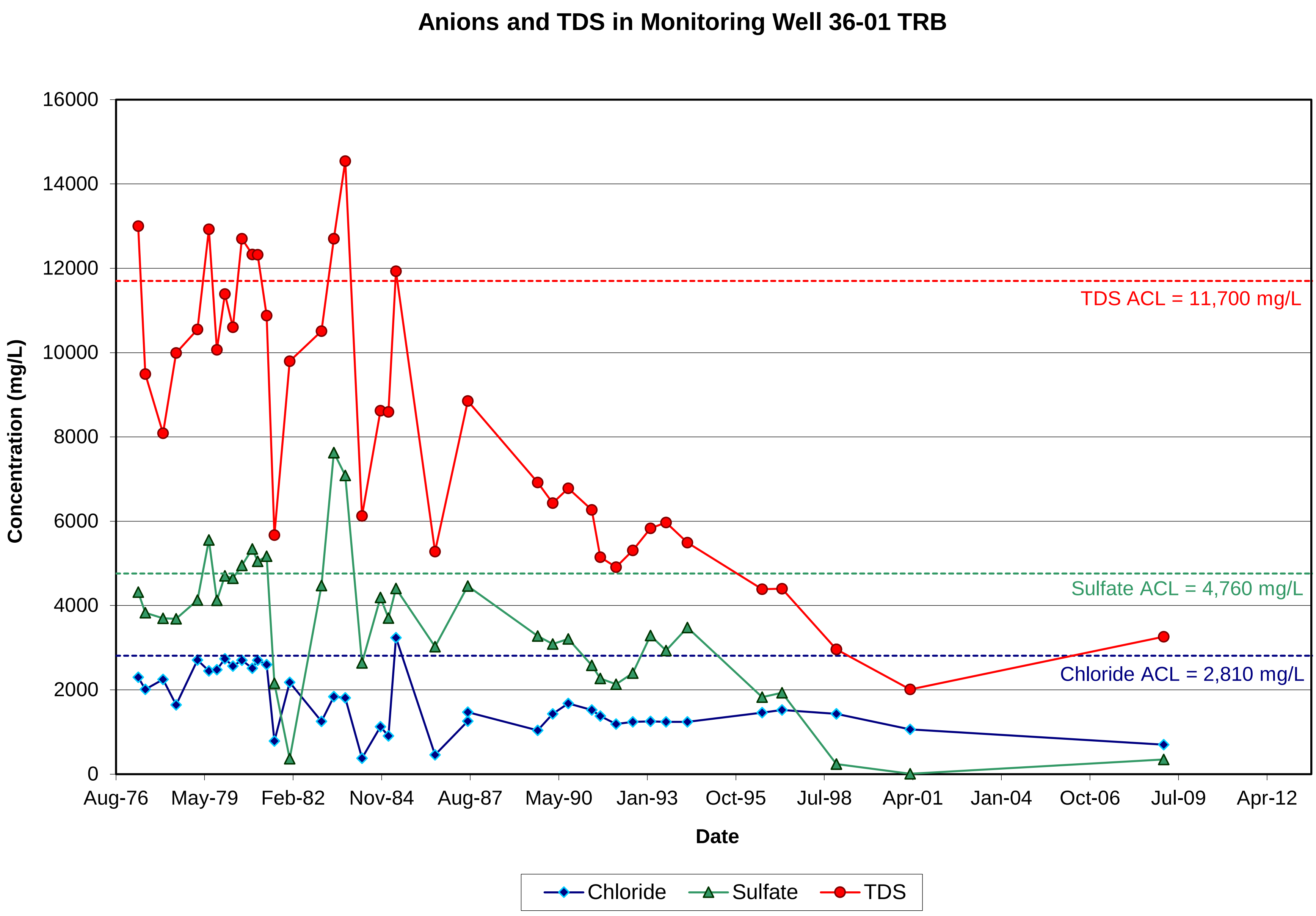

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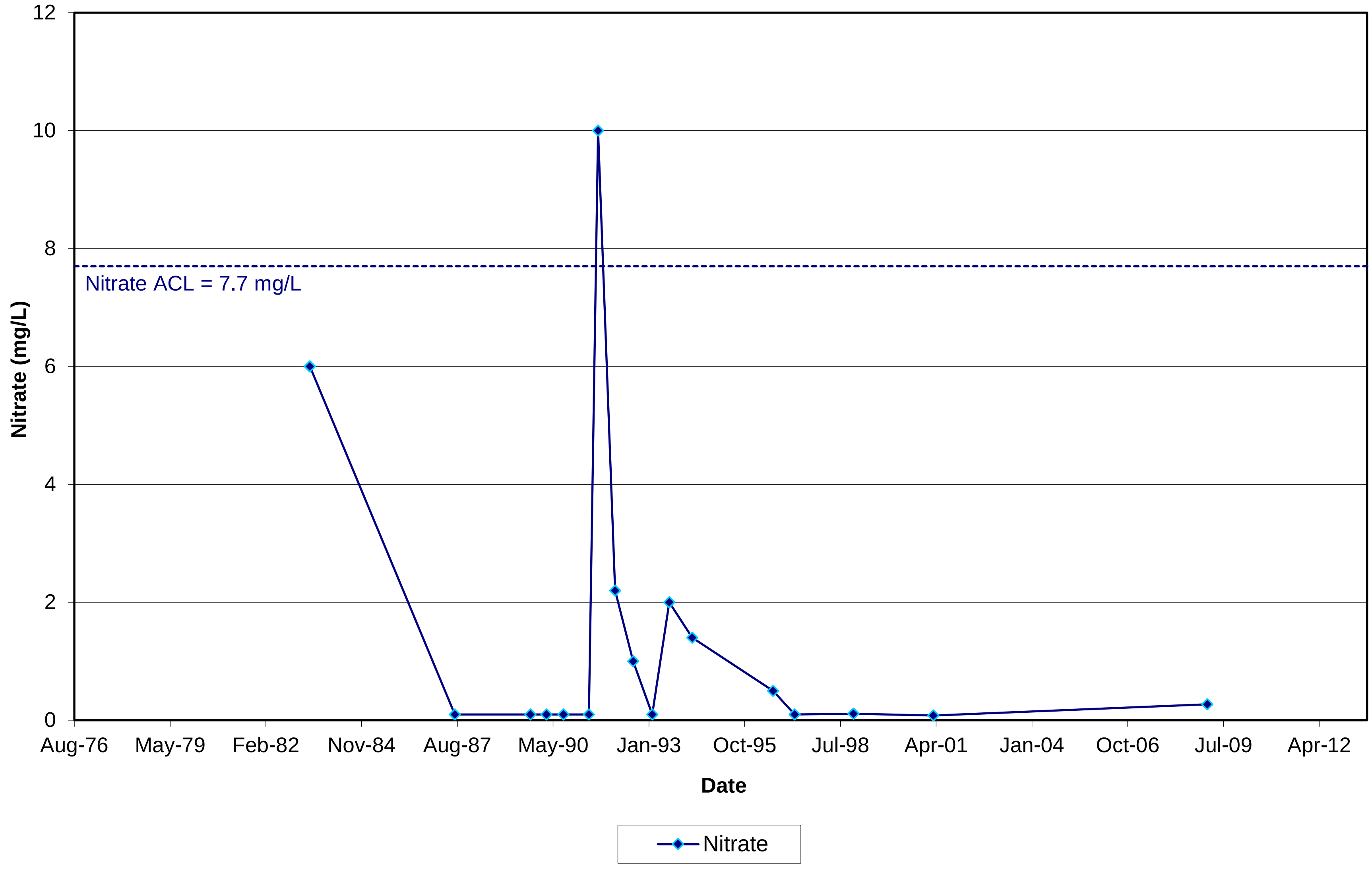
Nitrate in Monitoring Well 36-01 TRB



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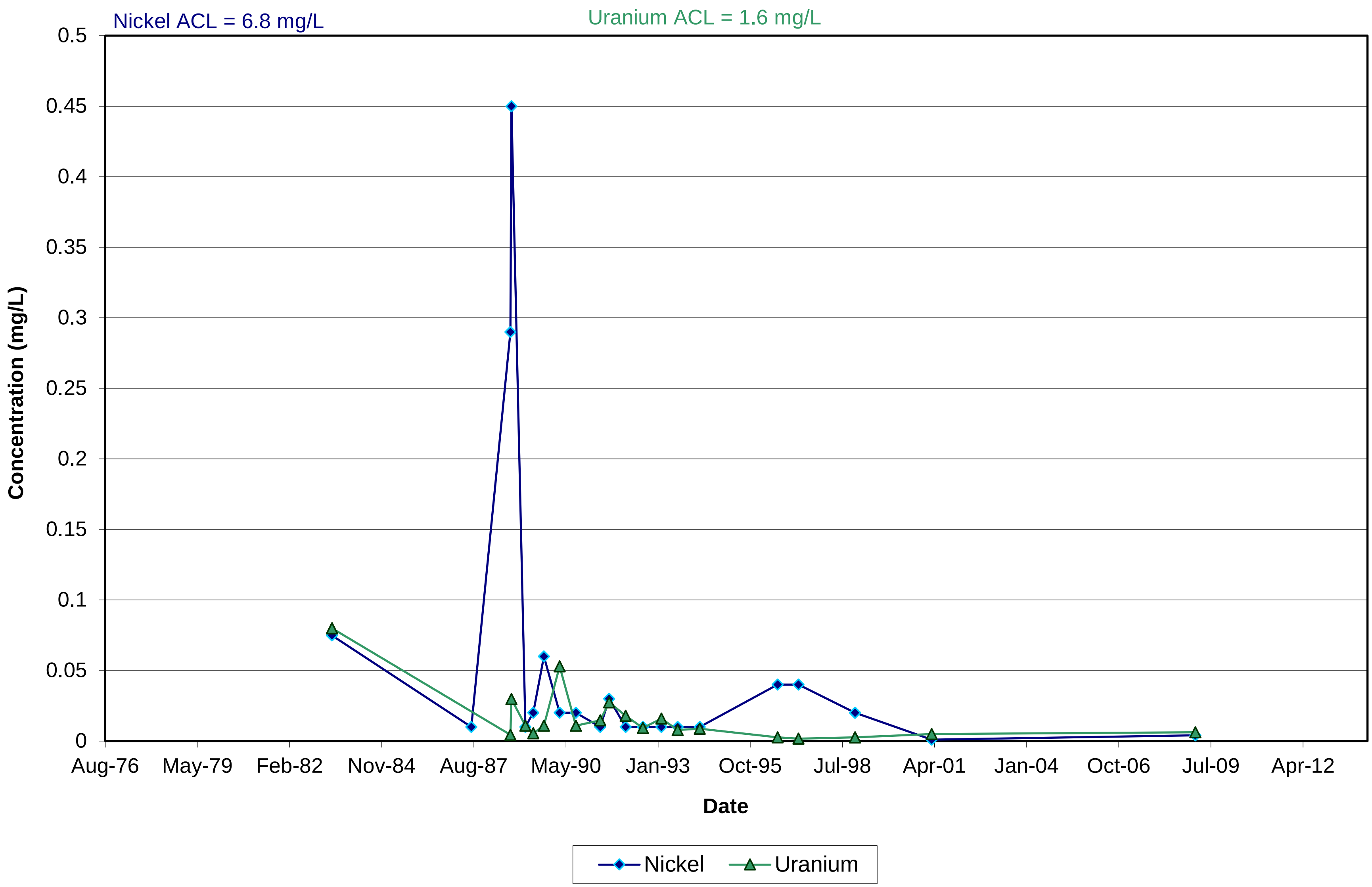
Metals in Monitoring Well 36-01 TRB



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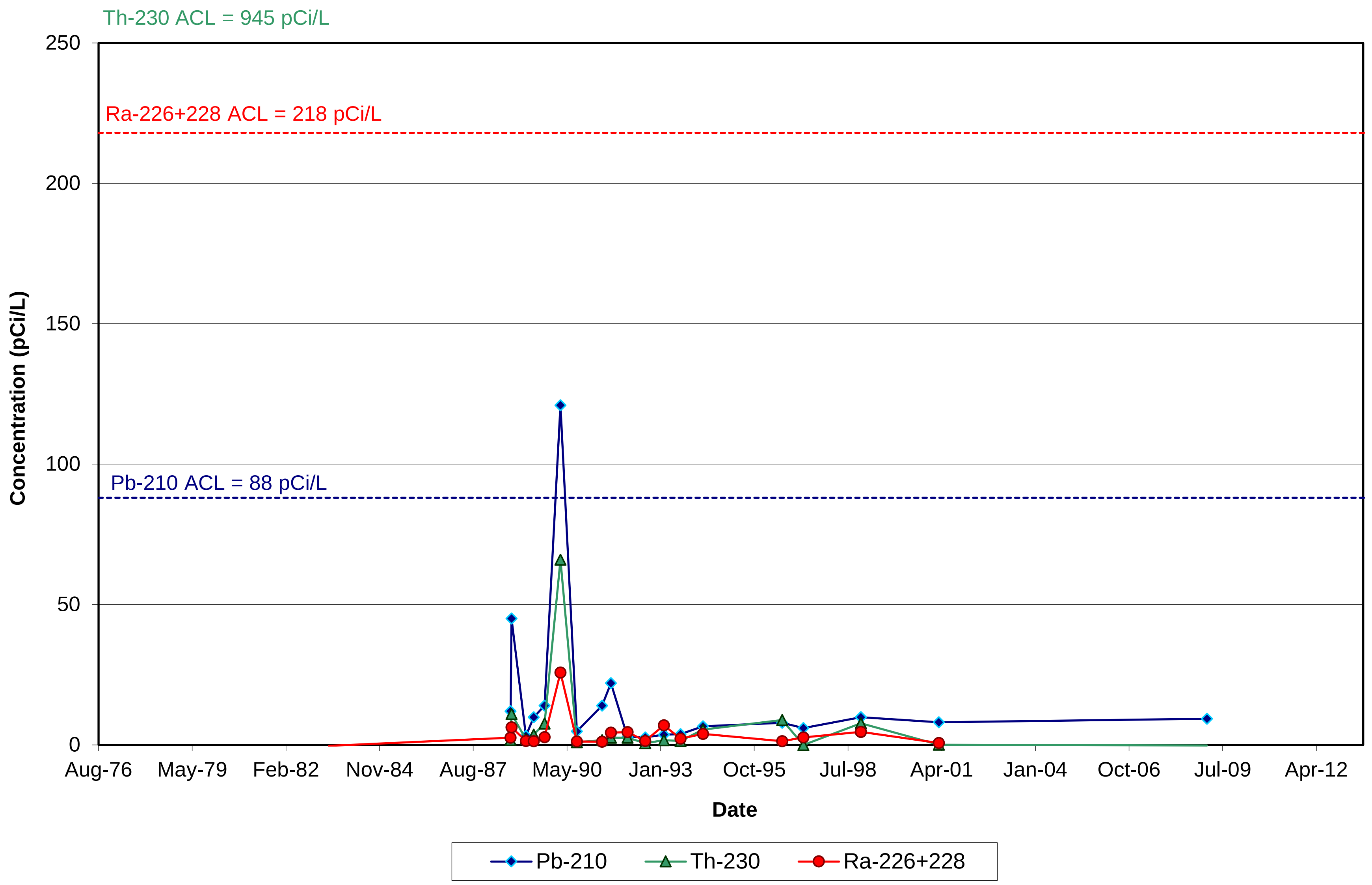
Radionuclides in Monitoring Well 36-01 TRB



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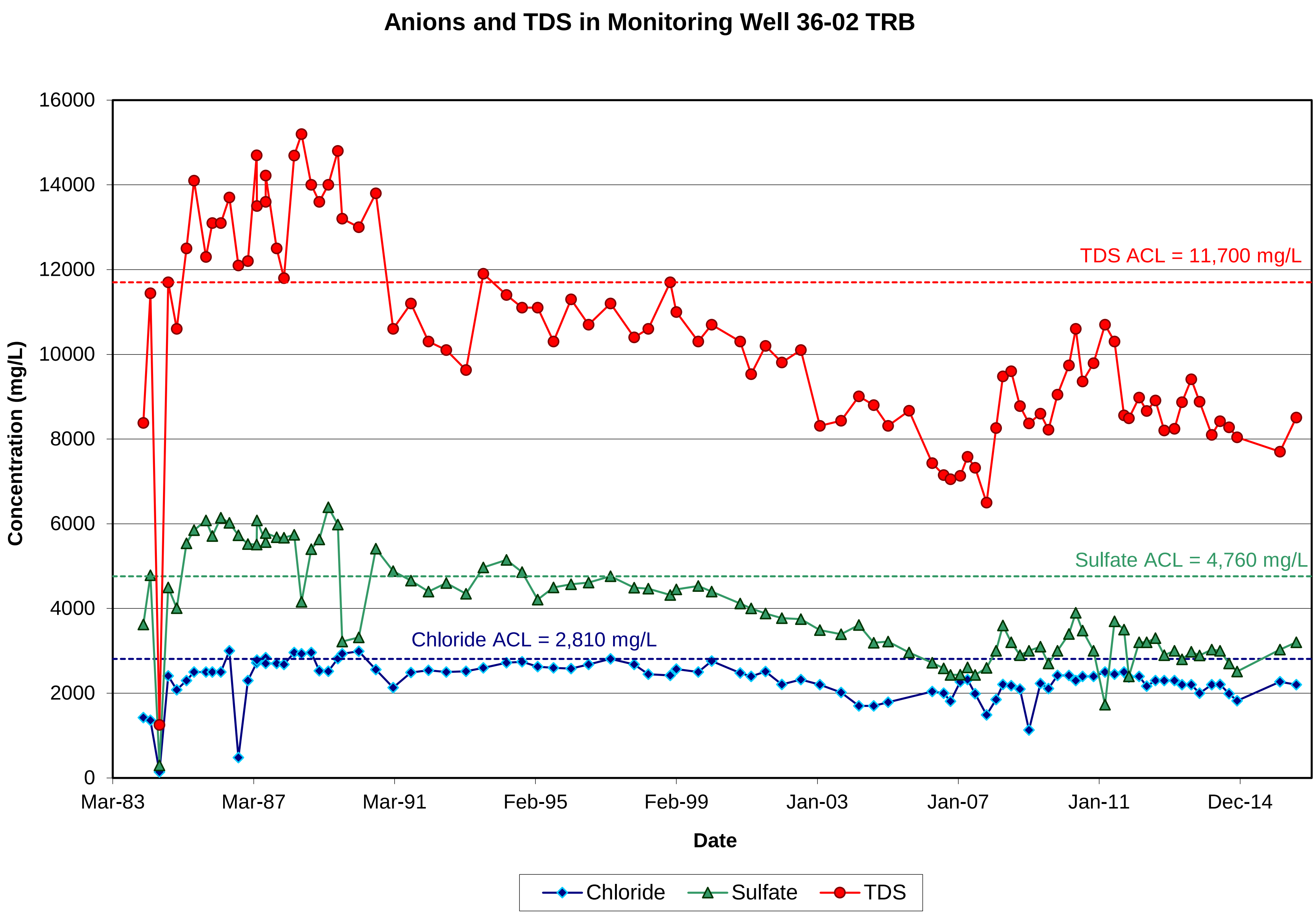
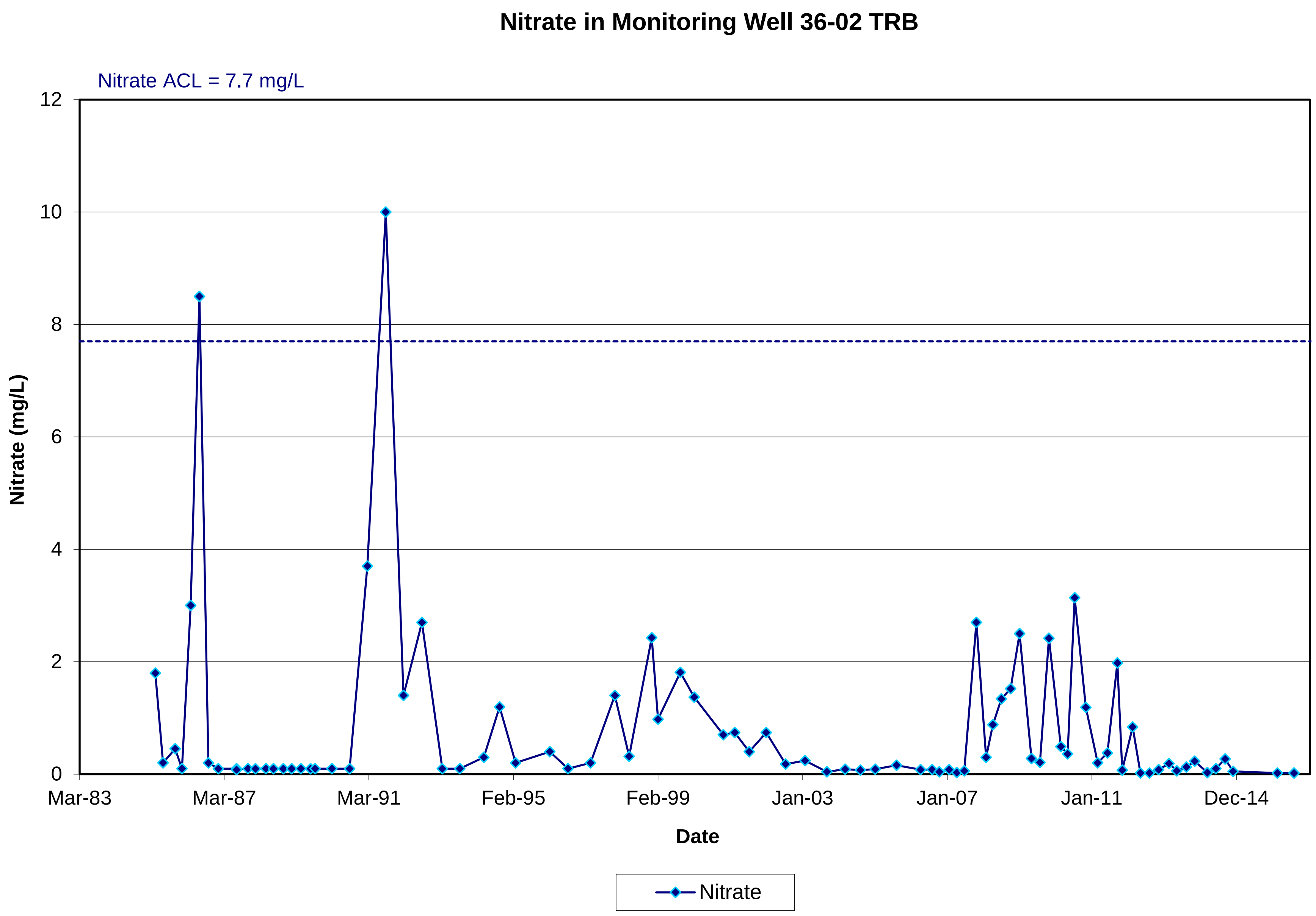
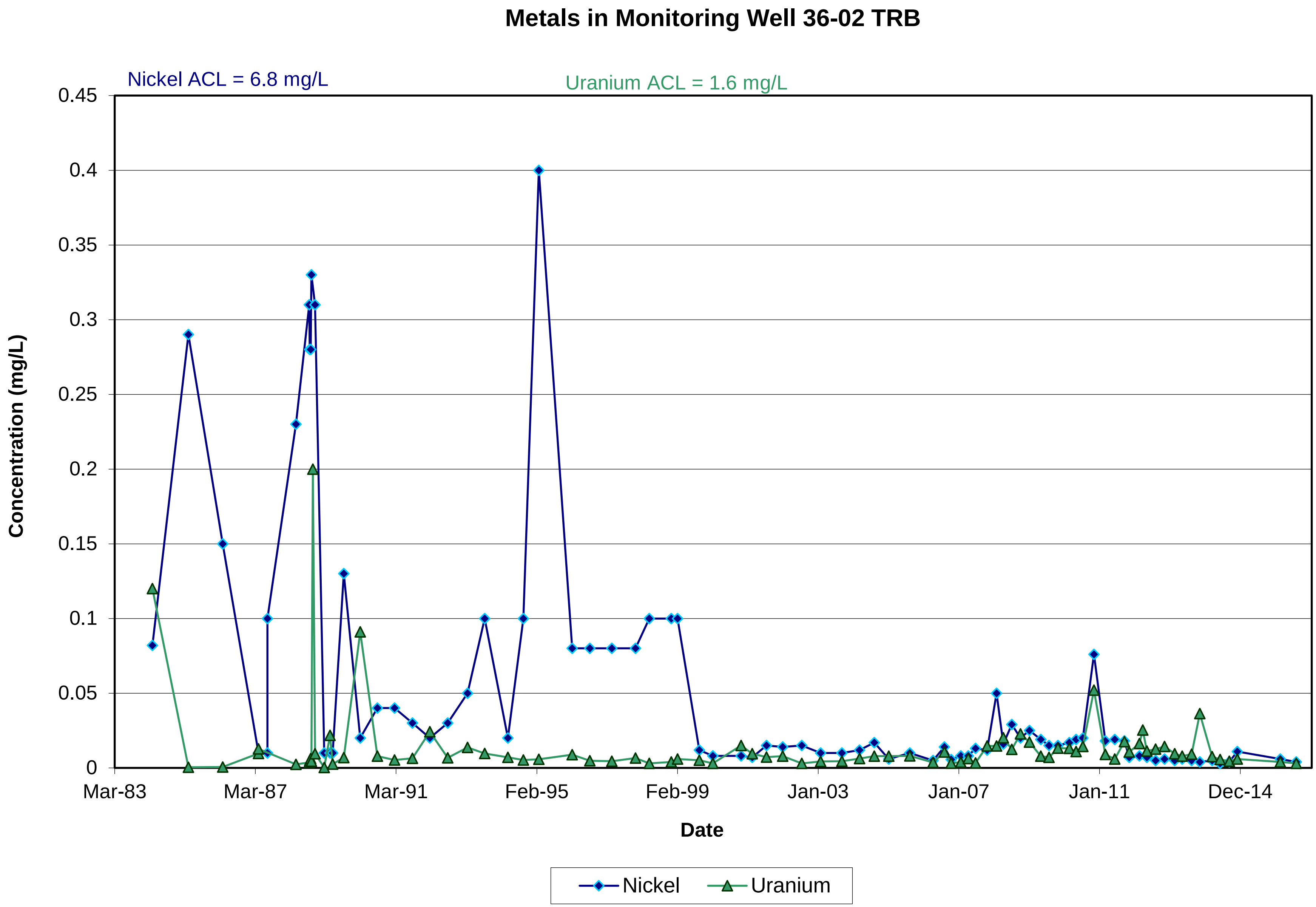


Anions and TDS in Monitoring Well 36-02 TRB
TDS ACL = 11,700 mg/L
Sulfate ACL = 4,760 mg/L
Chloride ACL = 2,810 mg/L
Concentration (mg/L)
16000
14000
12000
10000
8000
6000
4000
2000
0
Mar-83
Mar-87
Mar-91
Feb-95
Feb-99
Jan-03
Jan-07
Jan-11
Dec-14
Date
Chloride
Sulfate
TDS



Nitrate in Monitoring Well 36-02 TRB
Nitrate ACL = 7.7 mg/L
Nitrate (mg/L)
0
2
4
6
8
10
12
Mar-83
Mar-87
Mar-91
Feb-95
Feb-99
Jan-03
Jan-07
Jan-11
Dec-14
Date
Nitrate



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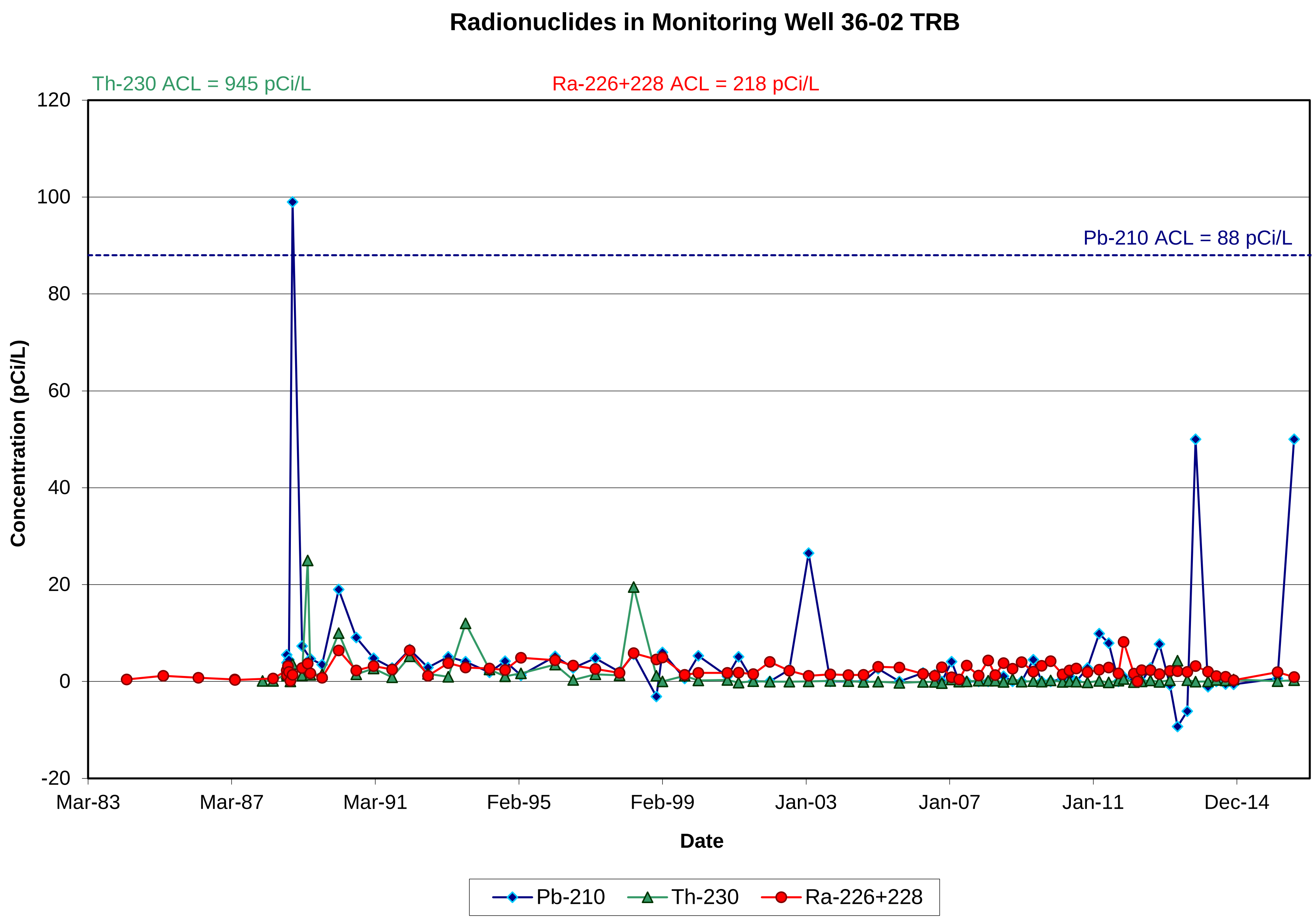

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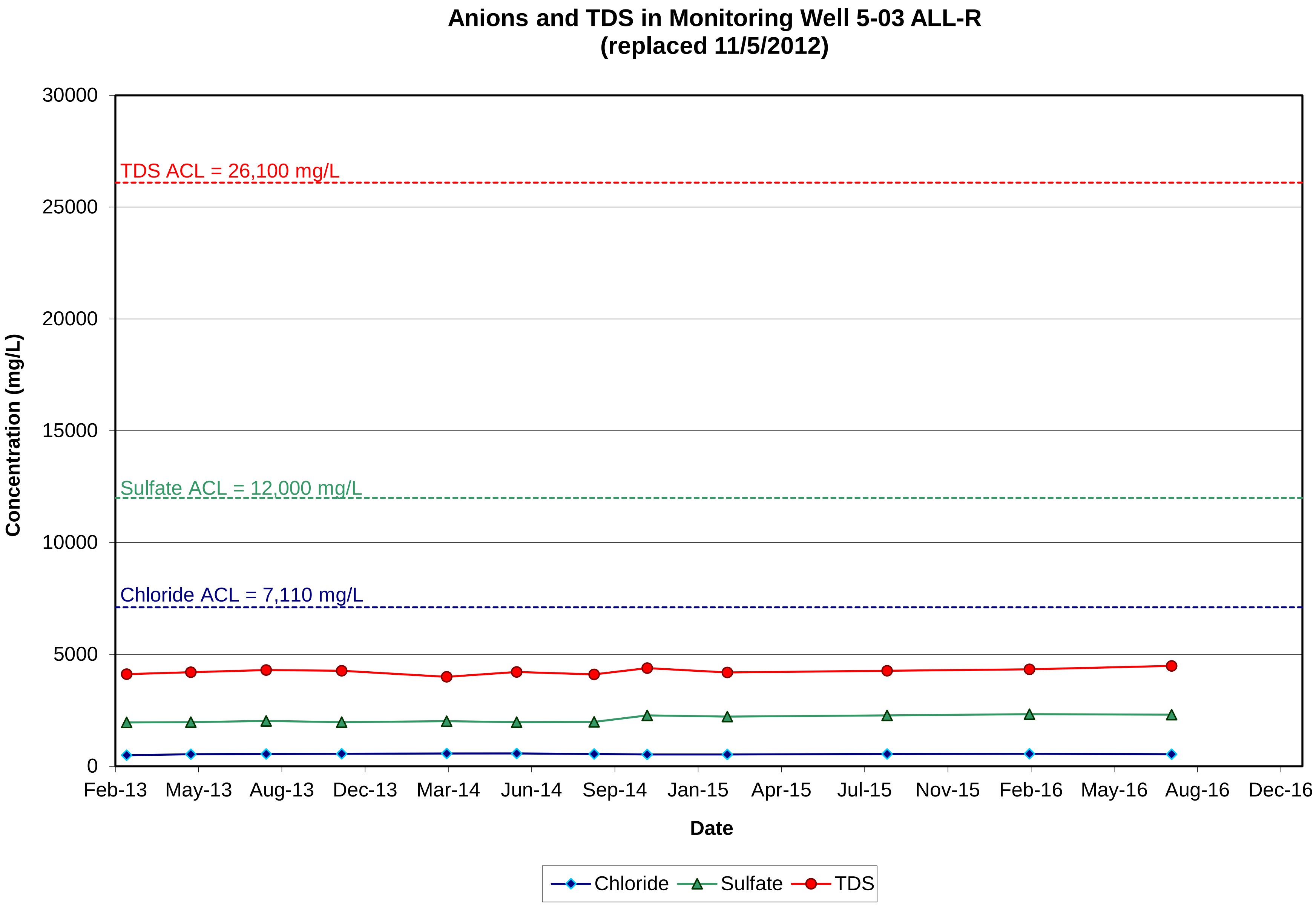
Stability Monitoring Plan
Time Versus Concentration Plots

Alluvium



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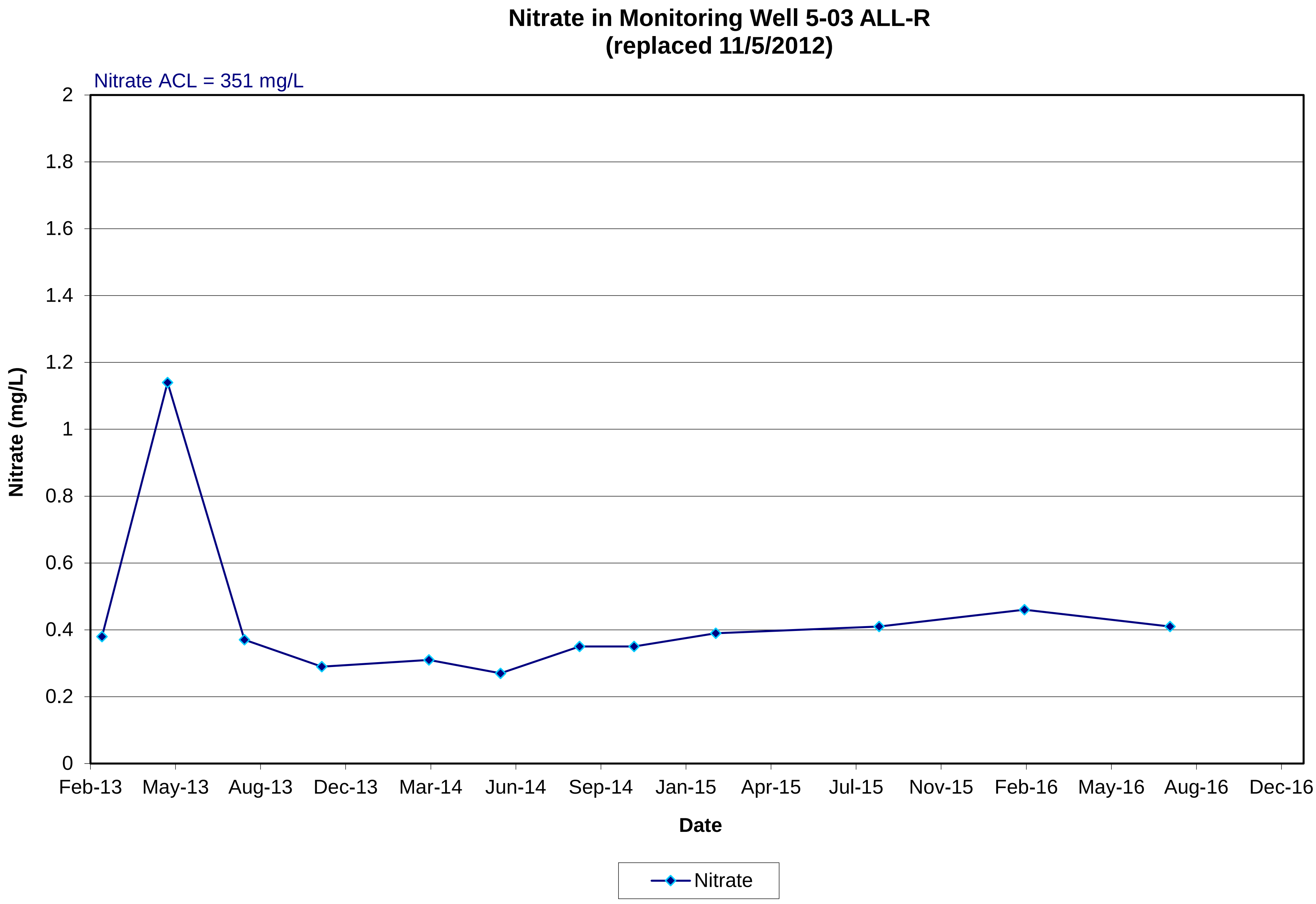
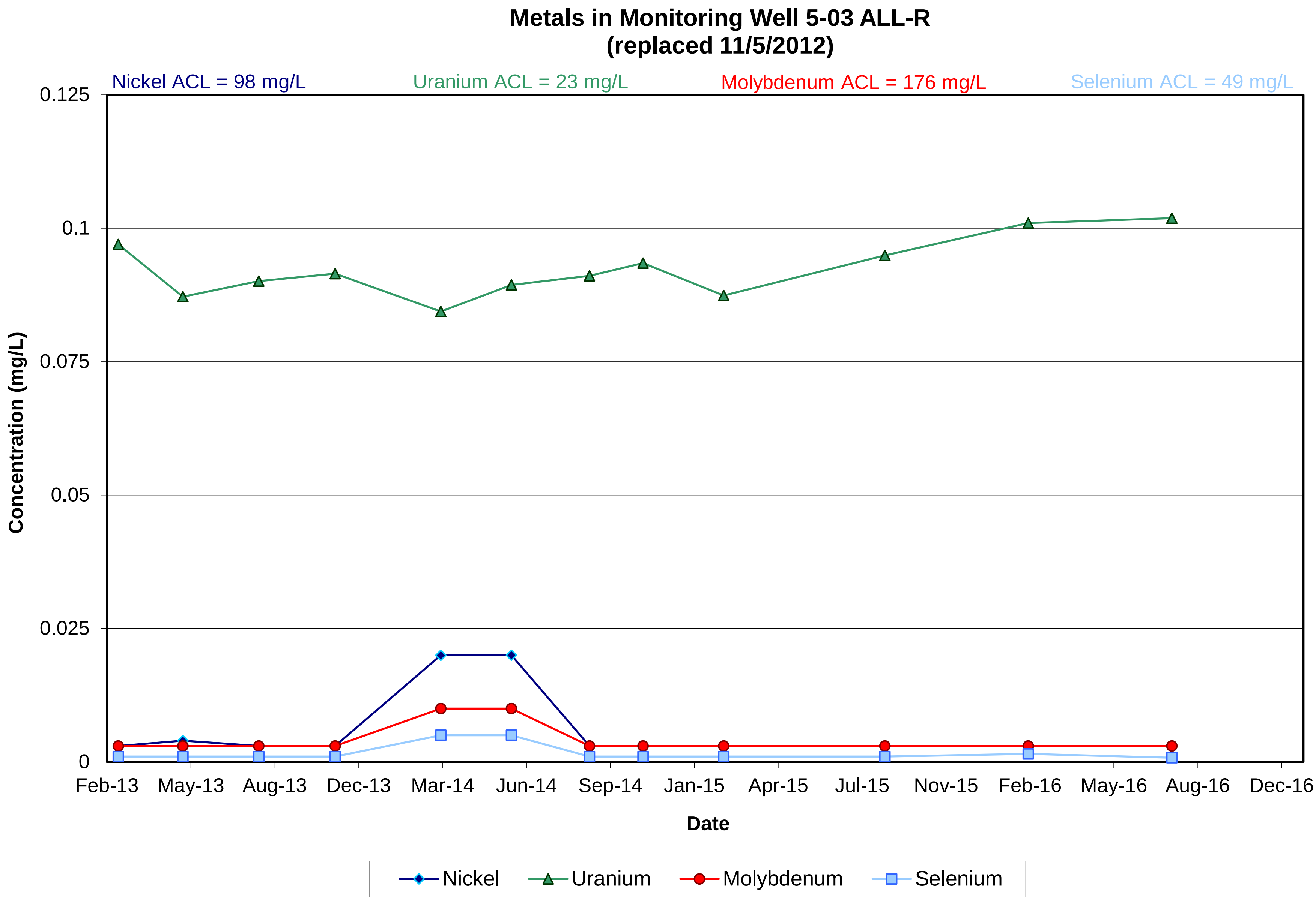

Nitrate in Monitoring Well 5-03 ALL-R
(replaced 11/5/2012)
Nitrate ACL = 351 mg/L
Nitrate (mg/L)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Feb-13
May-13
Aug-13
Dec-13
Mar-14
Jun-14
Sep-14
Jan-15
Apr-15
Jul-15
Nov-15
Feb-16
May-16
Aug-16
Dec-16
Date
Nitrate



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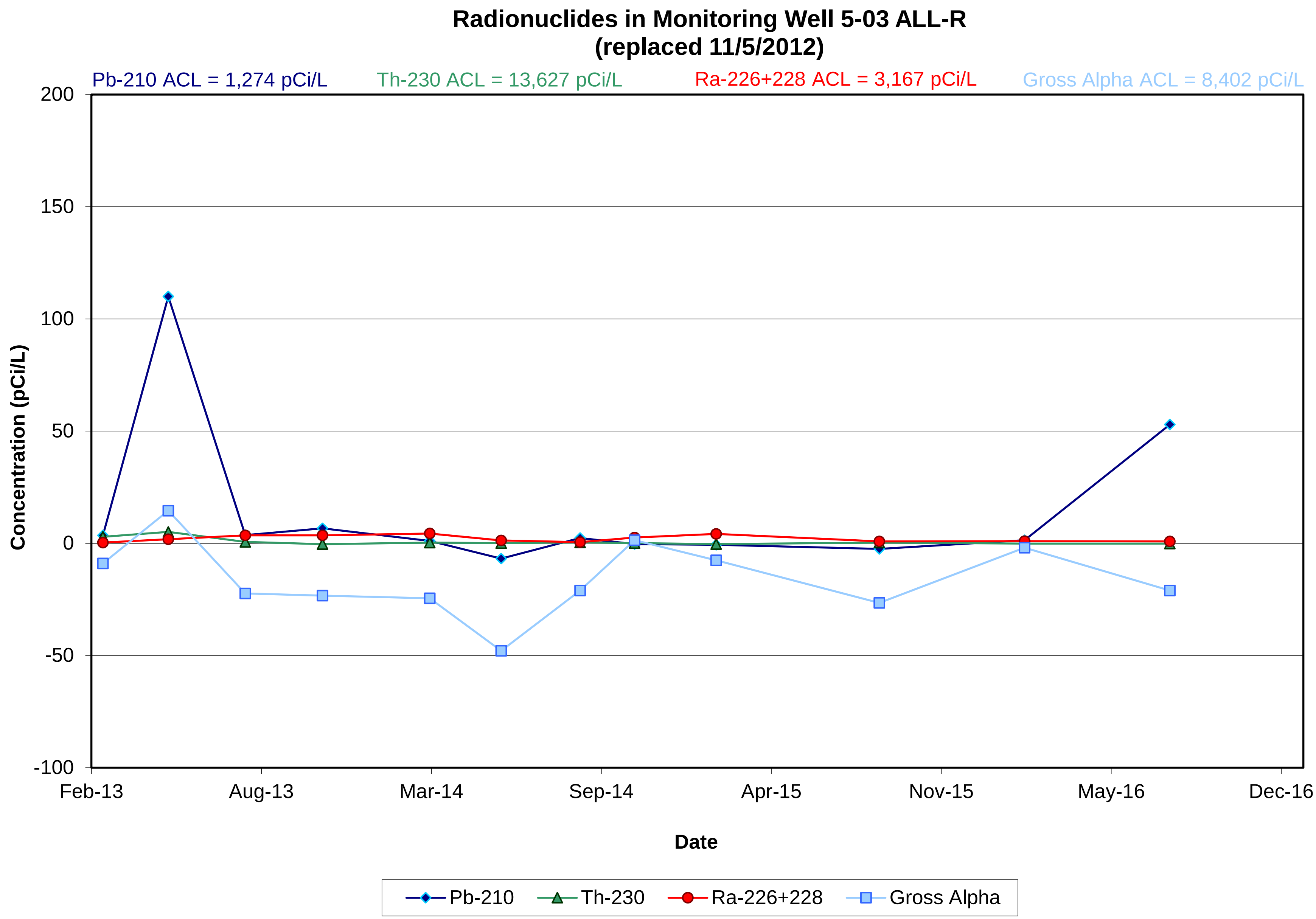
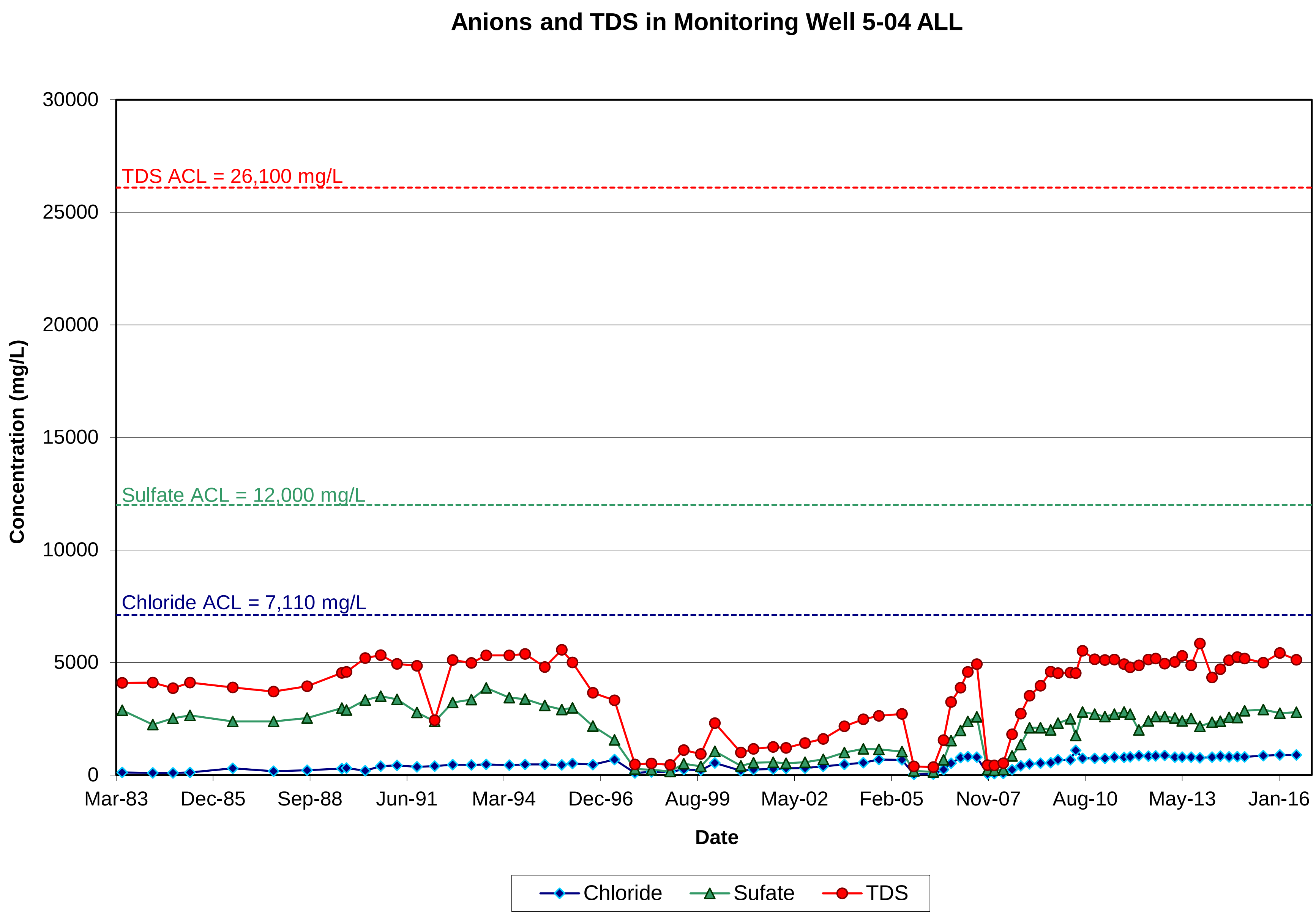

Radionuclides in Monitoring Well 5-03 ALL-R
(replaced 11/5/2012)
Pb-210 ACL = 1,274 pCi/L
Th-230 ACL = 13,627 pCi/L
Ra-226+228 ACL = 3,167 pCi/L
Gross Alpha ACL = 8,402 pCi/L
Concentration (pCi/L)
200
150
100
50
0
-50
-100
Feb-13
Aug-13
Mar-14
Sep-14
Apr-15
Nov-15
May-16
Dec-16
Date
Pb-210
Th-230
Ra-226+228
Gross Alpha

INTERA



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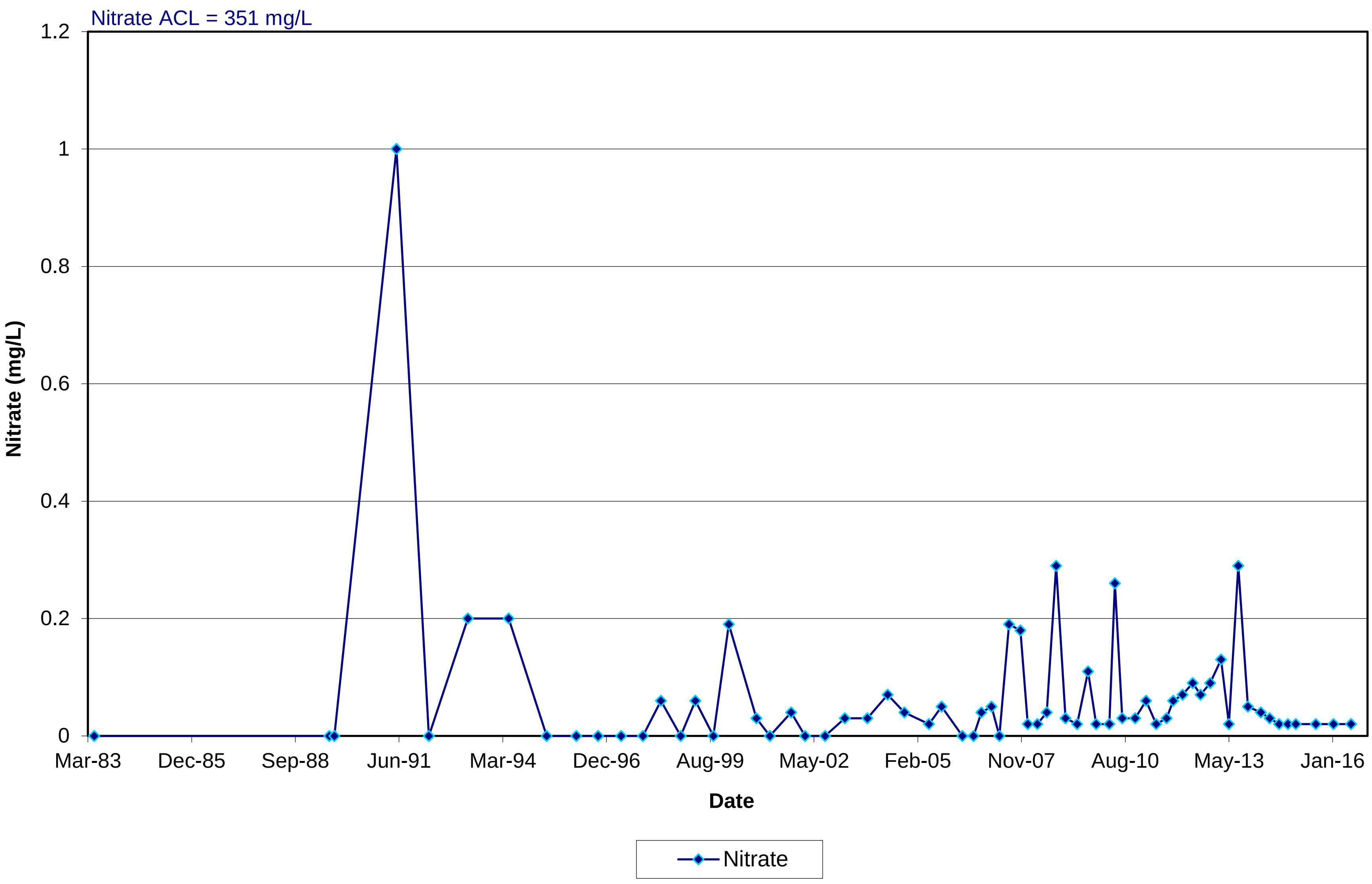
Nitrate in Monitoring Well 5-04 ALL



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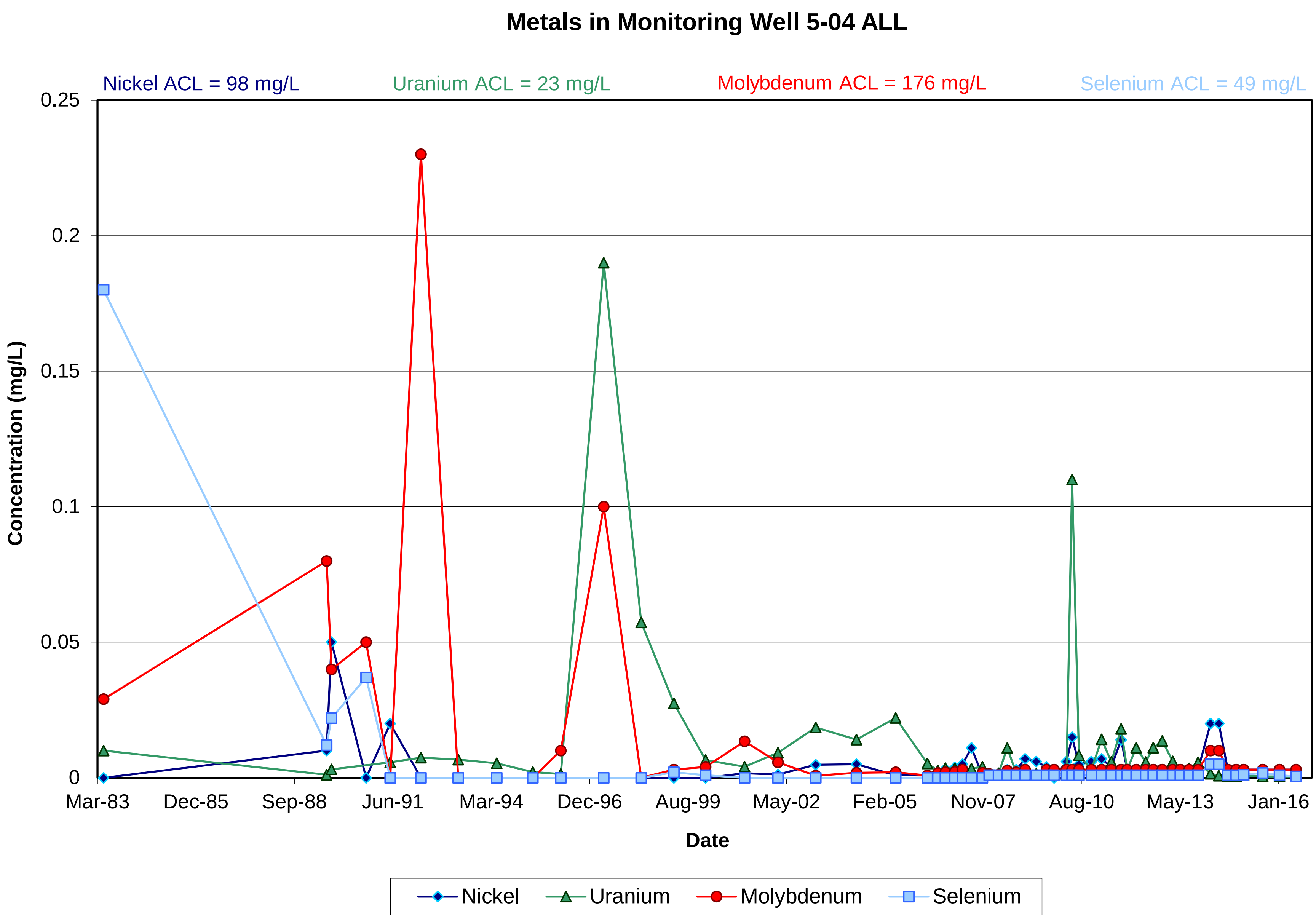

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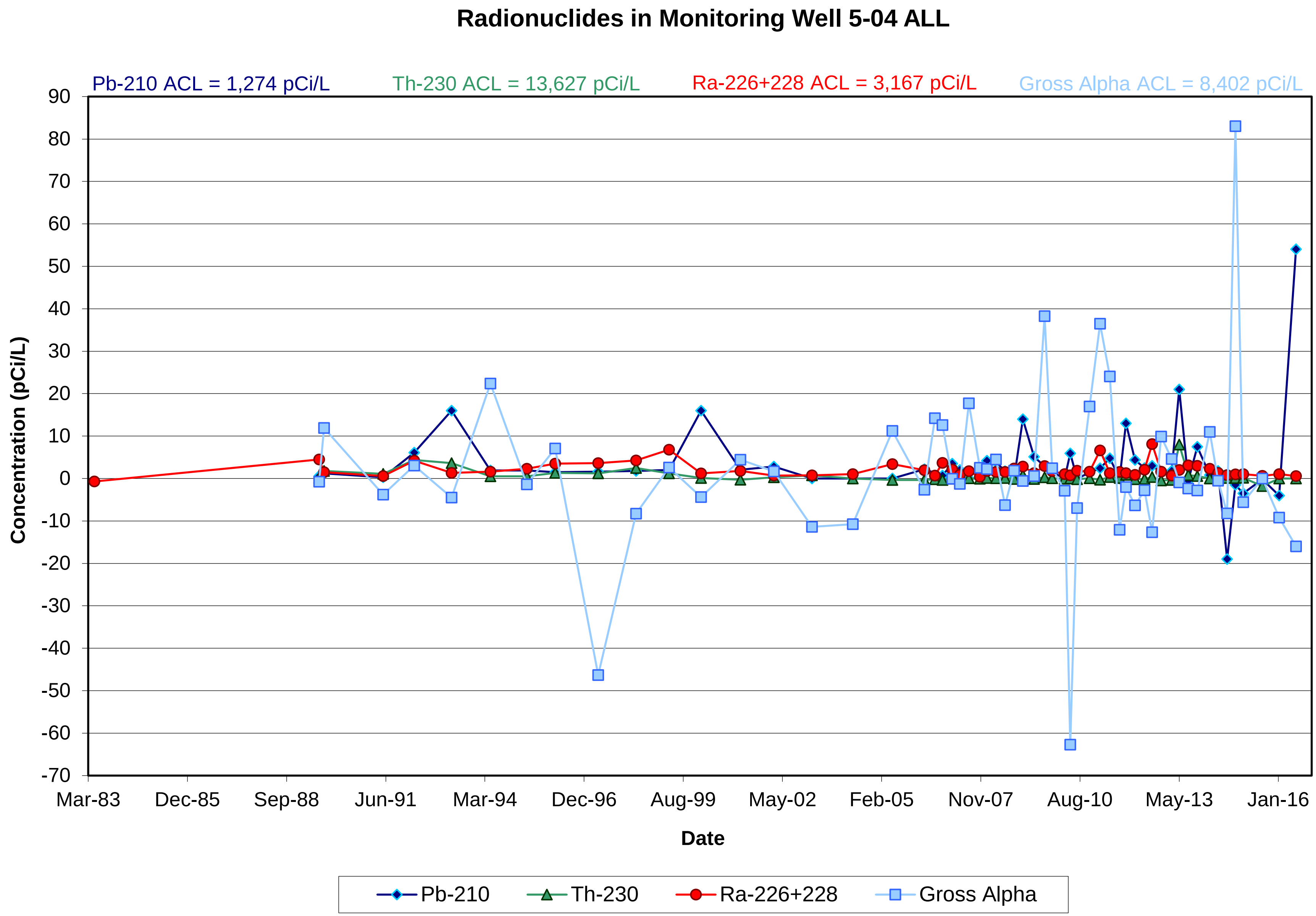

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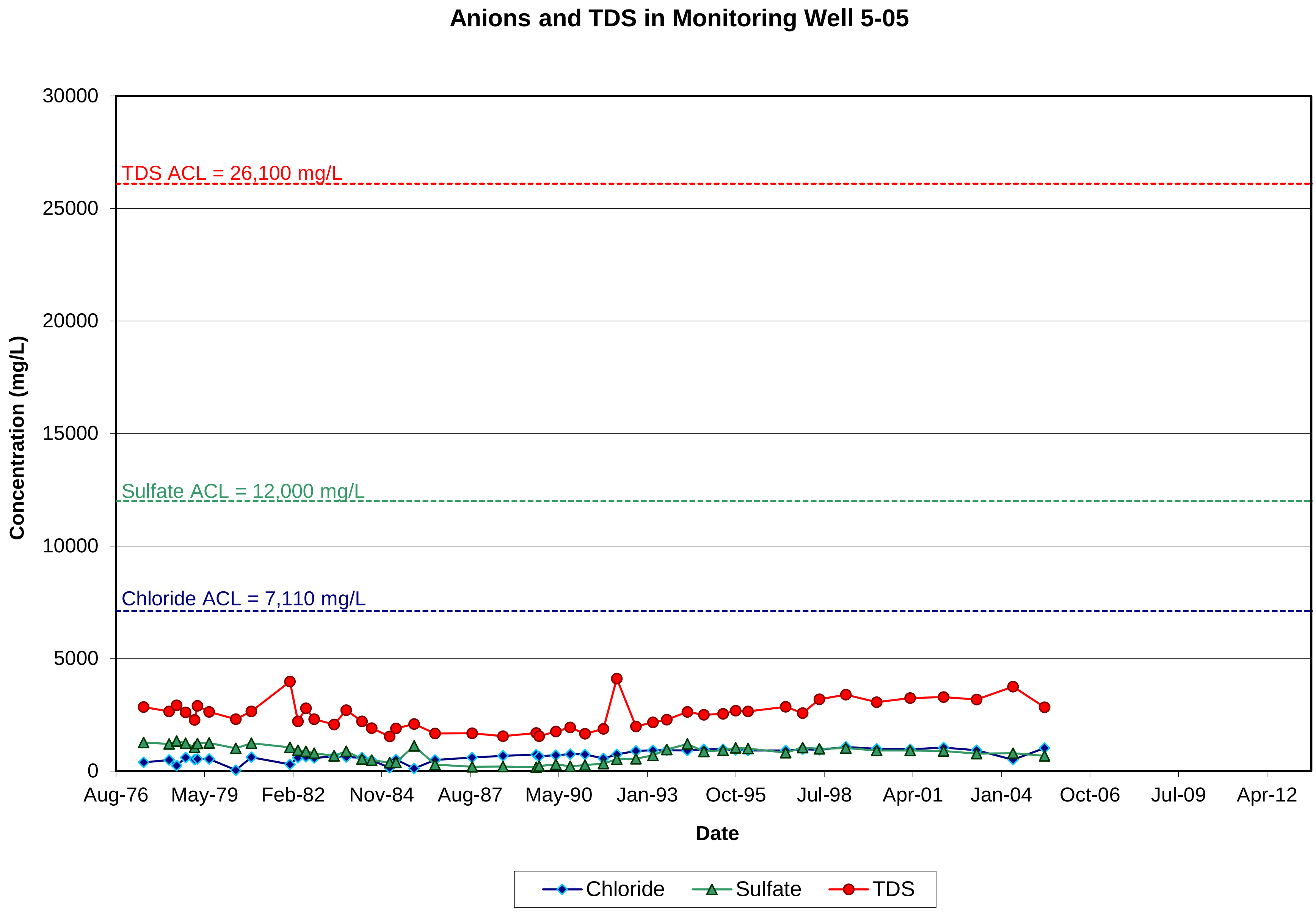

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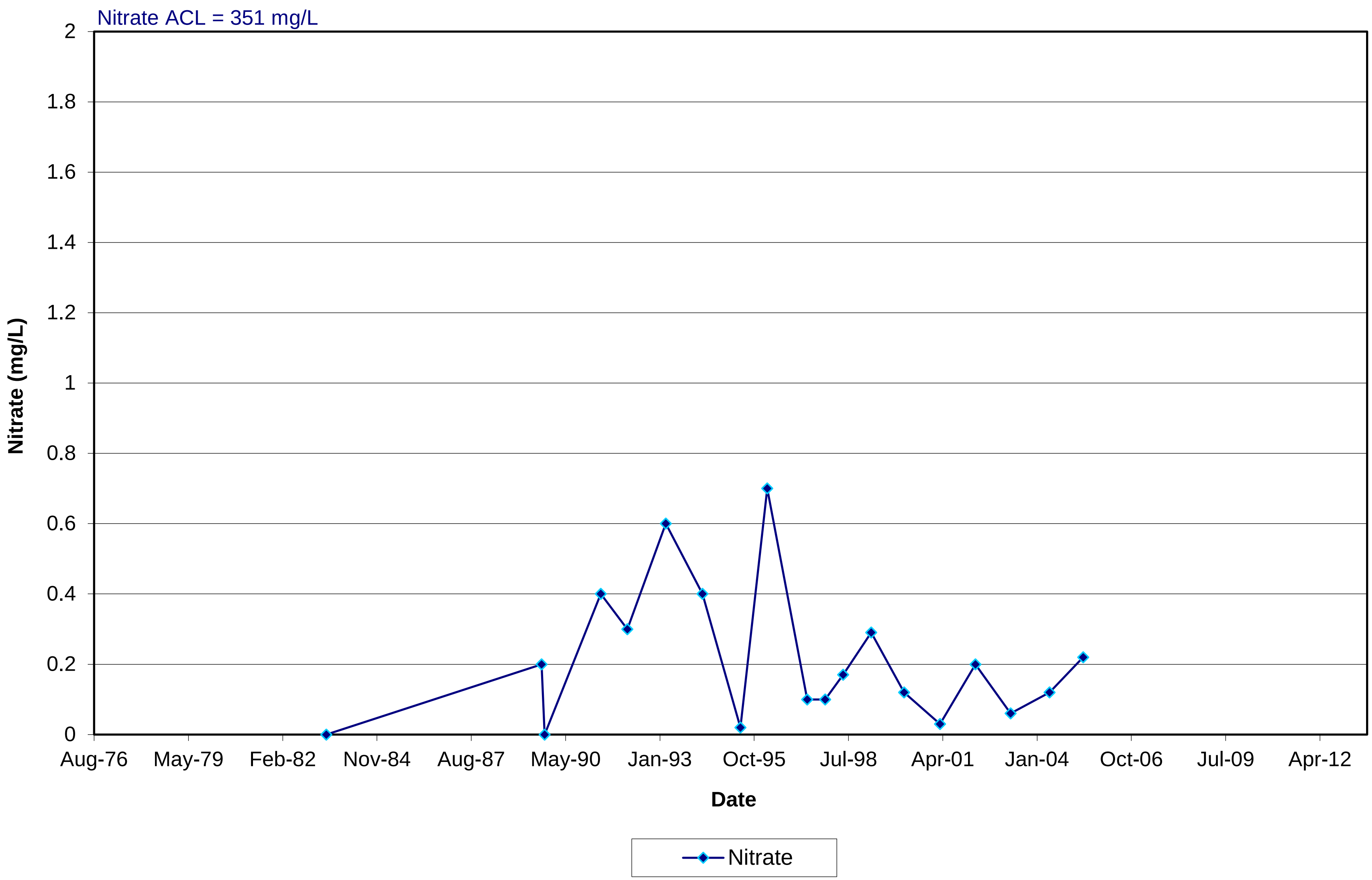
Nitrate in Monitoring Well 5-05



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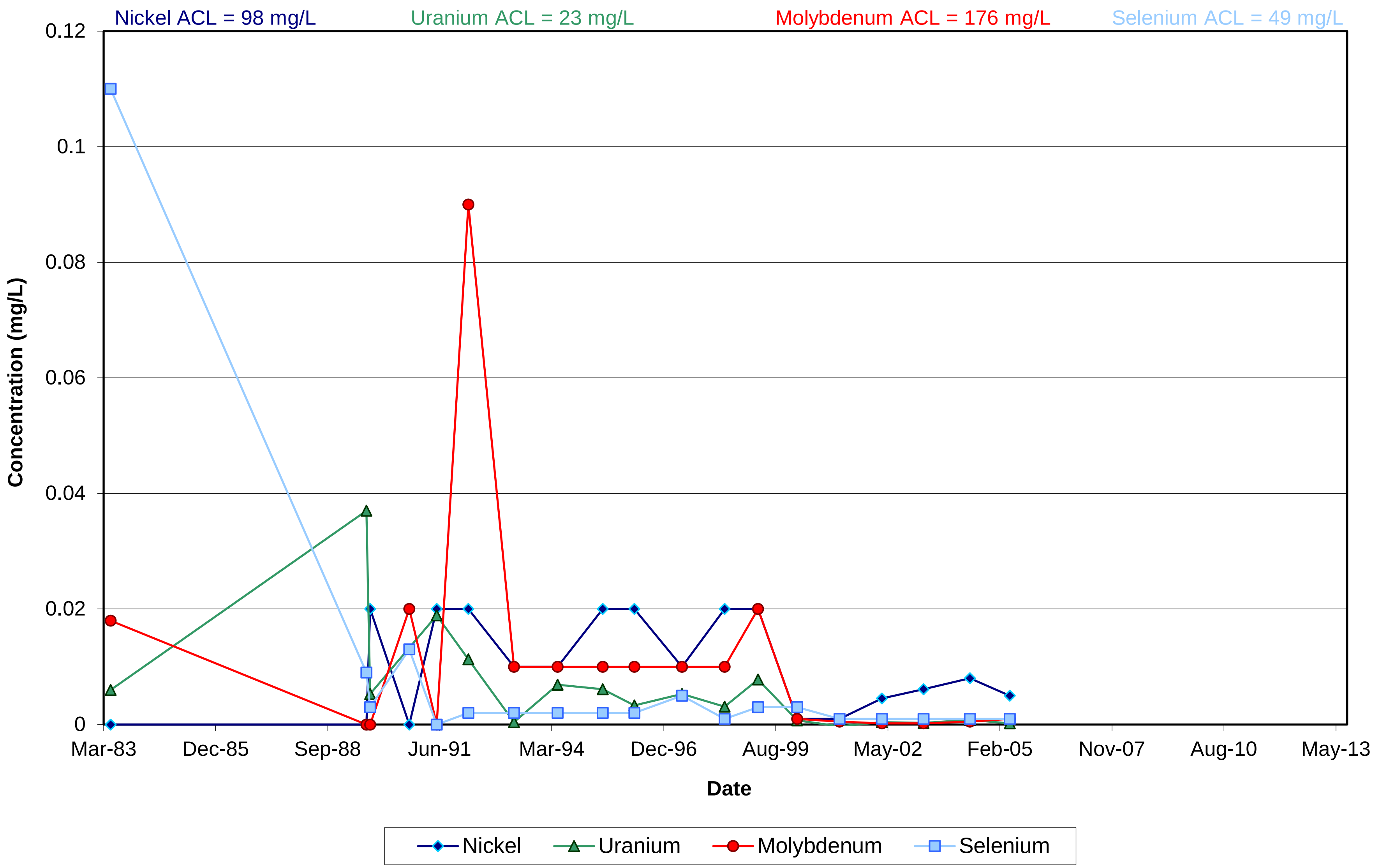
Metals in Monitoring Well 5-05



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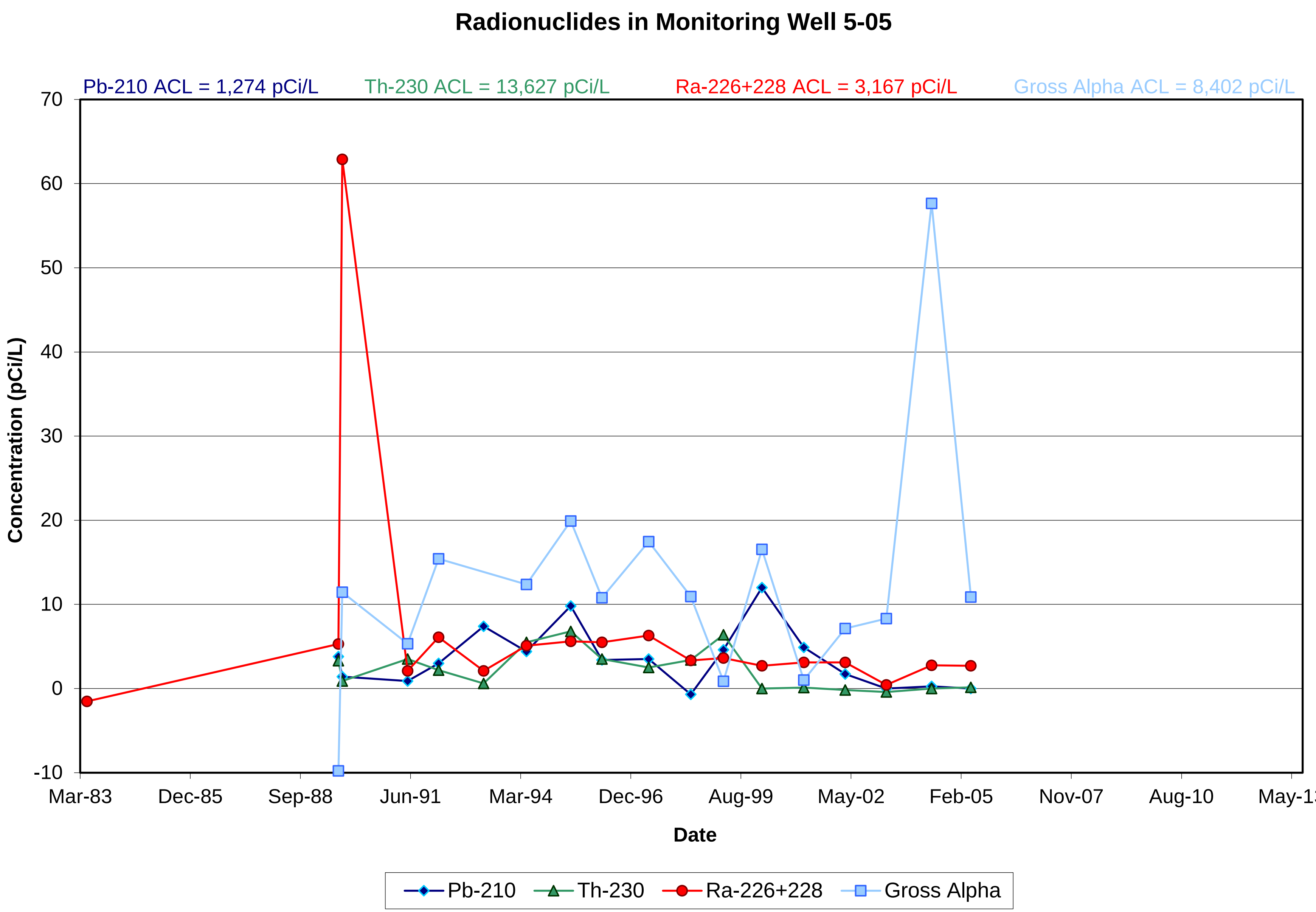

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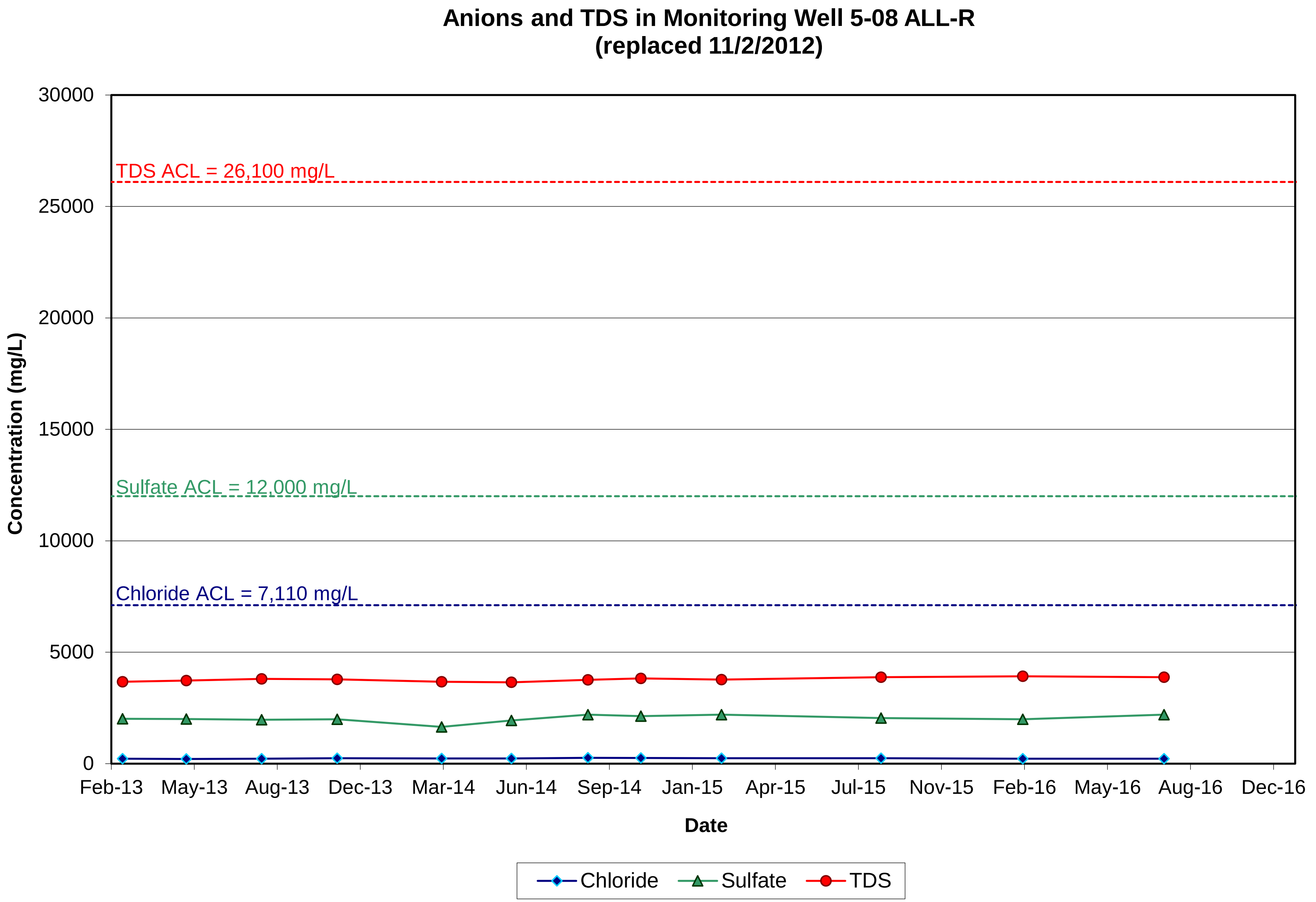
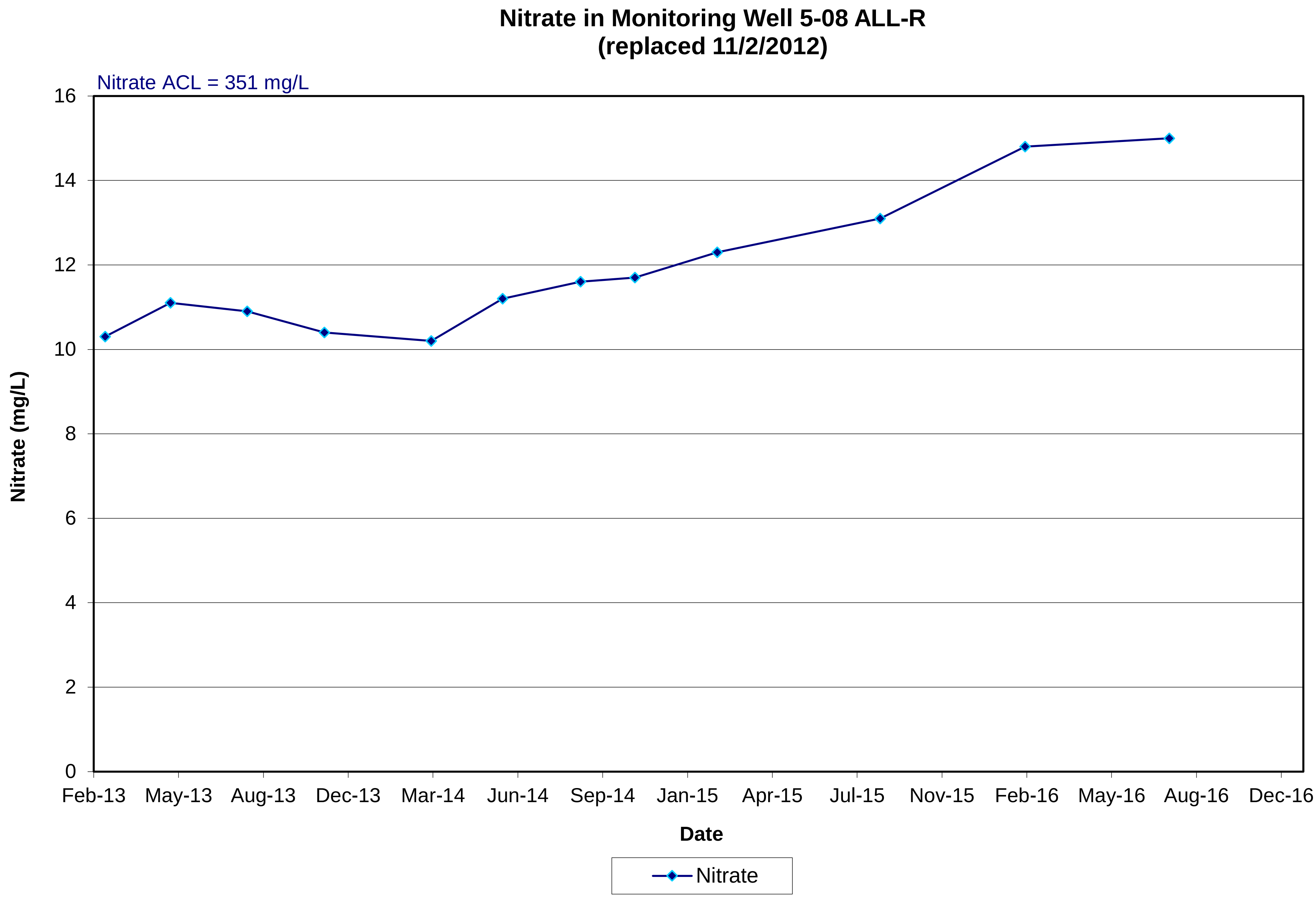
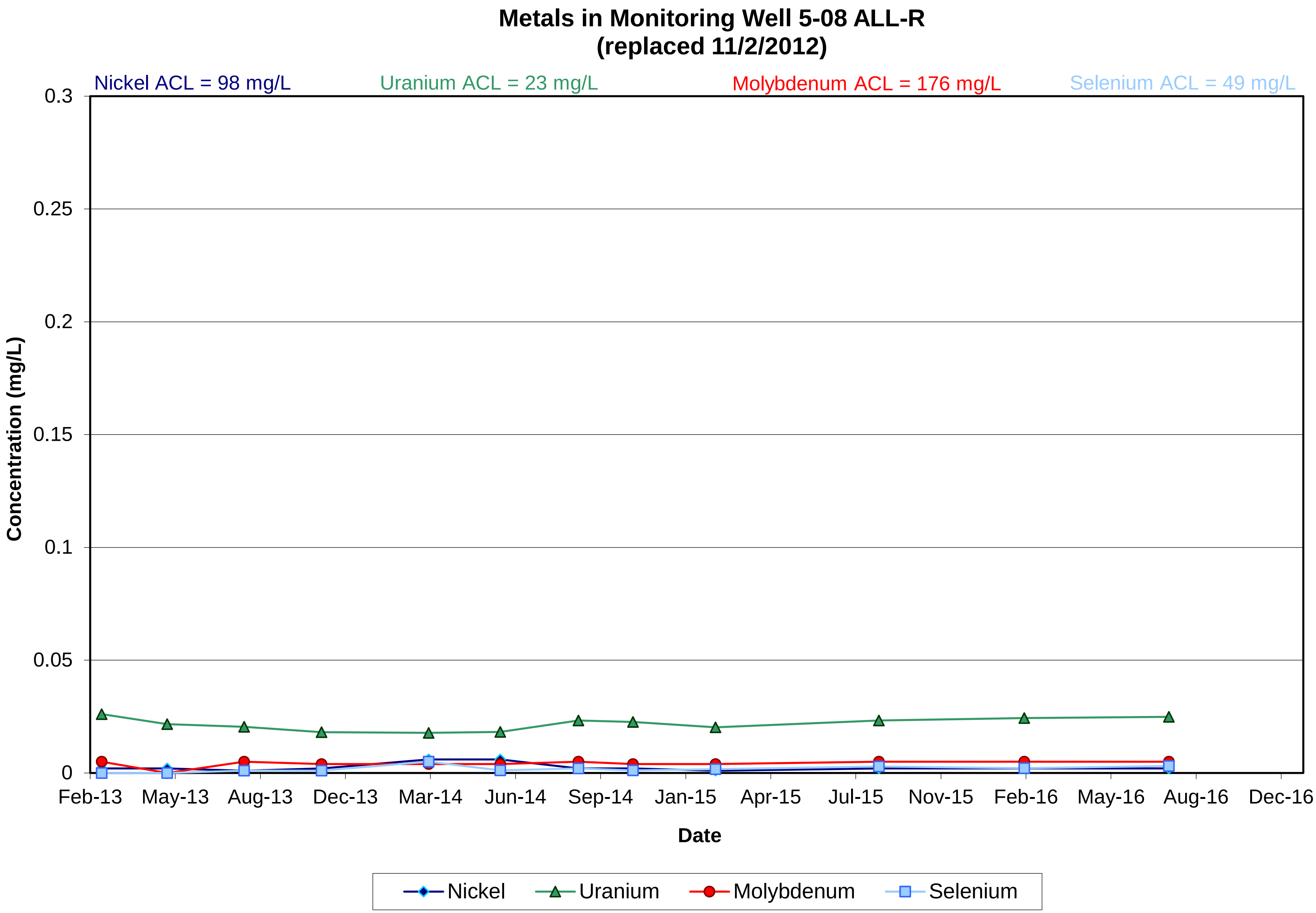
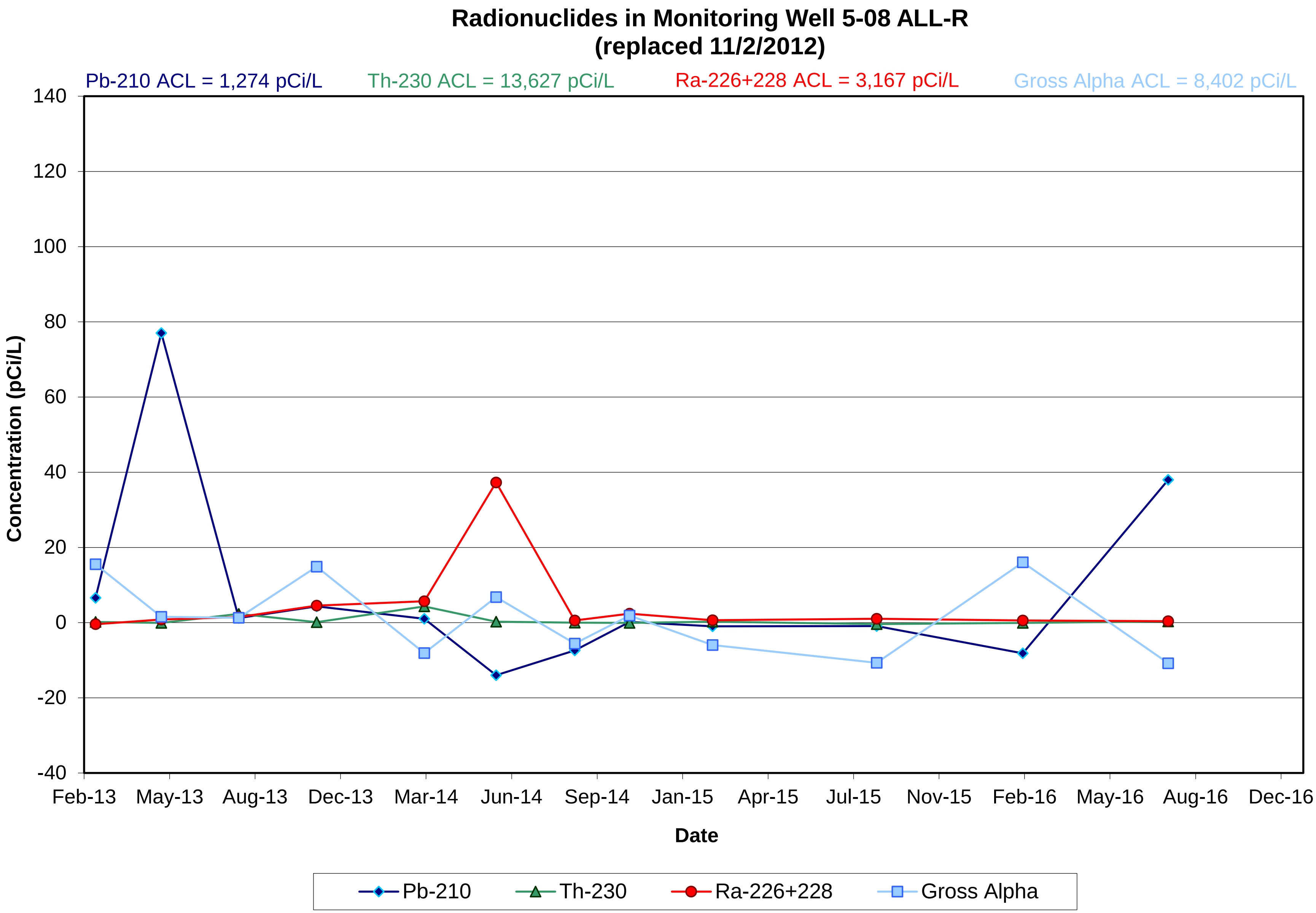

Anions and TDS in Monitoring Well 5-08 ALL-R
(replaced 11/2/2012)
TDS ACL = 26,100 mg/L
Sulfate ACL = 12,000 mg/L
Chloride ACL = 7,110 mg/L
Concentration (mg/L)
30000
25000
20000
15000
10000
5000
0
Feb-13
May-13
Aug-13
Dec-13
Mar-14
Jun-14
Sep-14
Jan-15
Apr-15
Jul-15
Nov-15
Feb-16
May-16
Aug-16
Dec-16
Date
Chloride
Sulfate
TDS



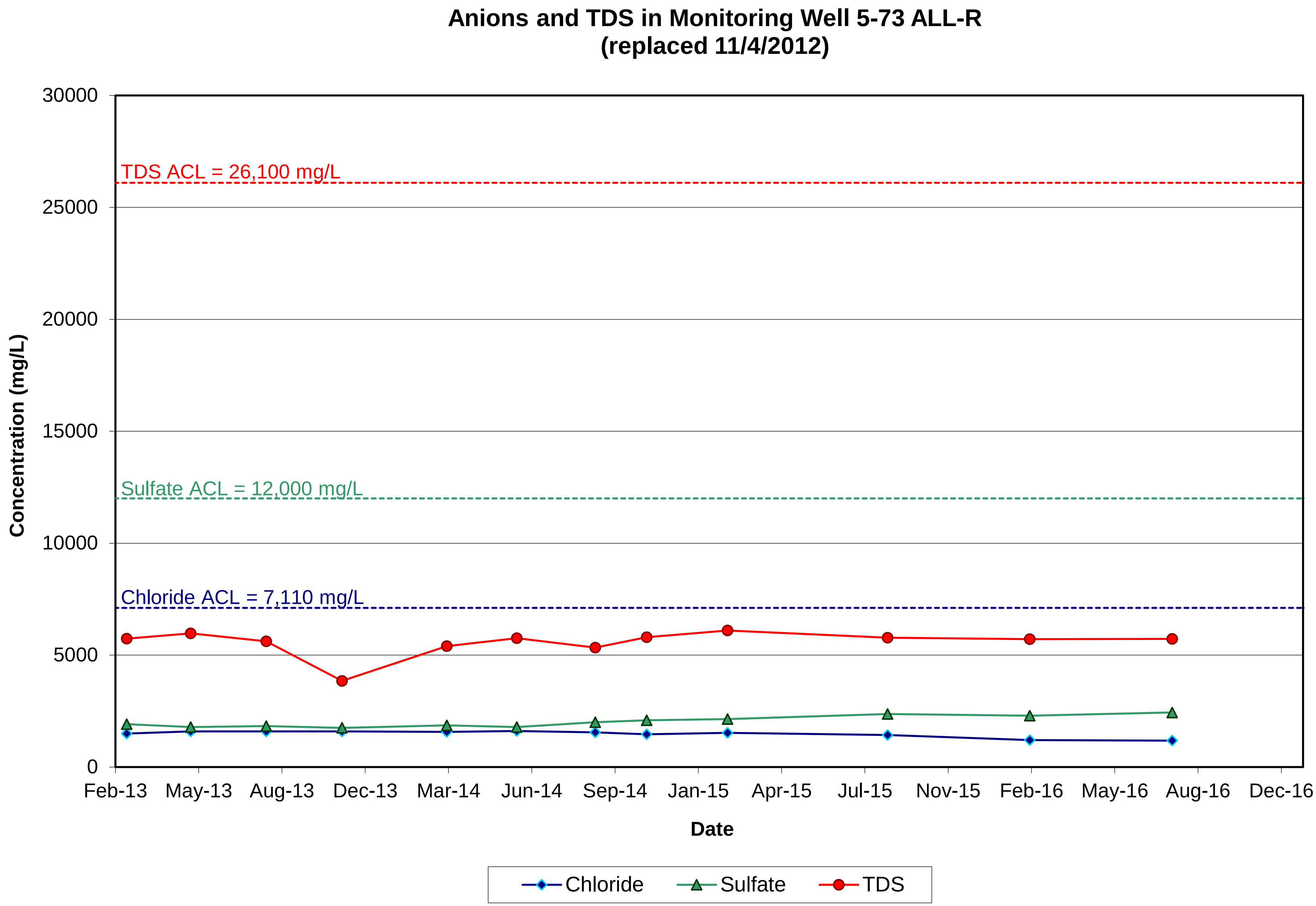
Nitrate in Monitoring Well 5-08 ALL-R
(replaced 11/2/2012)
Nitrate ACL = 351 mg/L
Nitrate (mg/L)
0
2
4
6
8
10
12
14
16
Feb-13
May-13
Aug-13
Dec-13
Mar-14
Jun-14
Sep-14
Jan-15
Apr-15
Jul-15
Nov-15
Feb-16
May-16
Aug-16
Dec-16
Date
Nitrate


Metals in Monitoring Well 5-08 ALL-R
(replaced 11/2/2012)
Nickel ACL = 98 mg/L
Uranium ACL = 23 mg/L
Molybdenum ACL = 176 mg/L
Selenium ACL = 49 mg/L
Concentration (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
Feb-13
May-13
Aug-13
Dec-13
Mar-14
Jun-14
Sep-14
Jan-15
Apr-15
Jul-15
Nov-15
Feb-16
May-16
Aug-16
Dec-16
Date
Nickel
Uranium
Molybdenum
Selenium

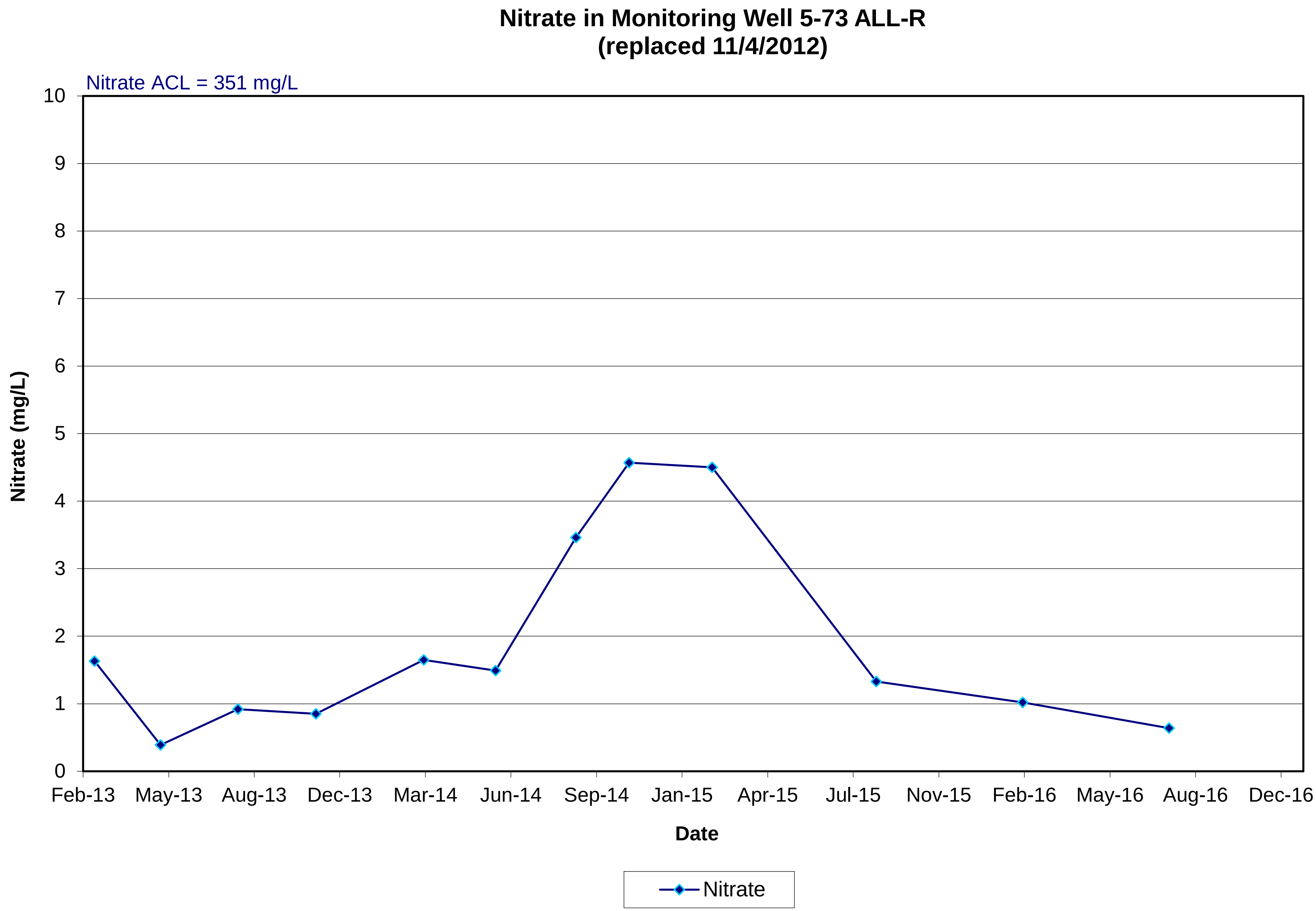
INTERA

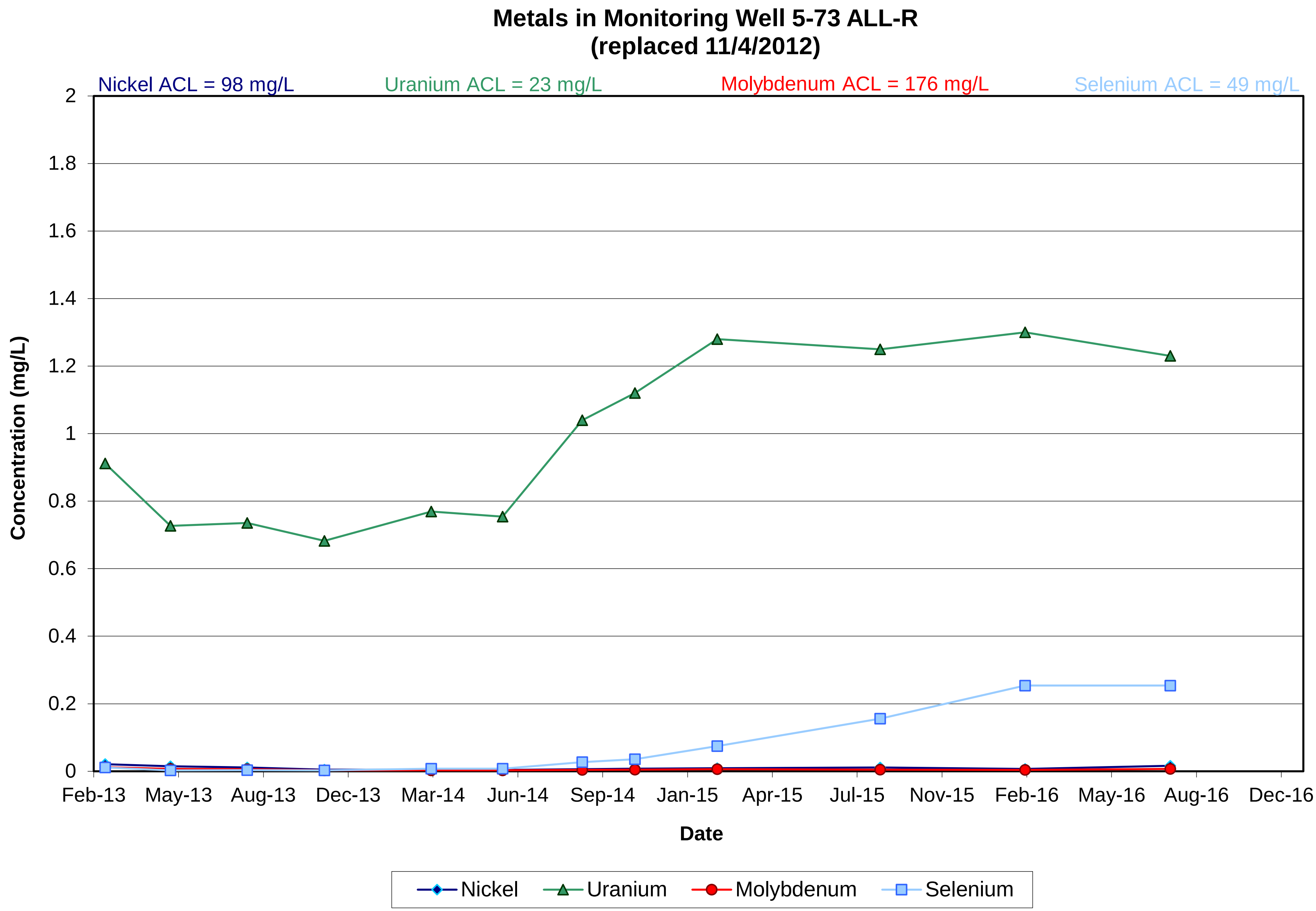


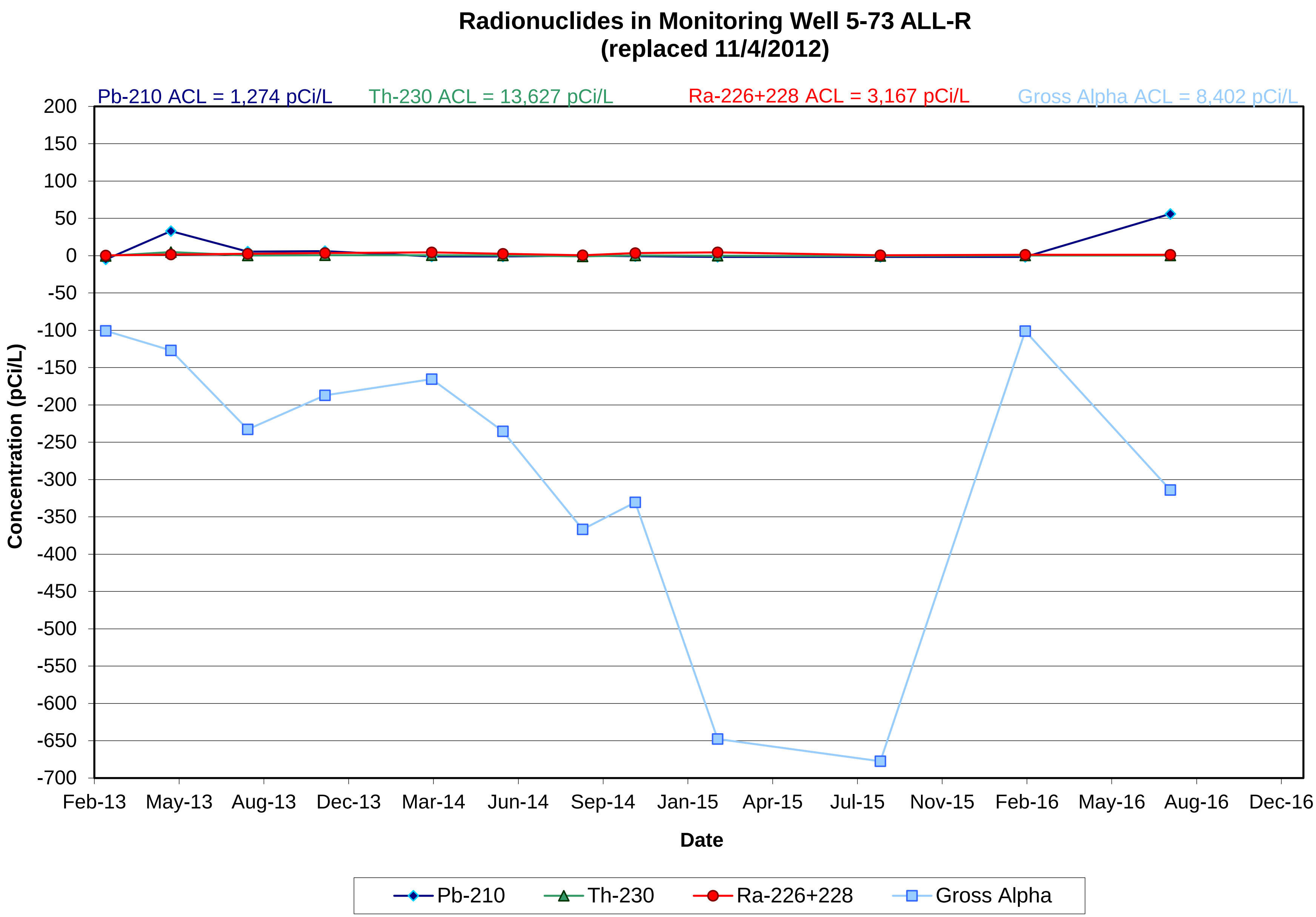
Radionuclides in Monitoring Well 5-08 ALL-R
(replaced 11/2/2012)
Pb-210 ACL = 1,274 pCi/L
Th-230 ACL = 13,627 pCi/L
Ra-226+228 ACL = 3,167 pCi/L
Gross Alpha ACL = 8,402 pCi/L
Concentration (pCi/L)
140
120
100
80
60
40
20
0
-20
-40
Feb-13
May-13
Aug-13
Dec-13
Mar-14
Jun-14
Sep-14
Jan-15
Apr-15
Jul-15
Nov-15
Feb-16
May-16
Aug-16
Dec-16
Date
Pb-210
Th-230
Ra-226+228
Gross Alpha



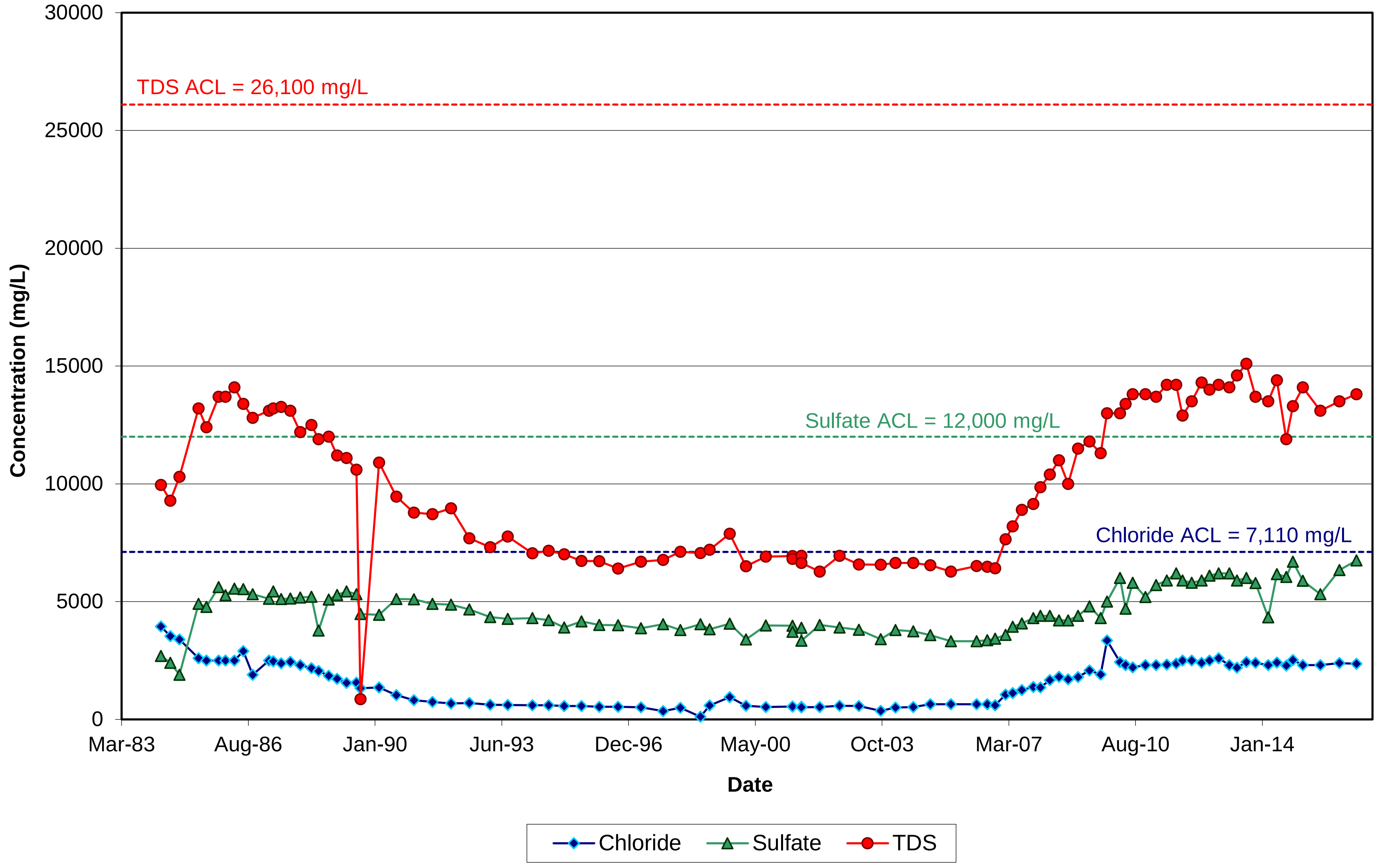
Anions and TDS in Monitoring Well 5-73 ALL-R
(replaced 11/4/2012)
Concentration (mg/L)
30000
25000
20000
15000
10000
5000
0
TDS ACL = 26,100 mg/L
Sulfate ACL = 12,000 mg/L
Chloride ACL = 7,110 mg/L
Feb-13
May-13
Aug-13
Dec-13
Mar-14
Jun-14
Sep-14
Jan-15
Apr-15
Jul-15
Nov-15
Feb-16
May-16
Aug-16
Dec-16
Date
Chloride
Sulfate
TDS


Nitrate in Monitoring Well 5-73 ALL-R
(replaced 11/4/2012)
Nitrate ACL = 351 mg/L
Nitrate (mg/L)
10
9
8
7
6
5
4
3
2
1
0
Feb-13
May-13
Aug-13
Dec-13
Mar-14
Jun-14
Sep-14
Jan-15
Apr-15
Jul-15
Nov-15
Feb-16
May-16
Aug-16
Dec-16
Date
Nitrate

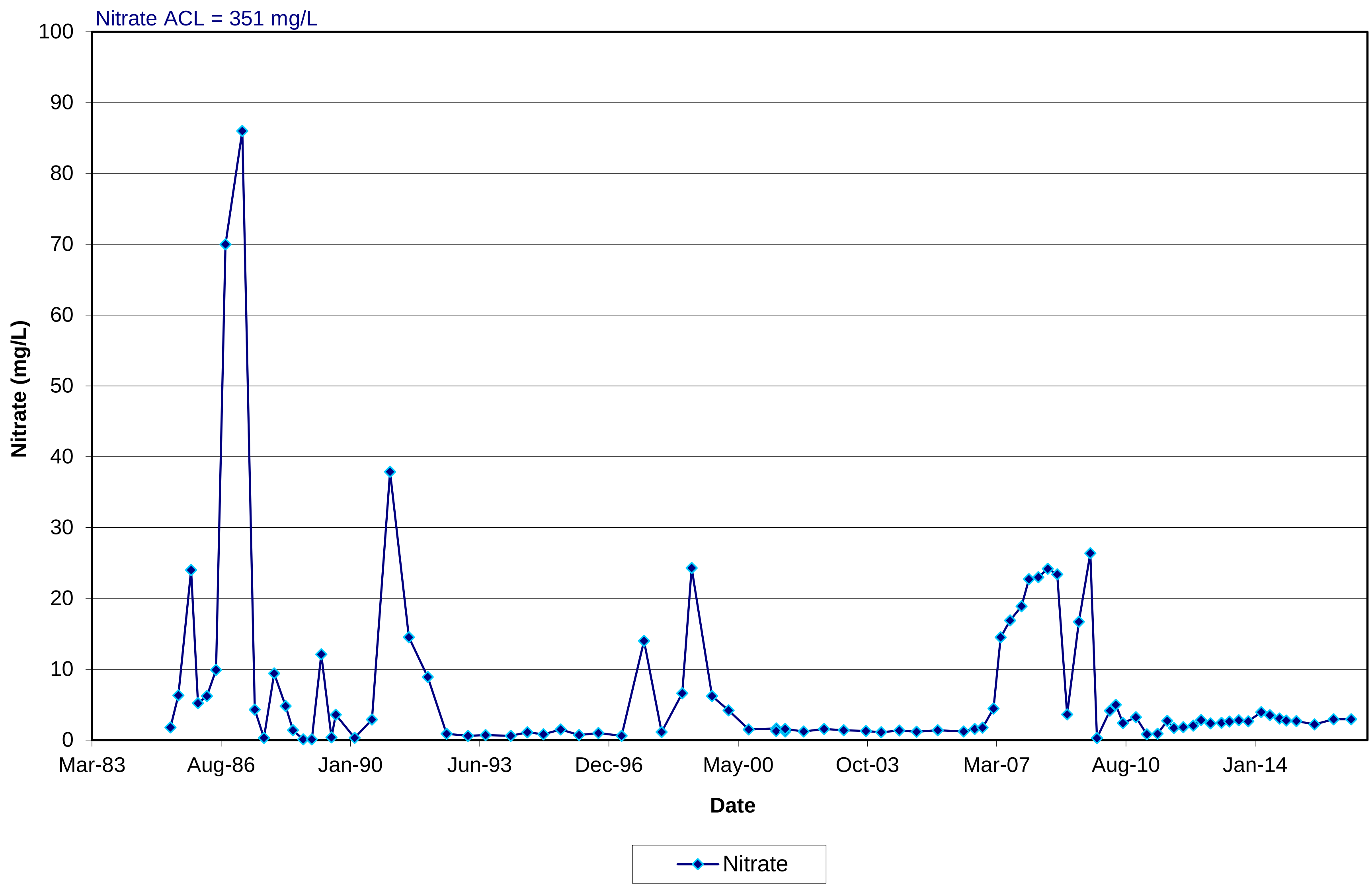

Metals in Monitoring Well 5-73 ALL-R
(replaced 11/4/2012)
Nickel ACL = 98 mg/L
Uranium ACL = 23 mg/L
Molybdenum ACL = 176 mg/L
Selenium ACL = 49 mg/L
Concentration (mg/L)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Feb-13
May-13
Aug-13
Dec-13
Mar-14
Jun-14
Sep-14
Jan-15
Apr-15
Jul-15
Nov-15
Feb-16
May-16
Aug-16
Dec-16
Date
Nickel
Uranium
Molybdenum
Selenium


Radionuclides in Monitoring Well 5-73 ALL-R
(replaced 11/4/2012)
Pb-210 ACL = 1,274 pCi/L
Th-230 ACL = 13,627 pCi/L
Ra-226+228 ACL = 3,167 pCi/L
Gross Alpha ACL = 8,402 pCi/L
200
150
100
50
0
-50
-100
-150
-200
-250
-300
-350
-400
-450
-500
-550
-600
-650
-700
Concentration (pCi/L)
Feb-13
May-13
Aug-13
Dec-13
Mar-14
Jun-14
Sep-14
Jan-15
Apr-15
Jul-15
Nov-15
Feb-16
May-16
Aug-16
Dec-16
Date
Pb-210
Th-230
Ra-226+228
Gross Alpha

Anions and TDS in Monitoring Well 31-61 ALL



Nitrate in Monitoring Well 31-61 ALL



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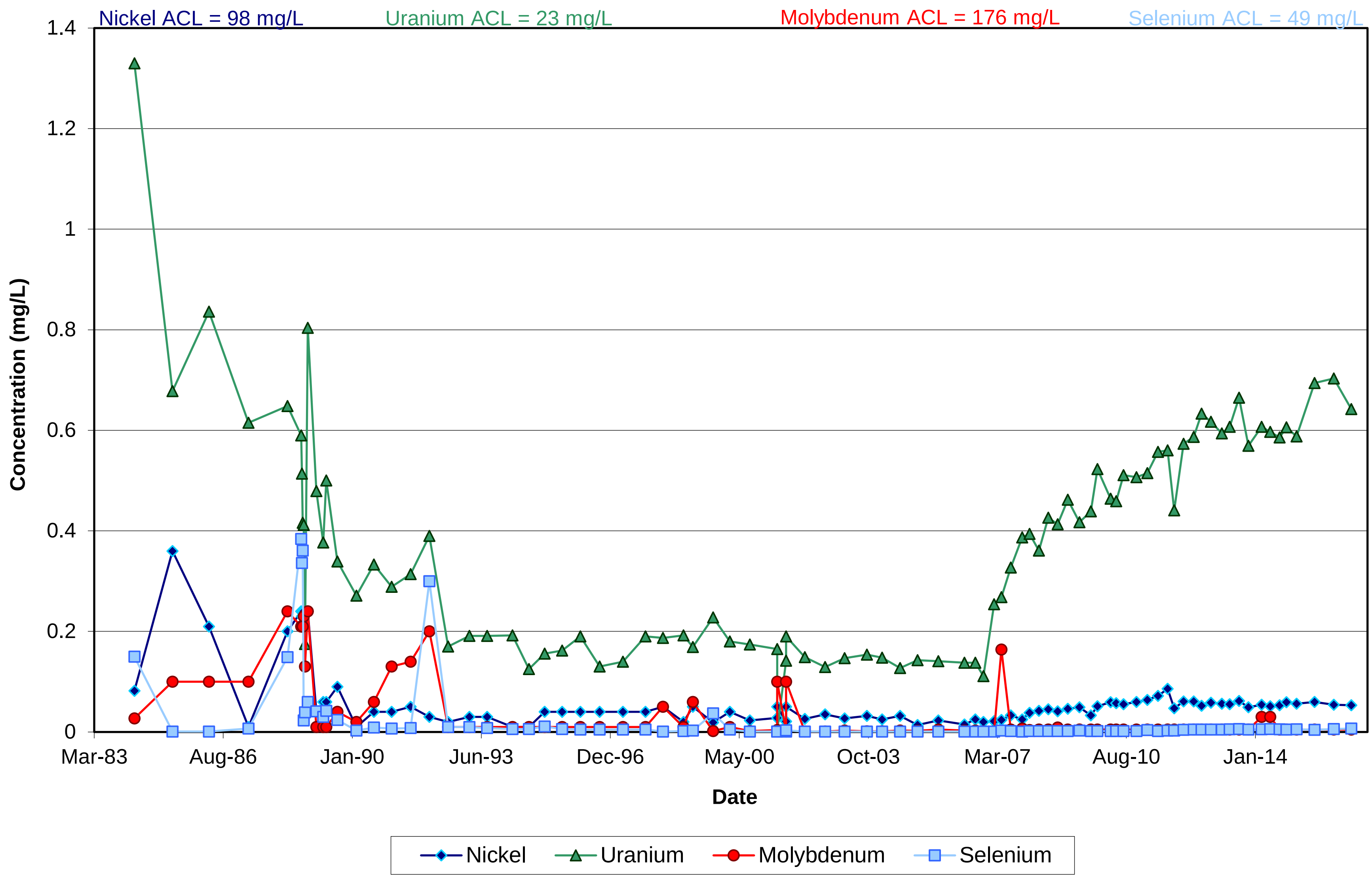
Metals in Monitoring Well 31-61 ALL



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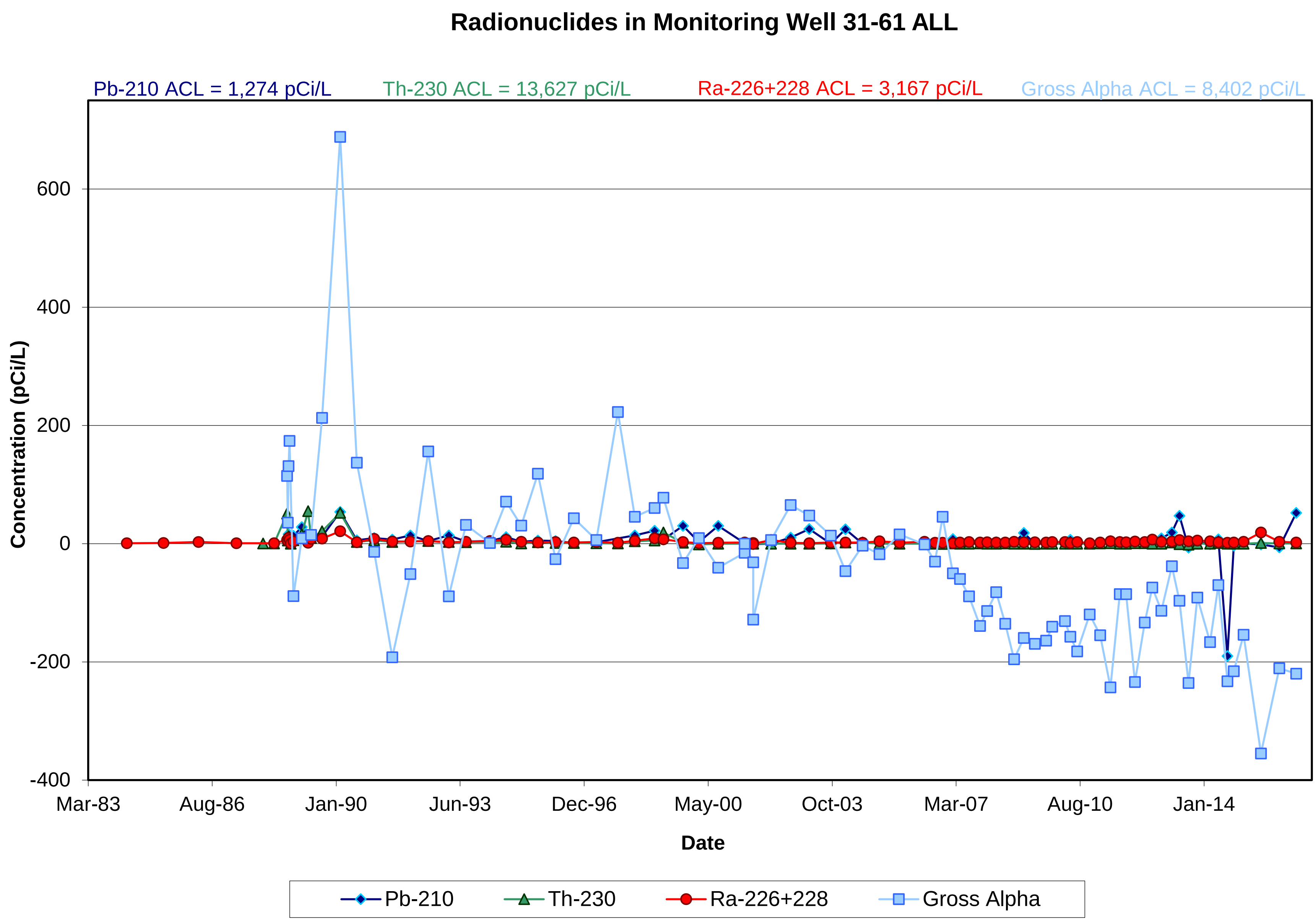

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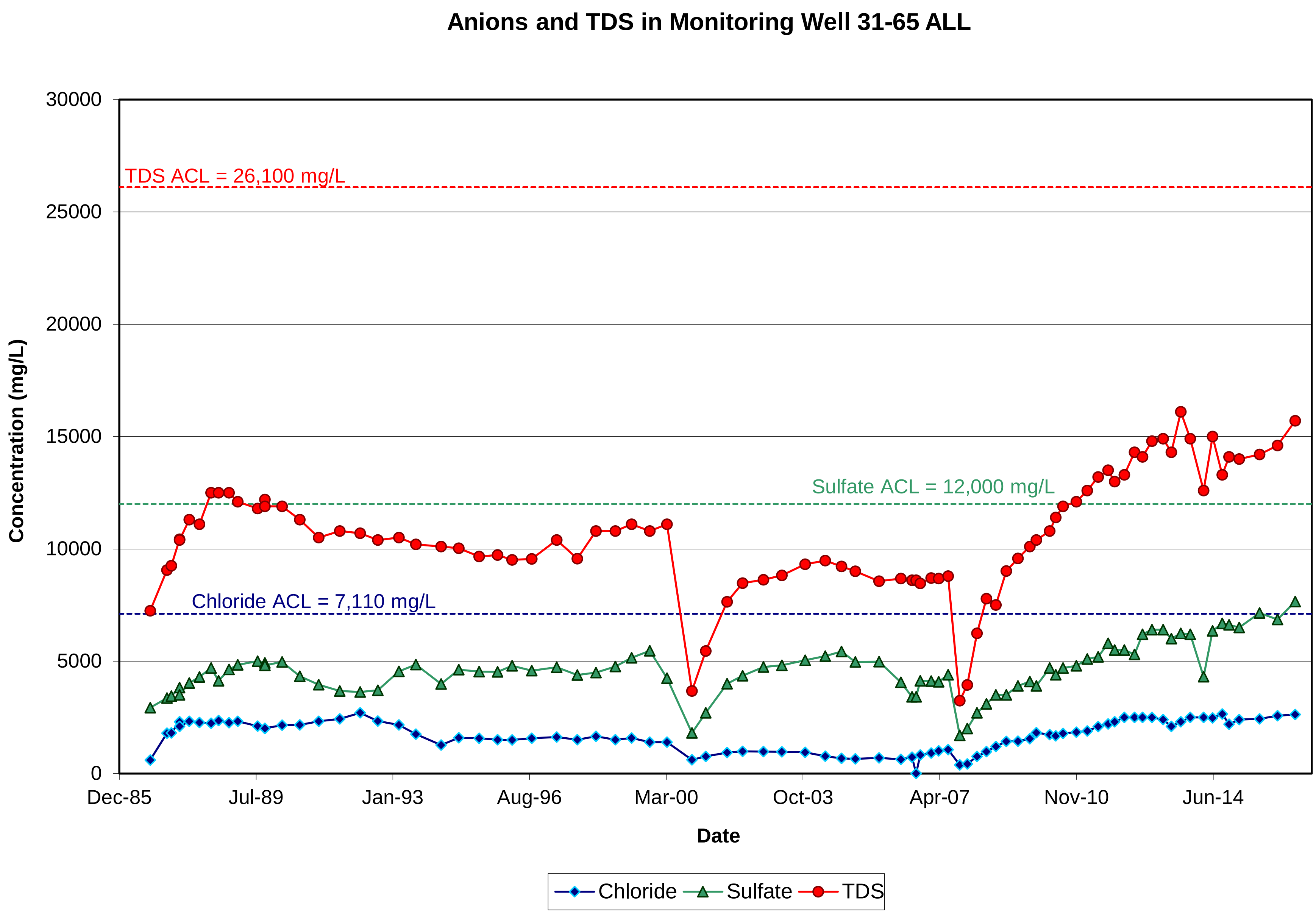

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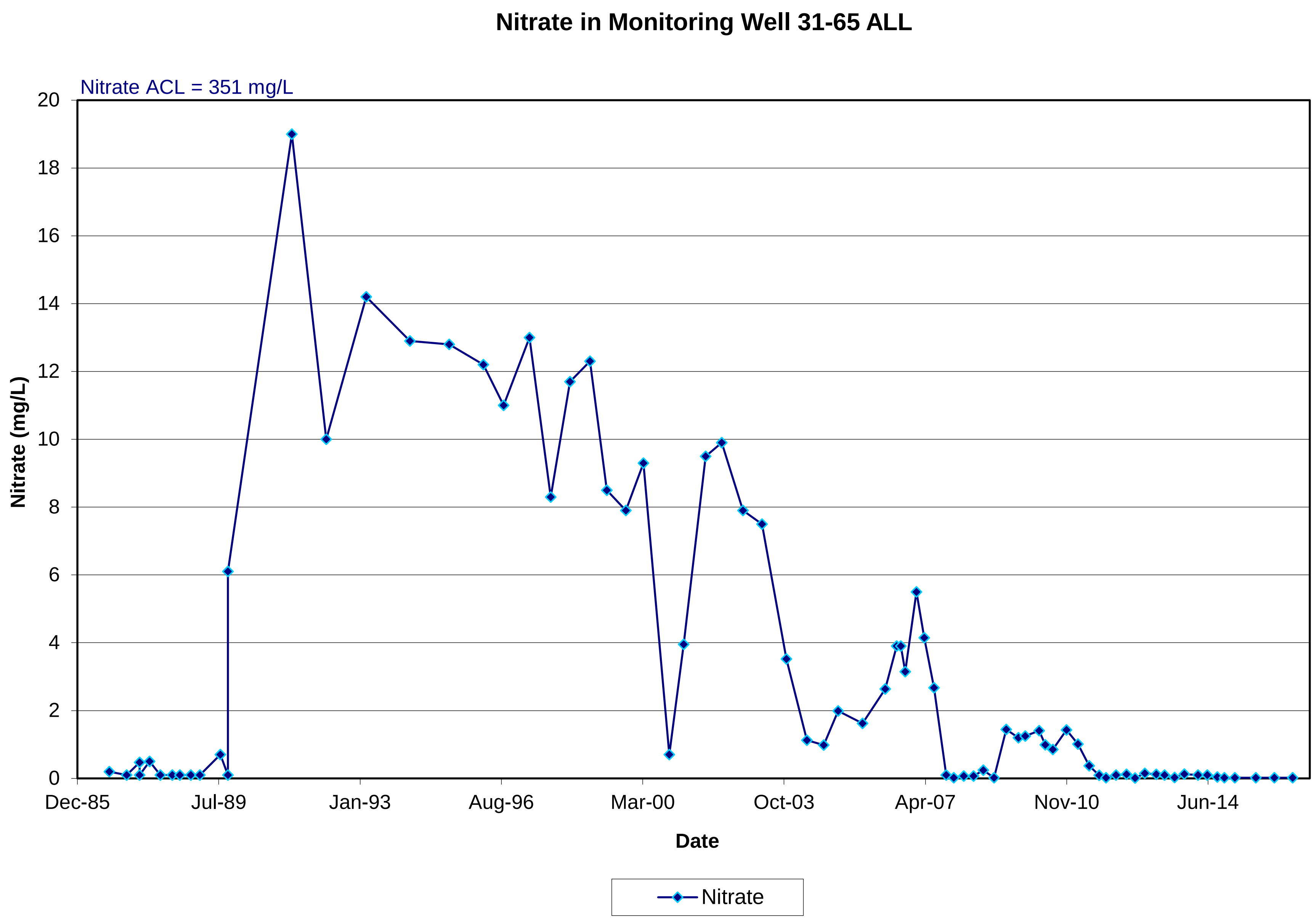
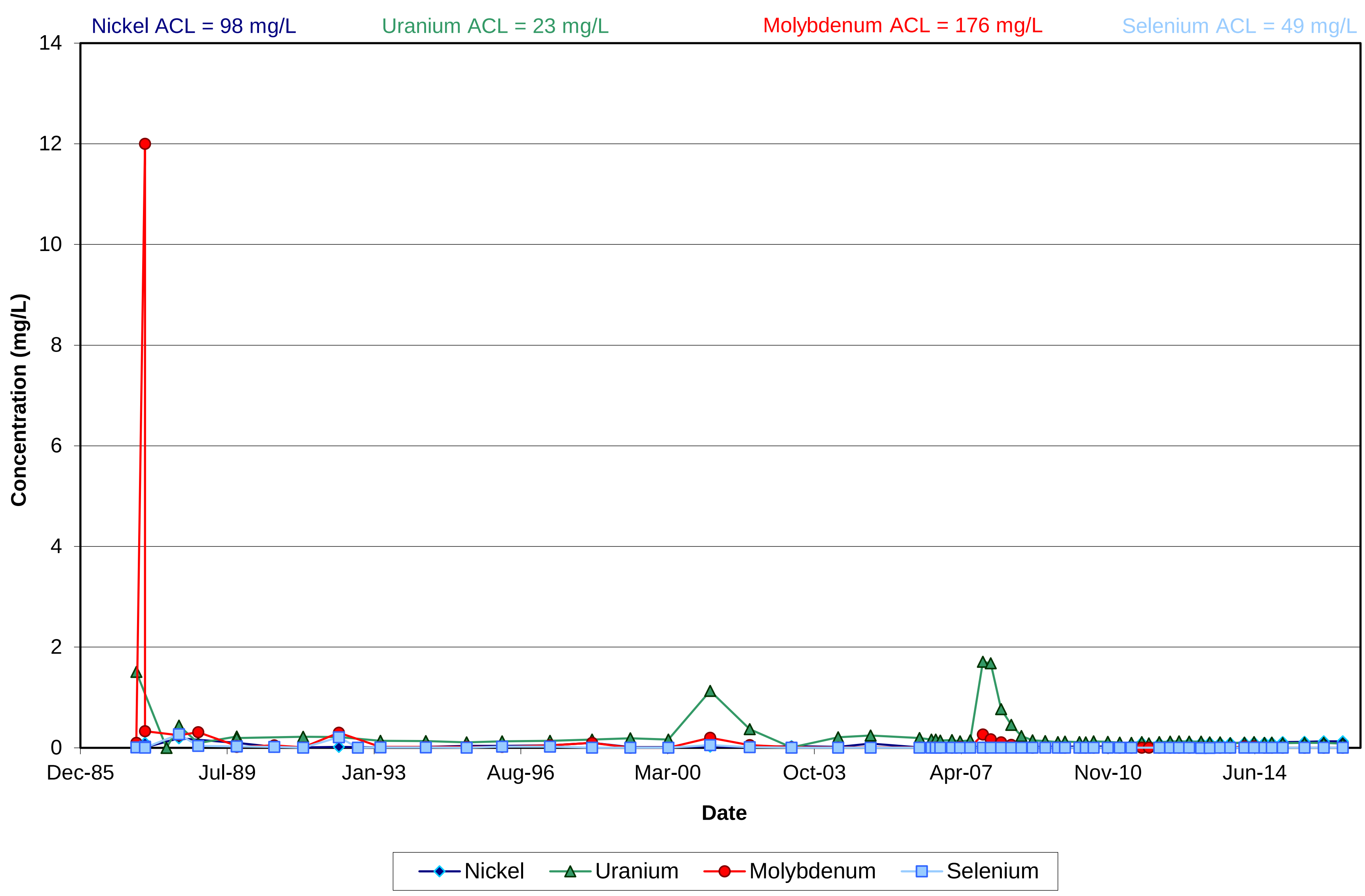
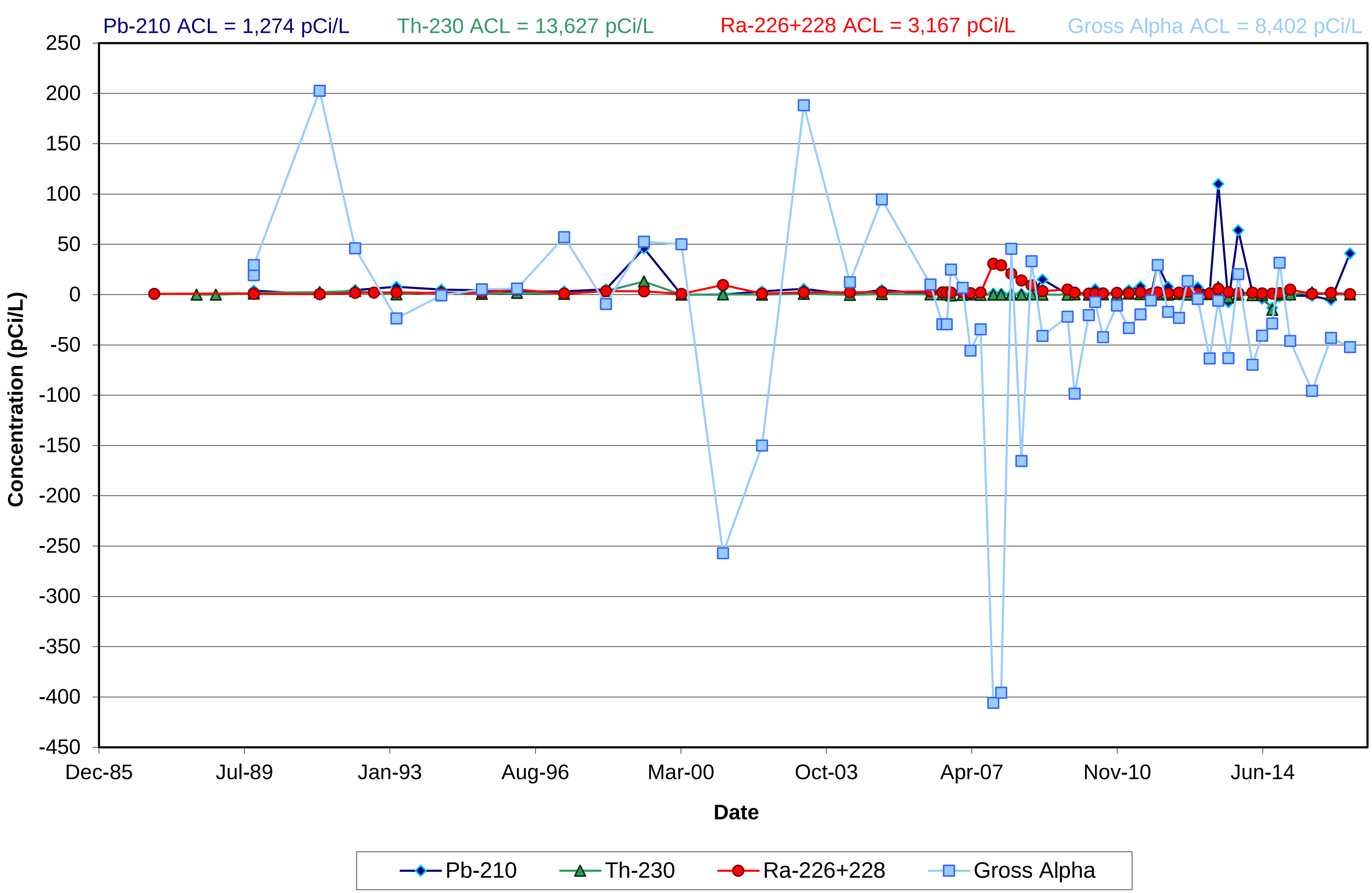


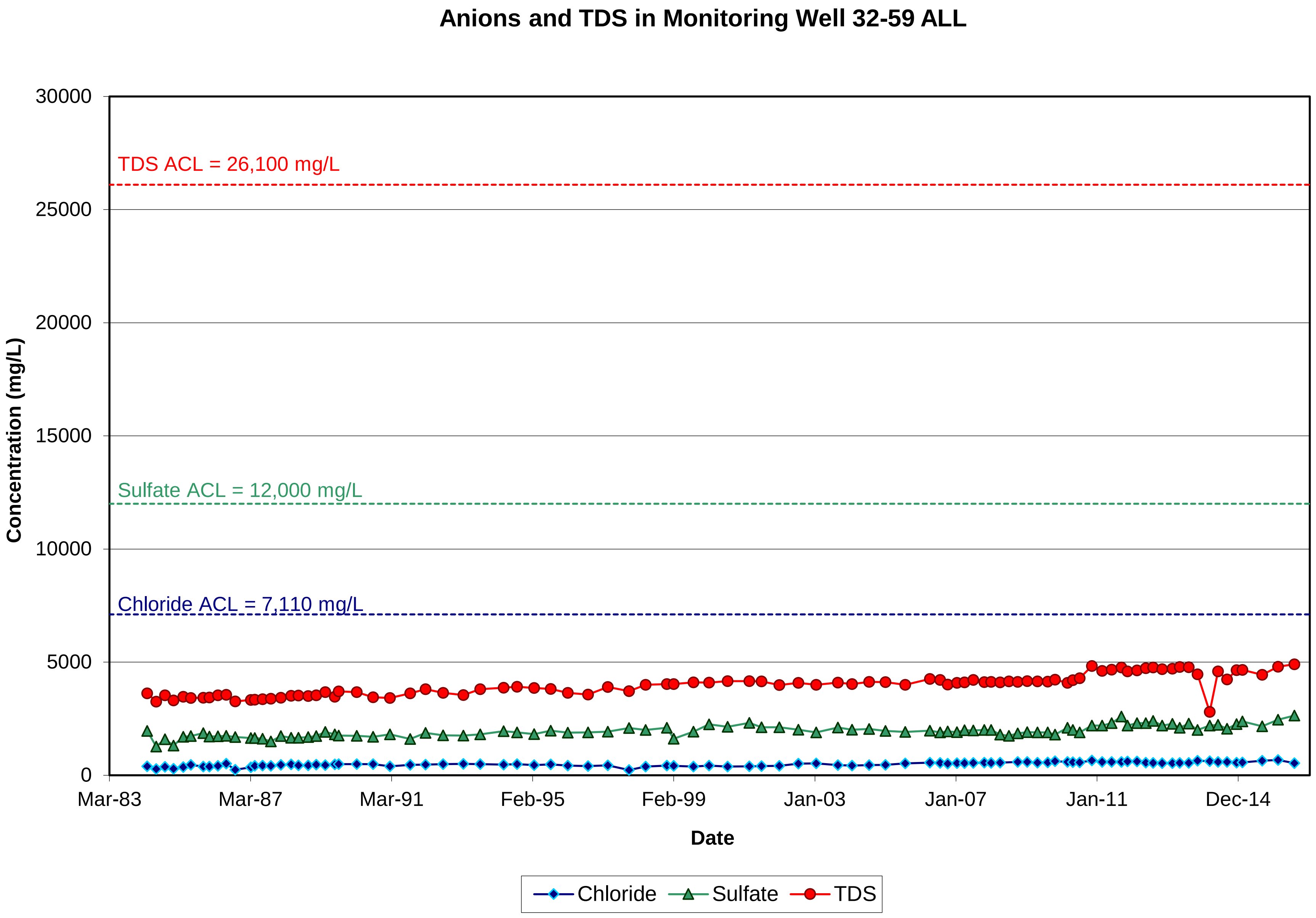
Nitrate in Monitoring Well 31-65 ALL
Nitrate ACL = 351 mg/L
Nitrate (mg/L)
20
18
16
14
12
10
8
6
4
2
0
Dec-85
Jul-89
Jan-93
Aug-96
Mar-00
Oct-03
Apr-07
Nov-10
Jun-14
Date
Nitrate

Metals in Monitoring Well 31-65 ALL



Radionuclides in Monitoring Well 31-65 ALL





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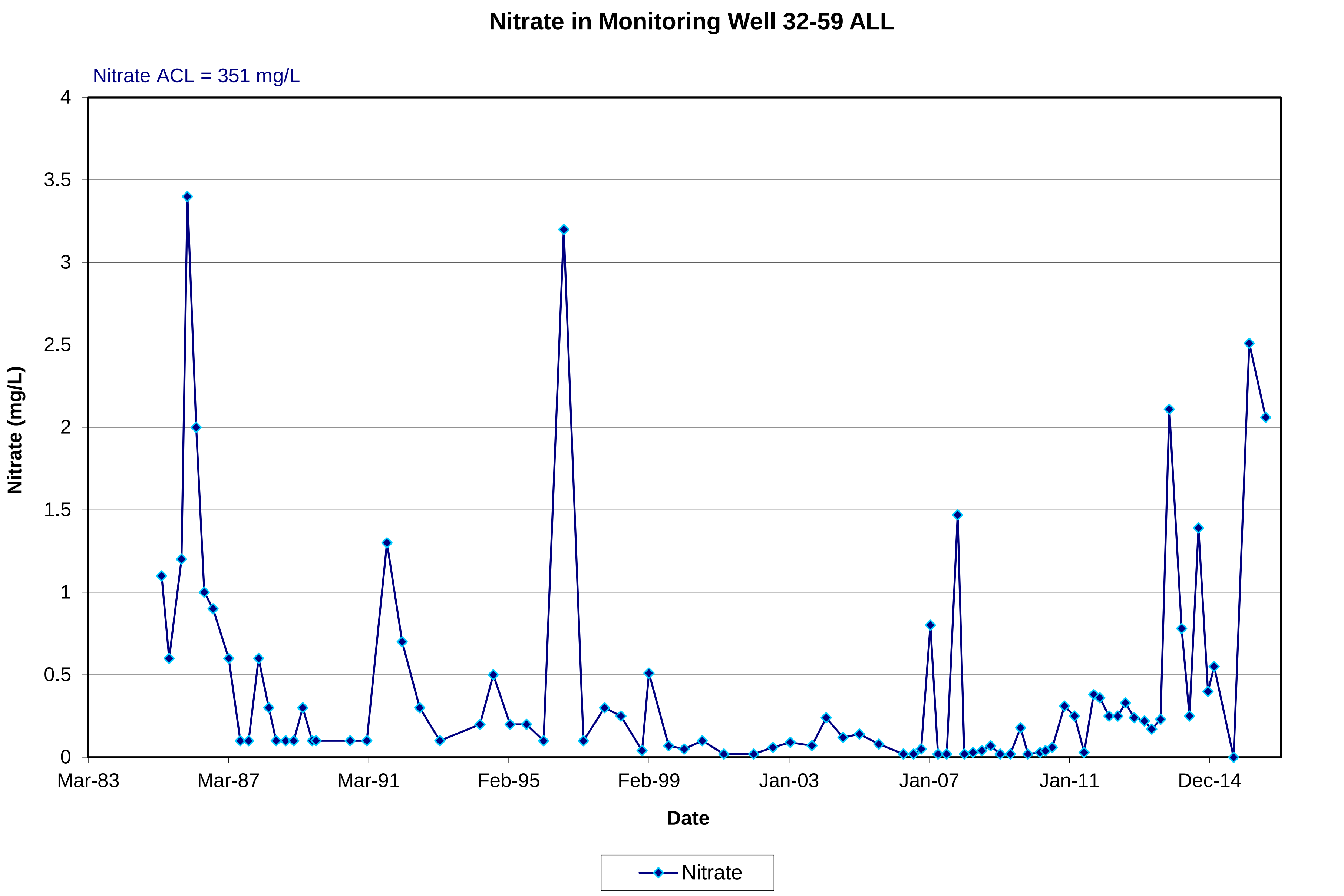
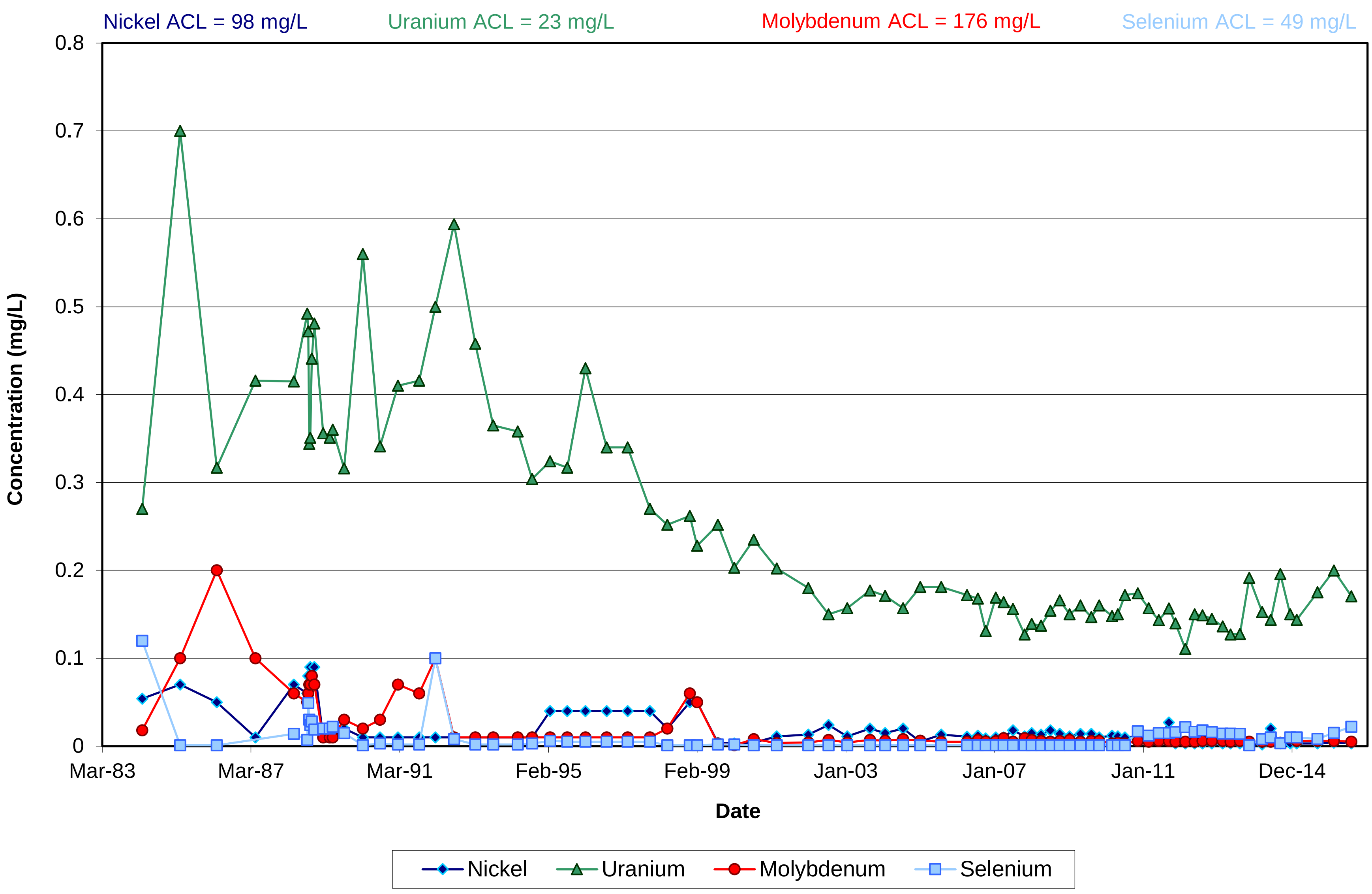
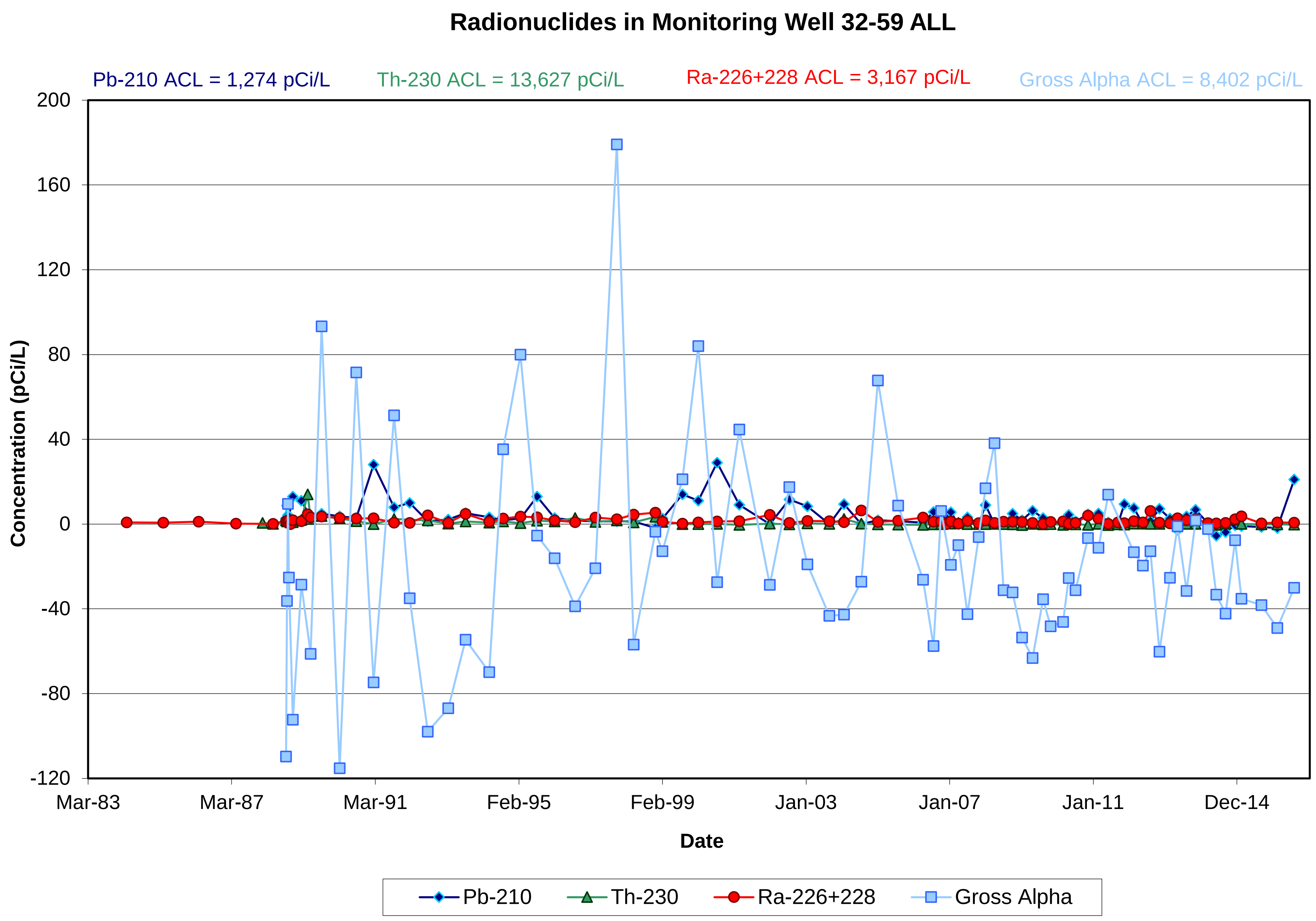


Nitrate in Monitoring Well 32-59 ALL
Nitrate ACL = 351 mg/L
Nitrate (mg/L)
4
3.5
3
2.5
2
1.5
1
0.5
0
Mar-83
Mar-87
Mar-91
Feb-95
Feb-99
Jan-03
Jan-07
Jan-11
Dec-14
Date
Nitrate

Metals in Monitoring Well 32-59 ALL





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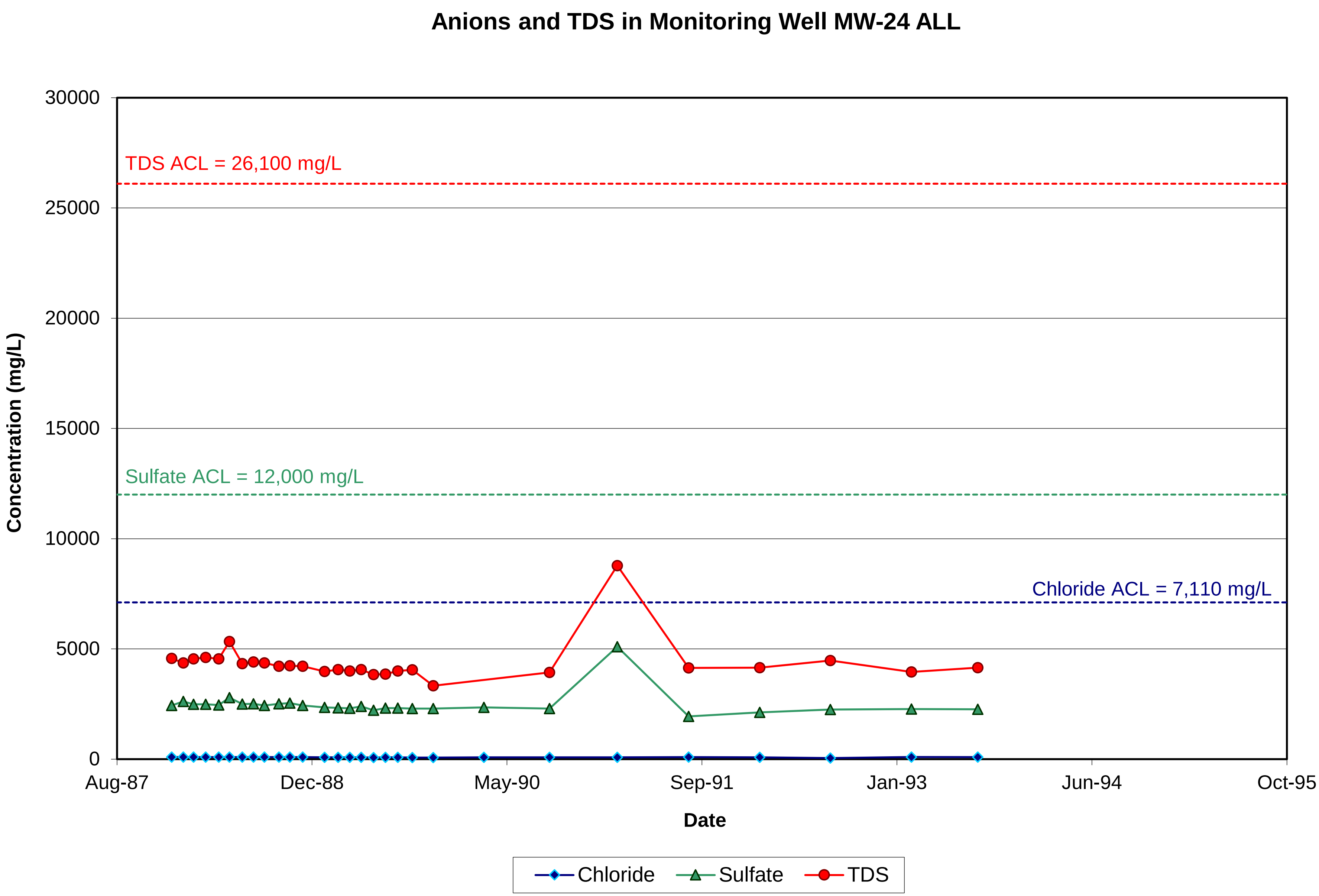
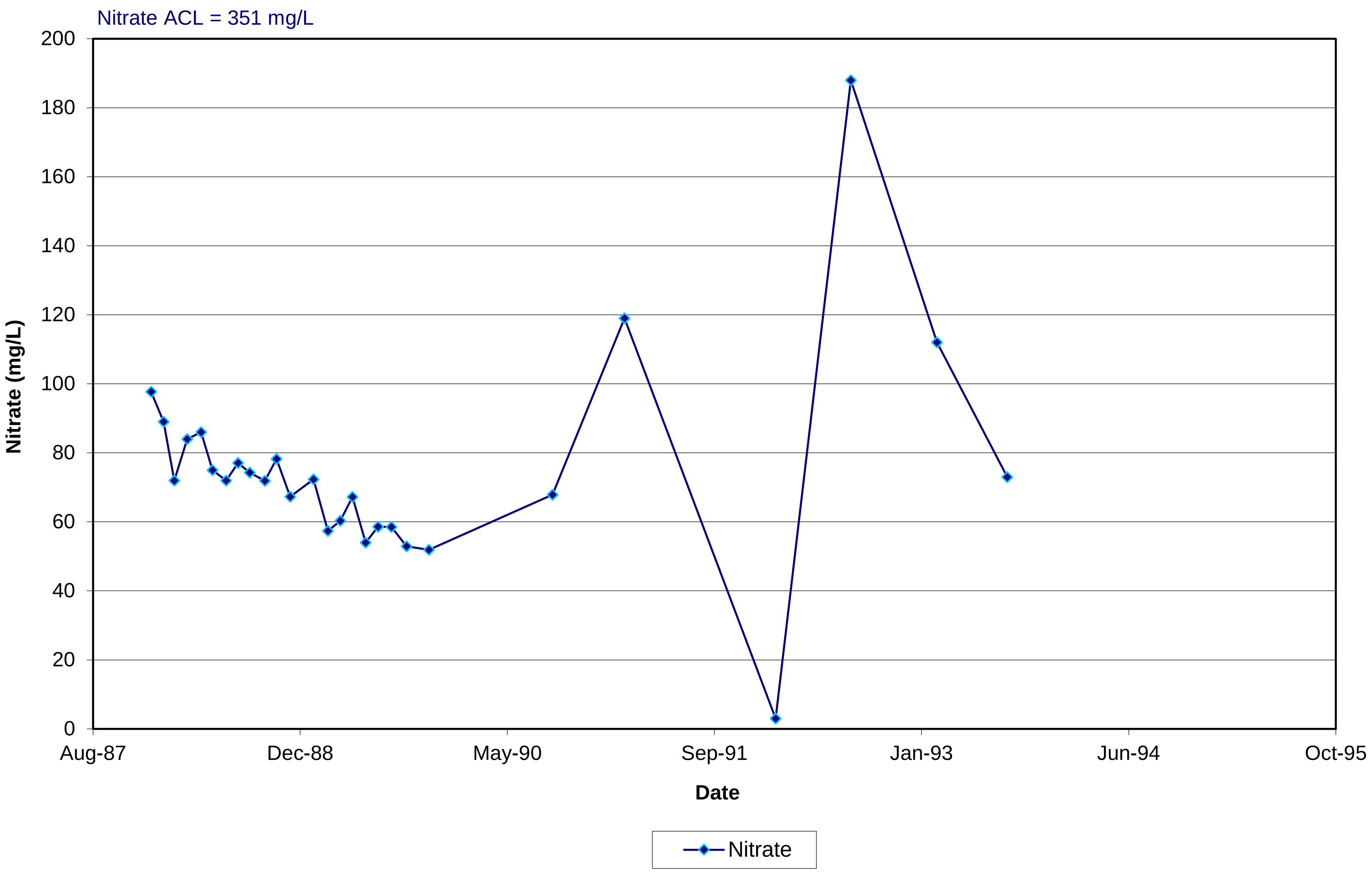


Anions and TDS in Monitoring Well MW-24 ALL
TDS ACL = 26,100 mg/L
Sulfate ACL = 12,000 mg/L
Chloride ACL = 7,110 mg/L
Concentration (mg/L)
30000
25000
20000
15000
10000
5000
0
Aug-87
Dec-88
May-90
Sep-91
Jan-93
Jun-94
Oct-95
Date
Chloride
Sulfate
TDS

Nitrate in Monitoring Well MW-24 ALL



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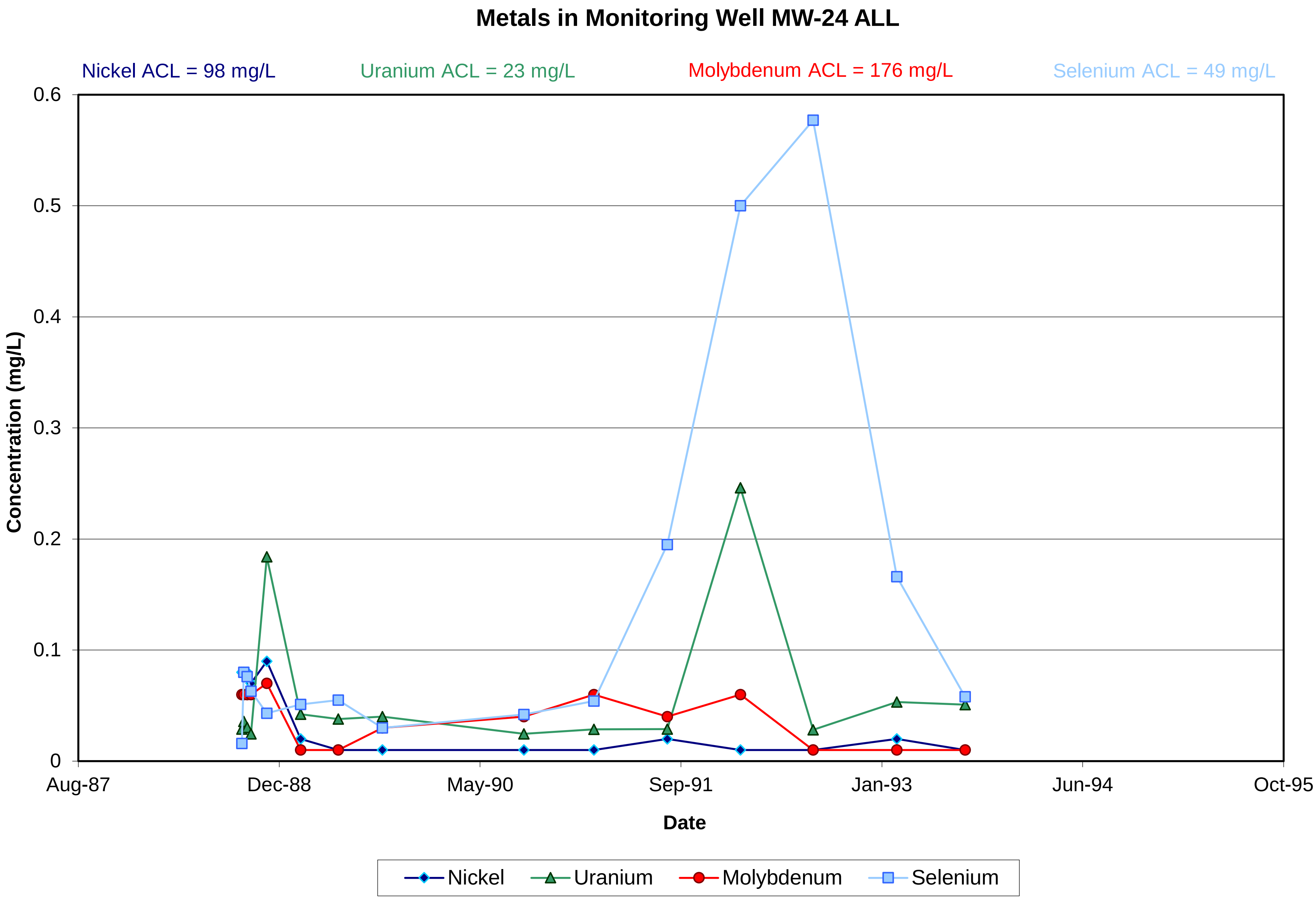
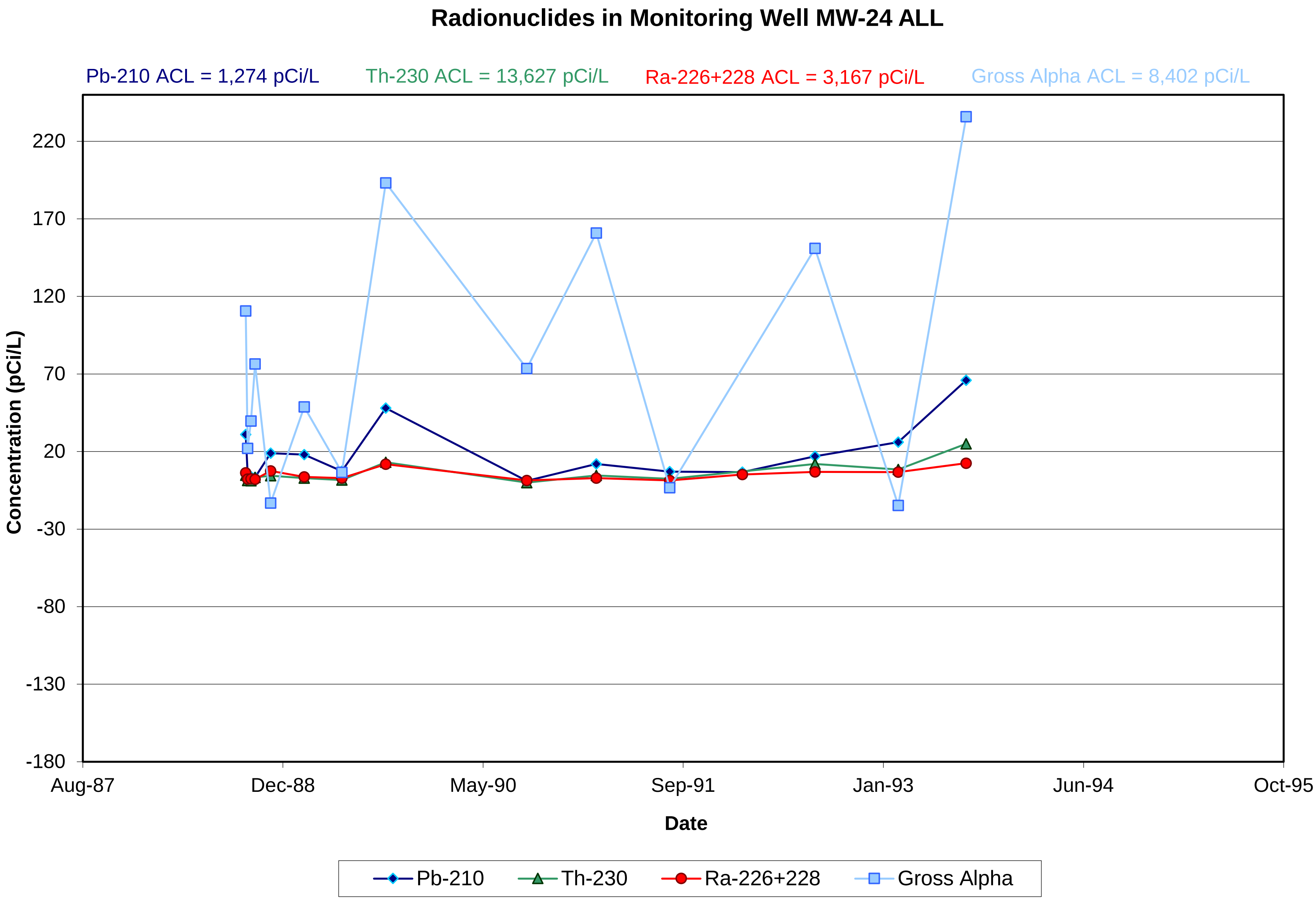


Metals in Monitoring Well MW-24 ALL
Nickel ACL = 98 mg/L
Uranium ACL = 23 mg/L
Molybdenum ACL = 176 mg/L
Selenium ACL = 49 mg/L
Concentration (mg/L)
0.6
0.5
0.4
0.3
0.2
0.1
0
Aug-87
Dec-88
May-90
Sep-91
Jan-93
Jun-94
Oct-95
Date
Nickel
Uranium
Molybdenum
Selenium



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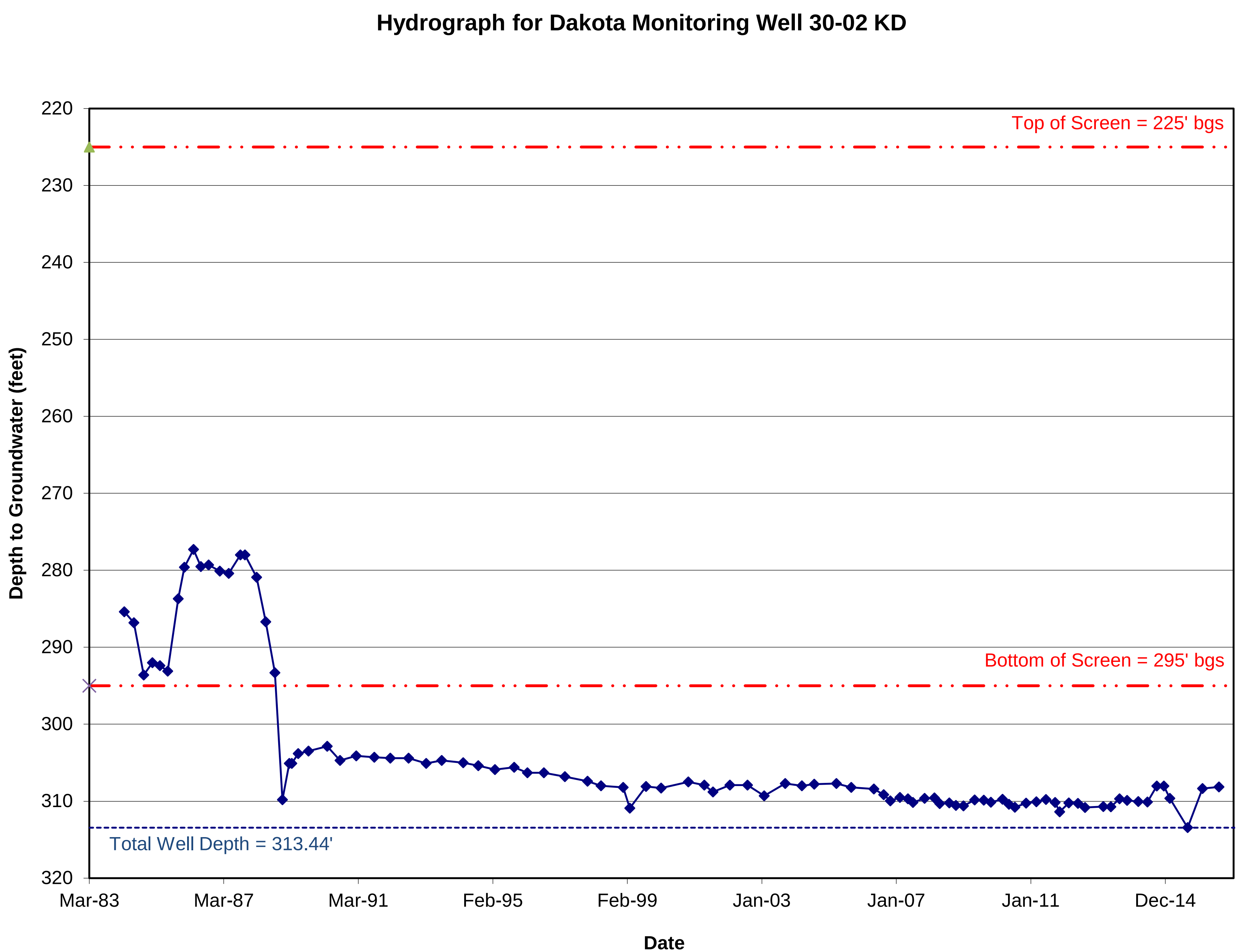
APPENDIX 3

Stability Monitoring Plan
Hydrographs



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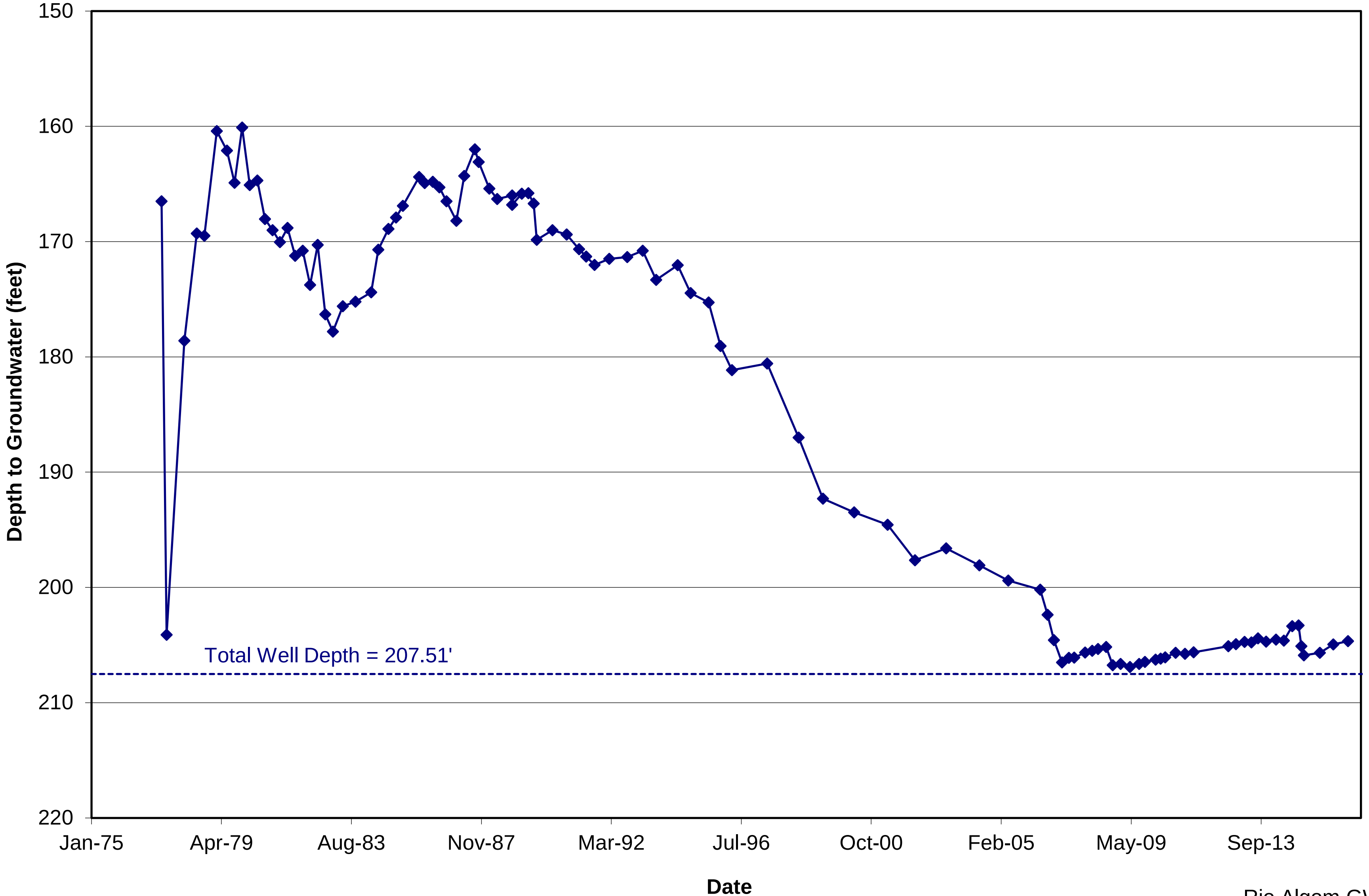
Hydrograph for TRA Monitoring Well 30-01 TRA



INTERA

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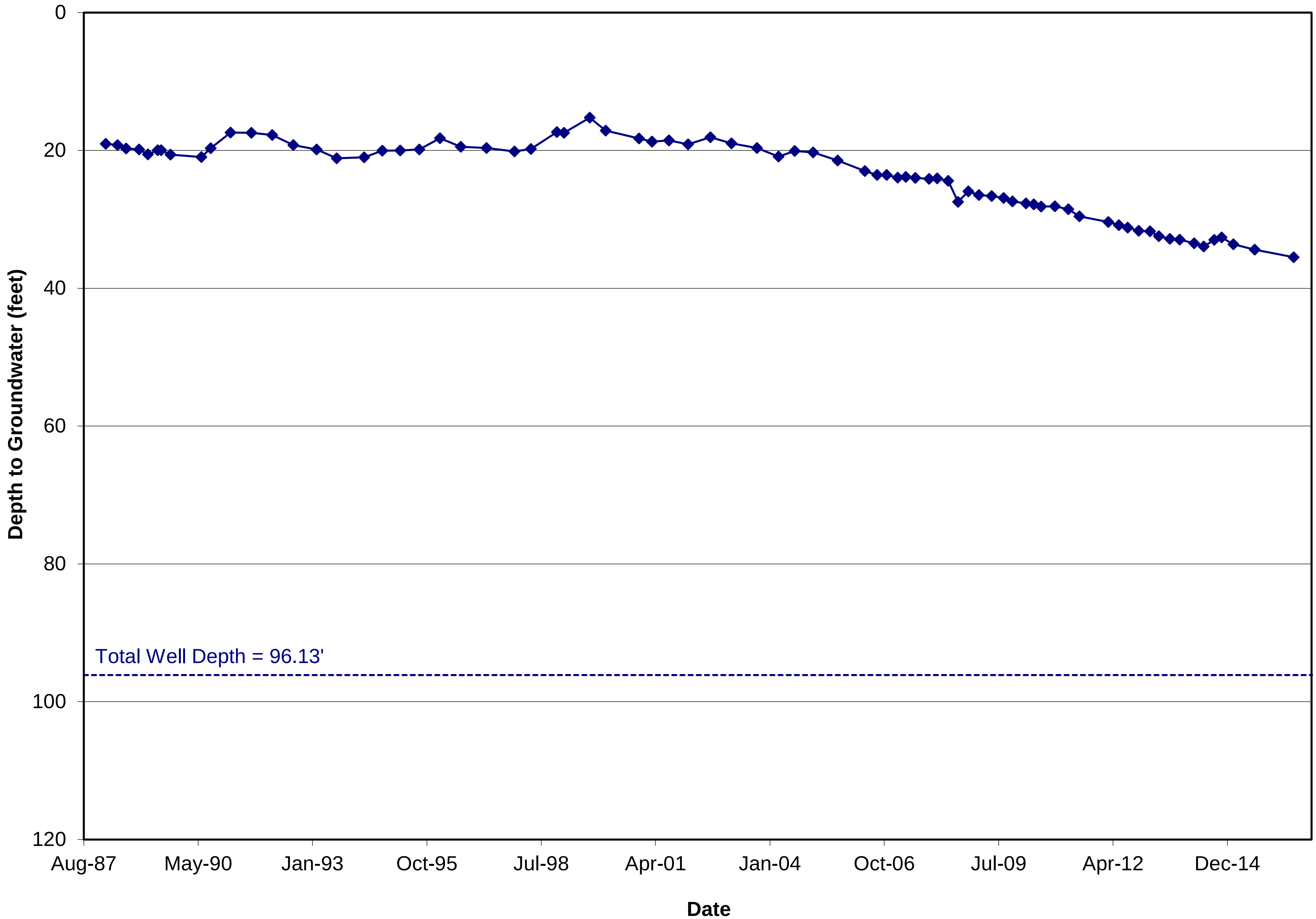
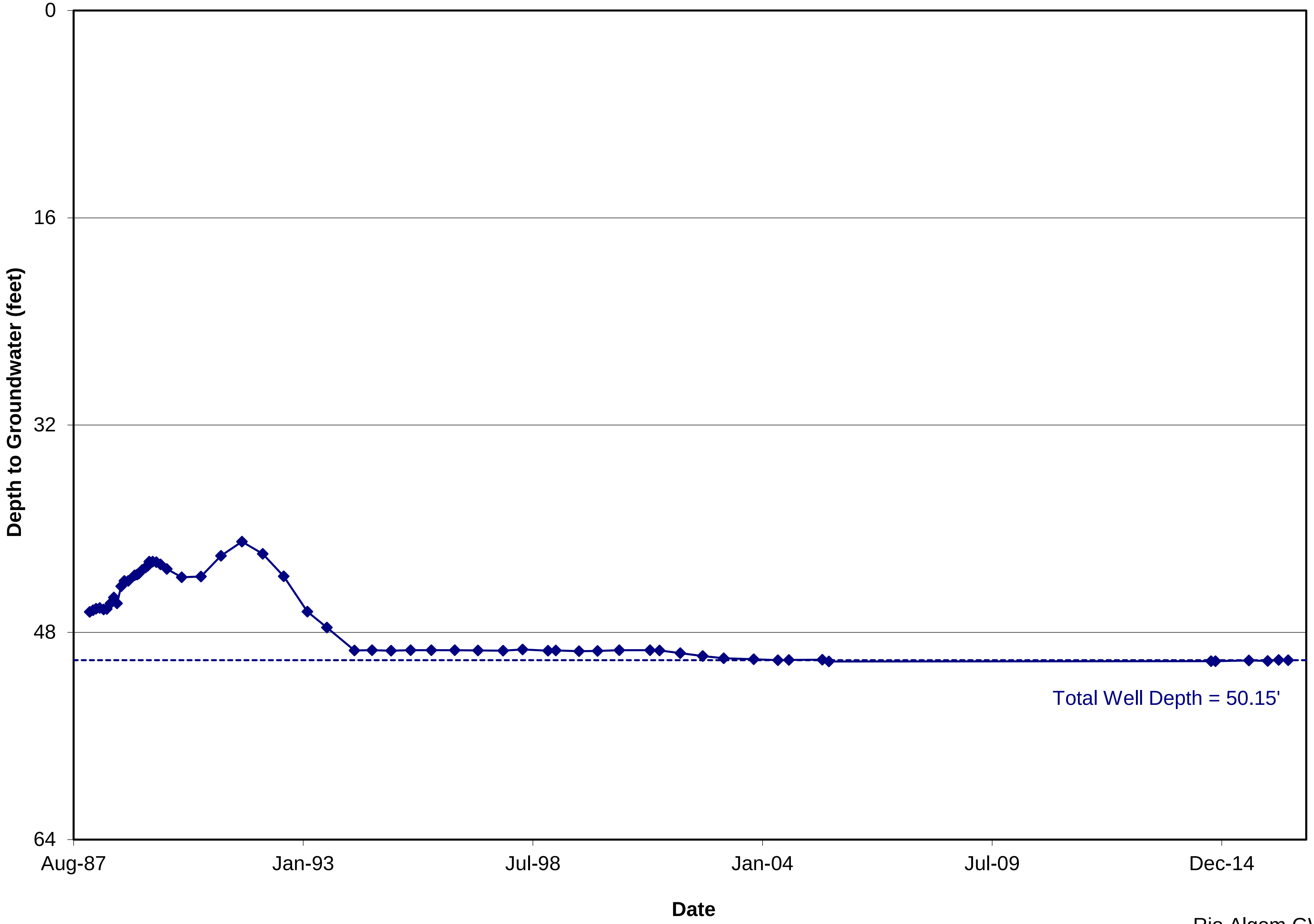
Hydrograph for TRB Monitoring Well 31-67 TRB



Hydrograph for Alluvial Monitoring Well MW-24 ALL



INTERA

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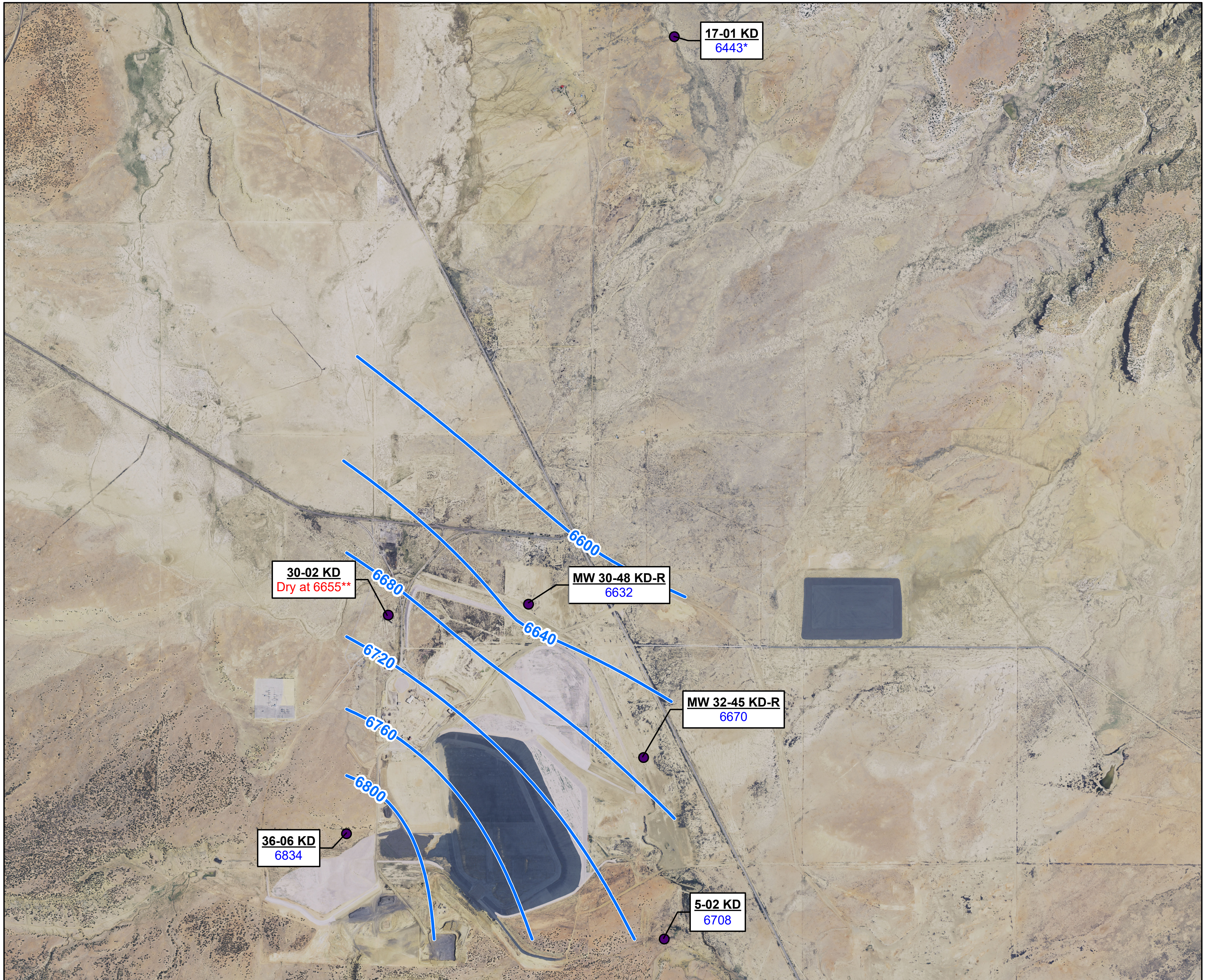
APPENDIX 4

Stability Monitoring Plan
Potentiometric Surface Maps



INTERA

N

0 1,250 2,500 5,000
Feet

Aerial – NAIP imagery, dated 2014

Legend

- ● Dakota Monitoring Well
- Dakota Potentiometric Iso-Contours (ft amsl)

Well ID
Groundwater Surface Elevation (ft amsl)

* indicates well 17-01 KD reading was taken 9/23/14, prior to pump install

** Elevation at bottom of screen since water level is below the bottom of the screened interval in the 30-02 KD well casing (sump)

Note: All data collected 3rd quarter, 2016 except 17-01 KD

Gradient calculation:
(Difference in Groundwater Elevation Between Point of Compliance Well 36-06 KD and Trend Well 30-48 KD-R = 6,834 - 6,632 = 202 feet) Divided by (Distance Along a Flow Path Between Point of Compliance Well 36-06 KD and Trend Well 30-48 KD-R = 5711 feet)

= 0.035 feet per foot

2nd Half 2016 Dakota Potentiometric Surface Elevation Iso-Contours
Rio Algom Mining LLC
Groundwater Stability Monitoring Report

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N

0 750 1,500 3,000
Feet

Aerial – NAIP imagery, dated 2014

Legend
TRA Monitoring Well Location
TRA Potentiometric Surface Elevation Iso-Contours (ft amsl)
Well ID
Groundwater Surface Elevation (ft amsl)

* Elevation at bottom of screen since water level is below the bottom of the screened interval in the 30-01 TRA well casing (sump)

Note: All data collected 3rd quarter, 2016

Gradient calculation:
(Difference in Groundwater Elevation Between Point of Compliance Well MW 31-01 TRA-R and Trend Well 33-01 TRA = 6,799 - 6,782 = 17 feet) Divided by (Distance Along a Flow Path Between Point of Compliance Well MW 31-01 TRA-R and Trend Well 33-01 TRA = 8947 feet)

= 0.002 feet per foot

2nd Half 2016 TRA Potentiometric Surface Elevation Iso-Contours
Rio Algom Mining LLC
Groundwater Stability Monitoring Report

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INTERA

N

0 750 1,500 3,000
Feet

Aerial – NAIP imagery, dated 2014

Legend

- TRB Monitoring Well Location
- Trb Potentiometric Surface Elevations (ft amsl)

Well ID
Groundwater Surface Elevation (ft amsl)

Note: All data collected 3rd quarter, 2016

Gradient calculation:
(Difference in Groundwater Elevation Between Point of Compliance Well 31-02 TRB-R and far downgradient Well 19-77 = 6,890 - 6,739 = 151 feet)
Divided by
(Distance Along a Flow Path Between Point of Compliance Well 31-02 TRB-R and far downgradient Well 19-77 = 9,640 feet)

= 0.016 feet per foot

2nd Half 2016 TRB Potentiometric Surface Elevation Iso-Contours ACL
Rio Algom Mining LLC
Groundwater Stability Monitoring Report

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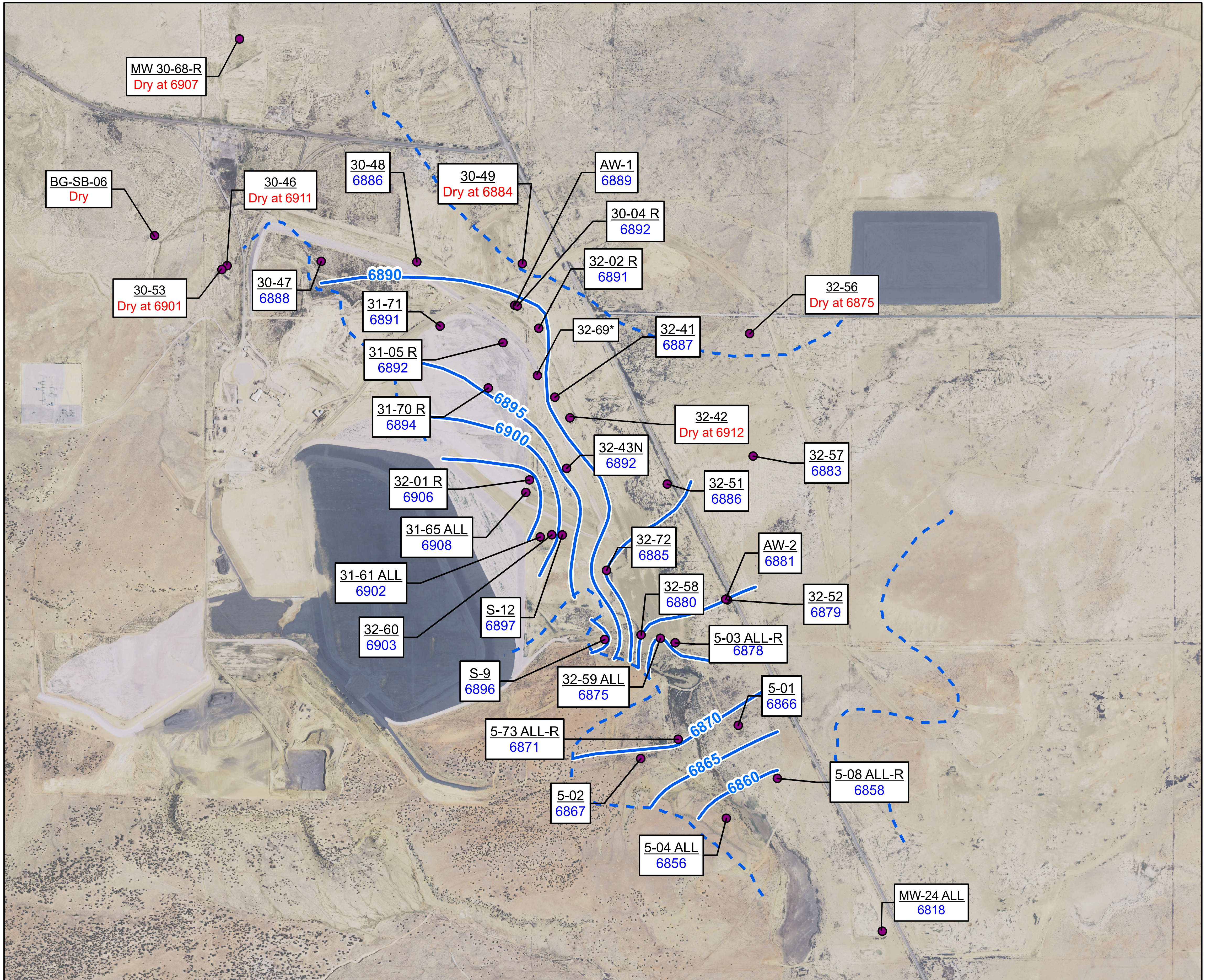

INTERA

N

0 1,800 3,600

Feet

Aerial – NAIP imagery, dated 2014

Legend

- Alluvial Monitoring Well Location
- Alluvial Groundwater Surface Elevation (ft amsl)
- Estimated Boundary of Saturated Alluvium

Well ID
Groundwater Surface Elevation (ft amsl)

Notes:
All data collected 3rd Quarter, 2016.
* = Water level at well not used for contouring due to inaccurate TOC survey.

Gradient calculation:
(Difference in Groundwater Elevation Between Point of Compliance Well 31-61 and Trend Well 5-08 ALL-R = 6,902 - 6,858 = 44 feet) Divided by (Distance Along a Flow Path Between Point of Compliance Well 31-61 and Trend Well 5-08 = 5560 feet)

= 0.008 feet per foot

2nd Half 2016 Alluvial Groundwater Surface Elevation Iso-Contours

Rio Algom Mining LLC

Groundwater Stability Monitoring Report

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