



Environmental Protection Department
Operations and Regulatory Affairs Division

LLNL
Experimental Test Site 300

**Compliance Monitoring Program for
RCRA-Closed Landfill Pits 1 and 7**

**Annual Report
for 2003**

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LLNL Experimental Test Site 300

Compliance Monitoring Program for

RCRA-Closed Landfill Pits 1 and 7

Annual Report for 2003

Summary

This combined fourth quarter and annual report summarizes compliance activities performed during calendar year 2003 at two LLNL Site 300 landfills known as Pits 1 and 7 that were closed in 1993 under the Resource Conservation and Recovery Act (RCRA). The compliance activities consisted primarily of quarterly ground water sampling and analysis. Quarterly and annual visual inspections of the capped facilities and an annual elevation survey to monitor cap subsidence were also conducted. Fourth quarter activities are emphasized in this report, because three quarterly reports have been submitted previously (Christofferson and MacQueen 2003a, 2003b, 2003c).

No new release of constituents of concern (COCs) to ground water from either Pit 1 or Pit 7 is evident in the chemical data obtained during 2003. A few COCs that have been detected in the past continued to be detected above their statistical limits of concentration (SLs). These COCs are most likely from local sources other than Pit 1 and Pit 7. The tritium detected in ground water by the network of Pit 1 monitoring wells is linked to a distant upgradient source in the Building 850 area. The volatile organic compound (VOC) known as Freon 113, which has been historically detected in ground water at three Pit 1 monitoring wells, is most likely from the nearby Advanced Test Accelerator (ATA) area. The primary sources of COCs detected by the network of Pit 7 monitoring wells are the closed landfills known as Pits 3 and 5, which are adjacent to Pit 7. Detected Pit 7 COCs include several metals, depleted uranium, tritium, and two VOCs, trichloroethene (TCE) and 1,1-dichloroethene (1,1-DCE). In the past, excessive seasonal rainfall caused ground water levels to rise into Pit 3 and Pit 5, leading to the release of COCs. Ground water elevations have generally fallen since 1998, because of reduced seasonal rainfall. Natural sources in the rocks and sediments surrounding Pit 7 also have contributed elements such as uranium to the ground water.

Five inspections of Pits 1 and 7 during 2003 found their condition to be satisfactory. Elevation surveys of the landfill covers during 2003 revealed no detrimental subsidence.

Tables of COC concentration measurements for 2003 are in **Appendix A**. Graphs of ground water COC concentrations, which include historical data, are in **Appendix E**.

Introduction

This required annual report summarizes environmental monitoring work performed during calendar year 2003 at the LLNL Experimental Test Site (Site 300). Site 300 is located in the Altamont Hills approximately 13 km (8 miles) southwest of Tracy, California (**Figure 1**). Specifically, this report covers compliance monitoring of two closed landfills, known as Pit 1 and Pit 7, located within Site 300 near its northern boundary (**Figure 2**). These Class I waste management units were officially closed in February 1993 under RCRA. Site 300 is owned by the United States Department of Energy (DOE) and is operated by the Regents of the University of California.

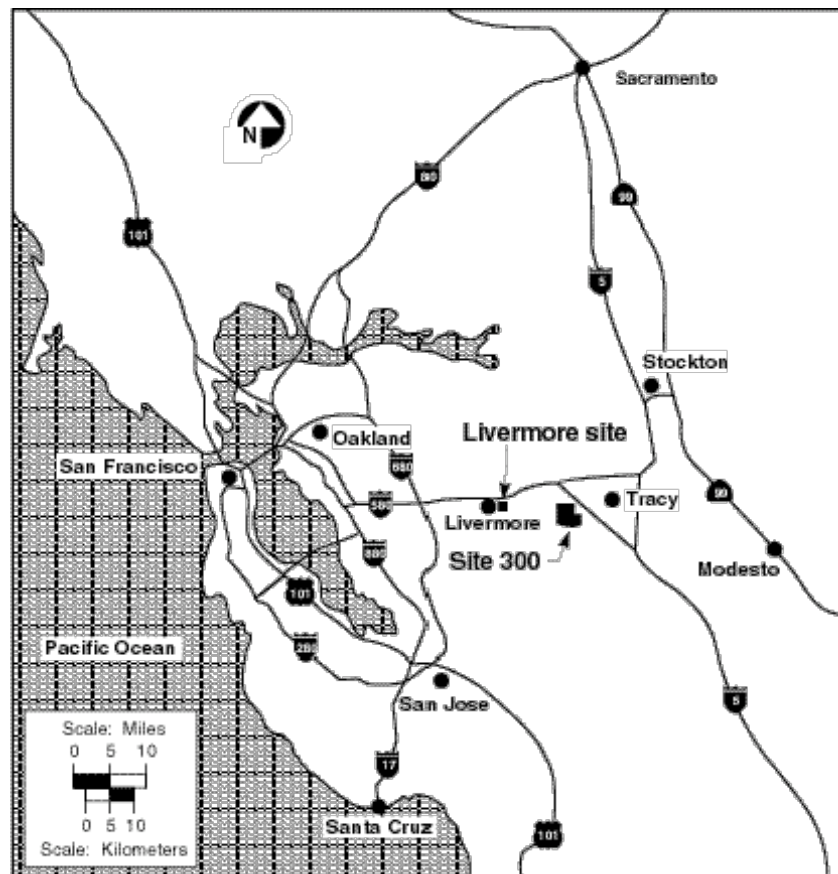


Figure 1. Location of LLNL Site 300.

This report fulfills quarterly and annual requirements set forth in the following two documents:

1. *Waste Discharge Requirements Order 93-100 (WDR 93-100), and Revised Programs No. 93-100 and 96-248*, administered by the California Central Valley Regional Water Quality Control Board (CVRWQCB 1993 and 1998); and

2. *LLNL Site 300 RCRA Closure and Post-Closure Plans, Landfill Pits 1 and 7* (Rogers/Pacific Corporation 1990).

The post-closure plan (PCP) was approved by the California Department of Health Services. It is currently administered under a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Federal Facility Agreement, with oversight by the U.S. Environmental Protection Agency (EPA) Region 9, the California Environmental Protection Agency (Cal EPA) Department of Toxic Substances Control (DTSC), and the CVRWQCB.

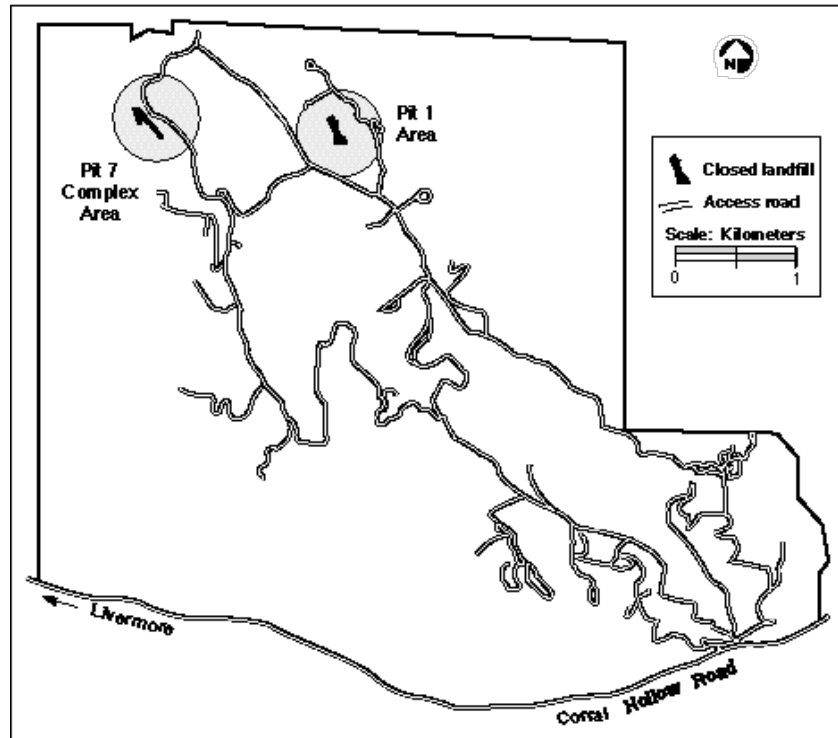


Figure 2. Locations of RCRA-closed landfill Pits 1 and 7 at LLNL Site 300.

Compliance Monitoring Program Overview

The Compliance Monitoring Program for Pits 1 and 7 combines PCP and WDR 93-100 requirements. The combined requirements include quarterly ground water sampling and analyses to detect potential releases of COCs from landfills, quarterly and annual visual inspections, annual surveys of pit cap marker elevations, repairs as necessary to maintain the integrity of the landfills and their water-diversion systems, and quarterly and annual written reports of work performed.

To detect potential releases from the landfills, LLNL obtains representative samples of ground water quarterly from monitoring wells upgradient and downgradient from the two landfills. Standard operating procedures (SOPs) are strictly followed to obtain the correct volumes of water in the proper bottles and to prevent contamination of samples during collection (Dibley and Depue 2002). Samples are clearly labeled and chain-of-custody forms are used to prevent sample loss. The ground water samples are

analyzed by state-certified laboratories for chemical COCs that may occur in the wastes buried in the two landfills. Most of the buried waste is gravel from firing tables at Site 300. The gravel contains debris, including wood, plastic, and wire, from explosive experiments. Hardcopy reports of chemical analyses are checked for accuracy by a quality assurance (QA) chemist. A water analyst then evaluates the data to determine if a release from the landfills is suggested. Routine COC measurements that fall outside the range of historical data, and especially those that exceed SLs, are evaluated further to determine their validity. Routine results may be validated, or invalidated, by obtaining two additional, independent ground water samples from the affected well(s) and analyzing them for the suspected COC. After evaluating the monitoring data, LLNL water analysts prepare this required report.

Physical Setting of the Closed Landfills

Site 300 is semi-arid, with an average annual rainfall of about 27 cm (10.5 in.). Rainfall is the primary source of the ground water there. Rainfall at Site 300 is rarely sufficient to produce flowing streams in arroyos. Typically, surface water in arroyos infiltrates quickly.

Pit 1 is located in the Elk Ravine drainage area, about 300 m above mean sea level (MSL). Ground water flows in an east-northeast direction beneath Pit 1, following the inclination (dip) of underlying Miocene age sedimentary rocks (Webster-Scholten 1994).

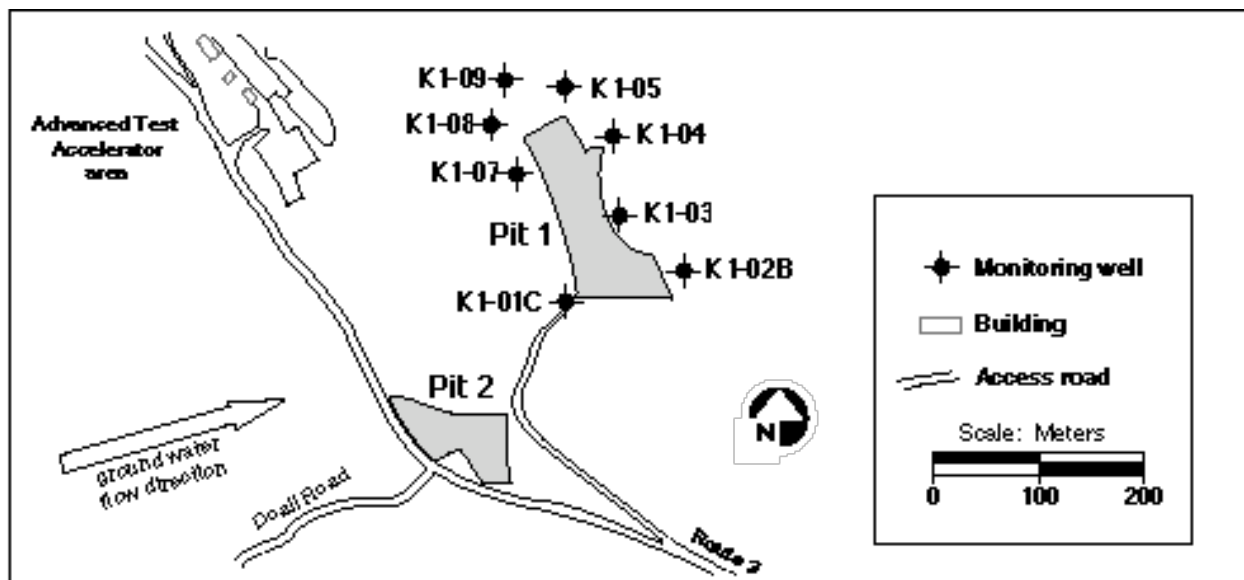


Figure 3. Locations of Pit 1 compliance monitoring wells.

Figure 3 shows the locations of the eight compliance monitoring wells that are used to sample the ground water in the vicinity of Pit 1. Wells K1-01C and K1-07 are hydrologically upgradient from Pit 1. Wells K1-02B, K1-03, K1-04, and K1-05 are downgradient. Wells K1-08 and K1-09 are cross-gradient. The wells are screened in the

uppermost water-bearing zone, either in the Neroly Formation lower blue sandstone unit (Tnbs₁), or beneath the Tnbs₁ in the Cierbo Formation (Tmss). The Neroly and Cierbo Formations contain the main aquifers beneath Site 300. Pit 2, which was closed before RCRA was enacted, is hydrologically upgradient from Pit 1.

In 1992, a 2.4 m (8 ft) thick RCRA cap, containing an impermeable layer of clay, 0.6 m (2 ft) thick, was constructed over Pit 1. The cap prevents rainwater from percolating through the waste buried in the pit. A water diversion channel was constructed around the pit cap to remove storm water runoff. The diversion channel empties into the arroyo in Elk Ravine.

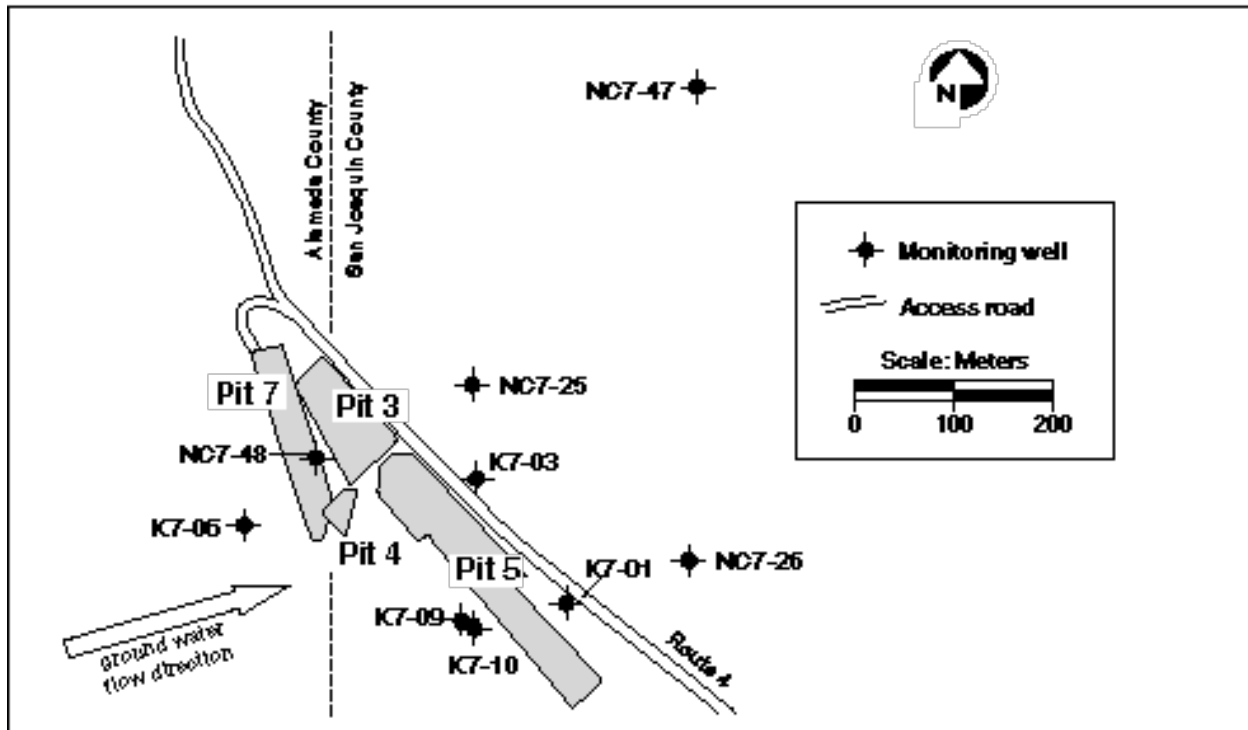


Figure 4. Locations of Pit 7 compliance monitoring wells.

Pit 7 is located in a valley 1.5 km west of Pit 1, at an elevation of about 400 m. The Pit 7 Complex comprises Pits 3, 4, 5, and 7. Pits 3, 4, and 5 ceased receiving waste before 1980, when RCRA was enacted. Ground water flows 5-15 m/yr in an east-northeast direction beneath the Pit 7 Complex, following the dip of underlying Tnbs₁ and Tmss sedimentary rocks (Webster-Scholten 1994).

Figure 4 shows the locations of the nine compliance monitoring wells that are used to sample the ground water in the vicinity of Pit 7. Well K7-06 is hydrologically upgradient from Pit 7. Wells K7-01, K7-03, NC7-25, NC7-26, NC7-47, and NC7-48 are downgradient. Wells K7-09 and K7-10 are cross-gradient. Eight of the nine wells are screened in the uppermost water-bearing zone. Well K7-09 samples a deeper water-bearing zone. Wells K7-01, K7-10, and NC7-26 are screened in the Tnbs₁ unit. The remaining wells are screened in the Cierbo Formation (Tmss). In 1992, a RCRA cap,

similar to the Pit 1 cap, was constructed over Pit 7. It, too, contains a layer of impermeable clay, 0.6 m (2 ft) thick, to prevent rain water infiltration. The RCRA cap also covers Pit 4 and about 30% of Pit 3. RCRA construction included surface water diversion channels around the cap and a shallow inter-flow interceptor trench on the west side (upgradient) of Pit 7. Some shallow recharge water is intercepted and diverted to lessen ground water rise into the unlined landfills.

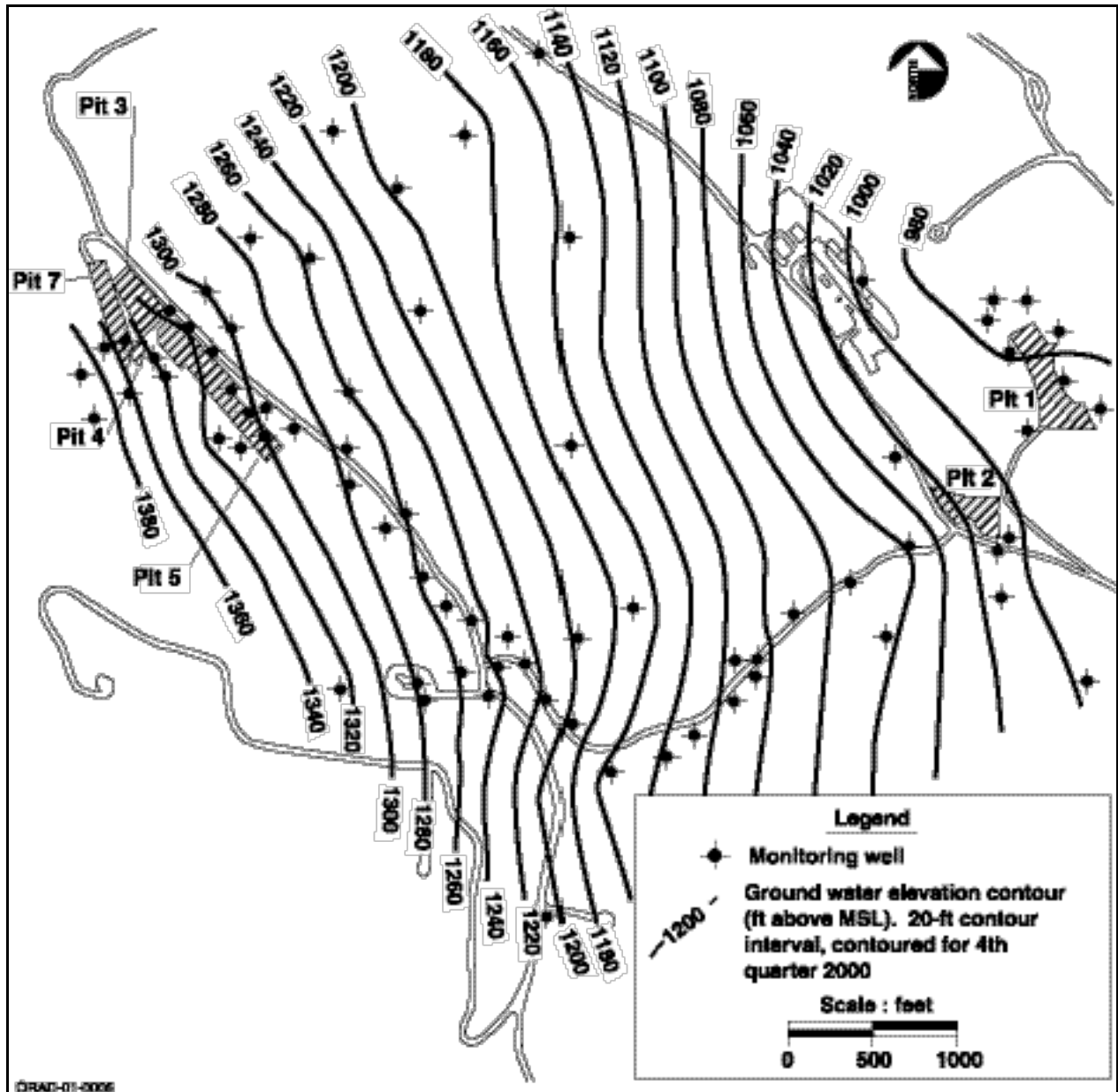


Figure 5. Ground water elevation contours for the first continuous water-bearing zone, northwestern Site 300, 4th quarter 2000.

Figure 5 shows contours of ground water elevations in the first continuous water-bearing zone beneath northern Site 300. The contours are drawn from field measurements made during the fourth quarter of 2000 at the CERCLA monitoring well

locations shown. The purpose of the map is to illustrate that the general direction of ground water flow within this area is to the east-northeast.

With sufficient seasonal rainfall, unconfined ground water can rise from bedrock into the more permeable valley-fill alluvium on the northeast side of the Pit 7 Complex and flow southeastward at seepage velocities of up to 40 m/yr. Surface drainage from the area also flows southeastward into Doall Ravine. However, surface water infiltrates quickly, and the arroyo in Doall Ravine rarely carries surface water as far as the arroyo in Elk Ravine.

Description of Report Contents

The **Summary of Analytical Results for 2003** section reviews those COCs that were detected in ground water during 2003. Emphasis is placed on fourth quarter monitoring results, because they have not been previously reported. COC measurements that exceeded SLs or maximum contaminant levels (MCLs) in drinking water are discussed, as are all detections of organic COCs. COC source information is given where it is known from LLNL CERCLA studies.

Appendix A contains the ground water measurements made during 2003. Pit 1 data are in **Tables A-1** and **A-2**. Pit 7 data are in **Tables A-3** and **A-4**. Note that the **Appendix A** tables include some small negative values for radioactivity. These values are below the method detection limits and indicate that the radioactivity of the sample is close to zero. As required by the DOE (Order 241.1), our measurements are reported in *Système Internationale* (SI) units. The SI unit for radioactivity is the becquerel (Bq), equal to 1 nuclear disintegration per second. The more commonly used unit, picocurie (pCi), is equal to 1 nuclear disintegration per 27 seconds. As a convenience, MCLs for radioactivity in drinking water are given in both becquerels per liter (Bq/L) and picocuries per liter (pCi/L) in **Table 1**. Note that MCLs are provided for reference only, because this report does not involve wells used for potable domestic, livestock, or industrial water supply.

Table 1. MCLs for radioactivity in drinking water.

Radiological parameter	MCL (Bq/L)	MCL (pCi/L)
Gross alpha	0.555	15
Gross beta	1.85	50
Tritium	740	20,000
Radium (total)	0.185	5
Uranium (total)	0.74	20

Appendix B explains the methods we use to determine the statistical limit of concentration (SL) for a COC. Requirements for statistical treatment of ground water

data are established in the *California Code of Regulations* (CCR), Title 23, Division 3, Chapter 15, Section 2550.7. The statistical methods we use, prediction intervals (PI) and control charts (CC), are consistent with CCR requirements. If a routine quarterly COC measurement exceeds its SL and is confirmed by retesting, it is reported to the CVRWQCB as statistically significant evidence of a release.

Table B-1 lists the COCs that have exceeded SLs since Pits 1 and 7 were officially closed in February 1993. Under the Federal Facility Agreement, CERCLA Remedial Project Managers (RPMs) may direct LLNL to undertake further study of a COC that shows statistically significant evidence of a release to ground water. Additional studies covering the Pits 1 and 7 areas have been completed for barium, tritium, uranium, and vanadium (Taffet *et al.* 1996).

Appendix C describes any significant changes made to the monitoring program for Pits 1 and 7. No significant changes were made during 2003.

Appendix D discusses Quality Assurance (QA). **Table D-1** (Pit 1) and **Table D-2** (Pit 7) compare COC measurements of field blanks and duplicate samples of ground water obtained from randomly selected monitoring wells. Field blanks are prepared at a randomly selected well when the routine quarterly samples are obtained from that well.

Appendix E is a required annual supplement that contains graphs of COC concentrations measured during 2003. Historical data have been added to the graphs to reveal post-closure trends.

Summary of Analytical Results for 2003

We summarize analytical results for 2003 by quarter-year. We have previously submitted detailed reports for the first, second, and third quarters of 2003 (Christofferson and MacQueen 2003a, 2003b, 2003c). We discuss fourth-quarter results in more detail, including the COCs that exceeded SLs or MCLs. Analytical results for 2003 are listed in **Appendix A, Tables A-1 through A-4**.

First quarter. No evidence of a new release of COCs from Pit 1 or Pit 7 is indicated by the first quarter of 2003 measurements (Christofferson and MacQueen 2003a).

At Pit 1, as in the past, barium concentration and tritium activity exceeded their respective SLs, but they do not signify a releases from Pit 1. Barium has been increasing slowly in the sampled groundwater over a period of several years. The slow increase likely represents slowly changing background concentrations, rather than a release of barium from Pit 1. Previous CERCLA tritium investigations have characterized three coalescing plumes of tritium-bearing ground water that originate at Pits 3 and 5 and the Building 850 firing table (Webster-Scholten 1994, Taffet *et al.* 1996, Ziagos and Reber-

Cox 1998). The Building 850 tritium plume extends eastward to Pit 1 and likely accounts for the tritium activity above background (ca. 3.7 Bq/L) there.

At Pit 7, as in the past, barium, nickel, and zinc, which are linked to earlier potential releases, continued to exceed their respective SLs.

Second quarter. No evidence of a new release of COCs from Pit 1 or Pit 7 is indicated by the second-quarter measurements (Christofferson and MacQueen 2003b).

At Pit 1, barium and tritium, which are both linked to earlier potential releases, continued to exceed their respective SLs at Pit 1.

At Pit 7, nickel and total uranium, which are both linked to earlier potential releases, continued to exceed their respective SLs.

Third quarter. No evidence of a new release of COCs from Pit 1 or Pit 7 is indicated by the third-quarter measurements (Christofferson and MacQueen 2003c).

At Pit 1, barium and tritium, which are both linked to earlier potential releases, continued to exceed their respective SLs at Pit 1.

At Pit 7, barium, nickel, and total uranium, which are all linked to earlier potential releases, continued to exceed their respective SLs.

Fourth quarter. No evidence of a new release of COCs from Pit 1 or Pit 7 is indicated by the fourth-quarter measurements. The few COCs that were detected above their SLs are most likely from local natural or artificial sources other than Pit 1 and Pit 7.

At Pit 1, as in the past, barium concentration slightly exceeded the SL of 25 $\mu\text{g/L}$ in the ground water at well K1-03 (27 $\mu\text{g/L}$) (see **Table A-1**). (LLNL first reported similar statistical evidence for a release of barium from Pit 1 to the CVRWQCB by telephone on October 25, 2000.) A release of barium from Pit 1 is unlikely. A local increase in background barium concentration is a more likely explanation. The barium SLs for the Pit 1 wells range from 25 $\mu\text{g/L}$ to 51 $\mu\text{g/L}$. The fourth-quarter barium concentrations in the ground water at the other Pit 1 monitoring wells range from <25 $\mu\text{g/L}$ to 45 $\mu\text{g/L}$, reflecting background differences in barium concentration from well to well in this area (**Table A-1**). The Pit 1 ground water barium graphs (**pp. E-15 to E-18**) show slowly increasing (background) concentrations of barium in the Pit 1 area.

Low tritium activity exceeded SLs in ground water sampled at wells K1-04 (6.6 Bq/L), K1-08 (9.0 Bq/L), and K1-09 (5.1 Bq/L). The tritium activity results from a tritium plume that is slowly extending beneath Pit 1 from an upgradient source of tritium beneath the Building 850 (B850) firing table area (Taffet *et al.* 1996, Ziagos and Reber-Cox 1998). **Figure 6c** shows the approximate areal extent of the tritium plume (for the second quarter of 2002). The Pit 1 monitoring well tritium graphs (**pp. E-55 to E-58**) reveal the historical effects of this tritium plume on the ground water in the Pit 1 area.

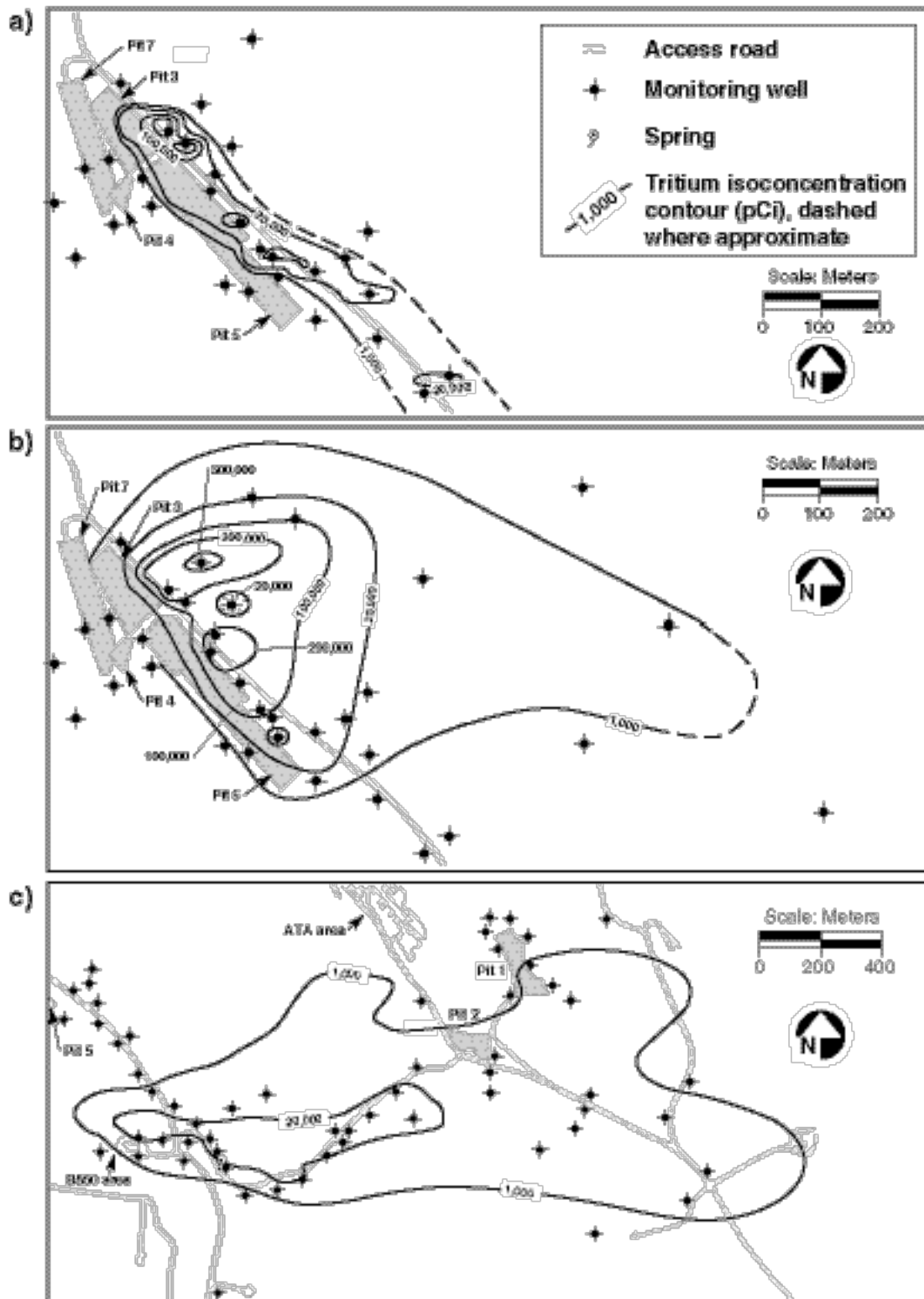


Figure 6. Distribution of tritium activity in ground water in a) Pit 7 Complex area alluvium and b) bedrock, and c) B850 area alluvium and bedrock (all 2nd quarter 2002).

Our annual measurements for VOCs in the ground water sampled at Pit 1 were made during the fourth quarter of 2003. As in the past, 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113), which has an MCL of 1200 $\mu\text{g/L}$, was detected in the ground water at Pit 1 monitoring wells K1-05 (13 $\mu\text{g/L}$), K1-08 (19 $\mu\text{g/L}$), and K1-09 (41 $\mu\text{g/L}$) (see **Table A-2**). This VOC is not from Pit 1. Rather, previous CERCLA investigations (Webster-Scholten 1994, Taffet *et al.* 1996) link the Freon 113 to past spills in the Advanced Test Accelerator (ATA) area (**Figure 6c**), which is cross-gradient to the affected monitoring wells. **Figure 7** shows the history of Freon 113 concentrations in the ground water sampled at wells K1-05, K1-08, and K1-09. The highest Freon 113 concentrations are found in ground water sampled at the well closest to the ATA area, well K1-09. The pattern of Freon 113 detections shown in **Figure 7** suggests that wells K1-05, K1-08, and K1-09 intercept the southern edge of a plume moving eastward from the ATA area.

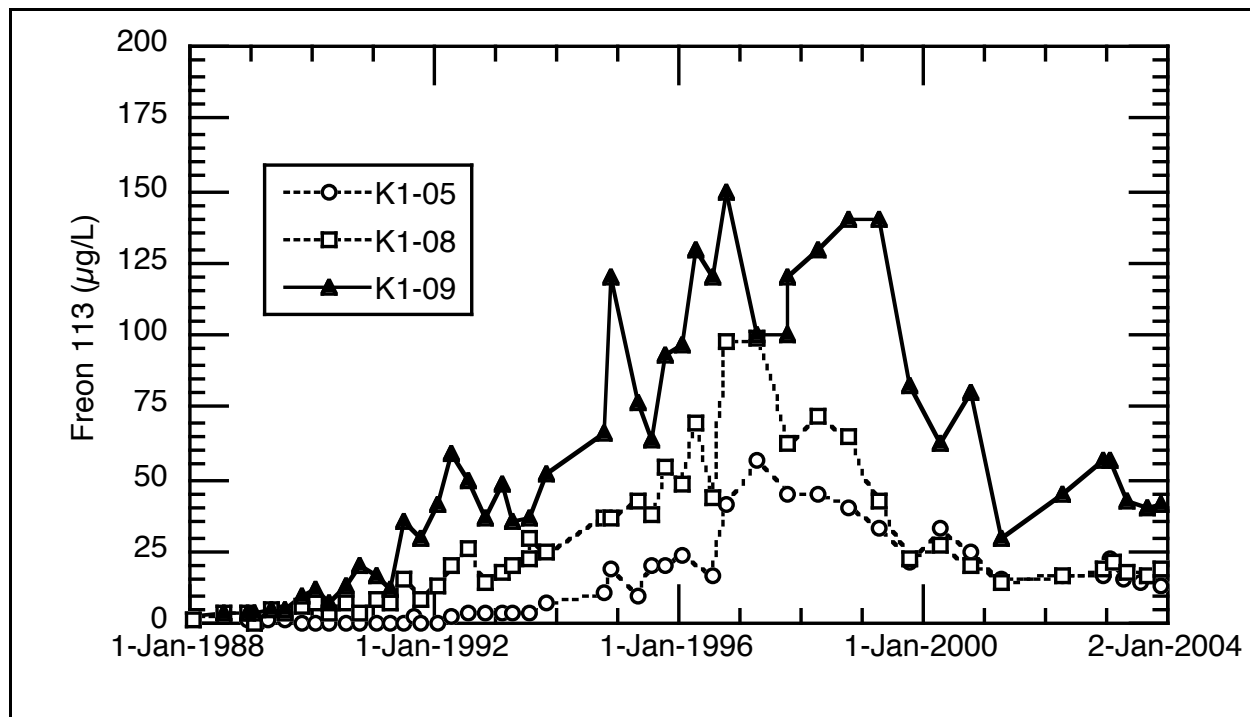


Figure 7. History of Freon 113 in ground water at Pit 1 wells K1-05, K1-08, and K1-09.

A single unexpected detection of TCE occurred in the routine ground water sample obtained from well K1-02B (0.6 $\mu\text{g/L}$) using EPA method 624, which we suspect to be a false positive result (see **Table A-2**). A duplicate ground water sample from well K1-02B that was analyzed separately for VOCs using EPA method 601 did not detect TCE above the reporting limit (RL) of 0.5 $\mu\text{g/L}$. The nondetection of TCE in the duplicate sample and the absence of any history of TCE detections in the ground water sampled at the Pit 1 monitoring wells leads us to believe that the routine fourth-quarter result for well K1-02B is faulty.

At Pit 7, the adjacent closed landfills known as Pit 3 and Pit 5, together with natural sources in the underlying rocks and sediments, are the primary sources of the COCs detected by the network of Pit 7 monitoring wells.

During the fourth quarter of 2003, zinc concentration was unexpectedly above its SL of 20 $\mu\text{g}/\text{L}$ in the ground water sampled at well K7-10 (23 $\mu\text{g}/\text{L}$) (see **Table A-3**). However, because monitoring well K7-10 is located cross-gradient from Pit 7, Pit 7 is an unlikely source. Note that we have previously reported relatively elevated zinc concentrations in the ground water at downgradient well K7-03 to be statistical evidence for a release of zinc from Pit 7 (Galles 1999) (see **Table B-1** for a list of release reports). The history of zinc concentrations in the ground water sampled at the Pit 7 monitoring wells is shown in the graphs on **pp. E-134 to E-138**.

As in the past, during the fourth quarter of 2003, total uranium activity was above SLs in the ground water sampled at Pit 7 monitoring wells K7-01 (0.78 Bq/L, SL = 0.64 Bq/L) and K7-03 (0.29 Bq/L, SL = 0.22 Bq/L) (see **Table A-3**). Previous CERCLA investigations that used a mass spectrometer to accurately measure the quantities of uranium isotopes present demonstrated that the uranium in the ground water at wells K7-01 and K7-03 was a mixture of depleted uranium that was released historically from Pits 3, 5, and 7, and natural uranium that likely originates from the surrounding rocks and sediments (Taffet *et al.* 1996). Note that we have previously reported relatively elevated total uranium activity in the ground water sampled at the Pit 7 monitoring wells to be statistical evidence for a release of uranium from Pit 7 (Galles 1998). The history of total uranium activities in the ground water sampled at the Pit 7 monitoring wells is shown in the graphs on **pp. E-149 to E-153**.

As in the past, the highest total uranium activity during the fourth quarter of 2003 was in the ground water sampled at well NC7-25 (1.24 Bq/L), which exceeds the MCL of 0.74 Bq/L for total uranium in drinking water (**Table 1**). Previous CERCLA investigations have demonstrated that the uranium in the ground water at well NC7-25 was natural uranium, most likely from natural sources in the surrounding rocks and sediments (Taffet *et al.* 1996). The ground water at well NC7-25 also exhibits relatively elevated gross alpha activity (0.64 Bq/L, **Table A-4**), which is above the gross alpha MCL of 0.56 Bq/L for drinking water, and most likely results from the decay of the natural uranium in the ground water there.

As in the past, tritium activity in the ground water at Pit 7 monitoring wells K7-01, K7-03, and NC7-25 remained above the MCL of 740 Bq/L throughout 2003 (see **Table A-3** and the Pit 7 monitoring well tritium activity graphs on **pp. E-144 to E-148**). Previous CERCLA investigations have linked the tritium activity in the ground water at monitoring wells K7-01, K7-03, and NC7-25 to slug releases of tritium from Pits 3 and 5 during the winter of 1992-93, and continuing during successive winters of 1994-95,

1995-96, 1996-97, and 1997-98, when these pits were partially inundated from beneath by rising ground water (Taffet *et al.* 1996, Ziagos and Reber-Cox 1998). **Figures 6a** and **6b** show the areal extent of the tritium released to ground water from Pits 3 and 5. The ground water immediately downgradient of Pit 7 at well NC7-48 continued to show very low tritium activity during 2003 (see **Table A-3**). Our tritium activity measurements of ground water at well NC7-48 indicate that tritium has not been released from Pit 7 to ground water since well NC7-48 was completed in 1986 (see the supporting tritium activity graph for well NC7-48 on **p. E-148**).

CERCLA modeling studies indicate that, given tritium's short half-life of 12.3 years, the relatively slow rate of ground water flow (5-40 m/yr), and the long flow path to the Site 300 boundary, tritium activity in ground water shown in **Figures 6a**, **6b**, and **6c** will decrease to several orders of magnitude below the MCL before it can travel off site (Taffet *et al.* 1996).

As in the past, two VOCs were detected during 2003. TCE was detected in the ground water at Pit 7 wells K7-01 and K7-03 at concentrations that ranged from <0.5 $\mu\text{g}/\text{L}$ to 2.8 $\mu\text{g}/\text{L}$, below the MCL of 5.0 $\mu\text{g}/\text{L}$ for TCE. The TCE is associated with historical releases from Pit 5, not Pit 7 (Webster-Scholten 1994, Taffet *et al.* 1996). 1,1-DCE was detected at low concentrations that ranged from 0.6 $\mu\text{g}/\text{L}$ to 1.0 $\mu\text{g}/\text{L}$ during 2003 in the ground water at Pit 7 monitoring well K7-03. The MCL for 1,1-DCE is 6.0 $\mu\text{g}/\text{L}$. No release of VOCs to ground water from Pit 7 during 2003 is indicated, primarily because none was detected in the ground water at the downgradient well nearest to Pit 7, well NC7-48 (see **Table A-4**).

Inspection and Maintenance Summary for 2003

First quarter. The routine first-quarter inspection of Pits 1 and 7 was conducted by LLNL technical staff on 24 February 2003. Conditions at both of the closed landfills were reported to be satisfactory. No significant erosion of the pit caps was observed and the vegetative cover was in good condition. The surface water diversion channels were clear of debris. The monitoring wells were in good working condition.

Second quarter. The routine second-quarter inspection of Pits 1 and 7 was conducted by LLNL technical staff on May 29, 2003. Conditions at both of the closed landfills were reported to be satisfactory. No significant erosion of the pit caps was observed and the vegetative cover was in good condition. The surface water diversion channels were clear of debris. The monitoring wells were in good working condition.

Third quarter. The annual inspection of Pits 1 and 7 was conducted on 25 September 2003 by an independent, state-registered Professional Engineer (PE). A copy of the PE's complete report is contained in our third-quarter report for 2003 (Christofferson and MacQueen 2003c). The PE reported that the caps on the two pits are

fully intact, the vegetative covers on the pits are in fair to good condition, the drainage systems appear to be functioning properly, and the monitoring wells generally appear to be in good condition. The PE noted some minor deficiencies and recommended corrective maintenance, including compacting soil, removing sediment and vegetation from drainage channels, and hydroseeding several areas of sparse vegetation on the pit covers. LLNL completed the necessary maintenance during the first quarter of 2004.

In September 2003, LLNL surveyors measured the elevations of numerous fixed markers that had been installed in 1995 on the Pit 1 and Pit 7 landfill covers. A comparison of the current marker elevations with their baseline elevations established in 1995 shows changes in elevations that range from plus 0.07 ft to minus 0.01 ft for Pit 1 and from plus 0.01 ft to minus 0.22 ft for Pit 7. It is unlikely that these small elevation changes occurring over the eight year period have adversely affected the integrity of the pit caps.

LLNL technical staff inspected Pits 1 and 7 on 11 August 2003. Conditions at both closed landfills were reported to be satisfactory.

Fourth quarter. The routine fourth-quarter inspection of Pits 1 and 7 was conducted by LLNL staff on 17 November 2003. No significant erosion or settlement of the pit caps was observed. The caps were in good physical condition. The vegetative cover was in good condition. The monitoring wells were in good working condition. The surface water diversion channels were clear of debris.

References

- California Code of Regulations*, Title 23, Division 3, Chapter 15, Section 2550.7.
- Central Valley Regional Water Quality Control Board (1993), *Order No. 93-100, Waste Discharge Requirements for University of California Lawrence Livermore National Laboratory Site 300 and U.S. Department of Energy, Landfill Pits 1 and 7, San Joaquin County* (June 25, 1993).
- Central Valley Regional Water Quality Control Board (1998), *Revised Monitoring and Reporting Programs No. 93-100 and 96-248, Lawrence Livermore National Laboratory Site 300, San Joaquin County* (September 25, 1998).
- Christofferson, E., and D. H. MacQueen (2003a), *LLNL Experimental Test Site 300 Compliance Monitoring Program for RCRA-Closed Landfill Pits 1 and 7, First Quarter Report, January-March 2003*, Lawrence Livermore National Laboratory, Livermore, CA (UCAR-10191-03-1).
- Christofferson, E., and D. H. MacQueen (2003b), *LLNL Experimental Test Site 300 Compliance Monitoring Program for RCRA-Closed Landfill Pits 1 and 7, Second Quarter Report, April-June 2003*, Lawrence Livermore National Laboratory, Livermore, CA (UCAR-10191-03-2).
- Christofferson, E., and D. H. MacQueen (2003c), *LLNL Experimental Test Site 300 Compliance Monitoring Program for RCRA-Closed Landfill Pits 1 and 7, Third Quarter Report, July-September 2003*, Lawrence Livermore National Laboratory, Livermore, CA (UCAR-10191-03-3).
- Dibley, V., and R. Depue (2002), *LLNL Livermore Site and Site 300 Environmental Restoration Project Standard Operating Procedures (SOPs)*, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-MA-109115 Rev. 9), February 2002.
- Galles, H. L., to S. Timm (1998), *Letter RE: Statistically Significant Evidence for a Release of Uranium From Lawrence Livermore National Laboratory Experimental Test Site (Site 300) Pit 7* (WGMG98-306, November 10, 1998).
- Galles, H. L., to S. Timm (1999), *Letter RE: Statistically Significant Evidence for a Release of Zinc From Lawrence Livermore National Laboratory Experimental Test Site (Site 300) Pit 7* (WGMG99-077, April 19, 1999).
- Merrigan, J. (2001), *Environmental Protection Department Quality Assurance Management Plan*, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-AR-146357, Rev. 4), November 2001.
- Rogers/Pacific Corporation (1990), *Lawrence Livermore National Laboratory Site 300 Resource Conservation and Recovery Act Closure and Post-Closure Plans, Landfill Pits 1 and 7, Volumes I and II*, Lawrence Livermore National Laboratory, Livermore, CA (Cal EPA No. CA2890090002).
- Taffet, M. J., L. K. Green-Horner, L. C. Hall, T. M. Carlsen, and J. A. Oberdorfer (1996), *Addendum to the Site-Wide Remedial Investigation Report, Lawrence Livermore National Laboratory Site 300: Building 850/Pit 7 Complex Operable Unit*, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-AR-108131 Add. 1).
- Tate, P., et al. (1999), *Environmental Monitoring Plan*, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-ID-106132 Rev. 2).
- U. S. Department of Energy (1998), *Scientific and Technical Information Management* (Order 241.1).
- Webster-Scholten, C. P. (Ed.) (1994), *Final Site-Wide Remedial Investigation Report, Lawrence Livermore National Laboratory Site 300*, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-AR-108131).

References (continued)

Ziagos, J. P., and E. Reber-Cox, to M. Piros, K. Setian, and S. Timm (1998), Letter RE: *Submittal of the Ground Water Tritium Plume Characterization Summary Report for the Building 850/Pits 3 and 5 Operable Unit, Lawrence Livermore National Laboratory Site 300* (10-98ERD/Tritium Plume Char. Summ.rtd, October 30, 1998).

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List of Abbreviations and Acronyms

ATA	Advanced Test Accelerator
1,1-DCE	1,1-dichloroethene
B850	Building 850 and its associated firing table area
Bq	becquerel (SI unit of radioactivity)
Cal EPA	California Environmental Protection Agency
CC	control chart (statistical method)
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	constituent of concern
CVRWQCB	Central Valley Regional Water Quality Control Board
DOE	U.S. Department of Energy
DTSC	Department of Toxic Substances Control (California)
EPA	U.S. Environmental Protection Agency
EPD	Environmental Protection Department (LLNL)
ft	foot
Freon 113	1,1,2-trichloro-1,2,2-trifluoroethane
GWE	ground water elevation (in feet above MSL)
km	kilometer
L	liter
LLNL	Lawrence Livermore National Laboratory
m	meter
MCL	maximum contaminant level (for drinking water)
mg	milligram
MSL	mean sea level (datum for elevation measurements)
m/yr	velocity in meters per year
μg	microgram
nd	no detections above reporting limits
nd (exc)	no detections, except as listed
pCi	picocurie (unit of radioactivity equal to 0.037 Bq)
PCP	post-closure plan
PE	Professional Engineer
PI	prediction interval (statistical method)
QA	quality assurance
RCRA	Resource Conservation and Recovery Act
RL	reporting limit (contractual concentration near zero)
RPM	Remedial Program Manager
SI	<i>Système Internationale</i> (units of measurement)
Site 300	Experimental Test Site, LLNL
SL	statistically determined concentration limit
SOP	standard operating procedure
TCE	trichloroethene
Tmss	Cierbo Formation
Tnbs ₁	Neroly Formation lower blue sandstone unit
VOC	volatile organic compound
WDR	Waste Discharge Requirements (permit)

Appendix A

Tables of Ground Water Measurements for 2003

Table A-1. Pit 1 COCs, monitoring wells, SLs, and quarterly analytical results for year 2003.

Quarter >			1	2	3	4
COC (units)	Well	SL	Result	Result	Result	Result
Arsenic ($\mu\text{g/L}$)	K1-01C	- ^(a)	11	11	14	11
	K1-07	- ^(a)	13	12	13	15
	K1-02B	20	12	11	13	12
	K1-03	19	12	12	13	14
	K1-04	19	11	10	12	10
	K1-05	24	13	13	15	14
	K1-08	21	13	12	15	15
	K1-09	19	12	12	16	13
Barium ($\mu\text{g/L}$)	K1-01C	-	< 25	< 25	< 25	< 25
	K1-07	-	27	26	26	28
	K1-02B	25	< 25	< 25	< 25	< 25
	K1-03	25	28	27	28	27
	K1-04	32	27	27	27	28
	K1-05	41	36	38	39	38
	K1-08	51	39	41	42	40
	K1-09	46	42	43	45	45
Beryllium ($\mu\text{g/L}$)	K1-01C	-	< 0.5	< 0.5	< 0.5	< 0.5
	K1-07	-	< 0.5	< 0.5	< 0.5	< 0.5
	K1-02B	0.5	< 0.5	< 0.5	< 0.5	< 0.5
	K1-03	0.5	< 0.5	< 0.5	< 0.5	< 0.5
	K1-04	0.5	< 0.5	< 0.5	< 0.5	< 0.5
	K1-05	0.5	< 0.5	< 0.5	< 0.5	< 0.5
	K1-08	0.5	< 0.5	< 0.5	< 0.5	< 0.5
	K1-09	0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cadmium ($\mu\text{g/L}$)	K1-01C	-	< 0.5	< 0.5	< 0.5	< 0.5
	K1-07	-	< 0.5	< 0.5	< 0.5	< 0.5
	K1-02B	0.5	< 0.5	< 0.5	< 0.5	< 0.5
	K1-03	0.5	< 0.5	< 0.5	< 0.5	< 0.5
	K1-04	0.5	< 0.5	< 0.5	< 0.5	< 0.5
	K1-05	0.5	< 0.5	< 0.5	< 0.5	< 0.5
	K1-08	0.5	< 0.5	< 0.5	< 0.5	< 0.5
	K1-09	0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cobalt ($\mu\text{g/L}$)	K1-01C	-	< 25	< 25	< 25	< 25
	K1-07	-	< 25	< 25	< 25	< 25
	K1-02B	25	< 25	< 25	< 25	< 25
	K1-03	25	< 25	< 25	< 25	< 25
	K1-04	25	< 25	< 25	< 25	< 25
	K1-05	25	< 25	< 25	< 25	< 25
	K1-08	25	< 25	< 25	< 25	< 25
	K1-09	25	< 25	< 25	< 25	< 25
Copper ($\mu\text{g/L}$)	K1-01C	-	20	20	13	13
	K1-07	-	< 10	< 10	< 10	< 10
	K1-02B	34	< 10	10	12	29
	K1-03	34	< 10	< 10	< 10	< 10
	K1-04	34	< 10	< 10	< 10	< 10
	K1-05	34	< 10	< 10	< 10	31
	K1-08	34	< 10	< 10	< 10	< 10
	K1-09	34	< 10	< 10	< 10	< 10

Continued

Table A-1. Pit 1 COCs, monitoring wells, SLs, and quarterly analytical results for year 2003.

Quarter >			1	2	3	4
COC (units)	Well	SL	Result	Result	Result	Result
Lead ($\mu\text{g/L}$)	K1-01C	-	< 2	< 2	< 2	< 2
	K1-07	-	< 2	< 2	< 2	< 2
	K1-02B	2	< 2	< 2	< 2	< 2
	K1-03	2	< 2	< 2	< 2	< 2
	K1-04	2	< 2	< 2	< 2	< 2
	K1-05	2	< 2	< 2	< 2	< 2
	K1-08	2	< 2	< 2	< 2	< 2
	K1-09	2	< 2	< 2	< 2	< 2
Nickel ($\mu\text{g/L}$)	K1-01C	-	< 5	< 5	< 5	< 5
	K1-07	-	< 5	< 5	9	< 5
	K1-02B	12	< 5	< 5	< 5	< 5
	K1-03	12	< 5	< 5	< 5	< 5
	K1-04	12	< 5	< 5	< 5	< 5
	K1-05	12	< 5	< 5	5.4	< 5
	K1-08	12	< 5	< 5	< 5	< 5
	K1-09	12	< 5	< 5	< 5	< 5
Vanadium ($\mu\text{g/L}$)	K1-01C	-	68	71	73	67
	K1-07	-	73	74	73	74
	K1-02B	78	51	54	56	50
	K1-03	72	49	51	60	47
	K1-04	48	38	37	47	35
	K1-05	97	69	71	82	70
	K1-08	100	70	73	72	69
	K1-09	92	61	63	66	62
Zinc ($\mu\text{g/L}$)	K1-01C	-	30	30	< 20	22
	K1-07	-	< 20	< 20	< 20	< 20
	K1-02B	94	< 20	< 20	< 20	45
	K1-03	94	40	< 20	< 20	< 20
	K1-04	94	< 20	< 20	< 20	< 20
	K1-05	94	< 20	< 20	< 20	< 20
	K1-08	94	< 20	< 20	< 20	< 20
	K1-09	94	< 20	< 20	< 20	< 20
Radium 226 (Bq/L)	K1-01C	-	- 0.001 ^(b)	0.003	0.004	0.013
	K1-07	-	0.002	0.006	0.004	0.009
	K1-02B	0.044	0.007	0.000	0.004	0.004
	K1-03	0.044	0.004	0.002	0.007	0.001
	K1-04	0.044	- 0.005	0.003	- 0.001	0.003
	K1-05	0.044	0.001	0.005	0.005	0.004
	K1-08	0.044	0.004	0.000	0.000	0.006
	K1-09	0.044	- 0.003	0.000	0.003	0.004
Tritium (Bq/L)	K1-01C	-	14	16	20	24
	K1-07	-	- 1.7	- 1.4	- 1.7	1.6
	K1-02B	- ^(c)	152	148	150	151
	K1-03	23	22	19	25	23
	K1-04	3.7	4.7	2.2	5.0	6.6
	K1-05	3.7	- 3.2	2.0	7.2	3.7
	K1-08	3.7	5.7	3.1	8.4	9.0
	K1-09	4.4	2.5	1.0	3.6	5.1

Continued

Table A-1. Pit 1 COCs, monitoring wells, SLs, and quarterly analytical results for year 2003.

Quarter >			1	2	3	4
COC (units)	Well	SL	Result	Result	Result	Result
Uranium (total, Bq/L)	K1-01C	-	0.099	0.099	0.127	0.106
	K1-07	-	0.068	0.088	0.088	0.077
	K1-02B	0.192	0.082	0.090	0.106	0.108
	K1-03	0.145	0.050	0.047	0.059	0.060
	K1-04	0.124	0.028	0.049	0.061	0.060
	K1-05	0.109	0.051	0.069	0.087	0.090
	K1-08	0.120	0.080	0.087	0.097	0.101
	K1-09	0.109	0.067	0.083	0.075	0.085
Thorium 228 (Bq/L)	K1-01C	-	0.000	0.000	0.000	0.000
	K1-07	-	0.002	0.000	0.001	0.000
	K1-02B	0.023	0.001	0.002	0.001	0.001
	K1-03	0.023	0.003	0.000	0.000	0.000
	K1-04	0.023	0.000	0.000	0.001	0.001
	K1-05	0.023	0.001	0.000	0.000	0.002
	K1-08	0.023	0.001	0.001	0.001	0.000
	K1-09	0.023	0.000	0.000	0.001	0.000
Thorium 232 (Bq/L)	K1-01C	-	0.000	0.000	0.000	0.000
	K1-07	-	0.000	0.000	0.000	0.000
	K1-02B	0.009	0.000	0.000	0.000	0.000
	K1-03	0.009	0.000	0.000	0.000	0.000
	K1-04	0.009	0.000	0.000	0.001	0.000
	K1-05	0.009	0.000	0.000	0.000	- 0.001
	K1-08	0.009	0.000	0.000	0.000	0.000
	K1-09	0.009	0.000	0.000	0.000	0.000
HMX ($\mu\text{g/L}$)	K1-01C	-	< 5	< 1	< 5	< 5
	K1-07	-	< 5	< 1	< 1	< 5
	K1-02B	5	< 5	< 1	< 5	< 5
	K1-03	5	< 5	< 1	< 5	< 5
	K1-04	5	< 1	< 2	< 5	< 5
	K1-05	5	< 1	< 2	< 5	< 5
	K1-08	5	< 1	< 1	< 5	< 5
	K1-09	5	< 5	< 1	< 5	< 5
RDX ($\mu\text{g/L}$)	K1-01C	-	< 5	< 1	< 5	< 5
	K1-07	-	< 5	< 1	< 1	< 5
	K1-02B	5	< 5	< 1	< 5	< 5
	K1-03	5	< 5	< 1	< 5	< 5
	K1-04	5	< 1	< 2	< 5	< 5
	K1-05	5	< 1	< 2	< 5	< 5
	K1-08	5	< 1	< 1	< 5	< 5
	K1-09	5	< 5	< 1	< 5	< 5

(a) Wells K1-01C and K1-07 have no release detection SLs for COCs, because they are upgradient of Pit 1.

(b) Radioactivity measurements are corrected for the background radioactivity inside the measurement chamber.

A negative result for radioactivity indicates that the sample measured less than the background by the amount shown.

Radioactivity values shown as 0.000 measured less than 0.0005 Bq/L.

(c) K1-02B is an exempt well (deemed to be insensitive to the detection of a tritium release from Pit 1).

Concluded

Table A-2. Pit 1 additional post-closure plan constituents, quarter sampled, monitoring wells, and analytical results for year 2003.

Constituent (units)	Quarter	Monitoring well							
		K1-01C	K1-07	K1-02B	K1-03	K1-04	K1-05	K1-08	K1-09
pH (pH units)	2	7.42	7.49	7.33	7.28	7.28	7.29	7.49	7.48
	4	7.48	7.61	7.39	7.53	7.64	7.59	7.74	7.64
Specific conductance (μ mhos/cm)	2	620	584	630	550	530	560	618	614
	4	663	595	691	613	571	604	626	611
Depth to water (ft)	2	99.5	135.0	128.2	130.9	150.3	166.0	149.2	156.2
	4	100.3	136.8	129.1	131.9	151.1	166.7	150.3	157.1
Ground water elevation (ft)	2	981.7	974.7	979.1	977.1	972.3	964.9	973.5	970.5
	4	980.9	972.8	978.1	976.1	971.6	964.2	972.4	969.6
Temperature ($^{\circ}$ C)	2	21.8	21.9	21.1	20.7	21.7	21.5	22.2	22.0
	4	20.8	20.3	19.9	20.4	20.3	21.1	18.6	17.4
Chromium (μ g/L)	2	1.0	1.0	1.0	<1.0	1.0	2.0	1.0	1.0
	4	<1	<1	<1	<1	<1	3	<1	<1
Iron (mg/L)	2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	4	<0.5	<0.1	<0.05	0.06	<0.1	<0.1	<0.1	<0.1
Manganese (mg/L)	2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Manganese (μ g/L)	4	<1	<0.1	<1	3.2	<100	<100	<0.1	<100
Mercury (μ g/L)	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Selenium (μ g/L)	2	<5	<5	<5	<5	<5	<5	<5	<5
	4	2.4	<2	2.6	2.4	3.1	<2	<2	<2
Silver (μ g/L)	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	4	<1	<0.5	<1	<1	<0.5	<0.5	<0.5	<0.5
Sodium (mg/L)	2	38	42	41	36	38	44	44	44
	4	37	41	43	37	35	42	44	41
Gross alpha (Bq/L)	2	0.04	0.05	0.07	0.02	0.02	0.06	0.04	0.04
	4	0.03	0.04	0.05	0.06	0.02	0.03	0.04	0.03
Gross beta (Bq/L)	2	0.16	0.12	0.13	0.11	0.13	0.15	0.07	0.12
	4	0.13	0.13	0.13	0.15	0.14	0.14	0.15	0.16
VOCs (EPA 624,8260)	4	0 of 44	0 of 44	1 of 44	1 of 44	0 of 44	1 of 44	0 of 44	1 of 44
Freon 113 (μ g/L)	4	<0.5	<0.5	<0.5	<0.5	<0.5	13	19	41
TCE	4	<0.5	<0.5	0.6	0.5	<0.5	<0.5	<0.5	<0.5
PCBs (EPA 608)	4	0 of 7	0 of 7	0 of 7	0 of 7	0 of 7	0 of 7	0 of 7	0 of 7
Semi-VOCs (EPA 625)	4	0 of 86	0 of 86	0 of 86	0 of 86	0 of 86	0 of 86	0 of 86	0 of 86
Pesticides (EPA 608)	4	0 of 19	0 of 19	0 of 19	0 of 19	0 of 19	0 of 19	0 of 19	0 of 19
TOC (mg/L,EPA 9060)	4	1.8	5.6	2.5	2.1	3.5	<1	<1	1.2
TOX (μ g/L,SW9020B)	4	<20	<20	<20	20	<20	<20	<20	31
Nitrate (mg/L) ^(a)	2	35	37	37	35	30	35	40	43
	3	36	29	34	32	34	38	38	38
	4	38	30	36	32	36	39	38	39
	2	<4	<4	<4	<4	<4	<4	<4	<4
Perchlorate (μ g/L) ^(a)	3	<4	<4	6.5	<4	<4	<4	<4	<4
	4	<4	<4	6.7	<4	<4	<4	<4	<4

(a) Nitrate and perchlorate are objects of continuing LLNL CERCLA investigations and are voluntarily reported.

Table A-3. Pit 7 COCs, monitoring wells, SLs, and quarterly analytical results for year 2003.

Quarter >			1	2	3	4
COC (units)	Well	SL	Result	Result	Result	Result
Arsenic ($\mu\text{g/L}$)	K7-06	— ^(a)	19	17	21	20
	K7-01	14	9	7	11	10
	K7-03	3.2	2	< 2	< 2	2.9
	K7-09	2	< 2	< 2	< 2	< 2
	K7-10	4.2	3	2	7.6, 3.8, 2.9	2.2
	NC7-25	8.6	5	5	7.0	5.9
	NC7-26	3.6	< 2	< 2	2.4	2.5
	NC7-47	17	11	11	13	12
	NC7-48	19	7	6	8	10
Barium ($\mu\text{g/L}$)	K7-06	—	87	83	88	87
	K7-01	230	200	200	210	210
	K7-03	85	73	85	86	85
	K7-09	25	< 25	29	< 25	25
	K7-10	120	120	59	46	44
	NC7-25	140	77	82	84	79
	NC7-26	39	27	26	26	27
	NC7-47	63	59	61	63	61
	NC7-48	400	130	150	140	150
Beryllium ($\mu\text{g/L}$)	K7-06	—	< 0.5	< 0.5	< 0.2	< 0.5
	K7-01	0.5	< 0.5	< 0.5	< 0.5	< 0.5
	K7-03	0.5	< 0.5	< 0.5	< 0.5	< 0.5
	K7-09	0.5	< 0.5	< 0.5	< 0.5	< 0.5
	K7-10	0.5	< 0.5	< 0.5	< 0.2	< 0.5
	NC7-25	0.5	< 0.5	< 0.5	< 0.2	< 0.5
	NC7-26	0.5	< 0.5	< 0.5	< 0.5	< 0.5
	NC7-47	0.5	< 0.5	< 2.5	< 0.2	< 0.5
	NC7-48	0.5	< 0.5	< 0.5	< 0.2	< 0.5
Cadmium ($\mu\text{g/L}$)	K7-06	—	< 0.5	< 0.5	< 0.5	< 0.5
	K7-01	0.5	< 0.5	< 0.5	< 0.5	< 0.5
	K7-03	0.5	< 0.5	< 0.5	< 0.5	< 0.5
	K7-09	0.5	< 0.5	< 0.5	< 0.5	< 0.9
	K7-10	1.6	< 0.5	< 0.5	< 0.5	< 0.5
	NC7-25	0.6	< 0.5	< 0.5	< 0.5	< 0.5
	NC7-26	0.5	< 0.5	< 0.5	< 0.5	< 0.5
	NC7-47	0.5	< 0.5	< 0.5	< 0.5	< 0.5
	NC7-48	1.2	< 0.5	< 0.5	< 0.5	< 0.5
Cobalt ($\mu\text{g/L}$)	K7-06	—	< 25	< 25	< 1	< 25
	K7-01	25	< 25	< 25	< 25	< 25
	K7-03	25	< 25	< 25	< 25	< 25
	K7-09	25	< 25	< 25	< 25	< 25
	K7-10	25	< 25	< 25	< 1	< 25
	NC7-25	25	< 25	< 25	< 1	< 25
	NC7-26	25	< 25	< 25	< 25	< 25
	NC7-47	25	< 25	< 25	< 1	< 25
	NC7-48	25	< 25	< 25	< 1	< 25

Continued

Table A-3. Pit 7 COCs, monitoring wells, SLs, and quarterly analytical results for year 2003.

Quarter >			1	2	3	4
COC (units)	Well	SL	Result	Result	Result	Result
Copper ($\mu\text{g/L}$)	K7-06	—	< 10	< 10	6.8	< 10
	K7-01	40	< 10	20	< 10	24
	K7-03	140	20	20	23	18
	K7-09	10	20, <10, <10	< 10	< 10	< 10
	K7-10	10	< 10	< 10	< 2	< 10
	NC7-25	10	< 10	< 10	< 2	< 10
	NC7-26	10	< 10	< 10	< 10	< 10
	NC7-47	10	< 10	< 10	2.1	< 10
	NC7-48	10	< 10	< 10	< 2	< 10
Lead ($\mu\text{g/L}$)	K7-06	—	< 2	< 2	< 1	< 2
	K7-01	6	< 2	< 2	< 2	< 2
	K7-03	6.1	< 2	< 2	< 2	< 2
	K7-09	5.9	3	< 2	< 2	< 2
	K7-10	2	< 2	< 2	< 1	< 2
	NC7-25	2	< 2	< 2	< 1	< 2
	NC7-26	5.1	< 2	< 2	< 2	< 2
	NC7-47	7.6	< 2	< 2	< 1	< 2
	NC7-48	2	< 2	< 2	< 1	< 2
Nickel ($\mu\text{g/L}$)	K7-06	—	< 5	< 5	< 2	< 5
	K7-01	25	< 5	< 5	< 5	< 5
	K7-03	26	33	35	40	26
	K7-09	29	< 5	< 5	< 5	< 5
	K7-10	13	< 5	< 5	4.8	< 5
	NC7-25	13	< 5	< 5	2.2	< 5
	NC7-26	5	< 5	< 5	< 5	< 5
	NC7-47	14	< 5	< 5	< 2	< 5
	NC7-48	48	< 5	< 5	2.8	< 5
Vanadium ($\mu\text{g/L}$)	K7-06	—	47	45	43	42
	K7-01	25	< 25	< 25	< 25	< 25
	K7-03	25	< 25	< 25	< 25	< 25
	K7-09	25	< 25	< 25	< 25	< 25
	K7-10	25	< 25	< 25	3.8	< 25
	NC7-25	25	< 25	< 25	22	< 25
	NC7-26	25	< 25	< 25	< 25	< 25
	NC7-47	79	65	67	66	69
	NC7-48	110	< 25	< 25	23	< 20
Zinc ($\mu\text{g/L}$)	K7-06	—	< 20	< 20	8.0	< 20
	K7-01	52	< 20	< 20	< 20	25
	K7-03	72	30	60	43	26
	K7-09	20	< 20	< 20	< 20	< 20
	K7-10	20	< 20	< 20	14	23
	NC7-25	36	< 20	< 20	9.1	< 20
	NC7-26	20	< 20	< 20	< 20	< 20
	NC7-47	50	< 20	< 20	11	< 20
	NC7-48	44	< 20	< 20	8.1	< 20

Continued

Table A-3. Pit 7 COCs, monitoring wells, SLs, and quarterly analytical results for year 2003.

Quarter >			1	2	3	4
COC (units)	Well	SL	Result	Result	Result	Result
HMX ($\mu\text{g/L}$)	K7-06	—	< 1	< 1	< 5	< 5
	K7-01	5	< 1	< 1	< 5	< 5
	K7-03	5	< 1	< 1	< 5	< 5
	K7-09	5	< 1	< 1	< 5	< 5
	K7-10	5	< 1	< 1	< 5	< 5
	NC7-25	5	< 1	< 1	< 5	< 5
	NC7-26	5	< 1	< 1	< 5	< 5
	NC7-47	5	< 1	< 1	< 5	< 5
	NC7-48	5	< 1	< 1	< 5	< 5
RDX ($\mu\text{g/L}$)	K7-06	—	< 1	< 1	< 5	< 5
	K7-01	5	< 1	< 1	< 5	< 5
	K7-03	5	< 1	< 1	< 5	< 5
	K7-09	5	< 1	< 1	< 5	< 5
	K7-10	5	< 1	< 1	< 5	< 5
	NC7-25	5	< 1	< 1	< 5	< 5
	NC7-26	5	< 1	< 1	< 5	< 5
	NC7-47	5	< 1	< 1	< 5	< 5
	NC7-48	5	< 1	< 1	< 5	< 5
Tritium (Bq/L)	K7-06	—	2.7	0.9	2.51	— 0.6
	K7-01	— ^(b)	2490	2460	2450	2360
	K7-03	— ^(b)	4660	4480	4590	3960
	K7-09	4.7	0.7	— 2.8	0.2	— 1.3
	K7-10	4.7	0.2	— 0.6	— 0.5	— 0.4
	NC7-25	— ^(b)	17400	16700	16200	15900
	NC7-26	— ^(b)	111	117	112	107
	NC7-47	4.7	— 1.85 ^(c)	— 2.1	3.0	0.3
	NC7-48	16.4	0.5	3.0	2.3	1.9
Radium 226 (Bq/L)	K7-06	—	0.004	0.018	0.014	0.015
	K7-01	0.080	0.012	0.052	0.043	0.031
	K7-03	0.030	0.002	0.006	0.005	0.008
	K7-09	0.023	0.005	0.008	0.005	0.008
	K7-10	0.032	0.009	0.007	0.004	0.006
	NC7-25	0.054	0.023	0.000	0.026	0.016
	NC7-26	0.034	0.005	0.006	0.005	0.010
	NC7-47	0.022	0.008	0.001	— 0.004	0.004
	NC7-48	0.040	0.004	0.011	0.010	0.016
Thorium 232 (Bq/L)	K7-06	—	0.000	0.001	0.000	0.000
	K7-01	0.014	0.000	0.000	0.000	0.000
	K7-03	0.014	0.000	0.001	0.000	0.000
	K7-09	0.014	0.000	0.000	0.000	0.000
	K7-10	0.014	0.000	0.000	0.000	0.000
	NC7-25	0.014	0.000	0.000	0.000	0.000
	NC7-26	0.014	0.001	0.000	0.000	— 0.001
	NC7-47	0.014	0.001	0.000	0.000	0.000
	NC7-48	0.014	0.001	0.000	0.000	0.000

Continued

Table A-3. Pit 7 COCs, monitoring wells, SLs, and quarterly analytical results for year 2003.

Quarter >			1	2	3	4
COC (units)	Well	SL	Result	Result	Result	Result
Thorium 228 (Bq/L)	K7-06	—	0.000	0.000	0.000	0.002
	K7-01	0.024	0.004	0.002	0.001	0.001
	K7-03	0.024	0.000	0.000	0.001	0.001
	K7-09	0.024	– 0.001	0.000	0.000	0.000
	K7-10	0.024	0.000	0.000	0.000	0.001
	NC7-25	0.024	0.001	0.000	0.000	0.002
	NC7-26	0.024	– 0.001	0.001	0.001	0.000
	NC7-47	0.024	– 0.002	0.001	0.001	0.002
	NC7-48	0.024	– 0.003	0.001	0.000	0.003
Uranium (total, Bq/L)	K7-06	—	0.021	0.034	0.032	0.036
	K7-01	0.636	0.691	0.758	0.738	0.779
	K7-03	0.224	0.153	0.232	0.273	0.287
	K7-09	0.035	0.000	0.002	0.009	0.007
	K7-10	0.083	0.013	0.011	0.062	0.014
	NC7-25	1.262	1.101	1.320	1.261	1.241
	NC7-26	0.034	0.009	0.008	0.009	0.010
	NC7-47	0.178	0.063	0.067	0.064	0.074
	NC7-48	2.327	0.526	0.500	0.356	0.354

(a) Well K7-06 has no SLs for COCs, because it is upgradient from Pit 7.

(b) Exempt well (insensitive to further detection of tritium releases).

(c) Radioactivity measurements are corrected for the background radioactivity inside the measurement chamber.

A negative result for radioactivity indicates that the sample measured less than the background by the amount shown.

Radioactivity values shown as 0.000 are less than 0.0005 Bq/L.

Concluded

Table A-4. Pit 7 additional post-closure plan constituents, monitoring wells, and quarterly analytical results for year 2003.

Constituent (units)	Monitoring well									
		K7-06 ^(a)	K7-01	K7-03	K7-09	K7-10	NC7-25	NC7-26	NC7-47	NC7-48
Depth to water (ft)	1	25.9	20.8	27.7	47.9	34.3	66.9	71.5	62.8	45.0
	2	26.1	20.8	29.2	48.6	35.9	67.1	71.6	62.8	47.1
	3	26.8	20.8	29.9	49.4	36.5	67.1	71.8	62.8	48.3
	4	26.7	20.9	30.2	58.9	36.9	67.2	71.7	62.8	48.3
Ground water elevation (ft)	1	1388.0	1298.2	1311.4	1297.4	1309.0	1299.9	1257.1	1205.7	1348.4
	2	1387.8	1298.2	1309.9	1296.8	1307.4	1299.8	1257.1	1205.8	1346.3
	3	1387.2	1298.2	1309.2	1295.9	1306.8	1299.7	1256.9	1205.8	1345.1
	4	1387.2	1298.1	1308.9	1295.8	1306.4	1299.6	1256.9	1205.7	1345.1
pH (pH units)	1	7.64	7.14	7.21	8.09	8.08	7.35	7.43	8.01	6.97
	2	7.75	7.06	7.20	7.96	7.43	7.45	7.49	7.75	6.91
	3	7.79	7.11	7.14	8.24	7.17	7.20	7.61	7.87	6.93
	4	7.71	7.11	7.47	7.97	7.44	7.33	7.63	7.05	6.92
Gross alpha (Bq/L) ^(b)	1	0.03	0.74	0.24	-0.004	0.04	0.36	-0.004	0.03	0.43
	2	0.04	0.62	0.15	0.03	0.01	0.88	0.01	0.01	0.37
	3	0.09	0.95	0.13	0.01	0.01	0.94	0.03	0.08	0.29
	4	0.04	0.20	0.25	-0.01	0.02	0.64	0.01	0.07	0.22
Gross beta (Bq/L) ^(b)	1	0.11	0.48	0.22	0.33	0.20	0.16	0.20	0.14	0.37
	2	0.12	0.38	0.22	0.46	0.24	0.44	0.16	0.17	0.28
	3	0.17	0.42	0.25	0.37	0.22	0.63	0.15	0.19	0.36
	4	0.12	0.11	0.21	0.38	0.16	0.43	0.12	0.16	0.32
1,1-DCE ($\mu\text{g/L}$)	1	nd ^(c)	nd	nd	nd	nd	nd	nd	nd	nd
	2	nd	nd	1.0	nd	nd	nd	nd	nd	nd
	3	nd	nd	0.6	nd	nd	nd	nd	nd	nd
	4	nd	nd	nd	nd	nd	nd	nd	nd	nd
TCE ($\mu\text{g/L}$)	1	nd	2.0	2.0	nd	nd	nd	nd	nd	nd
	2	nd	1.9	2.8	nd	nd	nd	nd	nd	nd
	3	nd	2.1	2.7	nd	nd	nd	nd	nd	nd
	4	nd	nd	1.8	nd	nd	nd	nd	nd	nd
Nitrate (mg/L) ^(d)	1	23	66	29	14	2	44	<0.1	67	29
	2	17	70	28	<0.1	<0.1	27	<0.1	85	22
	3	13	43	25	<0.5	1	36	<0.5	72	20
	4	1	44	19	<0.5	14	37	<0.5	71	20
Perchlorate ($\mu\text{g/L}$) ^(d)	1	<4	13	6	<4	<4	13	<4	<4	<4
	2	<4	14	8	<4	<4	11	<4	<4	<4
	3	<4	19	11	<4	<4	16	<4	<4	<4
	4	<4	18	10	<4	<4	17	<4	<4	<4

(a) Upgradient well.

(b) Gross alpha and beta are corrected for the background radioactivity within the measurement apparatus.

A negative result indicates that the sample measured less than the background by the amount shown.

(c) "nd" means the COC was not detected at or above the analytical reporting limit of 0.5 $\mu\text{g/L}$.

(d) Nitrate and perchlorate results are from continuing CERCLA investigations and are voluntarily reported.

Appendix B

Statistical Methods for Release Detection

Appendix B

Statistical Methods for Release Detection

Monitoring and reporting provisions of the RCRA closure and post-closure plan (PCP) for landfill Pits 1 and 7 require the use of U.S. EPA-approved statistical methods to evaluate the monitoring data. Waste Discharge Requirements (WDR) Order 93-100 requires statistical methods from the *California Code of Regulations* (CCR), Title 23. LLNL applies statistical methods from CCR, Title 23, Division 3, Chapter 15, Section 2550.7, as they are also consistent with U.S. EPA guidance.

We use statistically determined concentration limits (SLs) to detect potential releases of constituents of concern (COCs) to ground water from solid wastes contained in closed landfills. We employ two statistical methods, prediction intervals (PIs) and control charts (CCs), to generate SLs. Both methods are sensitive to COC concentration increases. Both methods are cost-effective, requiring only one measurement of a COC per quarter per monitoring well.

We prefer the PI method when COC concentrations in ground water are similar upgradient and downgradient from the monitored unit. We use parametric PI methods when the upgradient COC concentration data are all above the detection limit and the data are approximately normally distributed. Analysts also use parametric methods on log-transformed data, if the transformed data follow a normal distribution. Nonparametric PI methods are more effective when the data cannot be transformed to a normal distribution, or when they contain nondetections.

When the concentration of a COC is spatially variable in the vicinity of a monitored unit, we develop a control chart for each downgradient monitoring well. The control chart compares each new quarterly COC measurement with its concentration history for that well.

Wherever sufficient historical detections of a COC exist, we calculate an SL such that a single future measurement has approximately a 1-in-100 chance of exceeding the SL, when no change in concentration has actually occurred. This yields a statistical test with a significance level of approximately 0.01. Where historical detections exist, but nondetections constitute part of the data, we set the SL equal to the highest concentration measured. If historical analyses show all nondetections of a COC, then we select the analytical laboratory reporting limit (RL) as the SL. To test false-positive results, we employ a verification procedure containing two discrete retests, in accordance with CCR Title 23, Chapter 15, Section 2550.7.

Table B-1 below lists all COCs that have indicated statistically significant evidence of release to ground water from Pit 1 or Pit 7, the date when the CVRWQCB was notified by letter, and the status of any further investigation.

Table B-1. Reported WDR 93-100 COCs showing statistical evidence of release.

COC	Pit	Reported to CVRWQCB	Status of release investigation
Metals			
Arsenic	1	06/03/94	Transferred to CERCLA
Arsenic	7	10/17/95	Transferred to CERCLA
Barium	1	10/17/95	Transferred to CERCLA
Barium	1	06/14/96	Transferred to CERCLA
Barium	1	10/25/00	Transferred to CERCLA
Barium	7	11/09/93	Completed ^(a)
Barium	7	07/10/97	Transferred to CERCLA
Barium	7	08/03/00	Transferred to CERCLA
Barium	7	02/08/01	Transferred to CERCLA
Cadmium	7	10/17/95	Transferred to CERCLA
Copper	1	02/08/01	Transferred to CERCLA
Copper	7	10/17/95	Transferred to CERCLA
Lead	1	04/01/99	Transferred to CERCLA
Nickel	7	10/17/95	Transferred to CERCLA
Nickel	7	05/03/96	Transferred to CERCLA
Nickel	7	07/10/01	Transferred to CERCLA
Vanadium	7	06/03/94	Completed ^(a)
Zinc	7	10/17/95	Transferred to CERCLA
Zinc	7	04/19/99	Transferred to CERCLA
Radioisotopes			
Radium-226	7	10/17/95	Transferred to CERCLA
Tritium	1	10/21/96	Transferred to CERCLA
Tritium	1	01/14/99	Transferred to CERCLA
Tritium	7	01/11/93	Completed ^(a)
Uranium	1	02/17/94	Completed ^(a)
Uranium	1	10/21/96	Transferred to CERCLA
Uranium	7	09/10/93	Completed ^(a)
Uranium	7	11/10/98	Transferred to CERCLA

(a) Taffet *et al.* 1996.

Appendix C

Changes in Programs or Methods

Appendix C

Changes in Programs or Methods

During 2003, LLNL made no significant programmatic changes regarding constituents of concern (COCs), ground water sampling methods, sample tracking procedures, analytical methods, or data management.

Nitrate and perchlorate are not designated COCs, but their occurrence in ground water at Site 300 is being investigated by LLNL under CERCLA auspices. Thus, beginning with the second quarter of 2003, we have voluntarily added quarterly analytical results for nitrate and perchlorate in **Table A-2** for Pit 1 wells and **Table A-4** for Pit 7 wells.

Appendix D

Quality Assurance

Appendix D

Quality Assurance

To ensure good data quality, we work within the established Quality Assurance (QA) program of the LLNL Environmental Protection Department (EPD). We use protocols and procedures that cover all aspects of ground water sampling, sample tracking, and data management. These written protocols and procedures are contained in the *LLNL Livermore Site and Site 300 Environmental Restoration Project Standard Operating Procedures (SOPs)* (Dibley and Depue 2002), the *Environmental Monitoring Plan* (Tate *et al.* 1999), and the *EPD Quality Assurance Management Plan* (Merrigan 2001). SOPs are used to minimize inadvertent sample contamination and maintain sample integrity from the well to the analytical laboratory. Data management SOPs ensure that all laboratory measurements are received, are accurately recorded, and are properly stored both in a computer database and in hardcopy form. Data quality is assessed by the following methods.

Each quarter, a duplicate (collocated) set of ground water samples is collected from a randomly chosen well, one for each of the two monitoring networks. The routine and duplicate samples are labeled with different identifier codes. Identical analyses are performed on the routine and duplicate samples. Analytical results for the routine and duplicate samples are compared by the analysts responsible for this report. Any significant differences are investigated by the analysts in collaboration with a QA chemist. A representative of the analytical laboratory may be involved during an investigation.

Each quarter, a set of blank samples is prepared in the field at a randomly chosen well location, one for each of the two monitoring networks. The field blank samples are submitted to the analytical laboratories, together with the routine ground water samples for identical analyses. Field blanks use hydrogen-purged deionized water for organic compound analyses and liquid-chromatography-grade water for all other analyses, except tritium activity. Field blanks for tritium activity use water that is doubly distilled and filtered at LLNL for that purpose. Field blanks test the cleanliness of sample preparation in the field and sample processing at the analytical laboratory.

Each quarter, equipment blanks are prepared and analyzed to ensure that sampling equipment is properly cleaned before use.

Each day when samples are collected for volatile organic compound (VOC) analysis, a trip blank (prepared at the analytical laboratory) is carried into the field. It is returned unopened to the analytical laboratory for VOC analysis. If VOCs are detected in a trip blank and in any of the routine samples obtained that day, sample results may be discounted and new sampling may be performed.

QA results for fourth quarter 2003

Pit 1. The measurements of Pit 1 COCs are comparable between the routine and the duplicate ground water QA samples from randomly selected monitoring well K1-04; that is, the differences are within the uncertainties inherent in the various analytical methods (**Table D-1**). Radium was detected at an inconsequential activity of 0.010 ± 0.004 Bq/L in the Pit 1 field blank sample. No other COCs were detected in the field blank sample.

Pit 7. The measurements of Pit 7 COCs are comparable between the routine and the duplicate ground water QA samples from randomly selected monitoring well NC7-48; that is, the differences are within the uncertainties inherent in the various analytical methods (**Table D-2**). Radium was detected at an inconsequential activity of 0.004 ± 0.003 Bq/L in the Pit 7 field blank sample. No other COCs were detected in the field blank sample.

Table D-1. Pit 1 analyses of routine, duplicate, and field blank QA samples for fourth-quarter 2003.

Dates sampled: K1-04 on 11/18/03; field blank on 11/24/03.

Constituent ^(a)	Analytical method	QA samples		
		Well K1-04 routine	Well K1-04 duplicate	Pit 1 field blank
Arsenic	EPA 200.8	10	10	< 2
Barium	EPA 200.8	28	28	< 25
Beryllium	EPA 210.2	< 0.5	< 0.5	< 0.5
Cadmium	EPA 200.8	< 0.5	< 0.5	< 0.5
Chromium	EPA 218.2	< 1	< 1	< 1
Cobalt	EPA 200.8	< 25	< 25	< 25
Copper	EPA 200.8	< 10	< 10	< 10
Iron	EPA 200.7	< 100	< 100	< 100
Lead	EPA 200.8	< 2	< 2	< 2
Manganese	EPA 200.8	< 0.1	< 0.1	< 0.1
Mercury	EPA 245.2	< 0.2	< 0.2	< 0.2
Nickel	EPA 200.8	< 5	< 5	< 5
Potassium (mg/L)	EPA 6010	3.1	3	< 1
Selenium	EPA 200.8	3.1	3.4	< 2
Silver	EPA 200.8	< 0.5	< 0.5	< 0.5
Sodium (mg/L)	EPA 200.7	35	34	< 1
Vanadium	EPA 200.8	35	34	< 25
Zinc	EPA 200.8	< 20	< 20	< 20
Aldrin	EPA 608	< 0.005	< 0.005	< 0.005
BHC, alpha isomer	EPA 608	< 0.005	< 0.005	< 0.005
BHC, beta isomer	EPA 608	< 0.005	< 0.005	< 0.005
BHC, delta isomer	EPA 608	< 0.005	< 0.005	< 0.005
BHC, gamma isomer (Lindane)	EPA 608	< 0.005	< 0.005	< 0.005
Chlordane (Technical)	EPA 608	< 1	< 1	< 1
Dieldrin	EPA 608	< 0.005	< 0.005	< 0.005
Endosulfan I	EPA 608	< 0.005	< 0.005	< 0.005
Endosulfan II	EPA 608	< 0.005	< 0.005	< 0.005
Endosulfan sulfate	EPA 608	< 0.005	< 0.005	< 0.005
Endrin	EPA 608	< 0.005	< 0.005	< 0.005
Endrin aldehyde	EPA 608	< 0.01	< 0.01	< 0.01
Heptachlor	EPA 608	< 0.005	< 0.005	< 0.005
Heptachlor epoxide	EPA 608	< 0.005	< 0.005	< 0.005
Methoxychlor	EPA 608	< 0.01	< 0.01	< 0.01
Toxaphene	EPA 608	< 1	< 1	< 1
p,p-DDD	EPA 608	< 0.005	< 0.005	< 0.005
p,p-DDE	EPA 608	< 0.005	< 0.005	< 0.005
p,p-DDT	EPA 608	< 0.005	< 0.005	< 0.005
PCB 1016	EPA 608	< 0.2	< 0.2	< 0.2
PCB 1221	EPA 608	< 0.2	< 0.2	< 0.2
PCB 1232	EPA 608	< 0.2	< 0.2	< 0.2

Continued

Table D-1. Pit 1 analyses of routine, duplicate, and field blank QA samples for fourth-quarter 2003.

Dates sampled: K1-04 on 11/18/03; field blank on 11/24/03.

Constituent ^(a)	Analytical method	QA samples		
		Well K1-04 routine	Well K1-04 duplicate	Pit 1 field blank
PCB 1242	EPA 608	< 0.2	< 0.2	< 0.2
PCB 1248	EPA 608	< 0.2	< 0.2	< 0.2
PCB 1254	EPA 608	< 0.2	< 0.2	< 0.2
PCB 1260	EPA 608	< 0.2	< 0.2	< 0.2
1,1,1-Trichloroethane	EPA 624	< 0.5	< 0.5	< 0.5
1,1,2,2-Tetrachloroethane	EPA 624	< 0.5	< 0.5	< 0.5
1,1,2-Trichloroethane	EPA 624	< 0.5	< 0.5	< 0.5
1,1-Dichloroethane	EPA 624	< 0.5	< 0.5	< 0.5
1,1-Dichloroethene	EPA 624	< 0.5	< 0.5	< 0.5
1,2-Dichlorobenzene	EPA 624	< 0.5	< 0.5	< 0.5
1,2-Dichloroethane	EPA 624	< 0.5	< 0.5	< 0.5
trans-1,2-Dichloroethene	EPA 624	< 0.5	< 0.5	< 0.5
1,2-Dichloroethene (total)	EPA 624	< 1	< 1	< 1
1,2-Dichloropropane	EPA 624	< 0.5	< 0.5	< 0.5
1,3-Dichlorobenzene	EPA 624	< 0.5	< 0.5	< 0.5
1,4-Dichlorobenzene	EPA 624	< 0.5	< 0.5	< 0.5
cis-1,2-Dichloroethene	EPA 624	< 0.5	< 0.5	< 0.5
cis-1,3-Dichloropropene	EPA 624	< 0.5	< 0.5	< 0.5
2-Butanone	EPA 624	< 20	< 20	< 20
2-Chloroethylvinylether	EPA 624	< 10	< 10	< 10
trans-1,3-Dichloropropene	EPA 624	< 0.5	< 0.5	< 0.5
2-Hexanone	EPA 624	< 20	< 20	< 20
4-Methyl-2-pentanone	EPA 624	< 20	< 20	< 20
Acetone	EPA 624	< 20	< 20	< 20
Benzene	EPA 624	< 0.5	< 0.5	< 0.5
Bromodichloromethane	EPA 624	< 0.5	< 0.5	< 0.5
Bromoform	EPA 624	< 0.5	< 0.5	< 0.5
Bromomethane	EPA 624	< 1	< 1	< 1
Carbon disulfide	EPA 624	< 1	< 1	< 1
Carbon tetrachloride	EPA 624	< 0.5	< 0.5	< 0.5
Chlorobenzene	EPA 624	< 0.5	< 0.5	< 0.5
Chloroethane	EPA 624	< 0.5	< 0.5	< 0.5
Chloroform	EPA 624	< 0.5	< 0.5	< 0.5
Chloromethane	EPA 624	< 0.5	< 0.5	< 0.5
Dibromochloromethane	EPA 624	< 0.5	< 0.5	< 0.5
Dibromomethane	EPA 624	< 0.5	< 0.5	< 0.5
Dichlorodifluoromethane	EPA 624	< 0.5	< 0.5	< 0.5
Ethanol	EPA 624	< 1000	< 1000	< 1000
Ethylbenzene	EPA 624	< 0.5	< 0.5	< 0.5
Freon 113	EPA 624	< 0.5	< 0.5	18

Continued

Table D-1. Pit 1 analyses of routine, duplicate, and field blank QA samples for fourth-quarter 2003.

Dates sampled: K1-04 on 11/18/03; field blank on 11/24/03.

Constituent ^(a)	Analytical method	QA samples		
		Well K1-04 routine	Well K1-04 duplicate	Pit 1 field blank
Methylene chloride	EPA 624	< 1	< 1	< 1
Naphthalene	EPA 624	< 0.5	< 0.5	< 0.5
Styrene	EPA 624	< 0.5	< 0.5	< 0.5
Tetrachloroethene	EPA 624	< 0.5	< 0.5	< 0.5
Toluene	EPA 624	< 0.5	< 0.5	< 0.5
Total xylene isomers	EPA 624	< 1	< 1	< 1
Trichloroethene	EPA 624	< 0.5	< 0.5	< 0.5
Trichlorofluoromethane	EPA 624	< 0.5	< 0.5	< 0.5
Vinyl chloride	EPA 624	< 0.5	< 0.5	< 0.5
1,2,4-Trichlorobenzene	EPA 625	< 2	< 2	< 2
1,2-Dichlorobenzene	EPA 625	< 2	< 2	< 2
1,2-Diphenylhydrazine	EPA 625	< 2	< 2	< 2
1,3-Dichlorobenzene	EPA 625	< 2	< 2	< 2
1,4-Dichlorobenzene	EPA 625	< 2	< 2	< 2
2,4,5-Trichlorophenol	EPA 625	< 5	< 5	< 5
2,4,6-Trichlorophenol	EPA 625	< 5	< 5	< 5
2,4-Dichlorophenol	EPA 625	< 2	< 2	< 2
2,4-Dimethylphenol	EPA 625	< 2	< 2	< 2
2,4-Dinitrophenol	EPA 625	< 10	< 10	< 10
2,4-Dinitrotoluene	EPA 625	< 2	< 2	< 2
2,6-Dinitrotoluene	EPA 625	< 2	< 2	< 2
2-Chloronaphthalene	EPA 625	< 2	< 2	< 2
2-Chlorophenol	EPA 625	< 2	< 2	< 2
2-Methyl-4,6-dinitrophenol	EPA 625	< 10	< 10	< 10
2-Methylnaphthalene	EPA 625	< 2	< 2	< 2
2-Naphthylamine	EPA 625	< 20	< 20	< 20
2-Nitroaniline	EPA 625	< 2	< 2	< 2
2-Nitrophenol	EPA 625	< 2	< 2	< 2
3,3-Dichlorobenzidine	EPA 625	< 10	< 10	< 10
3-Nitroaniline	EPA 625	< 2	< 2	< 2
4-Bromophenylphenylether	EPA 625	< 2	< 2	< 2
4-Chloro-3-methylphenol	EPA 625	< 5	< 5	< 5
4-Chloroaniline	EPA 625	< 2	< 2	< 2
4-Chlorophenylphenylether	EPA 625	< 2	< 2	< 2
4-Nitroaniline	EPA 625	< 5	< 5	< 5
4-Nitrophenol	EPA 625	< 2	< 2	< 2
Acenaphthene	EPA 625	< 2	< 2	< 2
Acenaphthylene	EPA 625	< 2	< 2	< 2
Aldrin	EPA 625	< 2	< 2	< 2
Aniline	EPA 625	< 5	< 5	< 5

Continued

Table D-1. Pit 1 analyses of routine, duplicate, and field blank QA samples for fourth-quarter 2003.

Dates sampled: K1-04 on 11/18/03; field blank on 11/24/03.

Constituent ^(a)	Analytical method	QA samples		
		Well K1-04 routine	Well K1-04 duplicate	Pit 1 field blank
Anthracene	EPA 625	< 2	< 2	< 2
BHC, alpha isomer	EPA 625	< 2	< 2	< 2
BHC, beta isomer	EPA 625	< 2	< 2	< 2
BHC, delta isomer	EPA 625	< 2	< 2	< 2
BHC, gamma isomer (Lindane)	EPA 625	< 2	< 2	< 2
Benzidine	EPA 625	< 20	< 20	< 20
Benzo(a)anthracene	EPA 625	< 2	< 2	< 2
Benzo(a)pyrene	EPA 625	< 2	< 2	< 2
Benzo(b)fluoranthene	EPA 625	< 2	< 2	< 2
Benzo(g,h,i)perylene	EPA 625	< 2	< 2	< 2
Benzo(k)fluoranthene	EPA 625	< 2	< 2	< 2
Benzoic Acid	EPA 625	< 10	< 10	< 10
Benzyl Alcohol	EPA 625	< 2	< 2	< 2
Bis(2-chloroethoxy)methane	EPA 625	< 2	< 2	< 2
Bis(2-chloroethyl)ether	EPA 625	< 2	< 2	< 2
Bis(2-chloroisopropyl)ether	EPA 625	< 2	< 2	< 2
Bis(2-ethylhexyl)phthalate	EPA 625	< 5	< 5	< 5
Butylbenzylphthalate	EPA 625	< 2	< 2	< 2
Chrysene	EPA 625	< 2	< 2	< 2
Di-n-octylphthalate	EPA 625	< 2	< 2	< 2
Dibenzo(a,h)anthracene	EPA 625	< 3	< 3	< 3
Dibenzofuran	EPA 625	< 2	< 2	< 2
Dibutylphthalate	EPA 625	< 2	< 2	< 2
Dieldrin	EPA 625	< 3	< 3	< 3
Diethylphthalate	EPA 625	< 2	< 2	< 2
Dimethylphthalate	EPA 625	< 2	< 2	< 2
Endosulfan I	EPA 625	< 10	< 10	< 10
Endosulfan II	EPA 625	< 10	< 10	< 10
Endosulfan sulfate	EPA 625	< 3	< 3	< 3
Endrin	EPA 625	< 2	< 2	< 2
Endrin aldehyde	EPA 625	< 10	< 10	< 10
Fluoranthene	EPA 625	< 2	< 2	< 2
Fluorene	EPA 625	< 2	< 2	< 2
Heptachlor	EPA 625	< 2	< 2	< 2
Heptachlor epoxide	EPA 625	< 2	< 2	< 2
Hexachlorobenzene	EPA 625	< 2	< 2	< 2
Hexachlorobutadiene	EPA 625	< 2	< 2	< 2
Hexachlorocyclopentadiene	EPA 625	< 2	< 2	< 2
Hexachloroethane	EPA 625	< 2	< 2	< 2
Indeno(1,2,3-c,d)pyrene	EPA 625	< 2	< 2	< 2

Continued

Table D-1. Pit 1 analyses of routine, duplicate, and field blank QA samples for fourth-quarter 2003.

Dates sampled: K1-04 on 11/18/03; field blank on 11/24/03.

Constituent ^(a)	Analytical method	QA samples		
		Well K1-04 routine	Well K1-04 duplicate	Pit 1 field blank
Isophorone	EPA 625	< 2	< 2	< 2
N-Nitrosodi-n-propylamine	EPA 625	< 2	< 2	< 2
N-Nitrosodimethylamine	EPA 625	< 2	< 2	< 2
N-Nitrosodiphenylamine	EPA 625	< 2	< 2	< 2
Naphthalene	EPA 625	< 2	< 2	< 2
Nitrobenzene	EPA 625	< 2	< 2	< 2
Pentachlorophenol	EPA 625	< 10	< 10	< 10
Phenanthrene	EPA 625	< 2	< 2	< 2
Phenol	EPA 625	< 2	< 2	< 2
Pyrene	EPA 625	< 2	< 2	< 2
m- and p- Cresol	EPA 625	< 2	< 2	< 2
m- and p- Cresol	EPA 625	< 2	< 2	< 2
o-Cresol	EPA 625	< 2	< 2	< 2
p,p-DDD	EPA 625	< 2	< 2	< 2
p,p-DDE	EPA 625	< 3	< 3	< 3
p,p-DDT	EPA 625	< 2	< 2	< 2
HMX	EPA 8330	< 5	< 5	< 5
RDX	EPA 8330	< 5	< 5	< 5
TOC (mg/L)	EPA 9060	< 1	< 1	< 1
Gross alpha (Bq/L) ^(b)	EPA 900	2.8 ± 1.0	1.8 ± 0.8	-0.2 ± 0.2
Gross beta (Bq/L)	EPA 900	4.6 ± 1.1	3.6 ± 1.7	-0.1 ± 0.8
Radium 226 (Bq/L)	EPA 903	0.003 ± 0.003	0.006 ± 0.003	0.010 ± 0.004
Tritium (Bq/L)	EPA 906	6.6 ± 2.3	6.9 ± 2.3	0.6 ± 2.0
Thorium 228 (Bq/L)	HASL-300	0.0008 ± 0.0009	0.0010 ± 0.0009	-0.0001 ± 0.0007
Thorium 232 (Bq/L)	HASL-300	-0.0002 ± 0.0002	-0.0002 ± 0.0004	-0.0001 ± 0.0007
Uranium (total) (Bq/L)	HASL-300	0.060 ± 0.007	0.064 ± 0.007	0.0004 ± 0.0008

(a) Constituent units are micrograms per liter ($\mu\text{g/L}$) unless otherwise indicated.

(b) Radioactivity measurements are corrected for background radioactivity. Negative radioactivity indicates that the sample measured less than the background by the amount shown.

Concluded

Table D-2. Pit 7 analyses of routine, duplicate, and field blank QA samples for fourth-quarter 2003.

Dates sampled: NC7-48 on 12/9/03; field blank on 12/13/03.

Constituent ^(a)	Analytical method	QA Samples		
		Well NC7-48 routine	Well NC7-48 duplicate	Pit 7 field blank
Arsenic	EPA 200.8	9.7	9.7	< 2
Barium	EPA 200.8	150	160	< 25
Beryllium	EPA 210.2	< 0.5	< 0.5	< 0.5
Cadmium	EPA 200.8	< 0.5	< 0.5	< 0.5
Cobalt	EPA 200.8	< 25	< 25	< 25
Copper	EPA 200.8	< 10	< 10	< 10
Lead	EPA 200.8	< 2	< 2	< 2
Nickel	EPA 200.8	< 5	< 5	< 5
Vanadium	EPA 200.8	< 25	< 25	< 25
Zinc	EPA 200.8	< 20	< 20	< 20
1,1,1-Trichloroethane	EPA 601	< 0.5	< 0.5	< 0.5
1,1,2,2-Tetrachloroethane	EPA 601	< 0.5	< 0.5	< 0.5
1,1,2-Trichloroethane	EPA 601	< 0.5	< 0.5	< 0.5
1,1-Dichloroethane	EPA 601	< 0.5	< 0.5	< 0.5
1,1-Dichloroethene	EPA 601	< 0.5	< 0.5	< 0.5
1,2-Dichlorobenzene	EPA 601	< 0.5	< 0.5	< 0.5
1,2-Dichloroethane	EPA 601	< 0.5	< 0.5	< 0.5
1,2-Dichloroethene (total)	EPA 601	< 1	< 1	< 1
1,2-Dichloropropane	EPA 601	< 0.5	< 0.5	< 0.5
1,3-Dichlorobenzene	EPA 601	< 0.5	< 0.5	< 0.5
1,4-Dichlorobenzene	EPA 601	< 0.5	< 0.5	< 0.5
2-Chloroethylvinylether	EPA 601	< 10	< 10	< 10
Bromodichloromethane	EPA 601	< 0.5	< 0.5	< 0.5
Bromoform	EPA 601	< 0.5	< 0.5	< 0.5
Bromomethane	EPA 601	< 1	< 1	< 1
Carbon tetrachloride	EPA 601	< 0.5	< 0.5	< 0.5
Chlorobenzene	EPA 601	< 0.5	< 0.5	< 0.5
Chloroethane	EPA 601	< 0.5	< 0.5	< 0.5
Chloroform	EPA 601	< 0.5	< 0.5	< 0.5
Chloromethane	EPA 601	< 0.5	< 0.5	< 0.5
cis-1,3-Dichloropropene	EPA 601	< 0.5	< 0.5	< 0.5
Dibromochloromethane	EPA 601	< 0.5	< 0.5	< 0.5
Dichlorodifluoromethane	EPA 601	< 0.5	< 0.5	< 0.5
Freon 113	EPA 601	< 0.5	< 0.5	< 0.5
Methylene chloride	EPA 601	< 1	< 1	< 1
Tetrachloroethene	EPA 601	< 0.5	< 0.5	< 0.5
trans-1,3-Dichloropropene	EPA 601	< 0.5	< 0.5	< 0.5
Trichloroethene	EPA 601	< 0.5	< 0.5	< 0.5
Trichlorofluoromethane	EPA 601	< 0.5	< 0.5	< 0.5
Vinyl chloride	EPA 601	< 0.5	< 0.5	< 0.5

Continued

Table D-2. Pit 7 analyses of routine, duplicate, and field blank QA samples for fourth-quarter 2003.

Dates sampled: NC7-48 on 12/9/03; field blank on 12/13/03.

Constituent ^(a)	Analytical method	QA Samples		
		Well NC7-48 routine	Well NC7-48 duplicate	Pit 7 field blank
HMX	EPA 8330	< 5	< 5	< 5
RDX	EPA 8330	< 5	< 5	< 5
Gross alpha (Bq/L)	EPA 900	0.22 ± 0.07	0.22 ± 0.08	0.00 ± 0.01
Gross beta (Bq/L)	EPA 900	0.32 ± 0.07	0.28 ± 0.10	0.00 ± 0.03
Radium 226 (Bq/L)	EPA 903	0.016 ± 0.005	0.012 ± 0.004	0.004 ± 0.003
Tritium (Bq/L) ^(b)	EPA 906	1.9 ± 2.1	0.2 ± 2.0	-0.7 ± 2.1
Thorium 228 (Bq/L)	HASL-300	0.003 ± 0.002	0.001 ± 0.001	0.001 ± 0.002
Thorium 232 (Bq/L)	HASL-300	0.000 ± 0.001	0.000 ± 0.001	0.000 ± 0.001
Uranium (total) (Bq/L)	HASL-300	0.35 ± 0.03	0.36 ± 0.03	0.001 ± 0.001

(a) Constituent units are micrograms per liter ($\mu\text{g/L}$) unless otherwise indicated.

(b) Radioactivity measurements are corrected for background radioactivity. Negative radioactivity indicates that the sample measured less than the background by the amount shown.

Concluded

Appendix E

Graphs of Ground Water Measurements

Appendix E

As required by the monitoring and reporting provisions of WDR 93-100, this appendix contains graphs of COC concentrations measured during 2002. Historical data have been added to most of the graphs to show post-closure trends. Annual graphs of ground water measurements specific to the post-closure plan (**Table E-1**) are not required, but they have been included for completeness. Pit 1 data are plotted first.

The sequence of graphs is by COC and by well. For each COC, the sequence of wells is the same. Upgradient (background) well results are plotted first. Graphs show concentration (or other parameter) on the y axis, with time on the x axis (time in years is divided into quarterly sample periods). The header and the vertical axis labels on each plot give the units of measurement. Three different symbols are used to plot the data: a black diamond, an inverted white triangle, and a plus sign. Their different uses are explained below.

COC detections are plotted as black diamonds. Analytical laboratories report COC measurements above analytical reporting limits (RLs) as detections. (The RL for a COC is a contractual concentration value near zero.) COC concentrations below RLs are nondetections and are reported as "less than the RL." For nonradioactive COCs, nondetections are assigned RL values and appear as inverted white triangles in the data graphs.

Nondetections of radioactive COCs are treated differently. Activities below RLs have been estimated since 1992. Estimated activities below RLs appear as plus signs in the graphs of radioactive COCs. Estimated activities below RLs for historical data are not available prior to 1992. Total uranium activity is obtained by adding activities of its three main isotopes: uranium-234, uranium-235, and uranium-238. If one or more of the activities is estimated, total uranium is plotted as a plus sign.

Statistical limits of concentration (SLs) are shown on the COC graphs as horizontal dotted lines. The numerical value of an SL is given in the plot legend. If the SL for a COC is the same for all wells (prediction interval), then it appears on all of the well graphs (e.g., beryllium). If the SL for a COC is variable (control chart), then it appears only on the downgradient wells to which it applies (e.g., arsenic).

Wherever the vertical axis scale has been adjusted to graphically show more detail for the majority of the data by excluding a small number of outliers, the footnote "Data omitted" has been added to the graph.

Table E-1. Pits 1 and 7 constituents of concern (COC) and monitoring frequencies.^(a)

Constituent	WDR ^(b)	PCP ^(c)	Pit 1	Pit 7
Arsenic	X		Q	Q
Barium	X		Q	Q
Beryllium	X		Q	Q
Cadmium	X		Q	Q
Chloride		X	A	
Chromium		X	SA	
Cobalt	X		Q	Q
Copper	X		Q	Q
Iron		X	SA	
Lead	X		Q	Q
Manganese		X	SA	
Mercury		X	SA	
Nickel	X		Q	Q
Nitrate		X	SA	
Selenium		X	SA	
Silver		X	SA	
Sodium		X	SA	
Sulfate		X	A	missed
Vanadium	X		Q	Q
Zinc	X		Q	Q
Total organic carbon (TOC)		X	A	
Total organic halides (TOX)		X	A	
EPA Method 601		X		Q
EPA Method 624		X	A	
EPA Method 625		X	A	
EPA Method 608		X	A	
Gross alpha and gross beta		X	SA	Q
Radium 226	X		Q	Q
Thorium 228	X		Q	Q
Thorium 232	X		Q	Q
Tritium	X		Q	Q
Uranium (total)	X		Q	Q
HMX	X		Q	Q
RDX	X		Q	Q
Ground water elevation		X	SA	Q
Ground water temperature		X	SA	
pH		X	SA	
Specific conductance		X	SA	

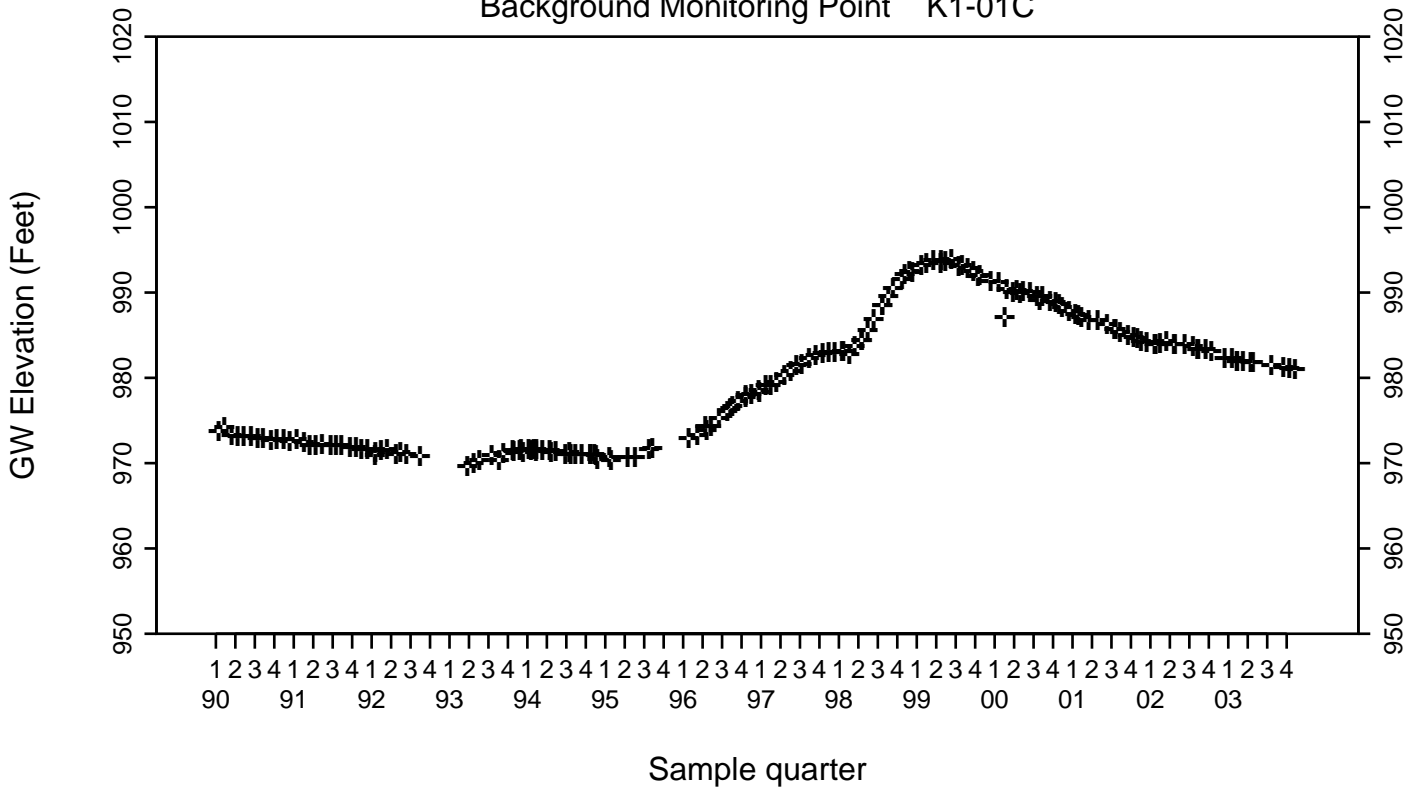
(a) Monitoring frequencies are: Q (quarterly); SA (semiannually); A (annually).

(b) COCs required to be monitored by WDR 93-100 Rev. 2 (CVRWQCB 1998).

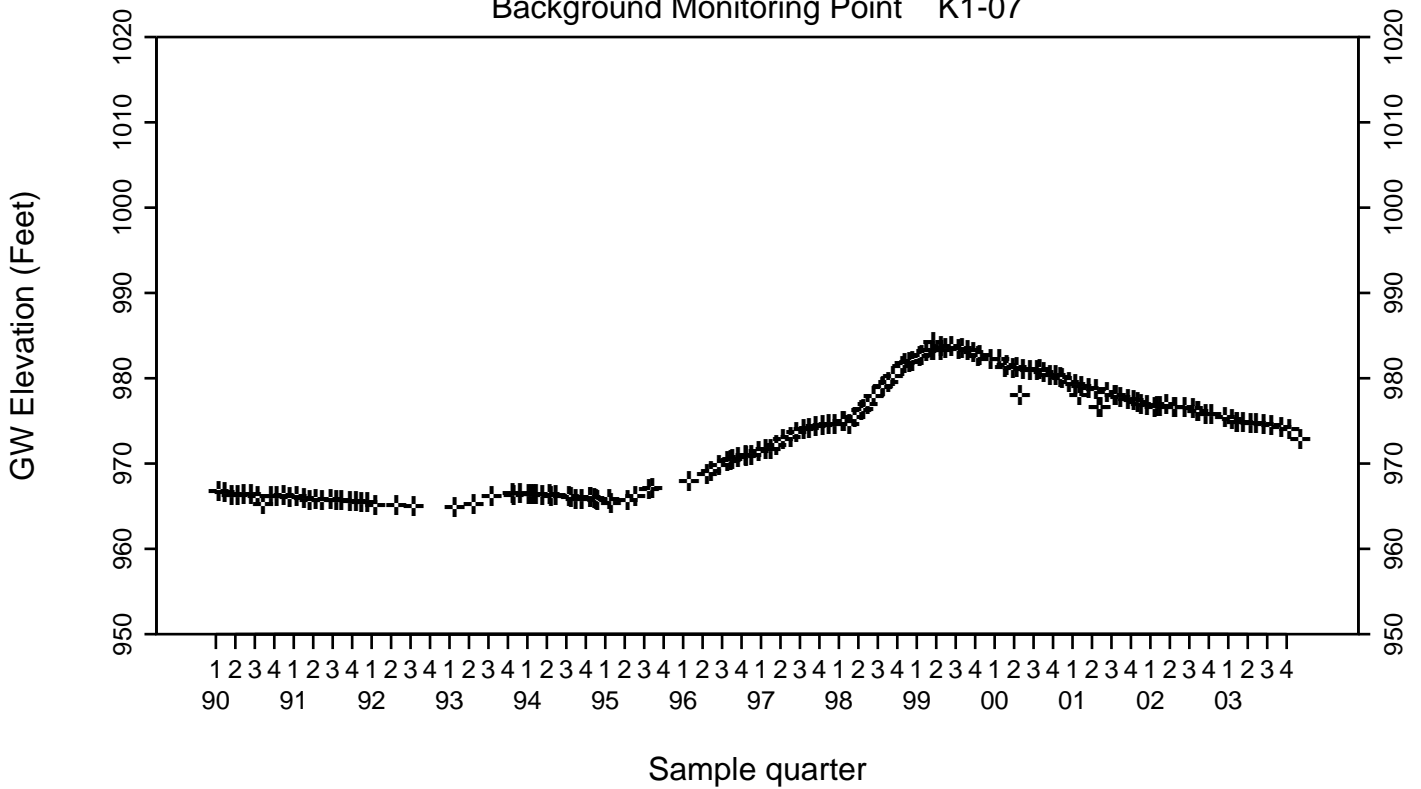
(c) Additional COCs required to be monitored by the post-closure plan (Rogers/Pacific Corporation 1990).

Pit 1 Area GW Elevation (Feet)

Background Monitoring Point K1-01C

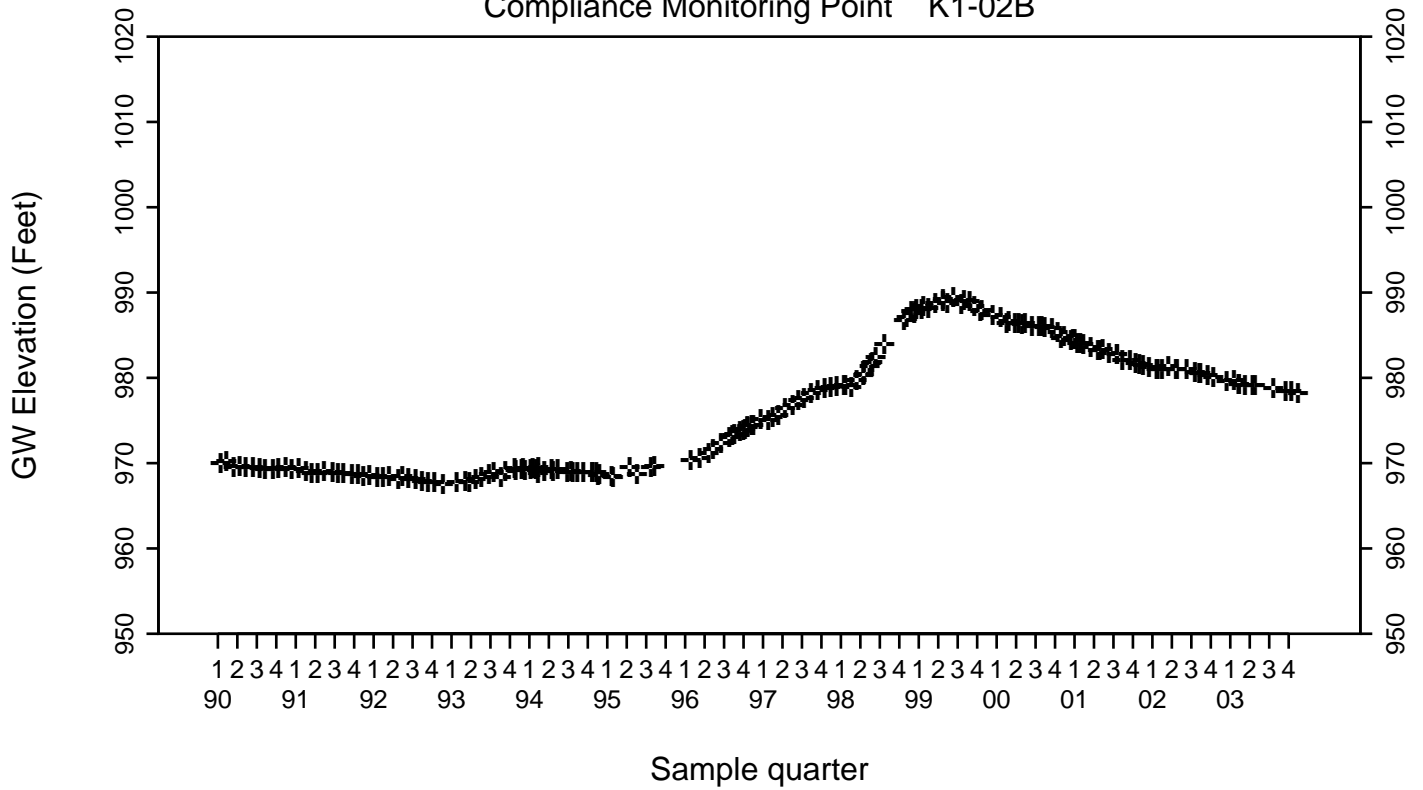


Background Monitoring Point K1-07

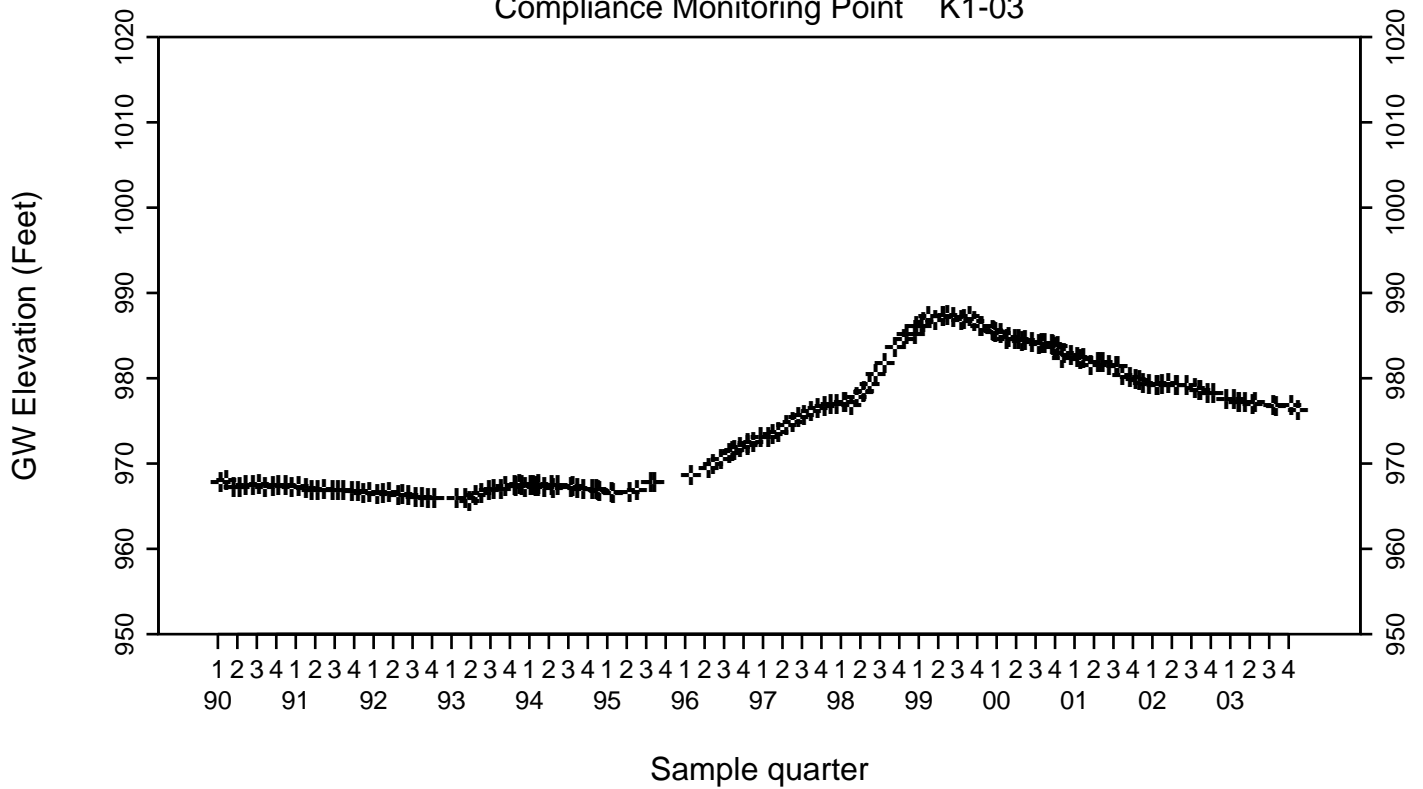


Pit 1 Area GW Elevation (Feet)

Compliance Monitoring Point K1-02B

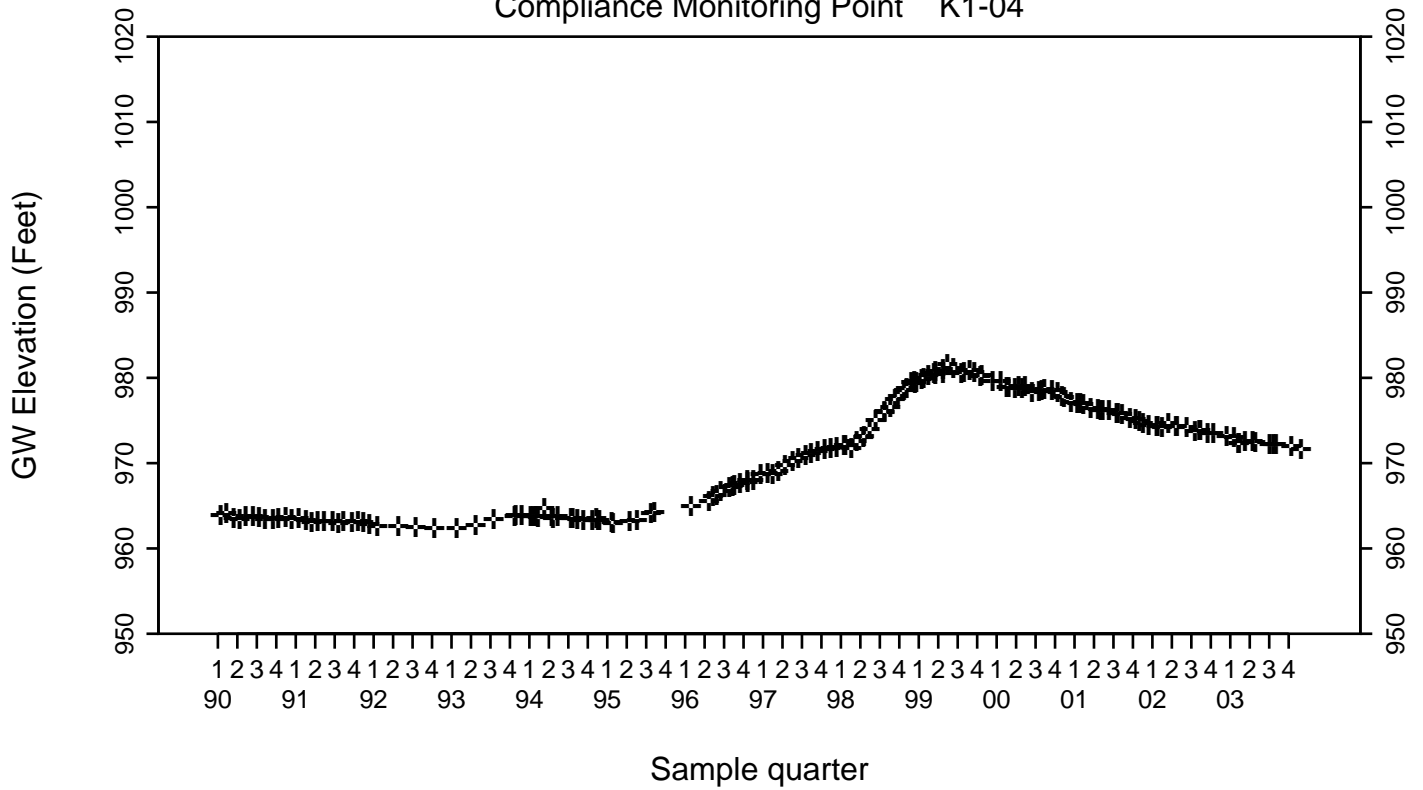


Compliance Monitoring Point K1-03

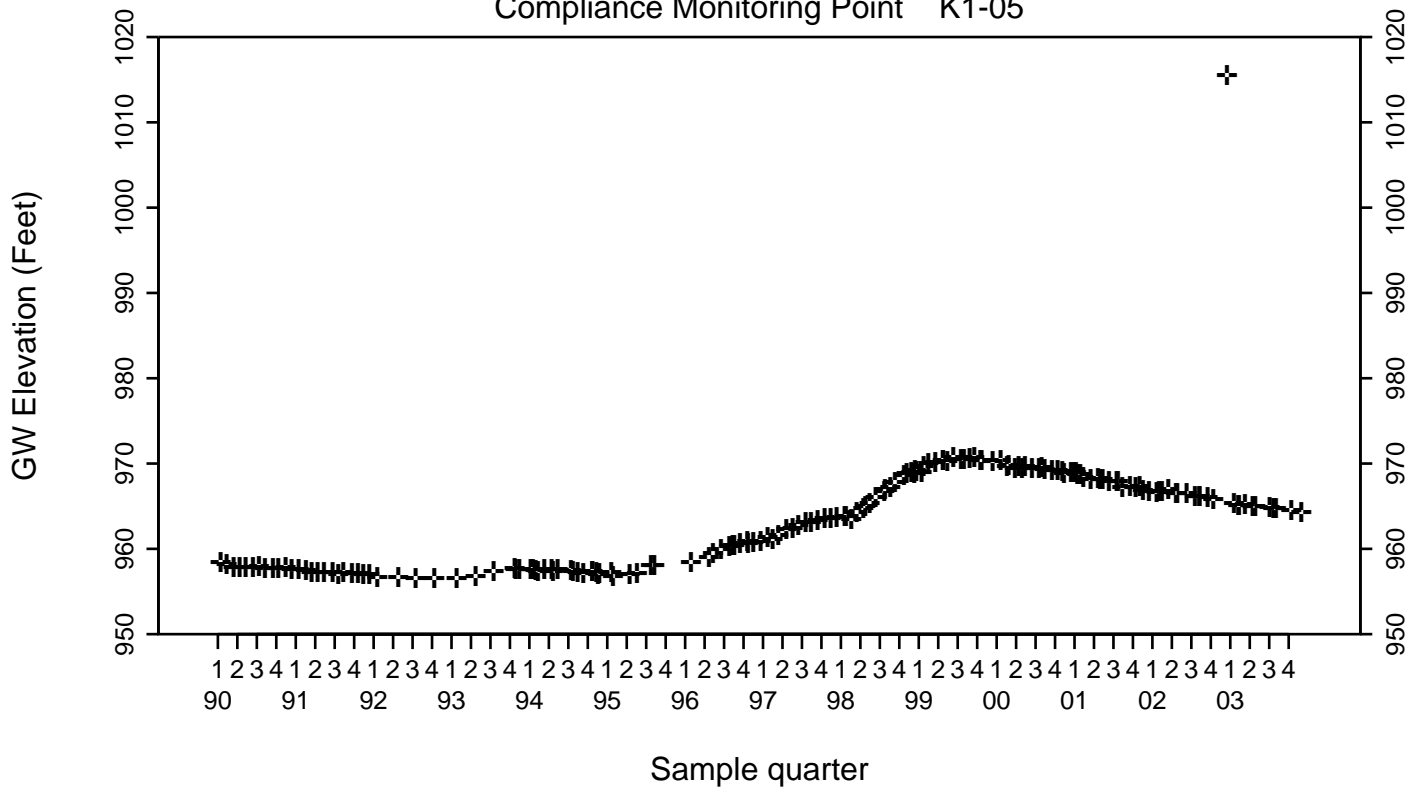


Pit 1 Area GW Elevation (Feet)

Compliance Monitoring Point K1-04

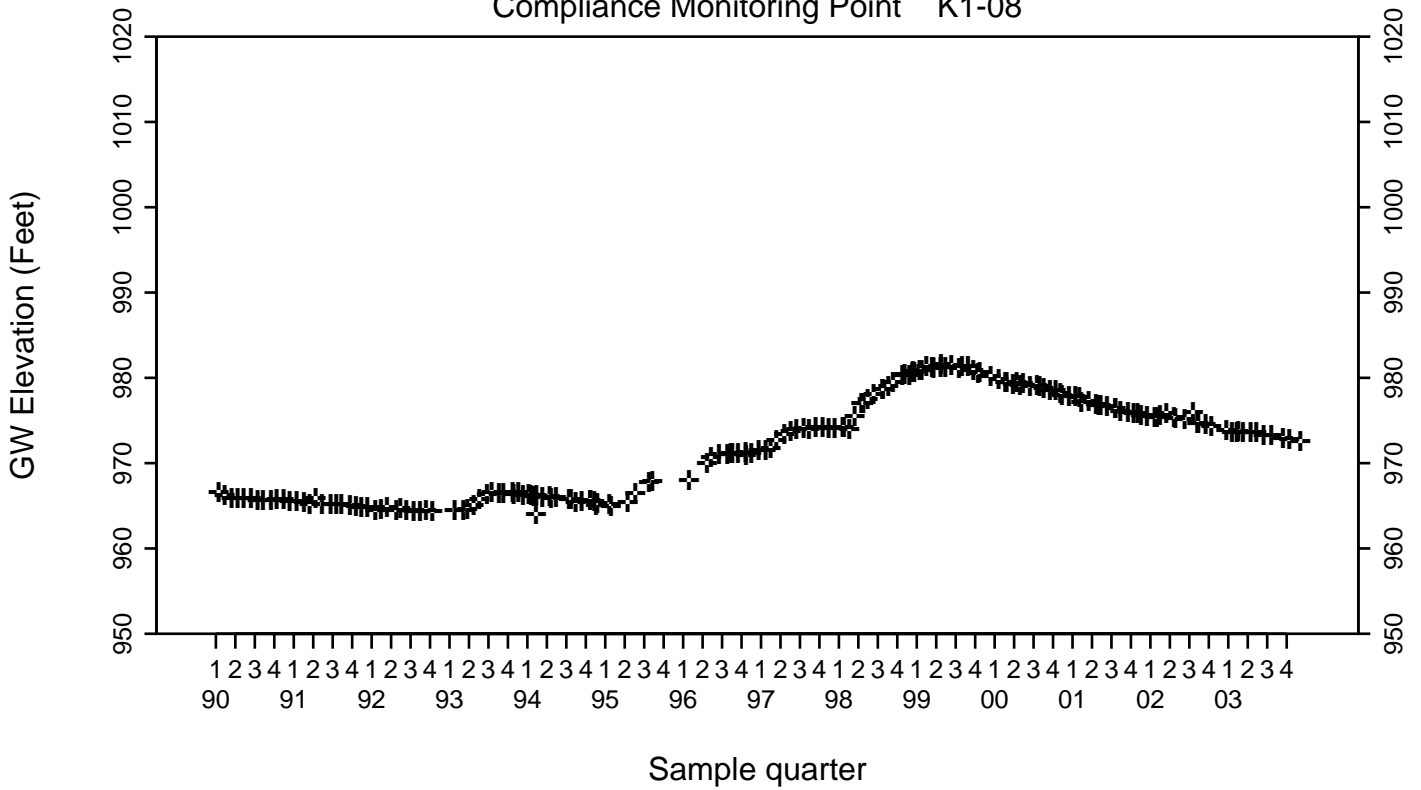


Compliance Monitoring Point K1-05

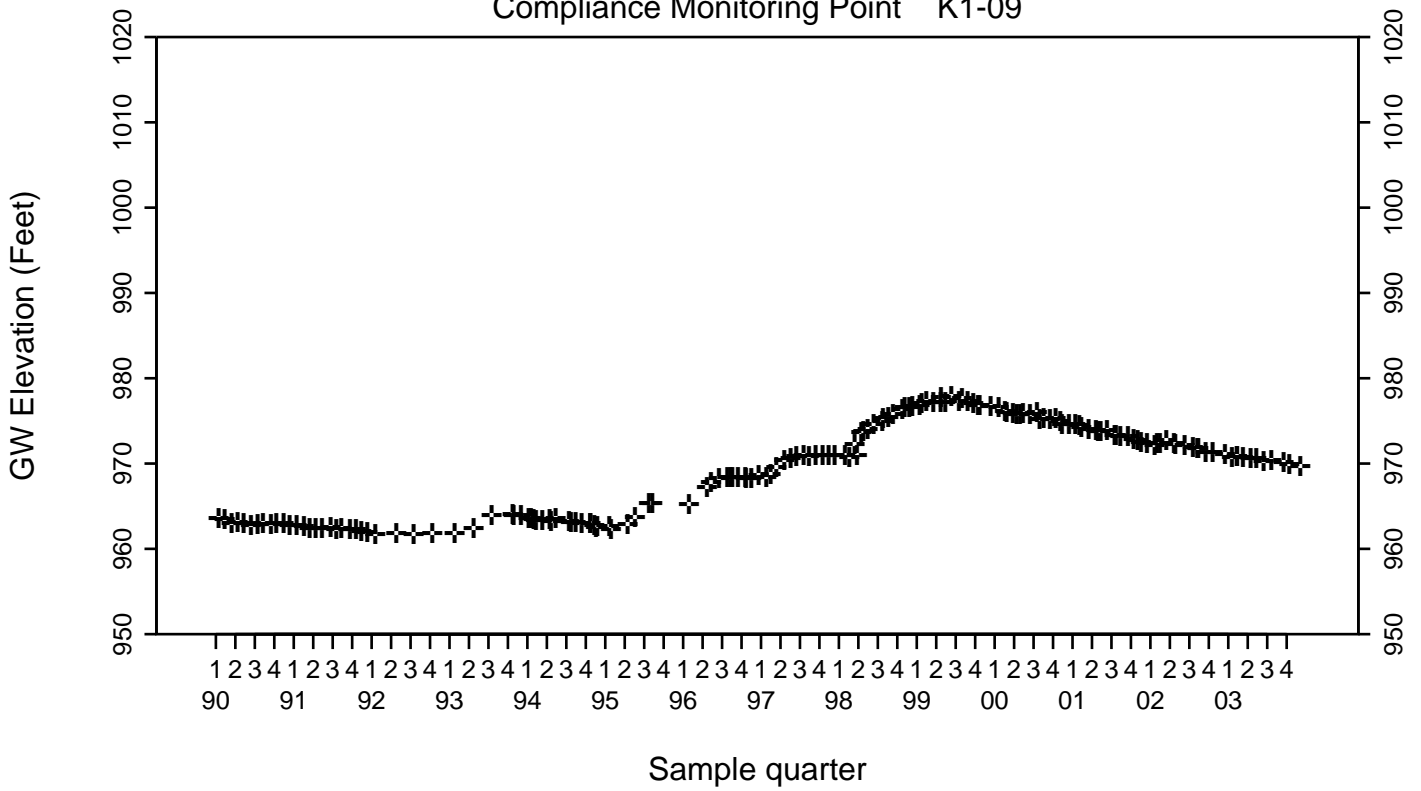


Pit 1 Area GW Elevation (Feet)

Compliance Monitoring Point K1-08

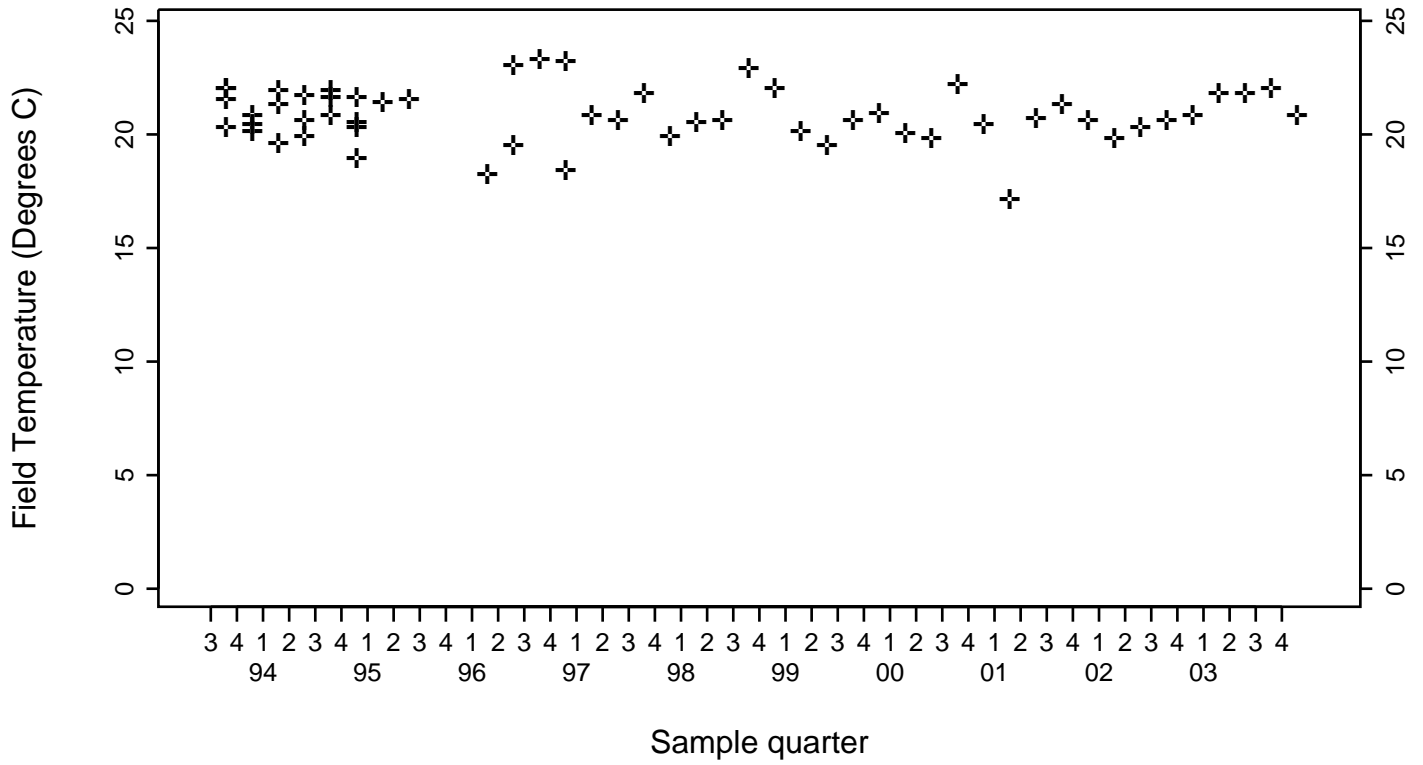


Compliance Monitoring Point K1-09

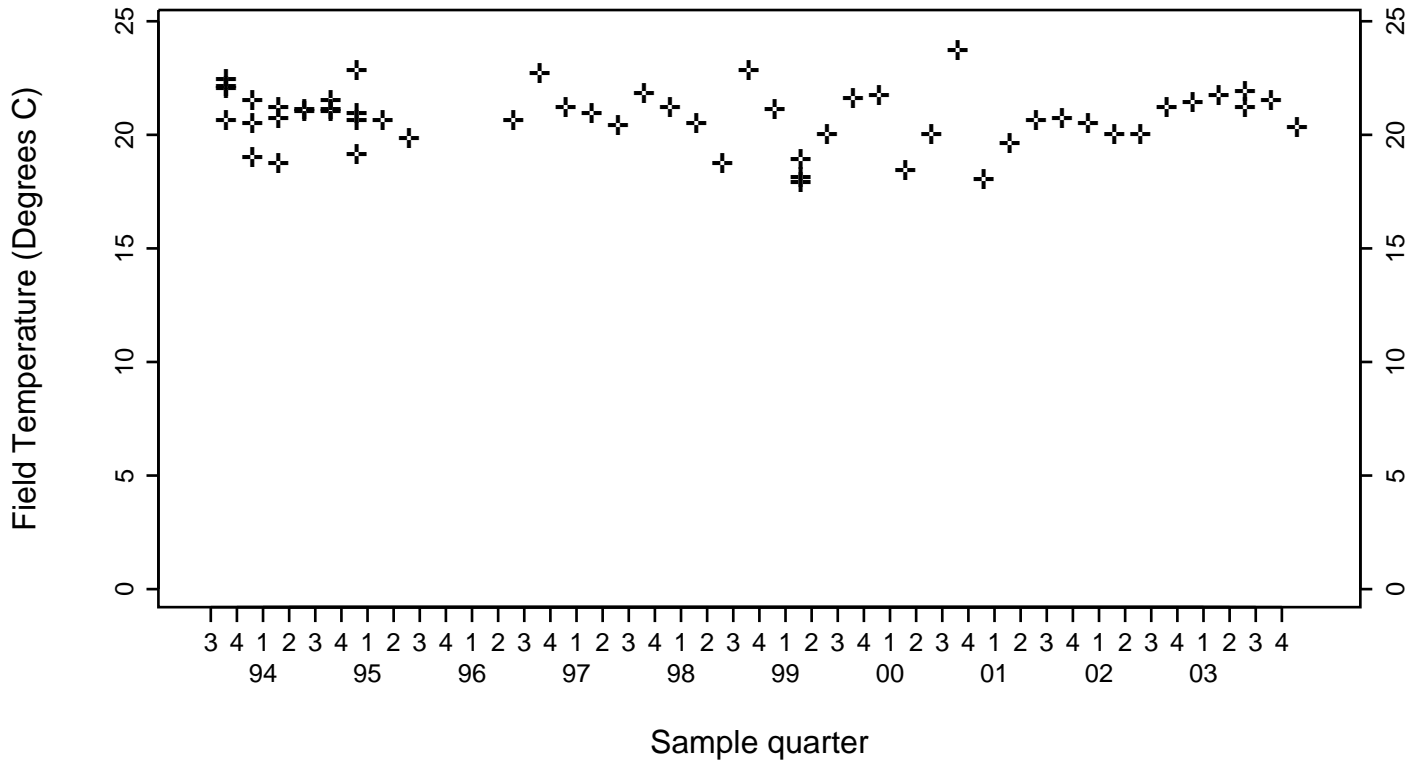


Pit 1 Area Field Temperature (Degrees C)

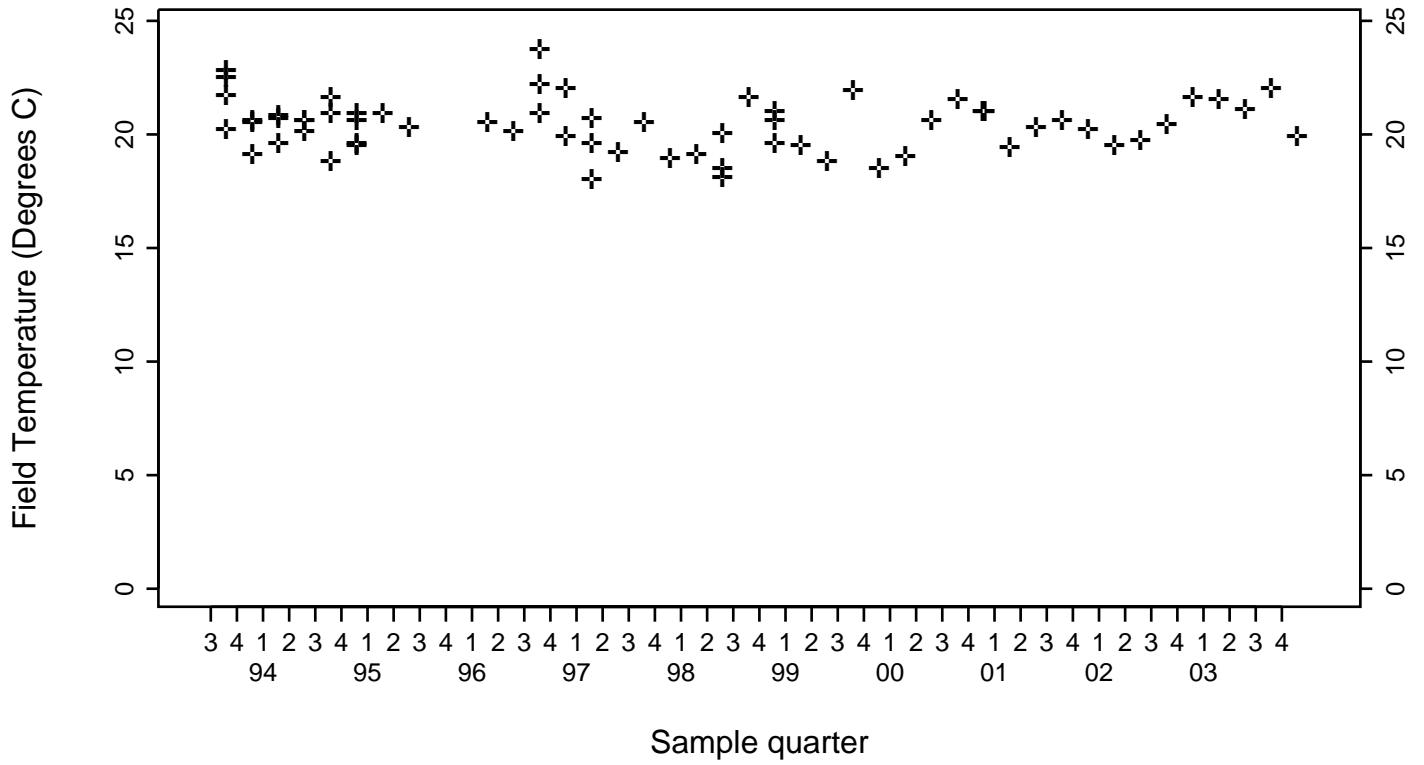
Background Monitoring Point K1-01C



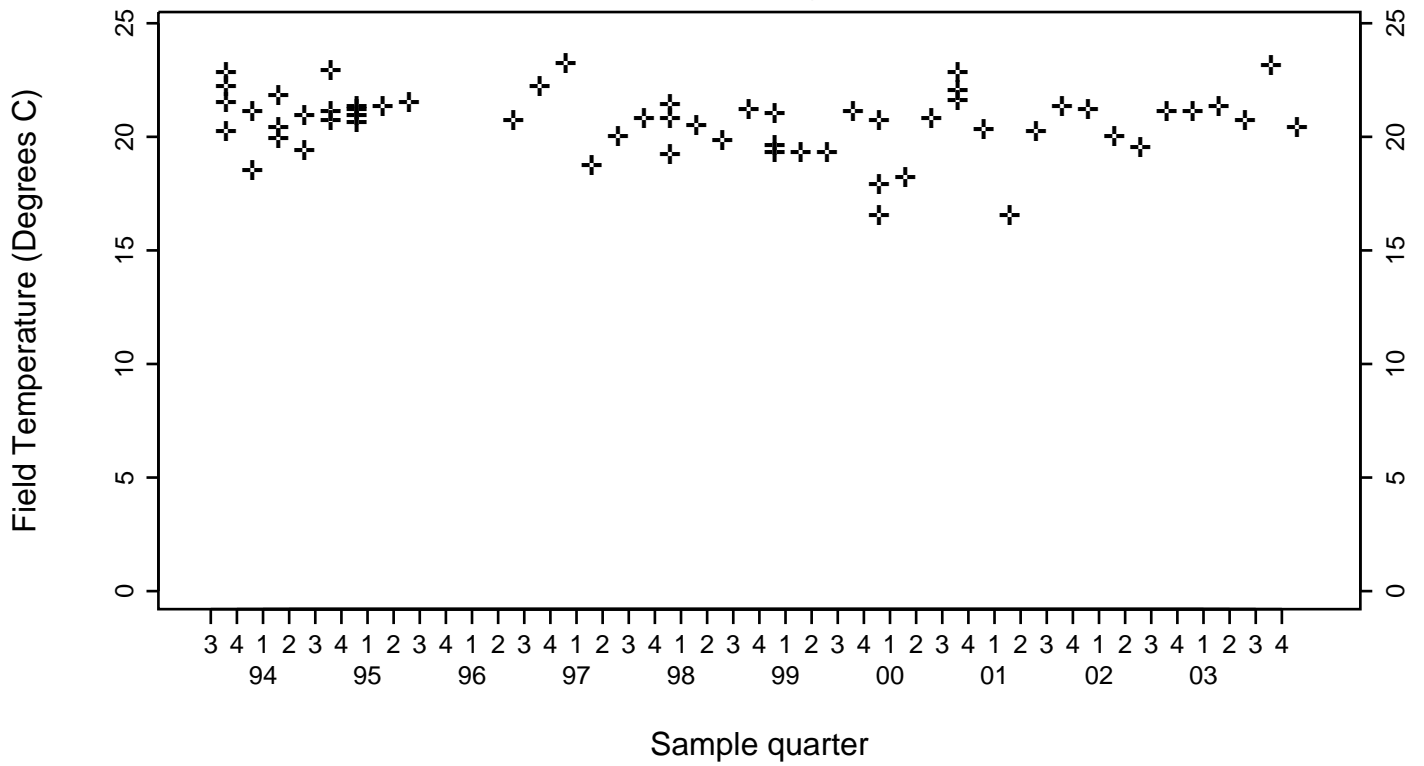
Background Monitoring Point K1-07



Pit 1 Area
Field Temperature (Degrees C)
Compliance Monitoring Point K1-02B

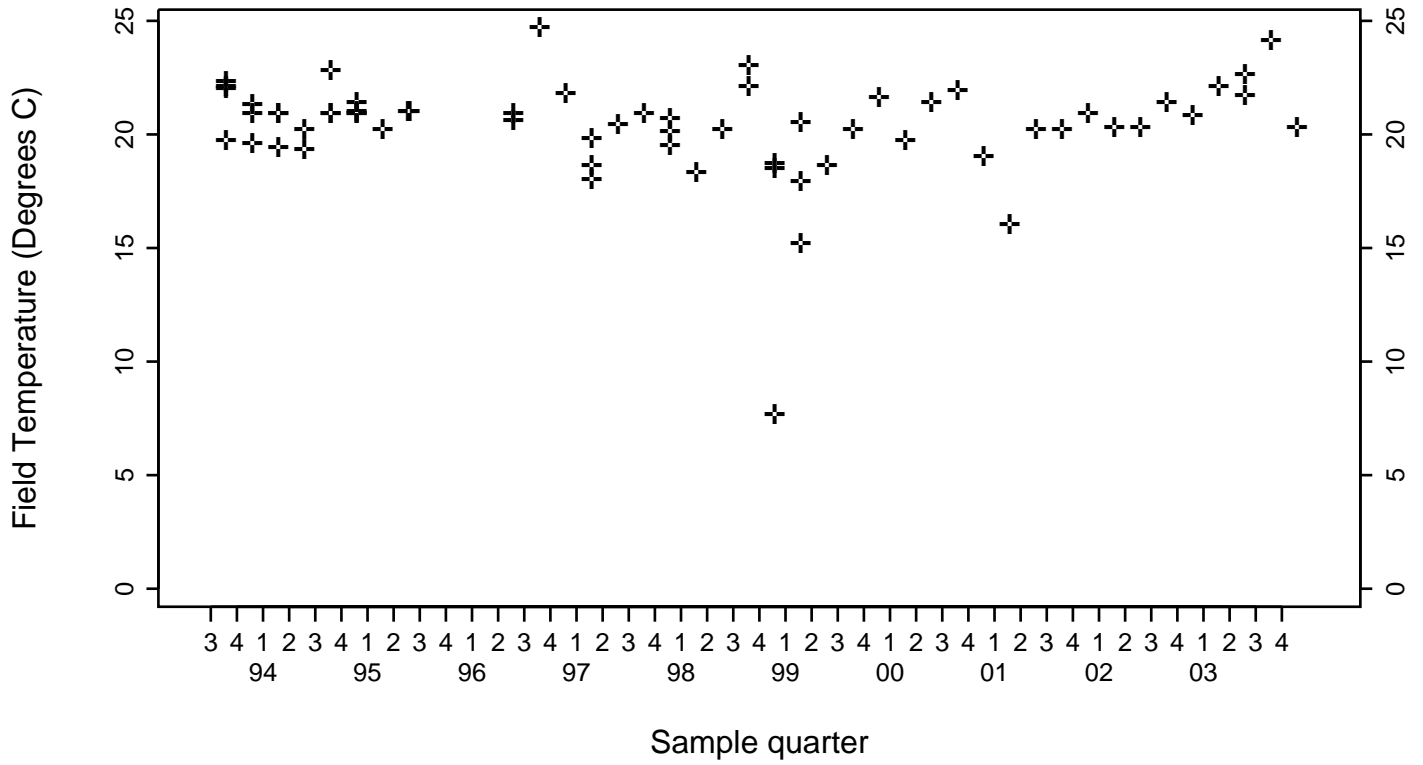


Compliance Monitoring Point K1-03

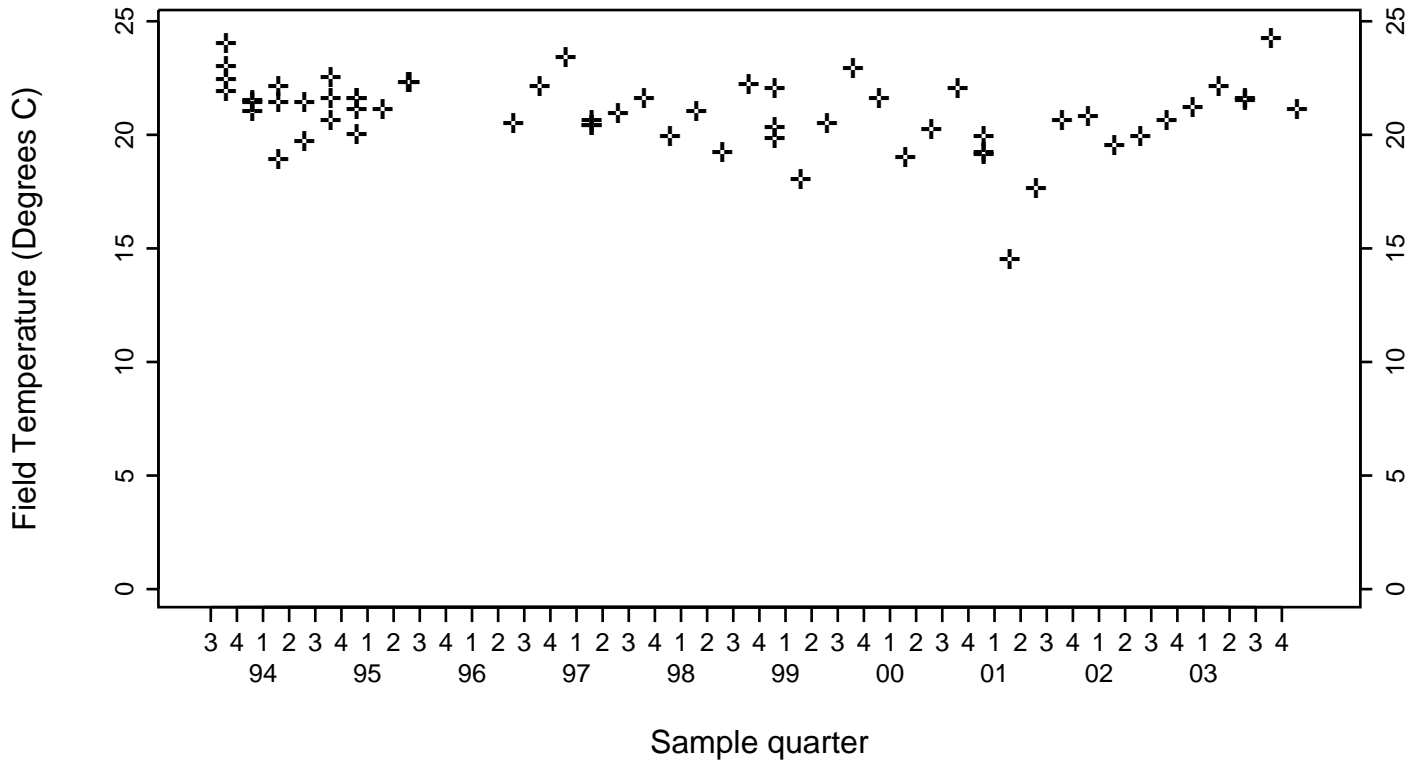


Pit 1 Area Field Temperature (Degrees C)

Compliance Monitoring Point K1-04

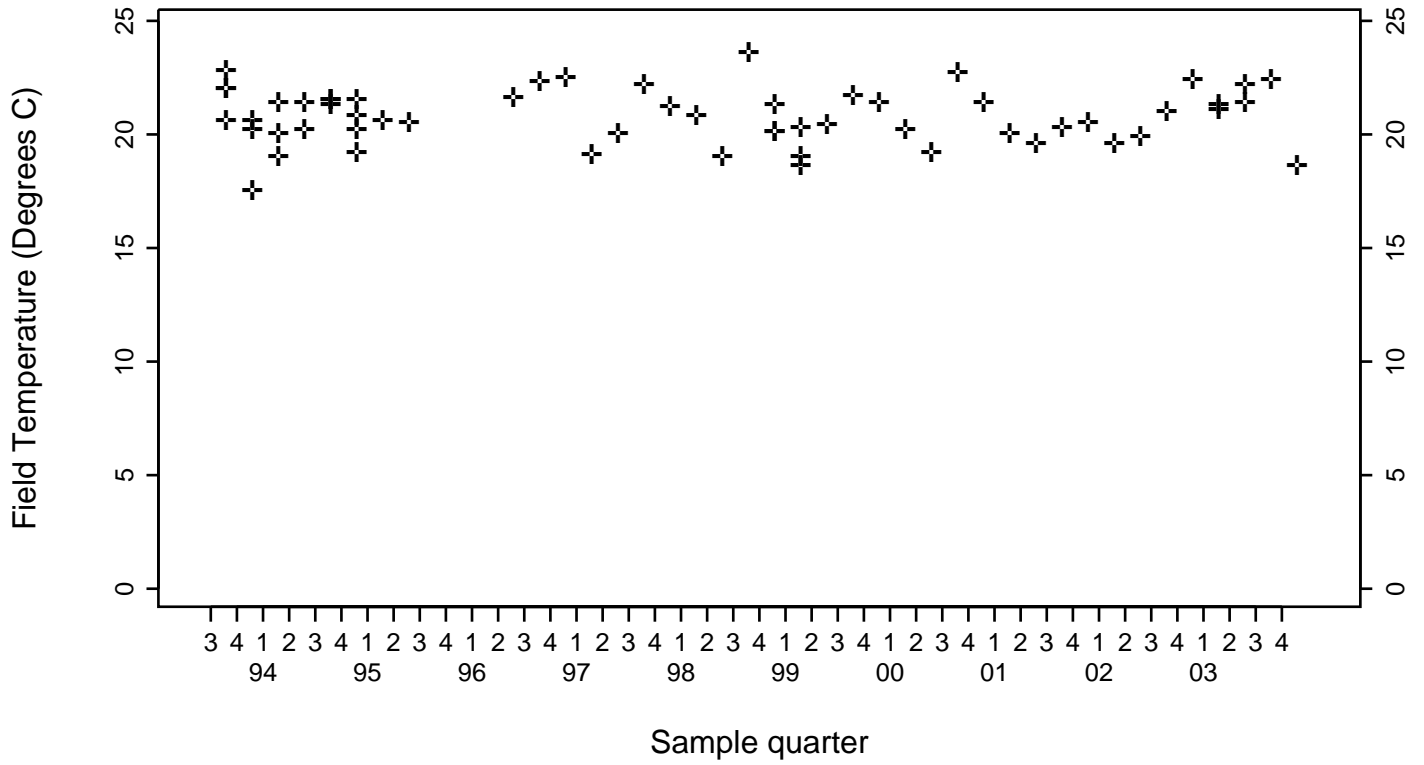


Compliance Monitoring Point K1-05

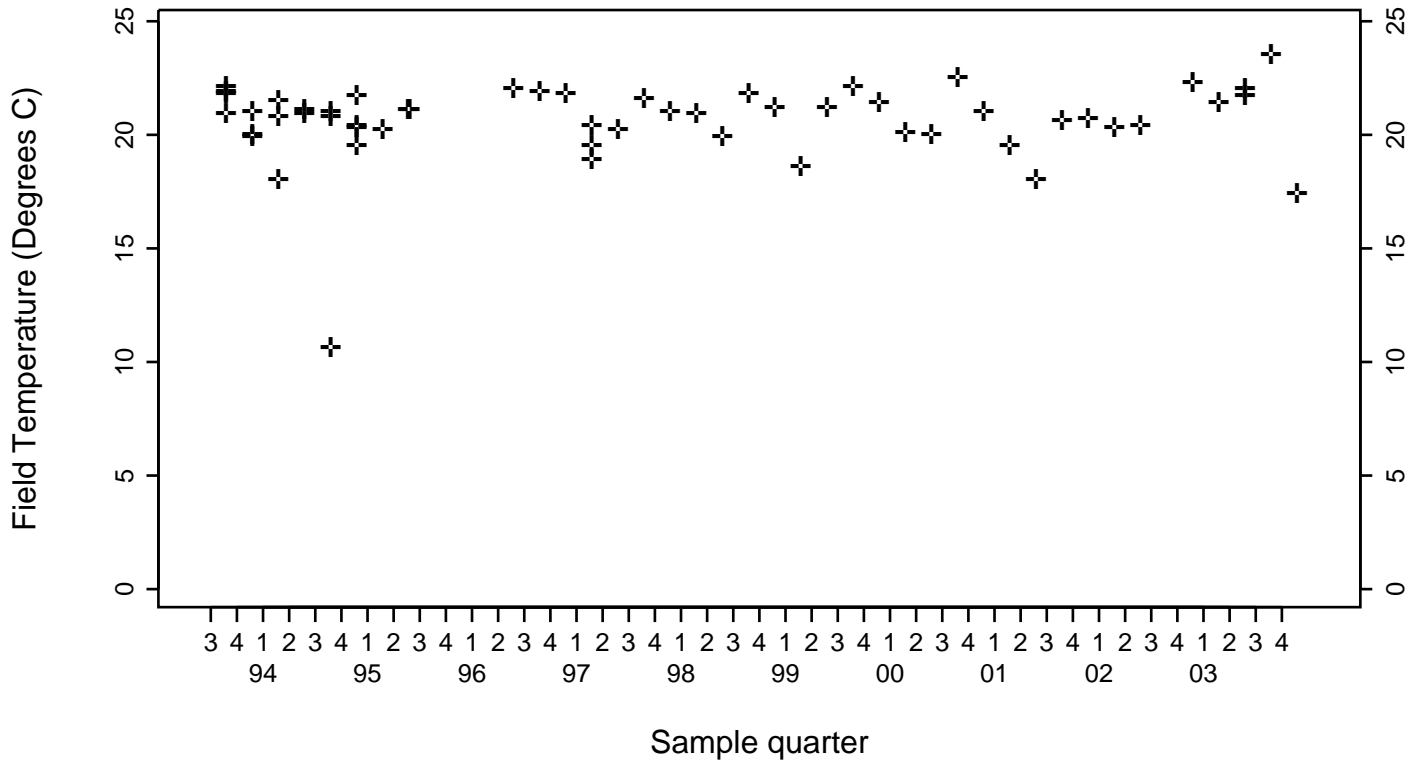


Pit 1 Area Field Temperature (Degrees C)

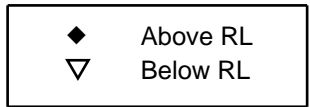
Compliance Monitoring Point K1-08



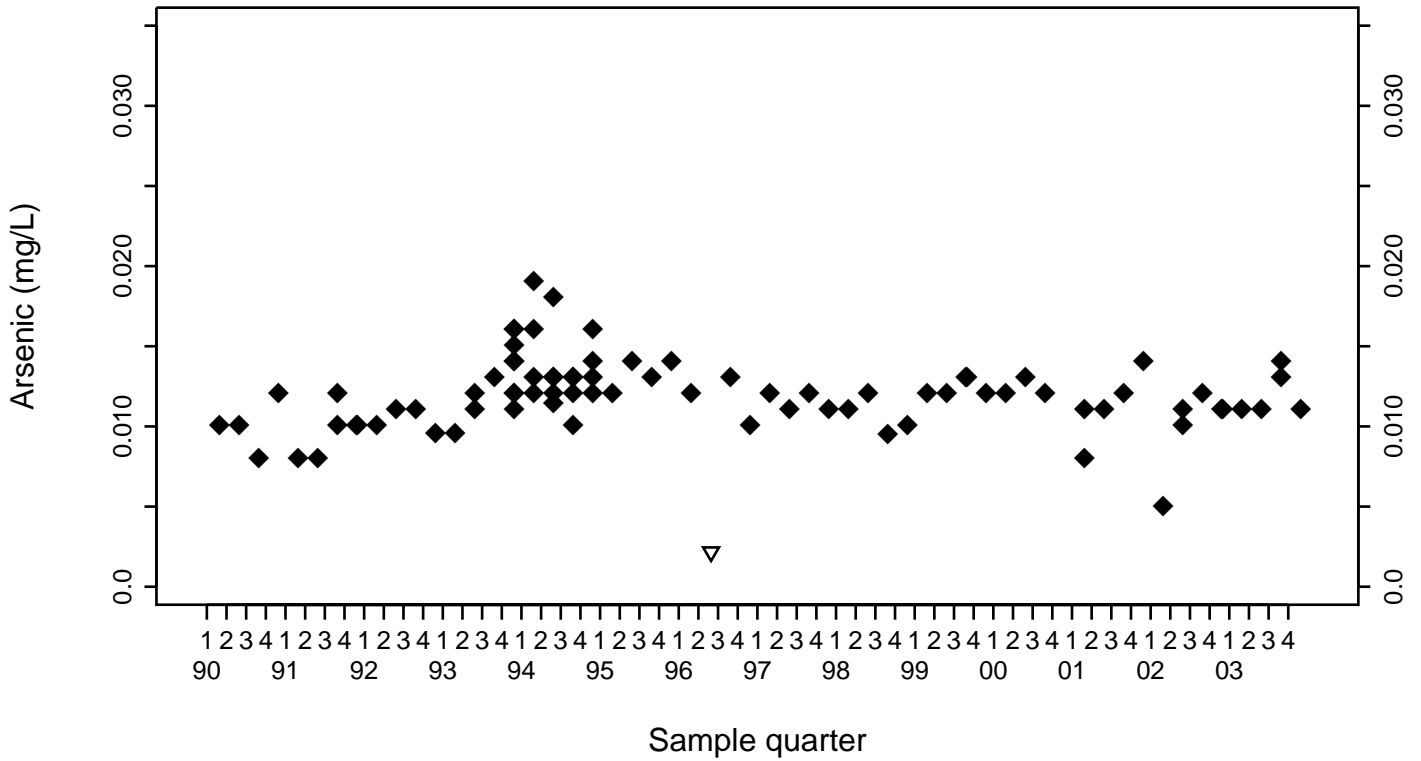
Compliance Monitoring Point K1-09



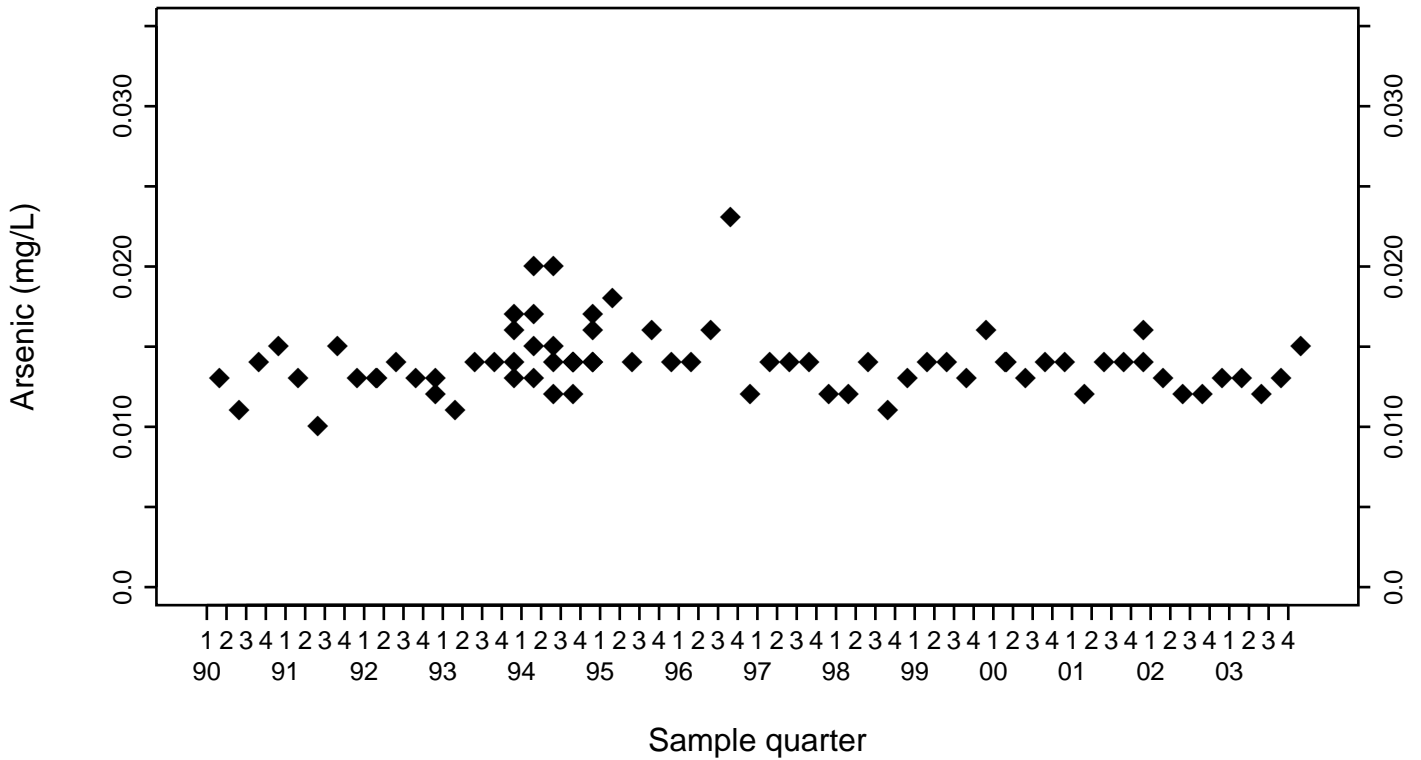
Pit 1 Area Arsenic (mg/L)



Background Monitoring Point K1-01C



Background Monitoring Point K1-07

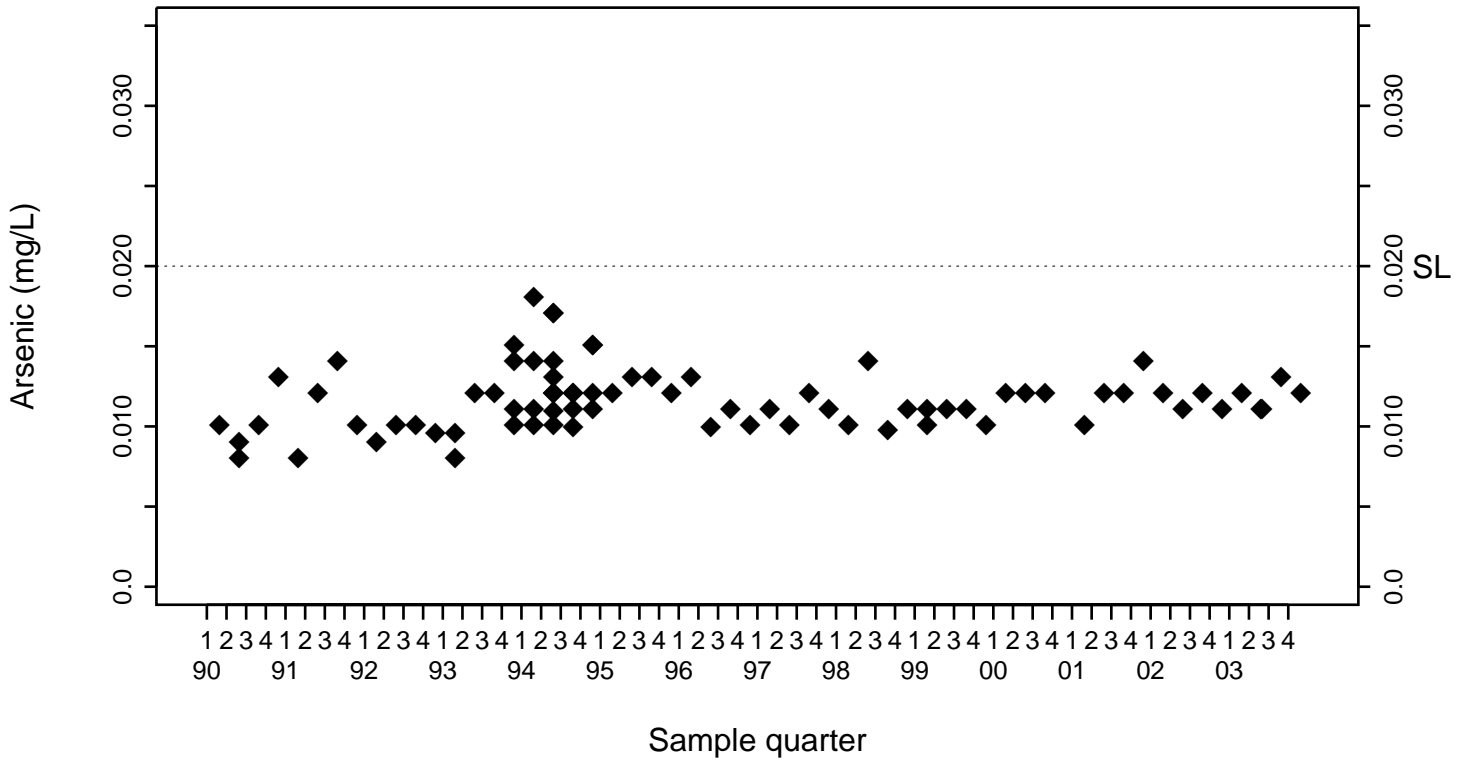


Pit 1 Area Arsenic (mg/L)

SL=0.02

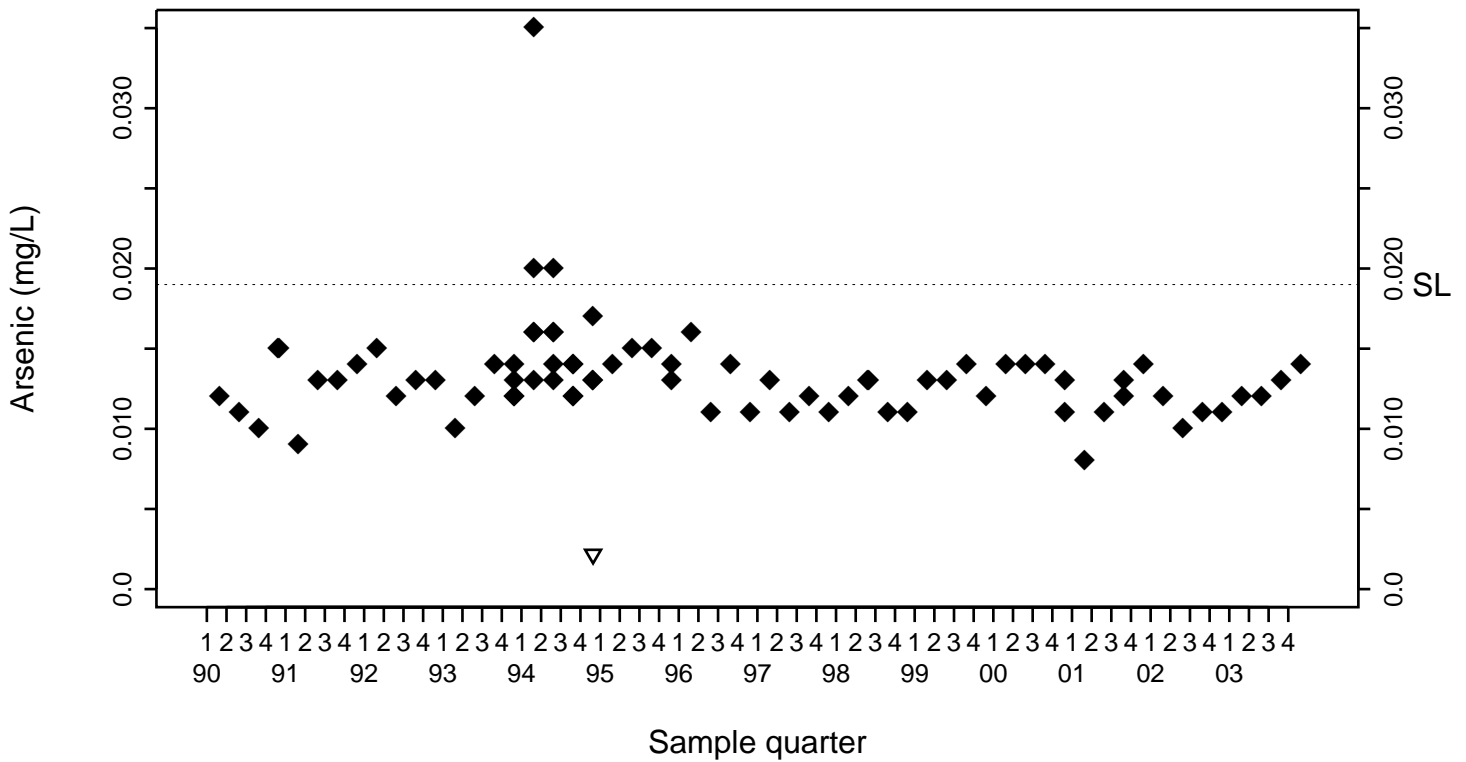
◆ Above RL
▽ Below RL

Compliance Monitoring Point K1-02B



SL=0.019

Compliance Monitoring Point K1-03

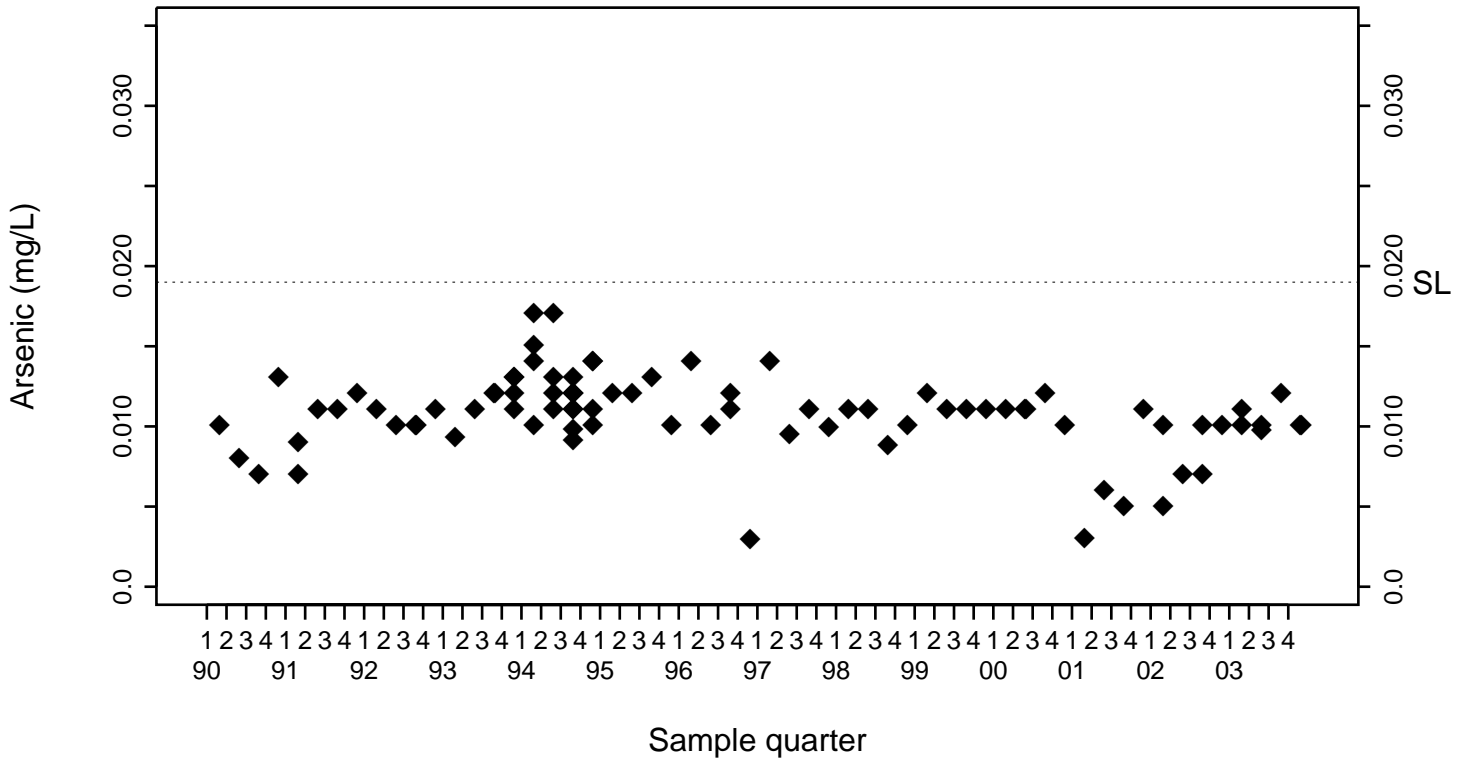


Pit 1 Area Arsenic (mg/L)

SL=0.019

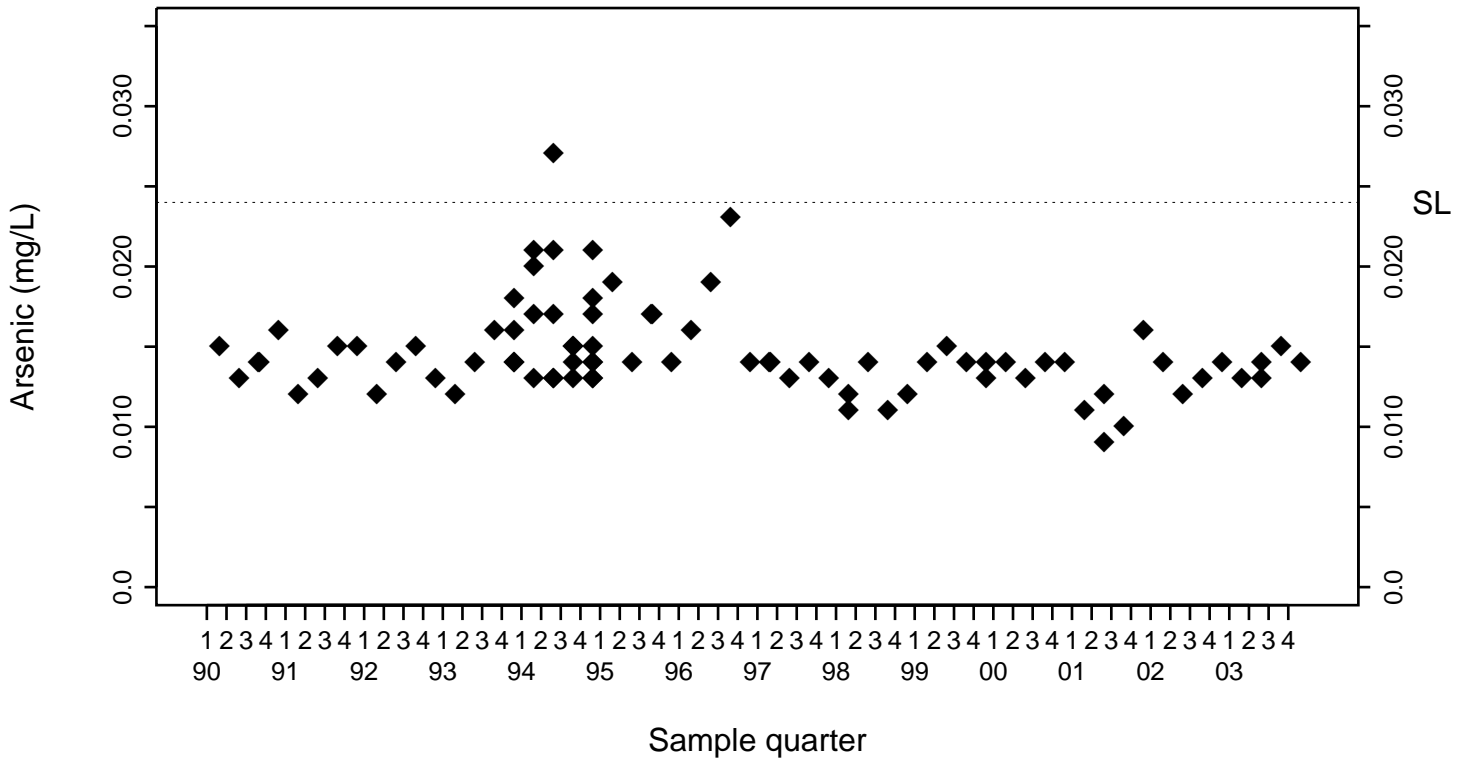
◆ Above RL
▽ Below RL

Compliance Monitoring Point K1-04



SL=0.024

Compliance Monitoring Point K1-05

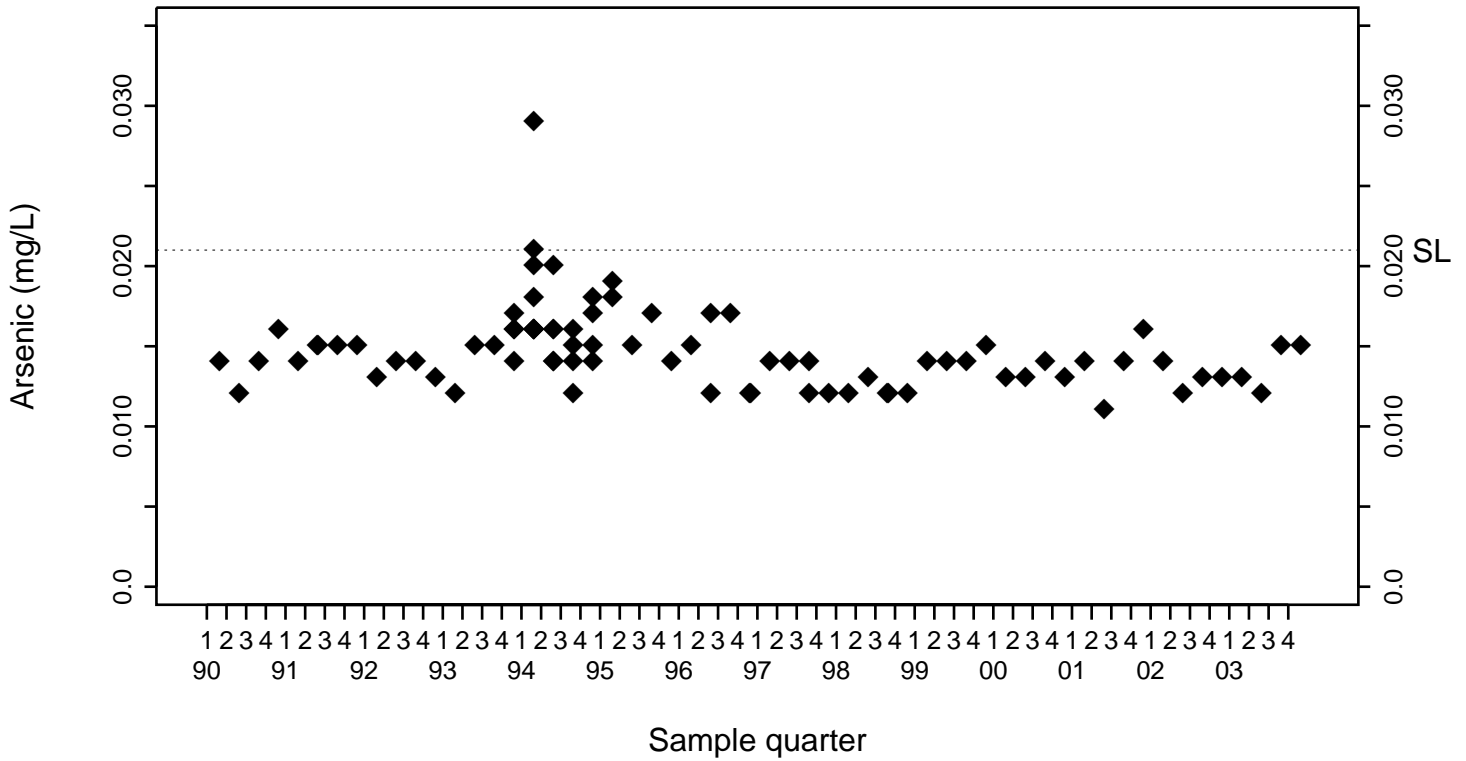


Pit 1 Area Arsenic (mg/L)

SL=0.021

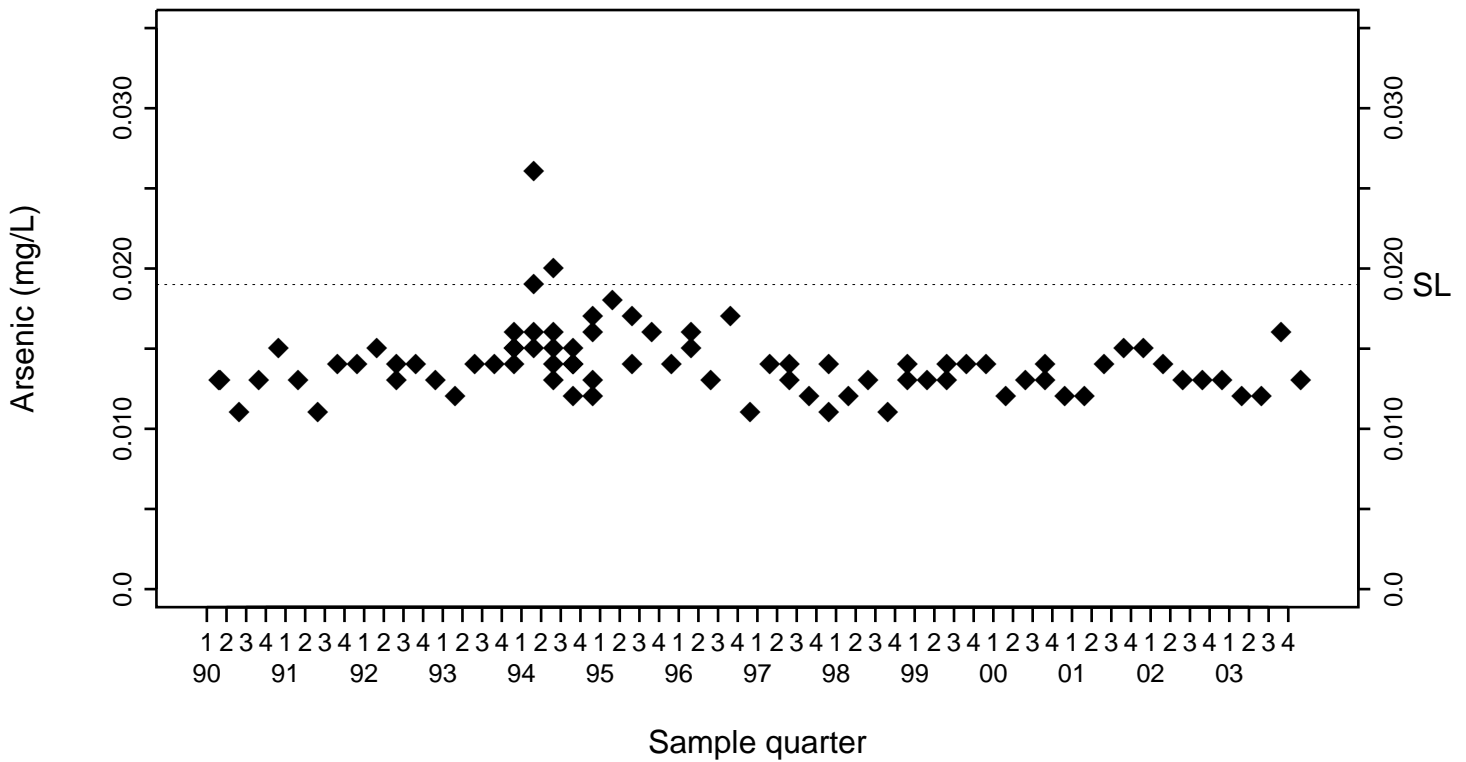
◆ Above RL
▽ Below RL

Compliance Monitoring Point K1-08



SL=0.019

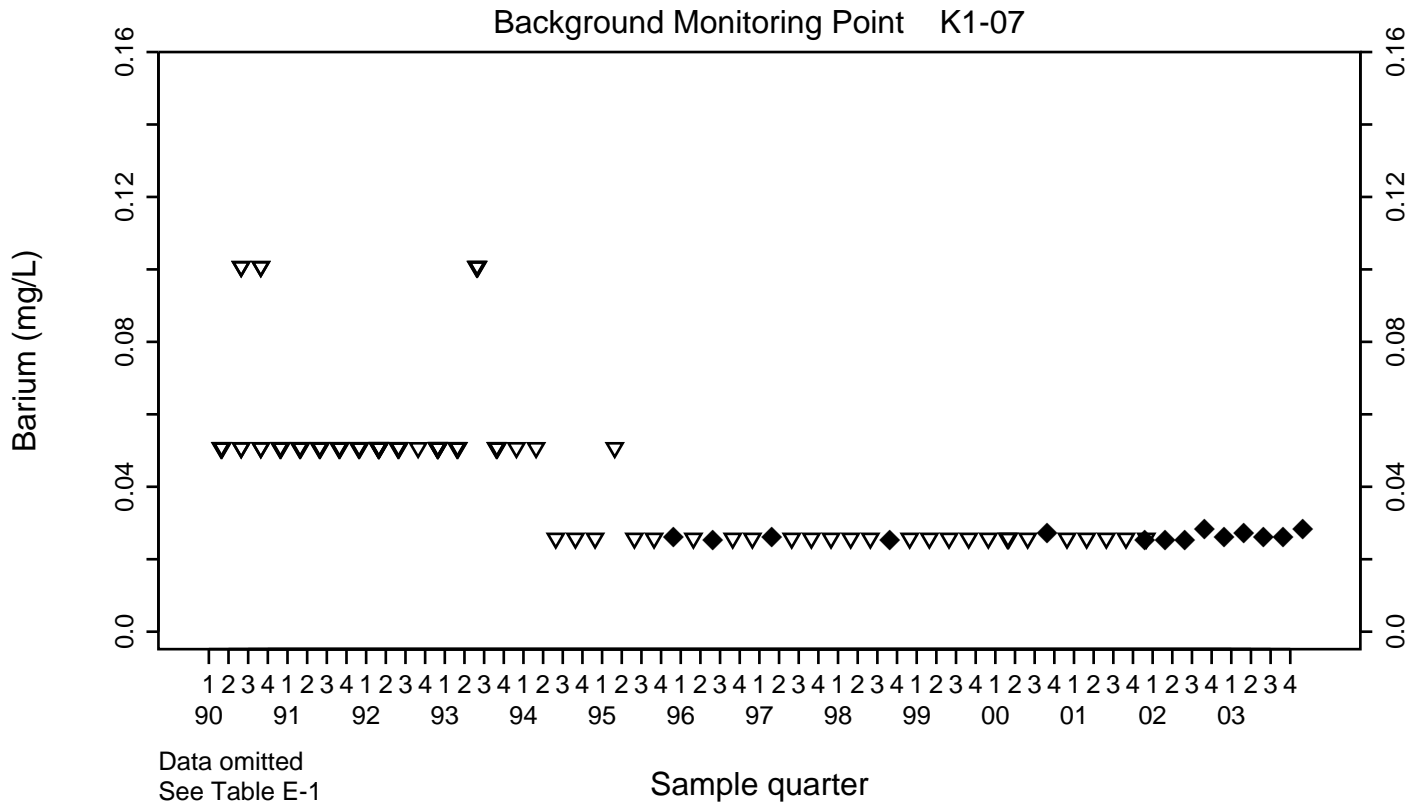
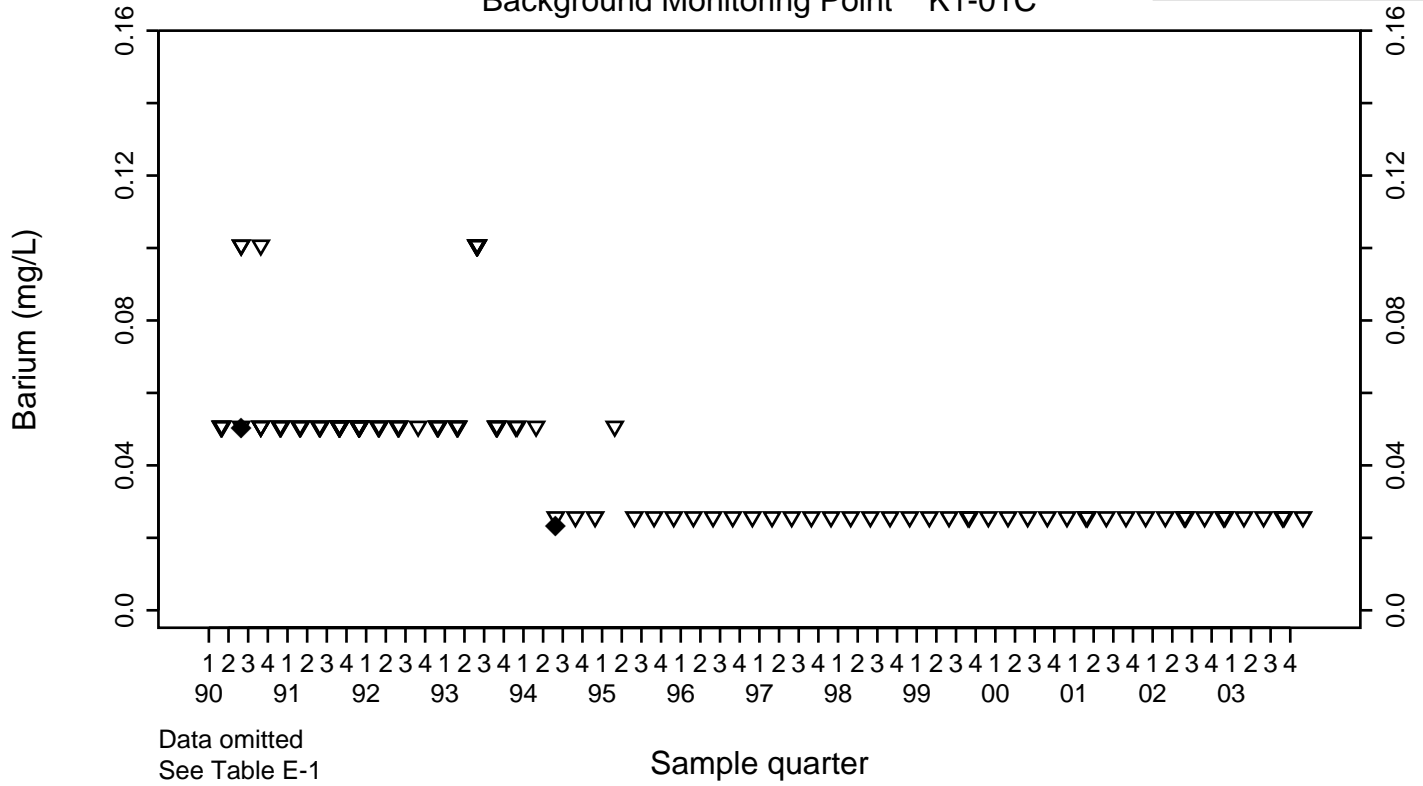
Compliance Monitoring Point K1-09



Pit 1 Area Barium (mg/L)

◆	Above RL
▽	Below RL

Background Monitoring Point K1-01C

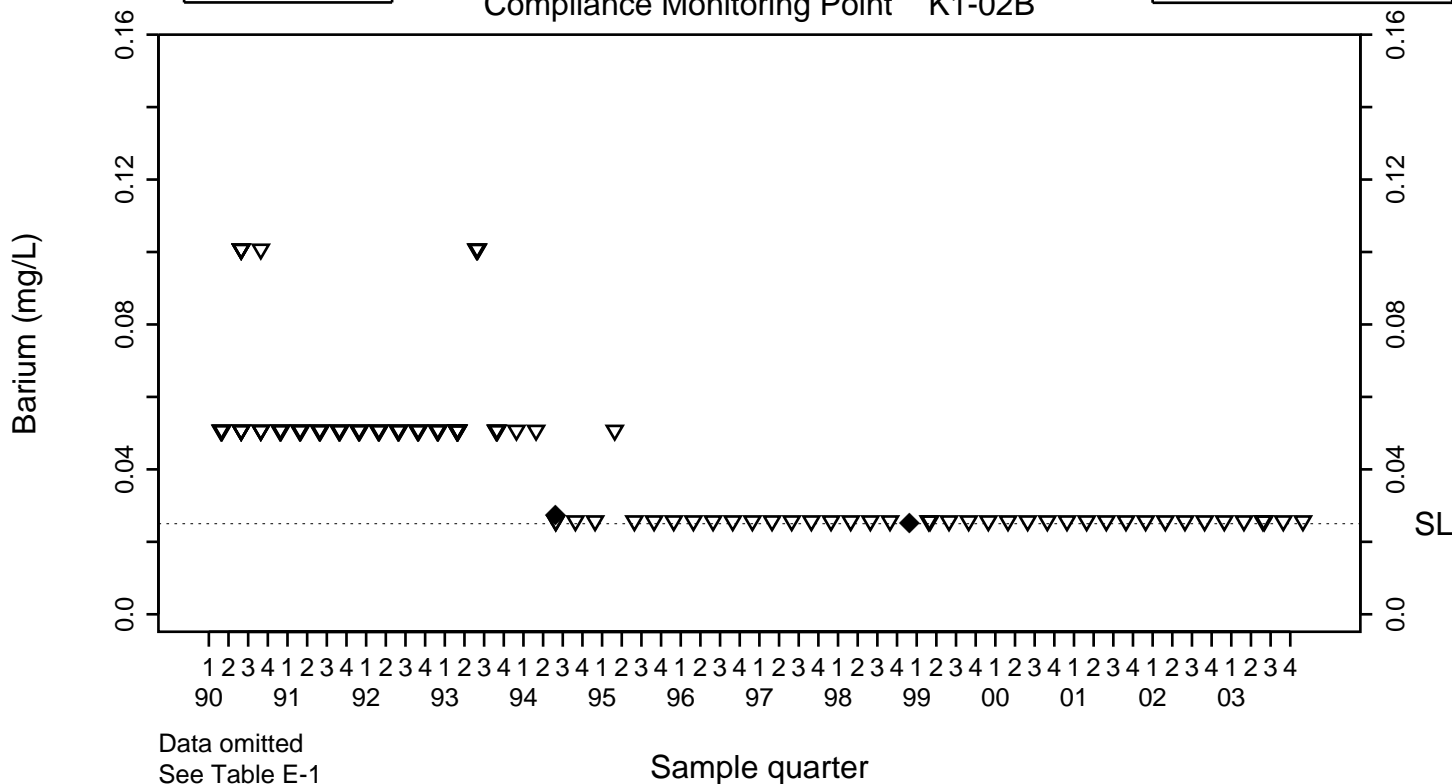


Pit 1 Area Barium (mg/L)

SL=0.025

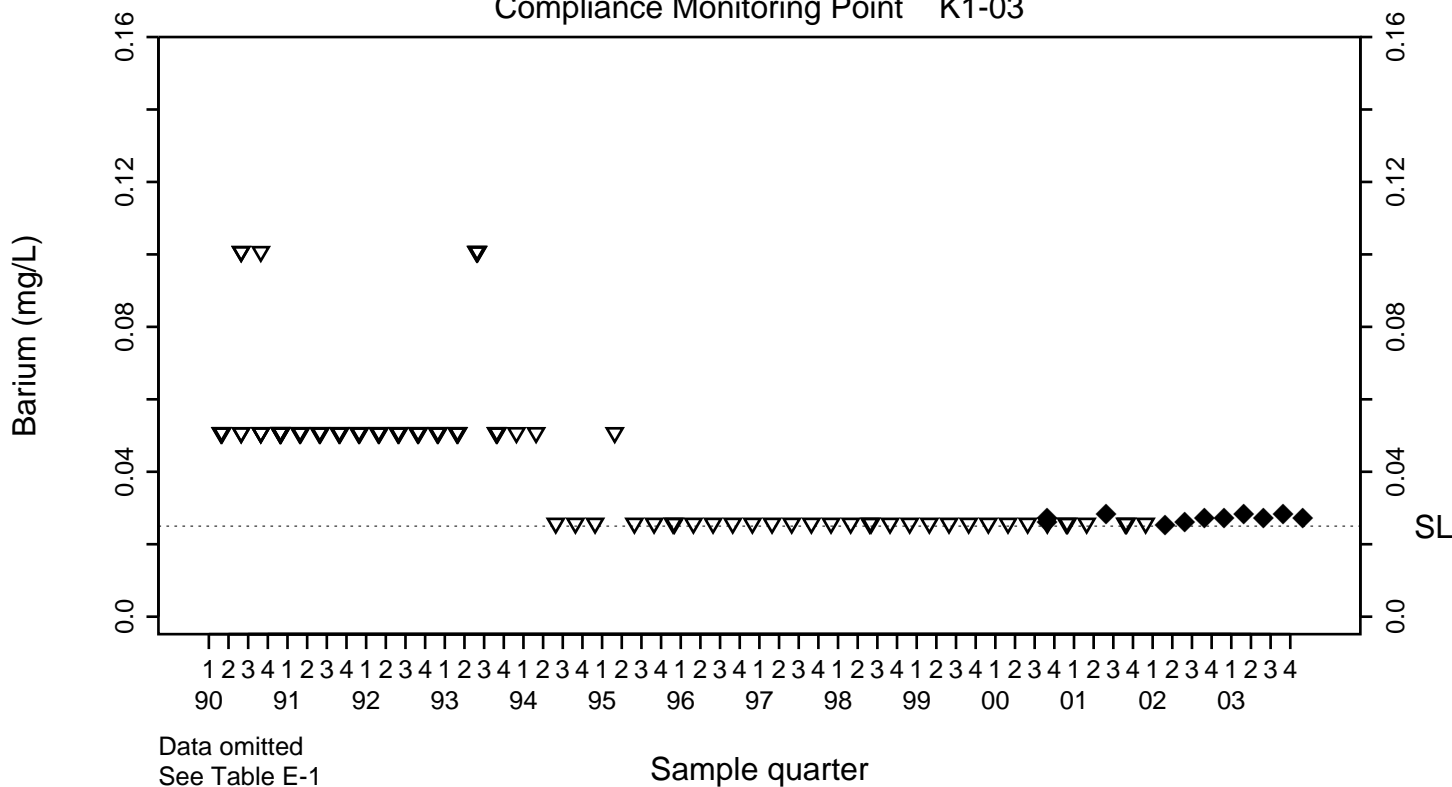
◆ Above RL
▽ Below RL

Compliance Monitoring Point K1-02B



SL=0.025

Compliance Monitoring Point K1-03

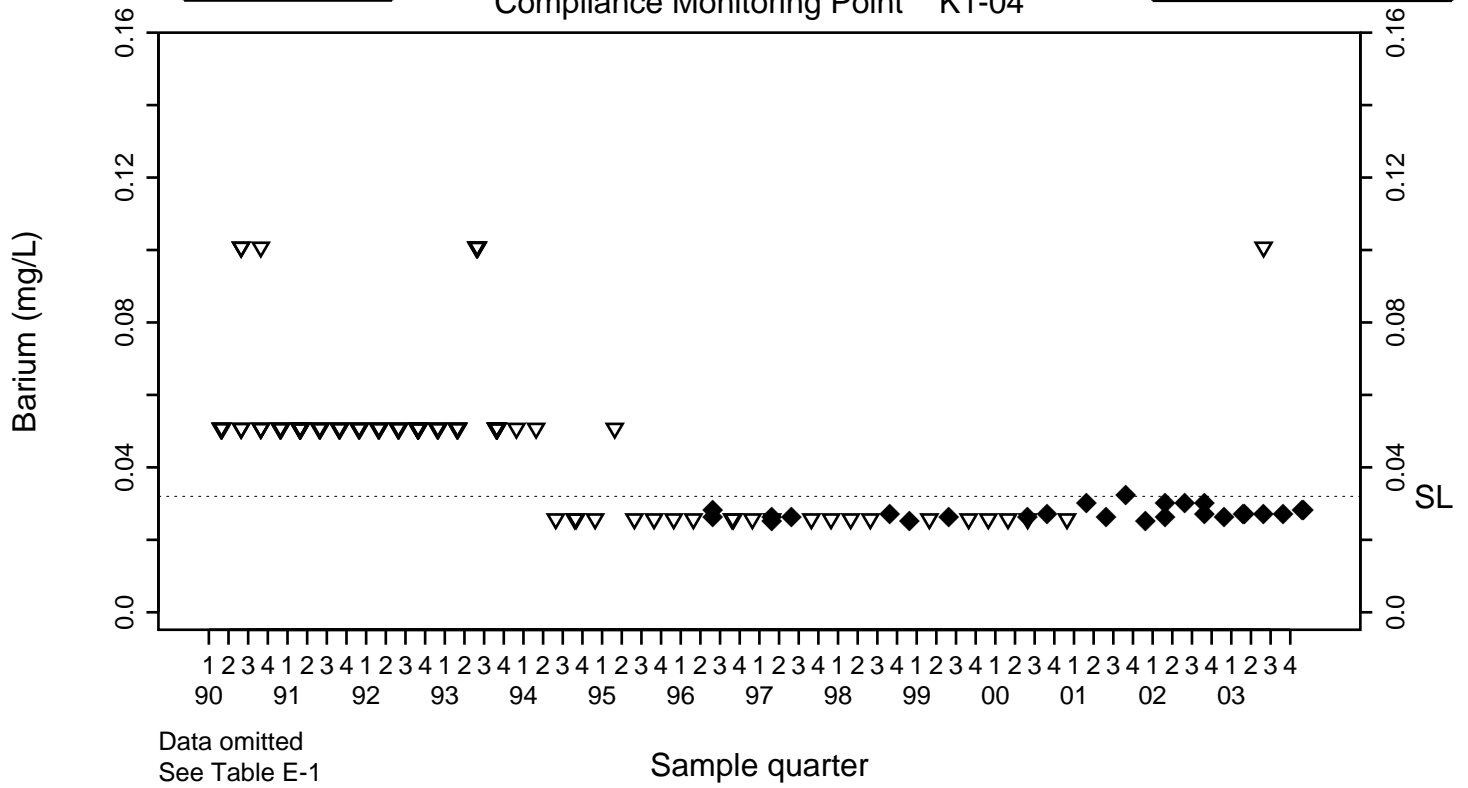


Pit 1 Area Barium (mg/L)

SL=0.032

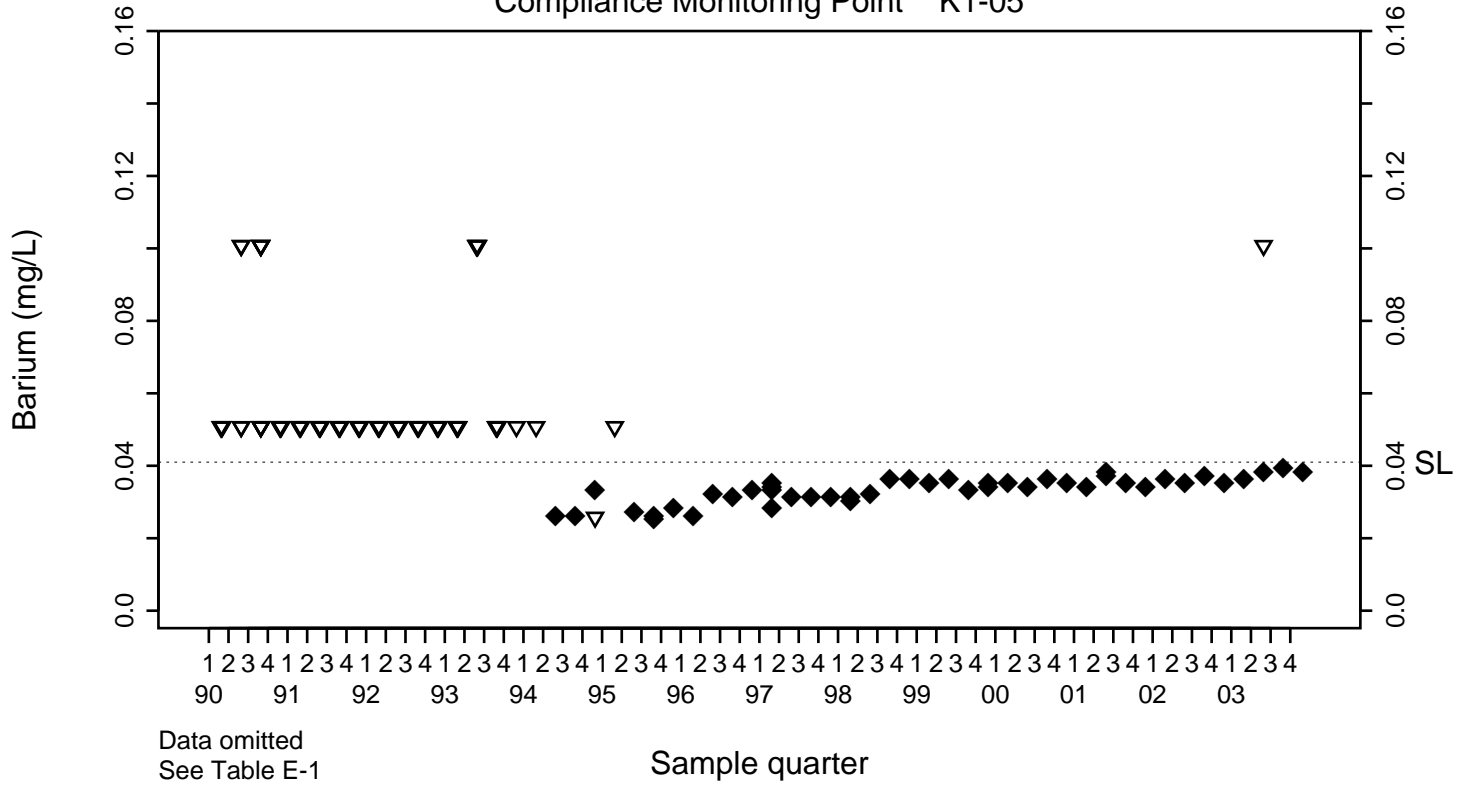
◆ Above RL
▽ Below RL

Compliance Monitoring Point K1-04



SL=0.041

Compliance Monitoring Point K1-05

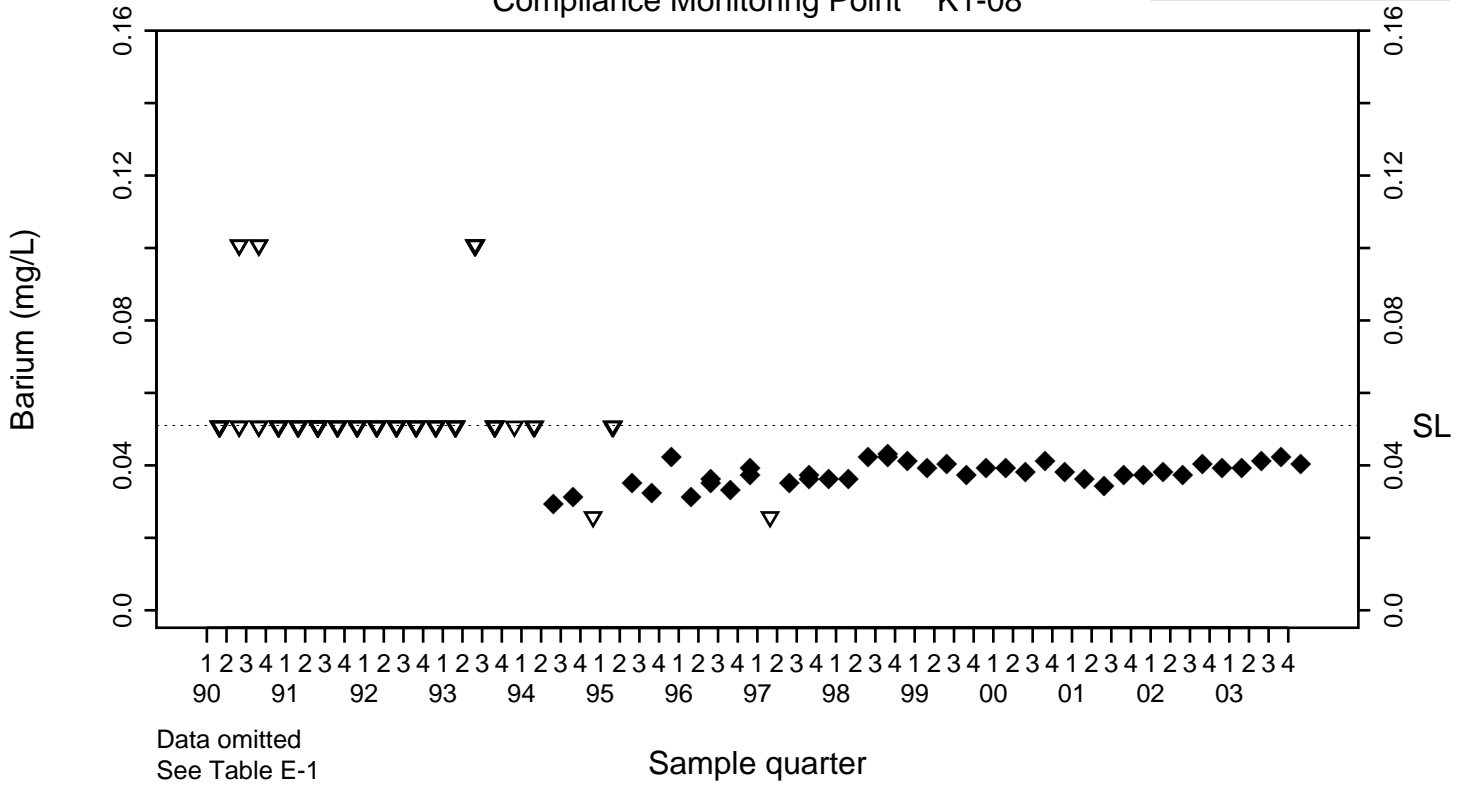


Pit 1 Area Barium (mg/L)

SL=0.051

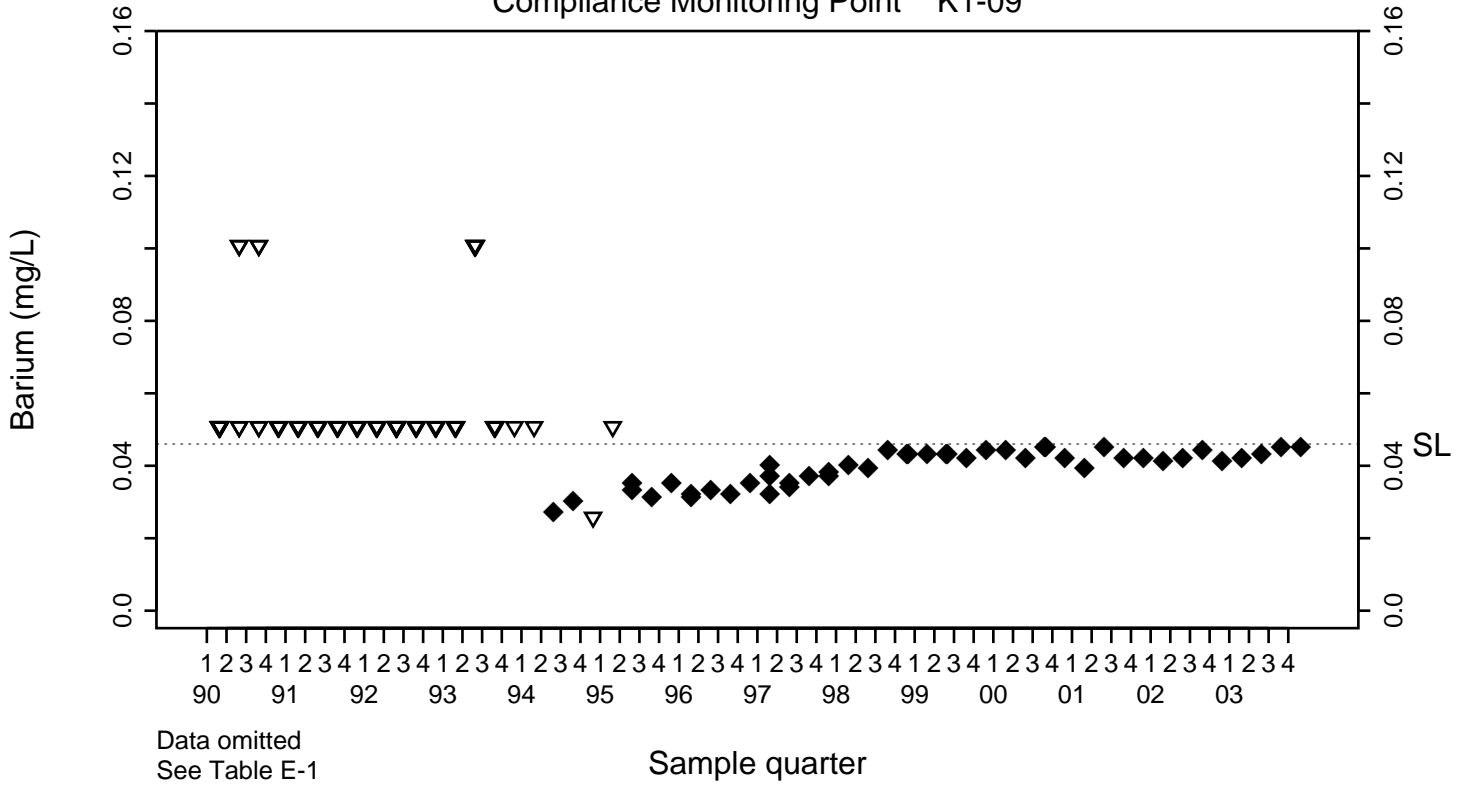
◆ Above RL
▽ Below RL

Compliance Monitoring Point K1-08



SL=0.046

Compliance Monitoring Point K1-09

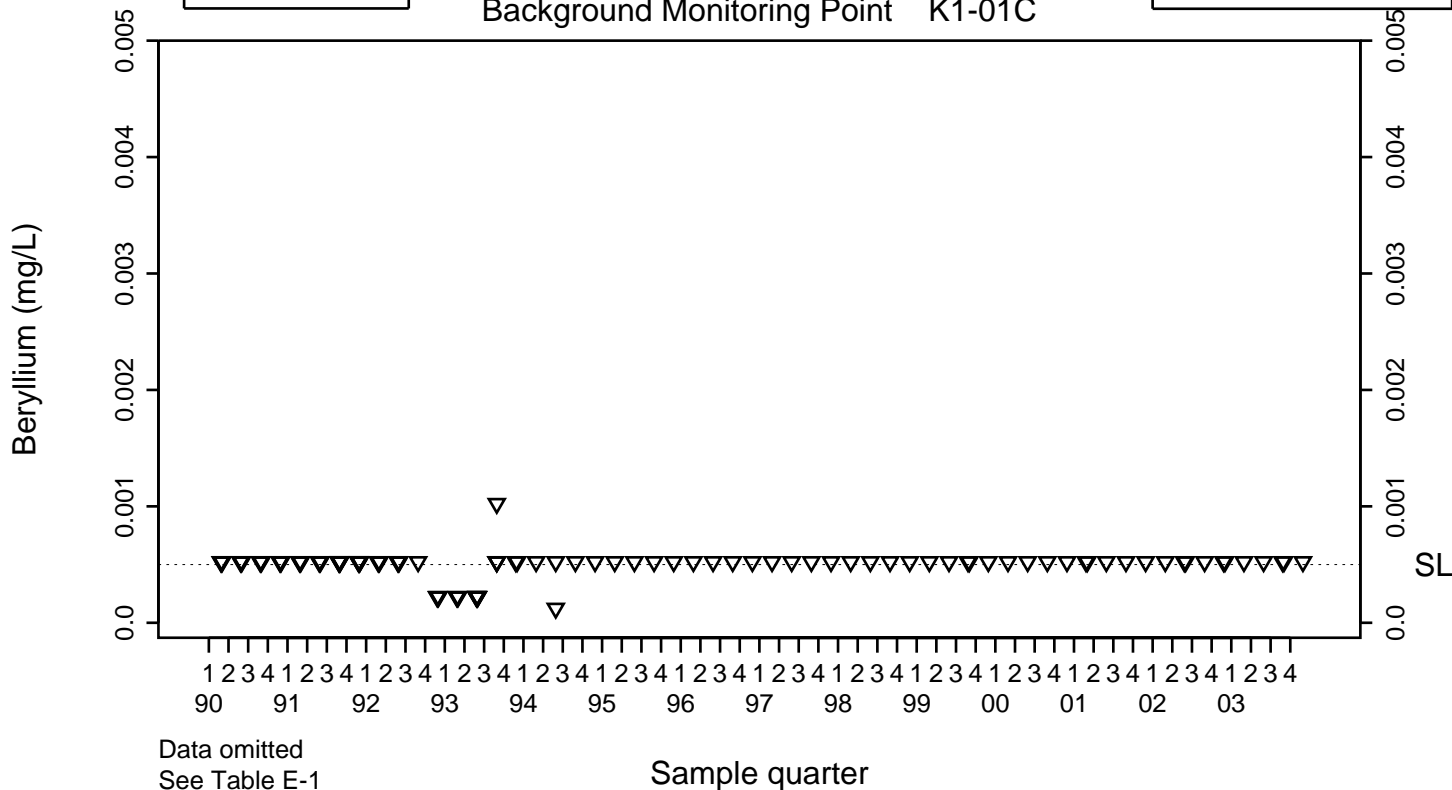


Pit 1 Area Beryllium (mg/L)

◆	Above RL
▽	Below RL

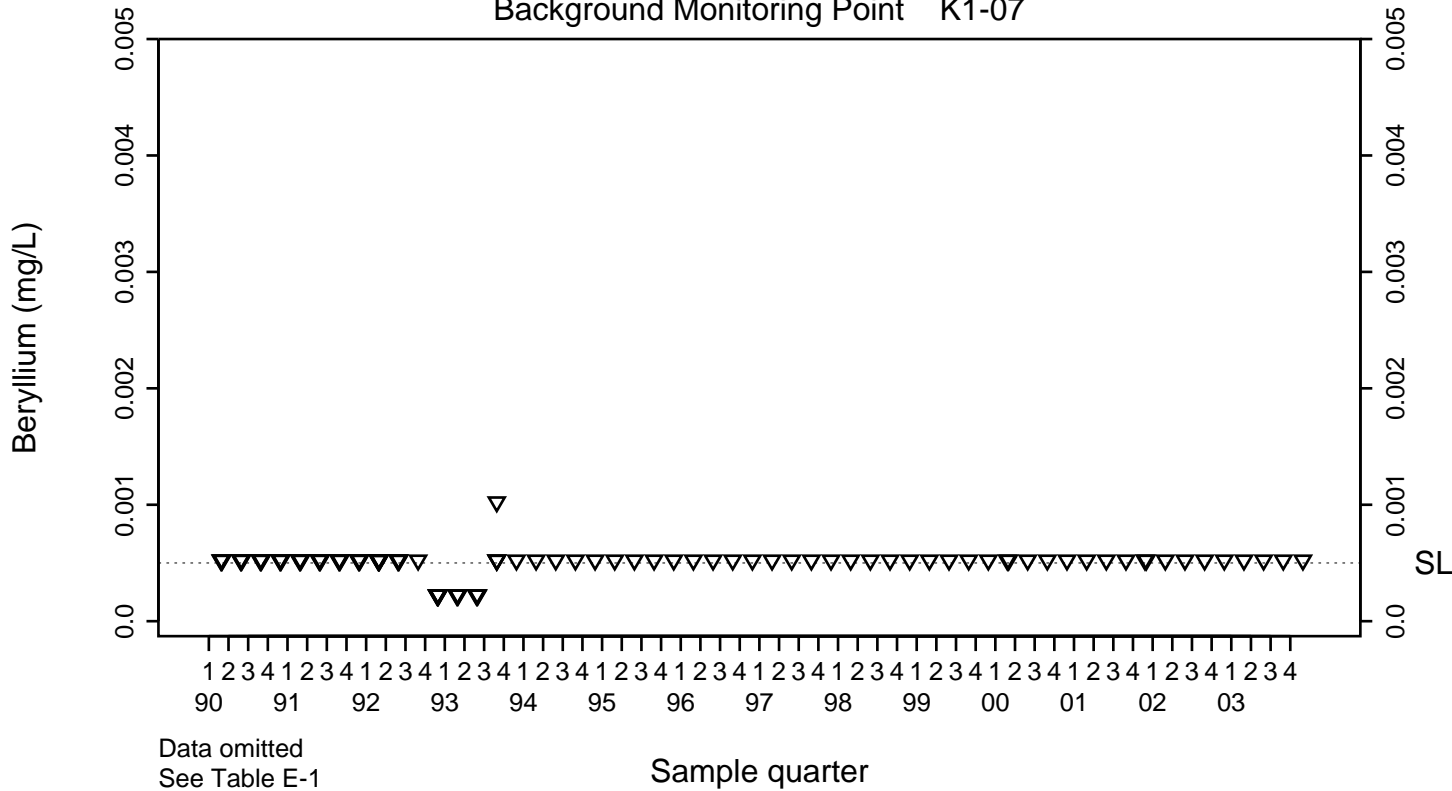
SL=0.0005

Background Monitoring Point K1-01C



SL=0.0005

Background Monitoring Point K1-07

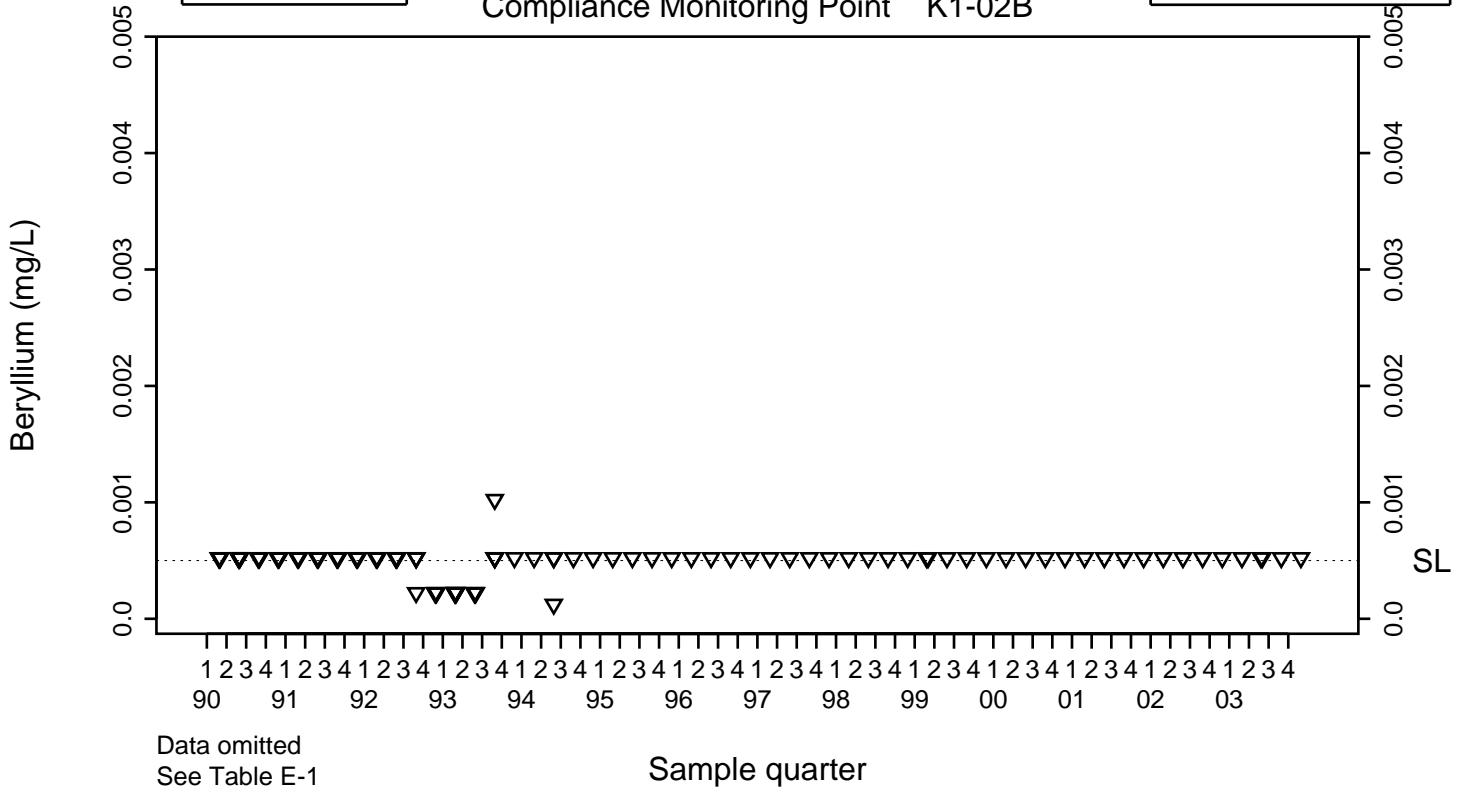


Pit 1 Area Beryllium (mg/L)

◆ Above RL
▽ Below RL

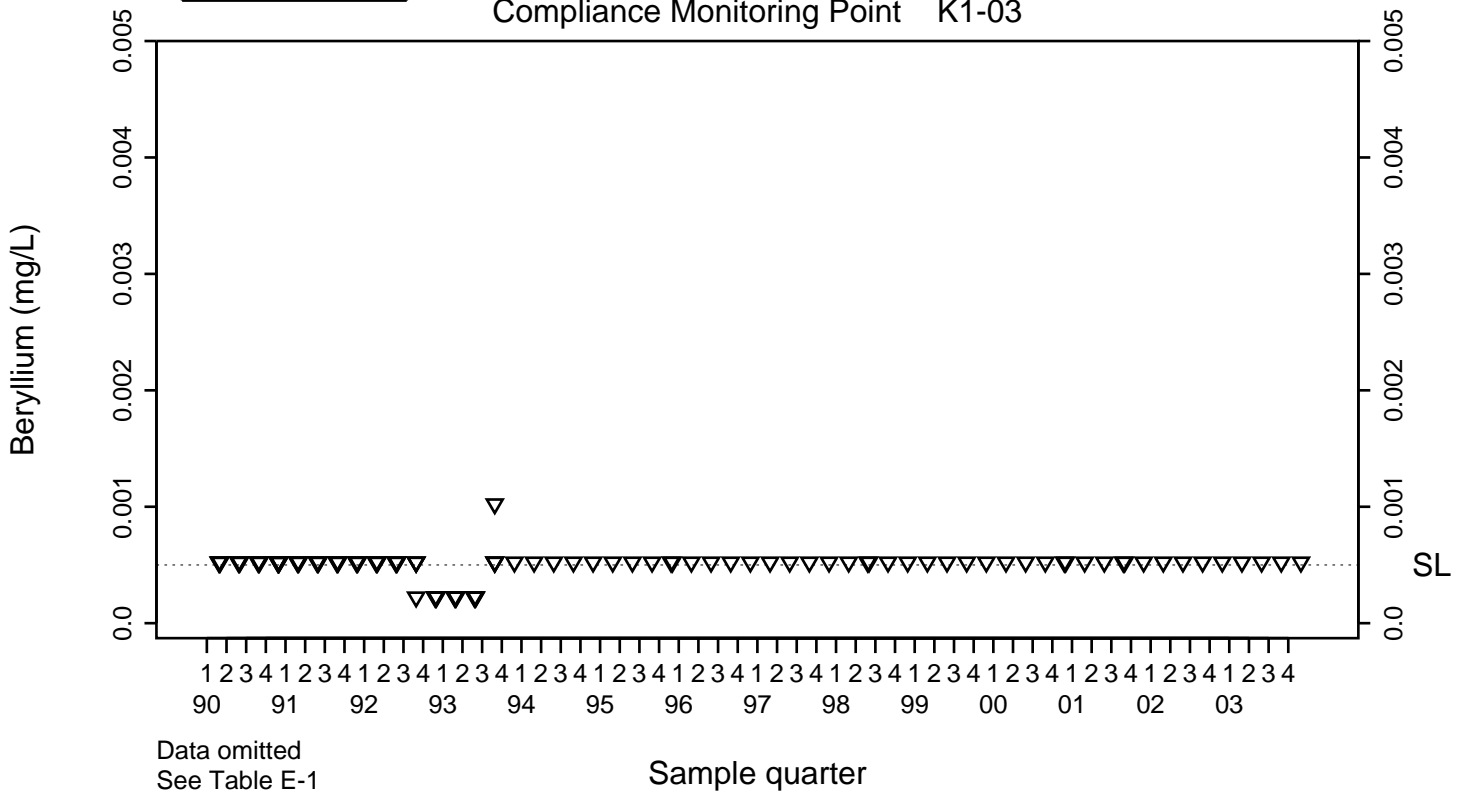
SL=0.0005

Compliance Monitoring Point K1-02B



SL=0.0005

Compliance Monitoring Point K1-03

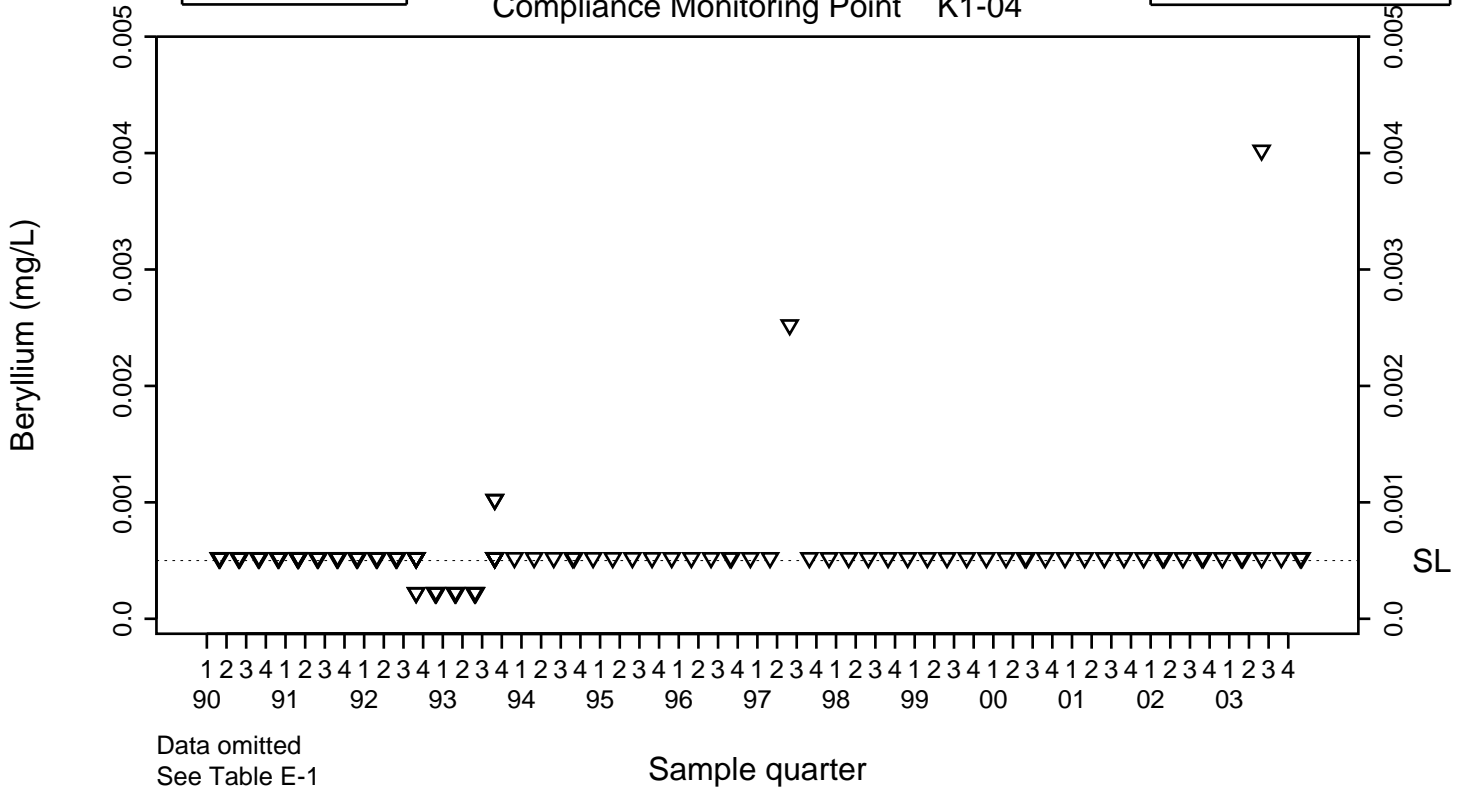


Pit 1 Area Beryllium (mg/L)

◆	Above RL
▽	Below RL

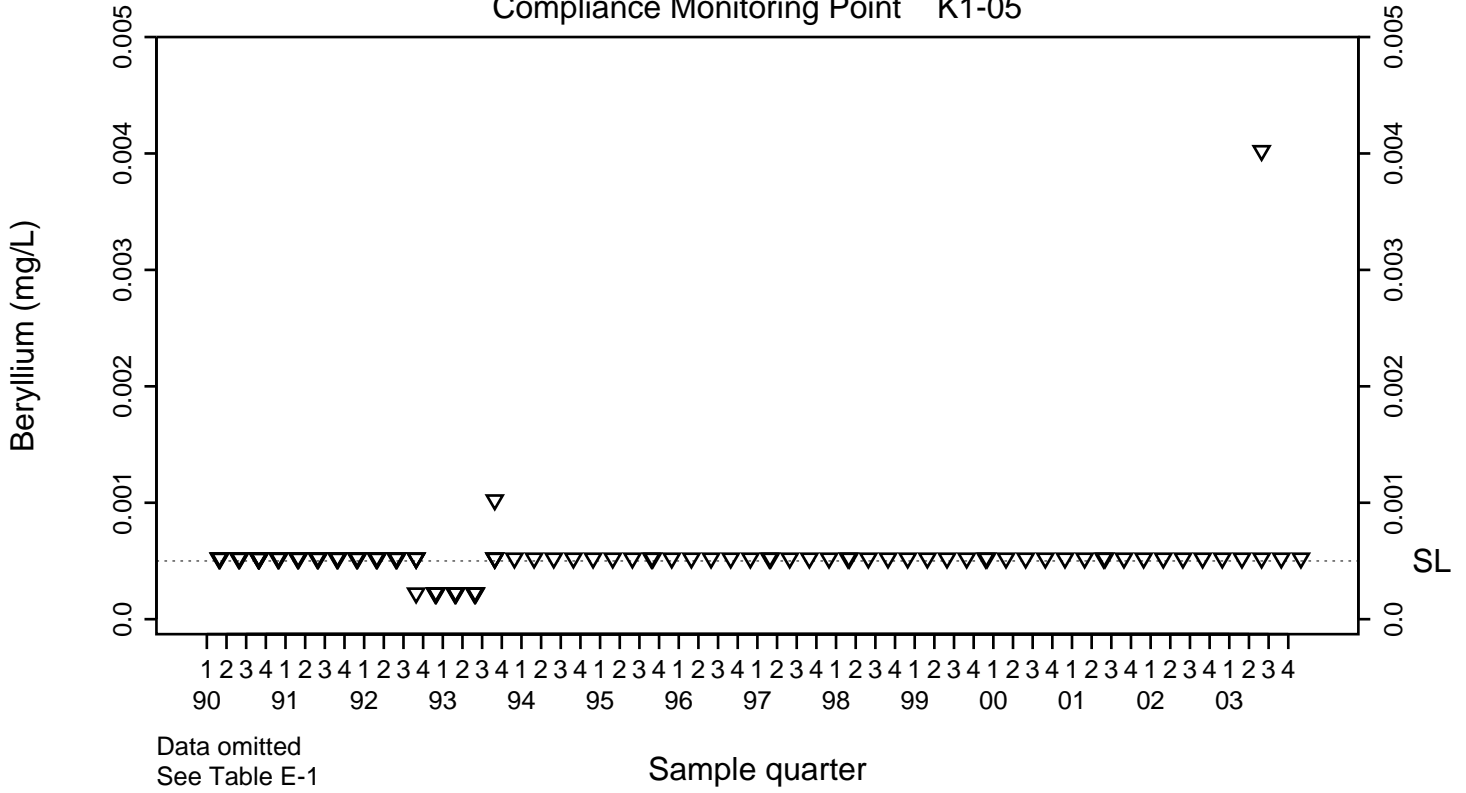
SL=0.0005

Compliance Monitoring Point K1-04



SL=0.0005

Compliance Monitoring Point K1-05

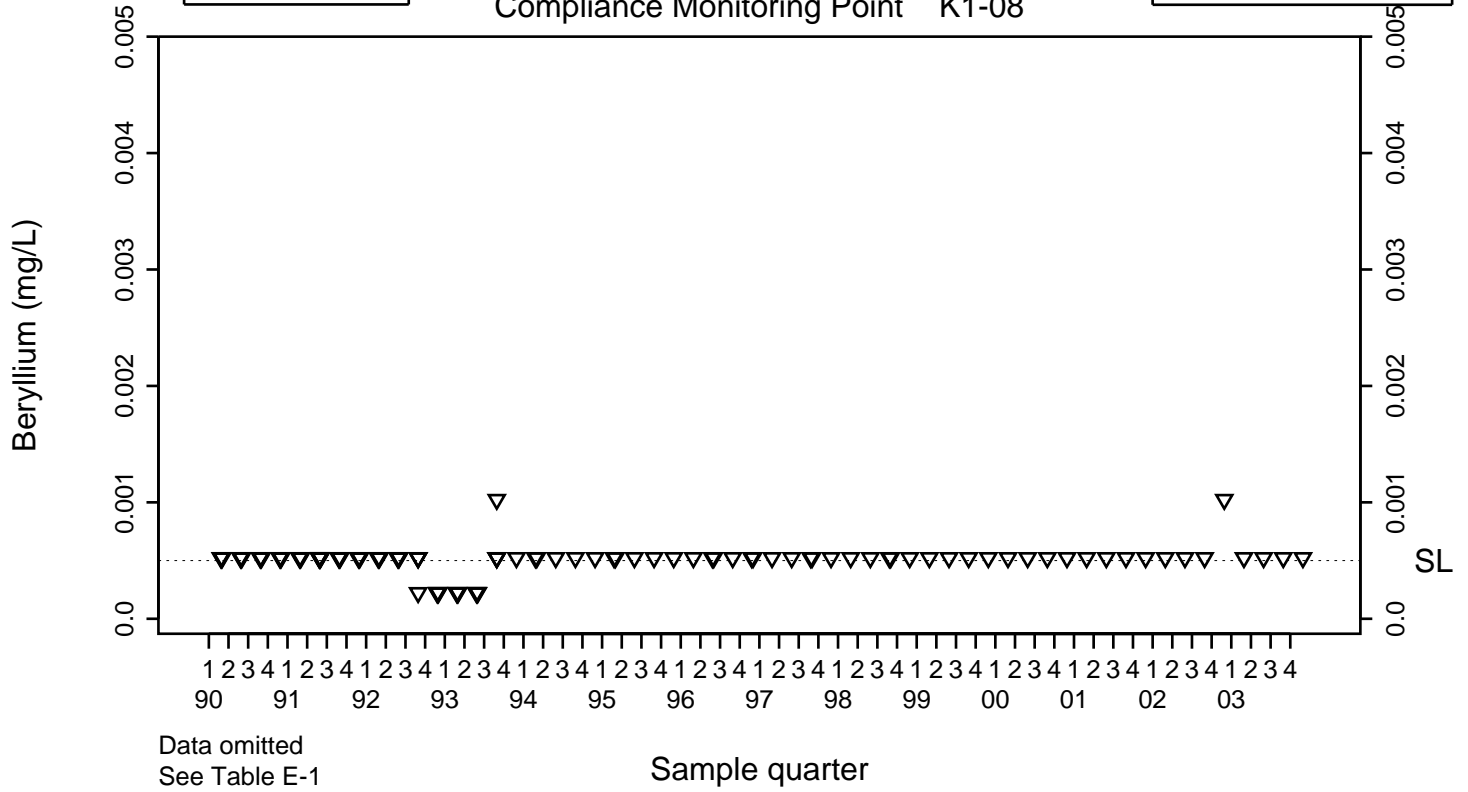


Pit 1 Area Beryllium (mg/L)

◆ Above RL
▽ Below RL

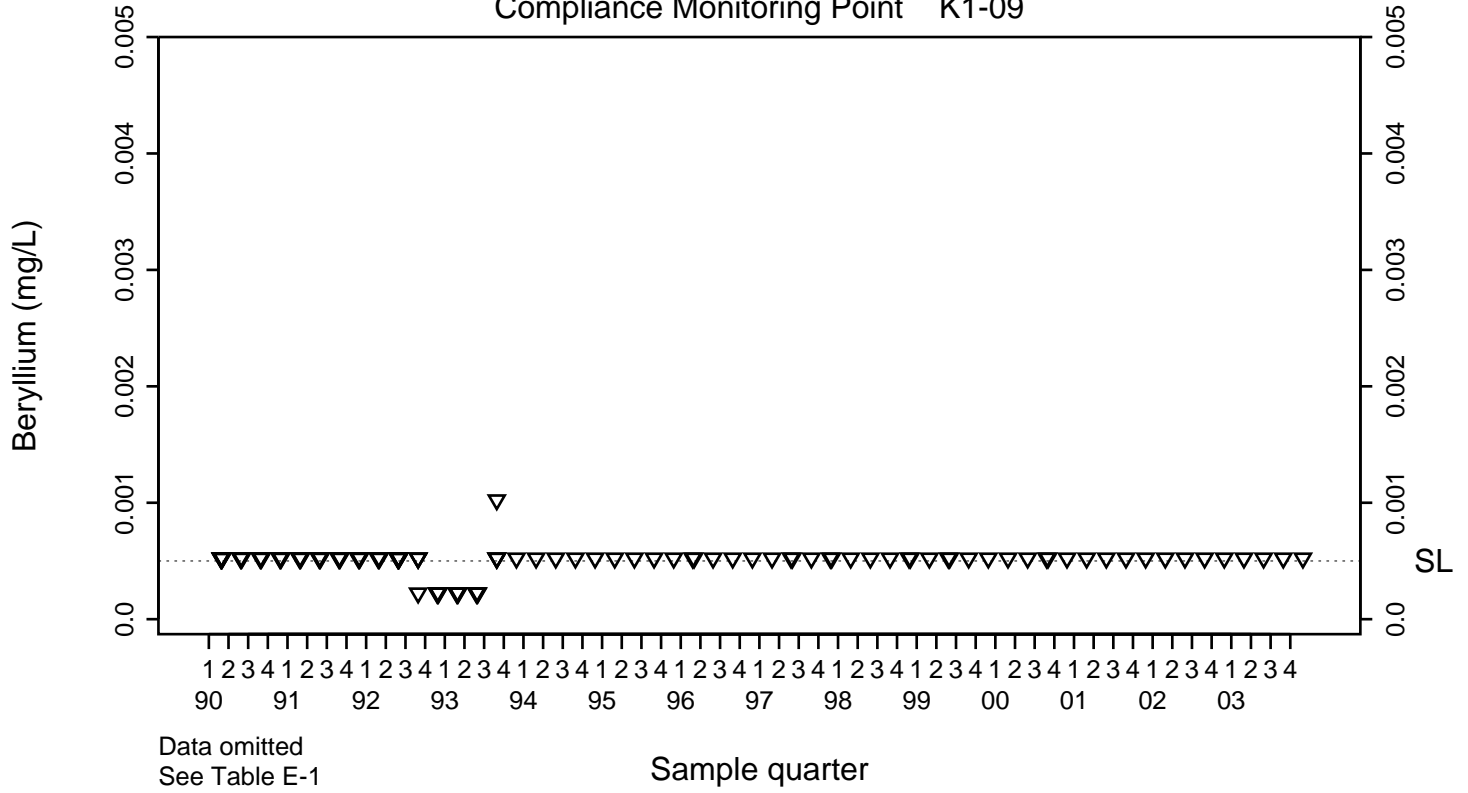
SL=0.0005

Compliance Monitoring Point K1-08



SL=0.0005

Compliance Monitoring Point K1-09

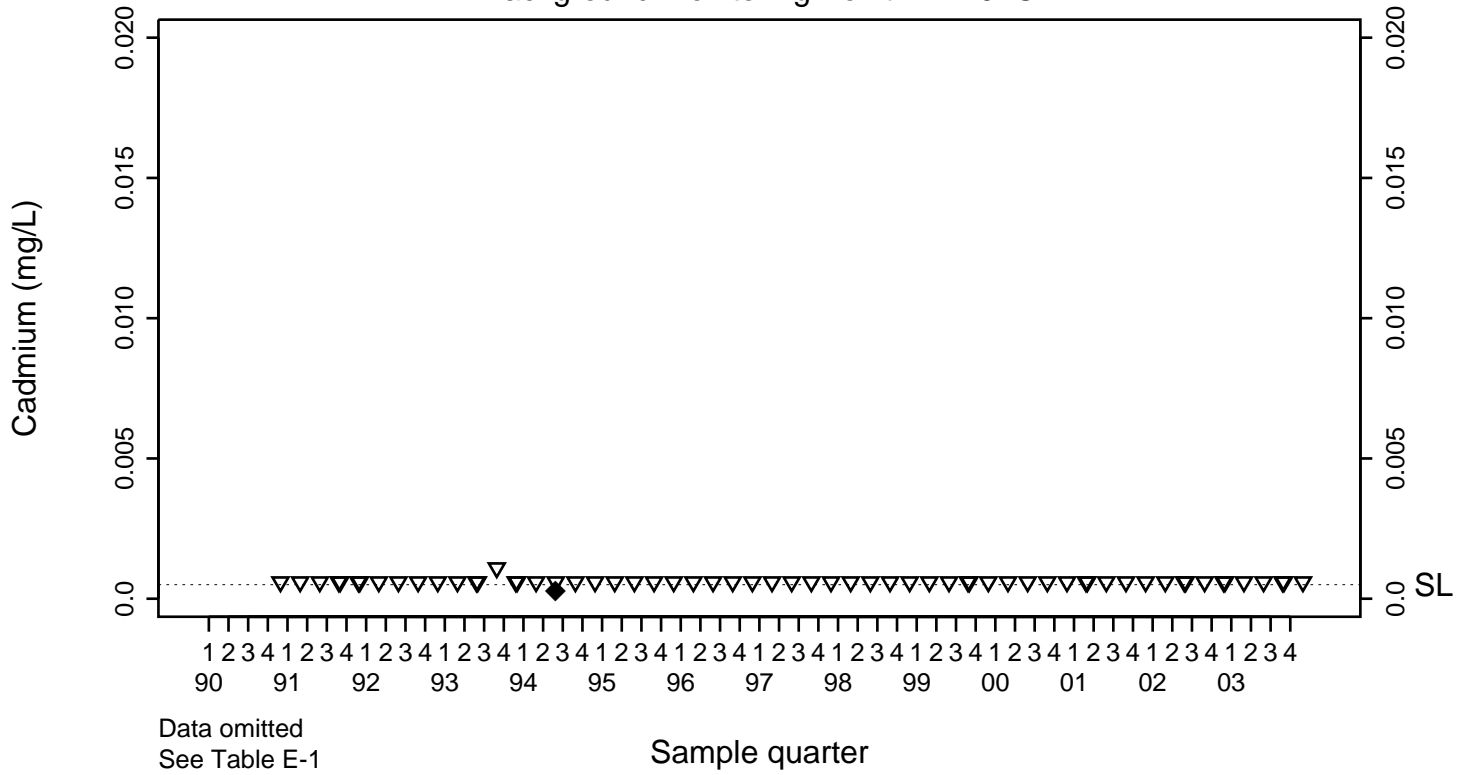


Pit 1 Area Cadmium (mg/L)

SL=0.0005

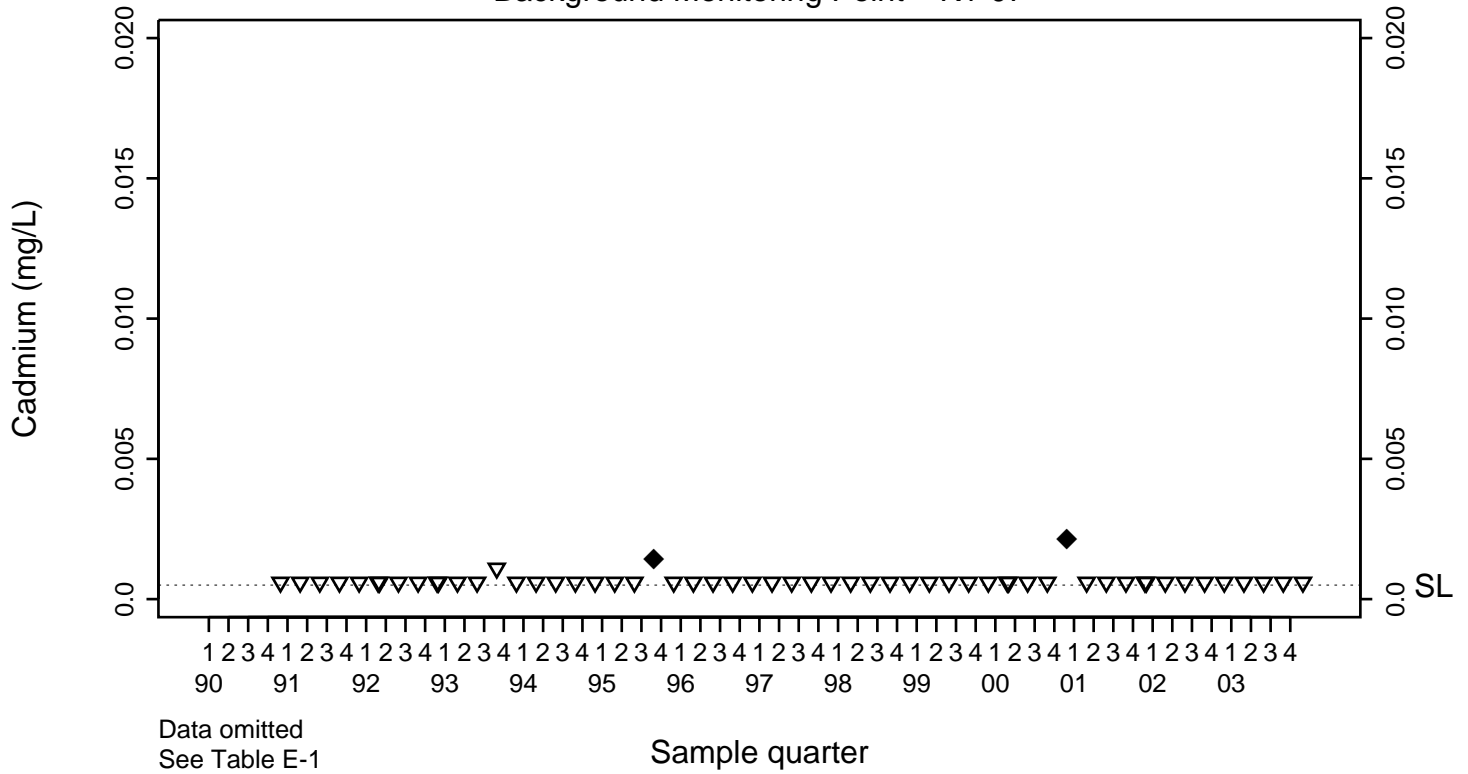
◆ Above RL
▽ Below RL

Background Monitoring Point K1-01C



SL=0.0005

Background Monitoring Point K1-07

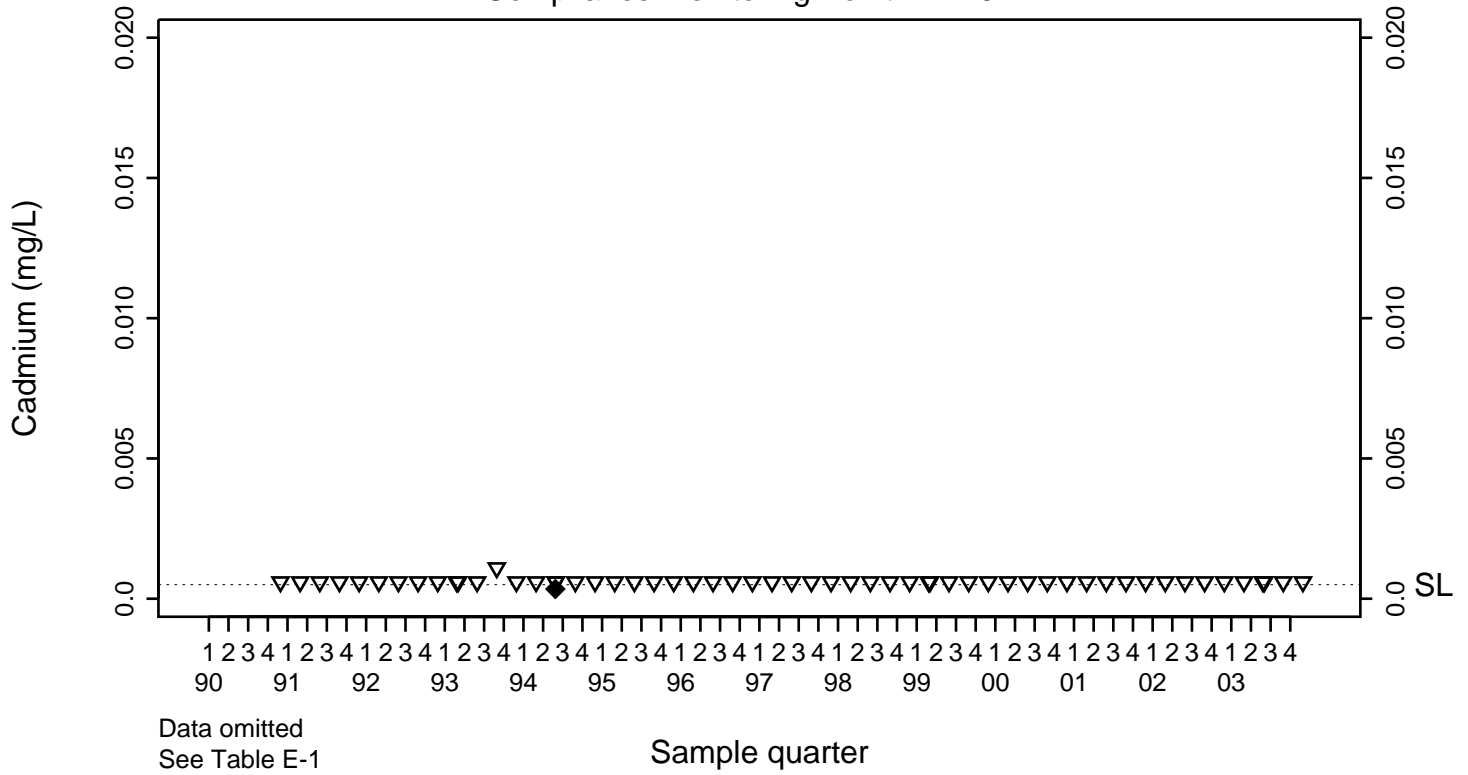


Pit 1 Area Cadmium (mg/L)

SL=0.0005

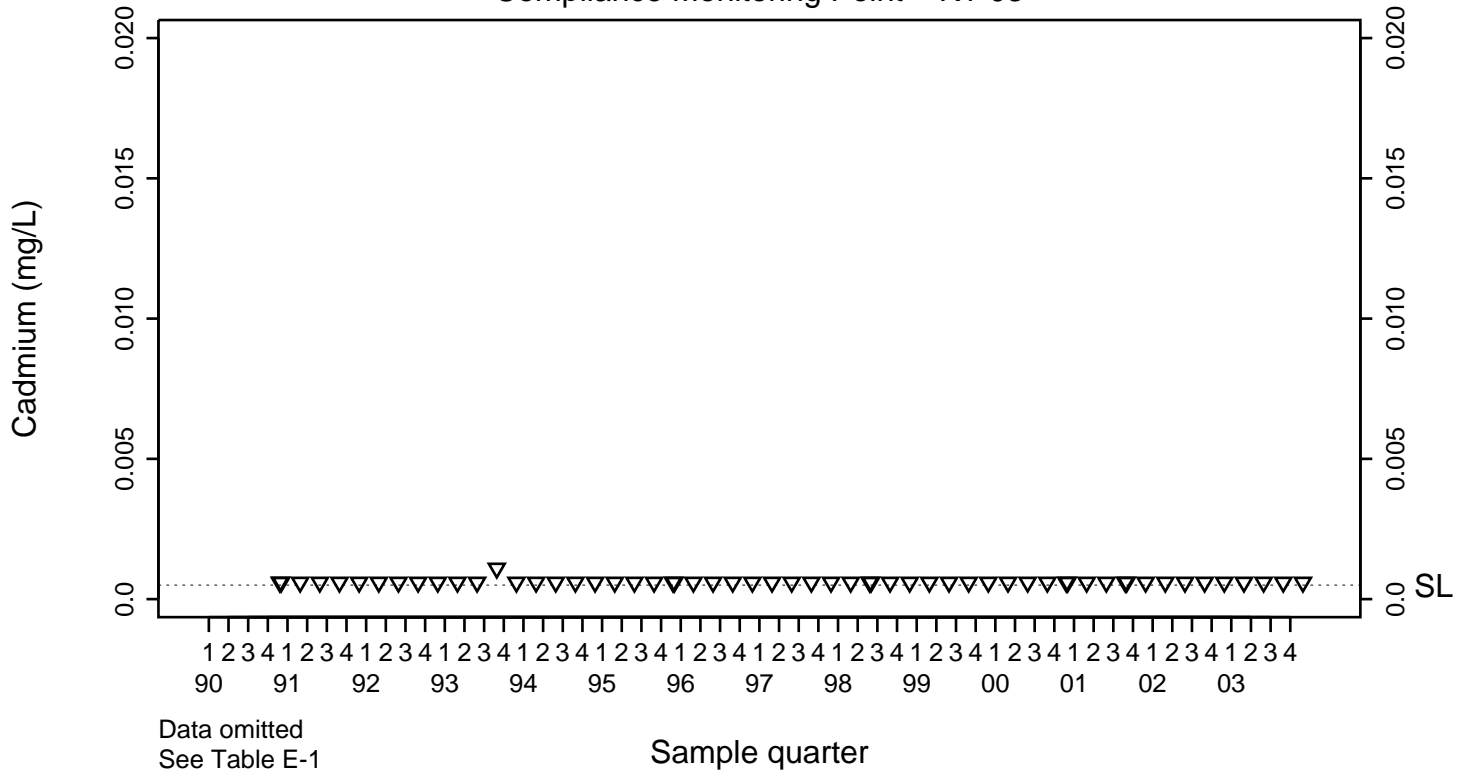
◆ Above RL
▽ Below RL

Compliance Monitoring Point K1-02B



SL=0.0005

Compliance Monitoring Point K1-03

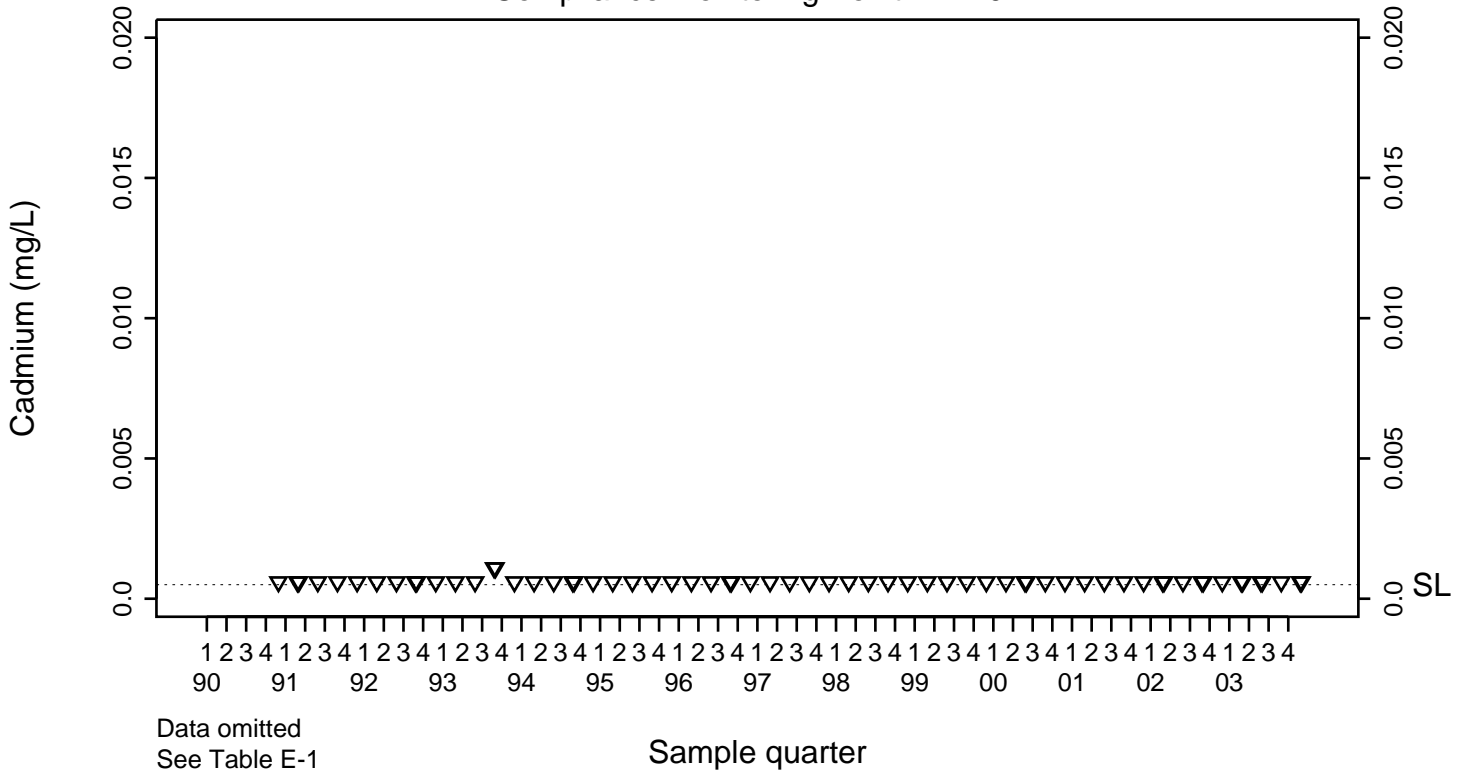


Pit 1 Area Cadmium (mg/L)

SL=0.0005

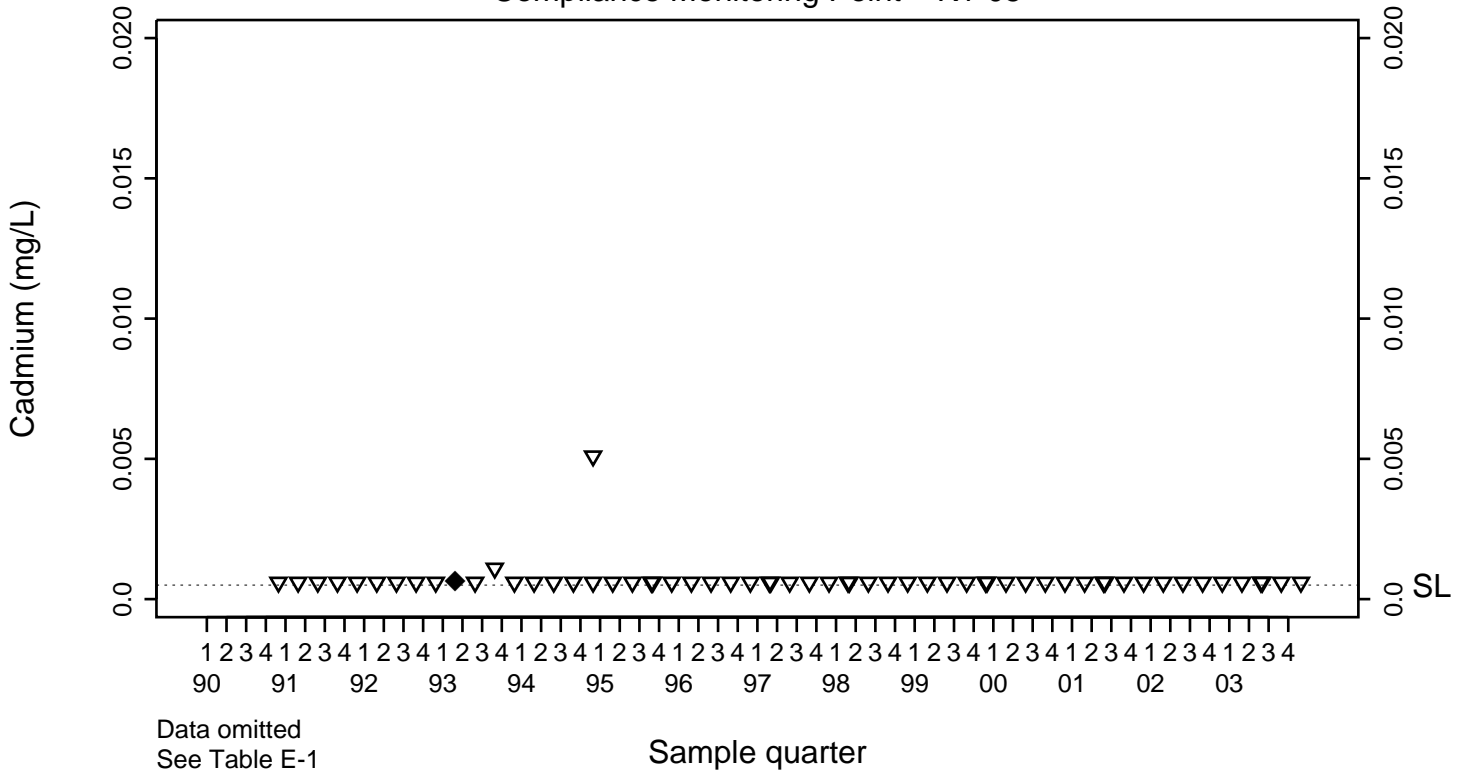
◆ Above RL
▽ Below RL

Compliance Monitoring Point K1-04



SL=0.0005

Compliance Monitoring Point K1-05

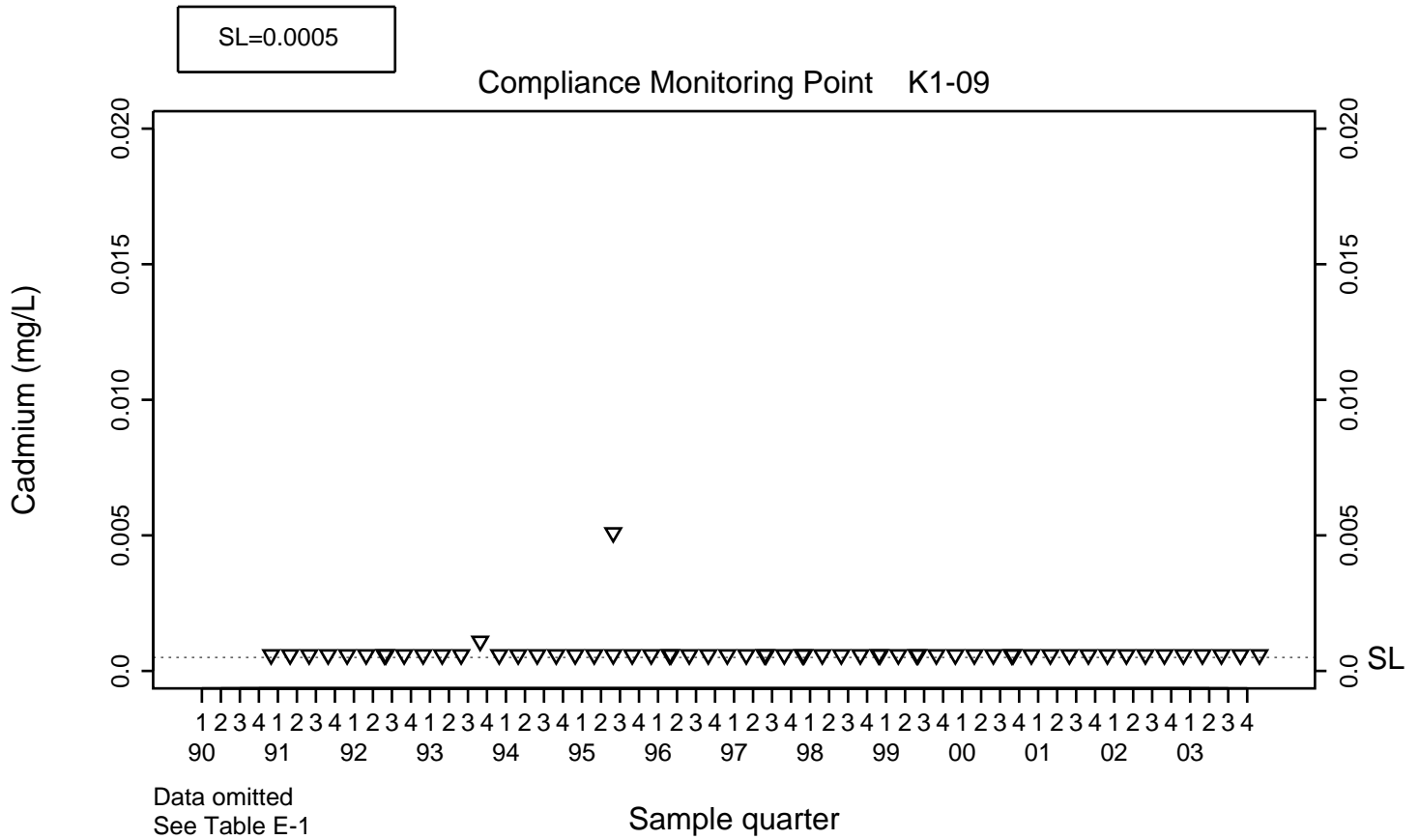
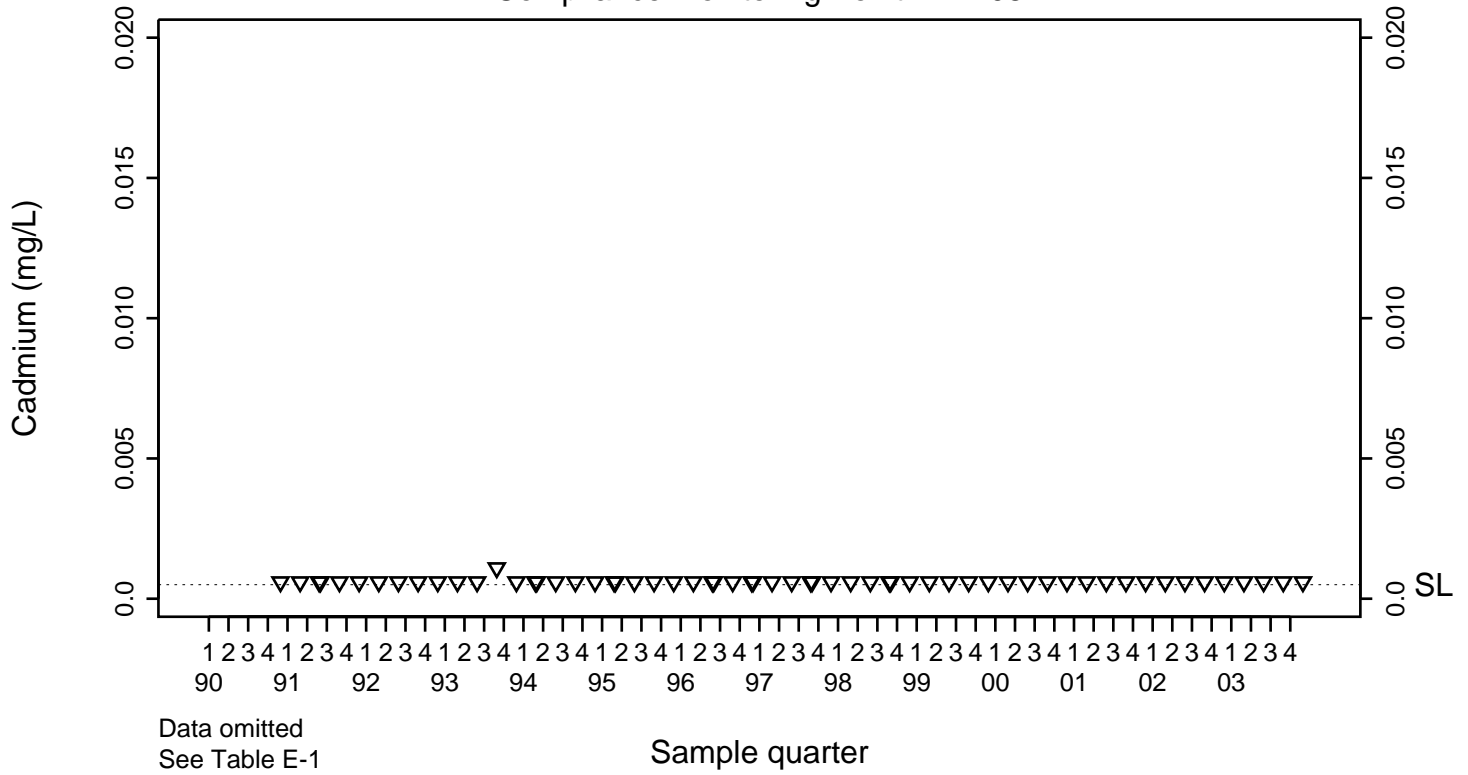


Pit 1 Area Cadmium (mg/L)

SL=0.0005

◆ Above RL
▽ Below RL

Compliance Monitoring Point K1-08

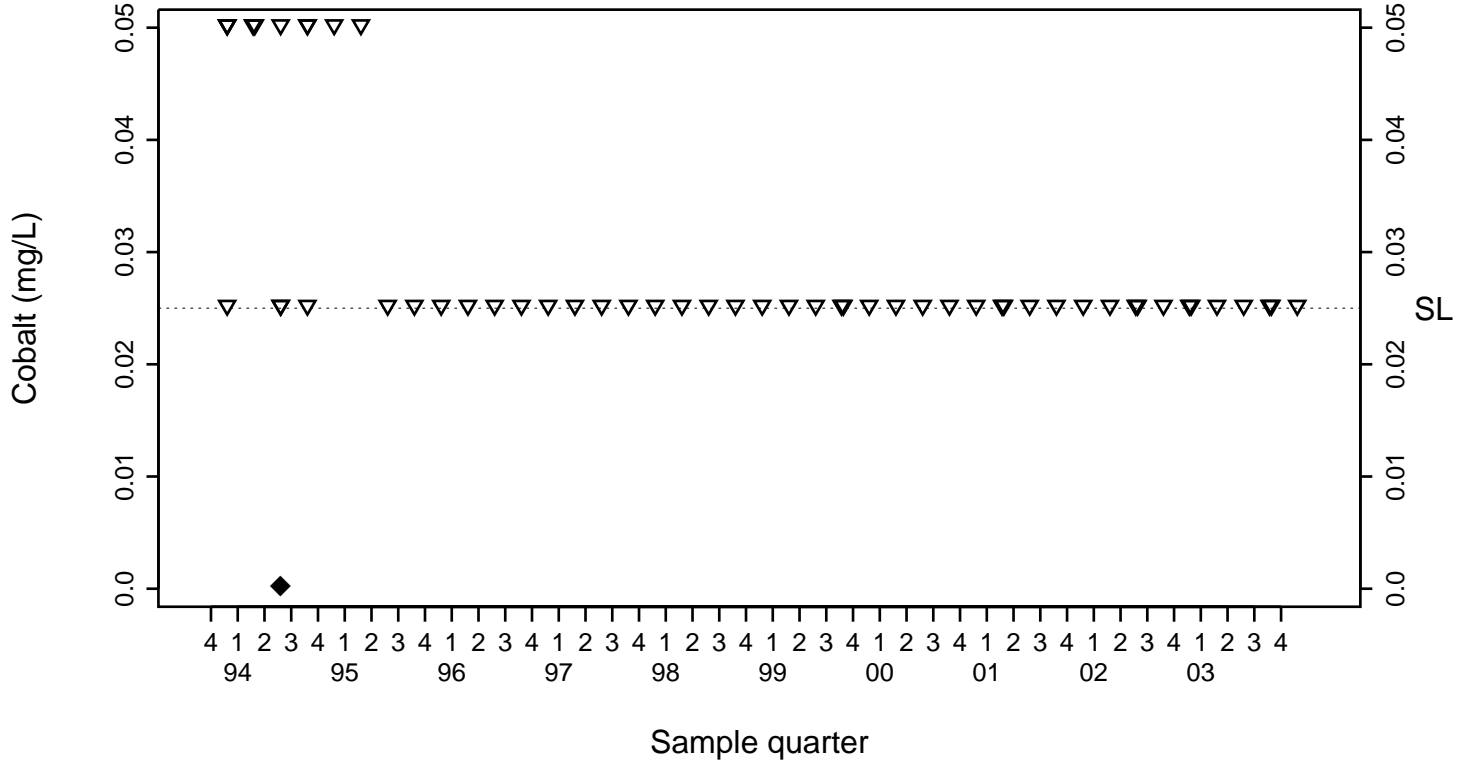


Pit 1 Area Cobalt (mg/L)

SL=0.025

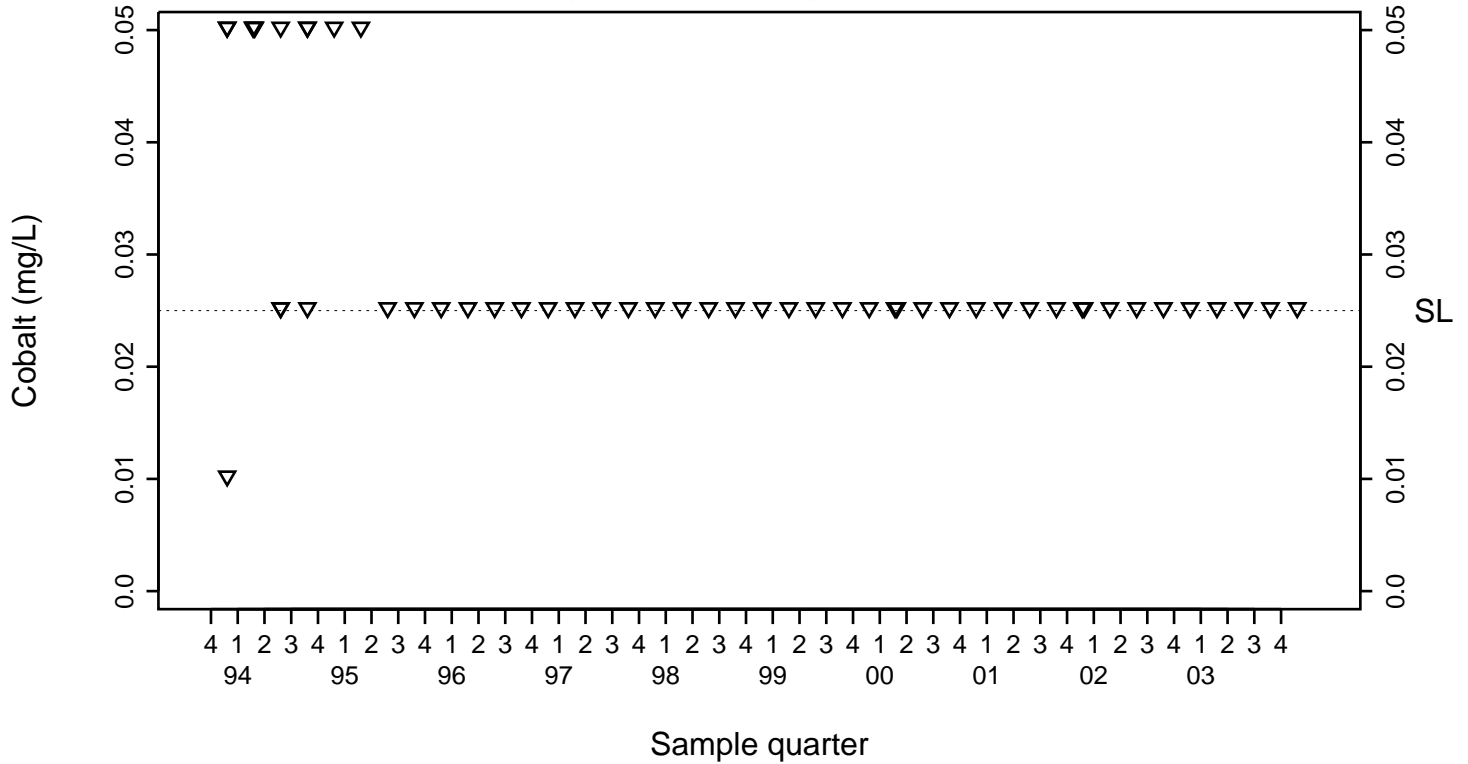
◆ Above RL
▽ Below RL

Background Monitoring Point K1-01C



SL=0.025

Background Monitoring Point K1-07

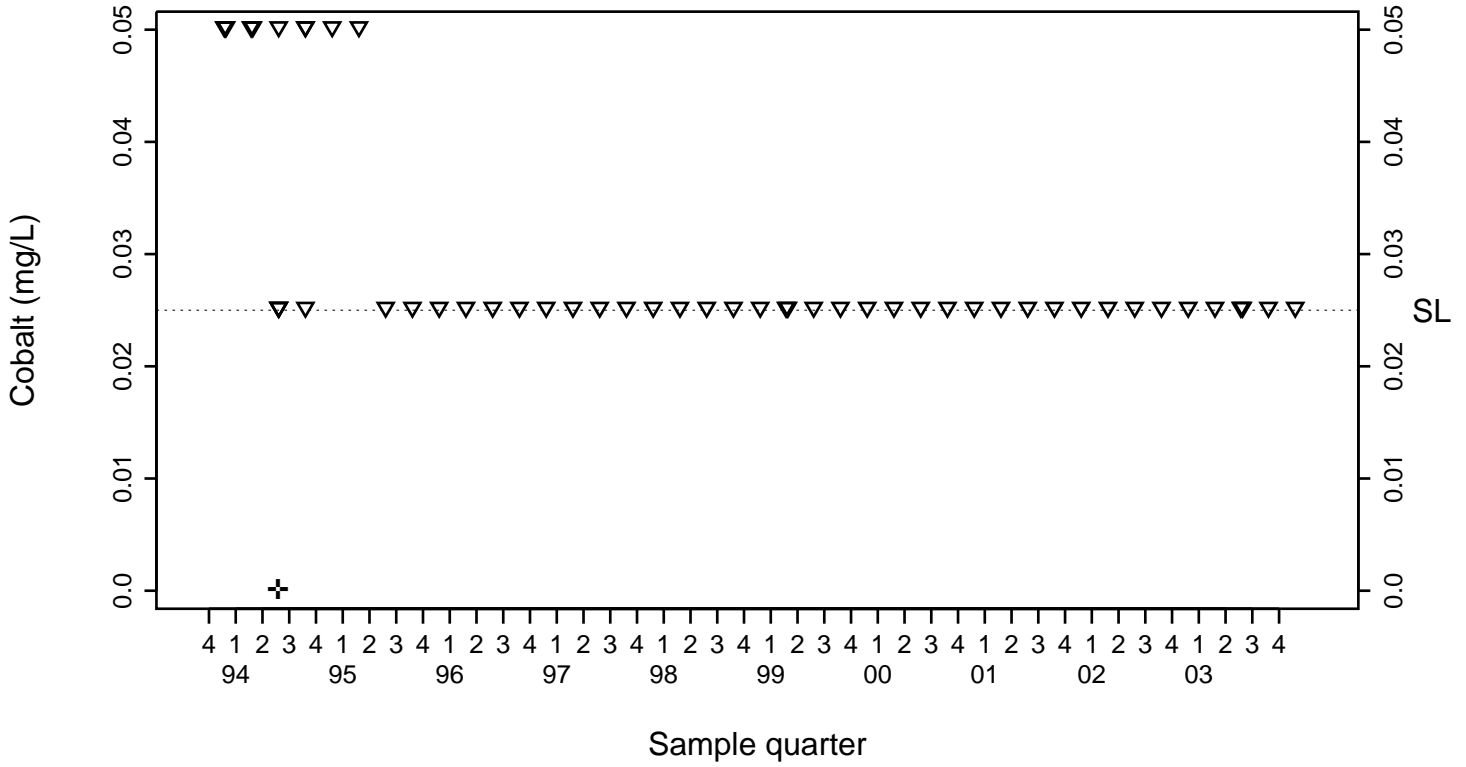


Pit 1 Area Cobalt (mg/L)

◆	Above RL
▽	Below RL
+	Estimated

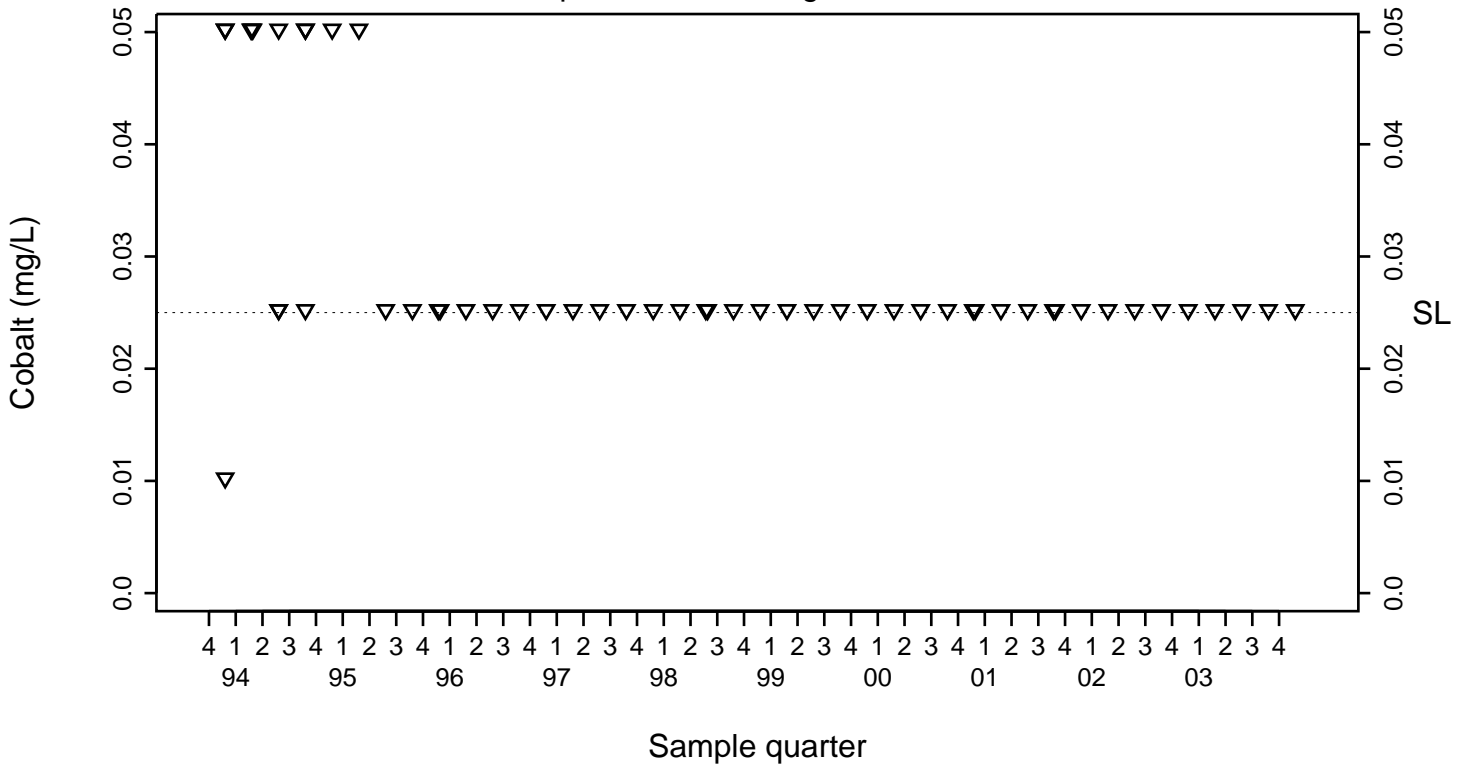
SL=0.025

Compliance Monitoring Point K1-02B



SL=0.025

Compliance Monitoring Point K1-03

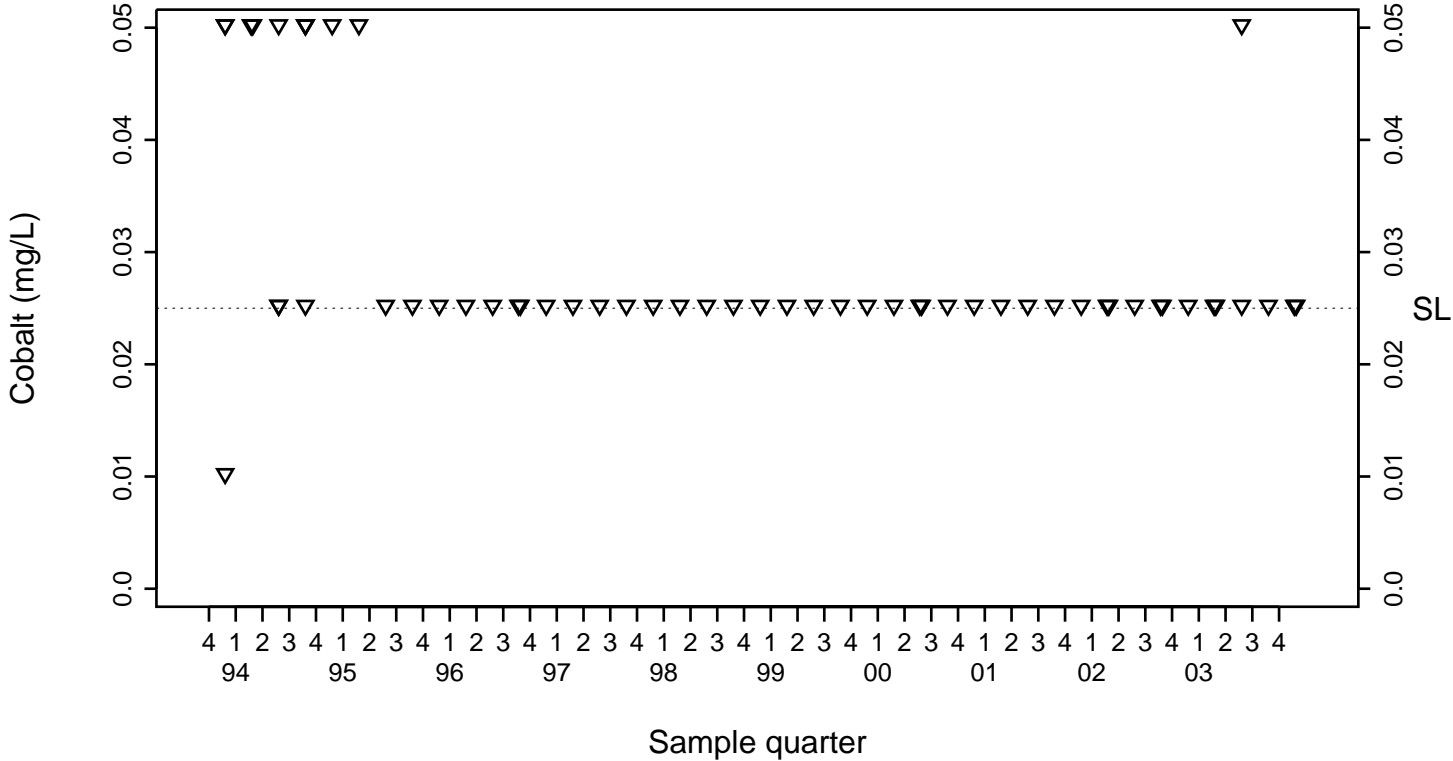


Pit 1 Area Cobalt (mg/L)

Compliance Monitoring Point K1-04

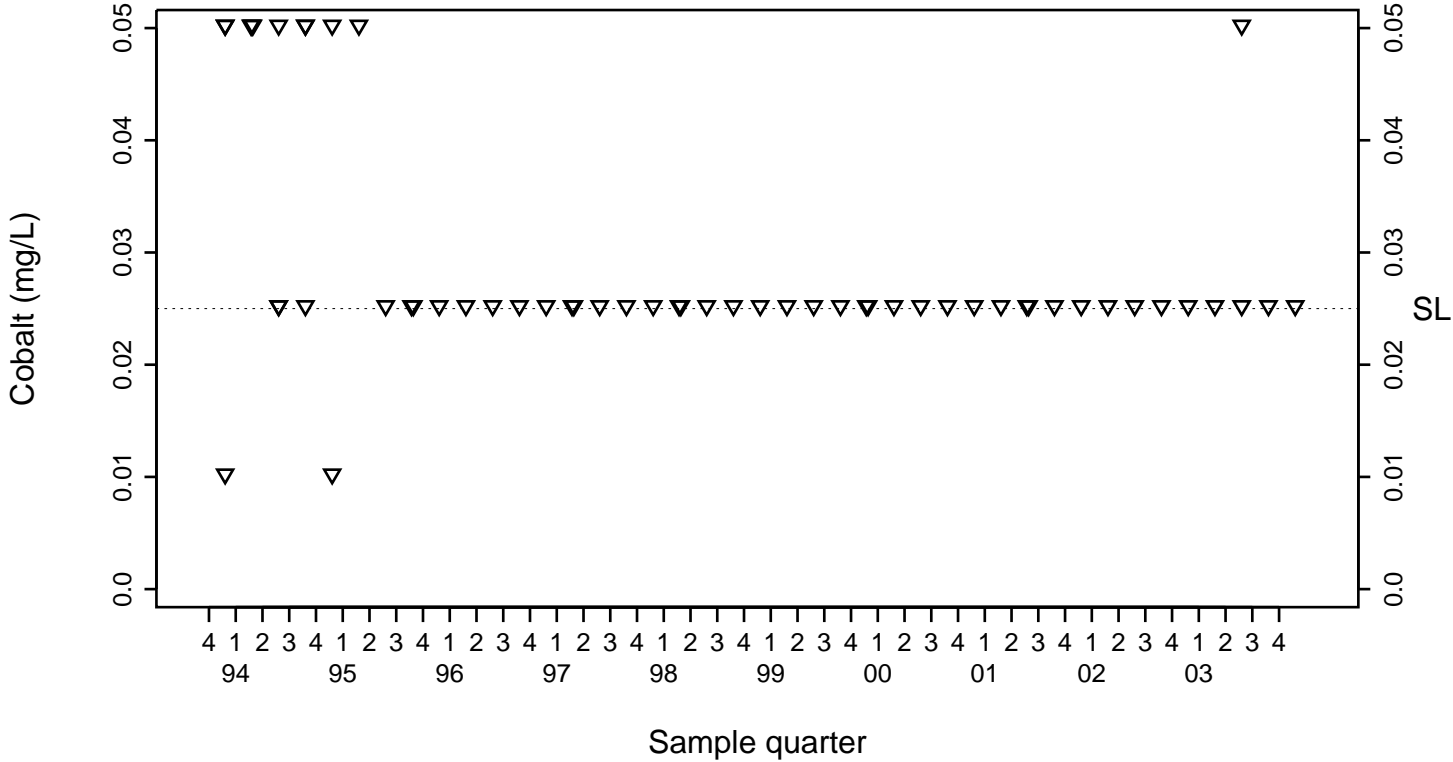
◆	Above RL
▽	Below RL

SL=0.025



Compliance Monitoring Point K1-05

SL=0.025

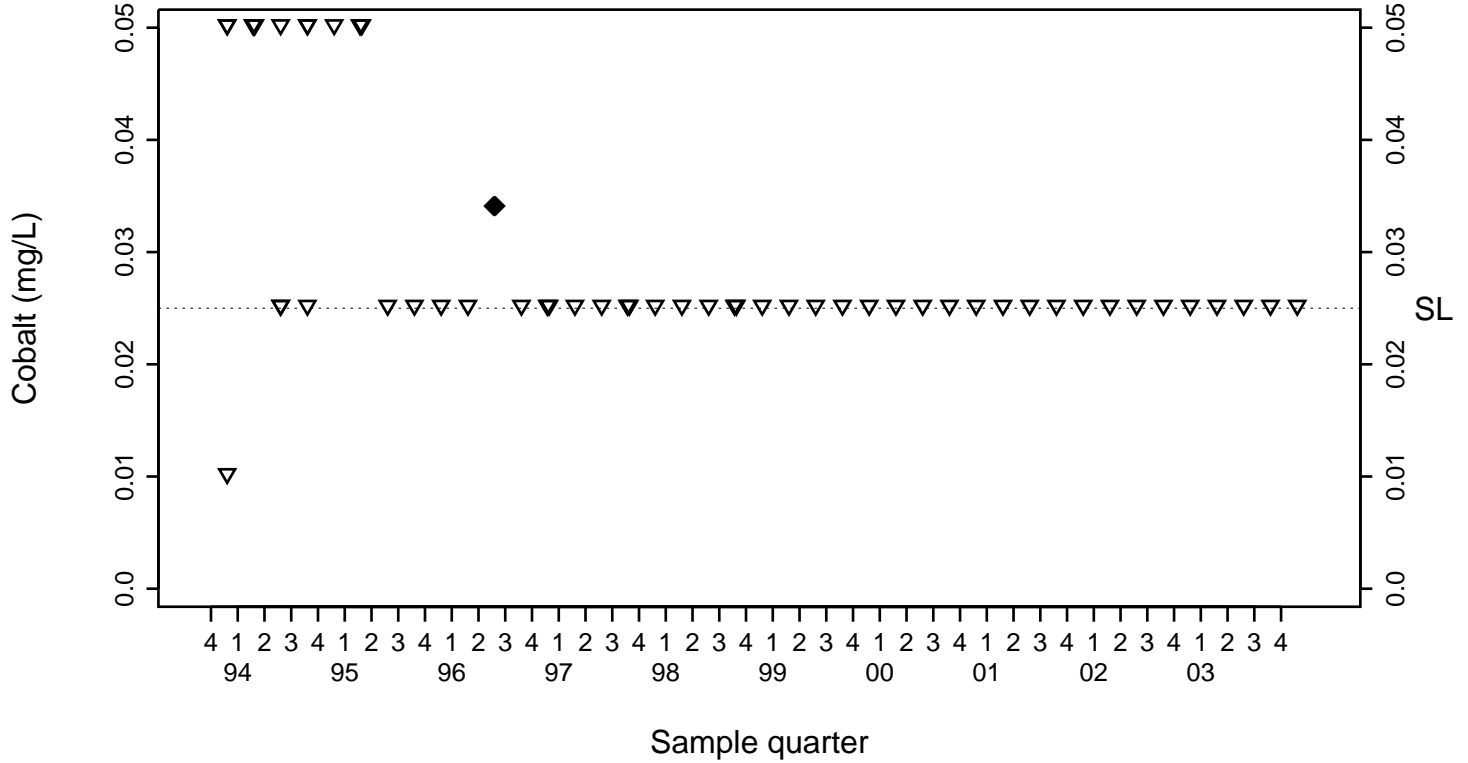


Pit 1 Area
Cobalt (mg/L)

SL=0.025

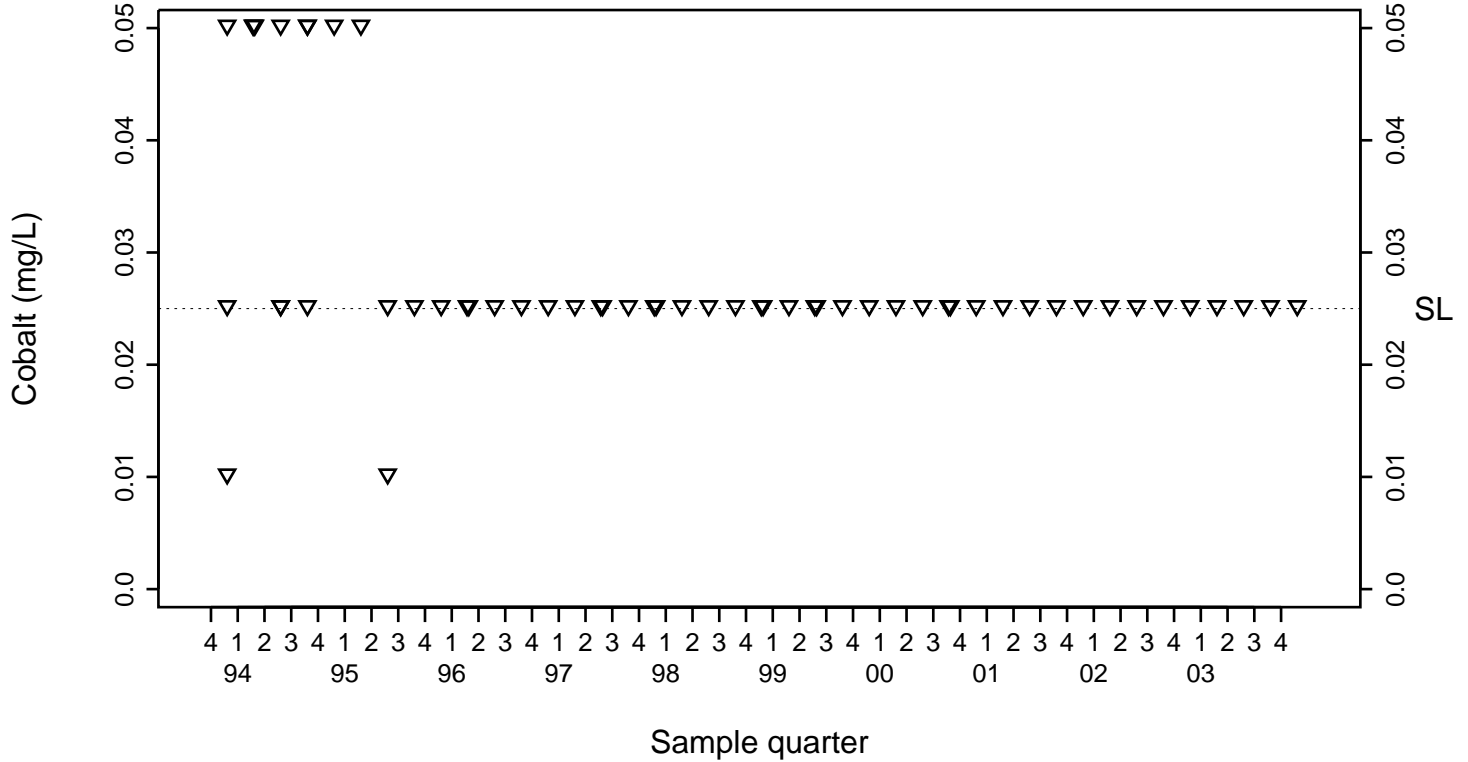
- ◆ Above RL
- ▽ Below RL

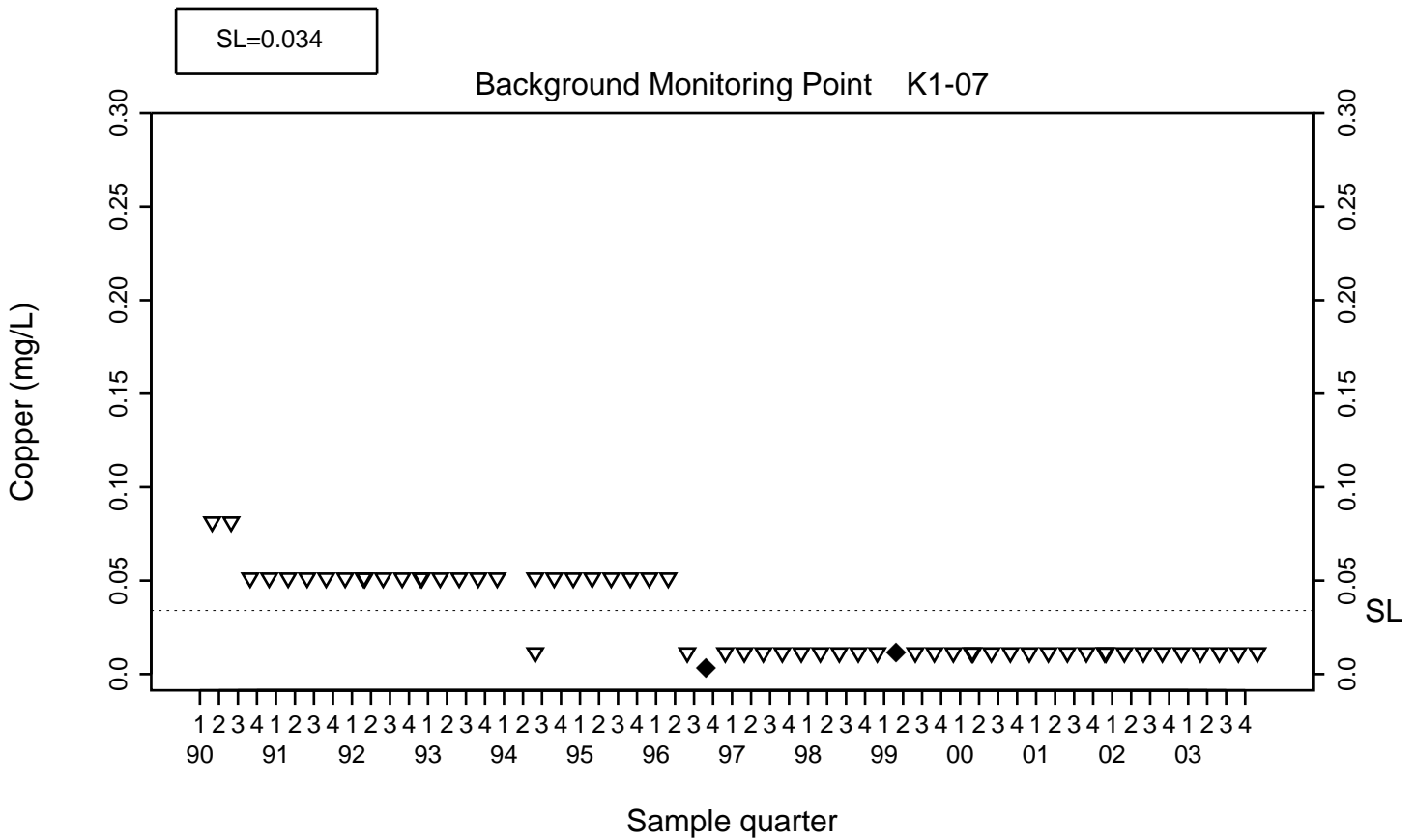
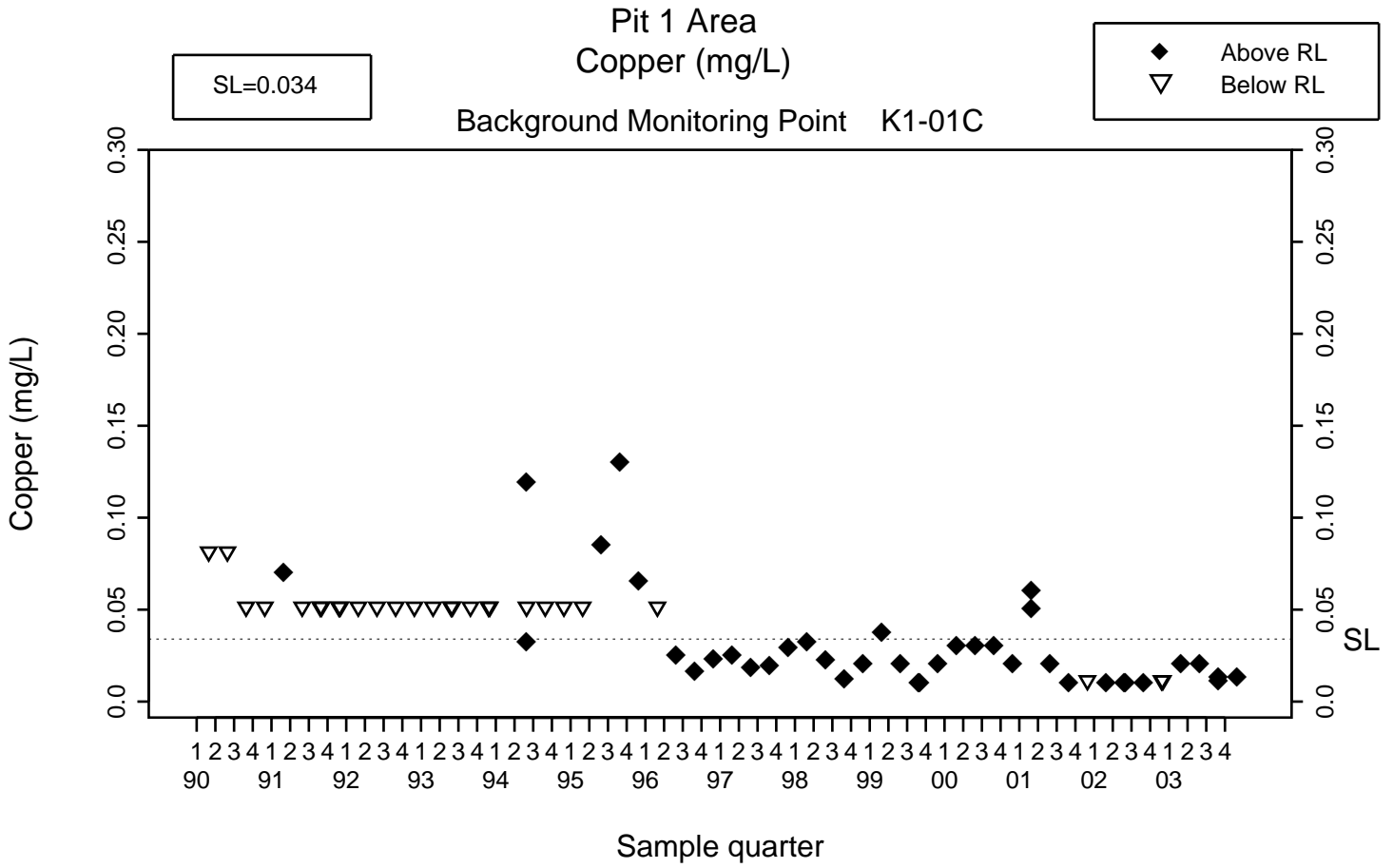
Compliance Monitoring Point K1-08



SL=0.025

Compliance Monitoring Point K1-09



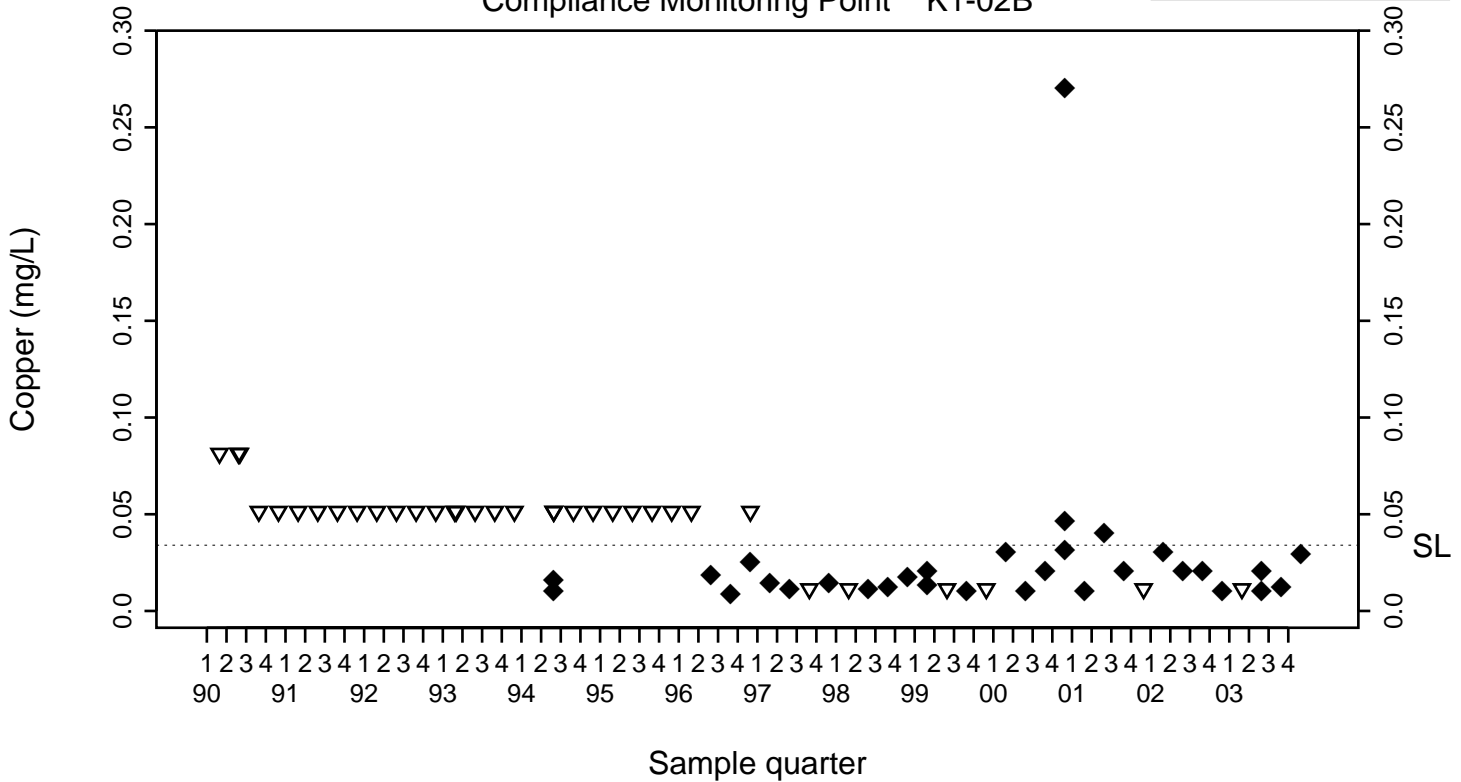


Pit 1 Area Copper (mg/L)

◆ Above RL
▽ Below RL

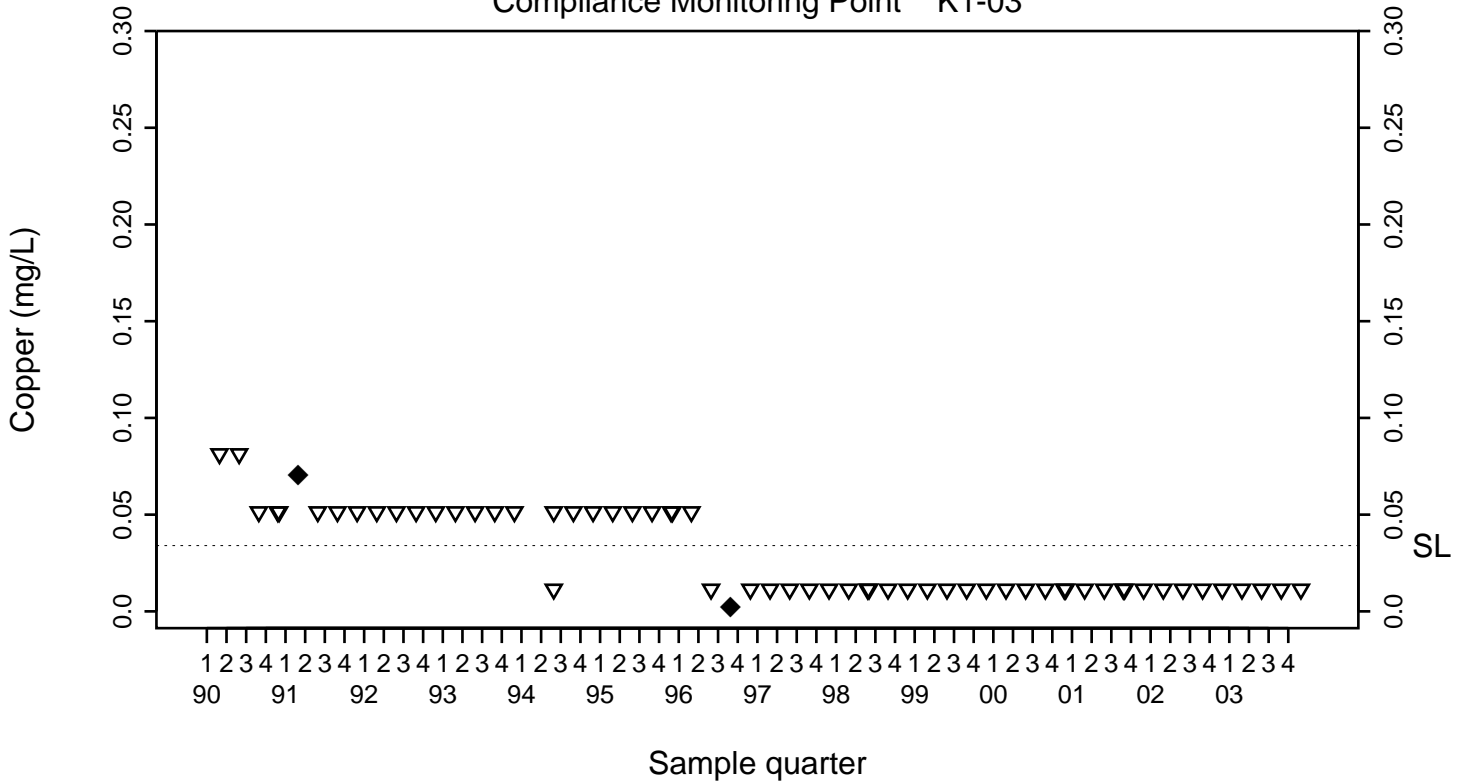
SL=0.034

Compliance Monitoring Point K1-02B



SL=0.034

Compliance Monitoring Point K1-03

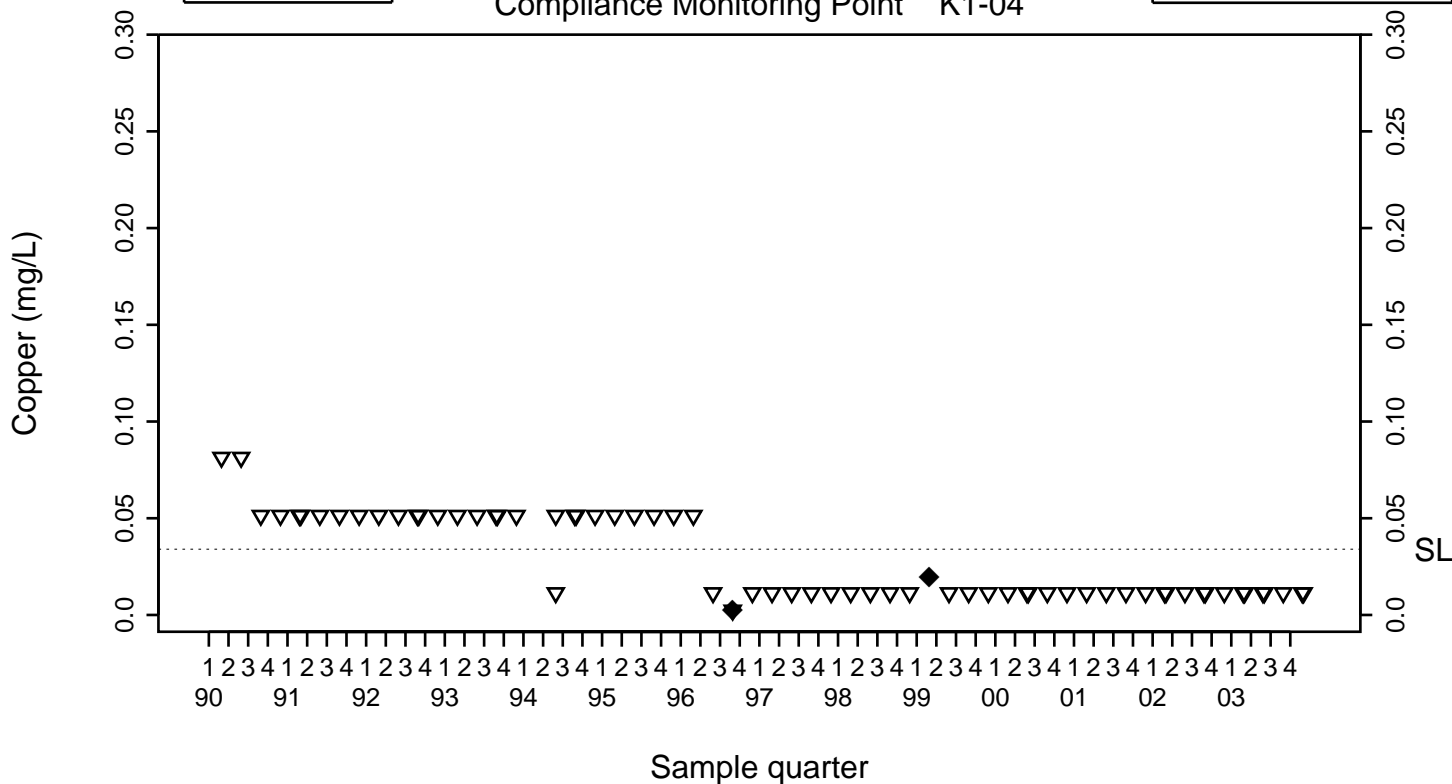


Pit 1 Area Copper (mg/L)

Compliance Monitoring Point K1-04

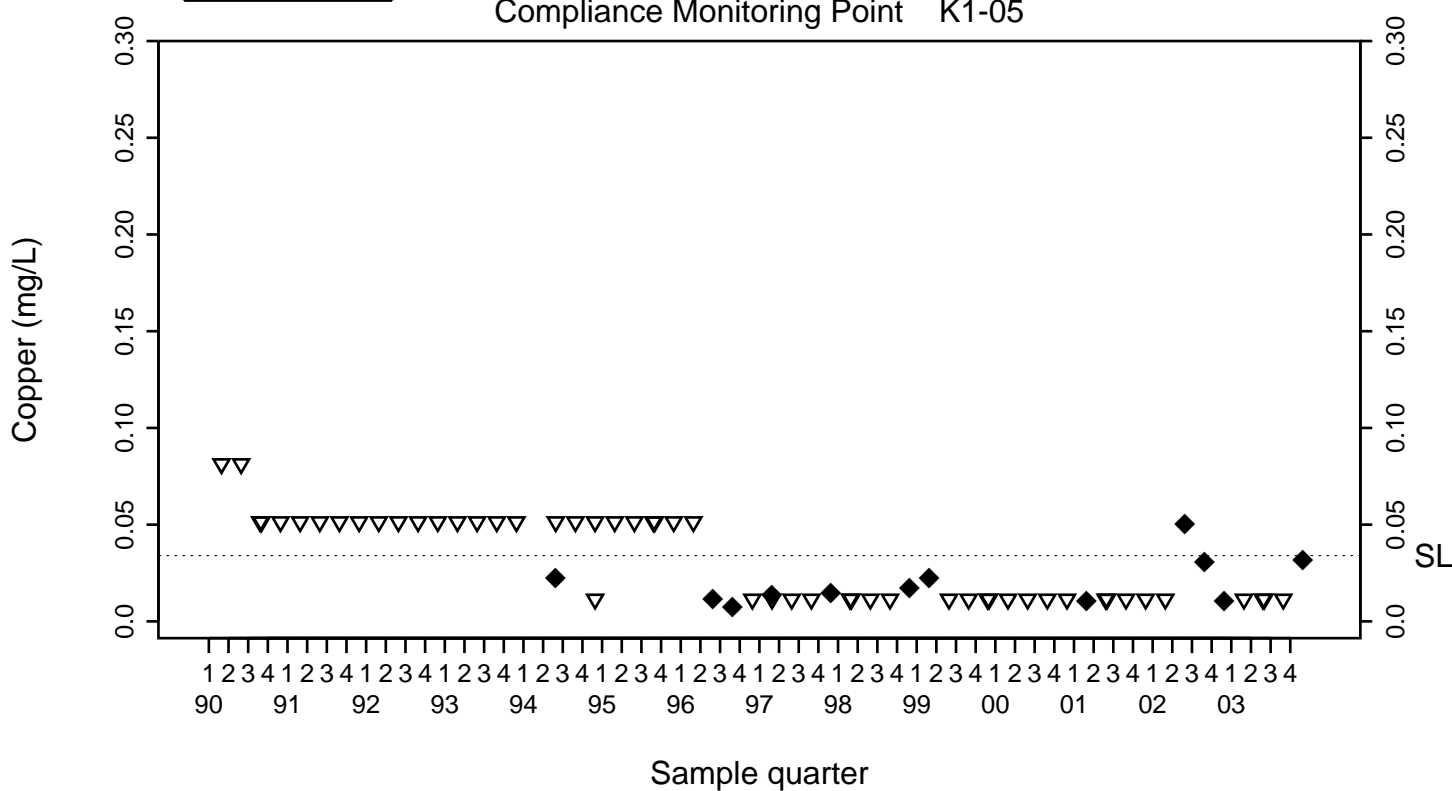
◆	Above RL
▽	Below RL

SL=0.034



Compliance Monitoring Point K1-05

SL=0.034

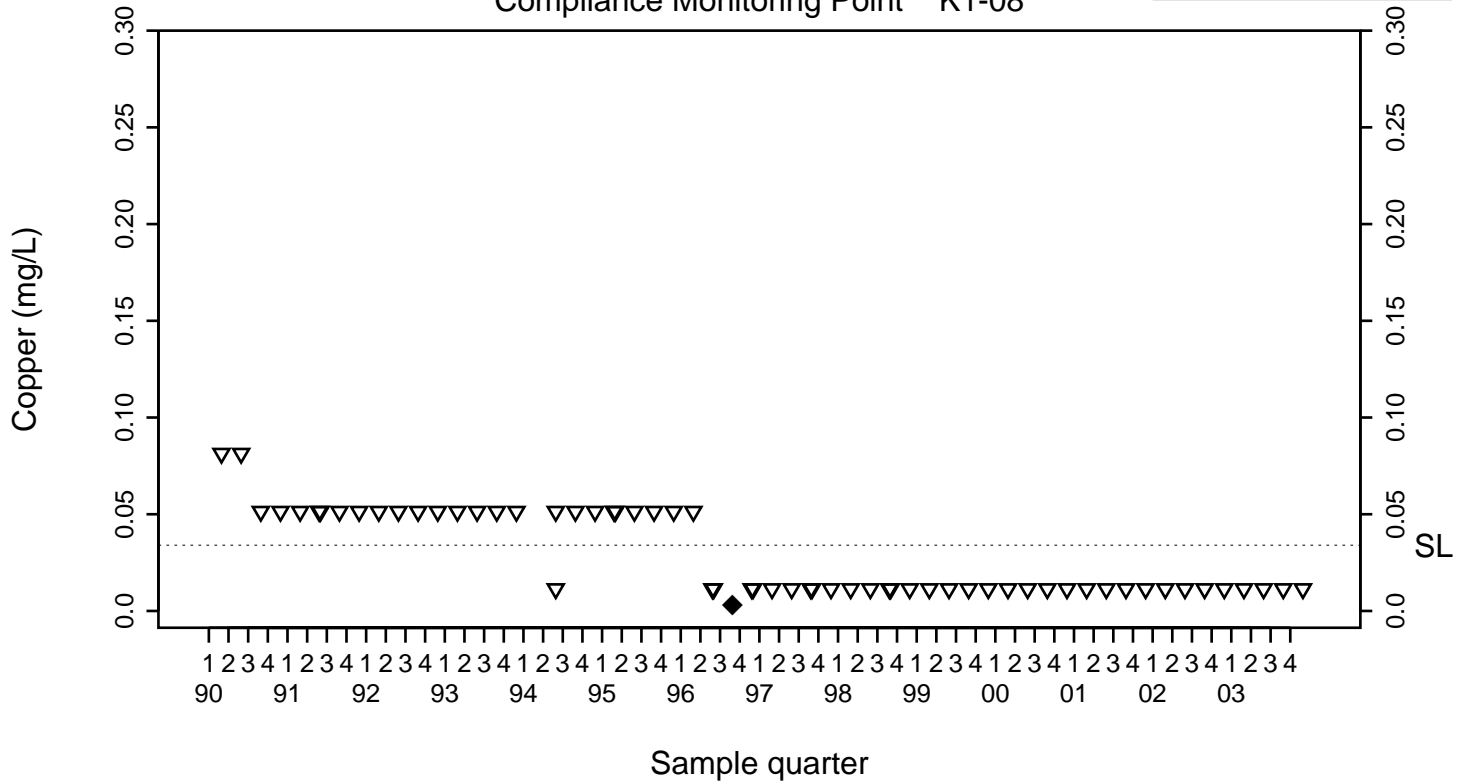


Pit 1 Area Copper (mg/L)

SL=0.034

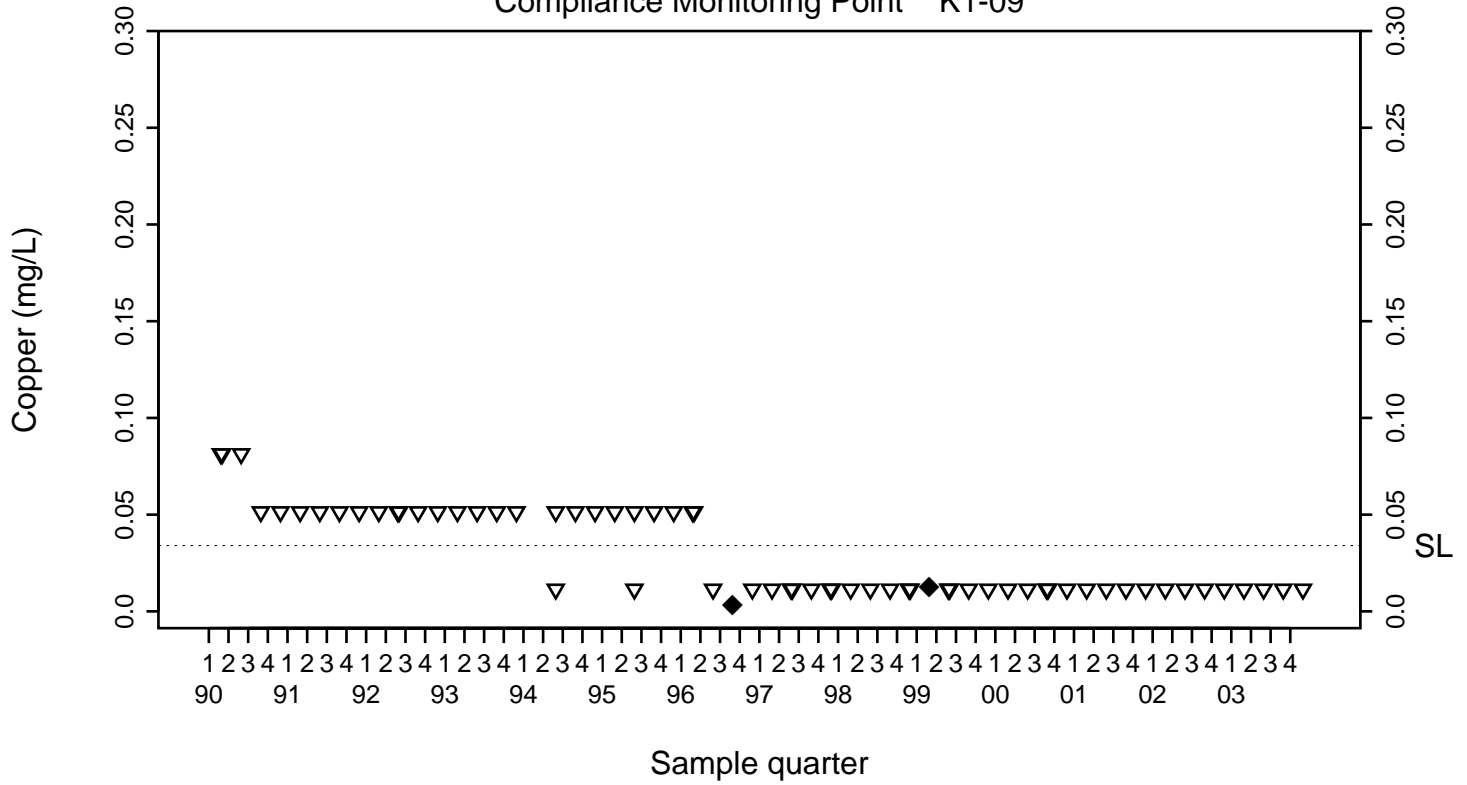
◆ Above RL
▽ Below RL

Compliance Monitoring Point K1-08



SL=0.034

Compliance Monitoring Point K1-09

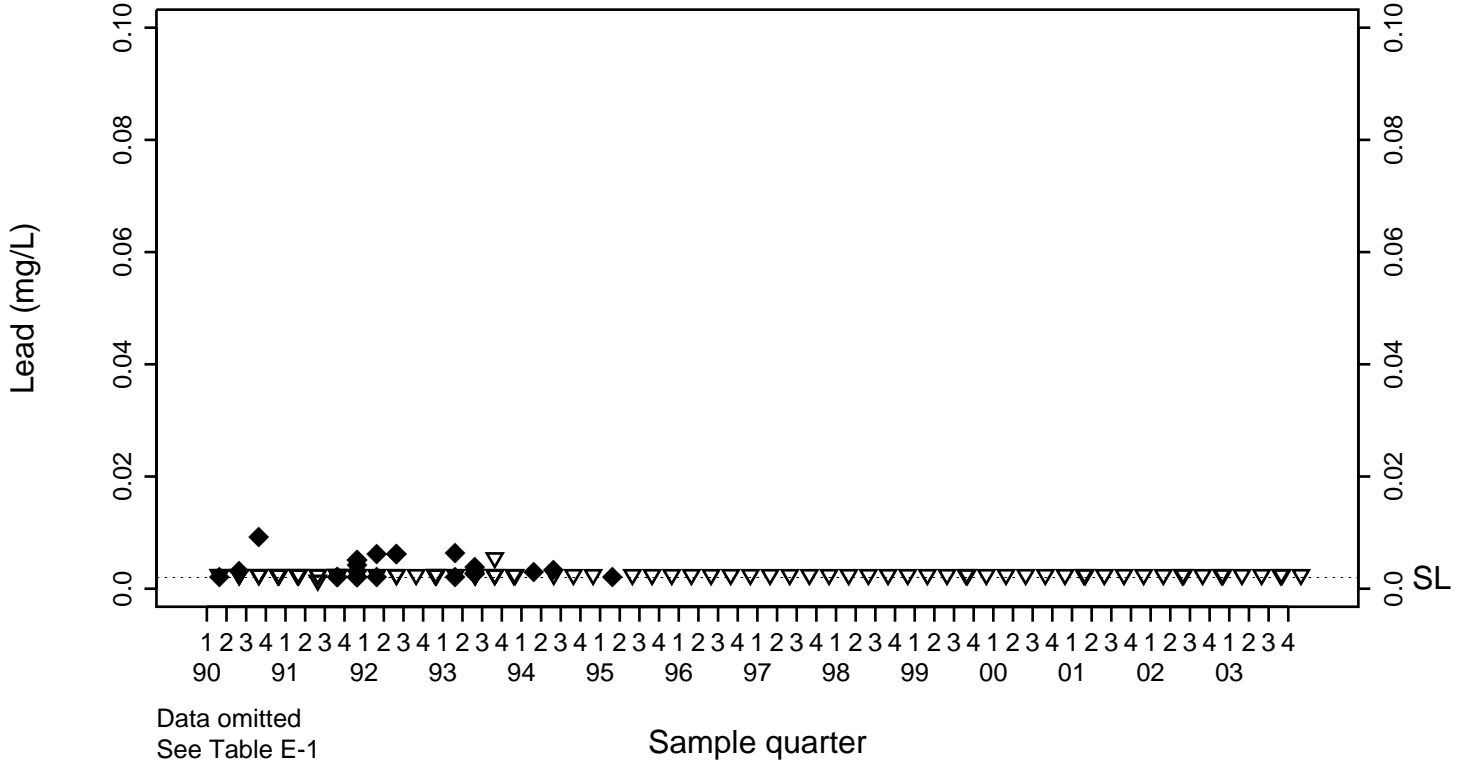


Pit 1 Area Lead (mg/L)

SL=0.002

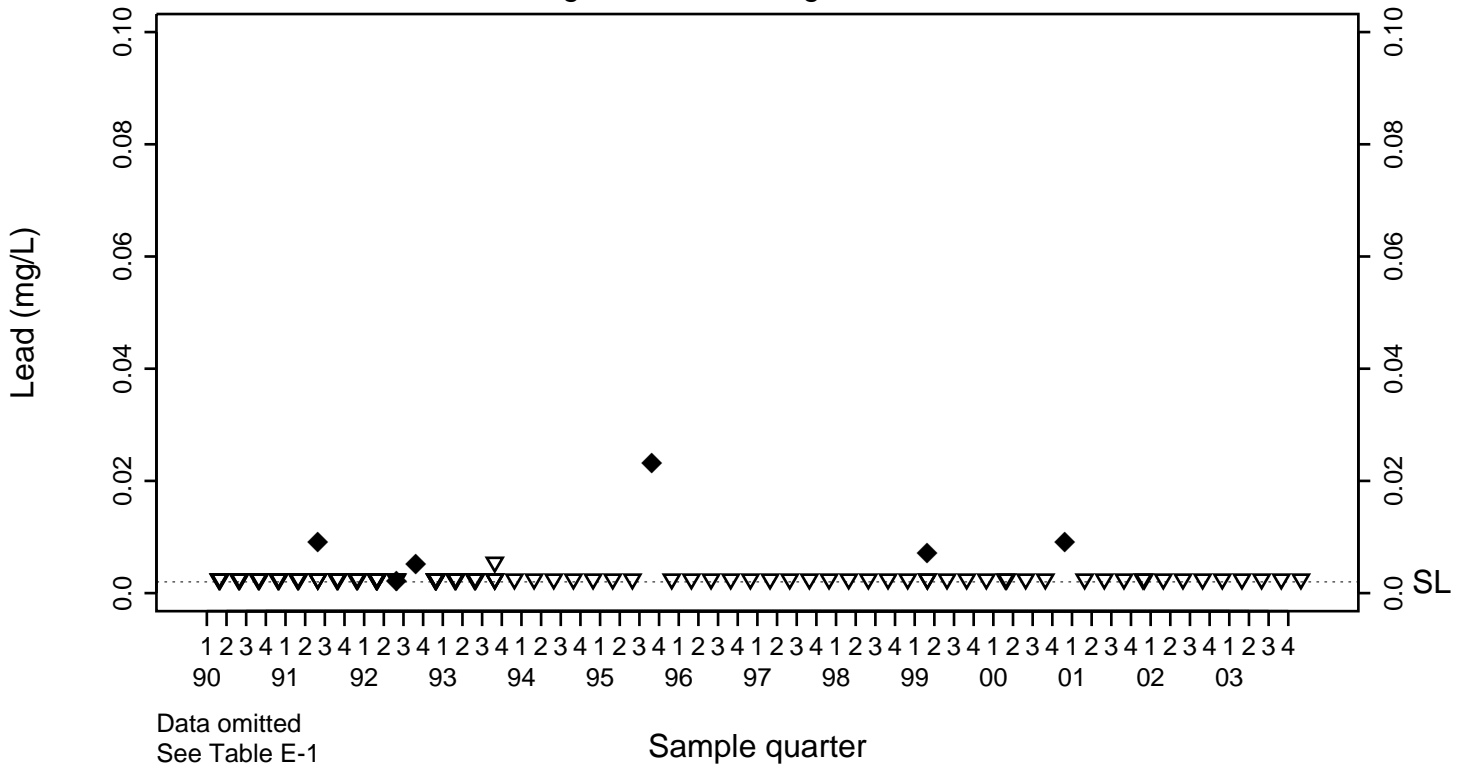
◆ Above RL
▽ Below RL

Background Monitoring Point K1-01C



SL=0.002

Background Monitoring Point K1-07

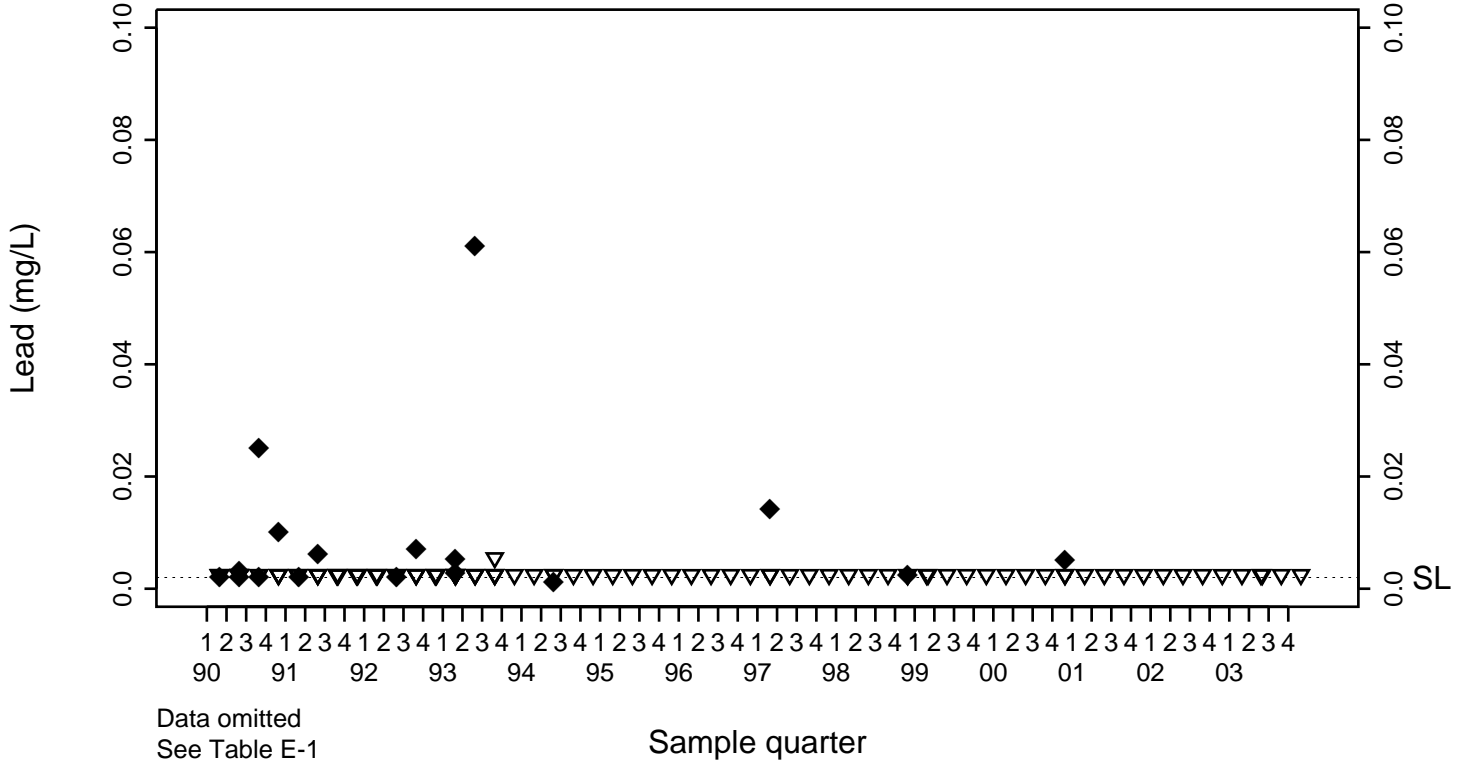


Pit 1 Area Lead (mg/L)

SL=0.002

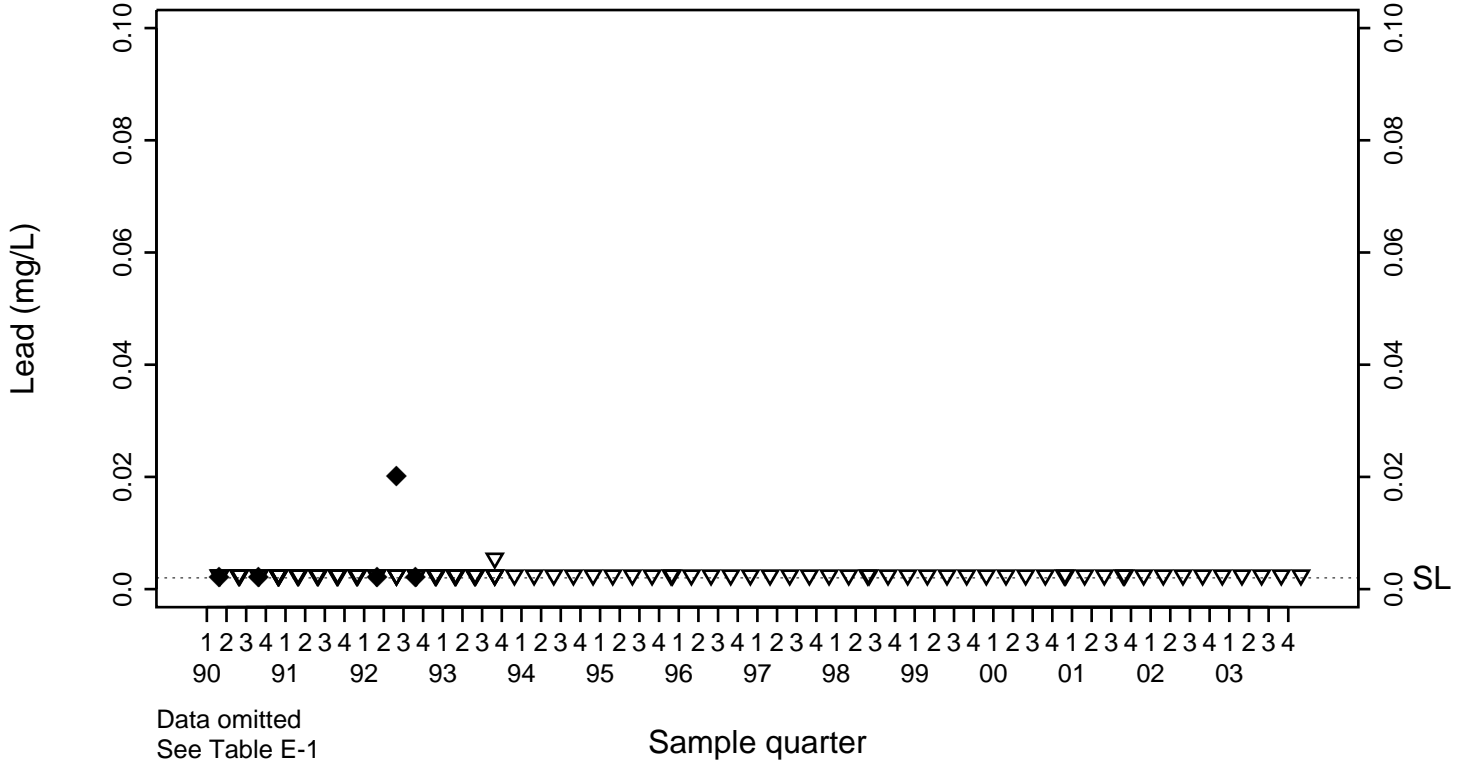
◆ Above RL
▽ Below RL

Compliance Monitoring Point K1-02B



SL=0.002

Compliance Monitoring Point K1-03

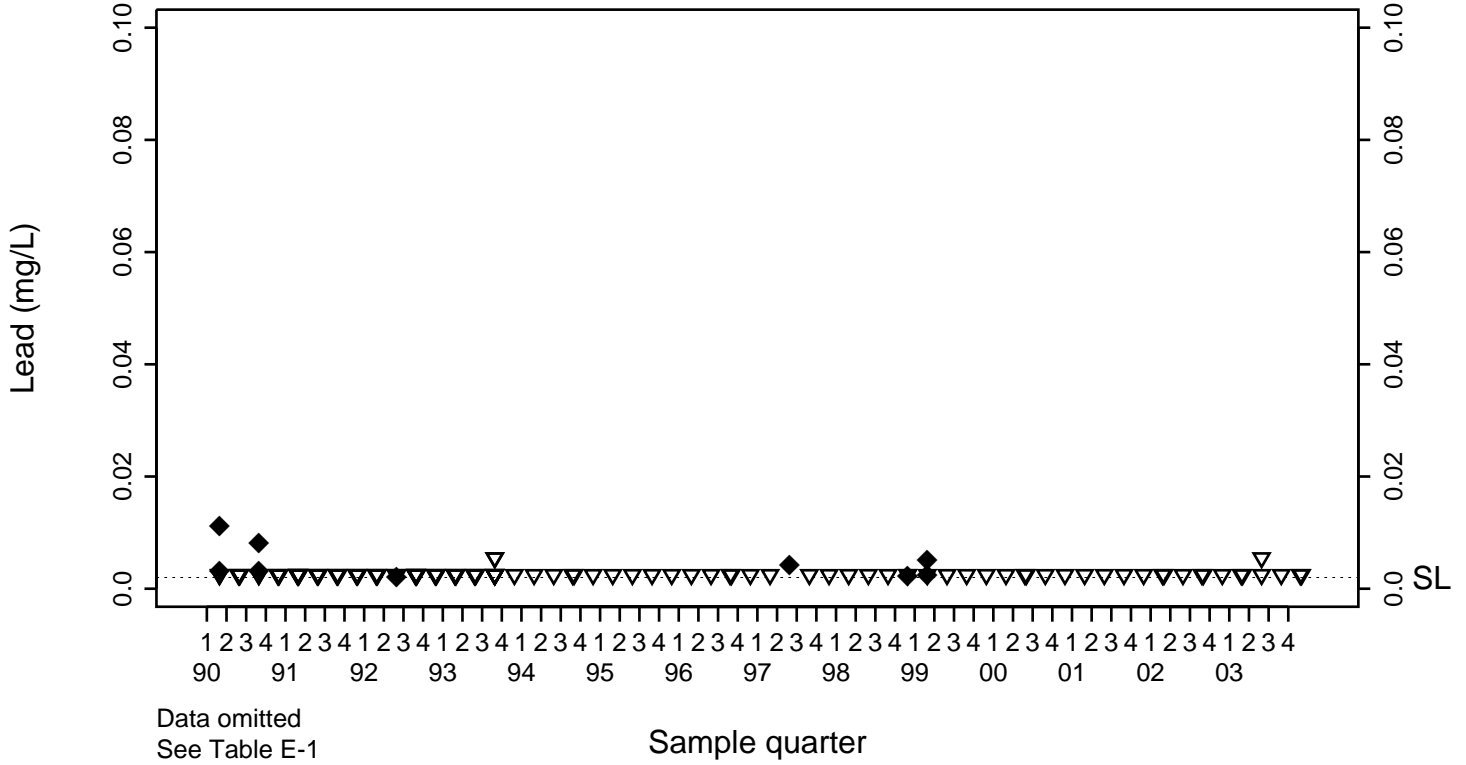


Pit 1 Area Lead (mg/L)

SL=0.002

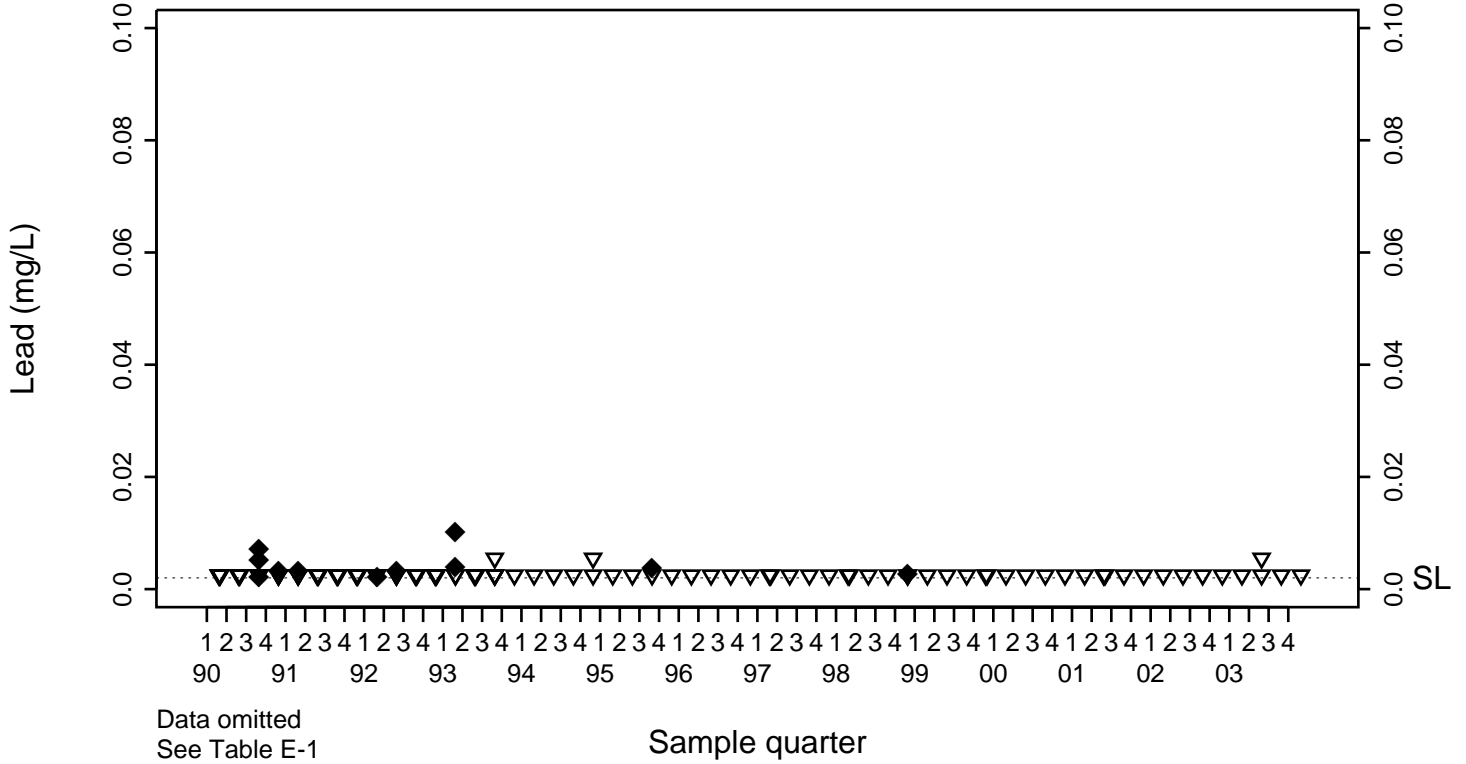
◆ Above RL
▽ Below RL

Compliance Monitoring Point K1-04



SL=0.002

Compliance Monitoring Point K1-05

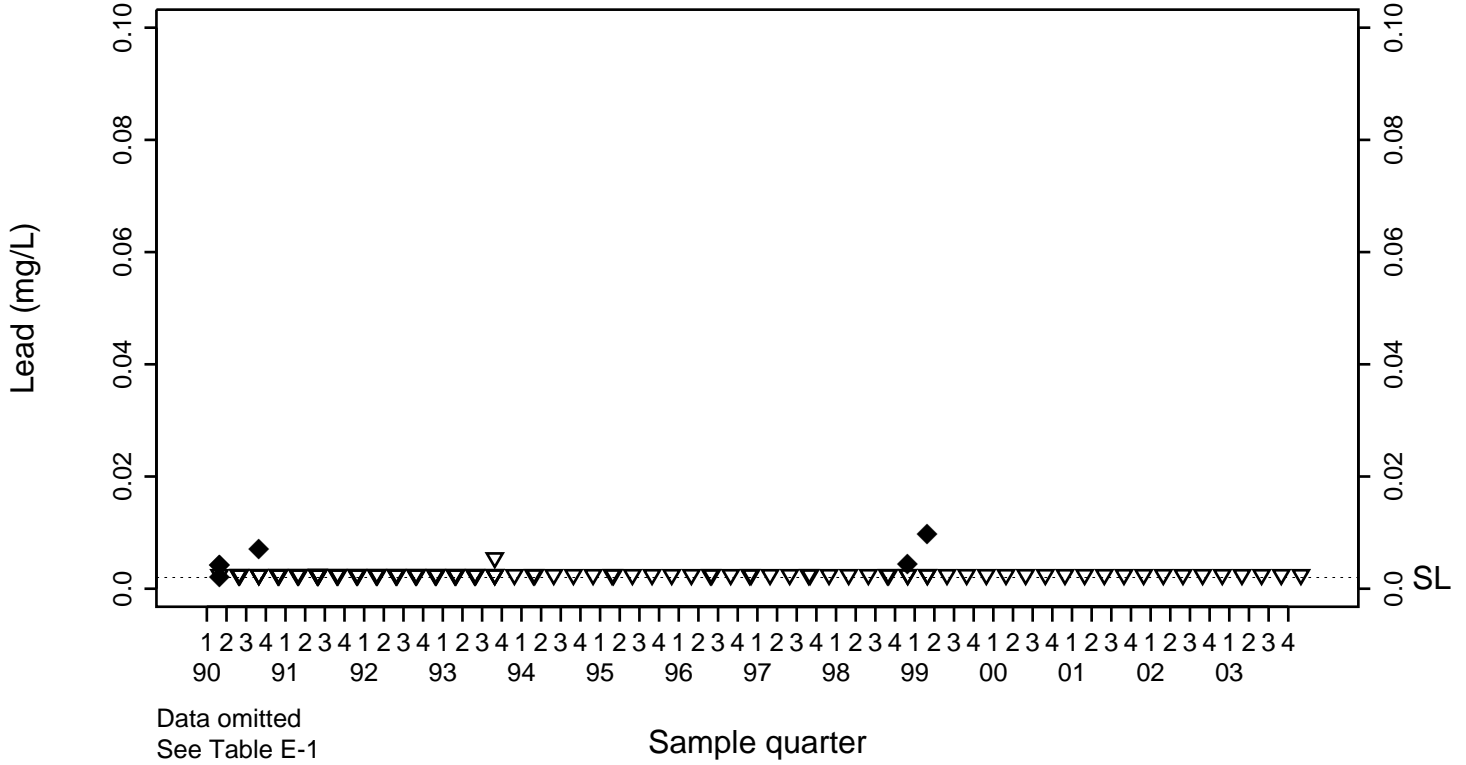


Pit 1 Area Lead (mg/L)

SL=0.002

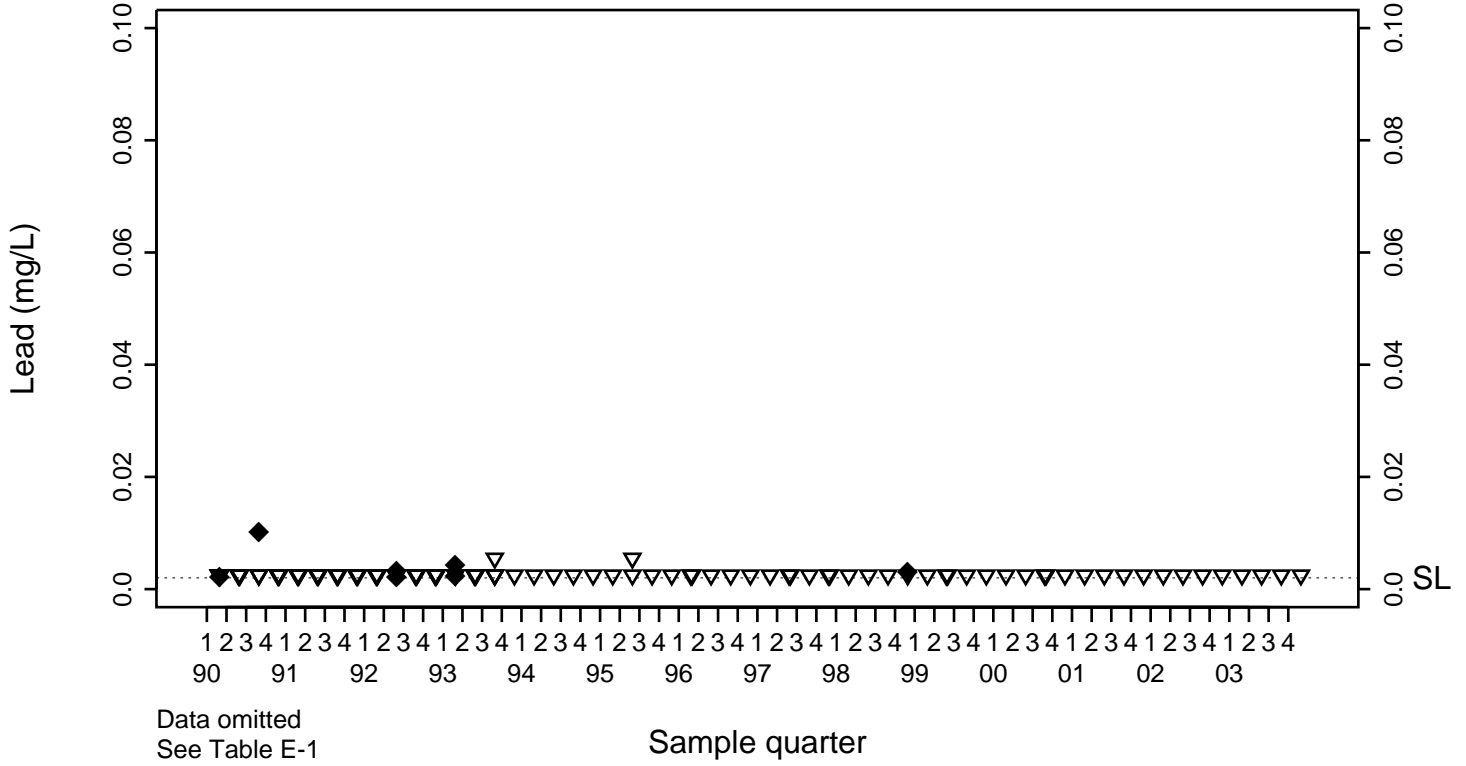
◆ Above RL
▽ Below RL

Compliance Monitoring Point K1-08



SL=0.002

Compliance Monitoring Point K1-09

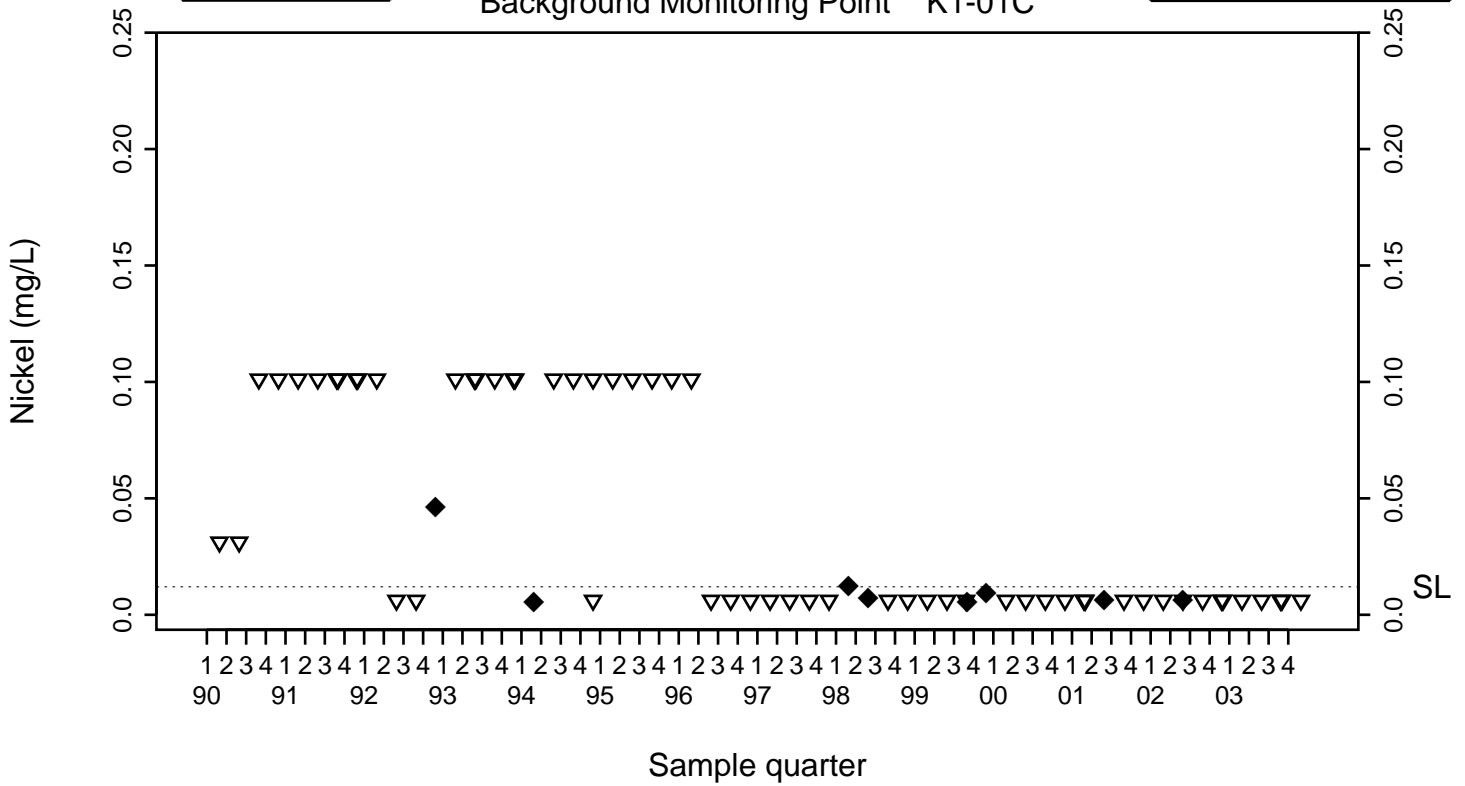


Pit 1 Area Nickel (mg/L)

SL=0.012

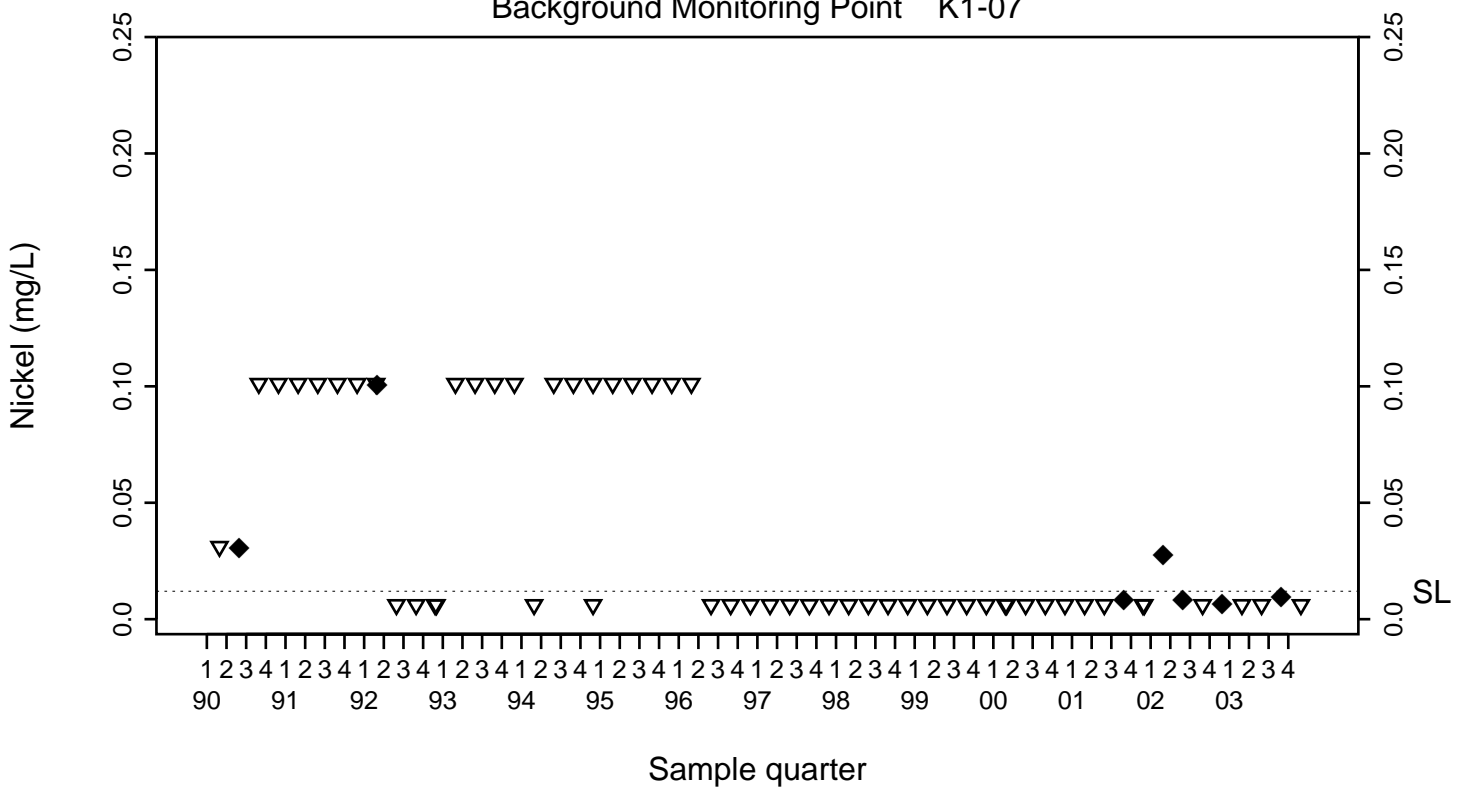
◆ Above RL
▽ Below RL

Background Monitoring Point K1-01C



SL=0.012

Background Monitoring Point K1-07

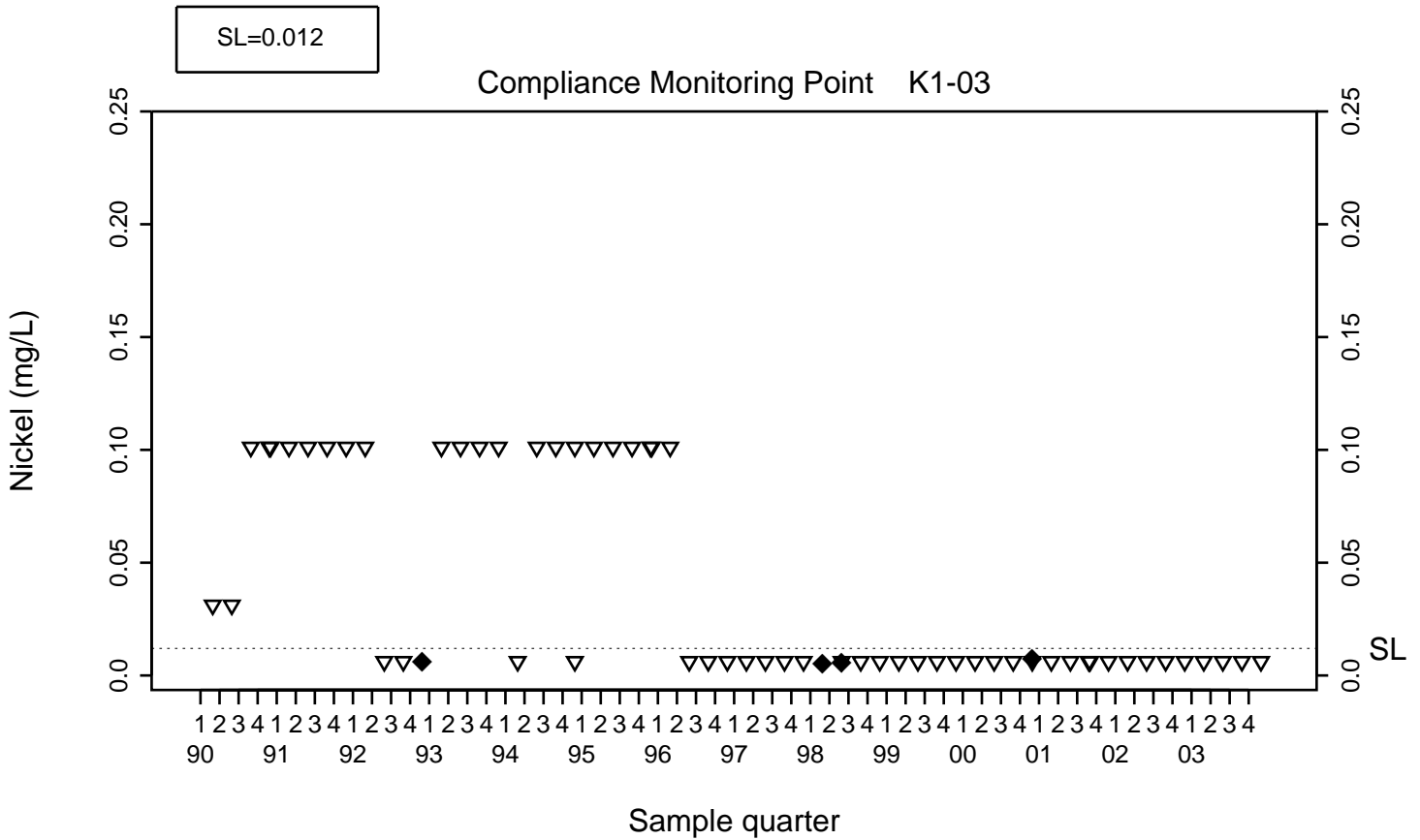
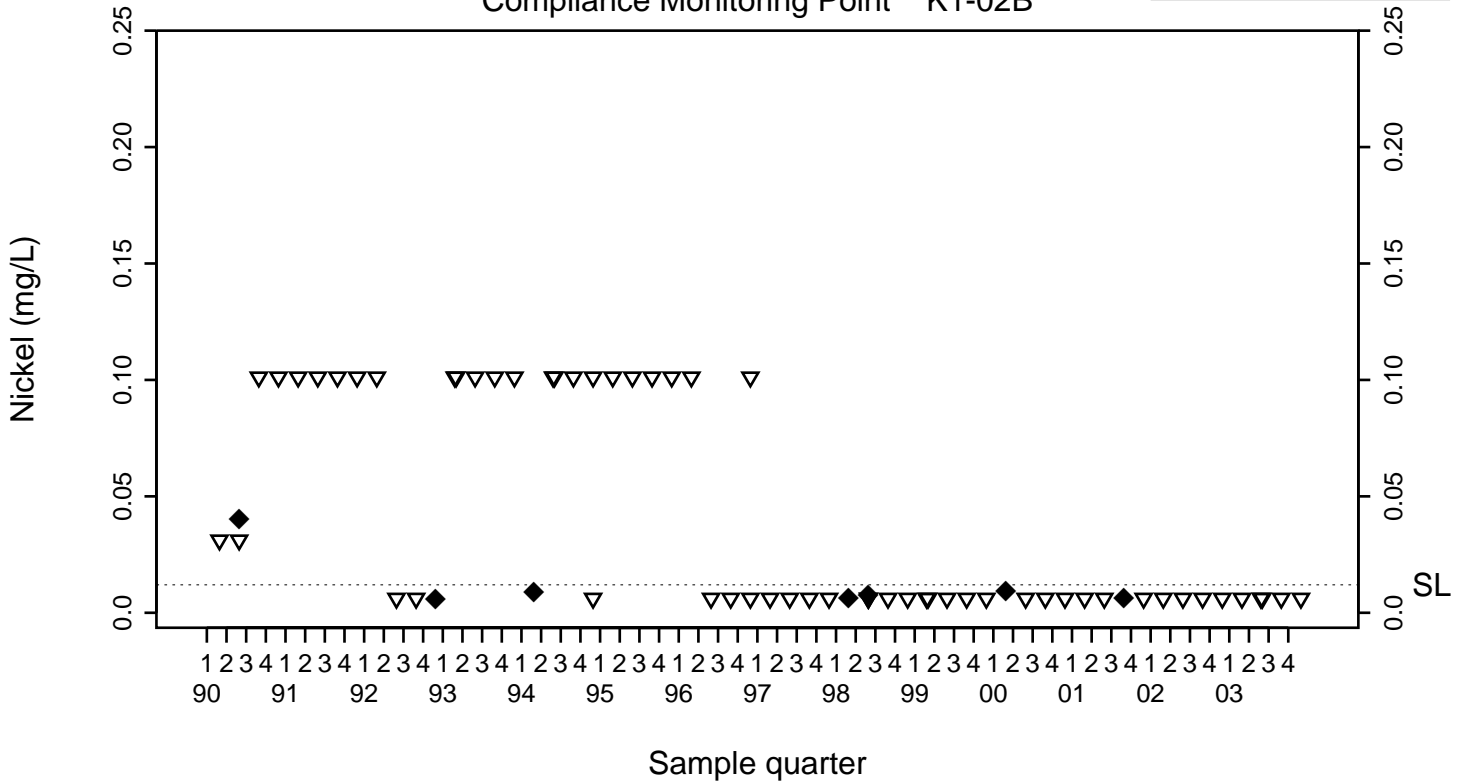


Pit 1 Area Nickel (mg/L)

Compliance Monitoring Point K1-02B

SL=0.012

◆ Above RL
▽ Below RL

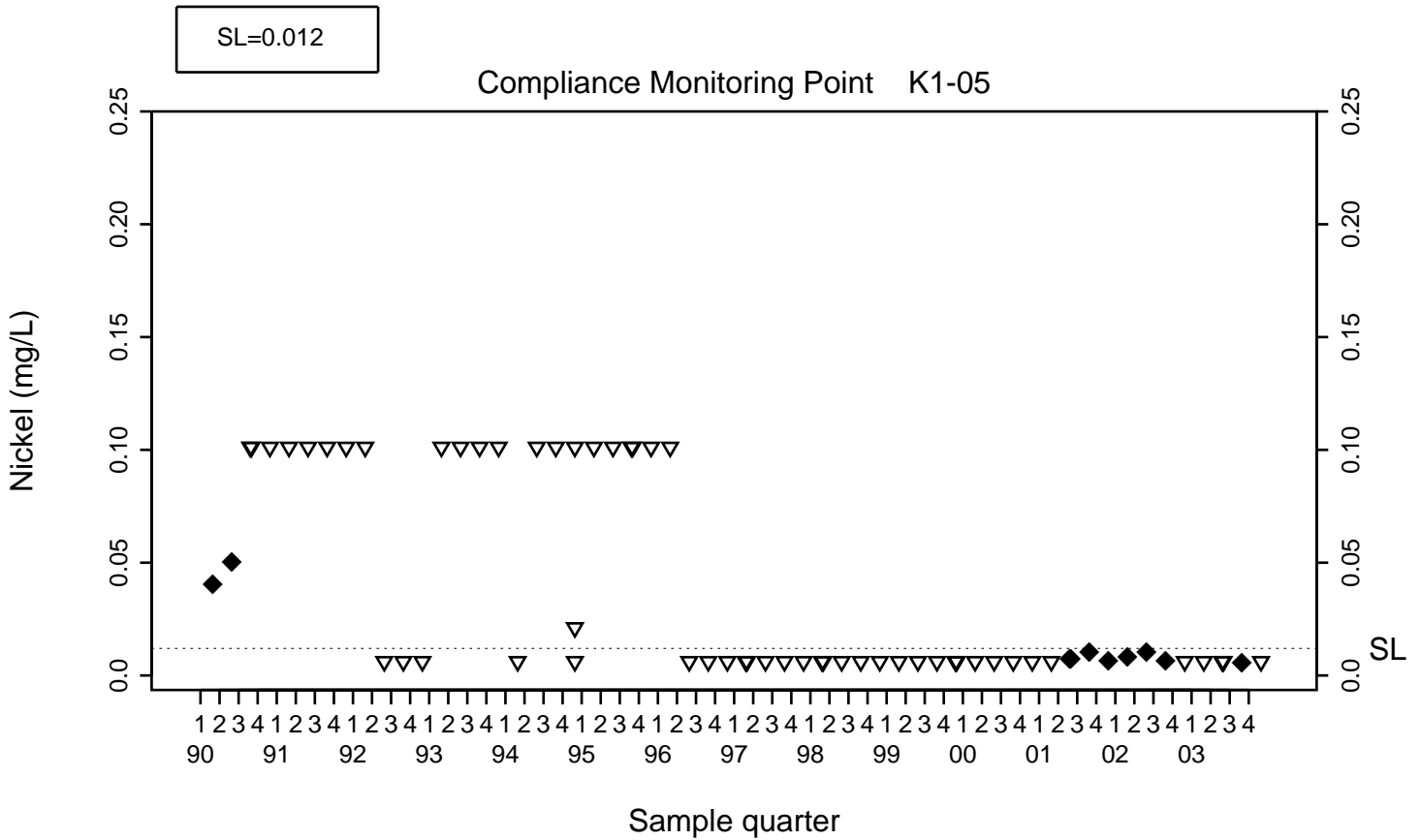
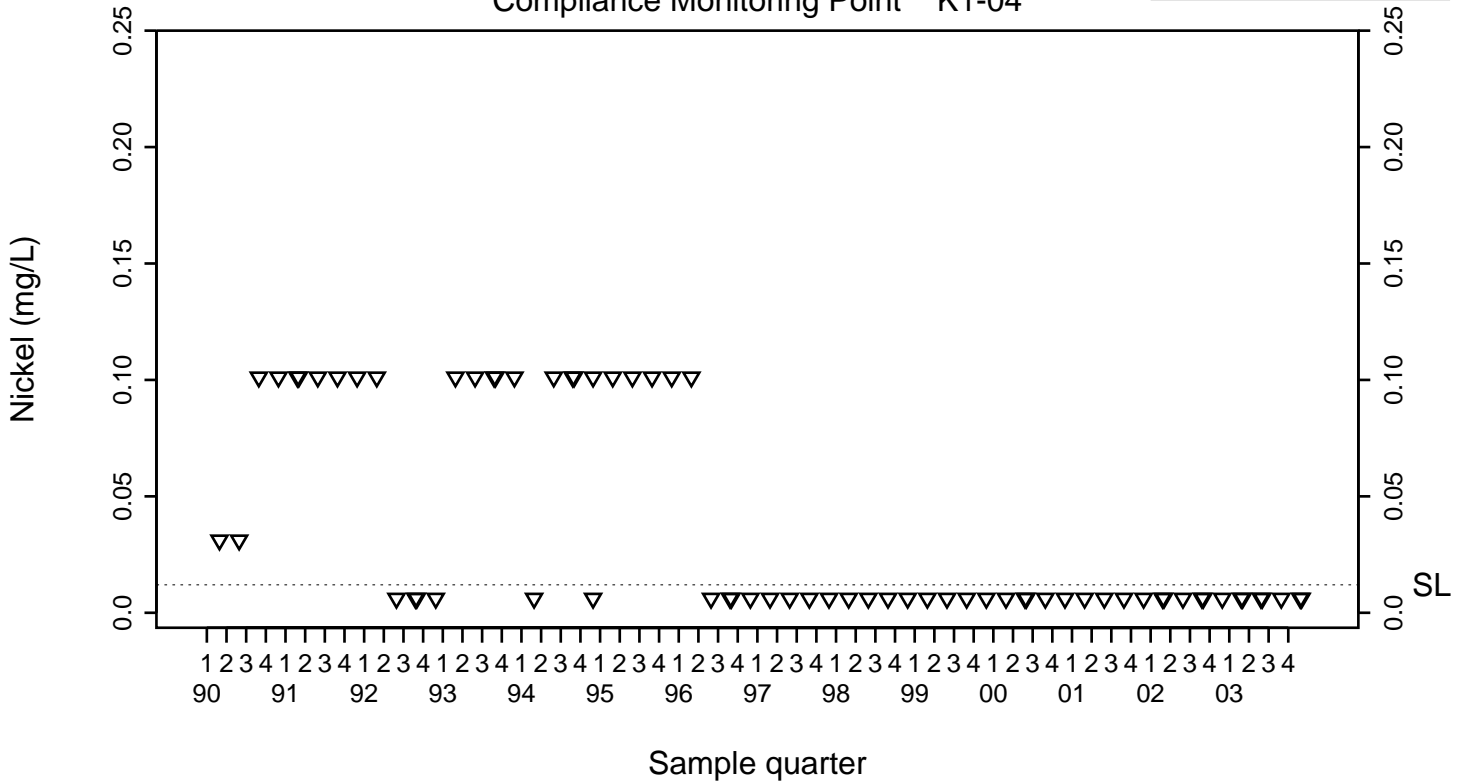


Pit 1 Area Nickel (mg/L)

SL=0.012

◆ Above RL
▽ Below RL

Compliance Monitoring Point K1-04

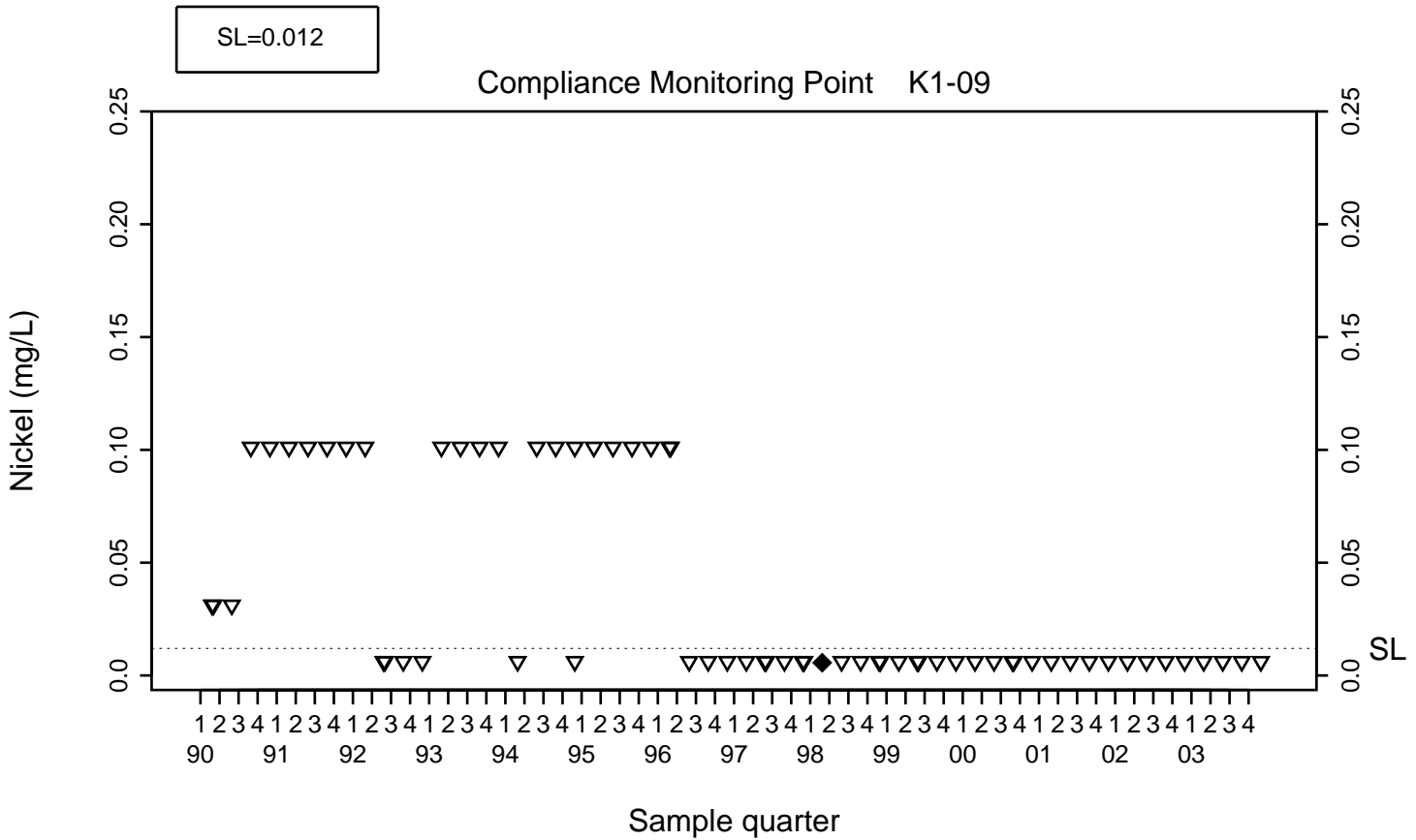
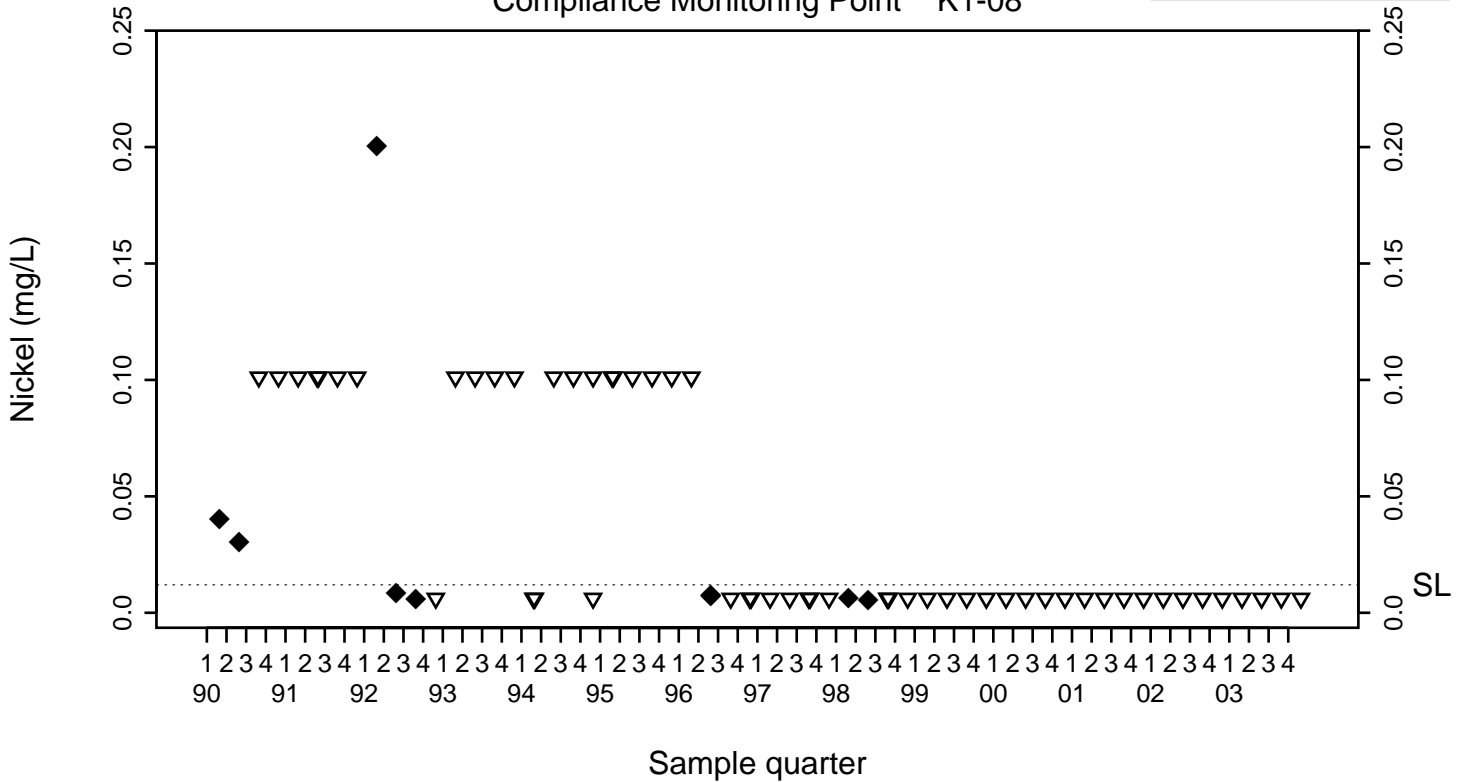


Pit 1 Area Nickel (mg/L)

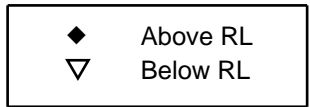
SL=0.012

◆ Above RL
▽ Below RL

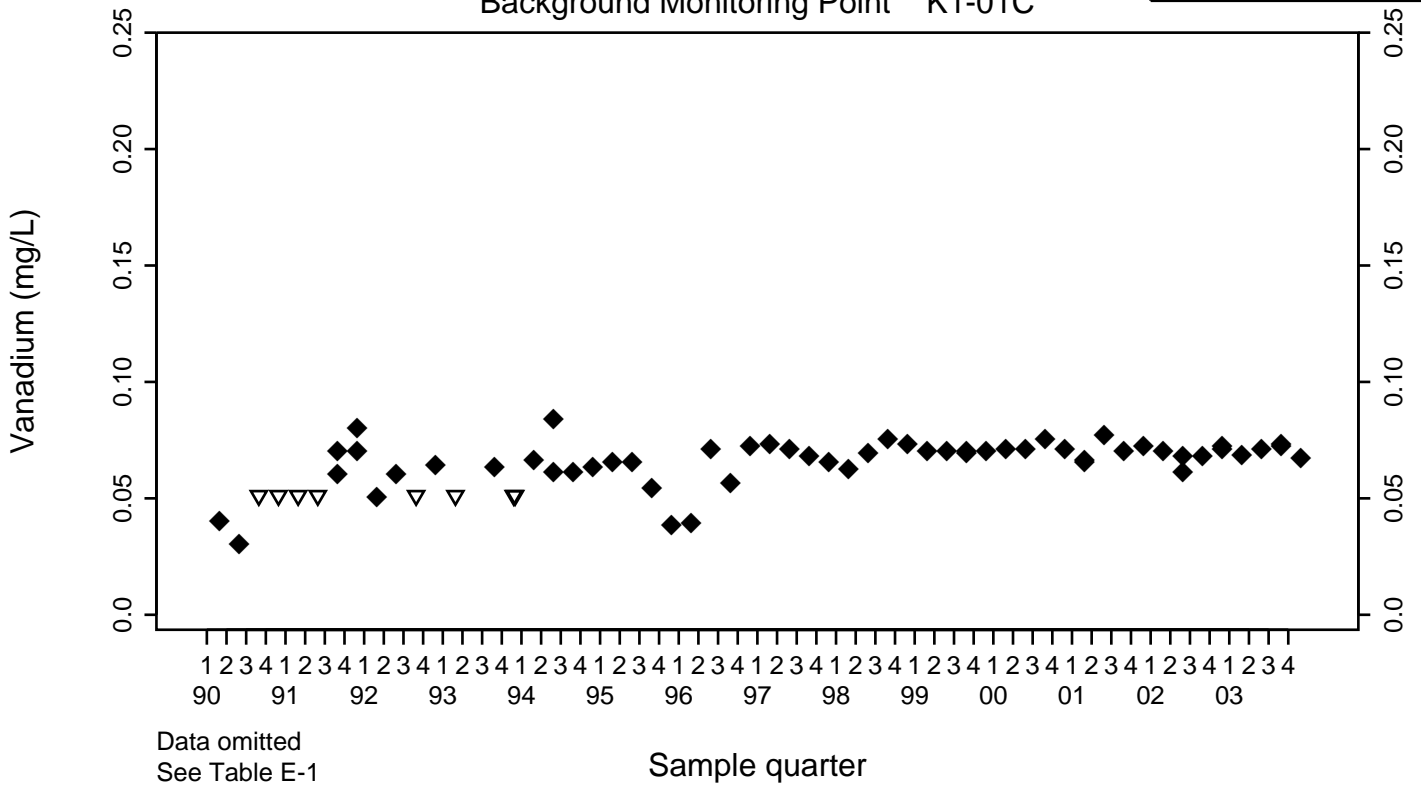
Compliance Monitoring Point K1-08



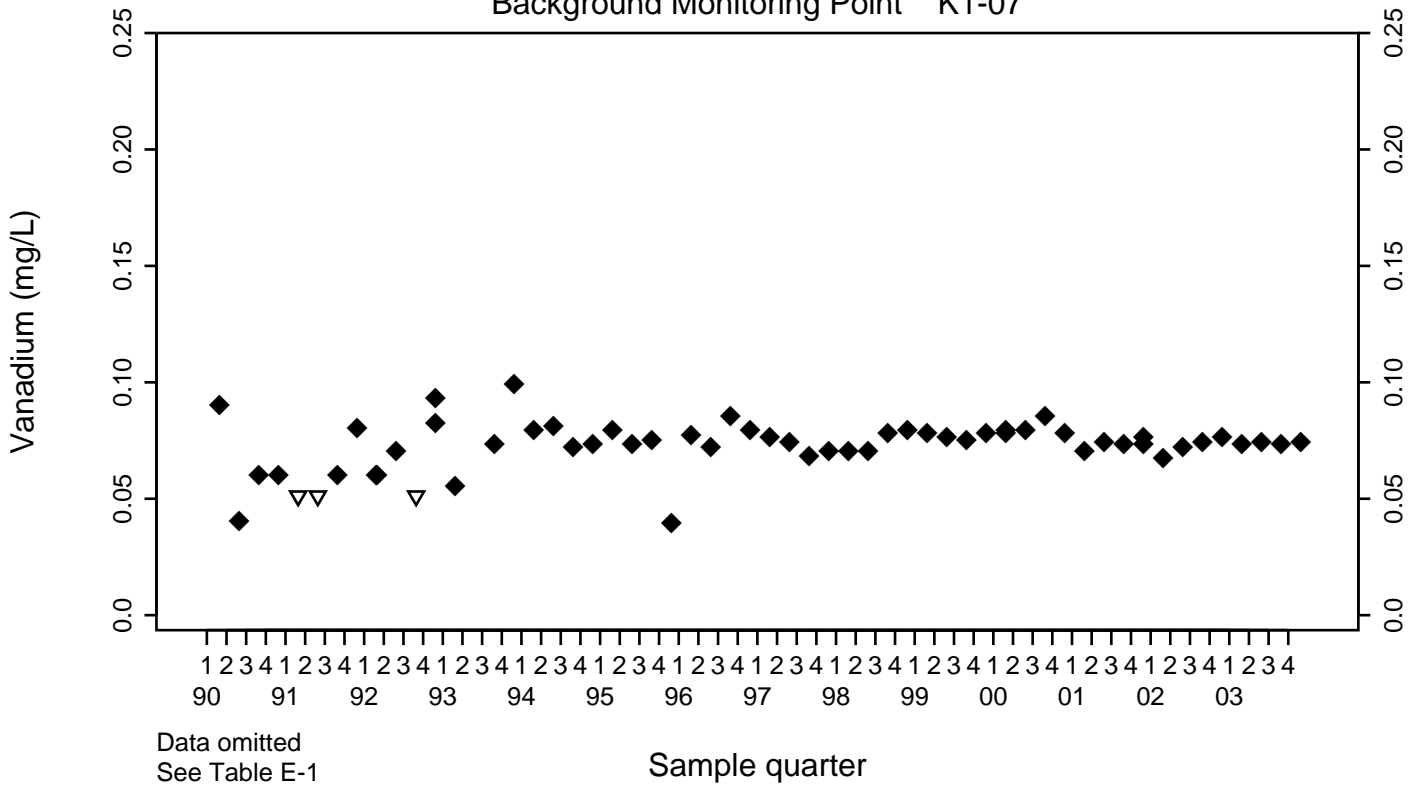
Pit 1 Area Vanadium (mg/L)

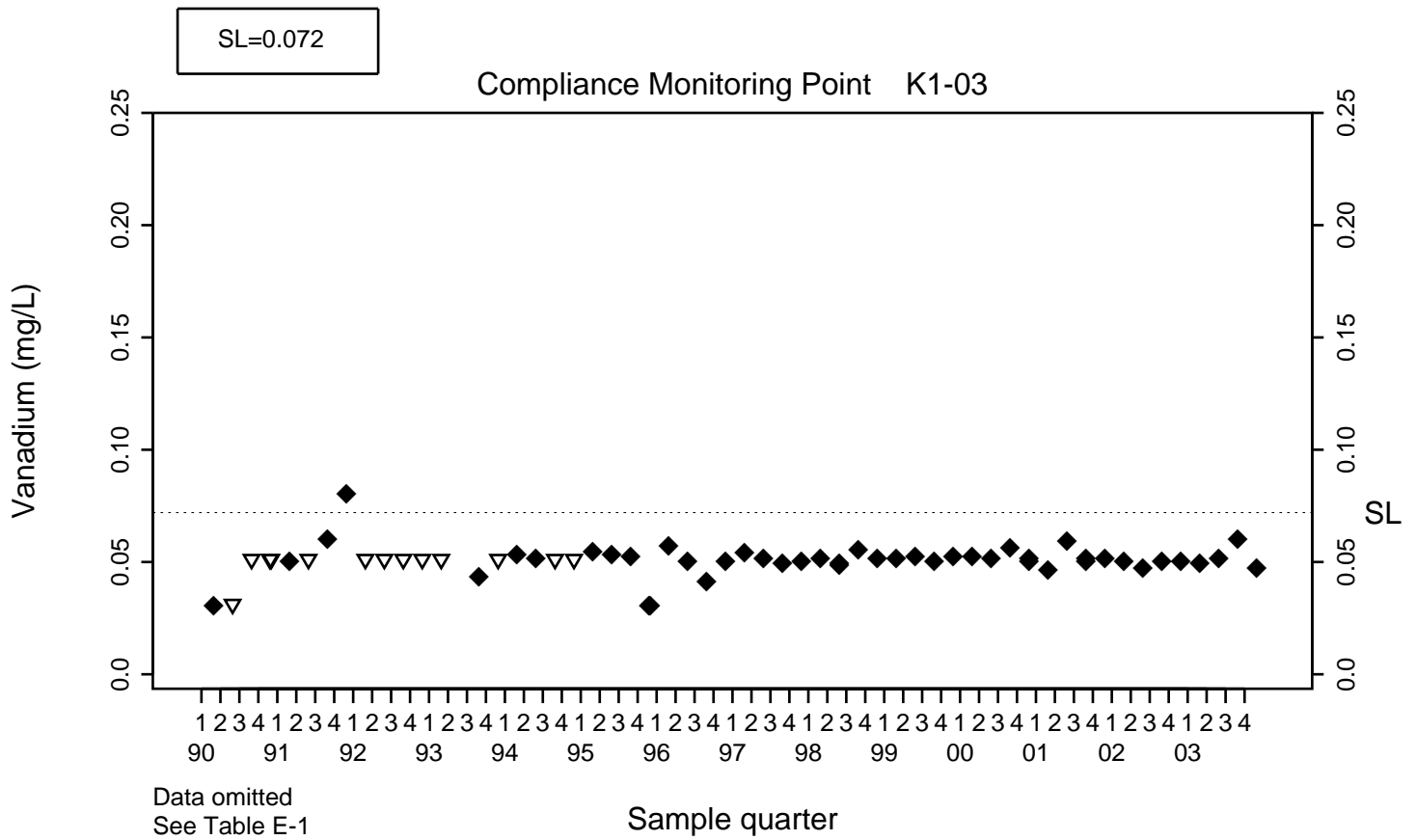
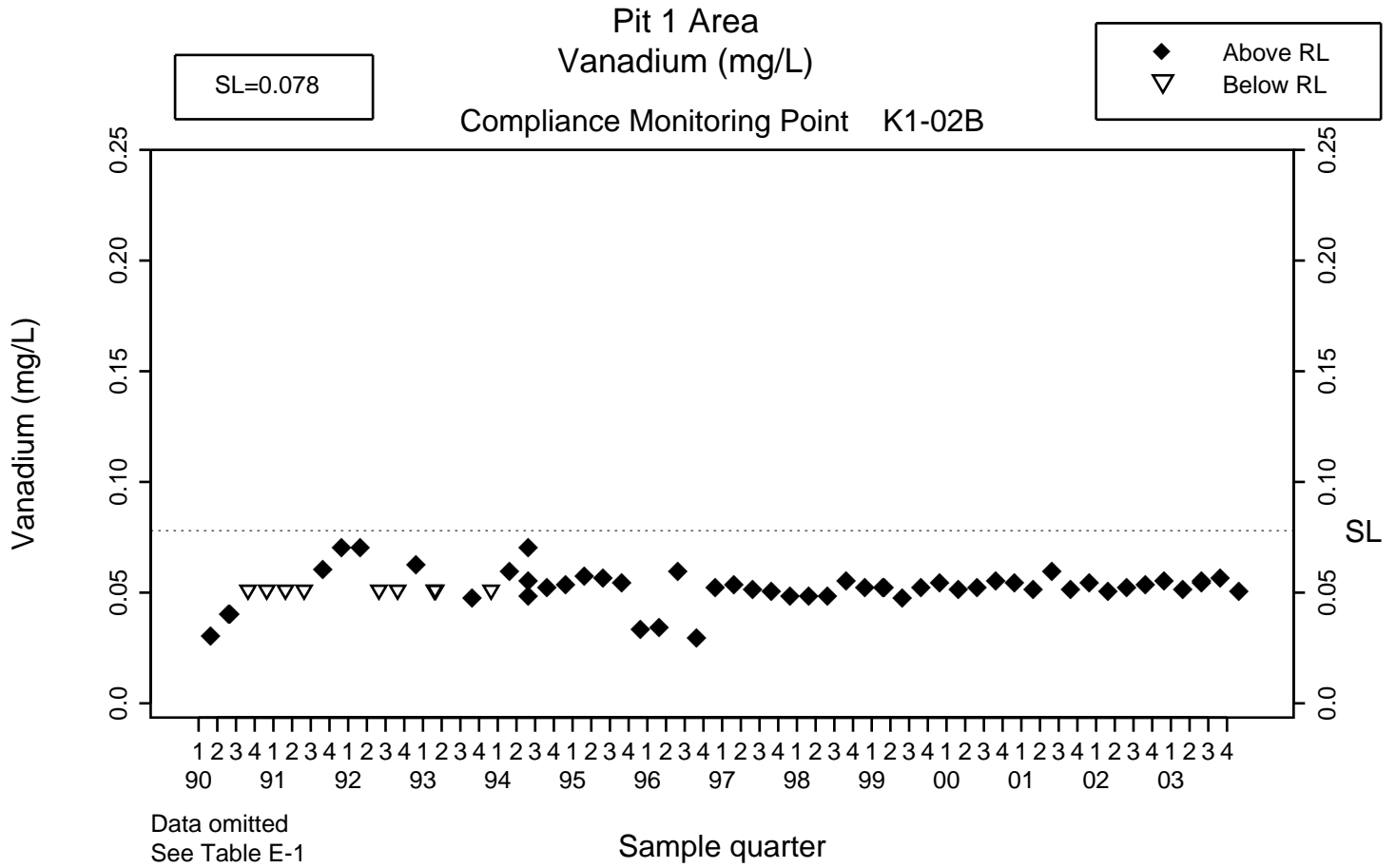


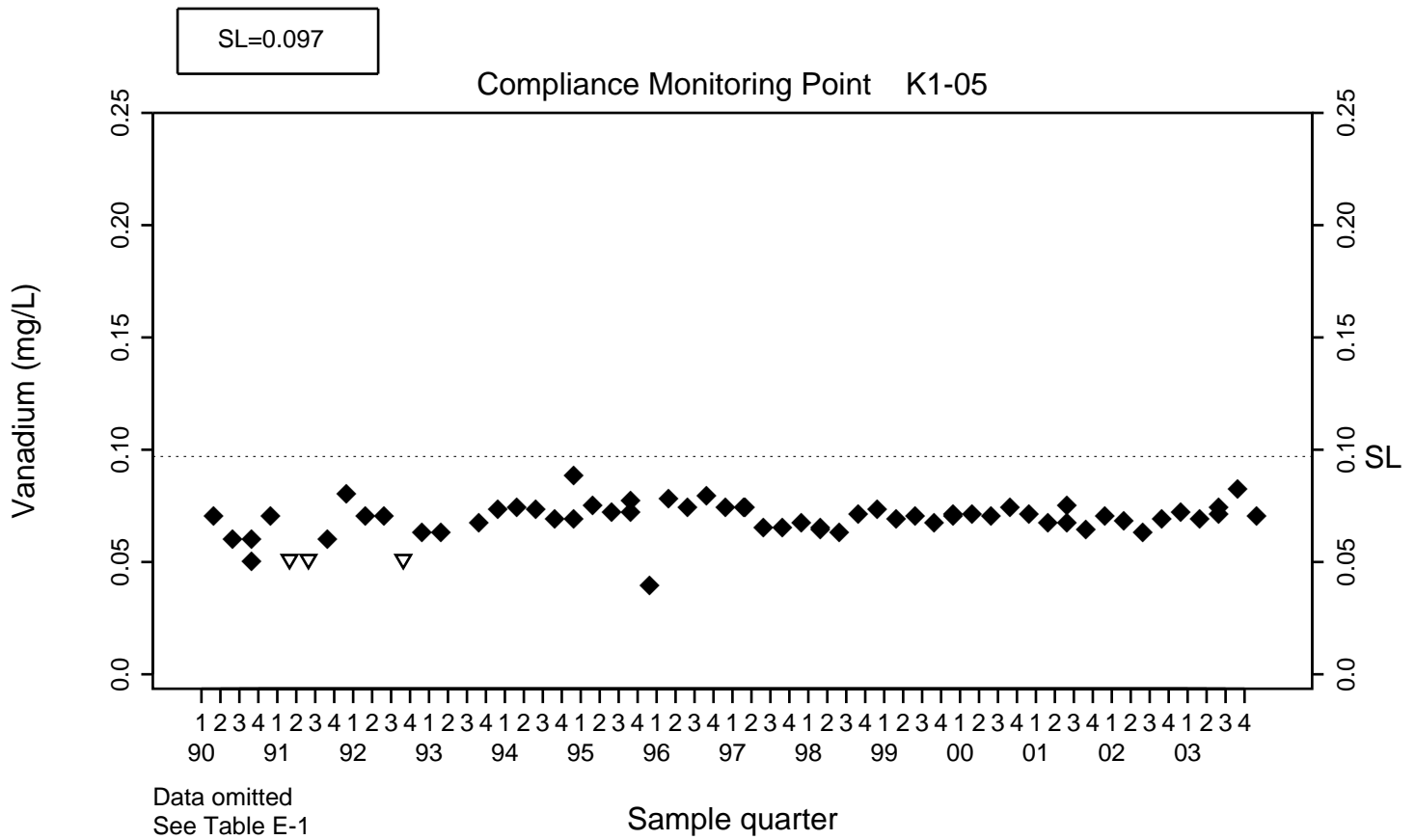
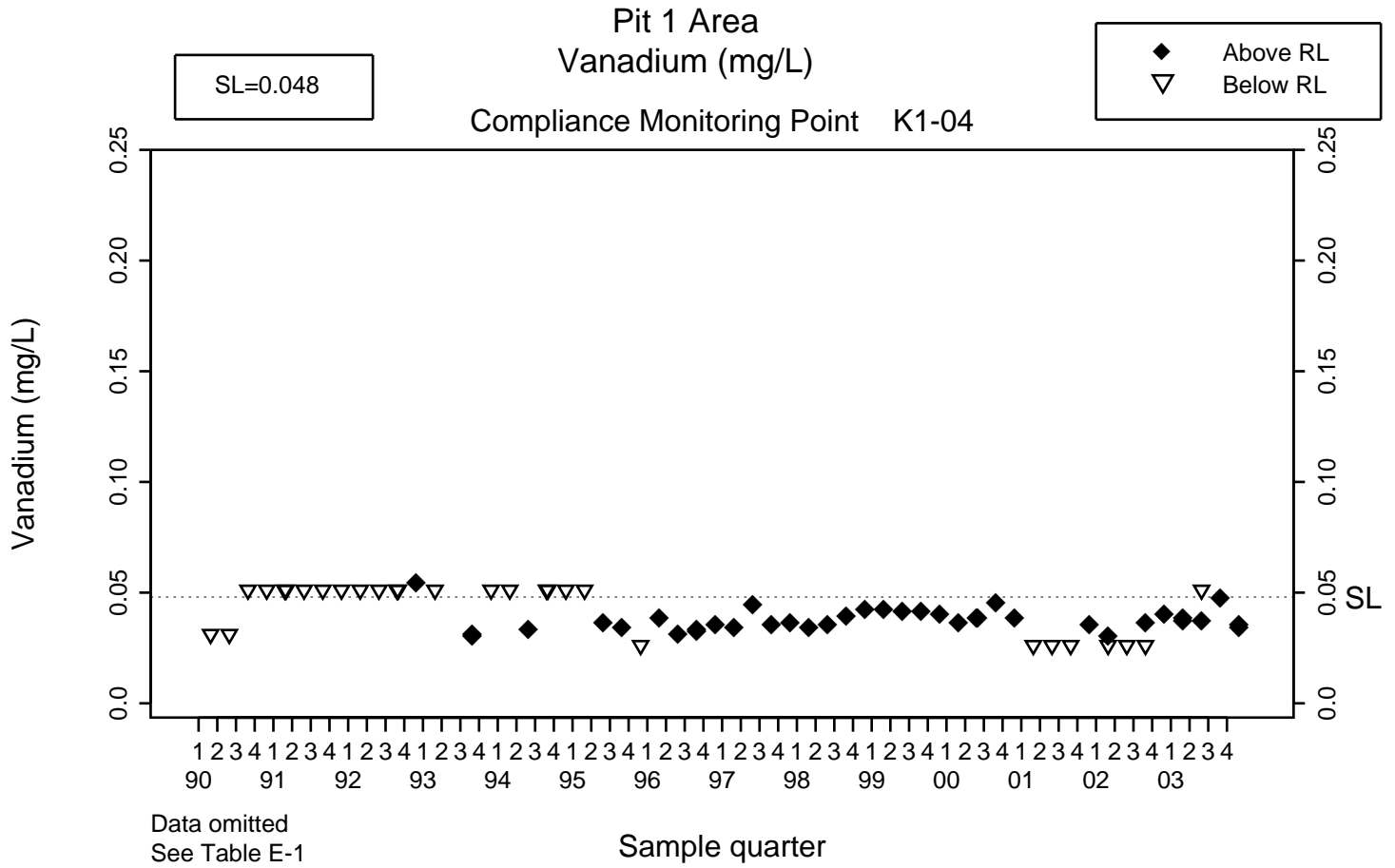
Background Monitoring Point K1-01C

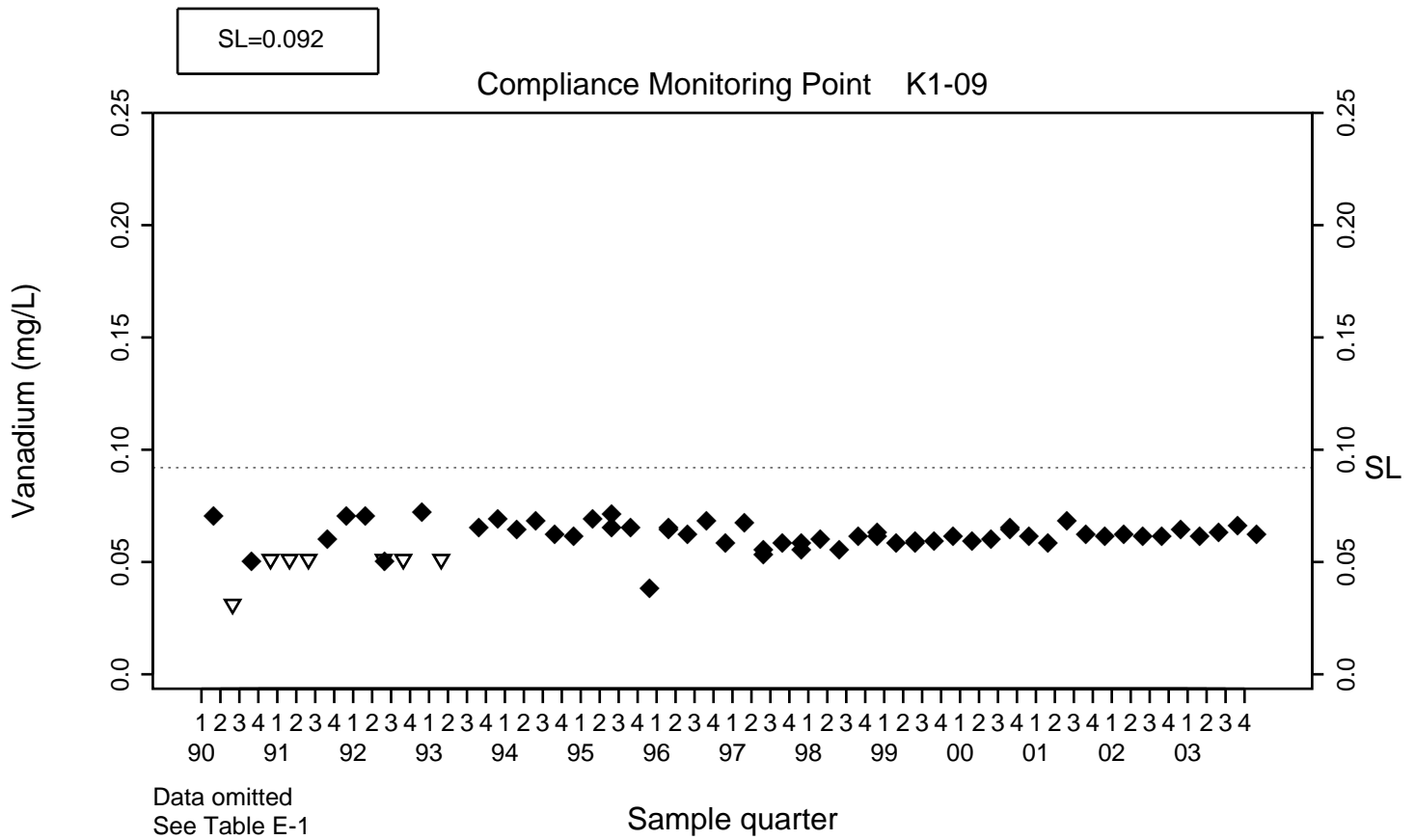
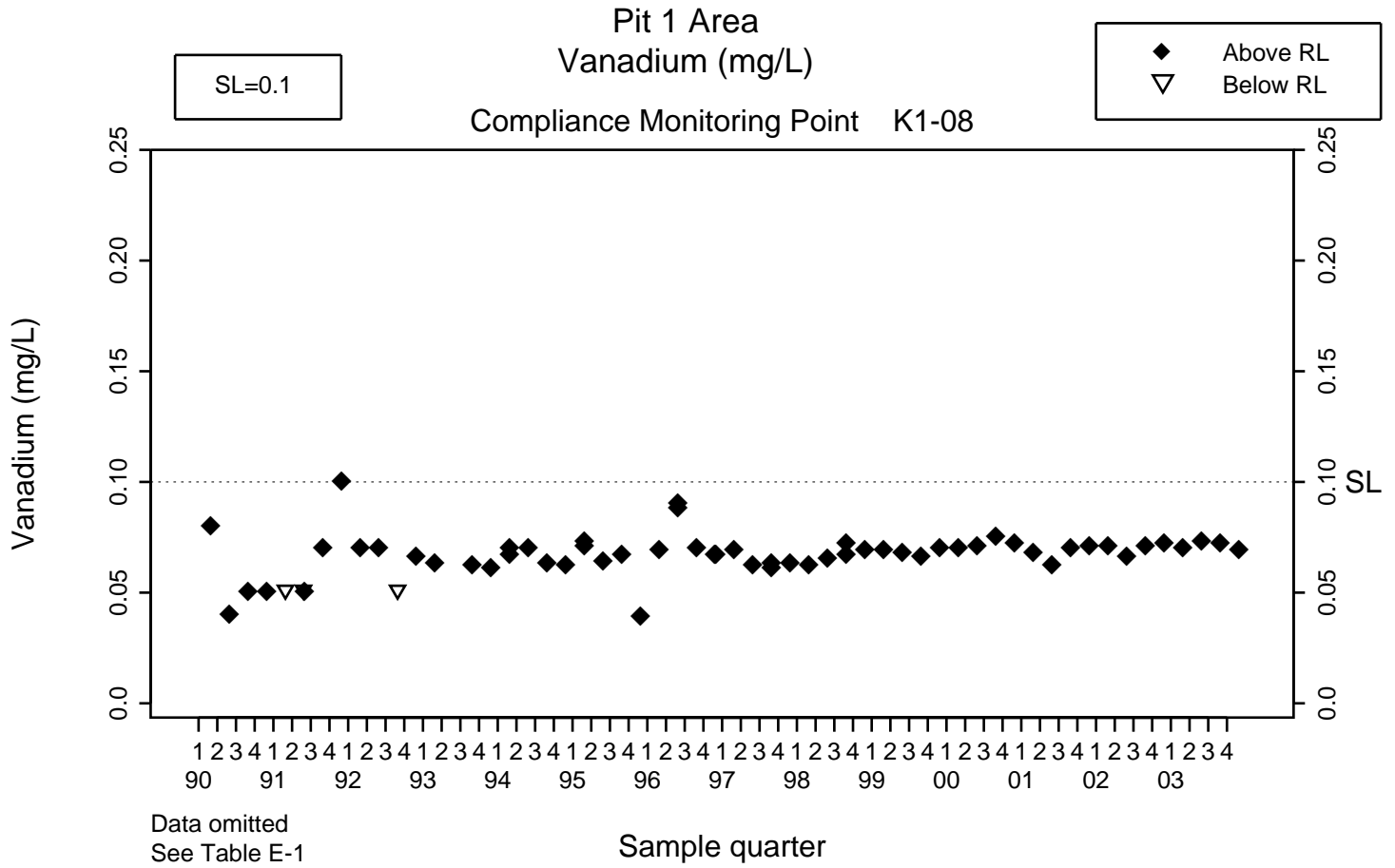


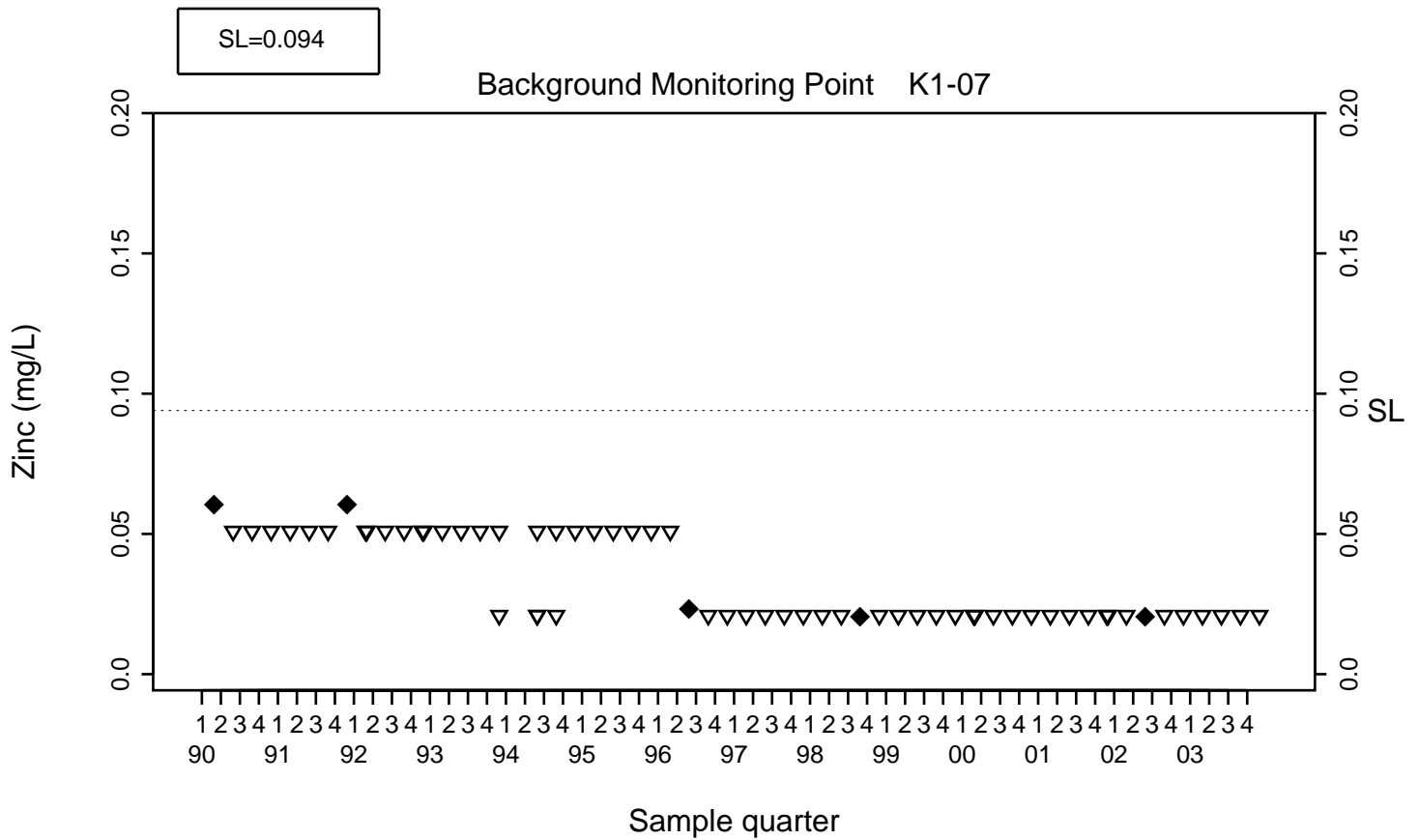
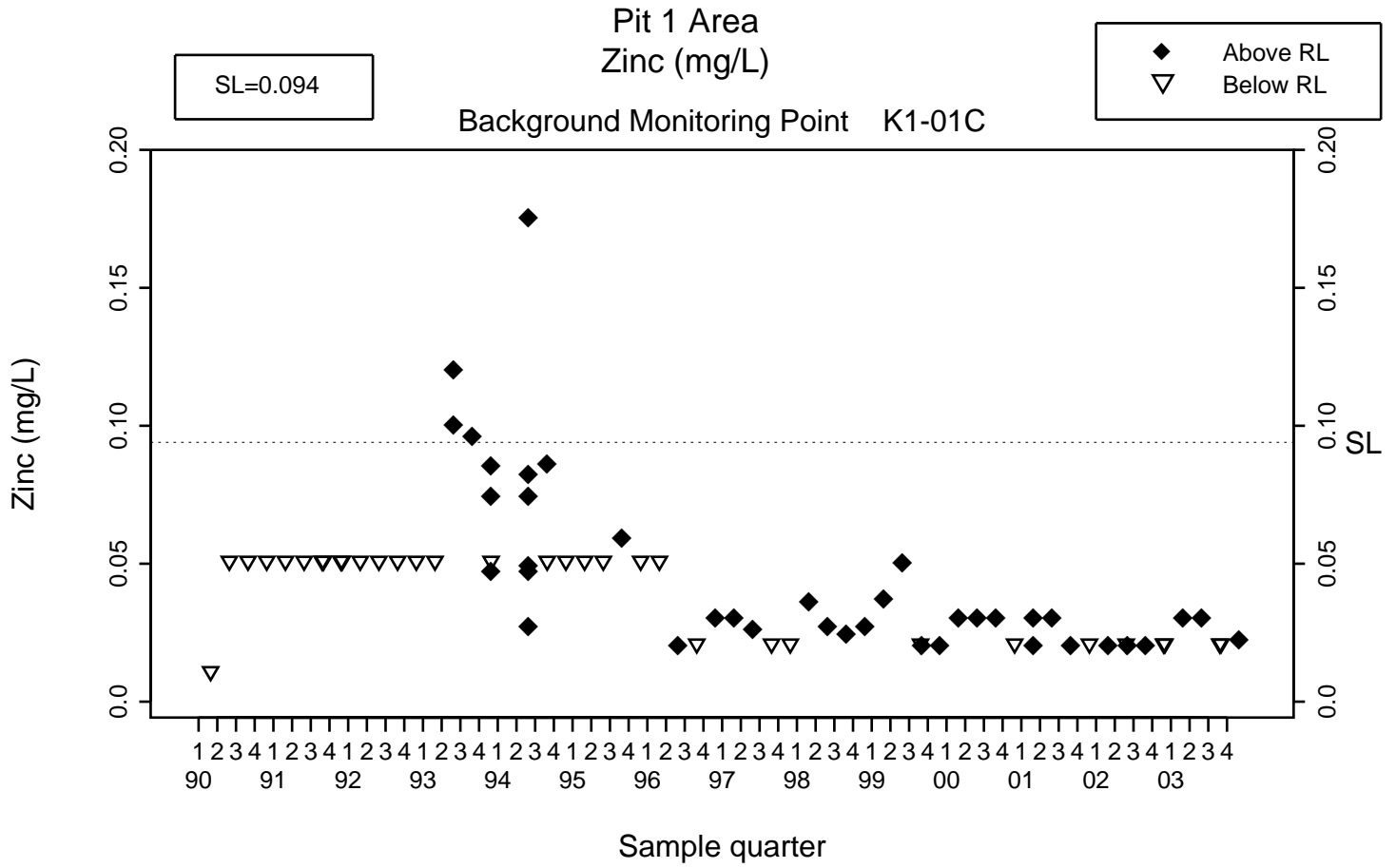
Background Monitoring Point K1-07

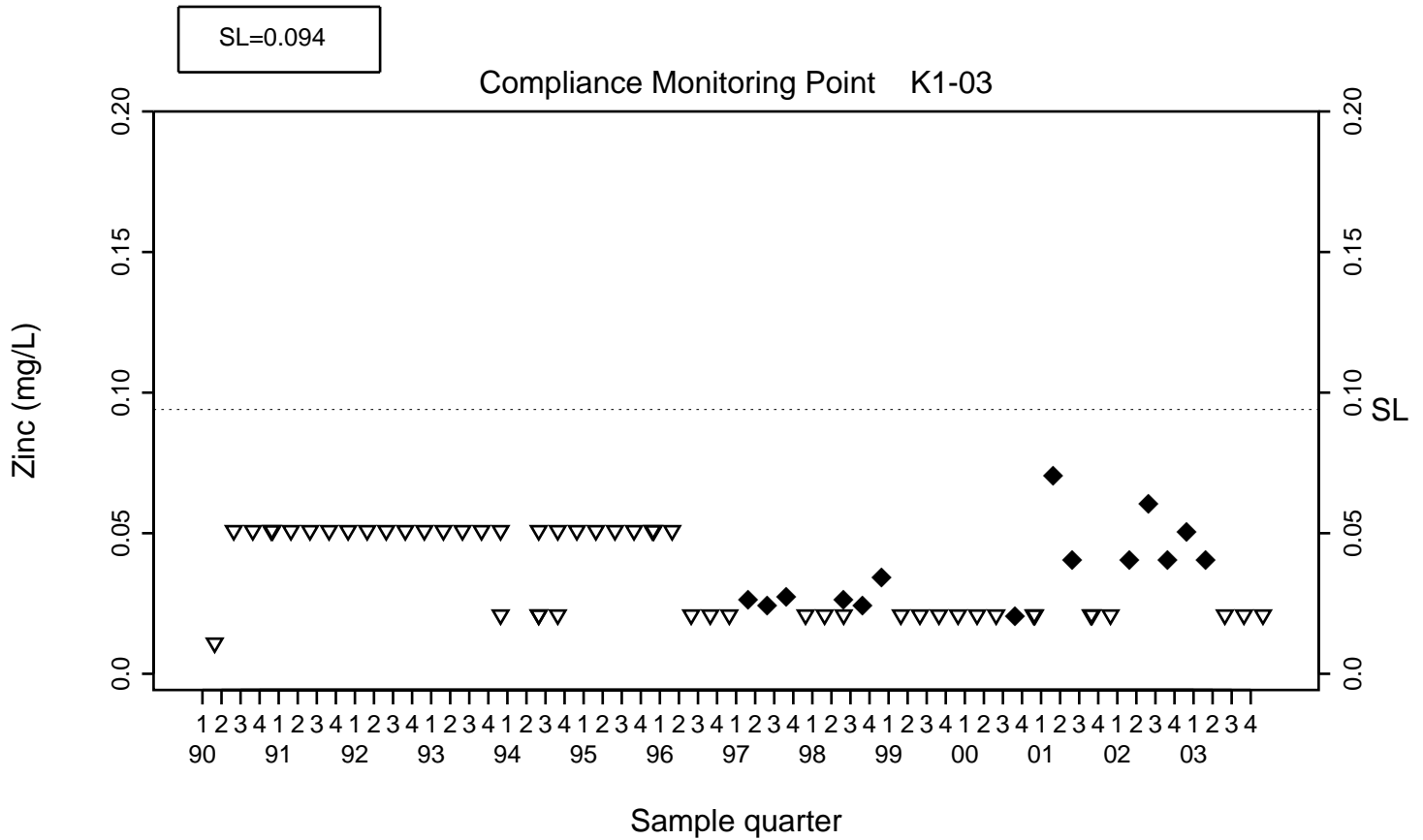
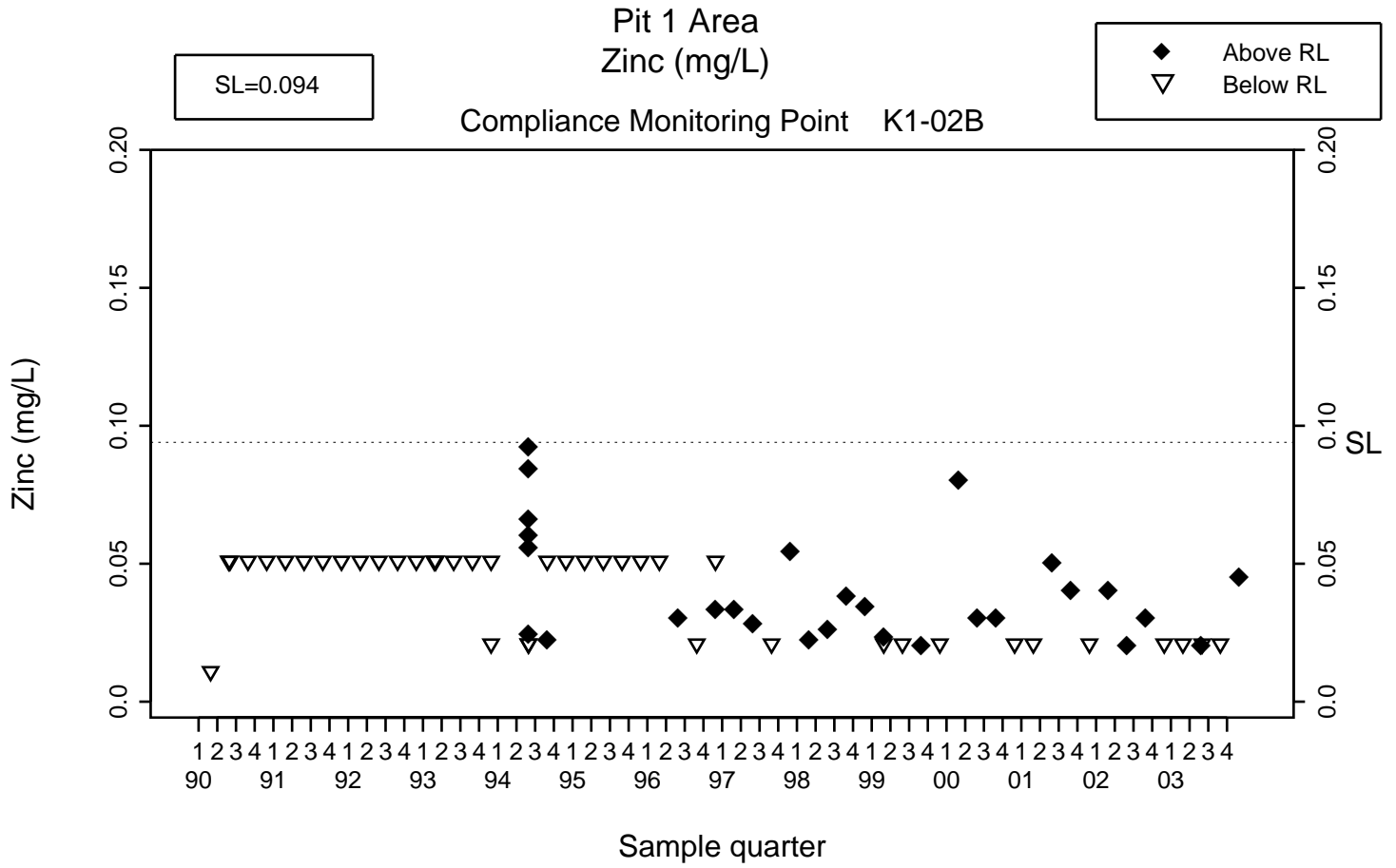










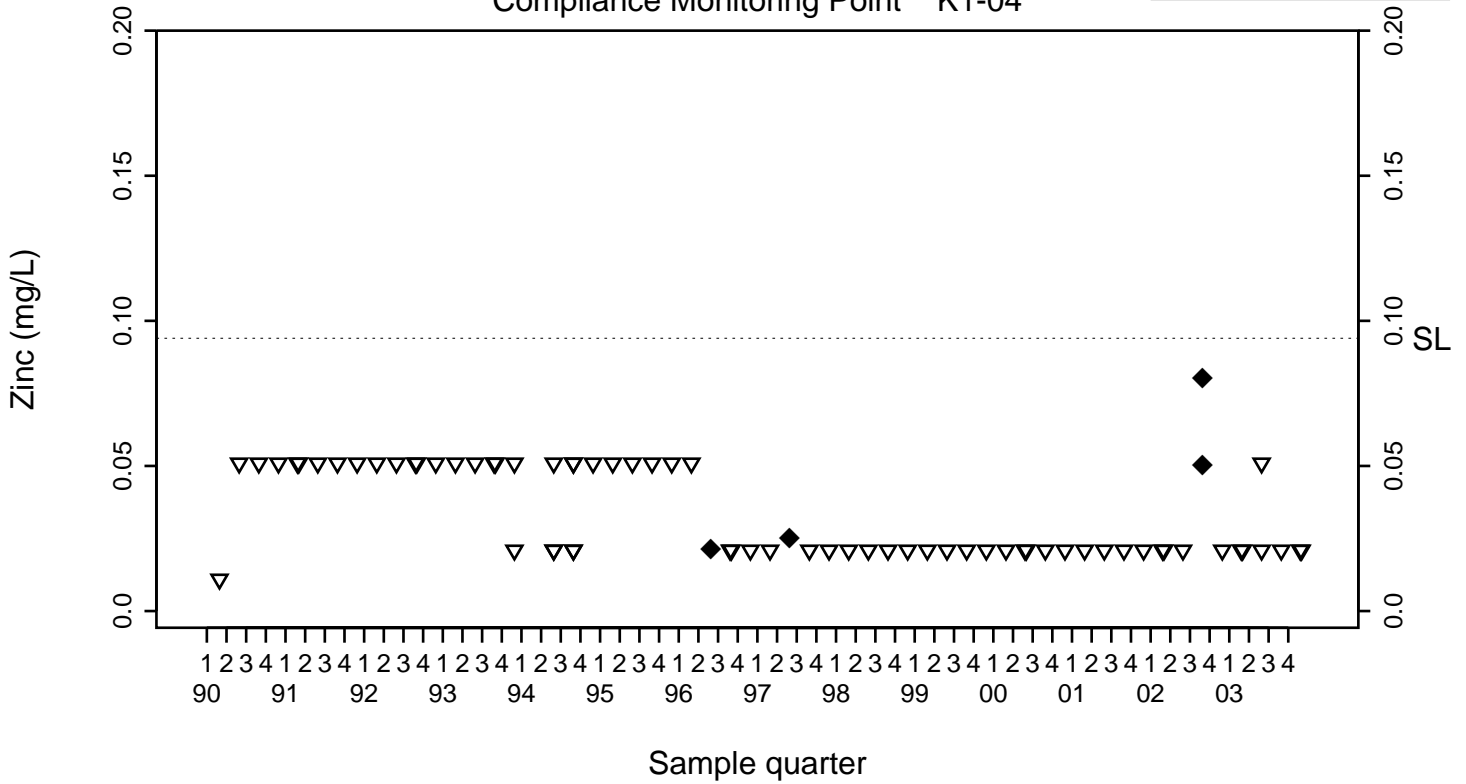


Pit 1 Area Zinc (mg/L)

SL=0.094

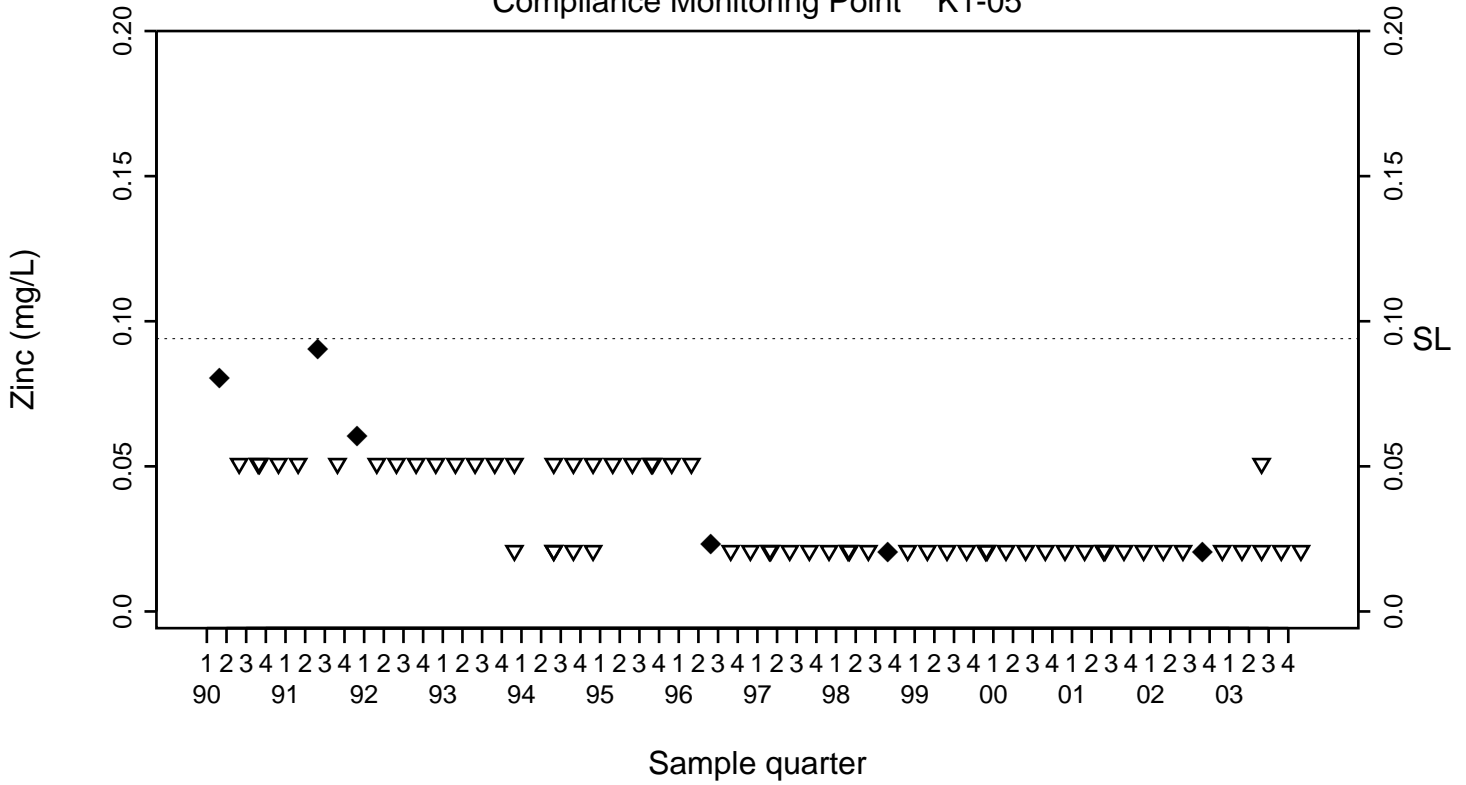
◆ Above RL
▽ Below RL

Compliance Monitoring Point K1-04



Compliance Monitoring Point K1-05

SL=0.094

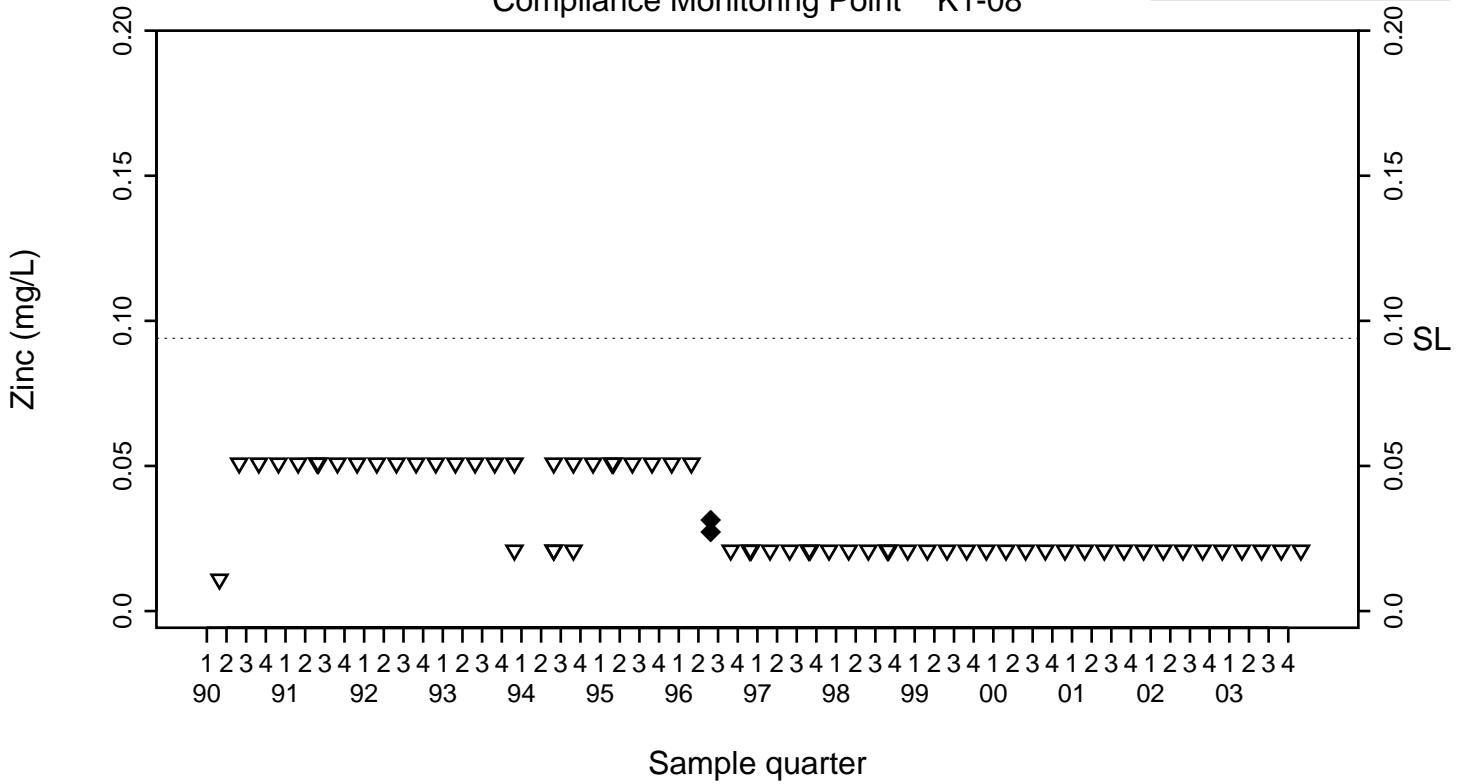


Pit 1 Area Zinc (mg/L)

SL=0.094

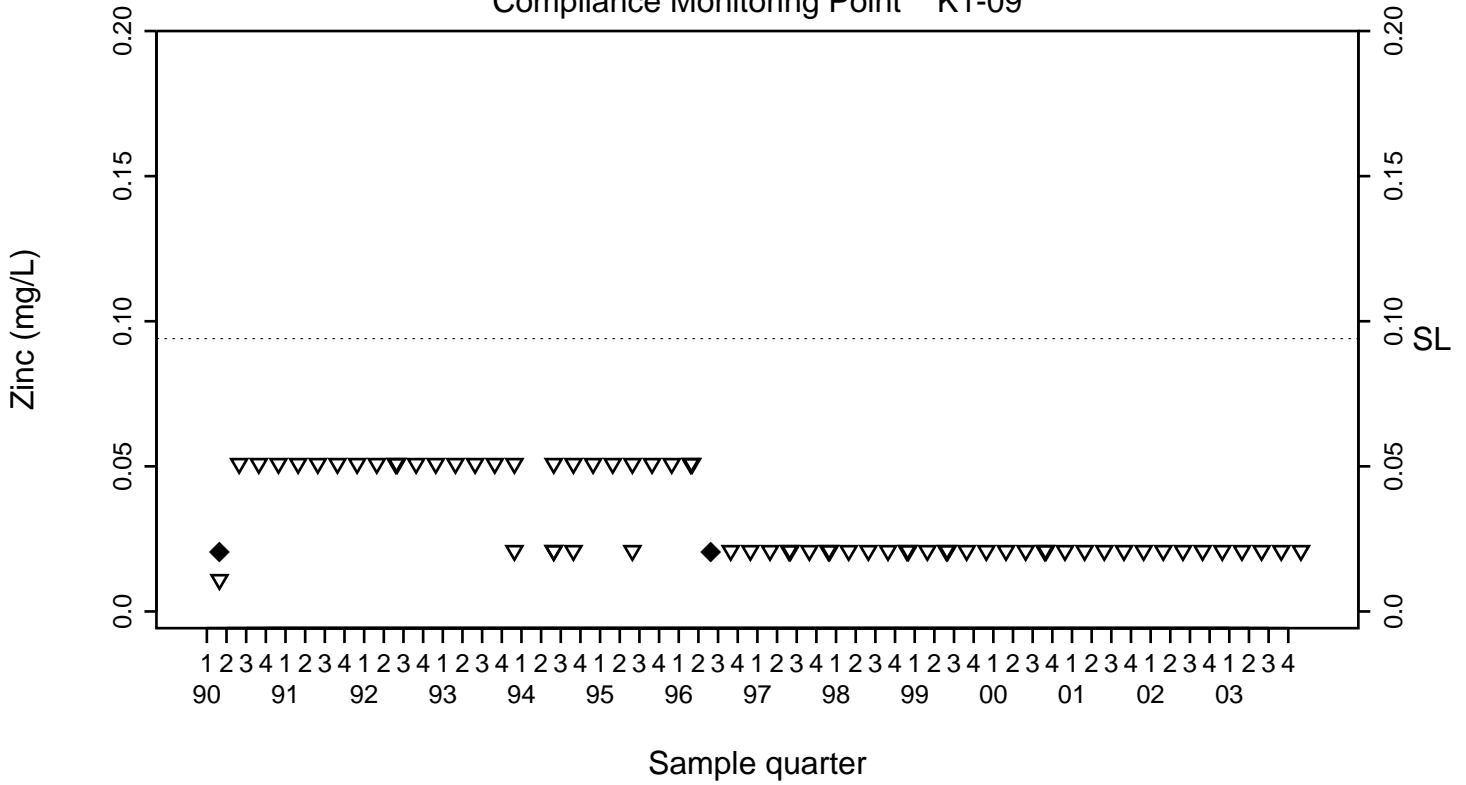
◆ Above RL
▽ Below RL

Compliance Monitoring Point K1-08

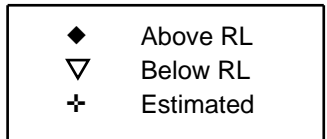


SL=0.094

Compliance Monitoring Point K1-09

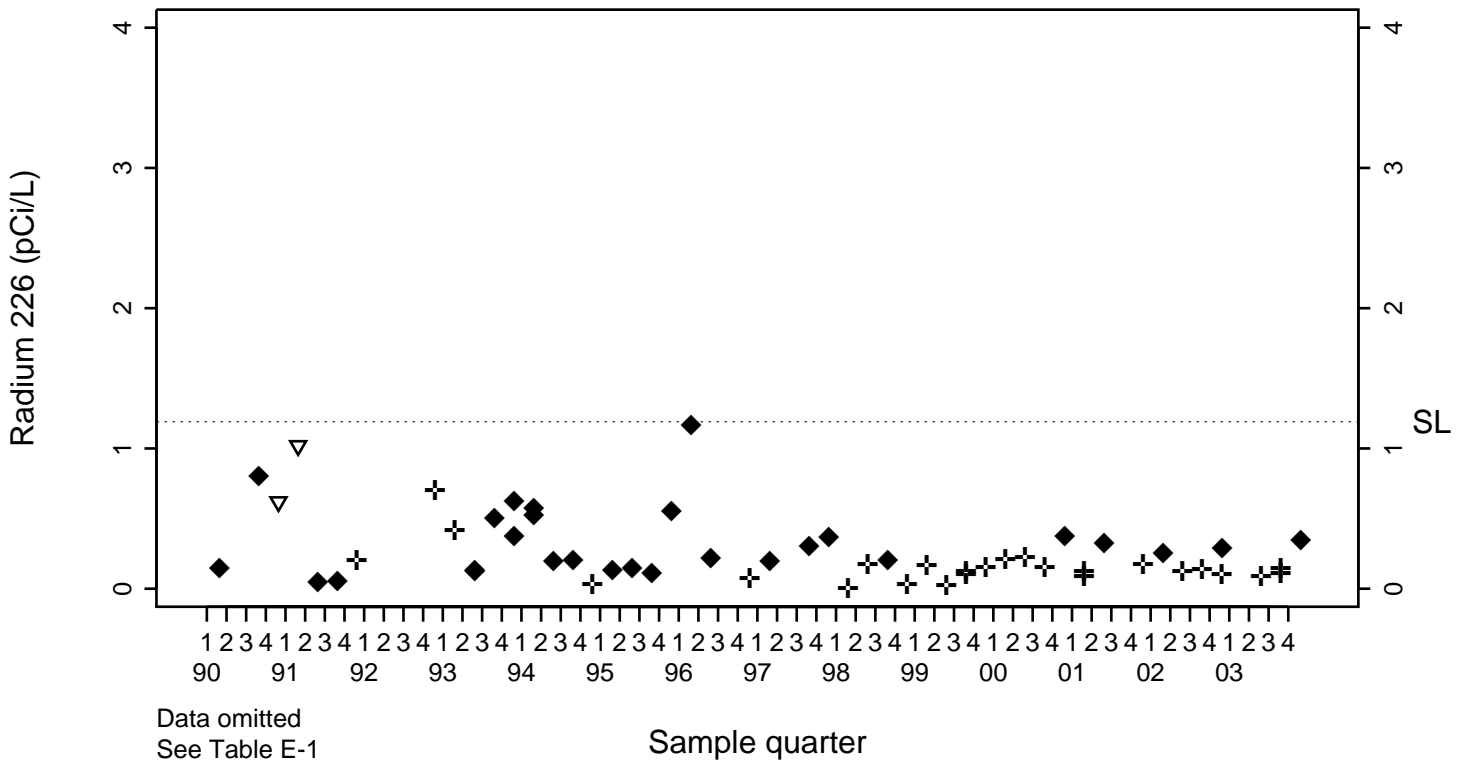


Pit 1 Area Radium 226 (pCi/L)



SL=1.19

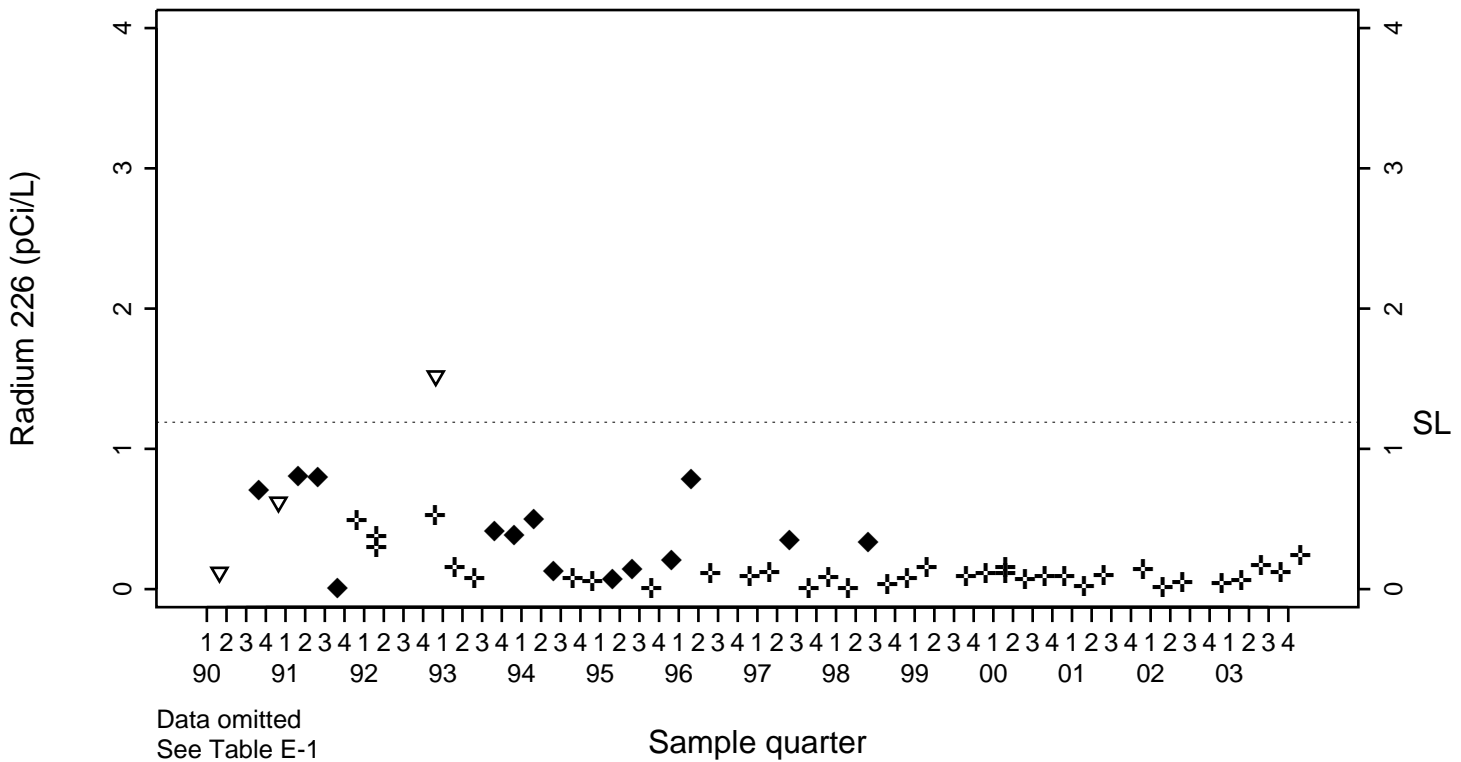
Background Monitoring Point K1-01C



Data omitted
See Table E-1

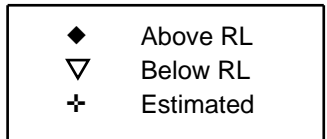
SL=1.19

Background Monitoring Point K1-07



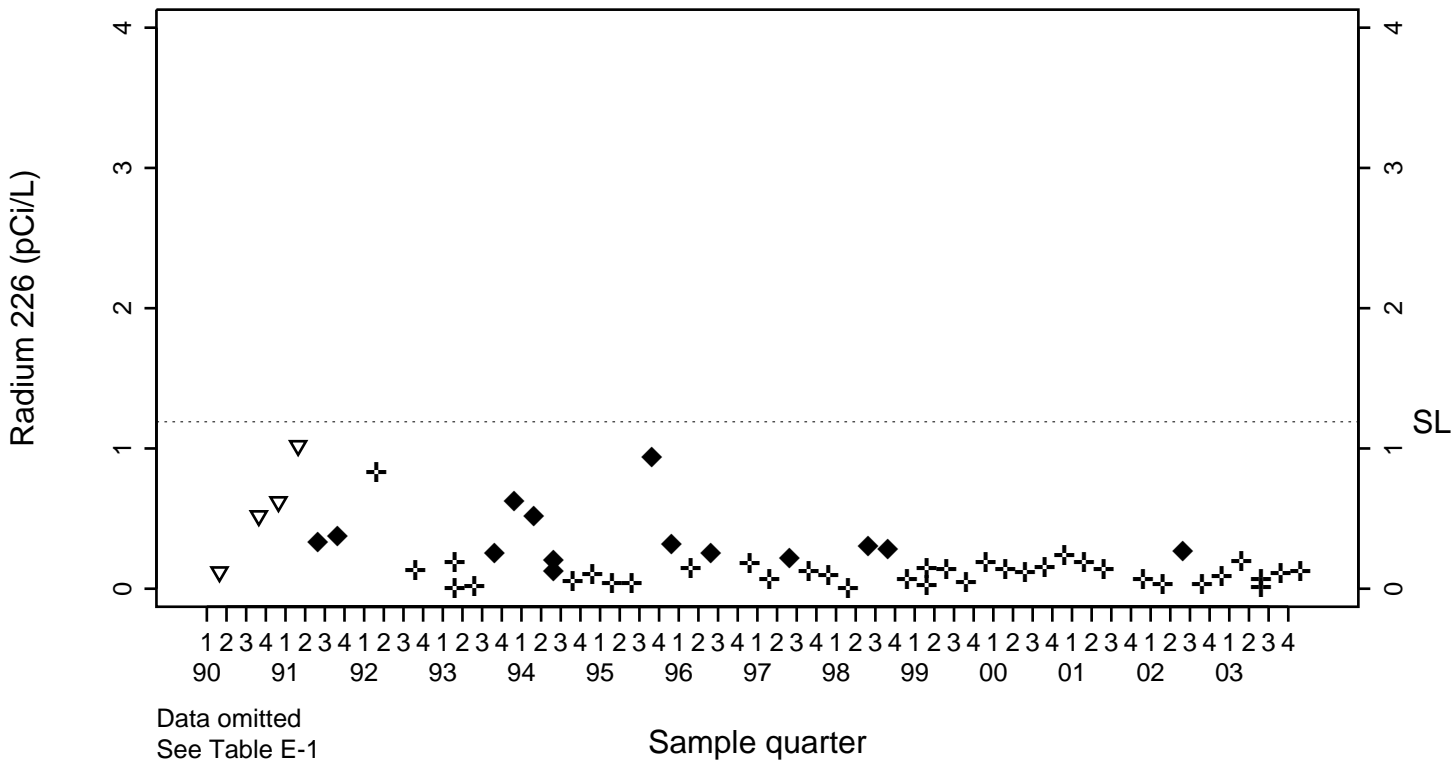
Data omitted
See Table E-1

Pit 1 Area Radium 226 (pCi/L)



SL=1.19

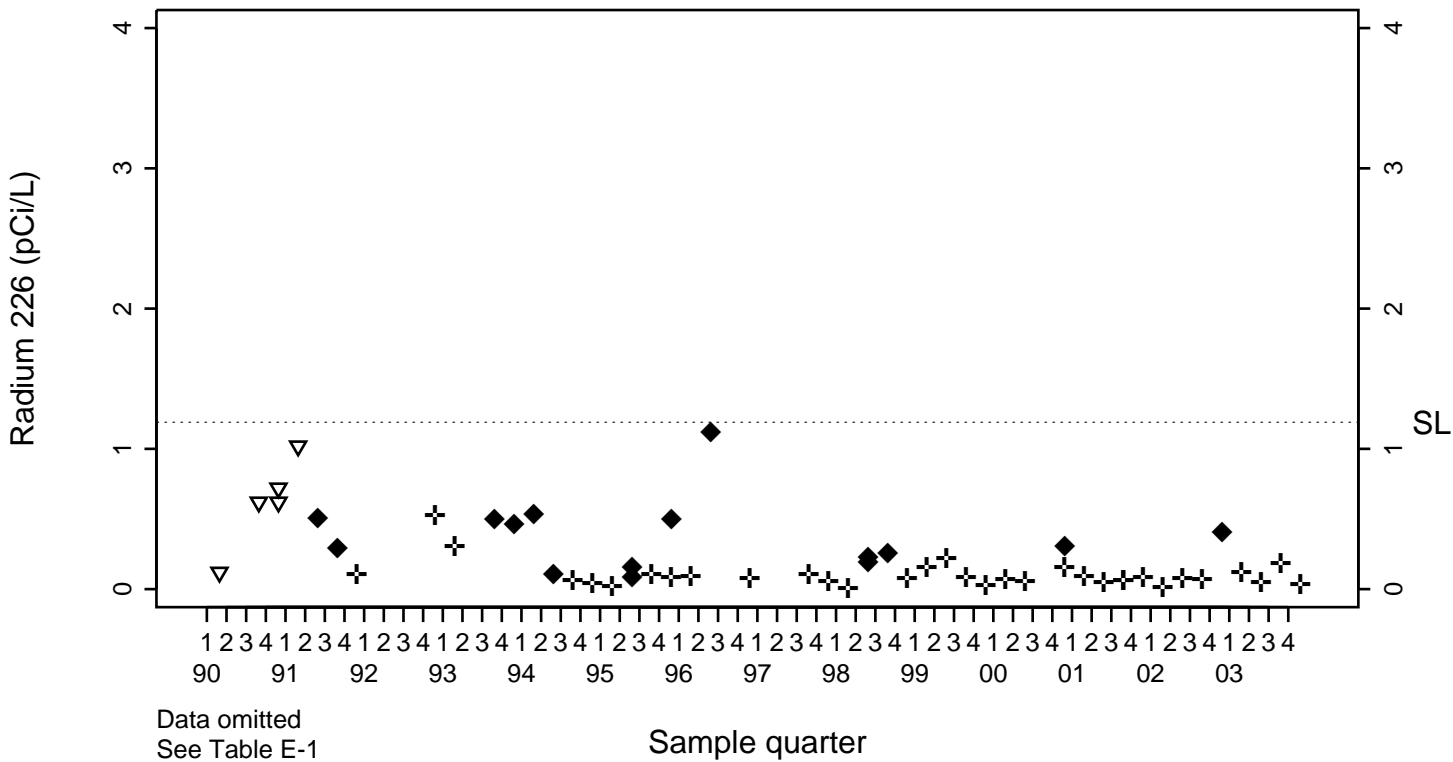
Compliance Monitoring Point K1-02B



Data omitted
See Table E-1

SL=1.19

Compliance Monitoring Point K1-03



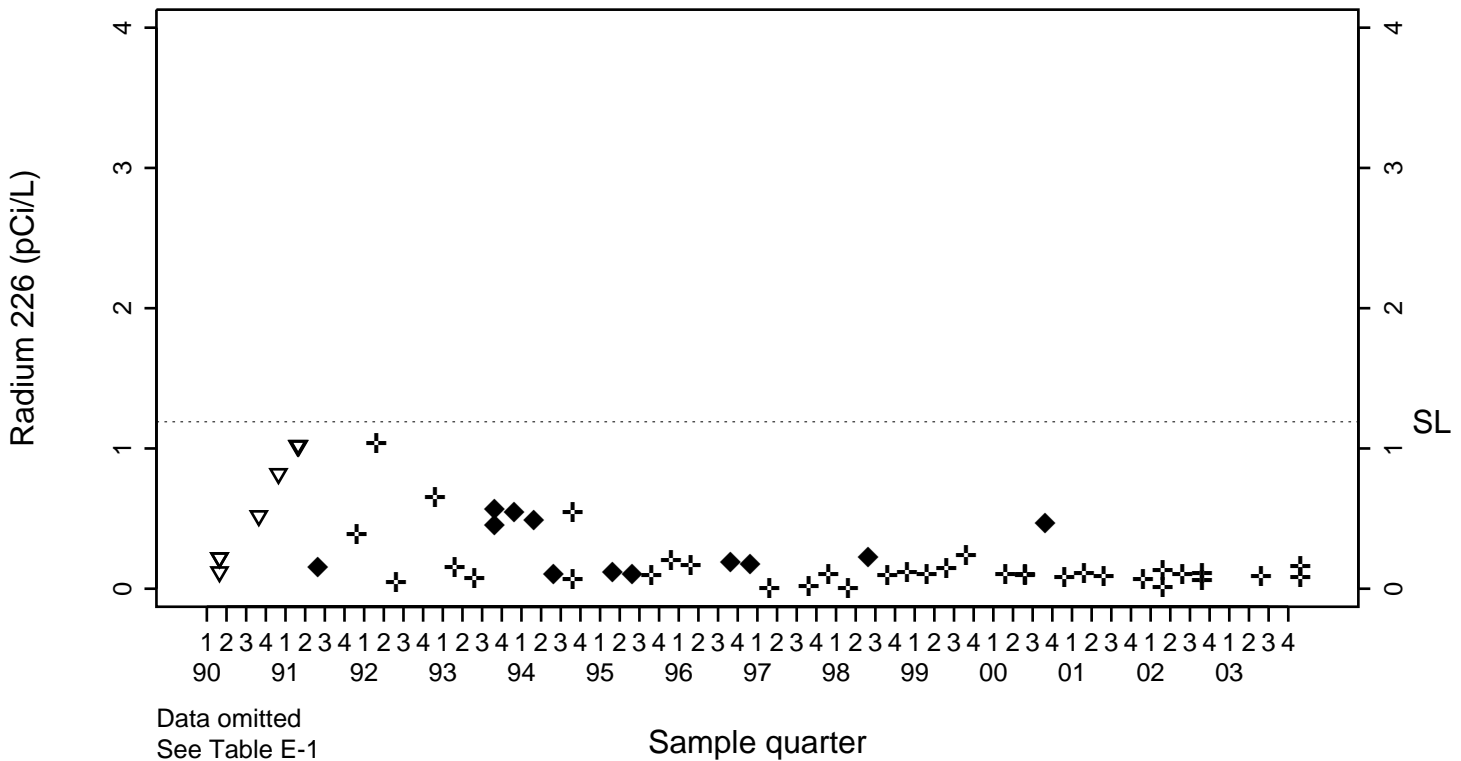
Data omitted
See Table E-1

Pit 1 Area Radium 226 (pCi/L)

- ◆ Above RL
- ▽ Below RL
- + Estimated

SL=1.19

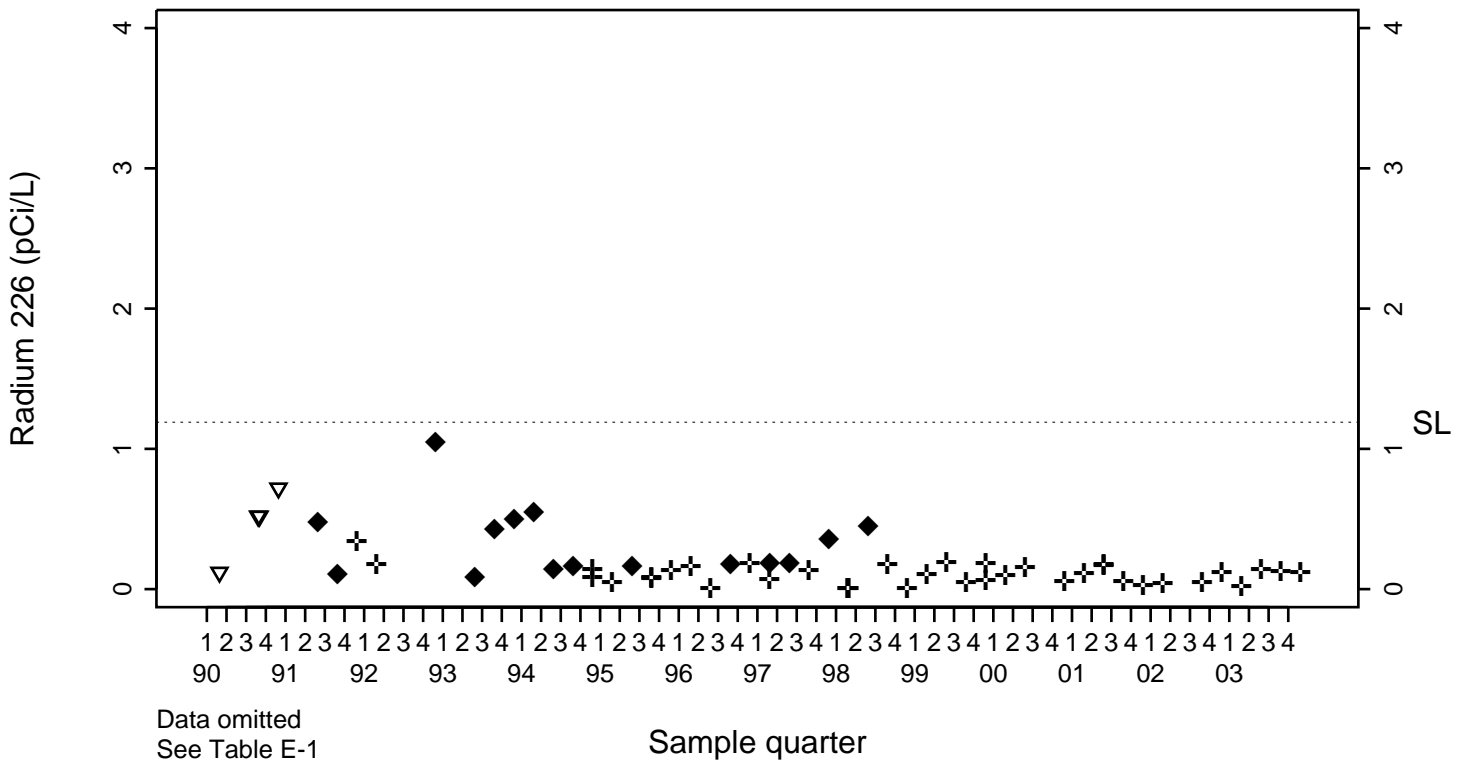
Compliance Monitoring Point K1-04



Data omitted
See Table E-1

SL=1.19

Compliance Monitoring Point K1-05



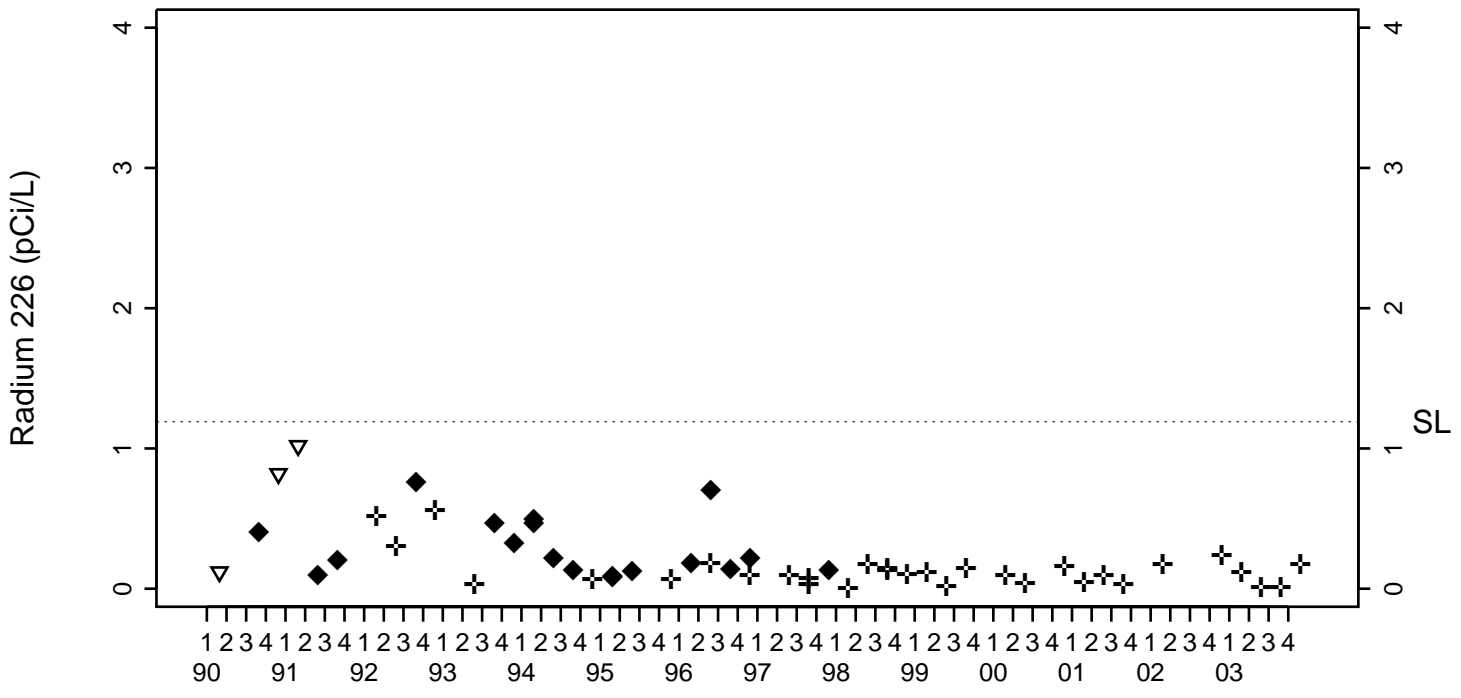
Data omitted
See Table E-1

Pit 1 Area Radium 226 (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

SL=1.19

Compliance Monitoring Point K1-08

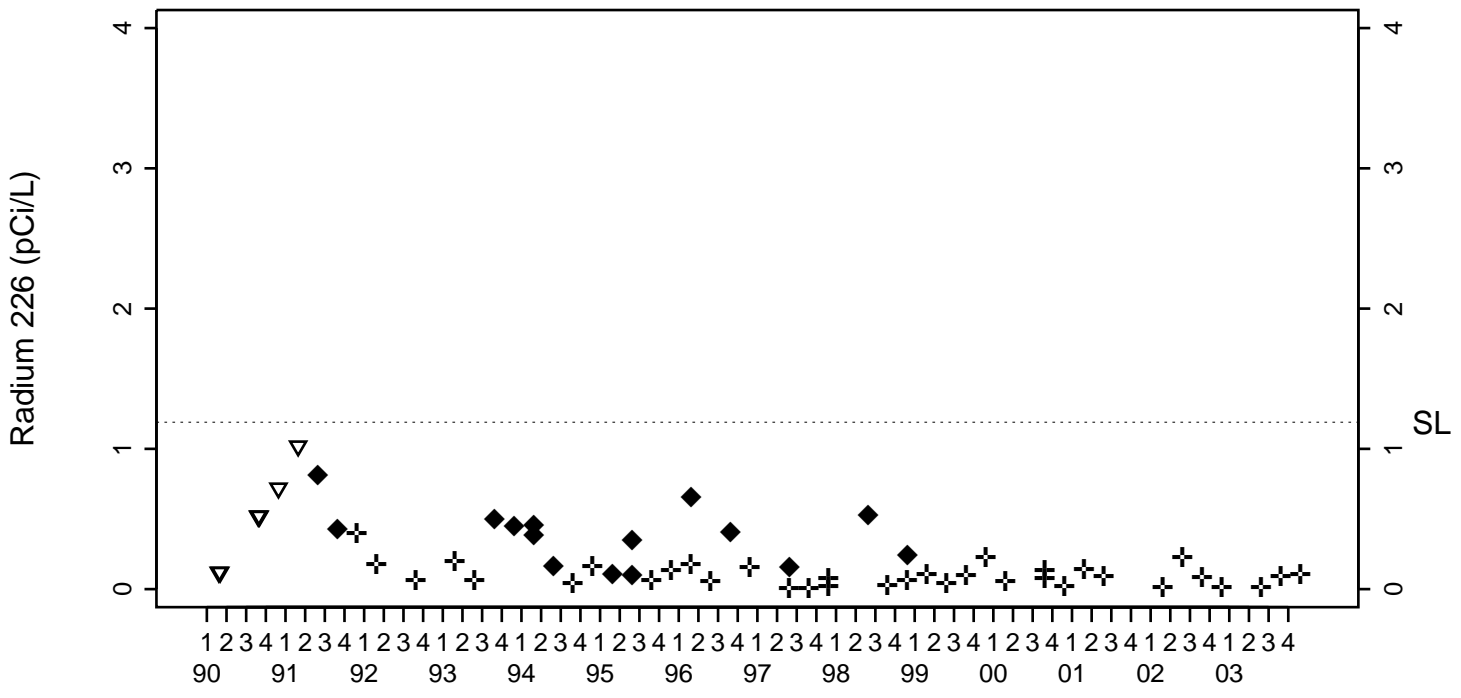


Data omitted
See Table E-1

Sample quarter

SL=1.19

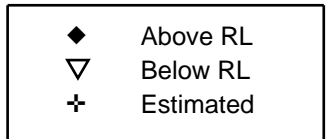
Compliance Monitoring Point K1-09



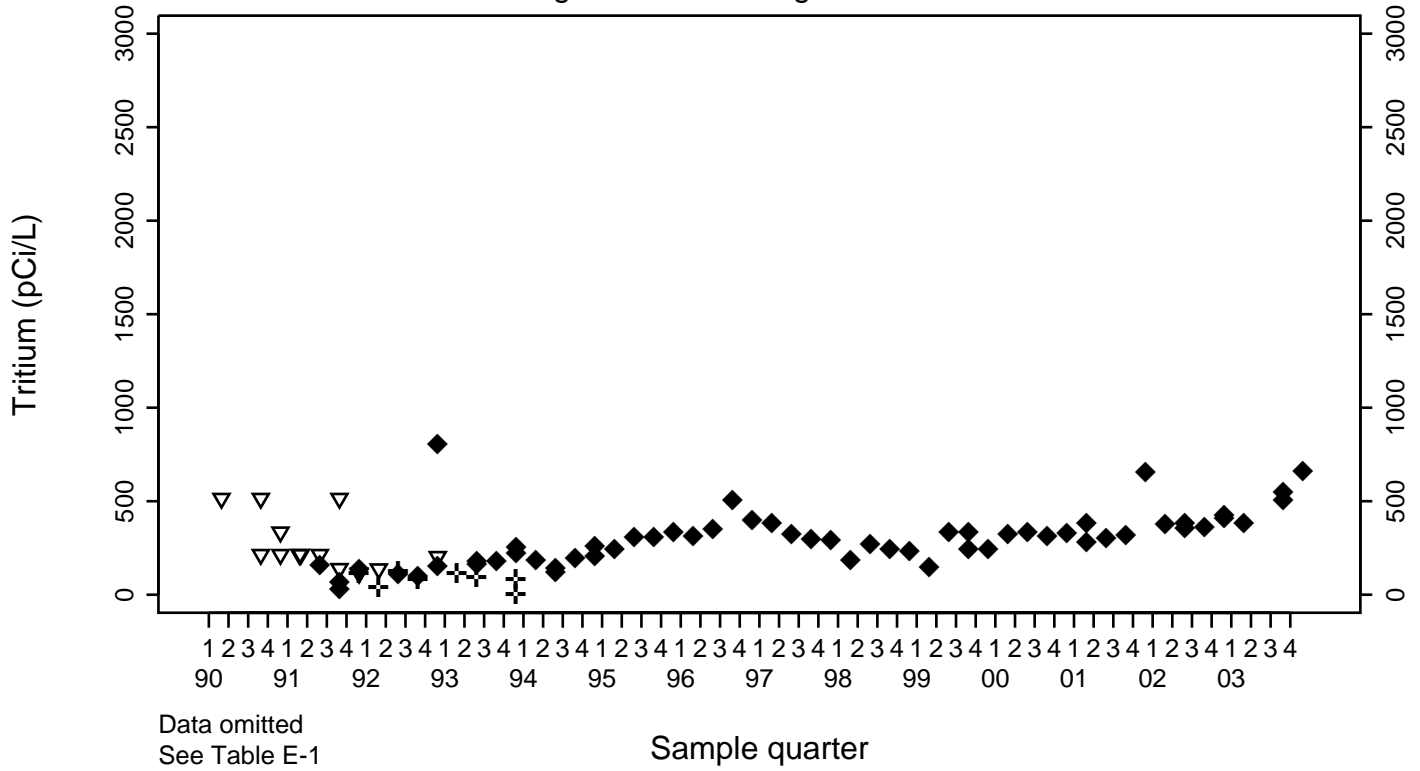
Data omitted
See Table E-1

Sample quarter

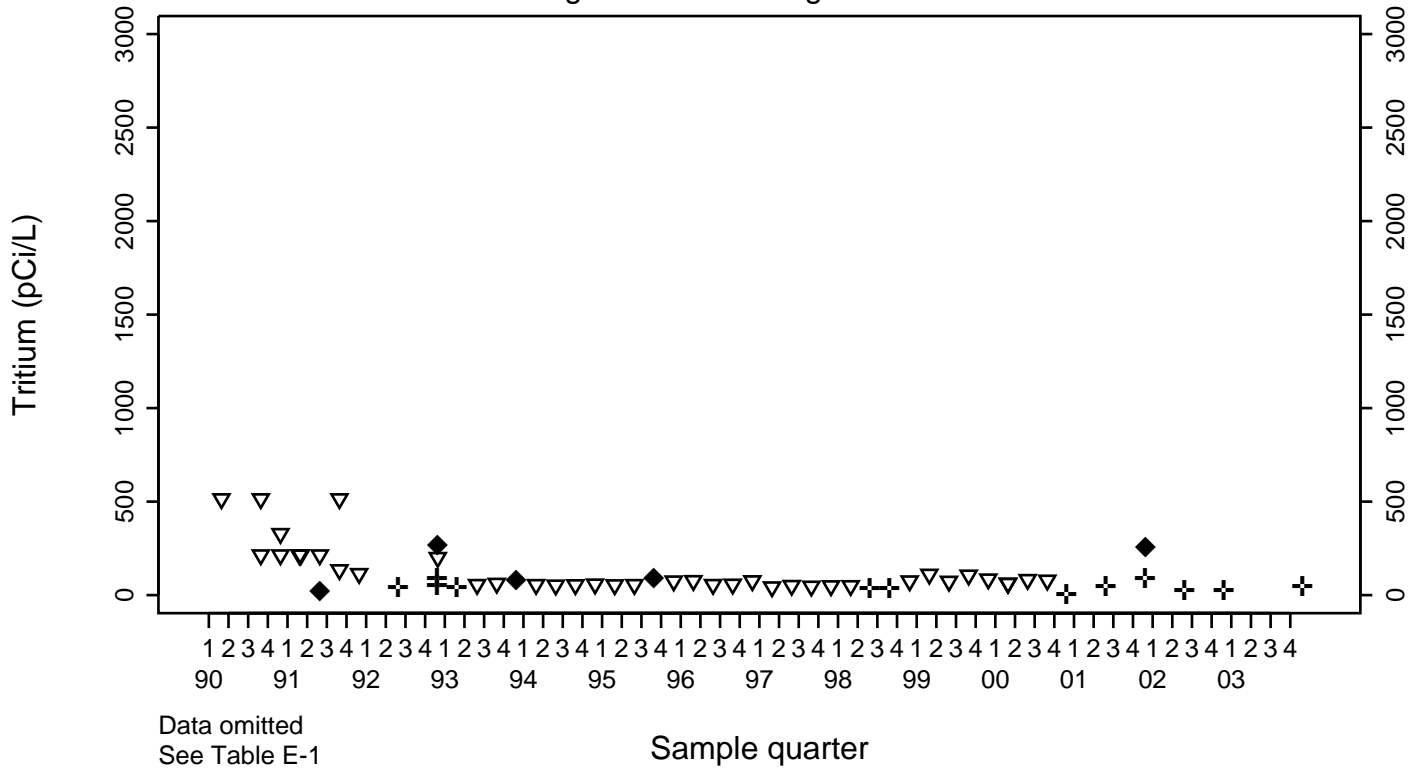
Pit 1 Area
Tritium (pCi/L)

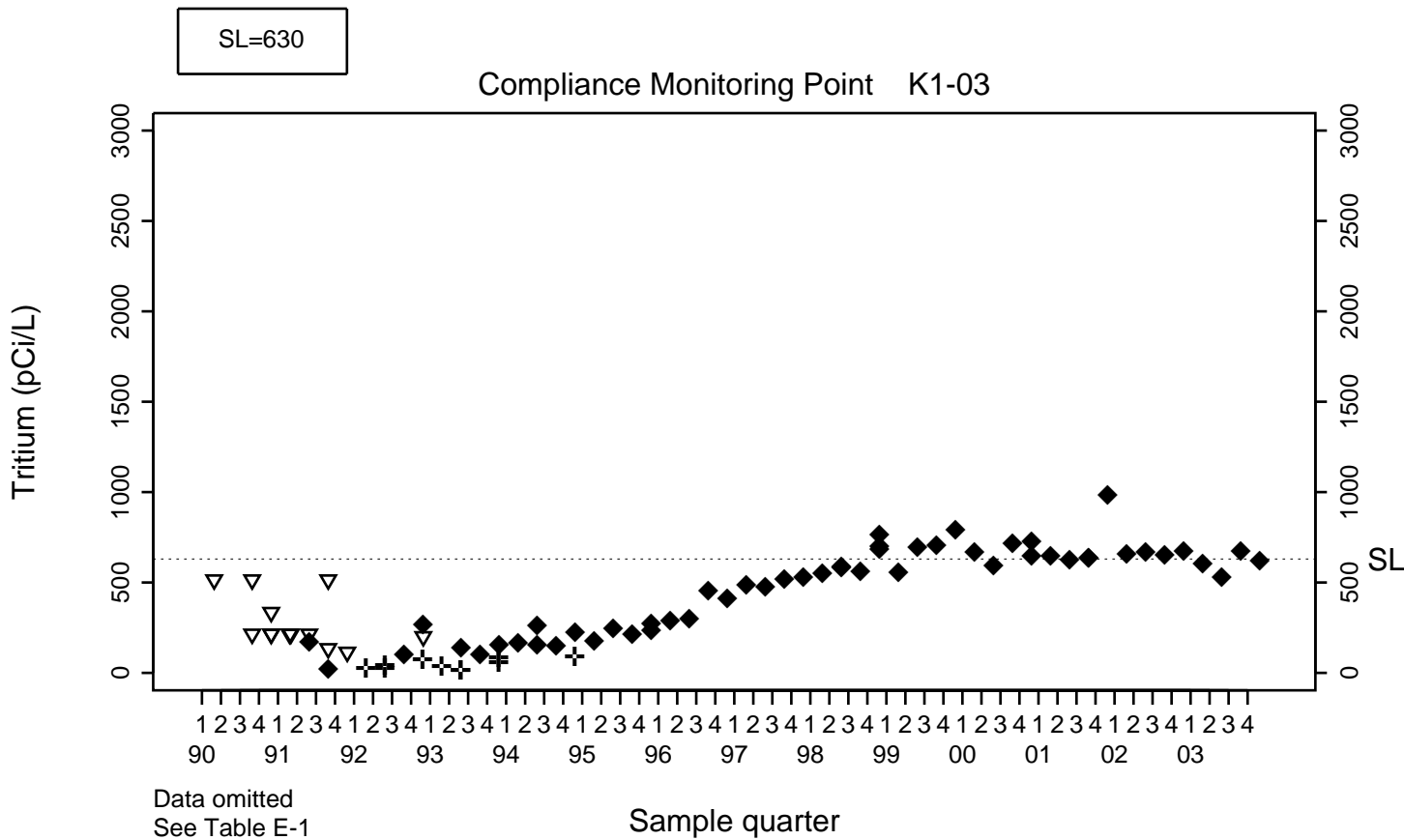
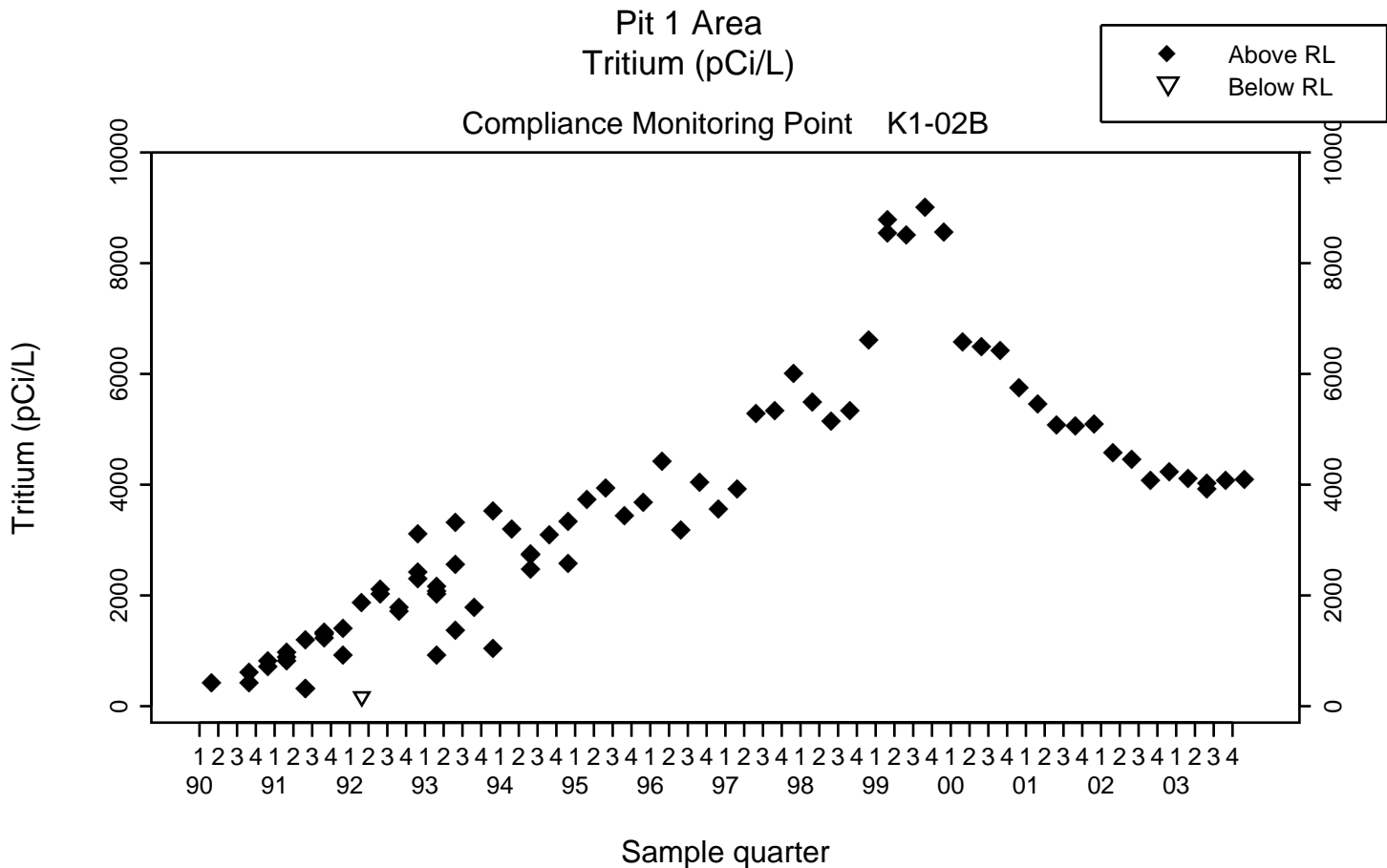


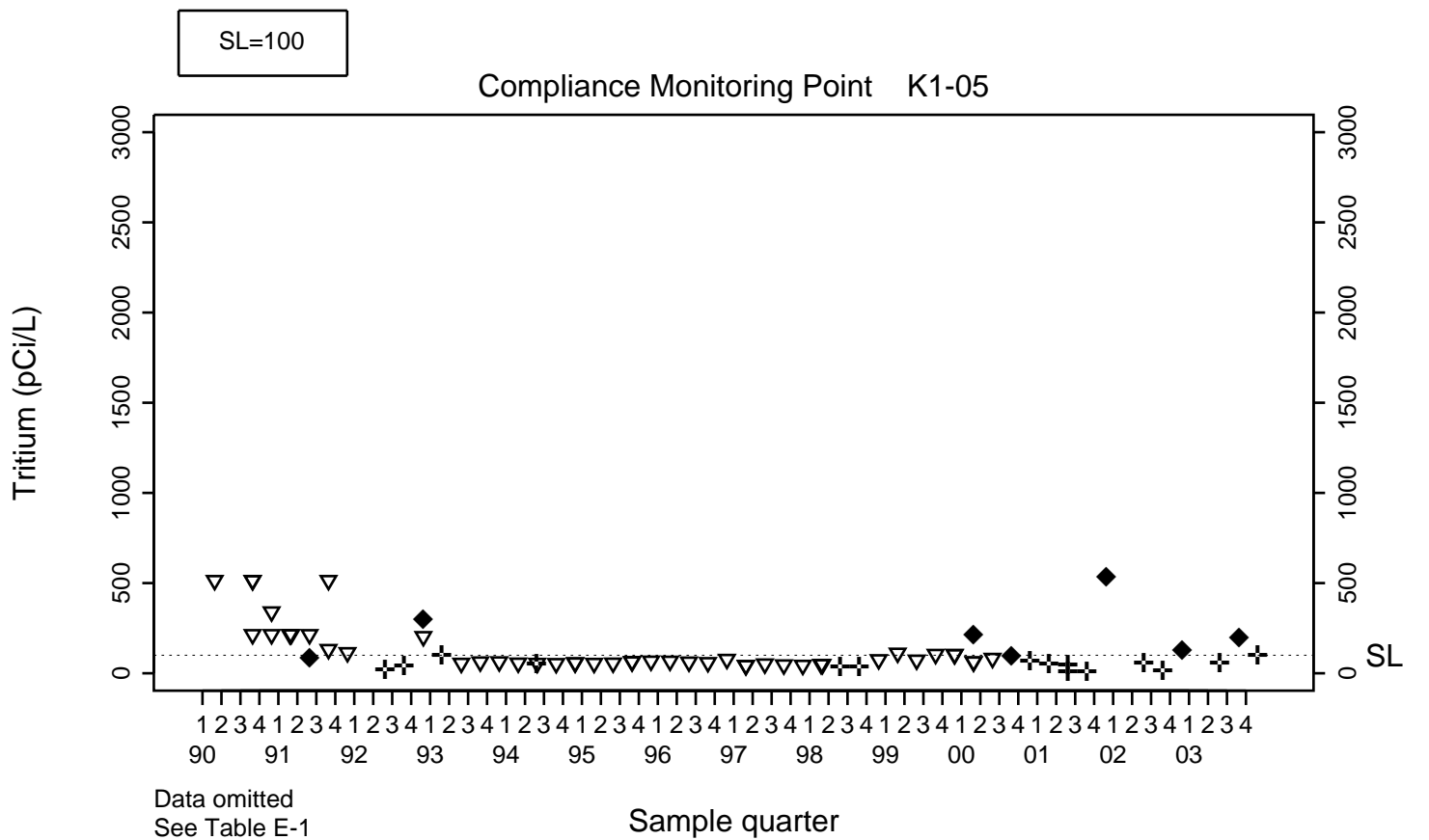
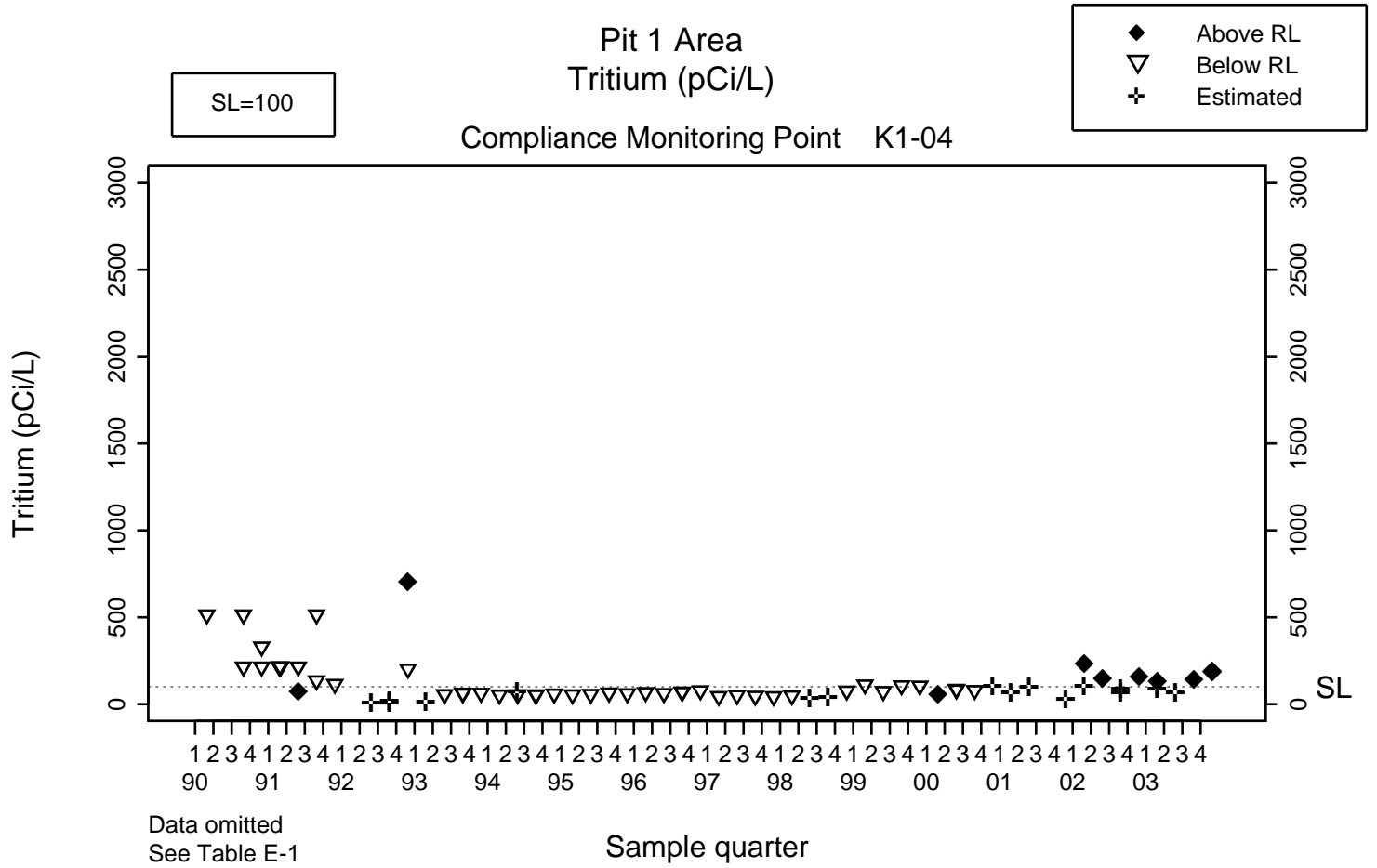
Background Monitoring Point K1-01C

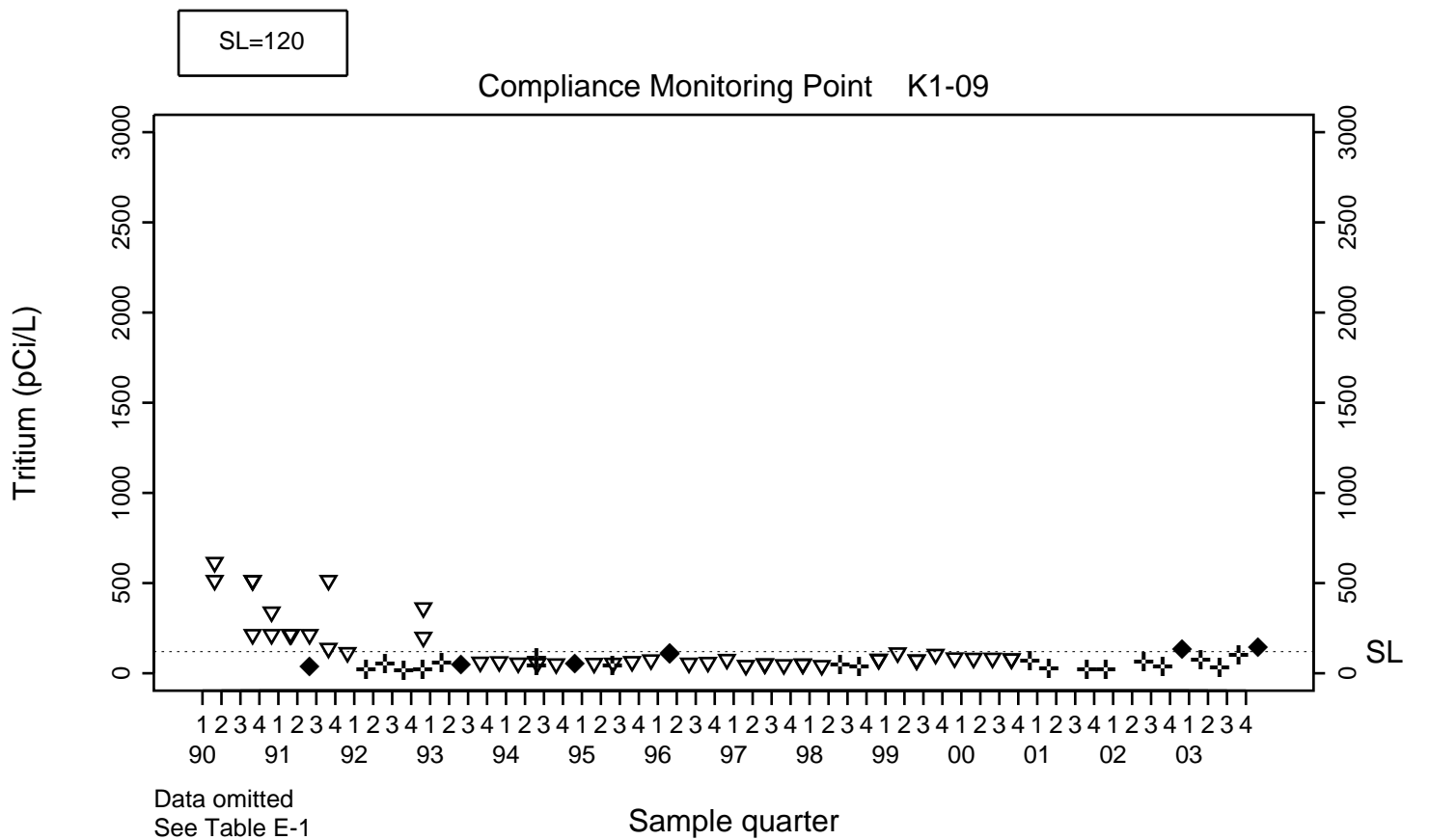
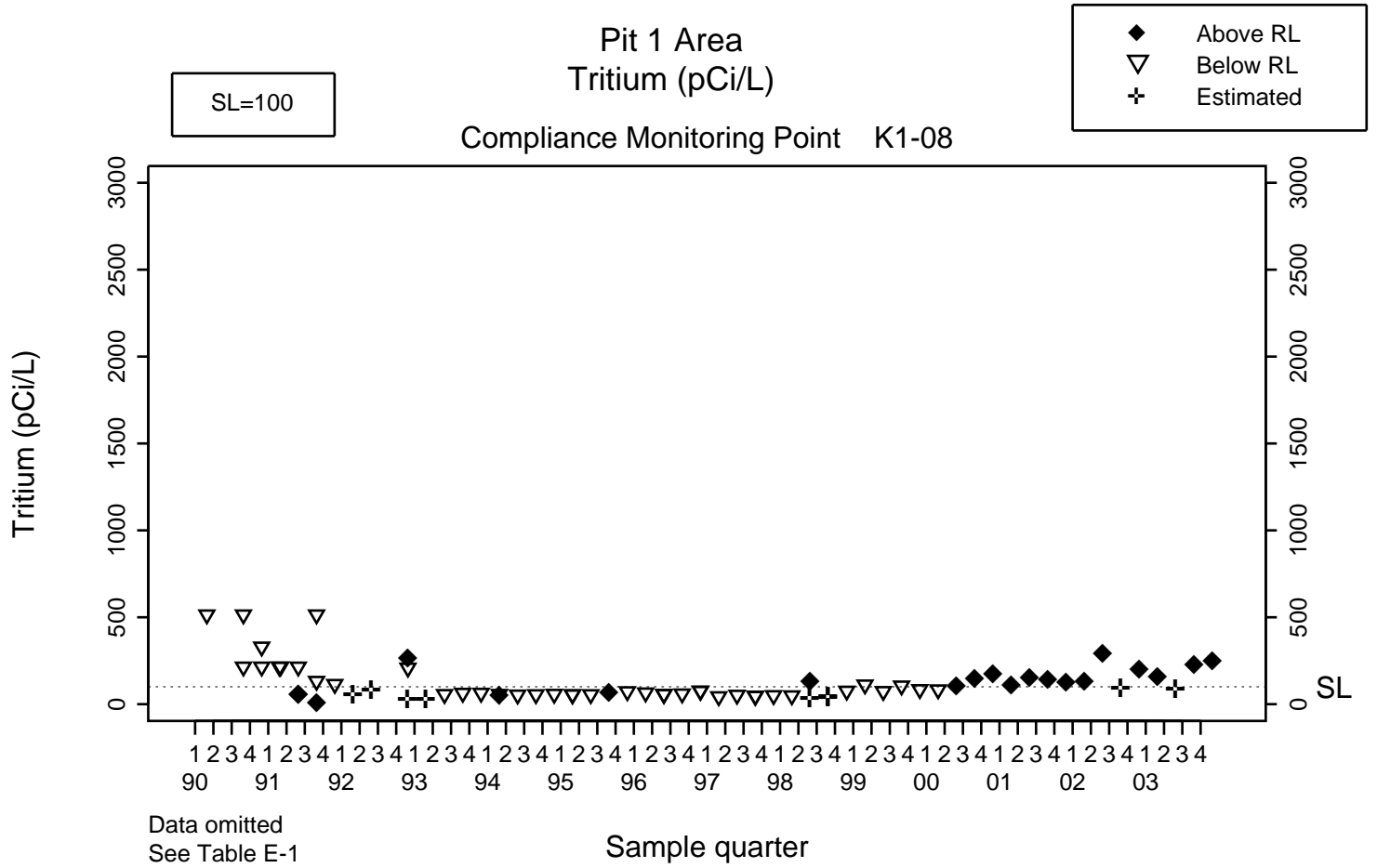


Background Monitoring Point K1-07

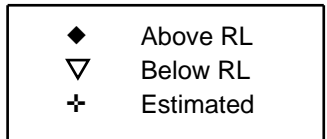




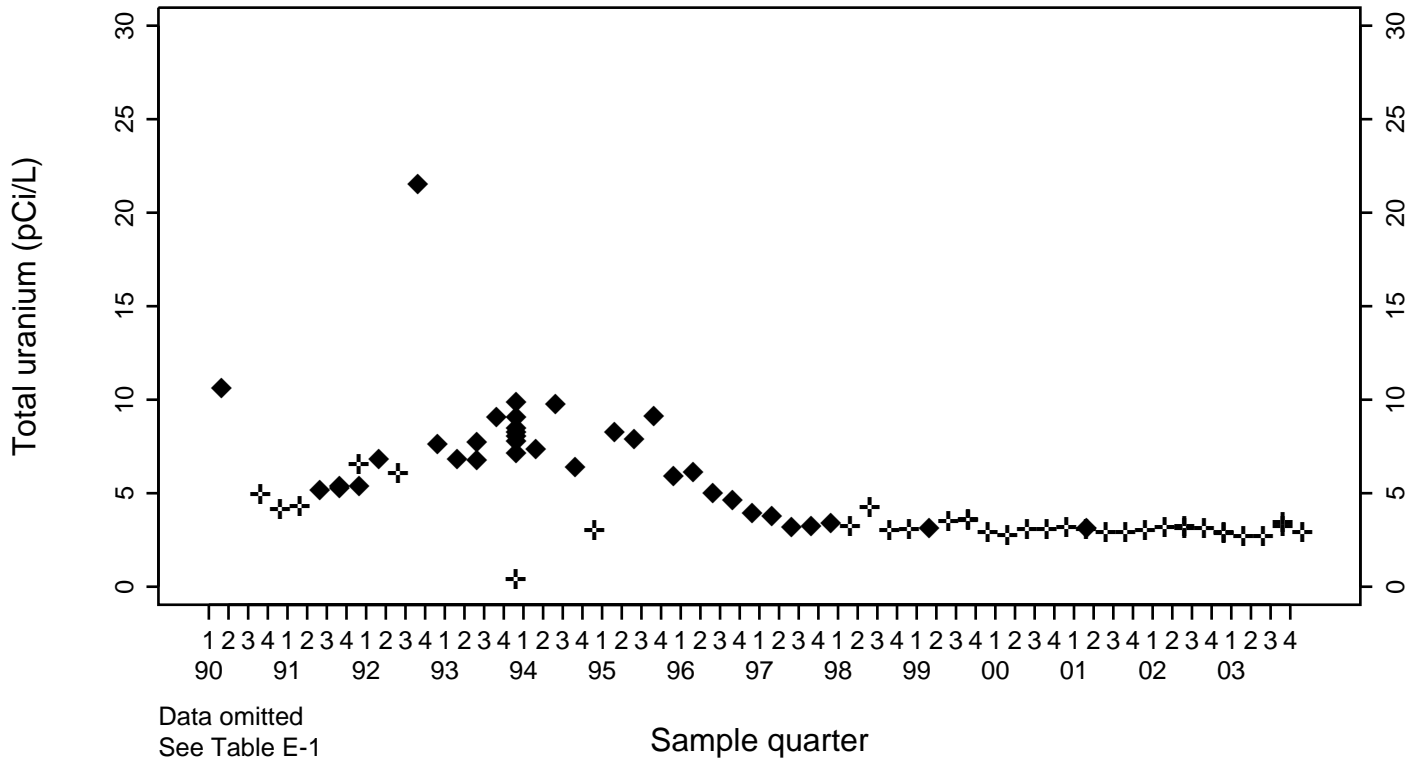




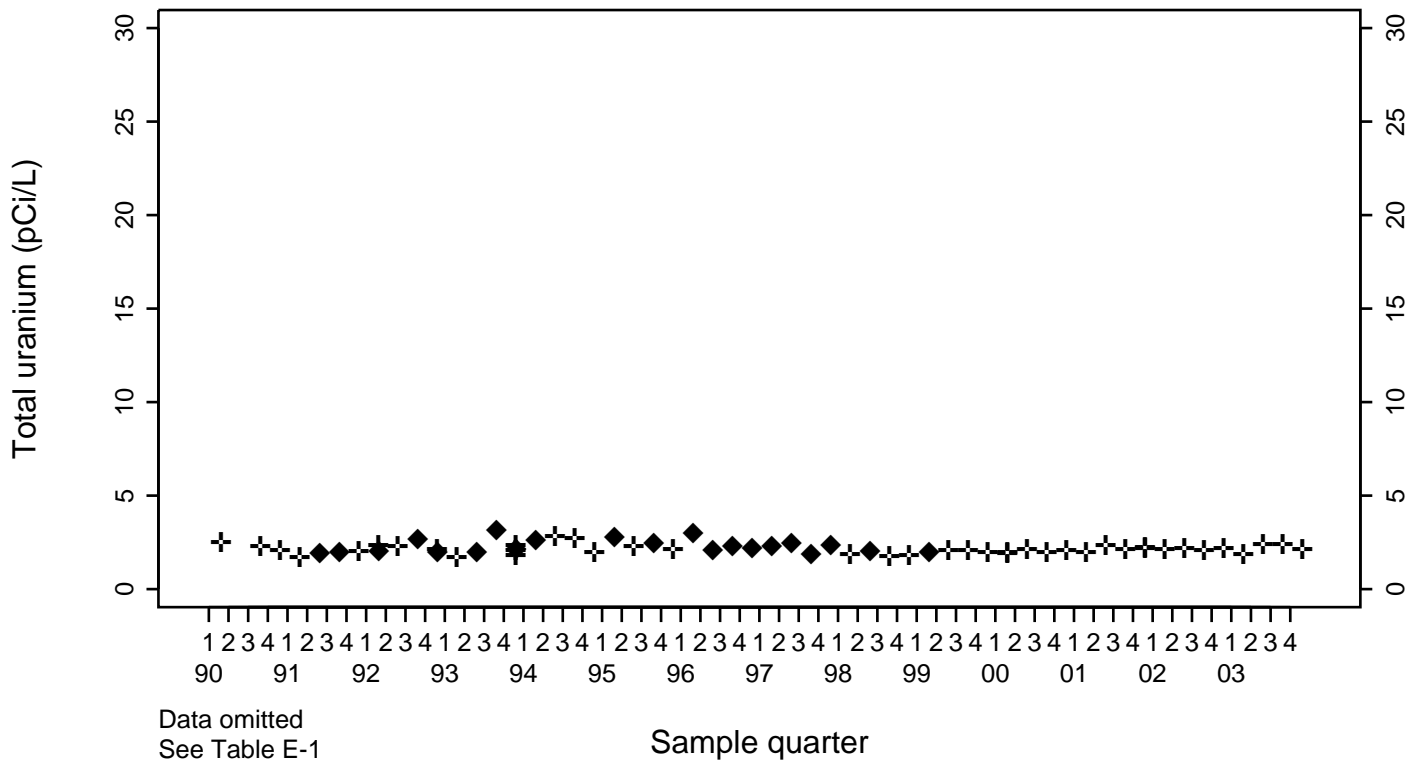
Pit 1 Area Total uranium (pCi/L)



Background Monitoring Point K1-01C



Background Monitoring Point K1-07

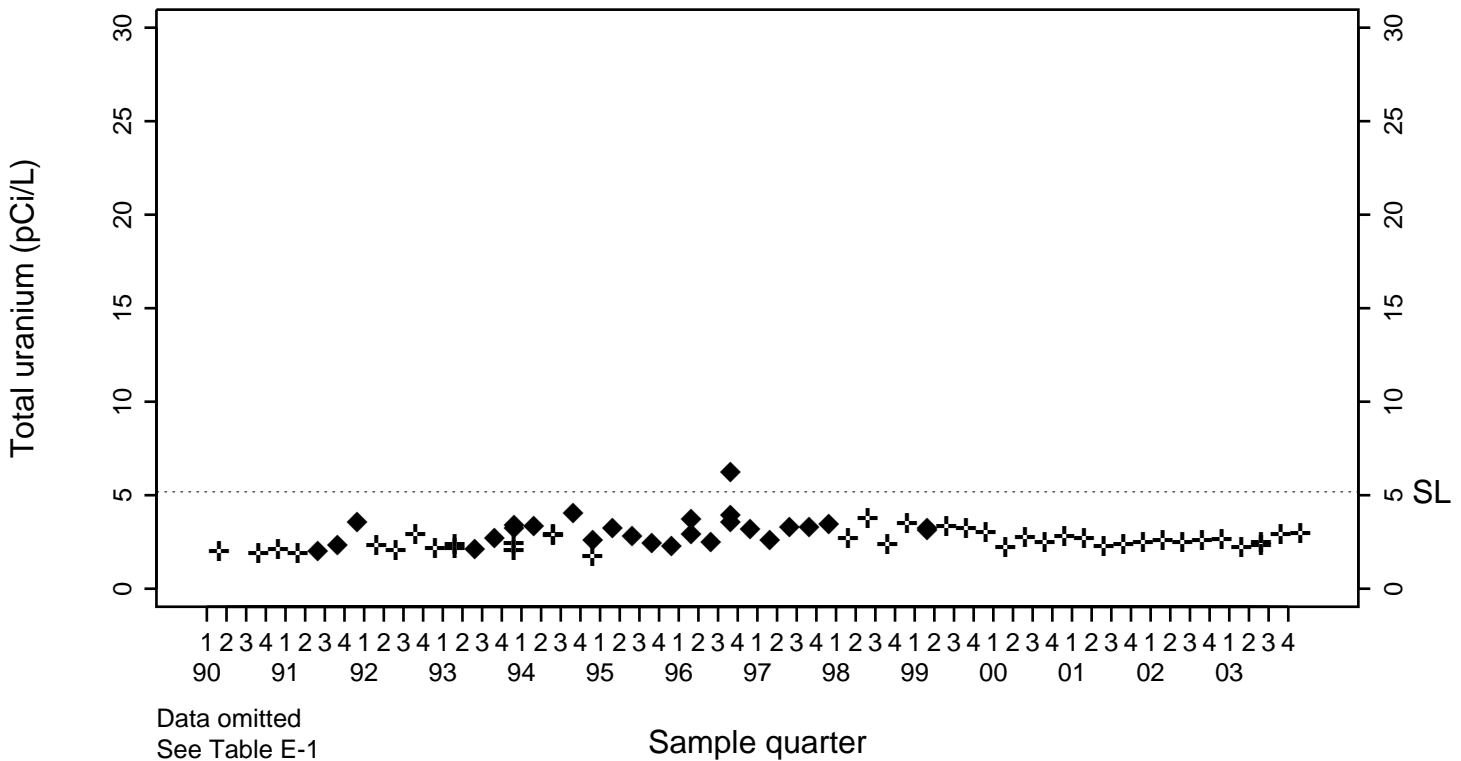


Pit 1 Area Total uranium (pCi/L)

- ◆ Above RL
- ▽ Below RL
- + Estimated

SL=5.18

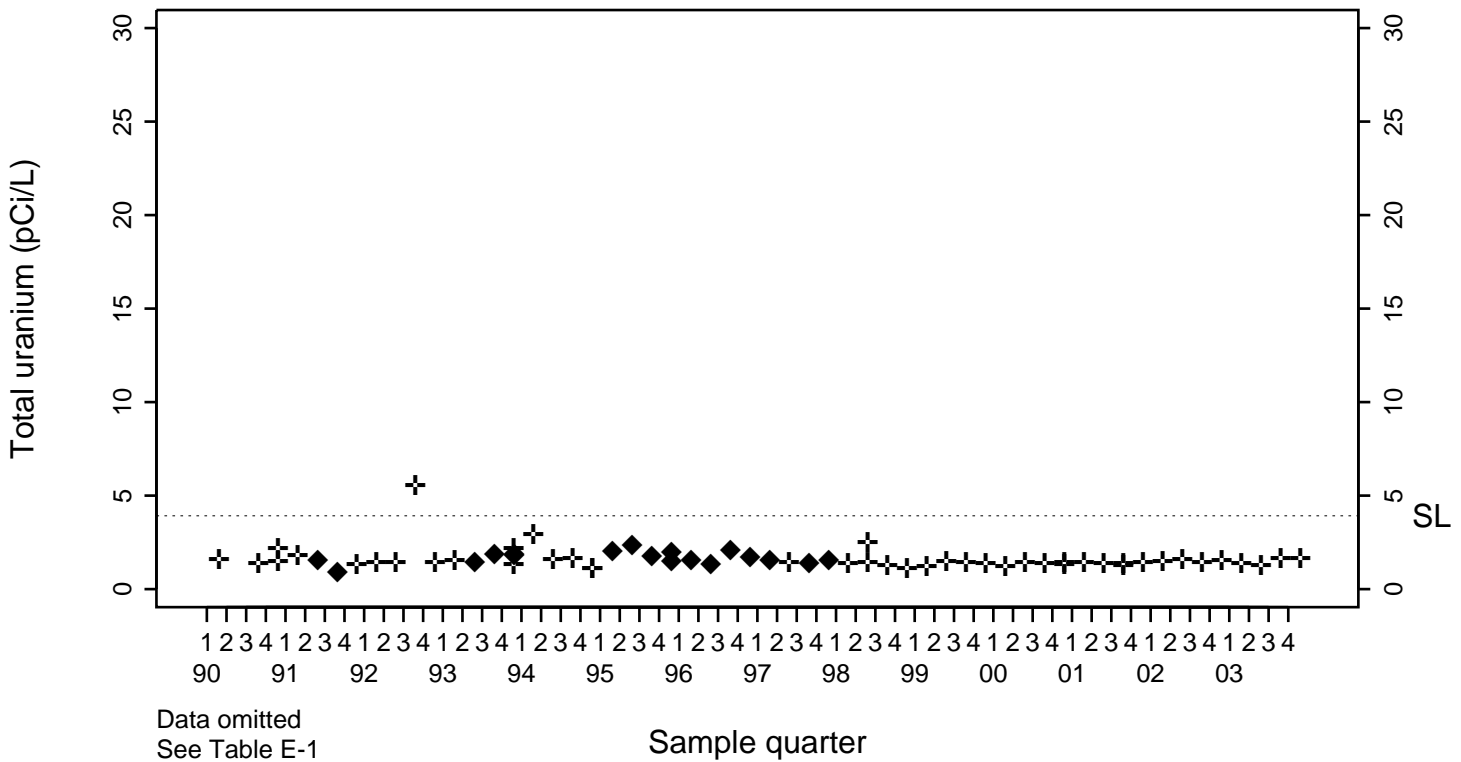
Compliance Monitoring Point K1-02B



Data omitted
See Table E-1

SL=3.92

Compliance Monitoring Point K1-03



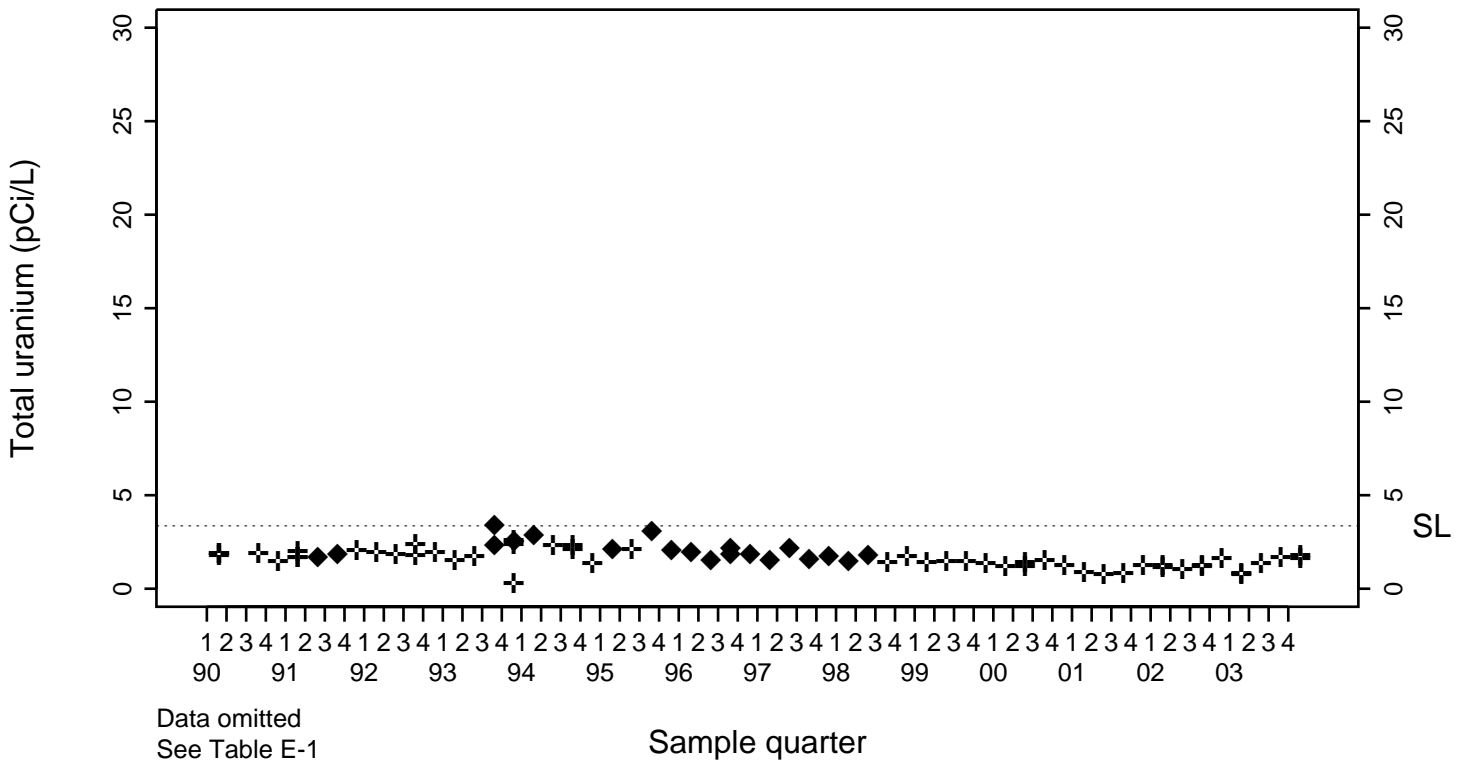
Data omitted
See Table E-1

Pit 1 Area Total uranium (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

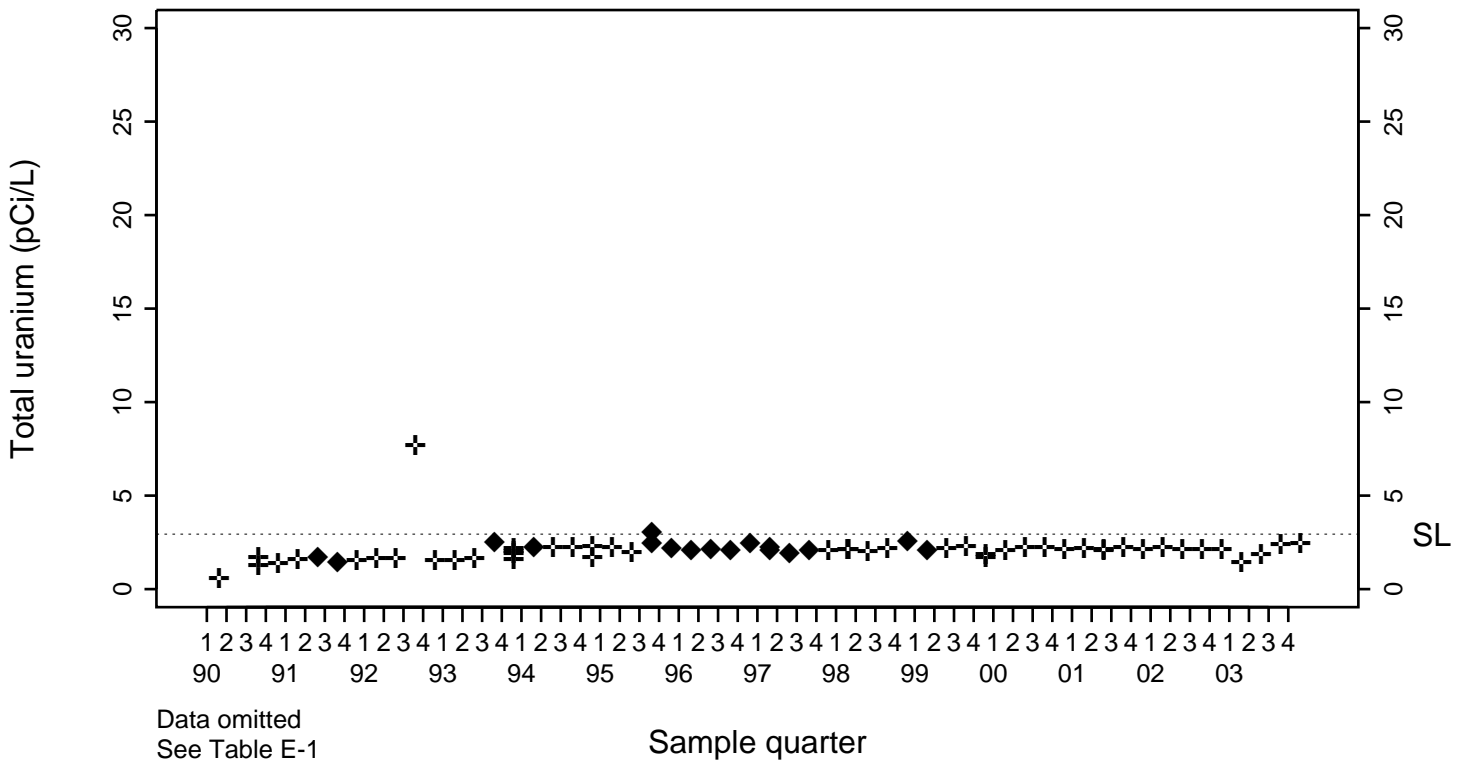
SL=3.36

Compliance Monitoring Point K1-04



SL=2.94

Compliance Monitoring Point K1-05

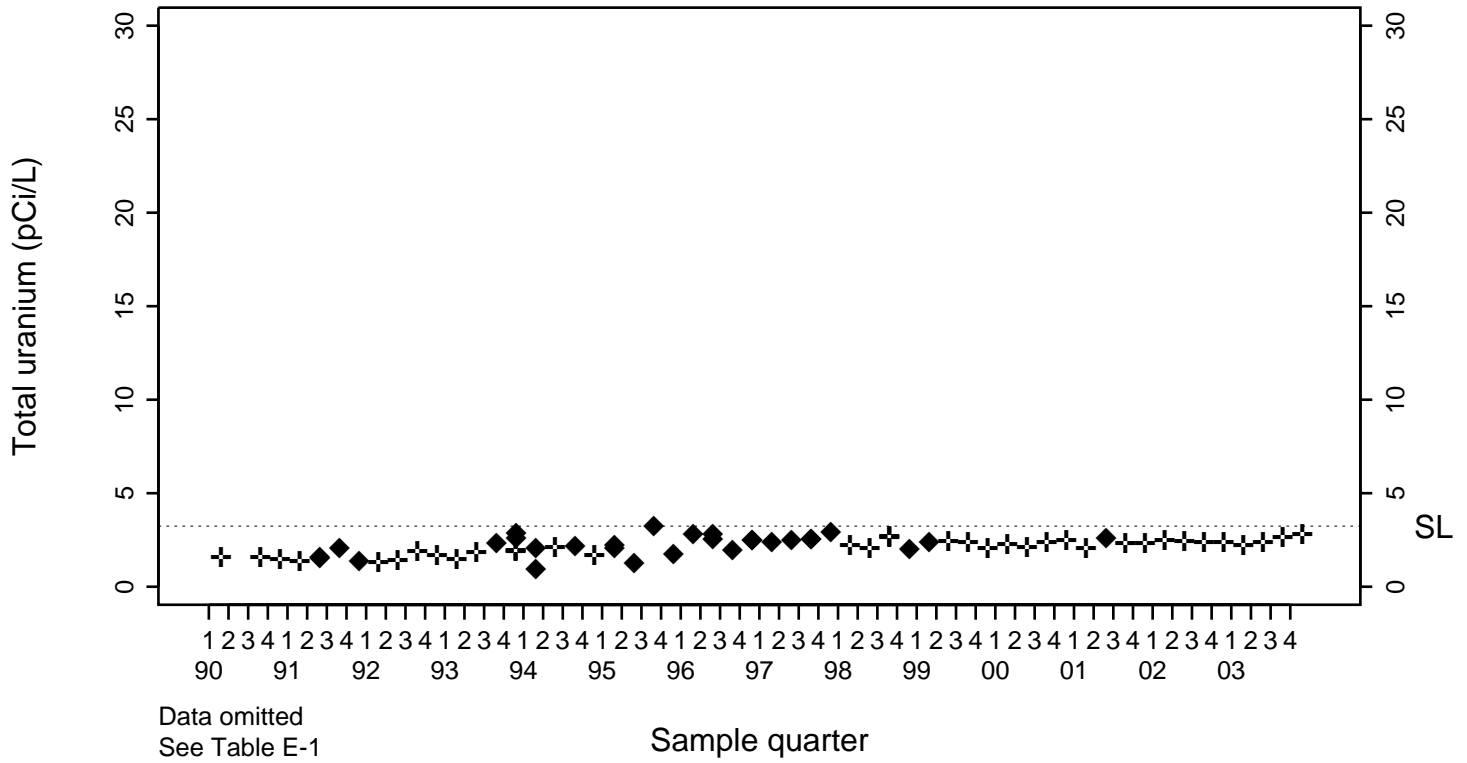


Pit 1 Area Total uranium (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

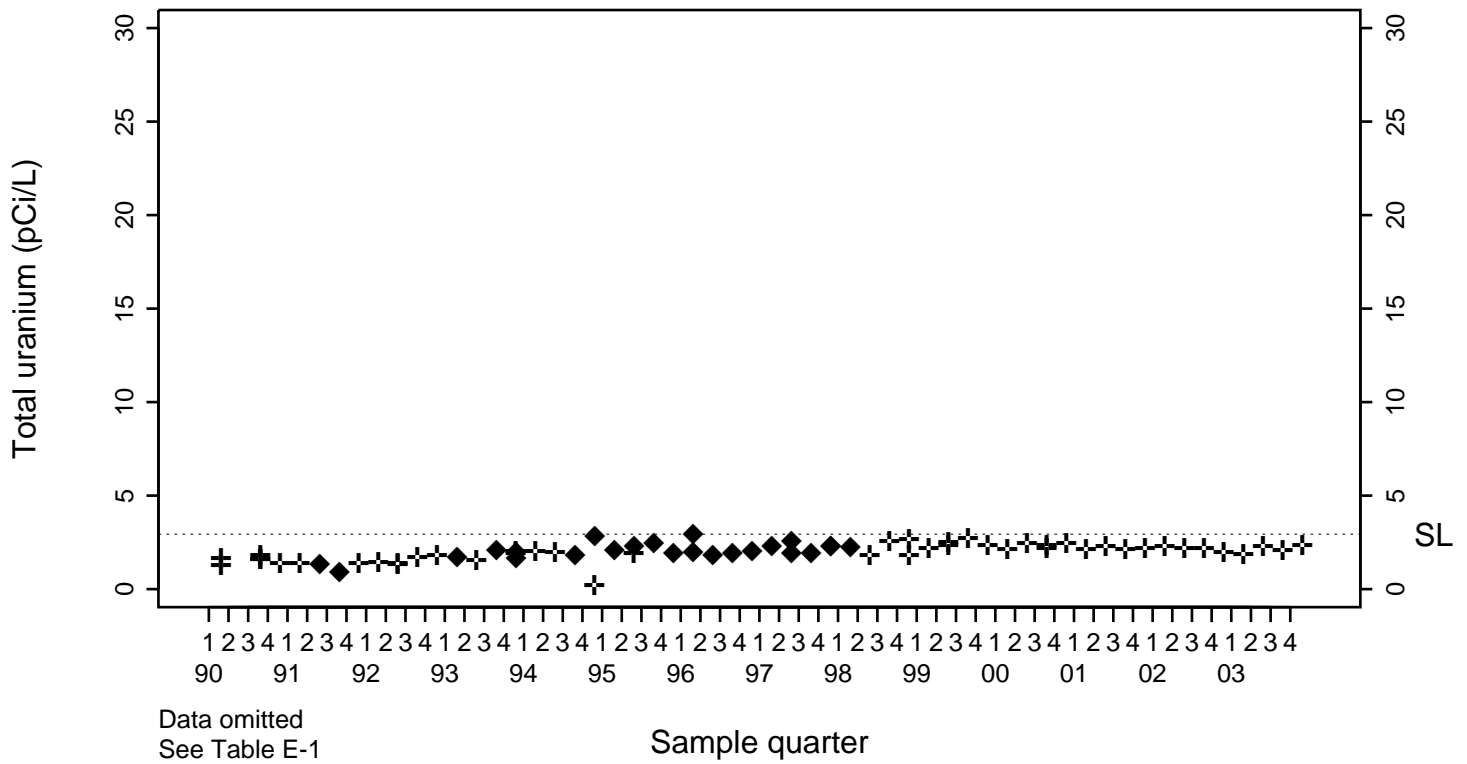
SL=3.24

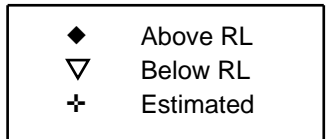
Compliance Monitoring Point K1-08



SL=2.94

Compliance Monitoring Point K1-09

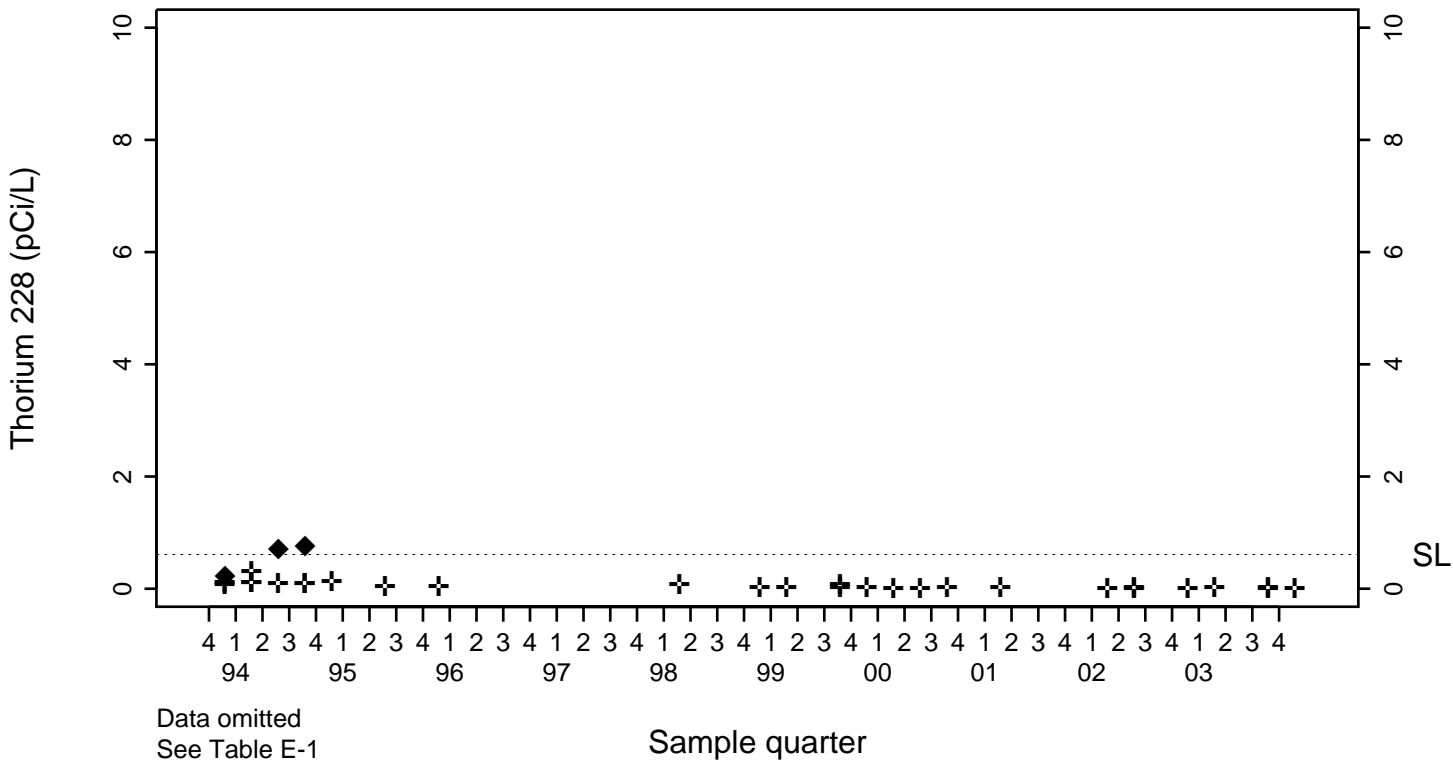




Pit 1 Area Thorium 228 (pCi/L)

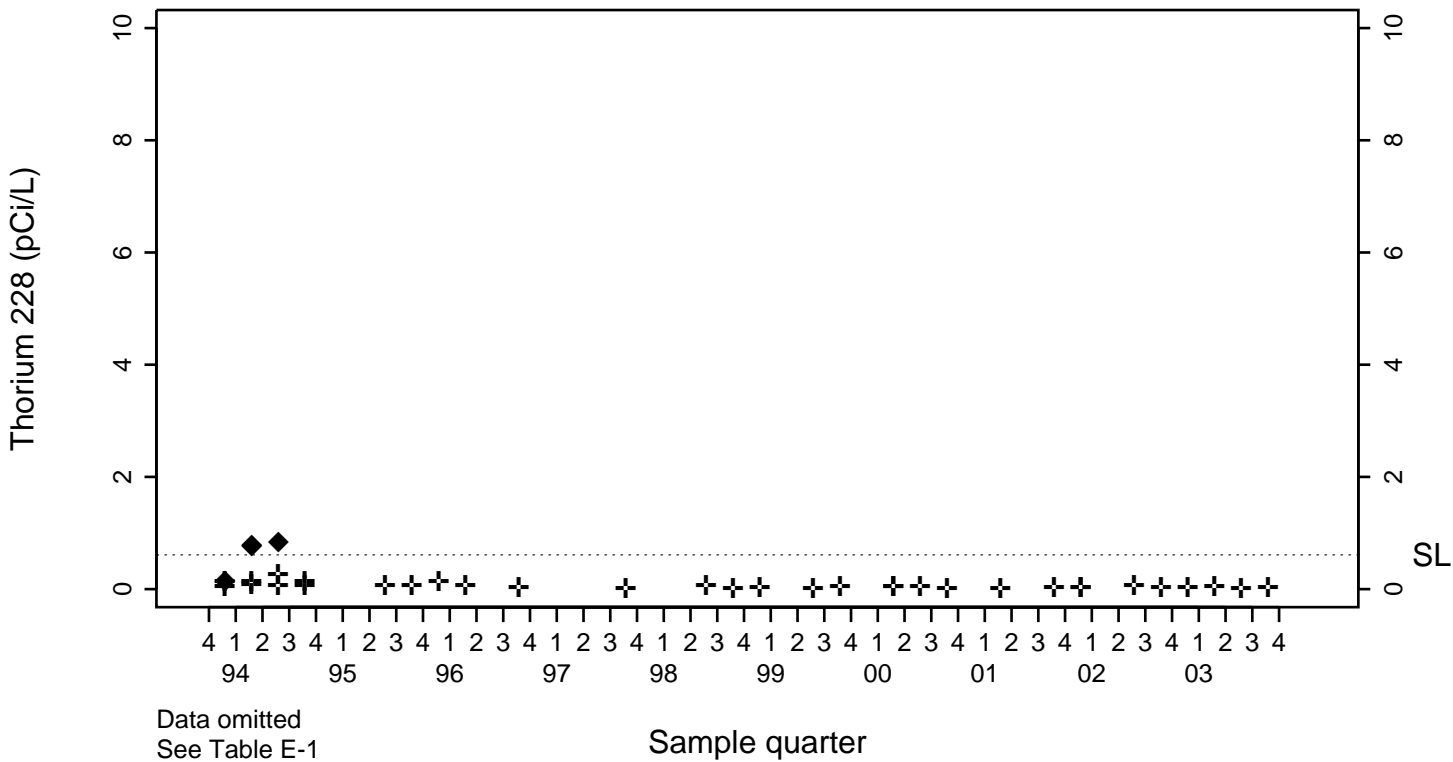
SL=0.61

Background Monitoring Point K1-01C



SL=0.61

Background Monitoring Point K1-07

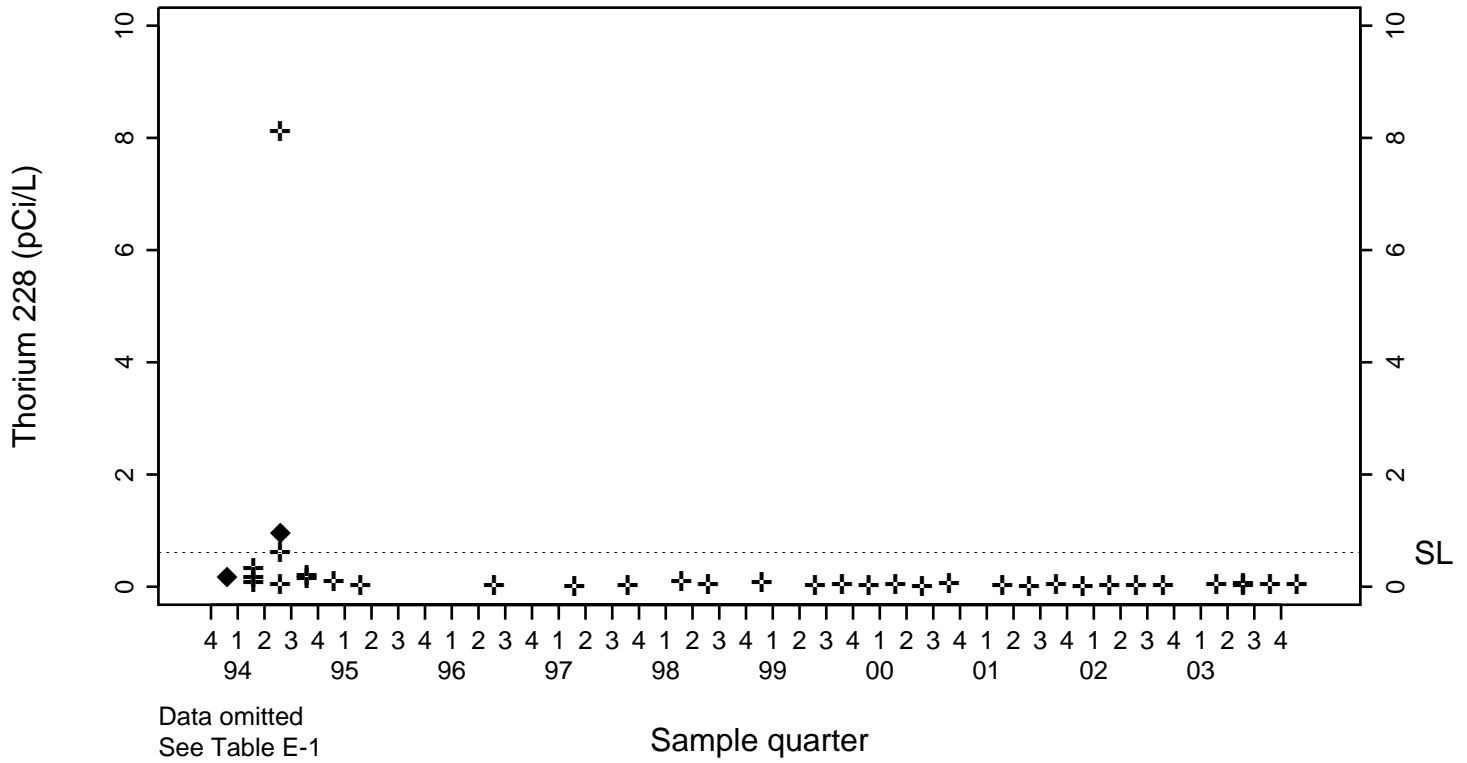


Pit 1 Area Thorium 228 (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

SL=0.61

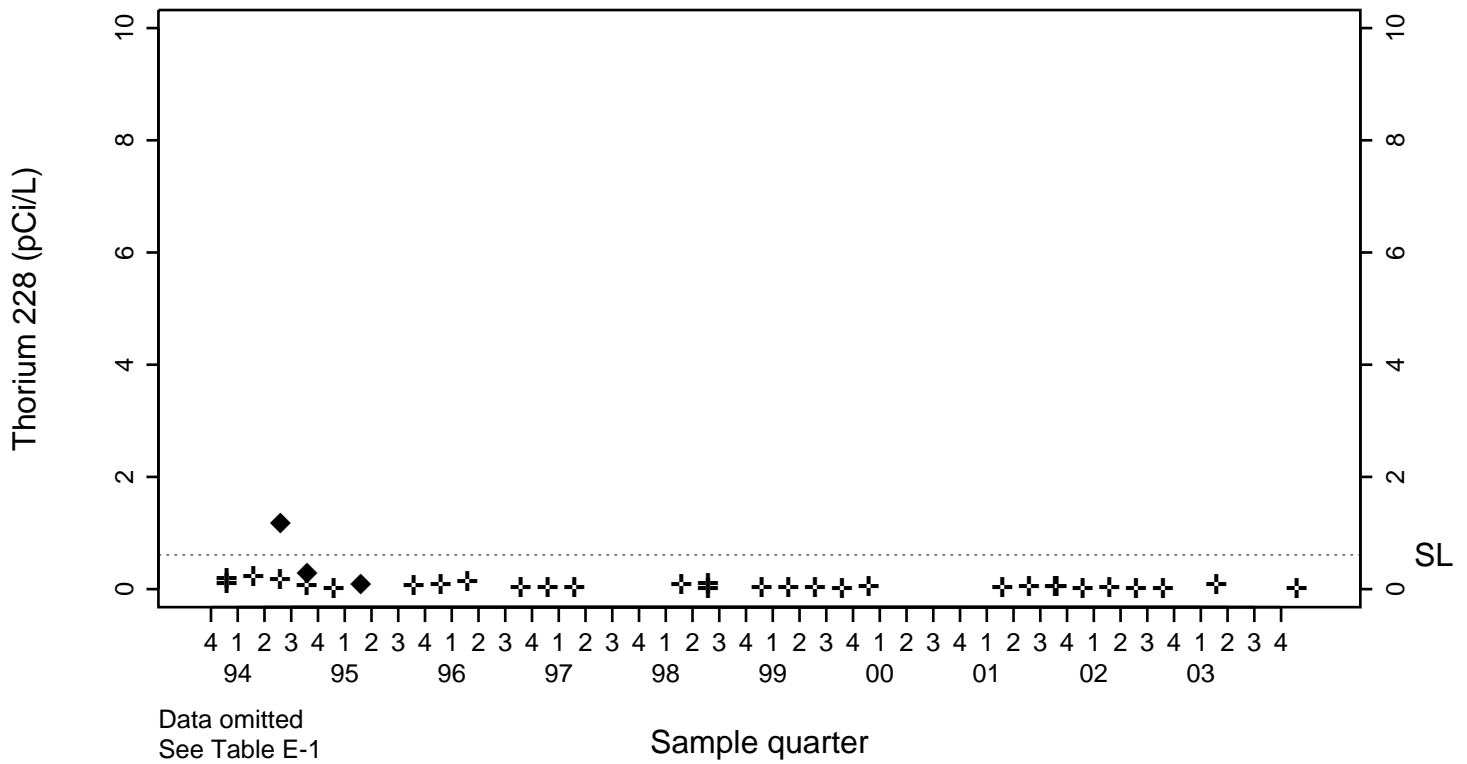
Compliance Monitoring Point K1-02B



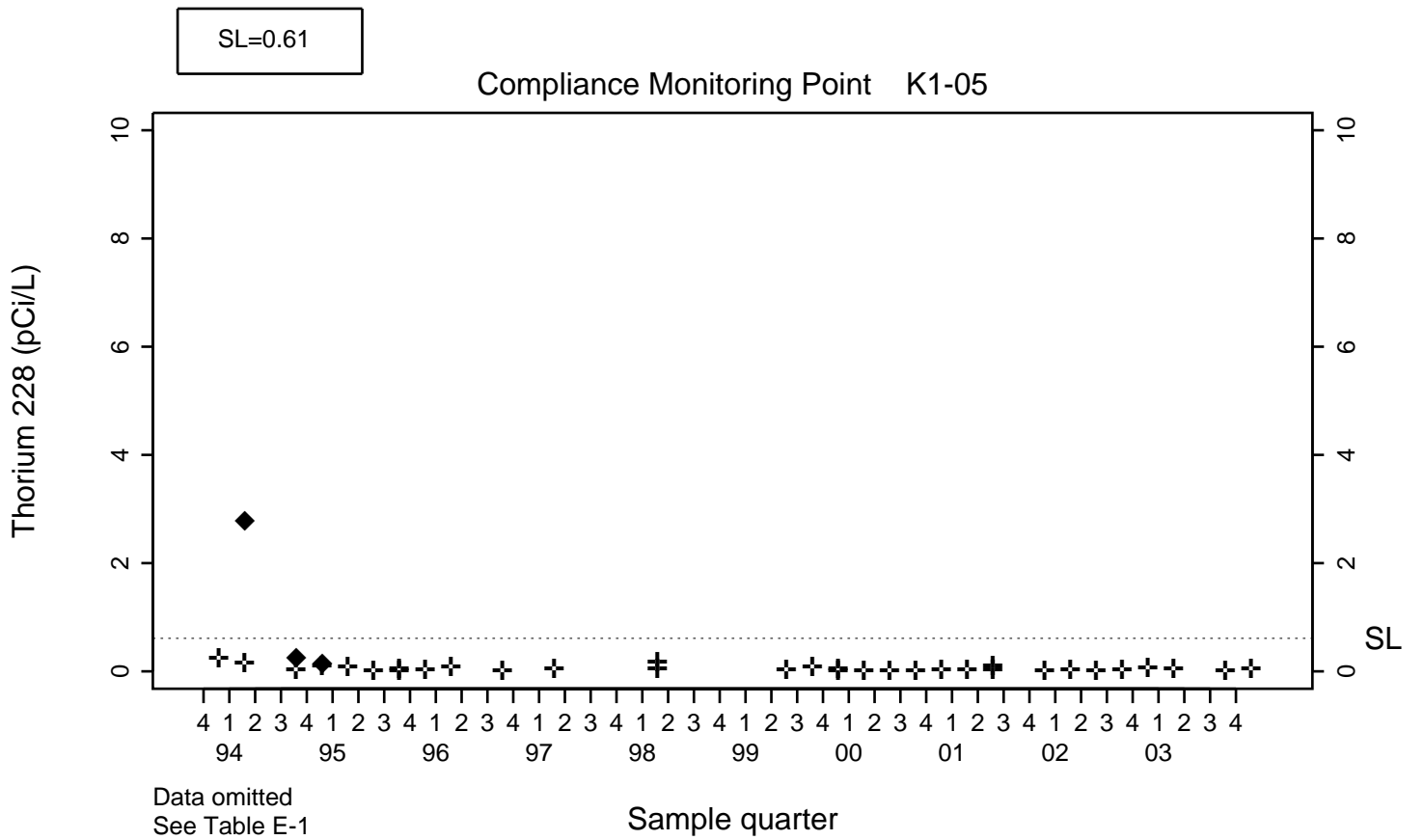
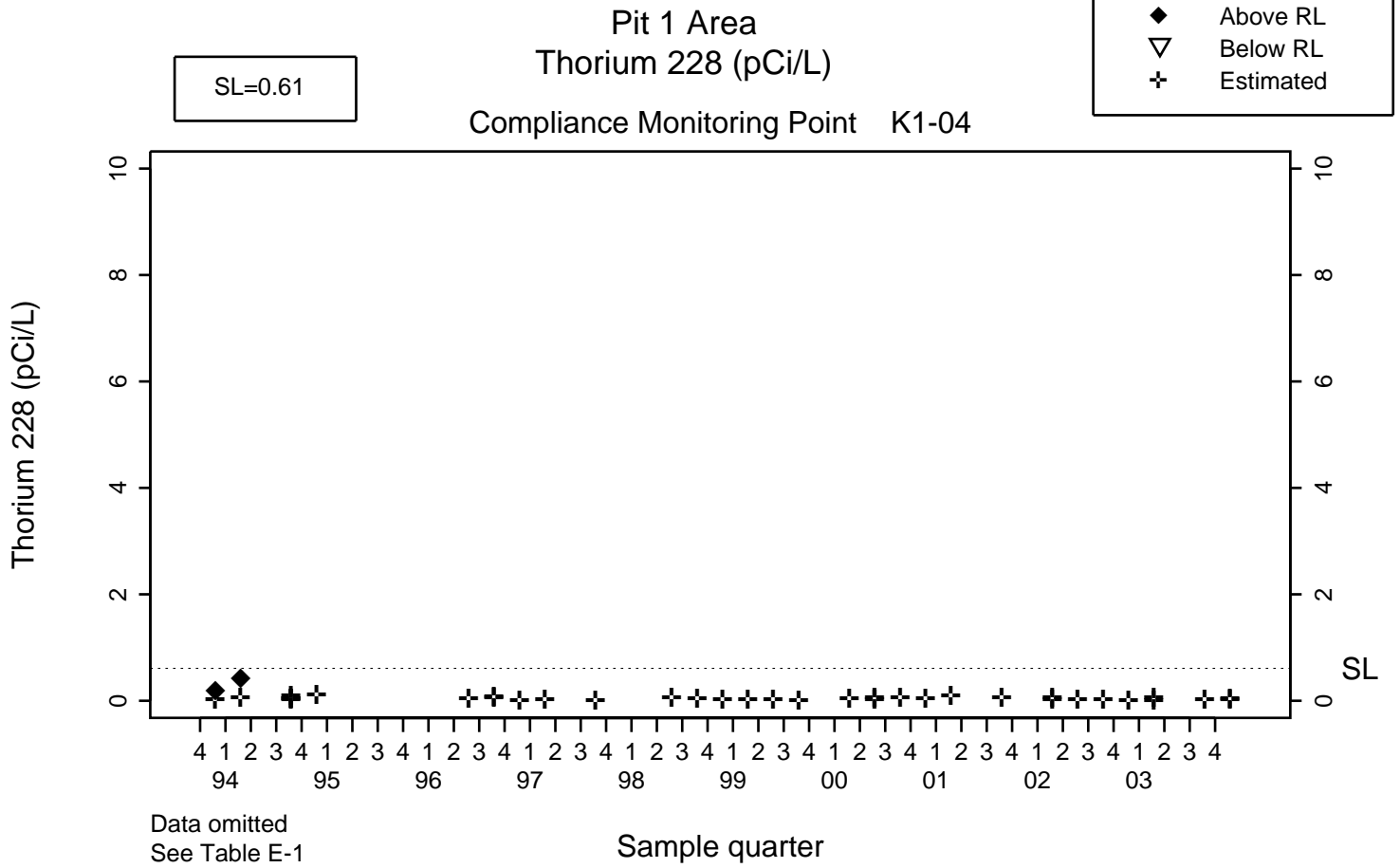
Data omitted
See Table E-1

SL=0.61

Compliance Monitoring Point K1-03



Data omitted
See Table E-1

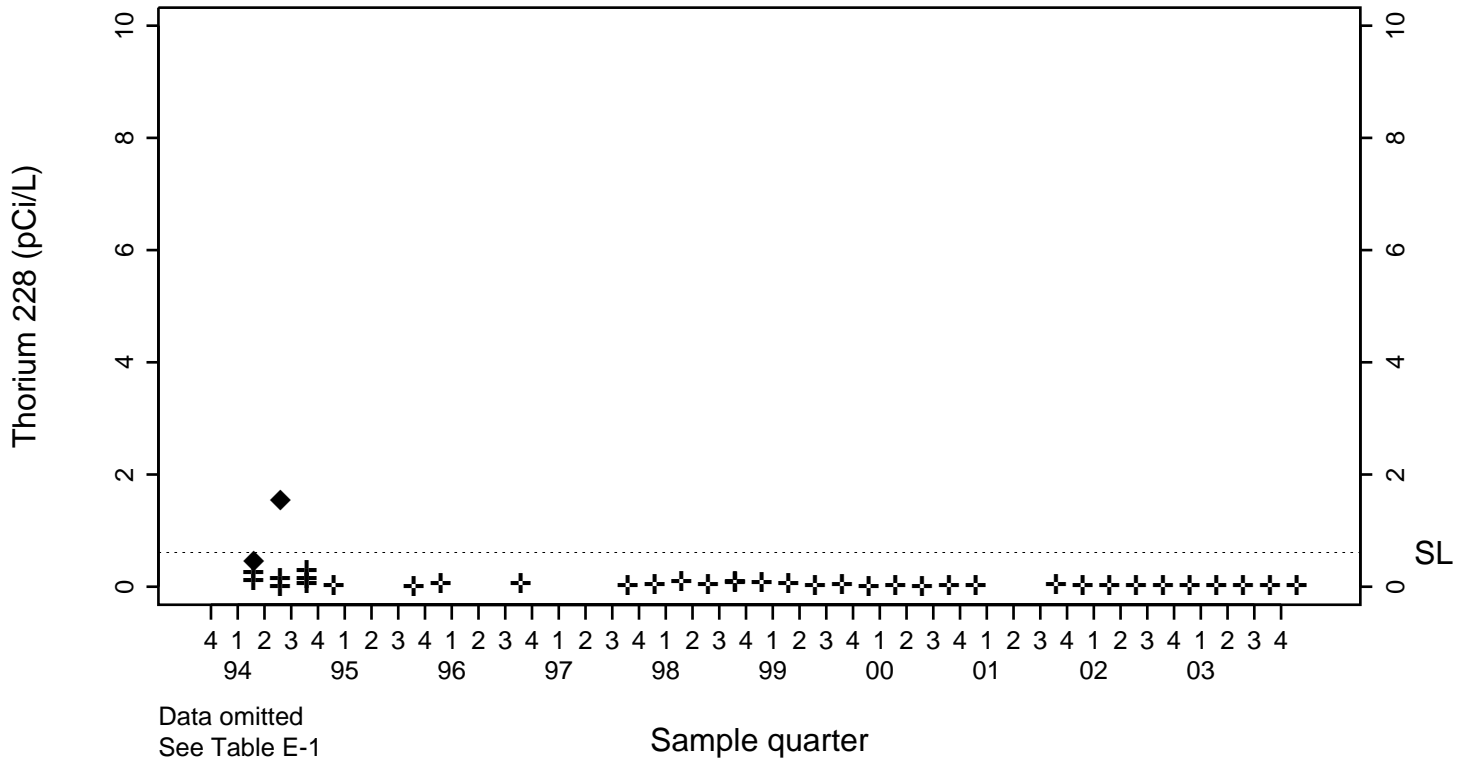


Pit 1 Area
Thorium 228 (pCi/L)

◆ Above RL
▽ Below RL
+ Estimated

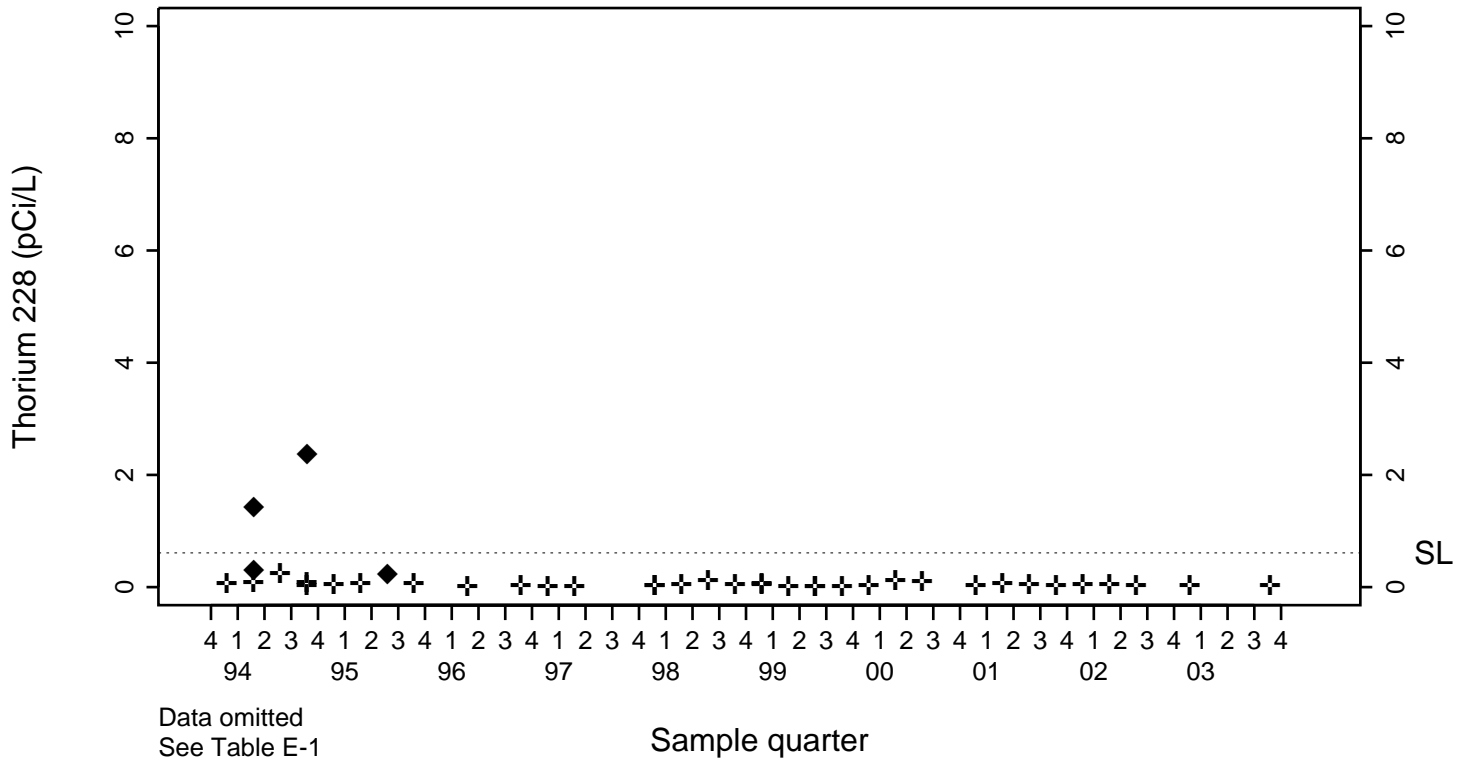
SL=0.61

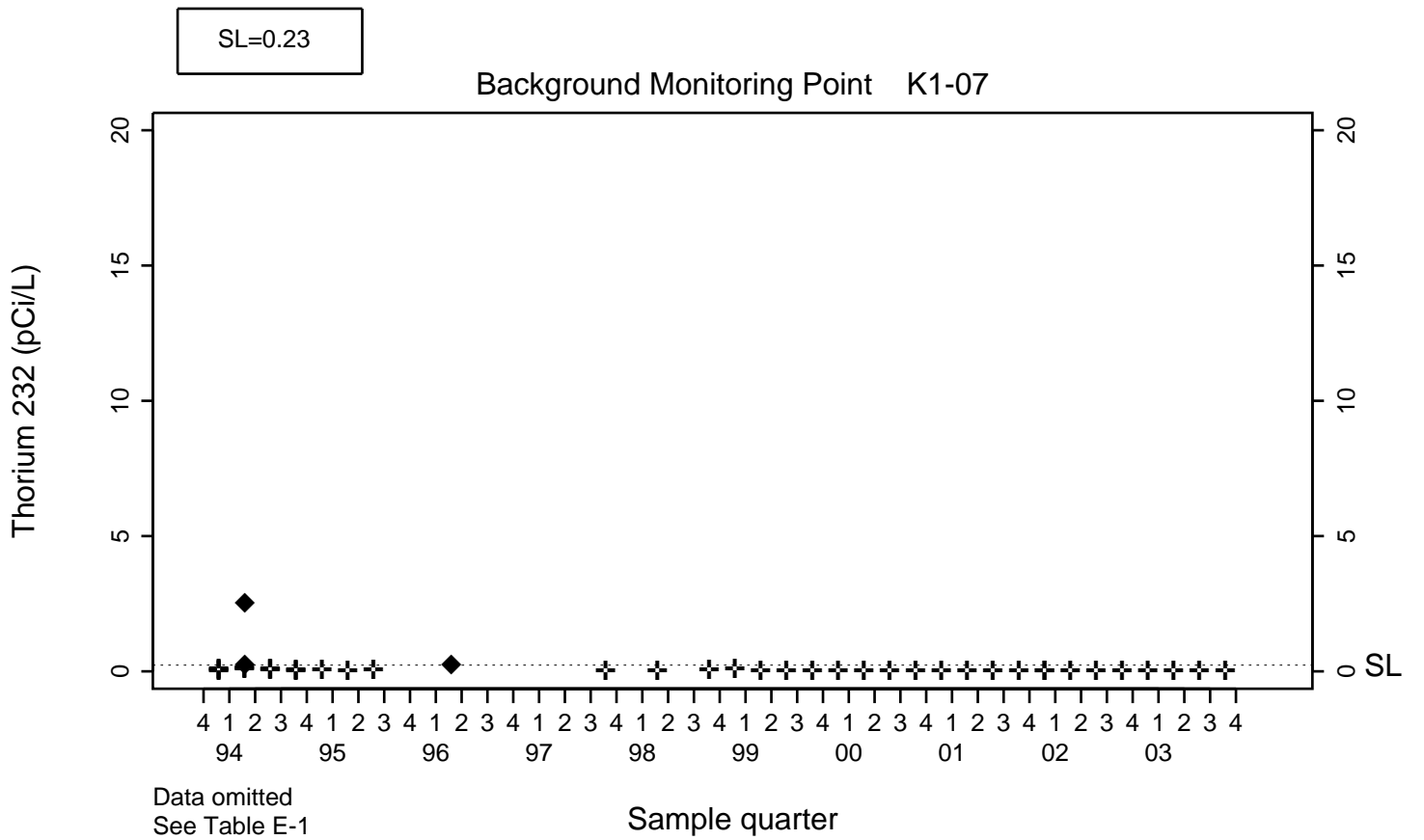
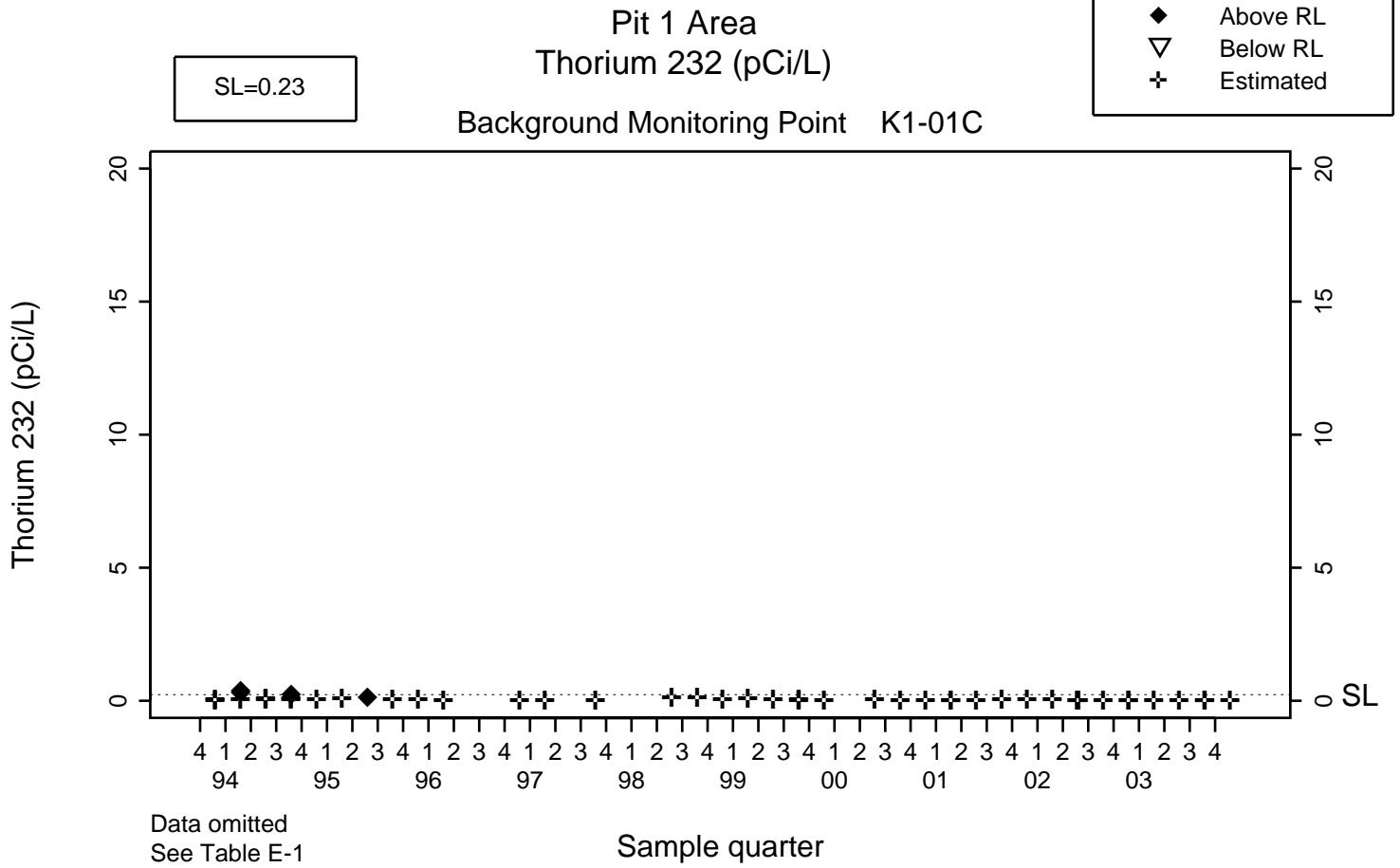
Compliance Monitoring Point K1-08



SL=0.61

Compliance Monitoring Point K1-09



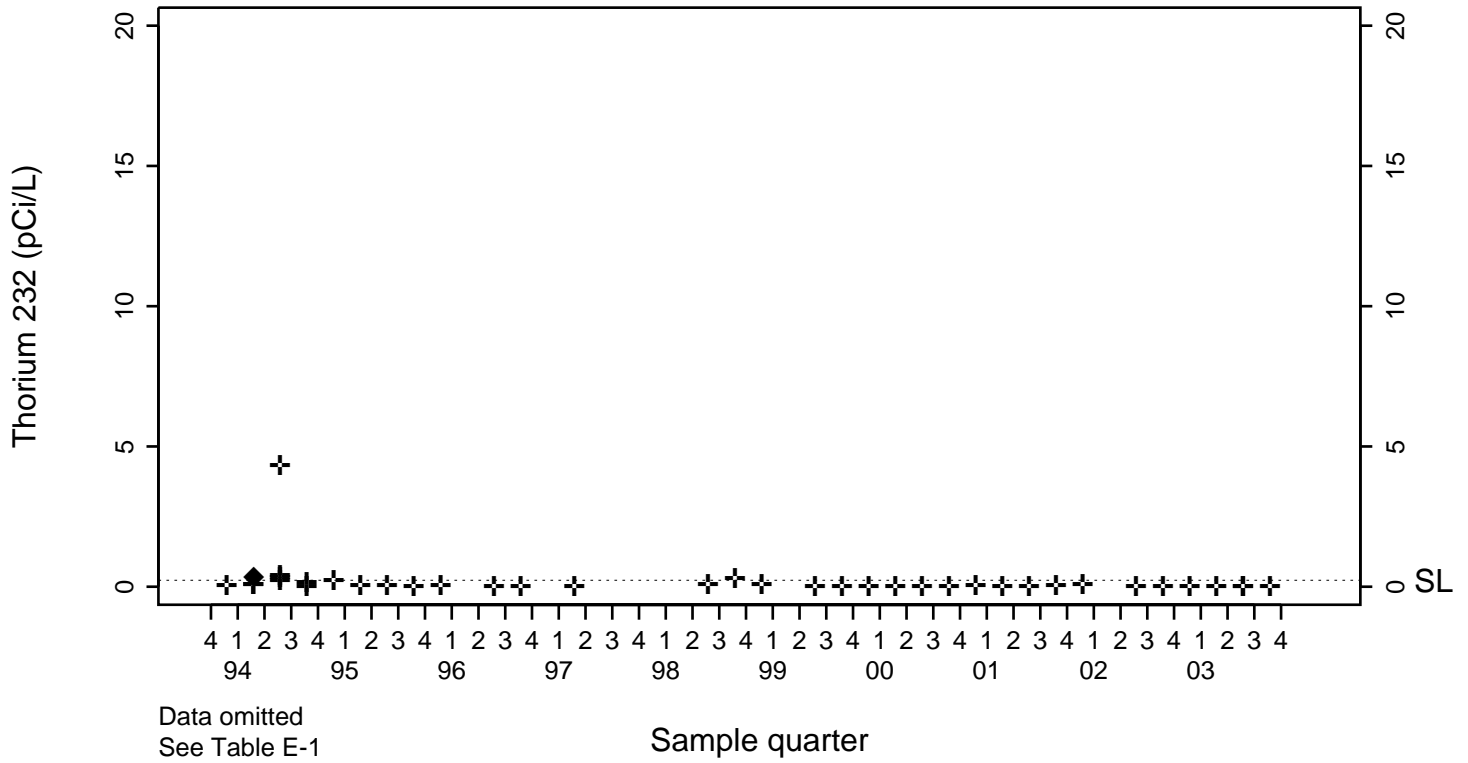


Pit 1 Area
Thorium 232 (pCi/L)

- ◆ Above RL
- ▽ Below RL
- + Estimated

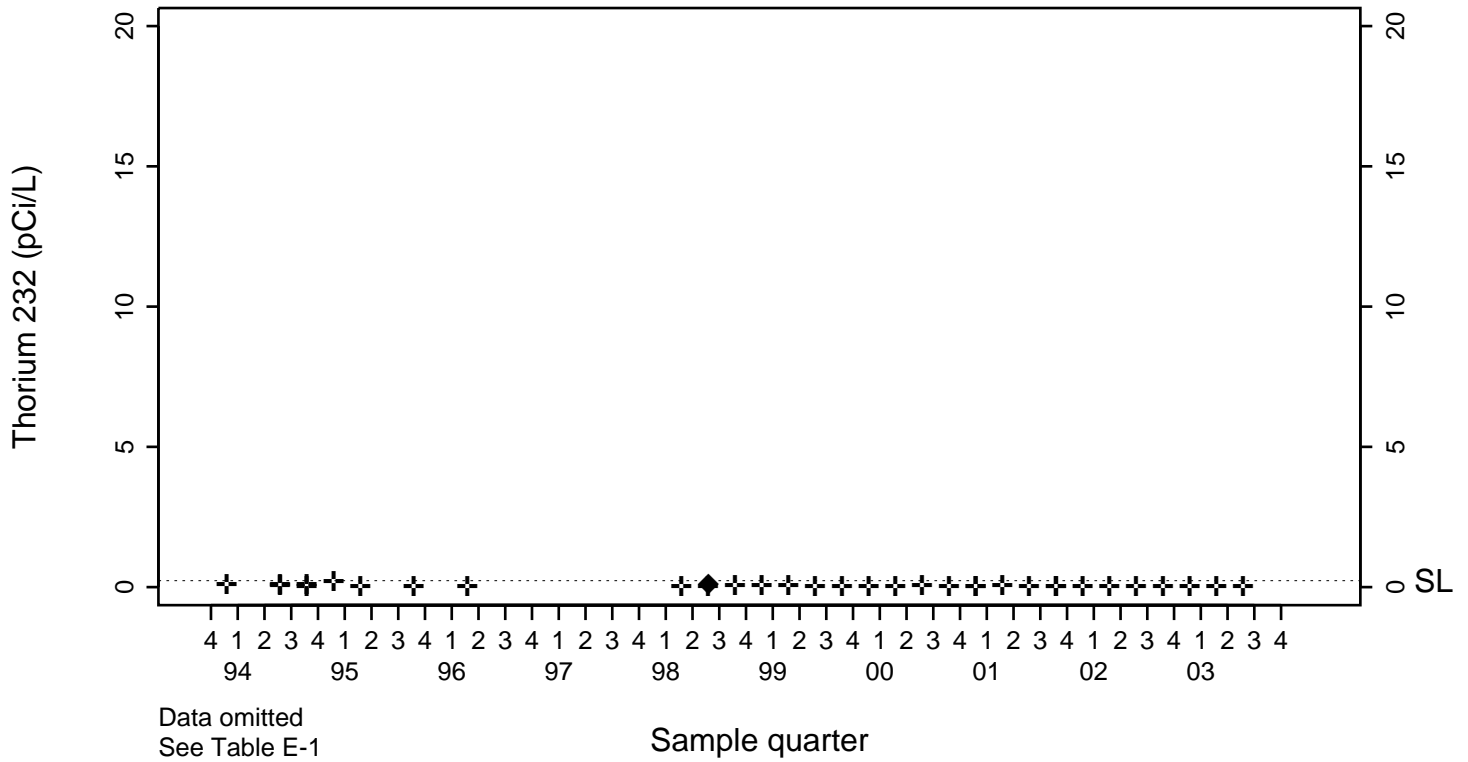
SL=0.23

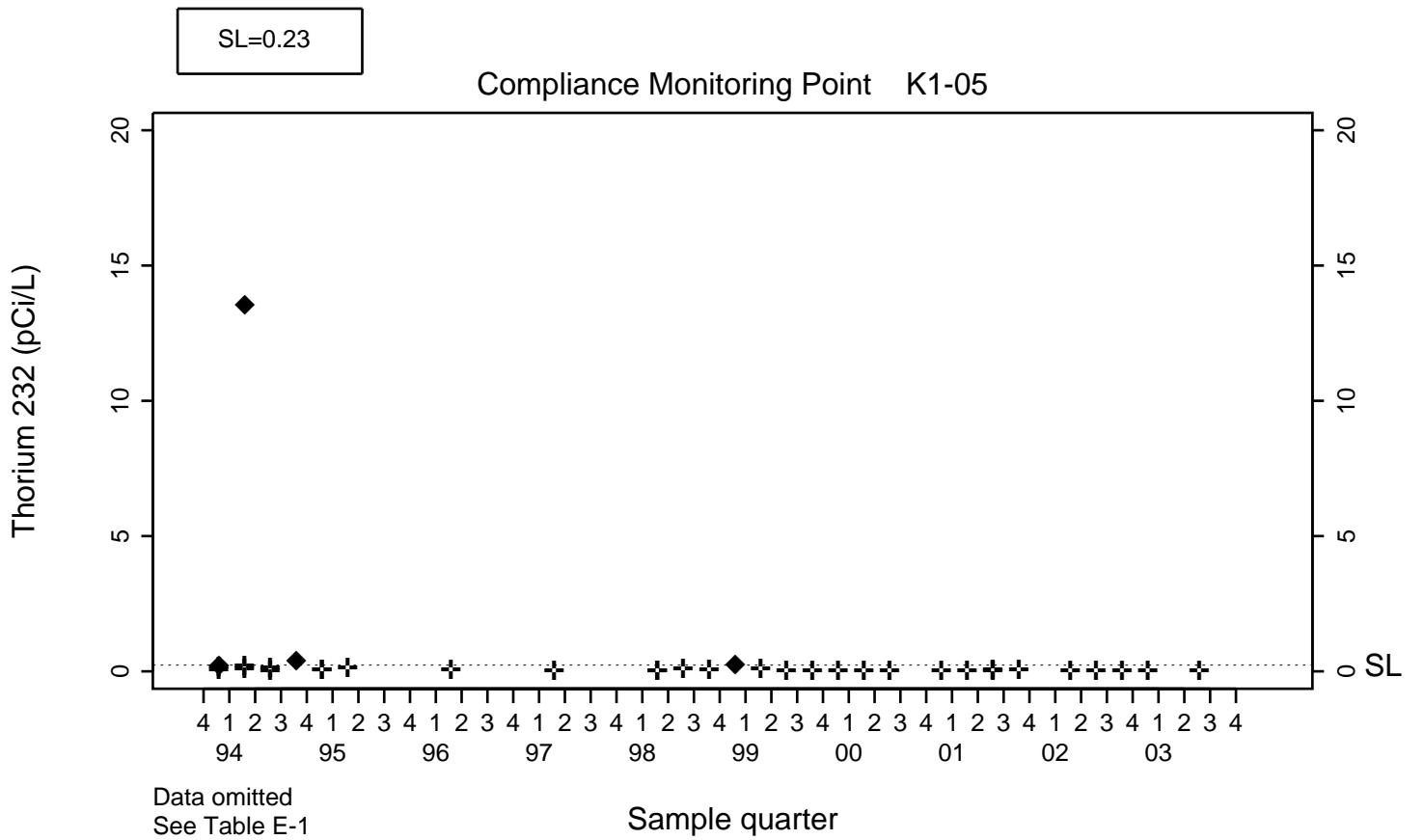
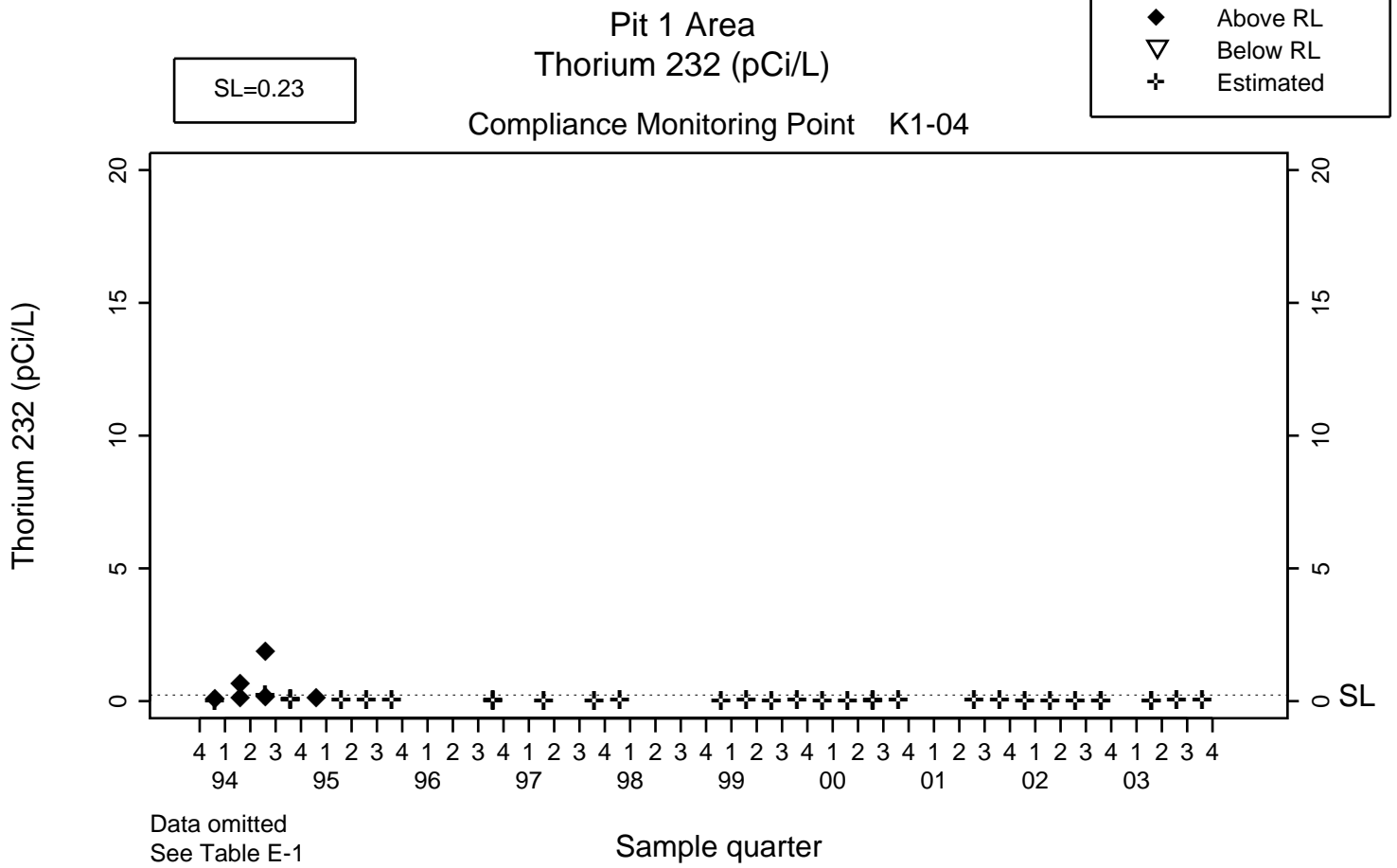
Compliance Monitoring Point K1-02B

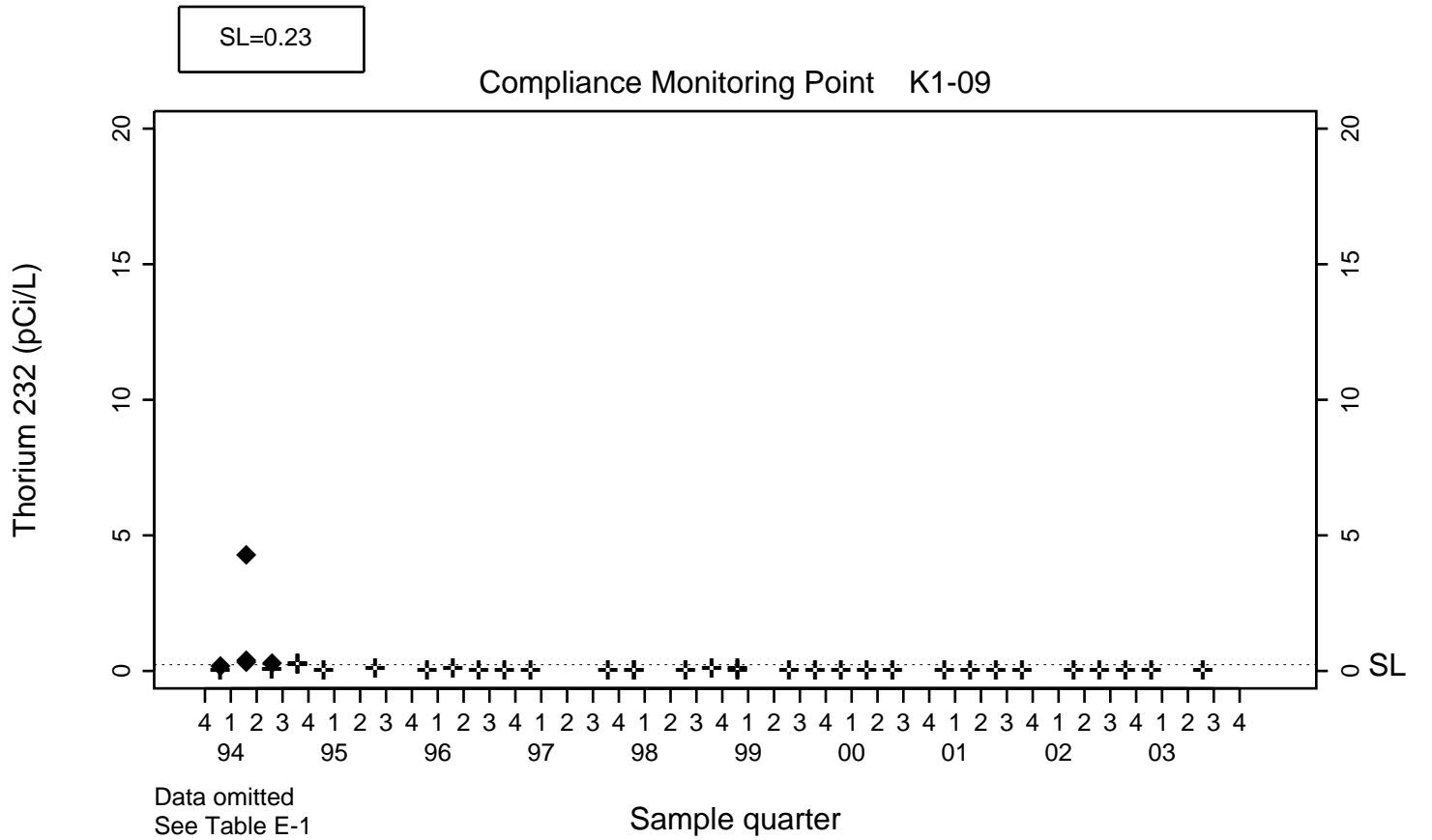
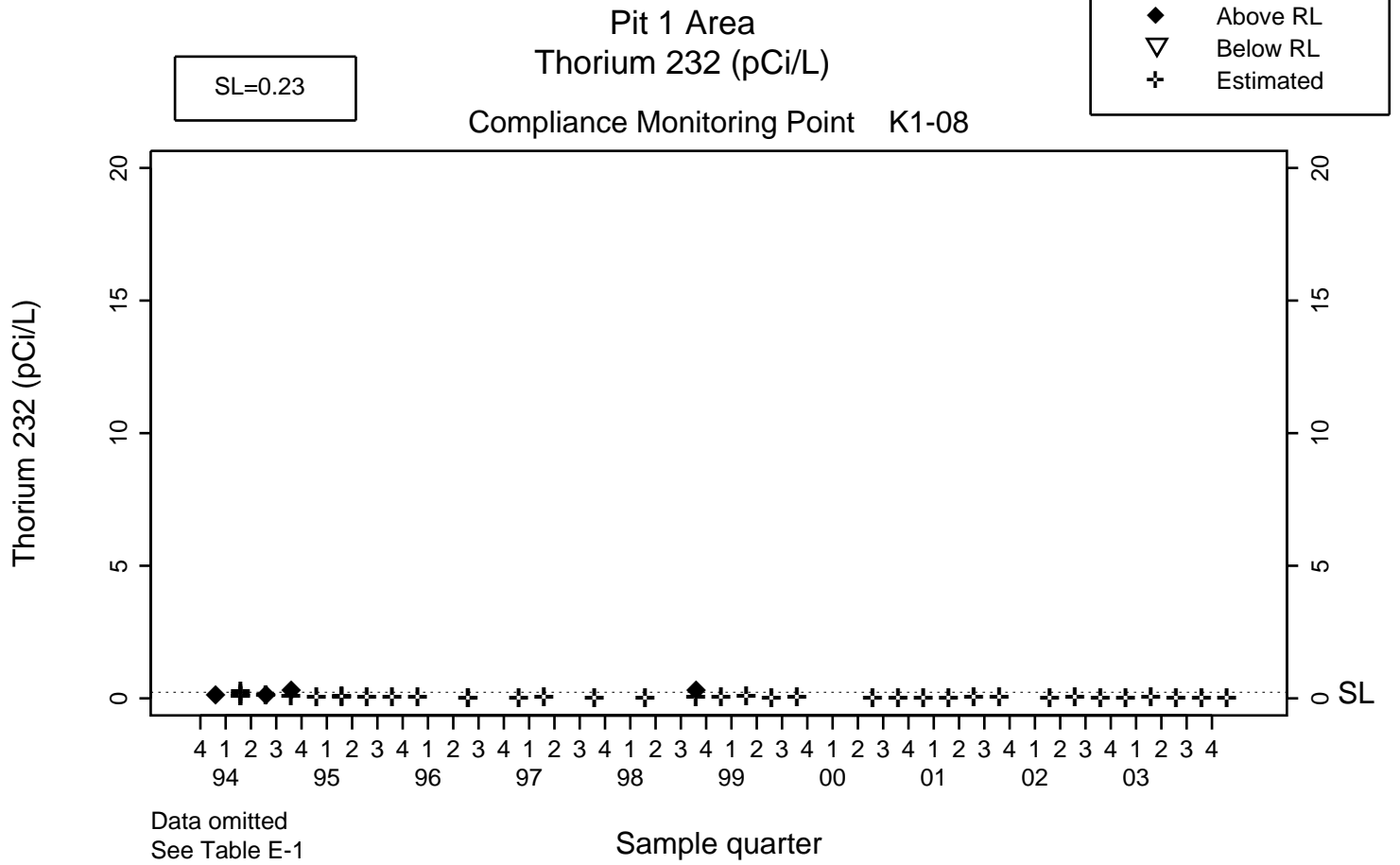


SL=0.23

Compliance Monitoring Point K1-03





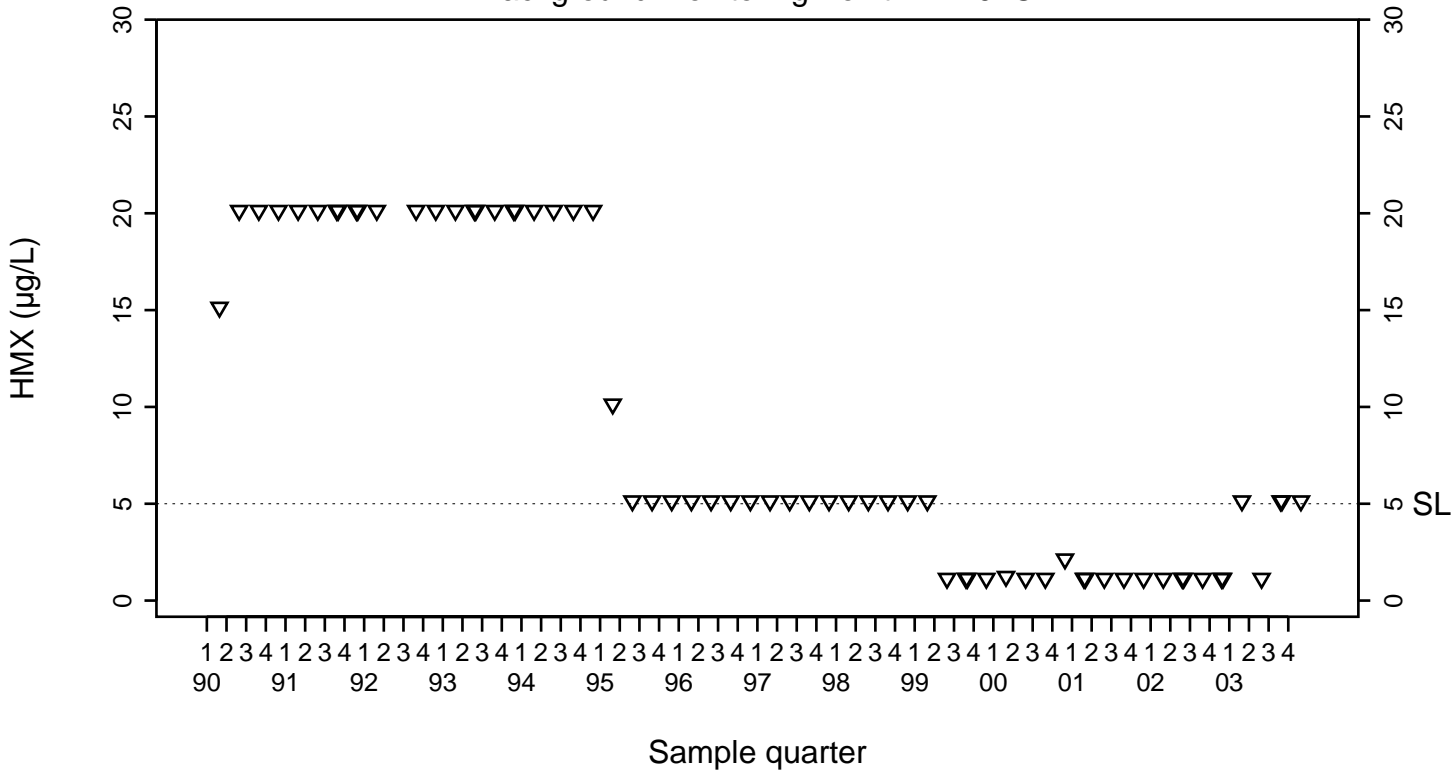


Pit 1 Area HMX ($\mu\text{g/L}$)

Background Monitoring Point K1-01C

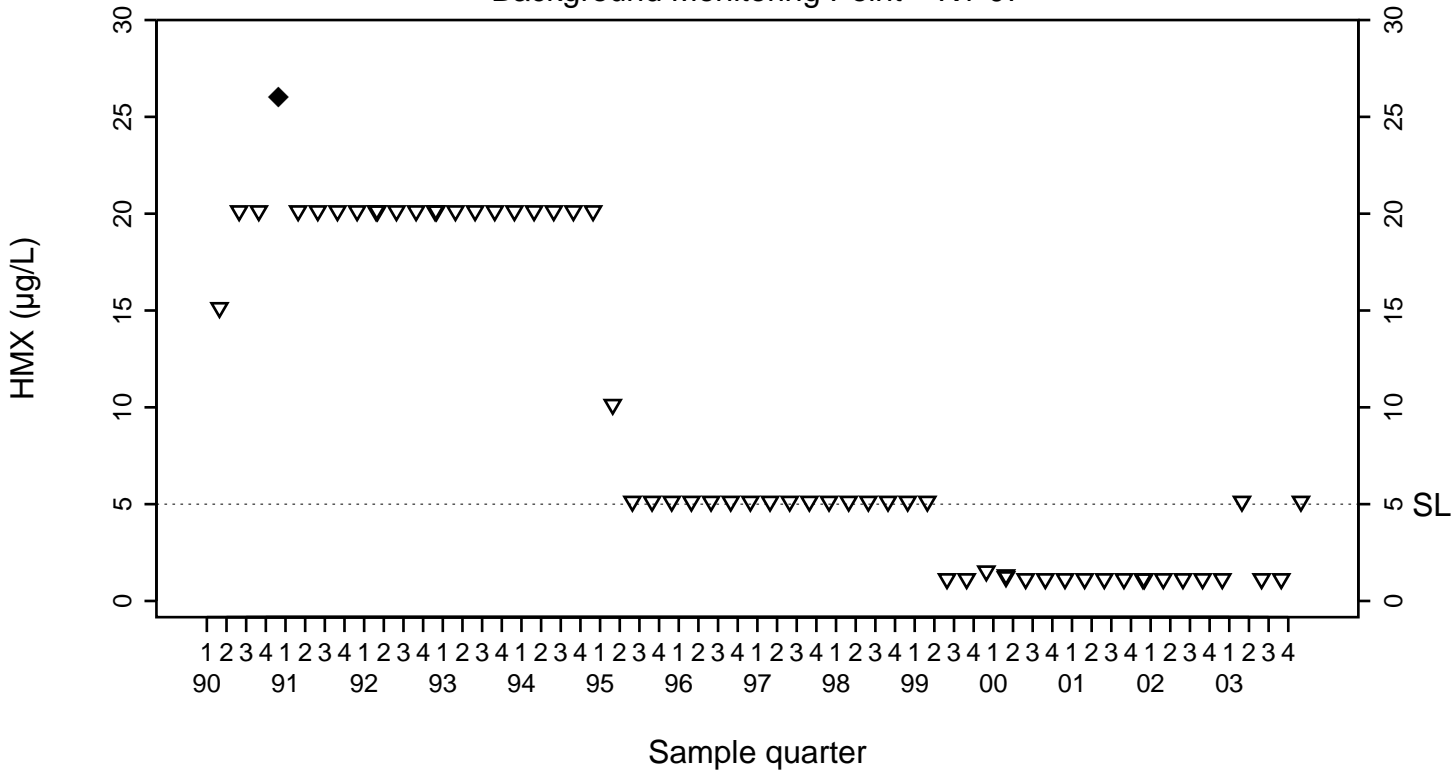
◆	Above RL
▽	Below RL

SL=5



SL=5

Background Monitoring Point K1-07

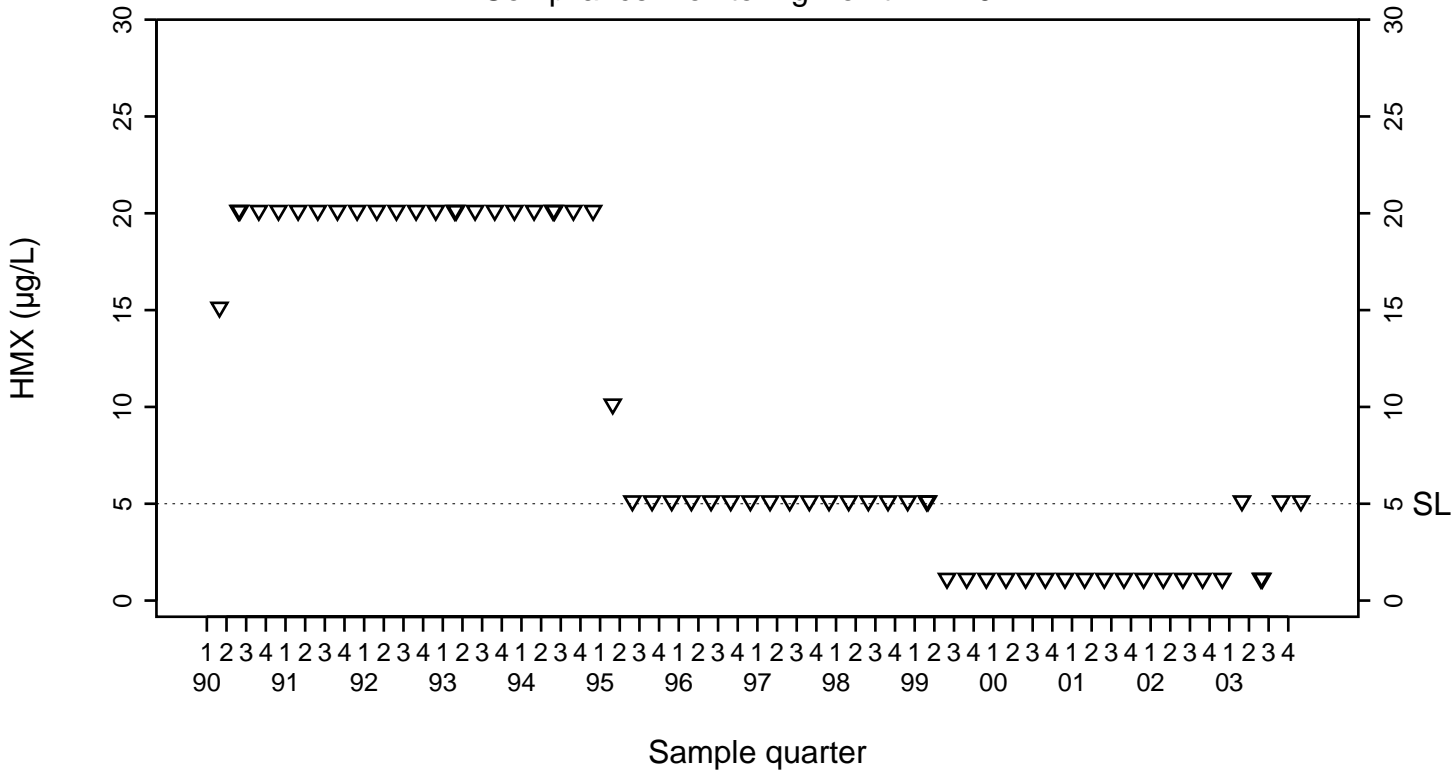


Pit 1 Area HMX ($\mu\text{g/L}$)

Compliance Monitoring Point K1-02B

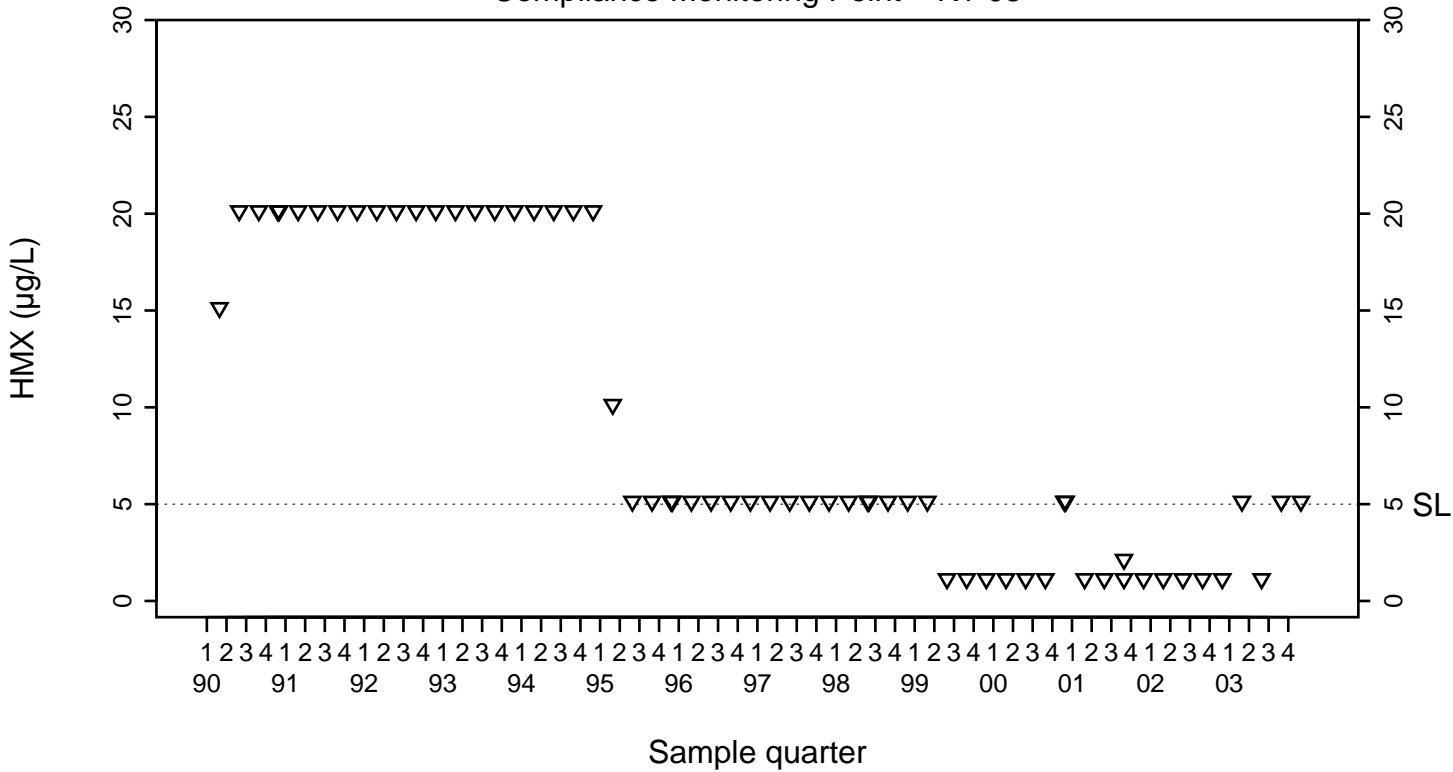
◆	Above RL
▽	Below RL

SL=5



SL=5

Compliance Monitoring Point K1-03

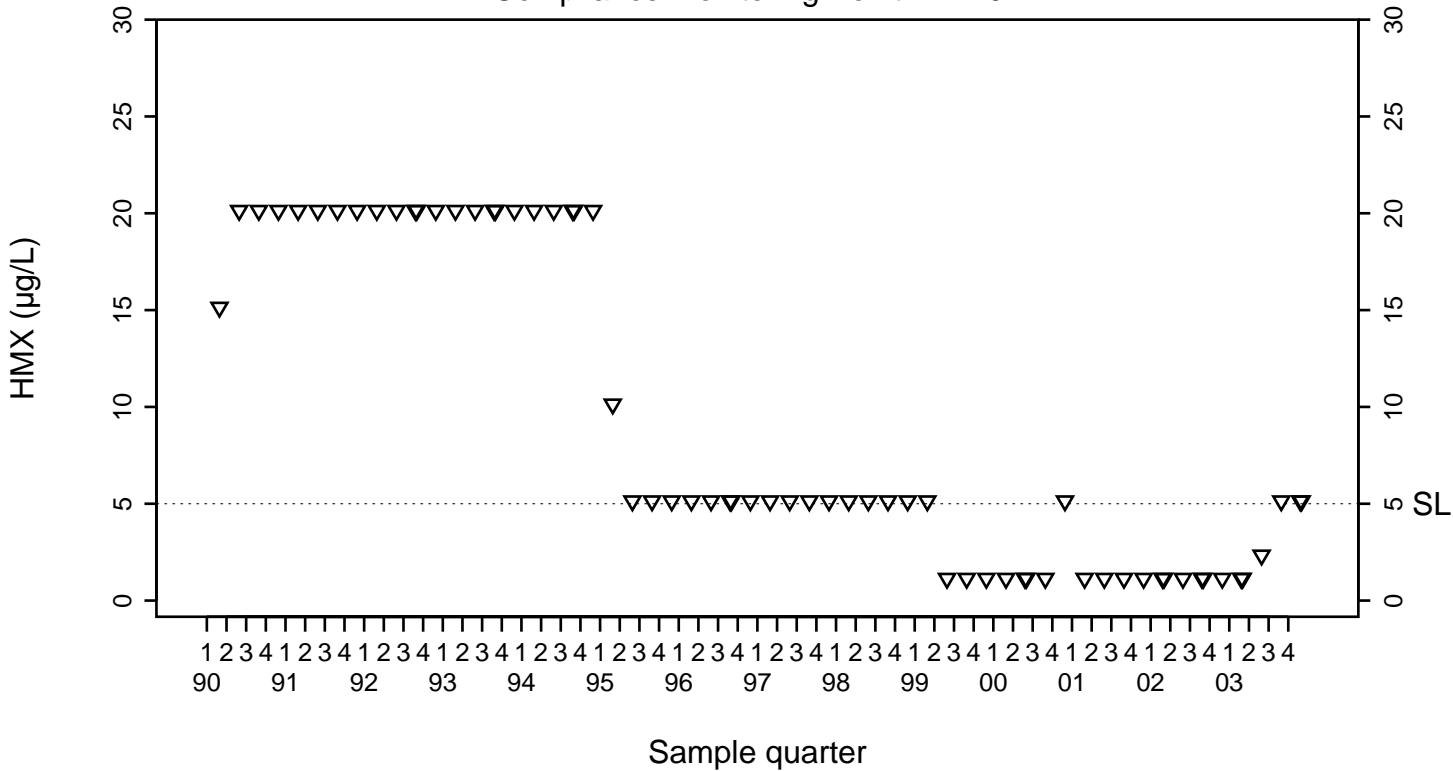


Pit 1 Area HMX ($\mu\text{g/L}$)

Compliance Monitoring Point K1-04

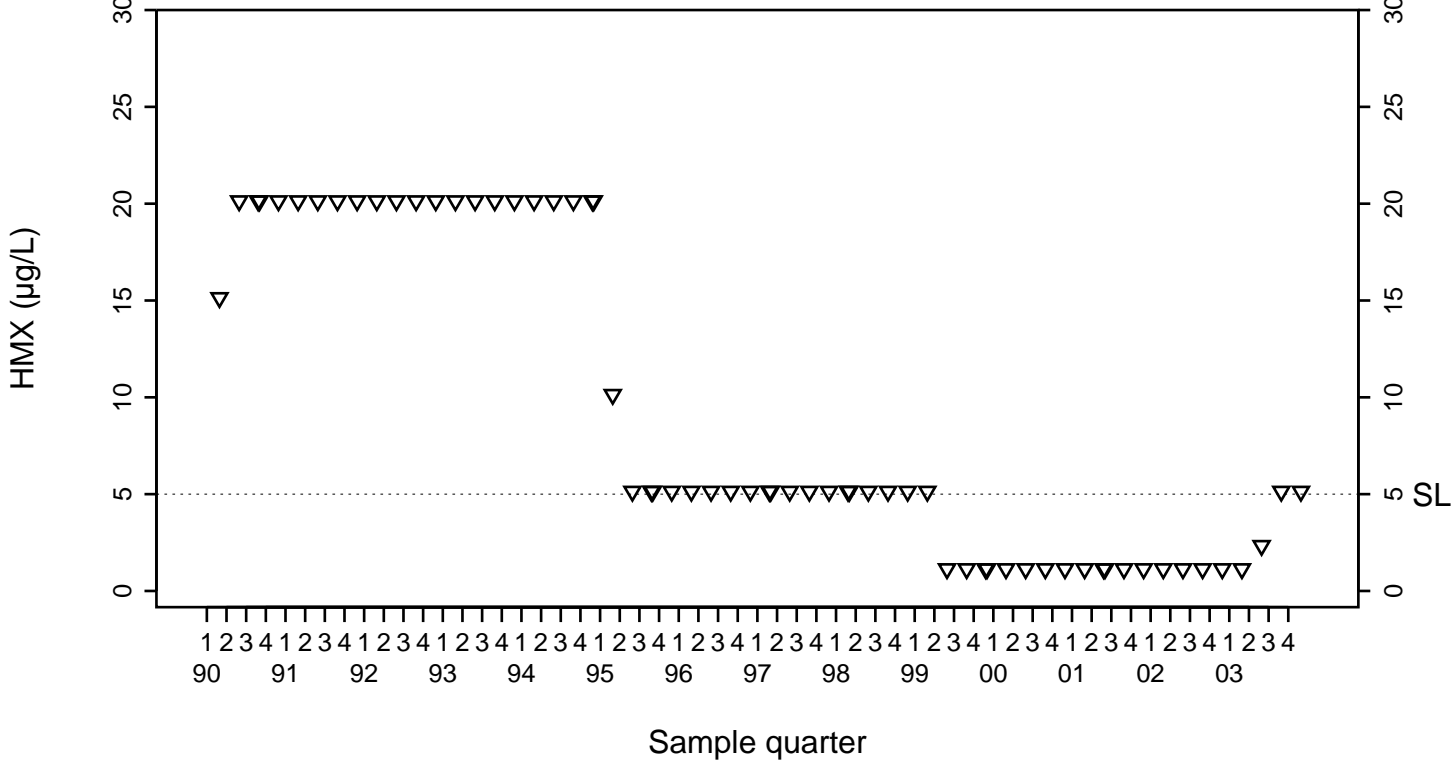
◆	Above RL
▽	Below RL

SL=5



SL=5

Compliance Monitoring Point K1-05

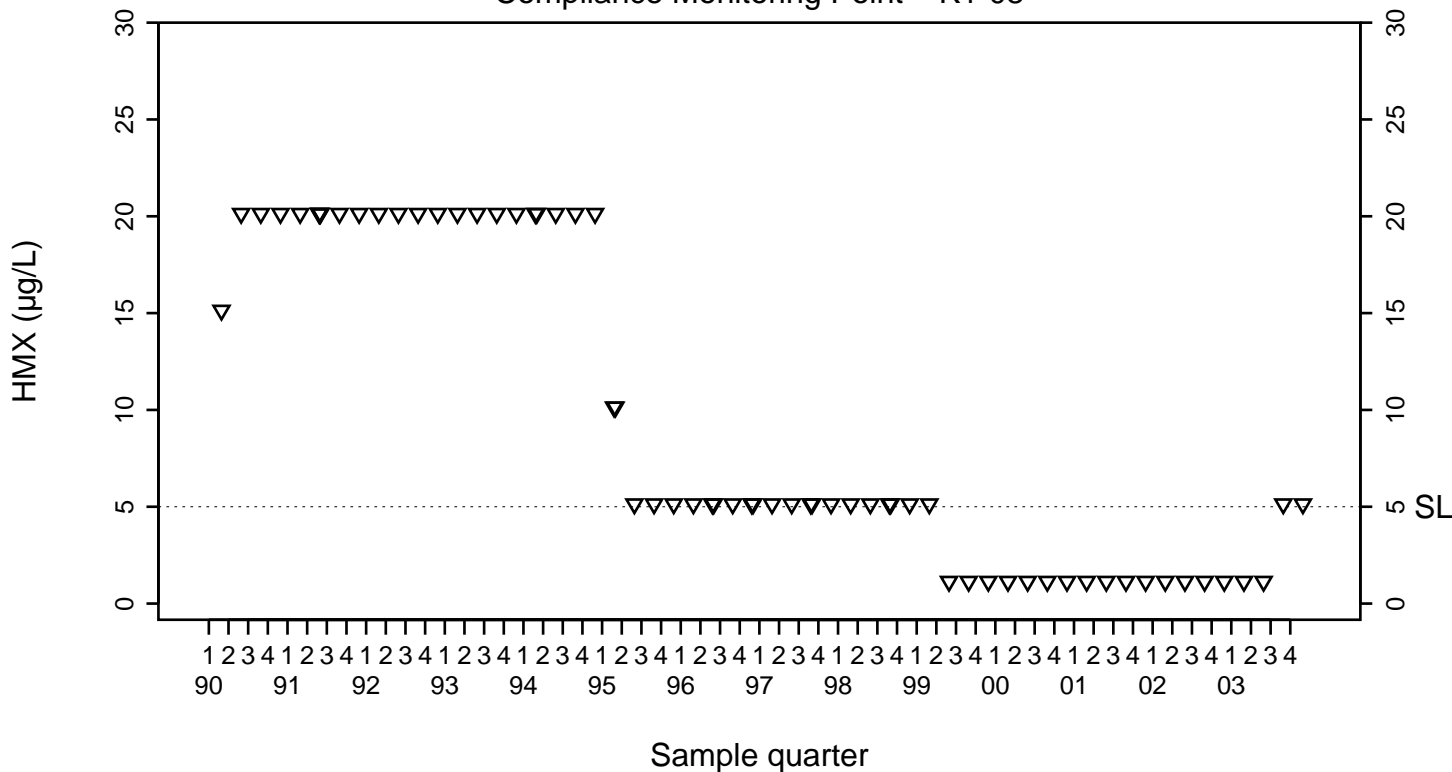


Pit 1 Area HMX ($\mu\text{g/L}$)

Compliance Monitoring Point K1-08

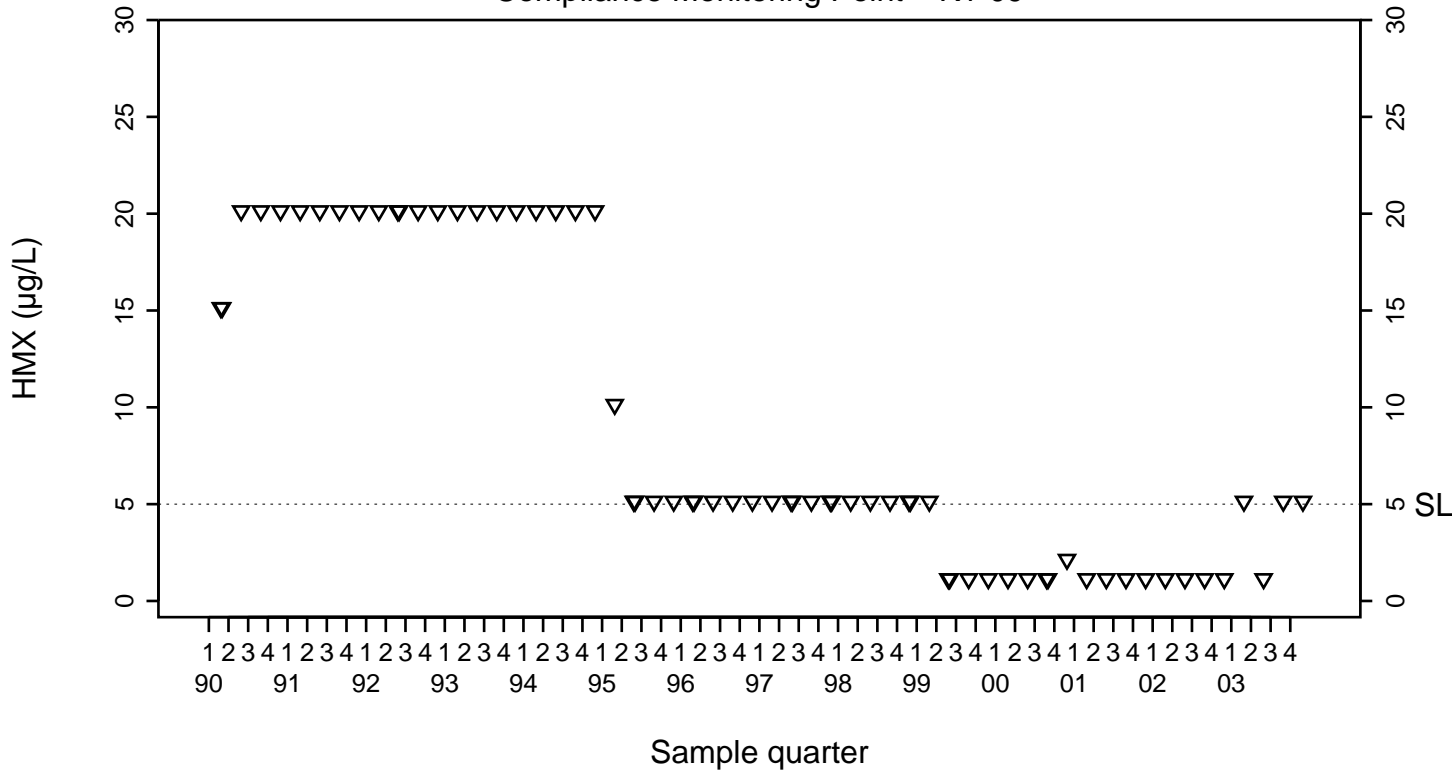
◆	Above RL
▽	Below RL

SL=5



SL=5

Compliance Monitoring Point K1-09

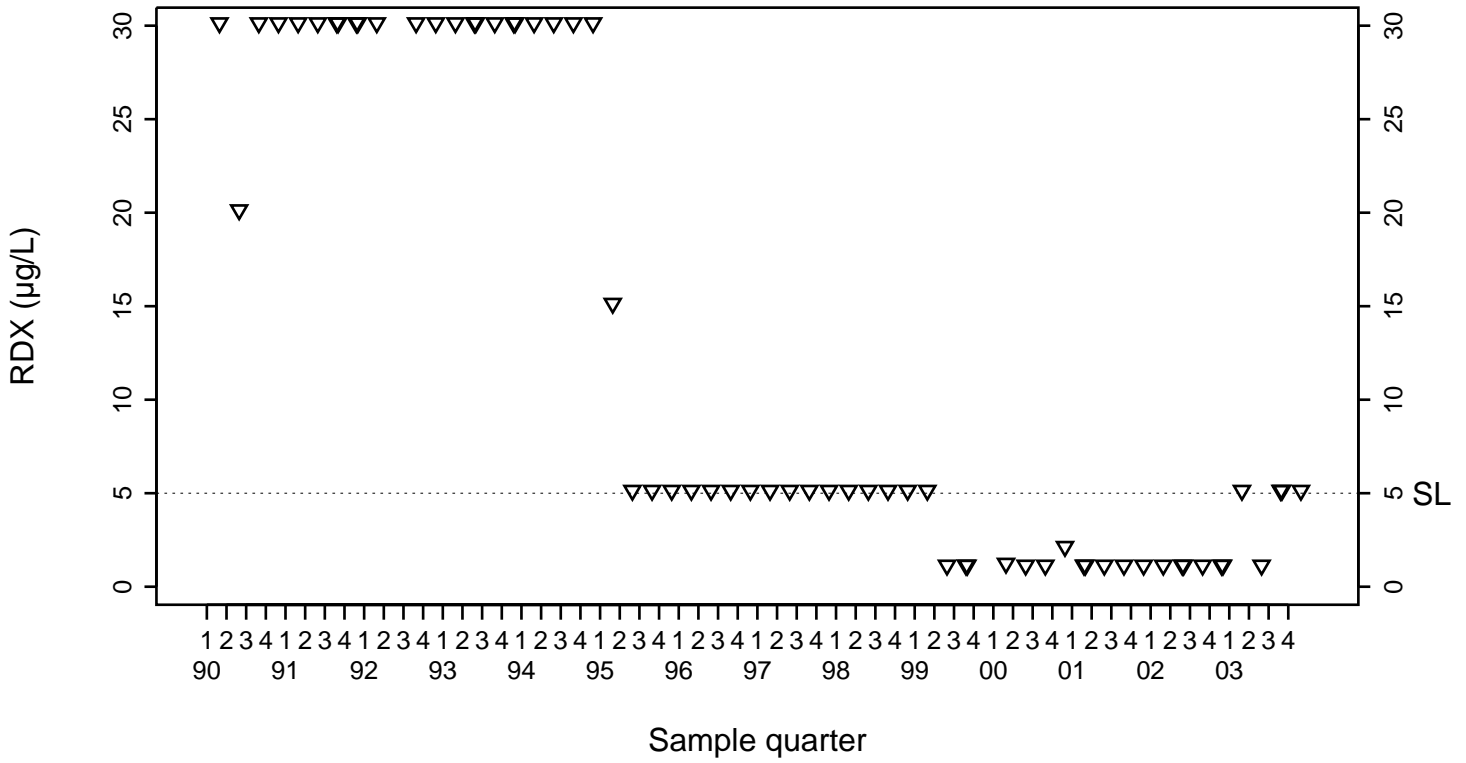


Pit 1 Area
RDX ($\mu\text{g/L}$)

◆ Above RL
▽ Below RL

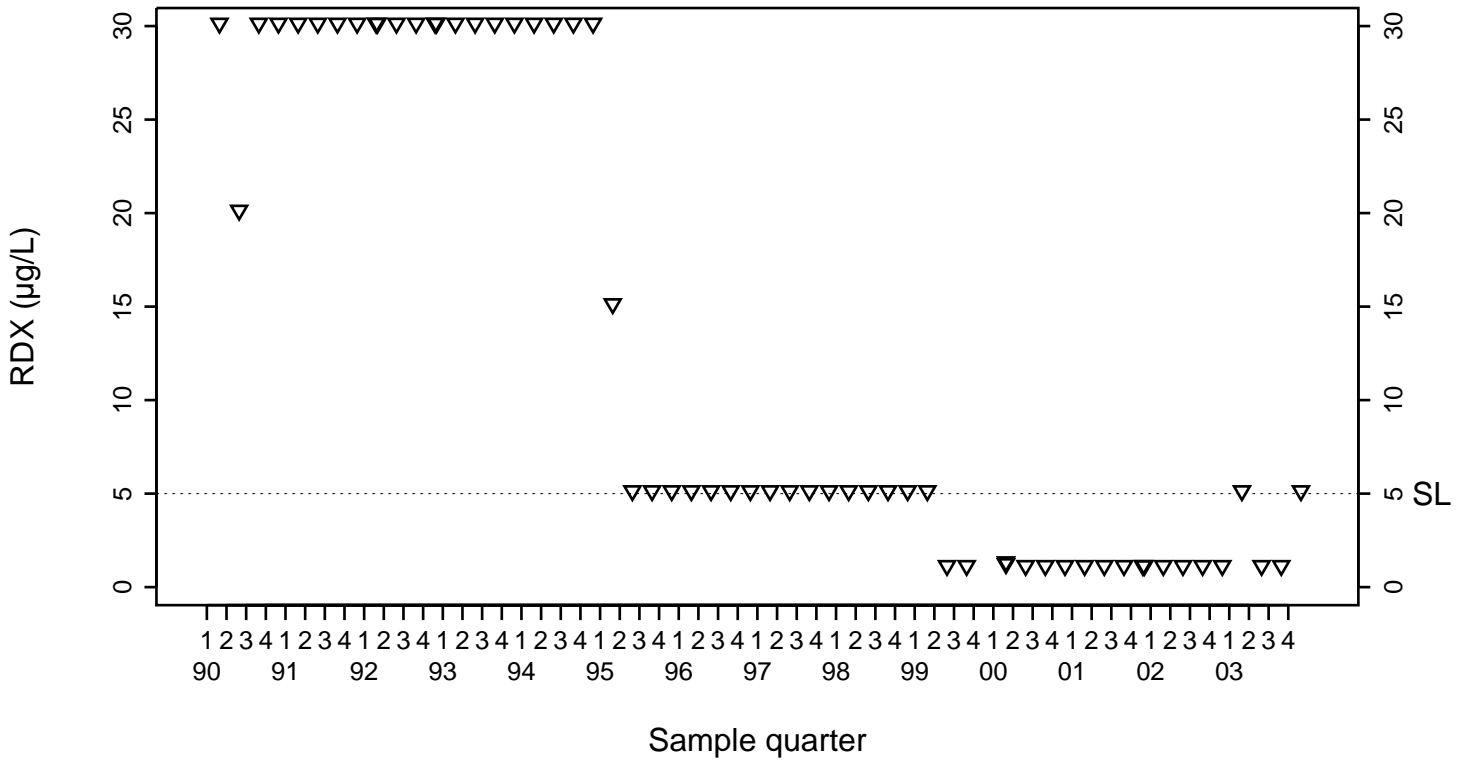
SL=5

Background Monitoring Point K1-01C



SL=5

Background Monitoring Point K1-07

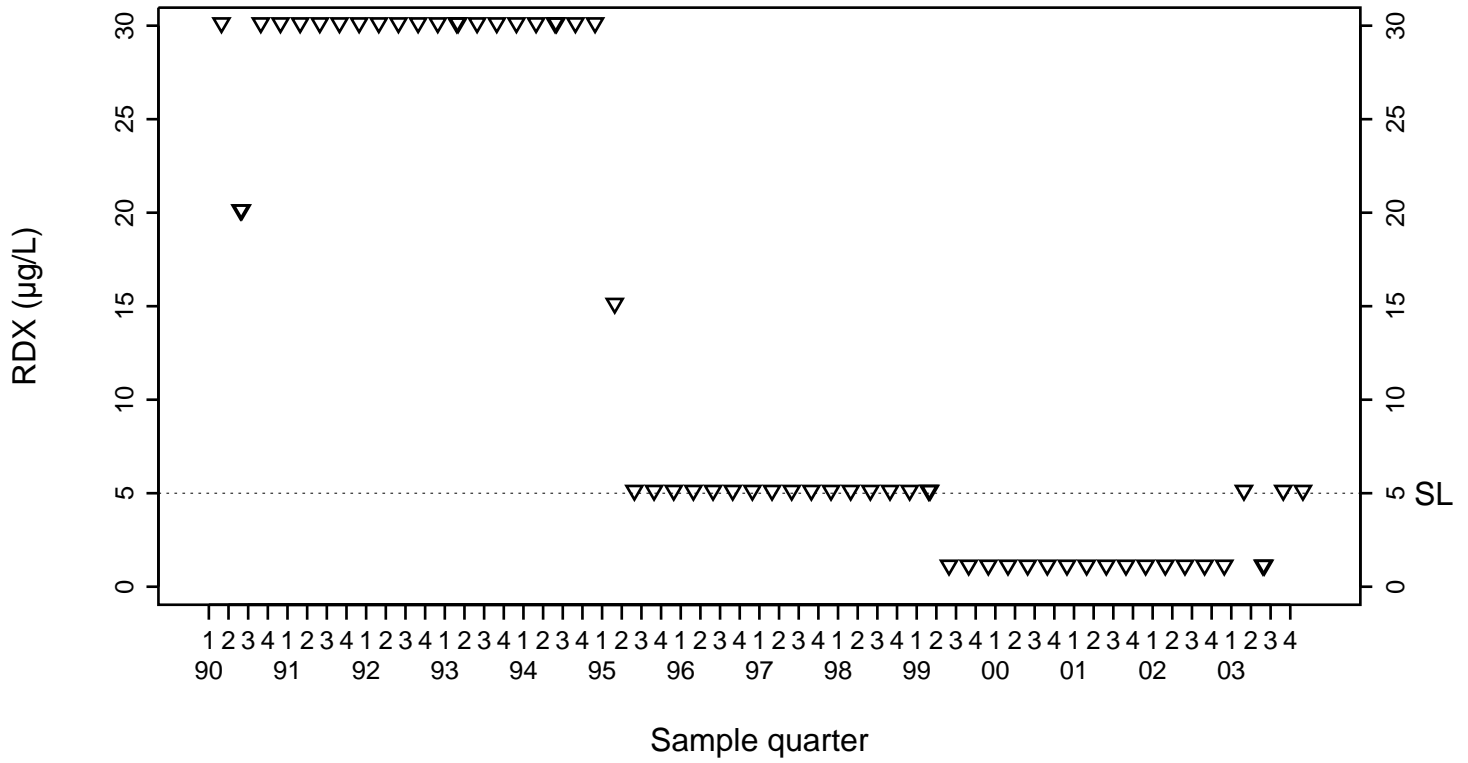


Pit 1 Area
RDX ($\mu\text{g/L}$)

SL=5

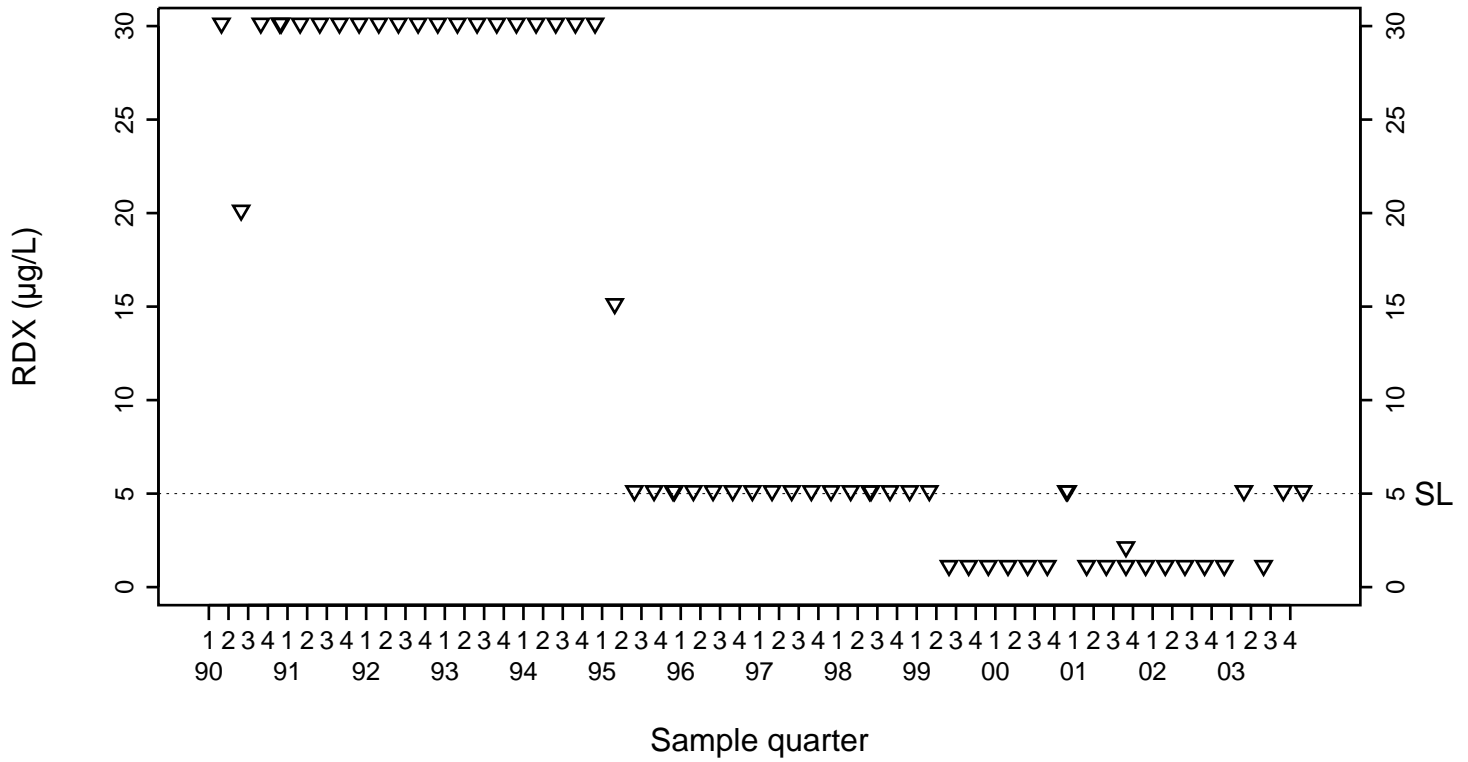
◆ Above RL
▽ Below RL

Compliance Monitoring Point K1-02B



SL=5

Compliance Monitoring Point K1-03

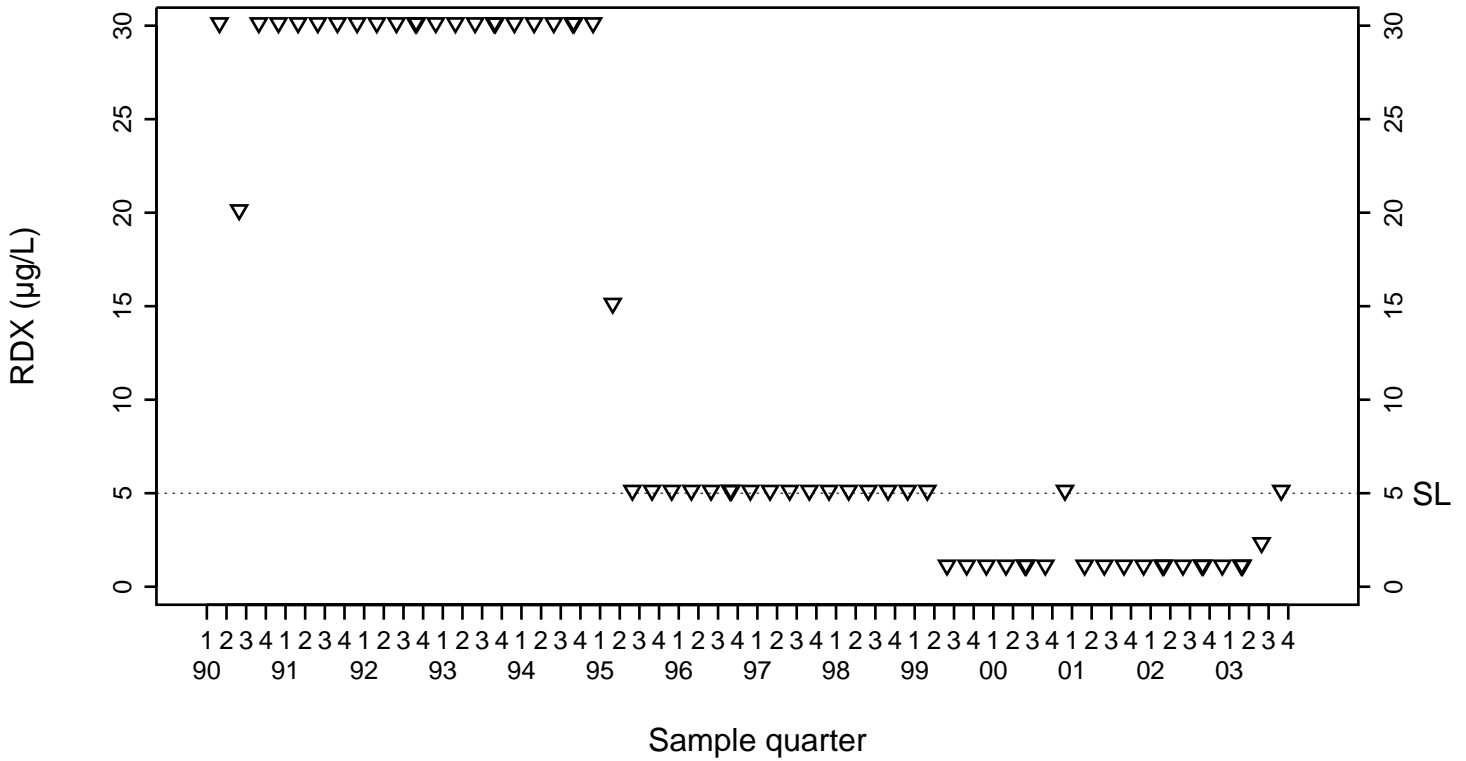


Pit 1 Area RDX ($\mu\text{g/L}$)

SL=5

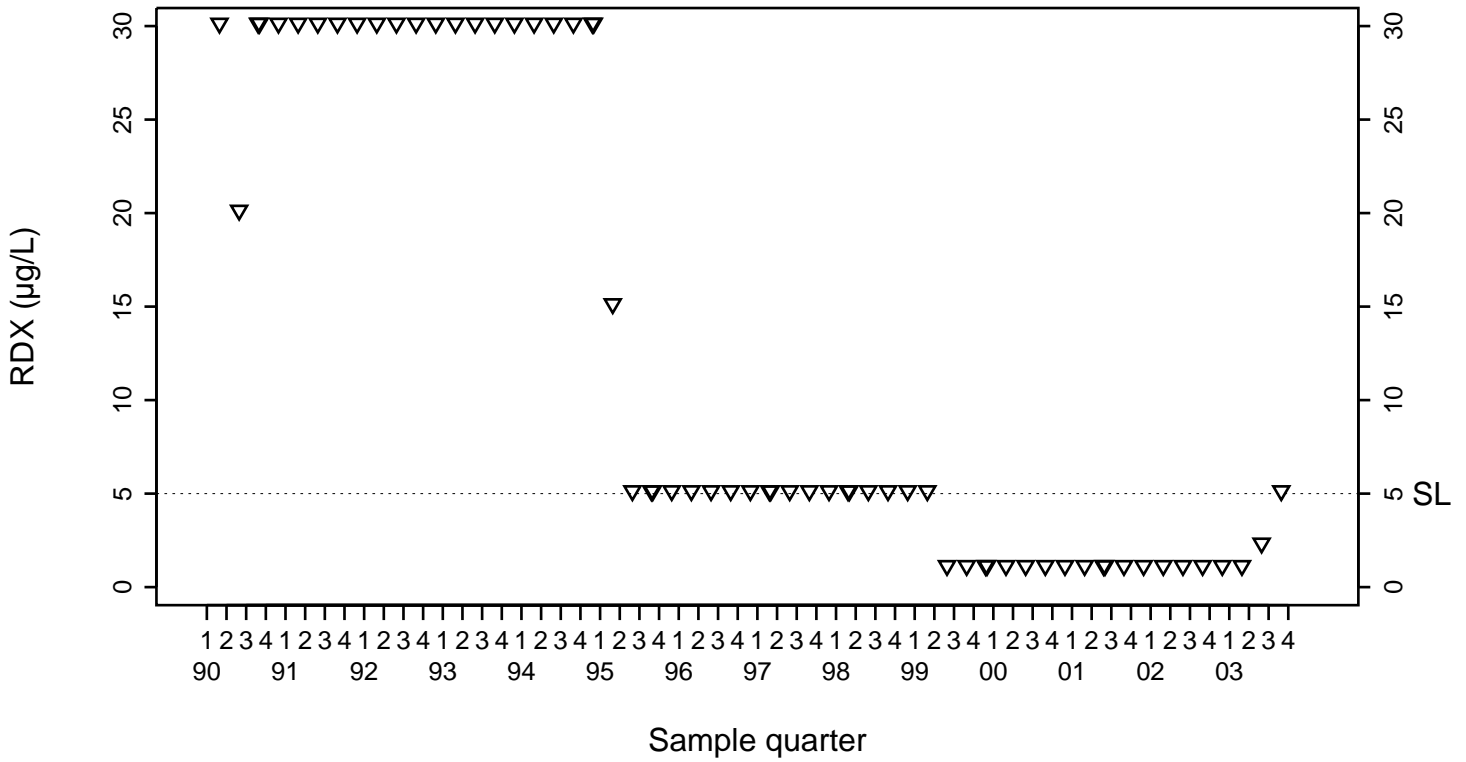
◆ Above RL
▽ Below RL

Compliance Monitoring Point K1-04



SL=5

Compliance Monitoring Point K1-05

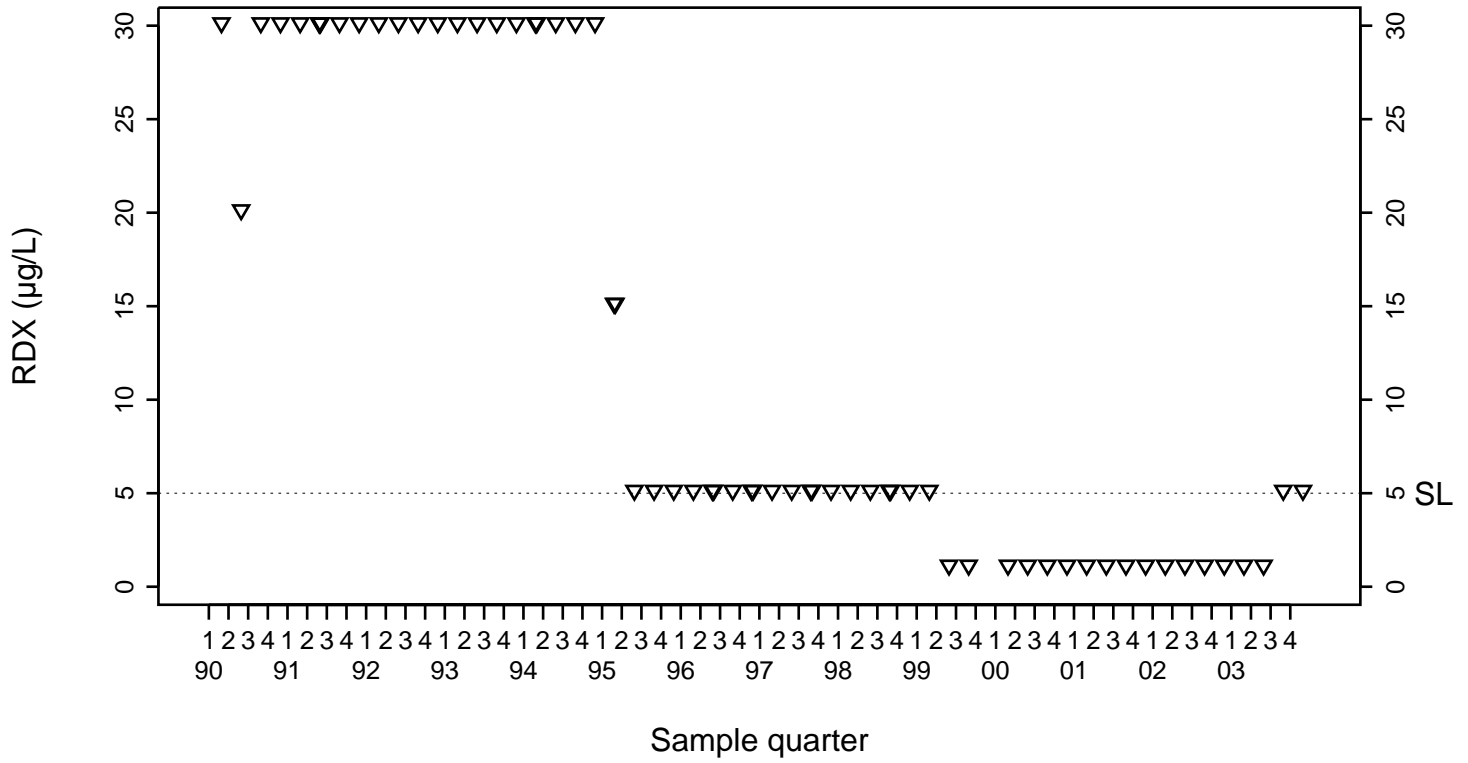


Pit 1 Area RDX ($\mu\text{g/L}$)

SL=5

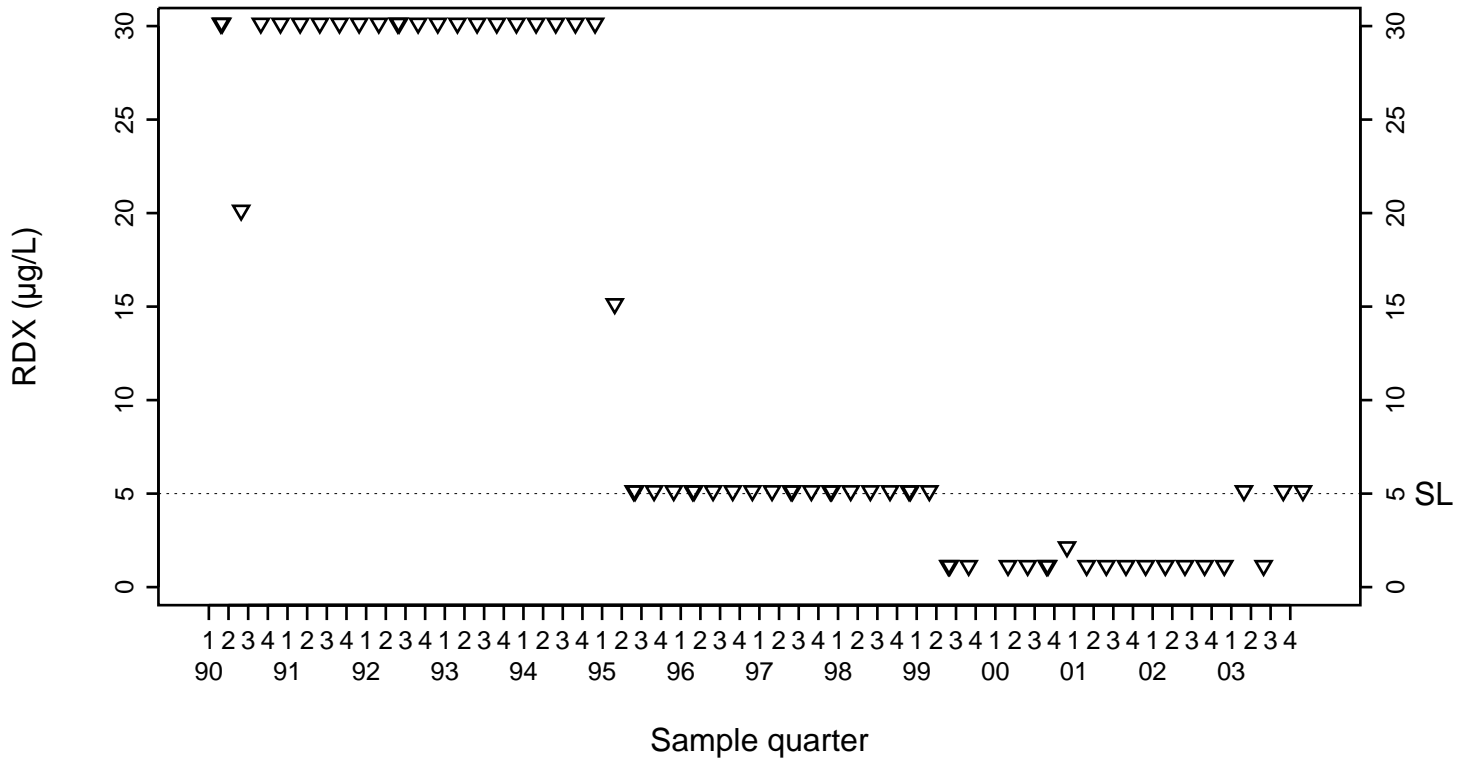
◆ Above RL
▽ Below RL

Compliance Monitoring Point K1-08



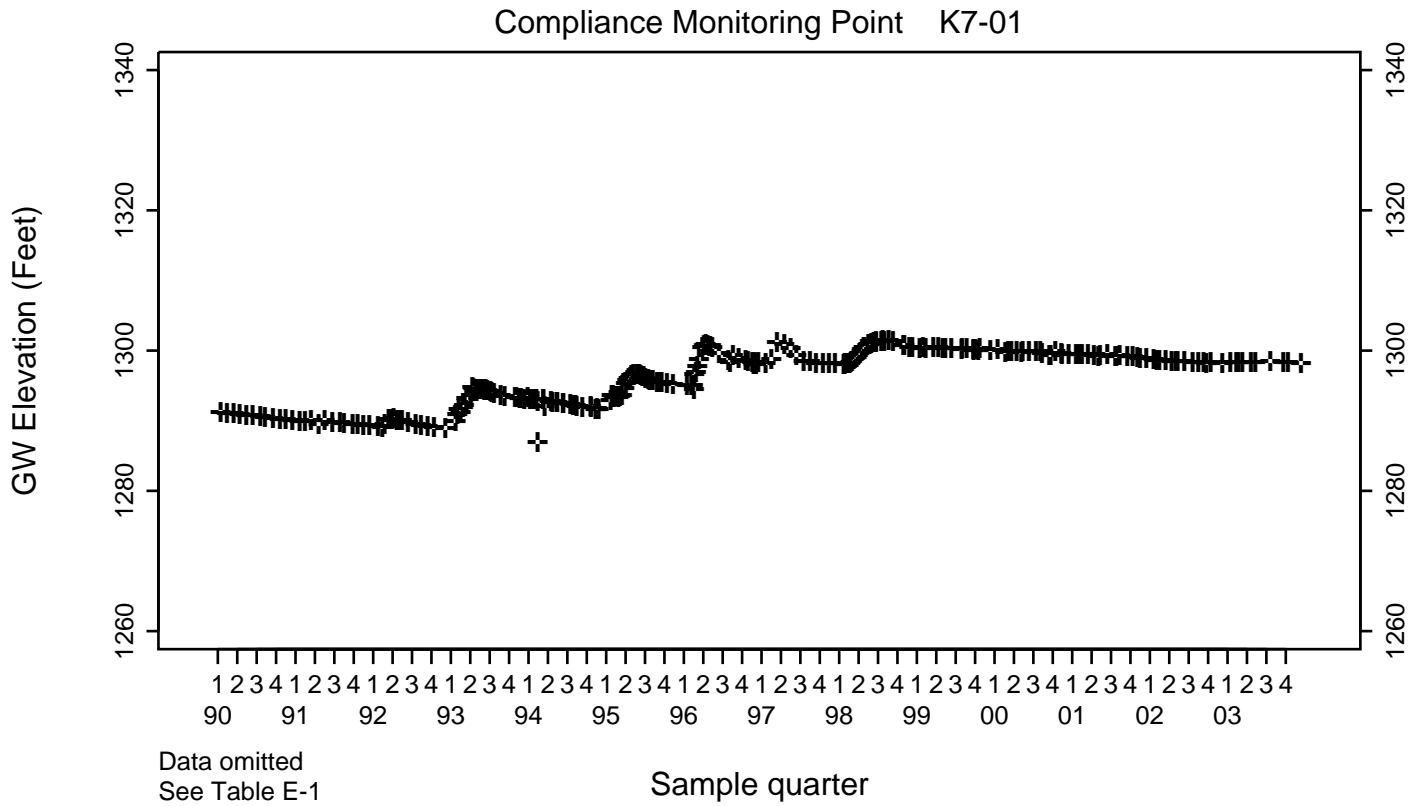
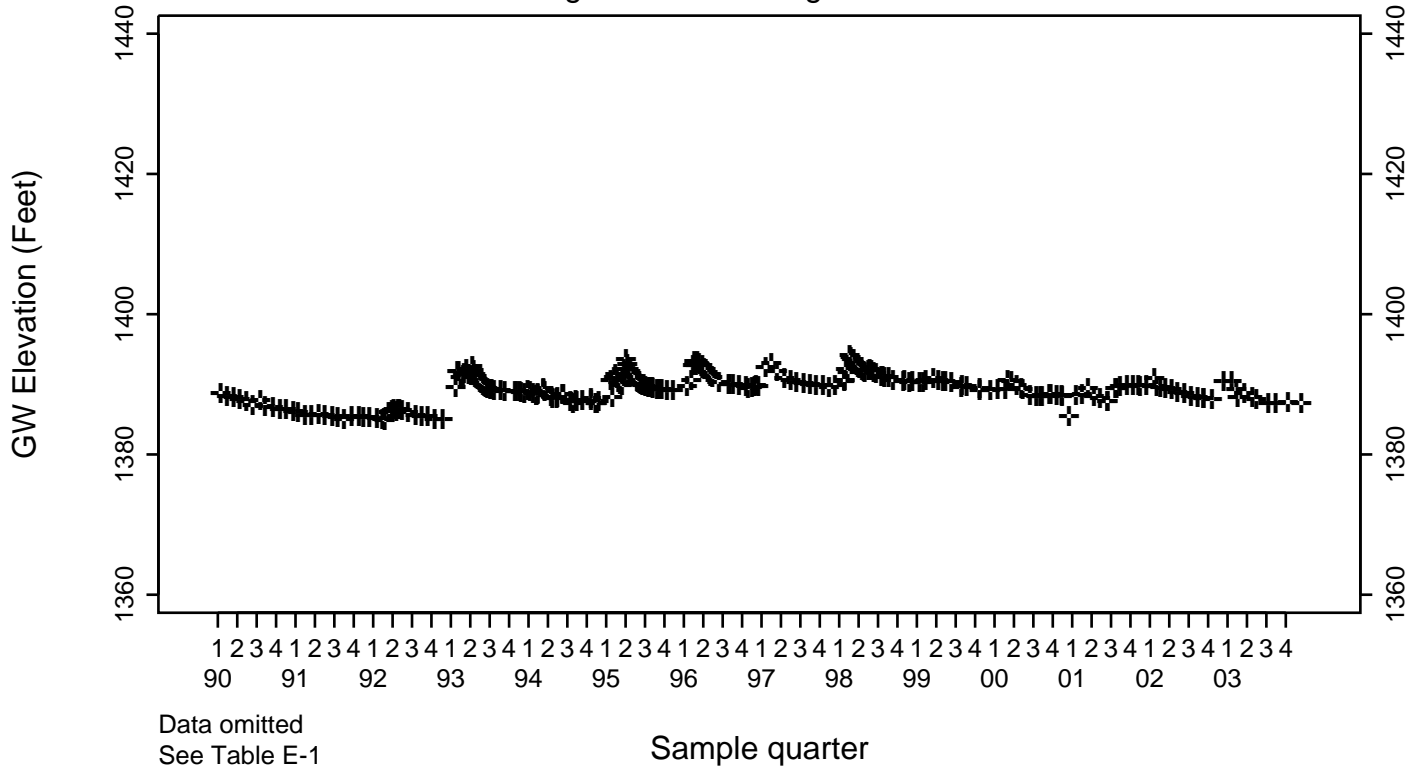
SL=5

Compliance Monitoring Point K1-09



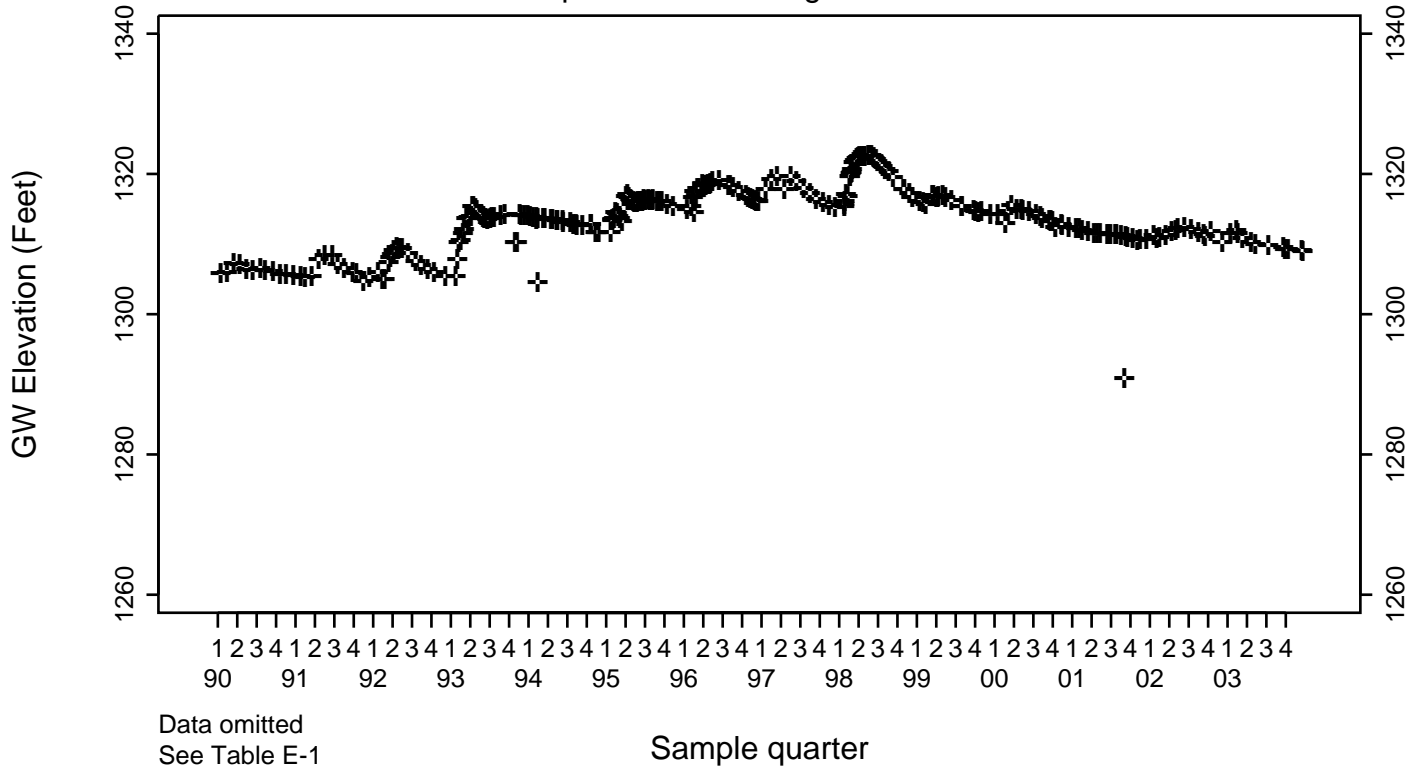
Pit 7 Complex GW Elevation (Feet)

Background Monitoring Point K7-06

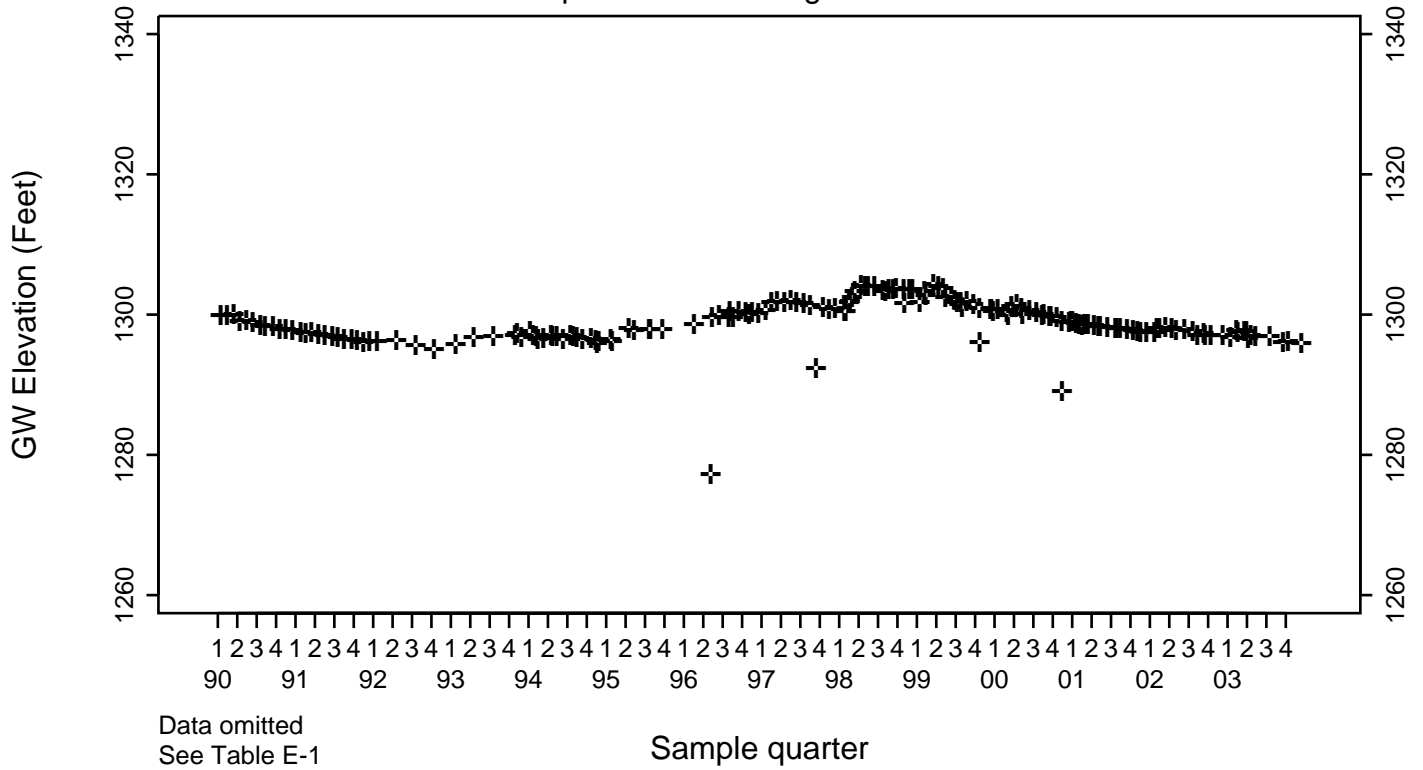


Pit 7 Complex GW Elevation (Feet)

Compliance Monitoring Point K7-03

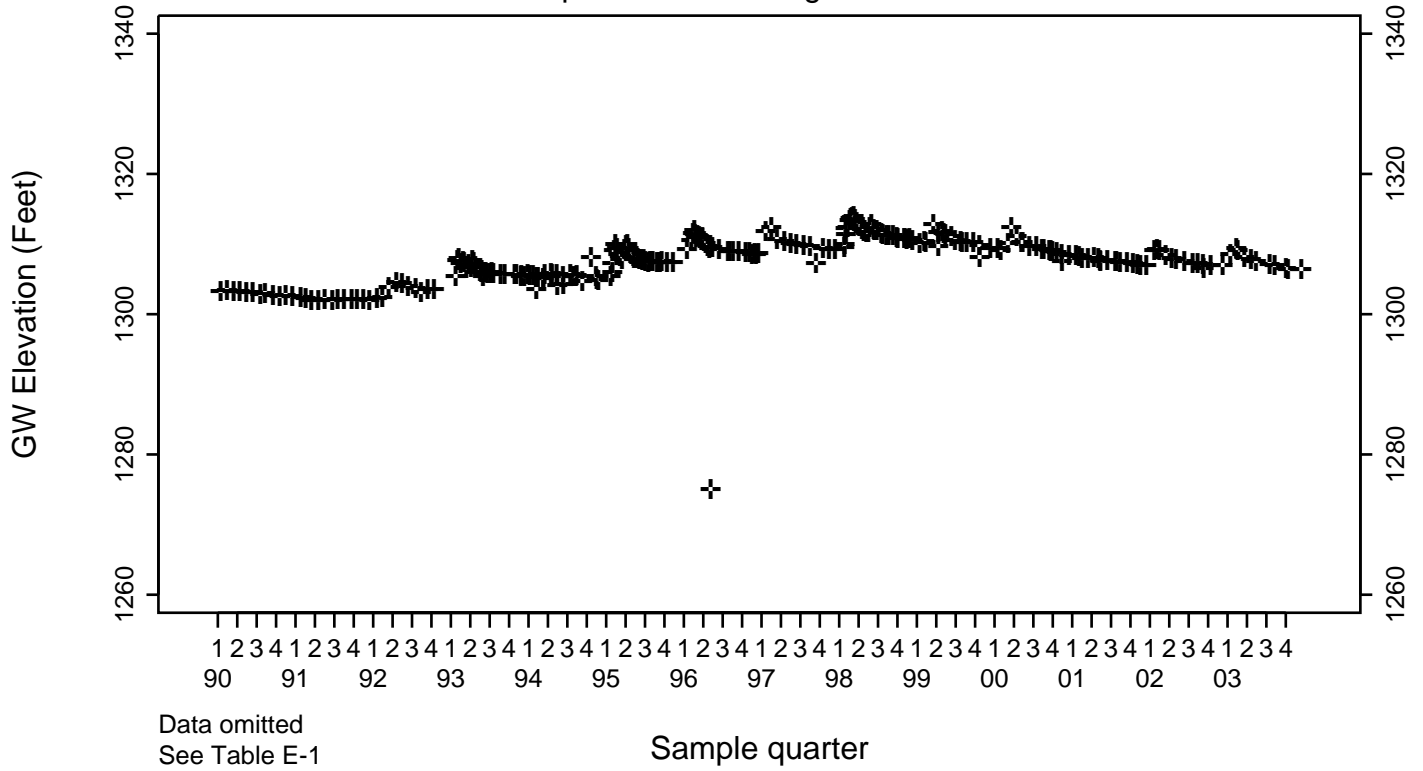


Compliance Monitoring Point K7-09

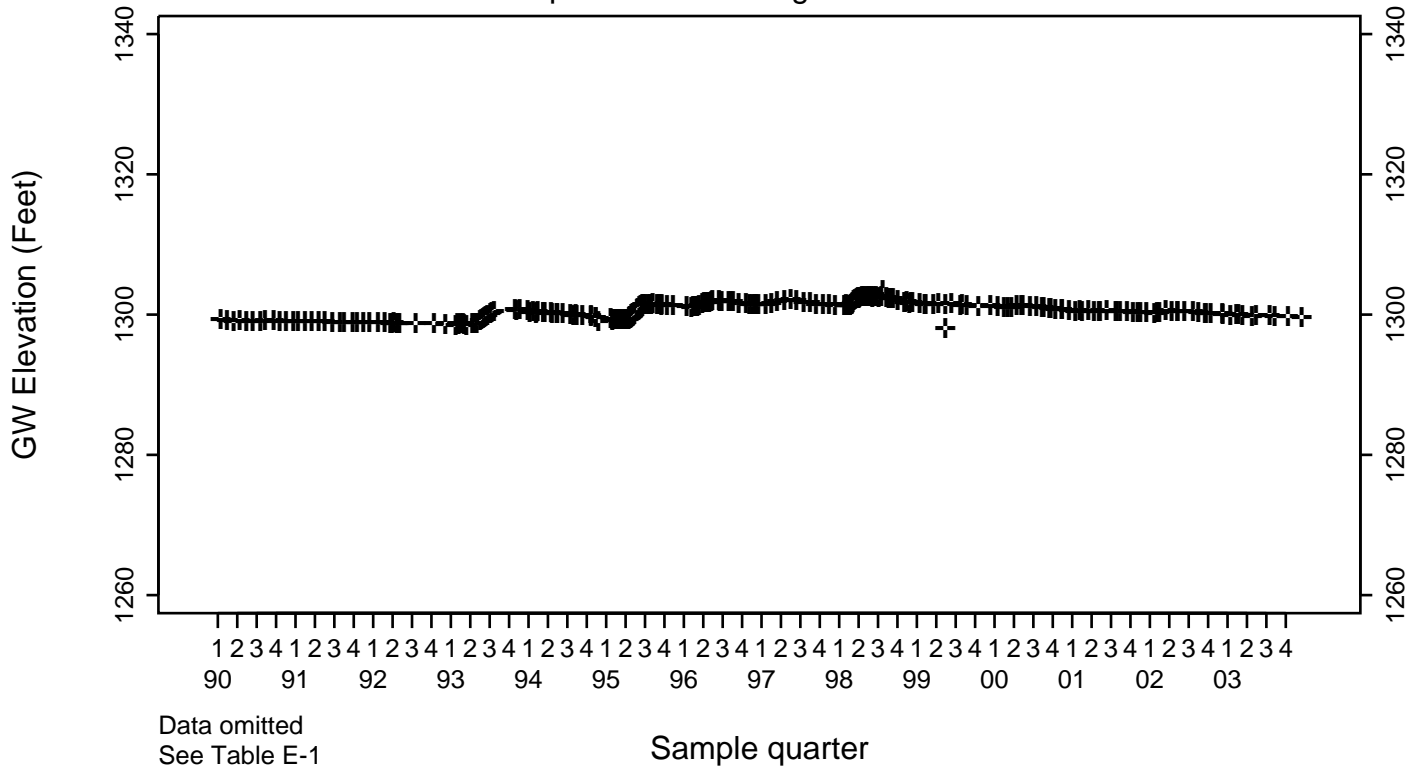


Pit 7 Complex GW Elevation (Feet)

Compliance Monitoring Point K7-10

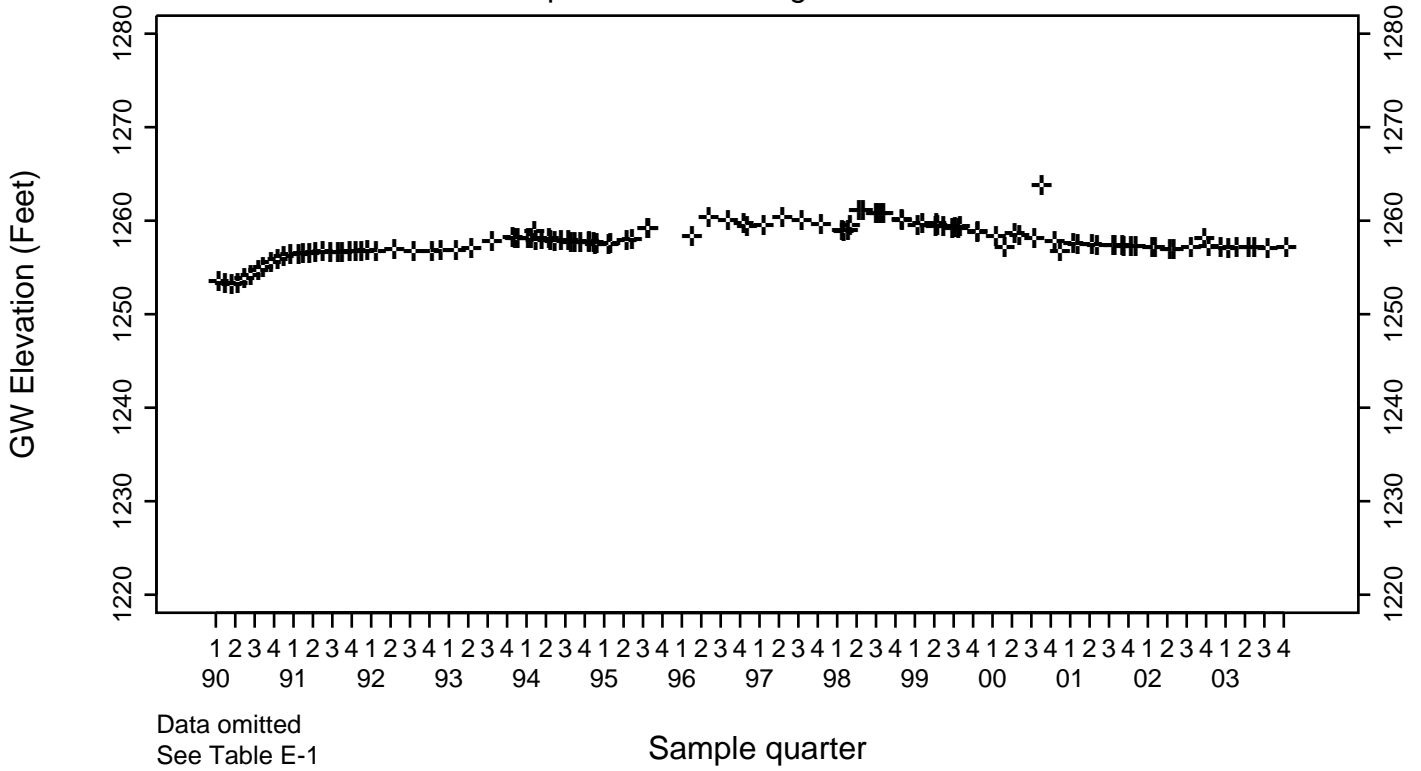


Compliance Monitoring Point NC7-25

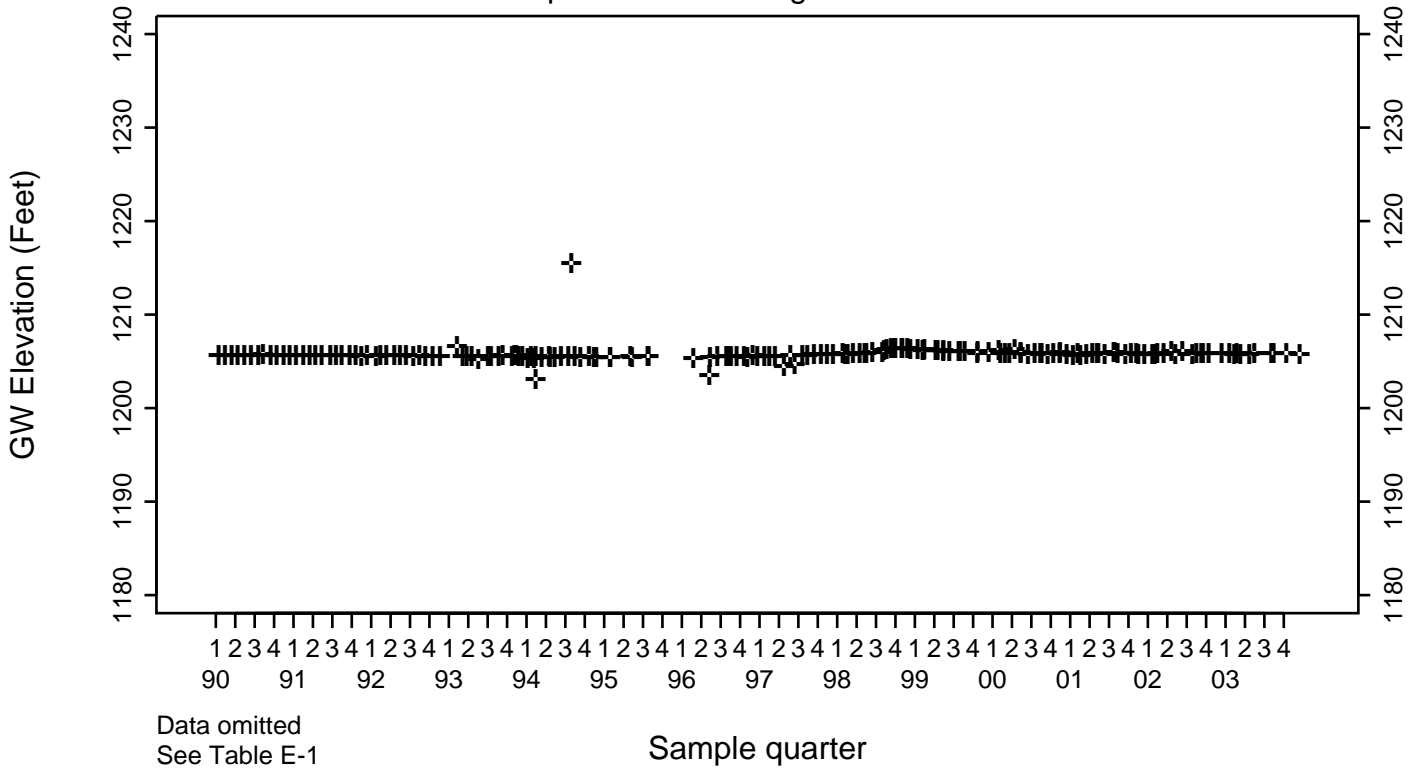


Pit 7 Complex GW Elevation (Feet)

Compliance Monitoring Point NC7-26

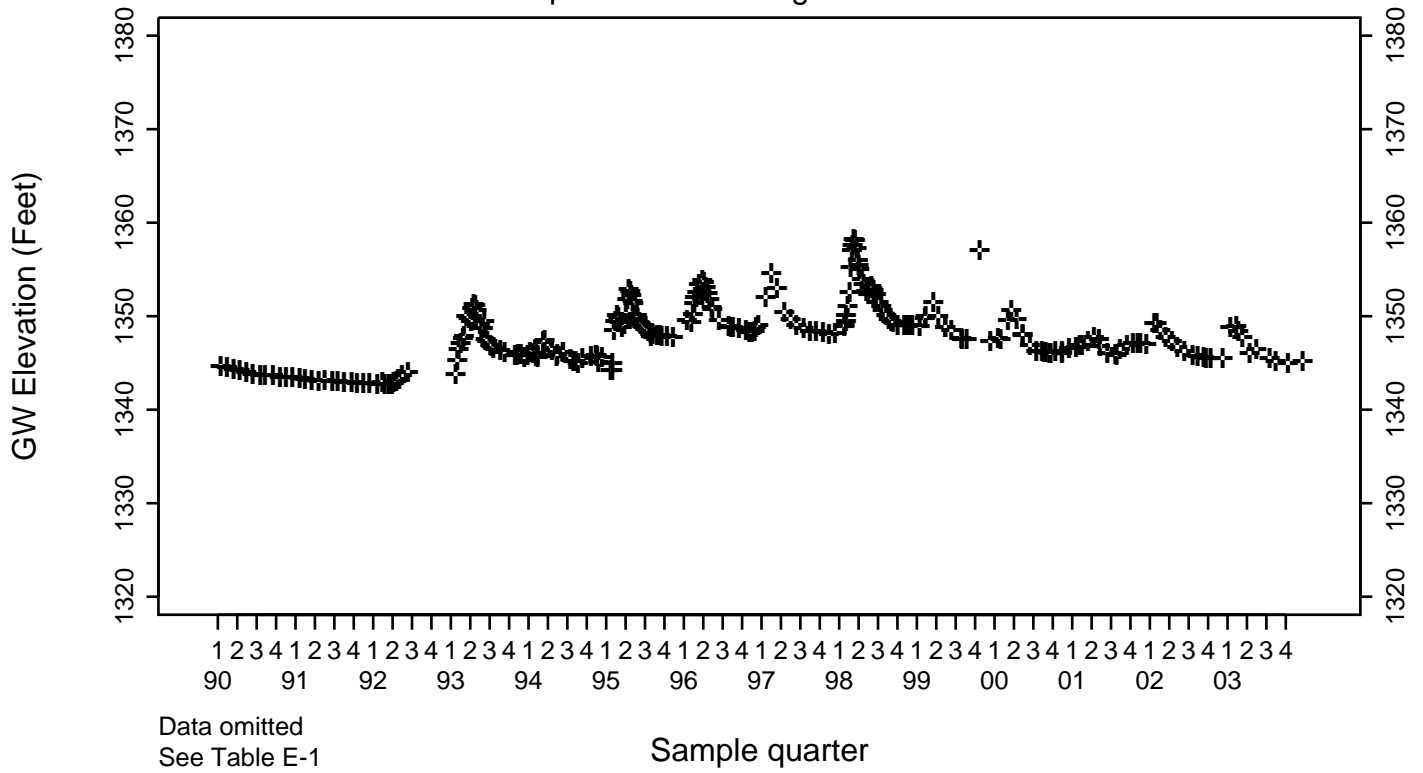


Compliance Monitoring Point NC7-47



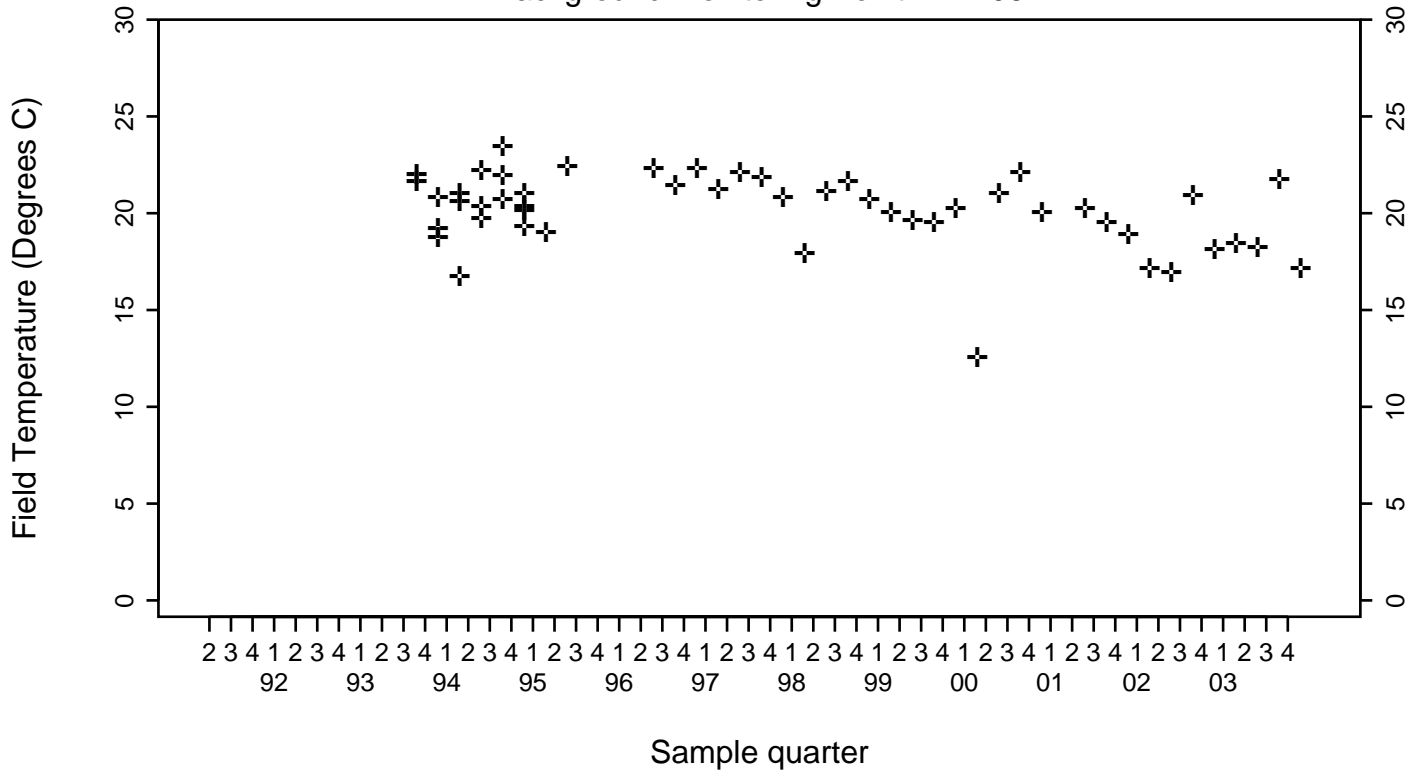
Pit 7 Complex GW Elevation (Feet)

Compliance Monitoring Point NC7-48

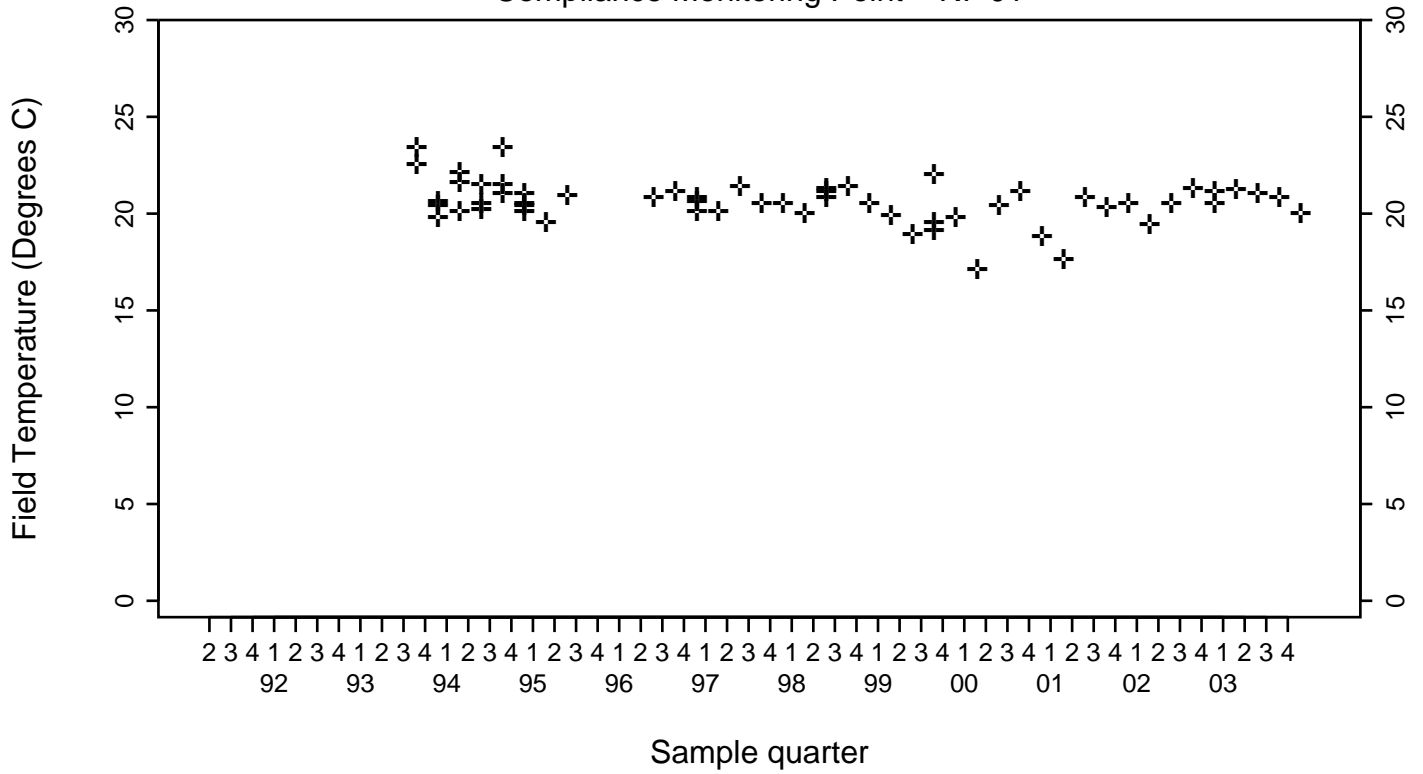


Pit 7 Complex Field Temperature (Degrees C)

Background Monitoring Point K7-06

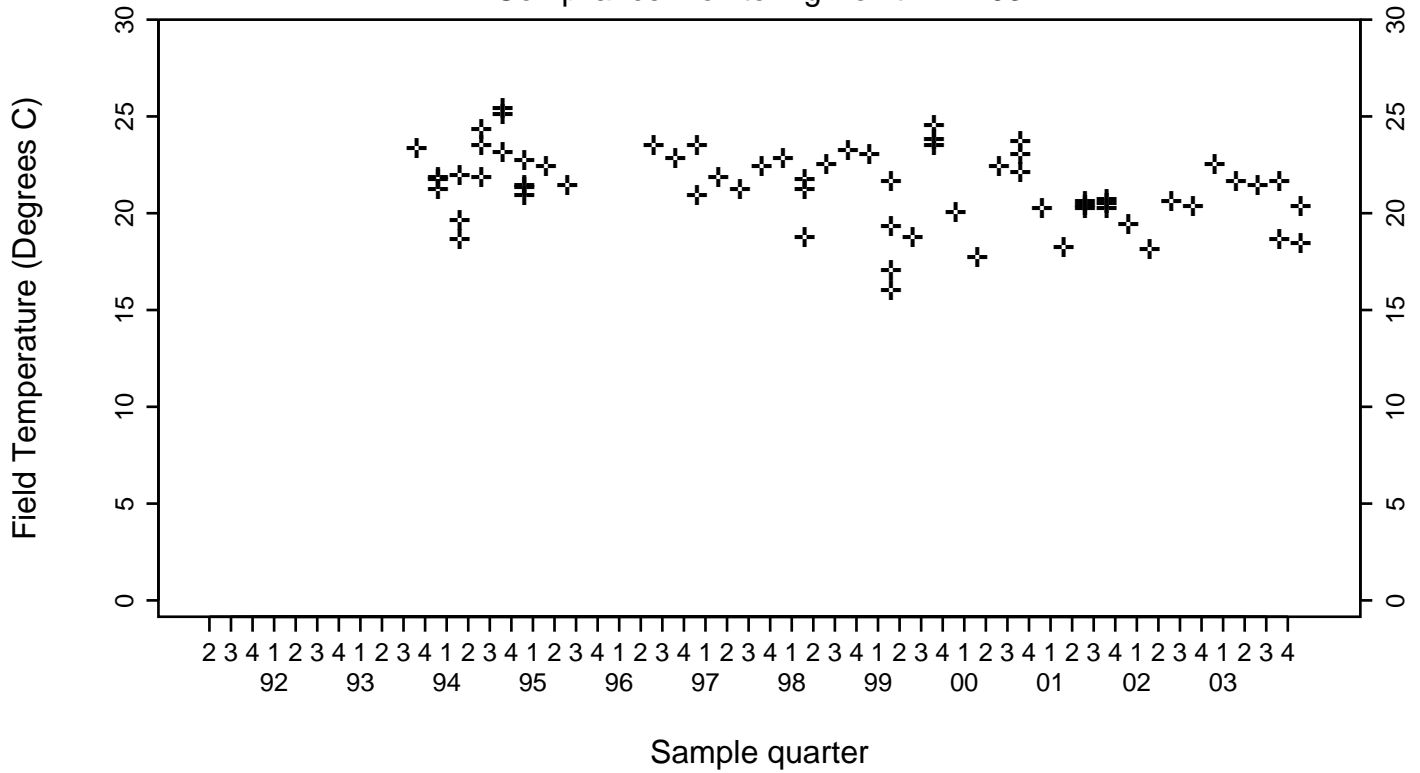


Compliance Monitoring Point K7-01

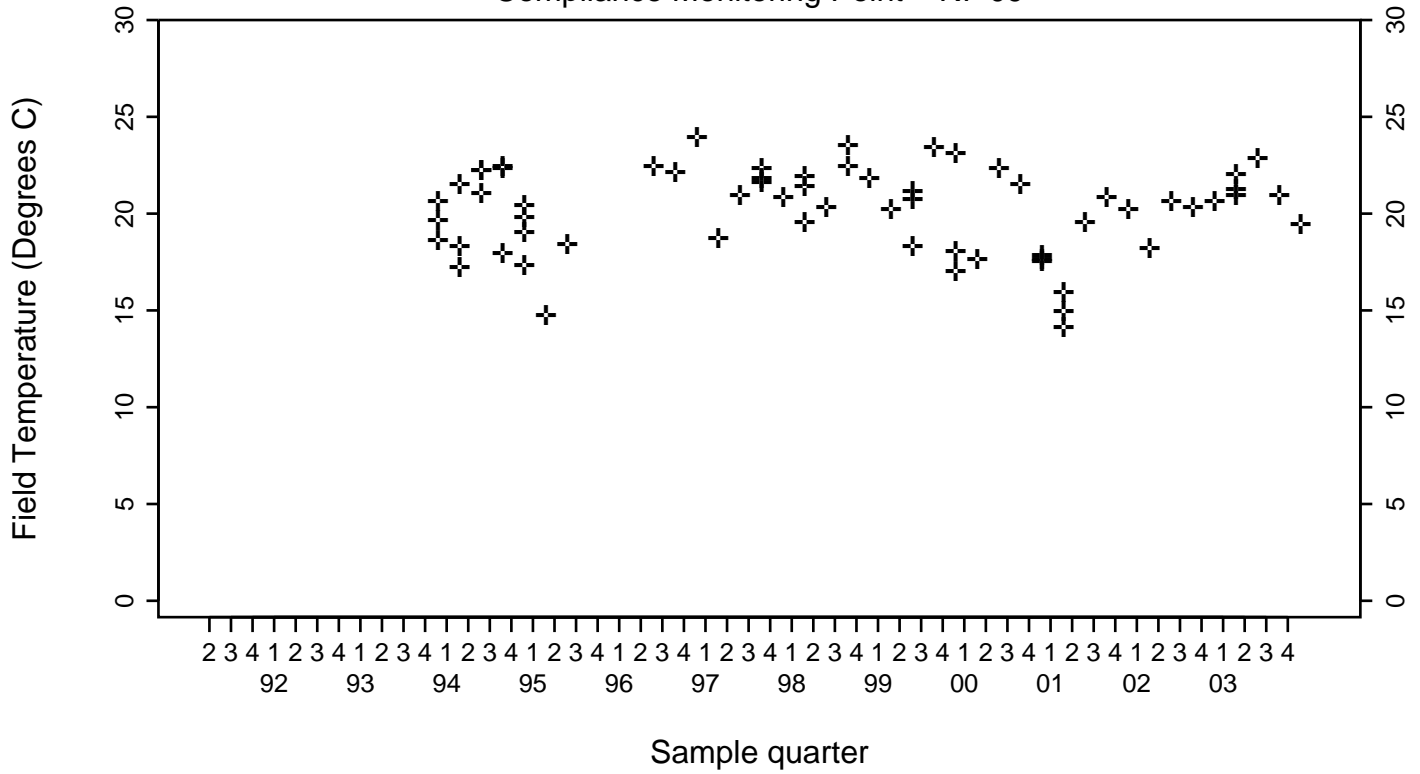


Pit 7 Complex Field Temperature (Degrees C)

Compliance Monitoring Point K7-03

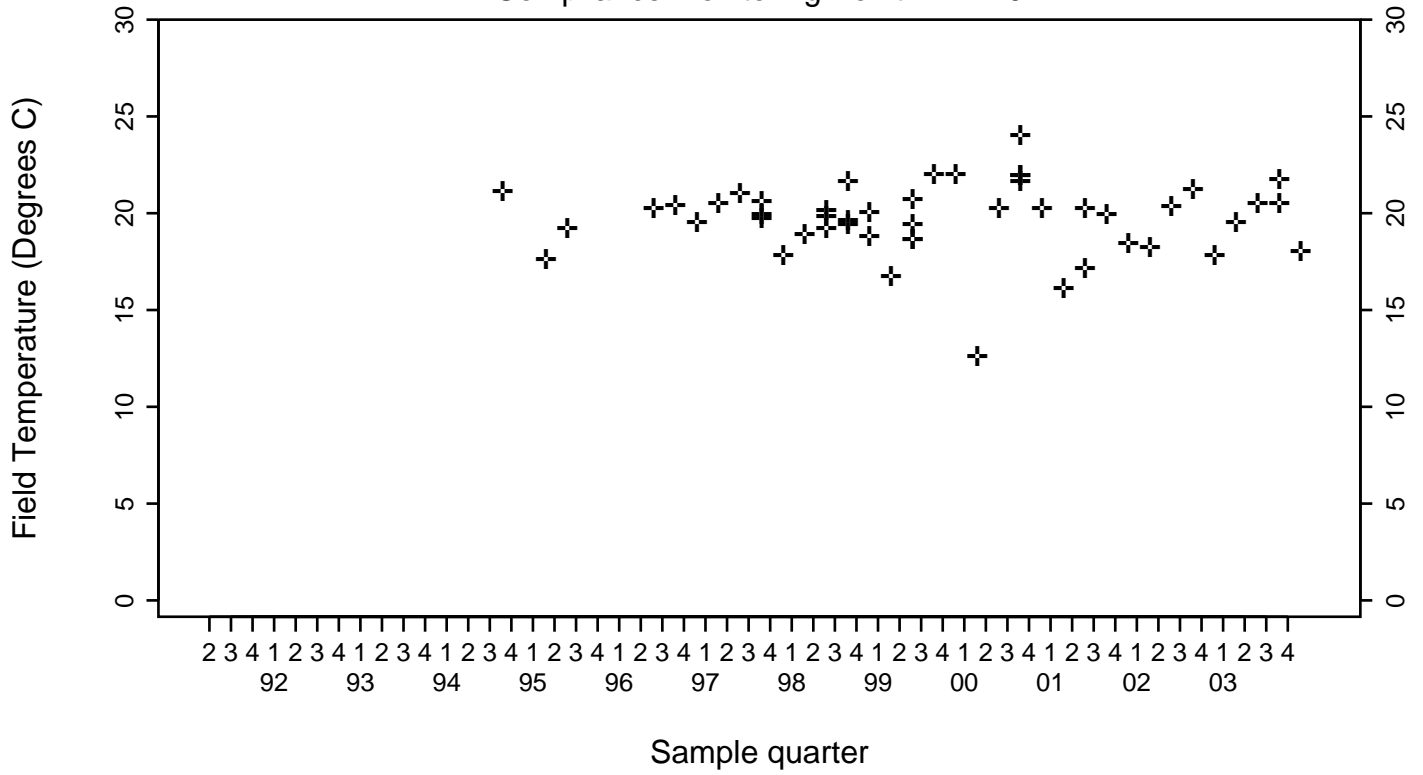


Compliance Monitoring Point K7-09

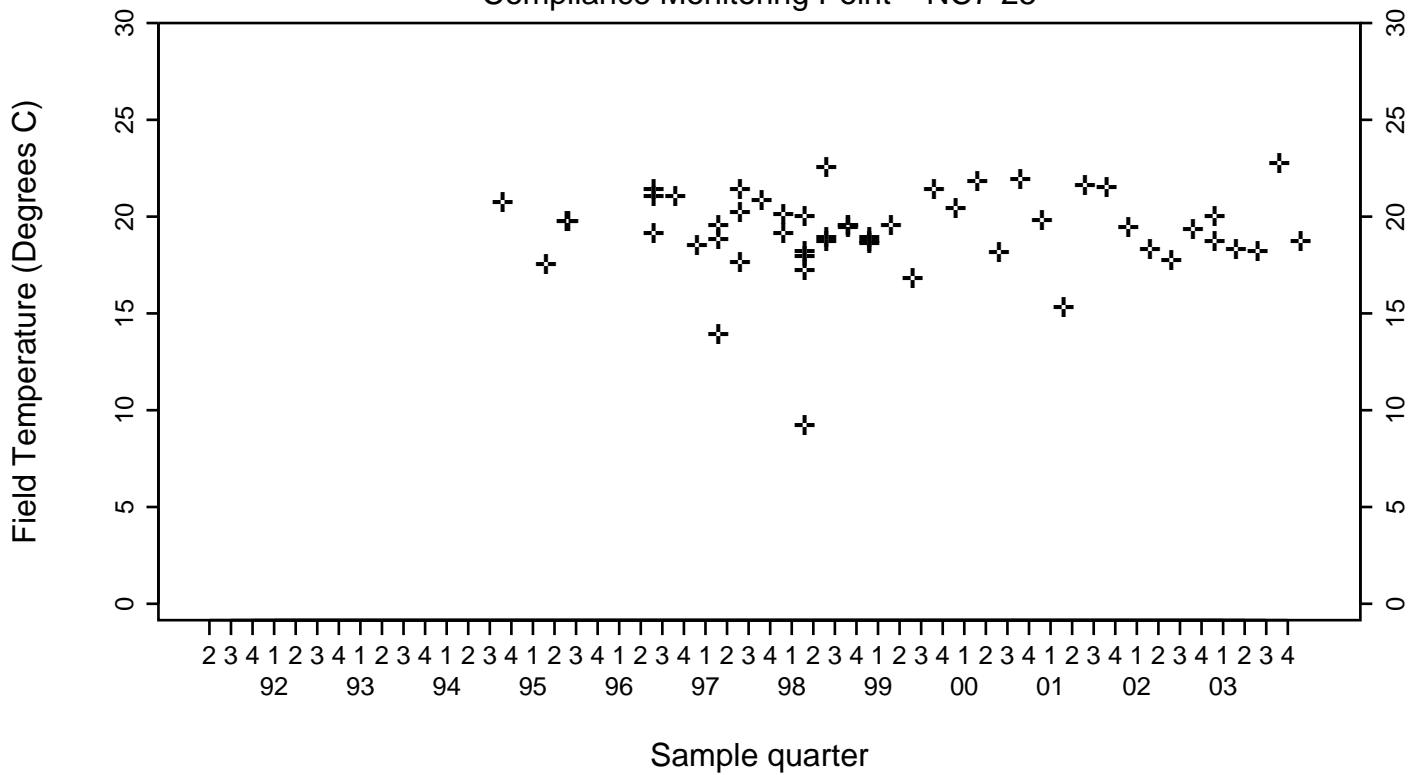


Pit 7 Complex Field Temperature (Degrees C)

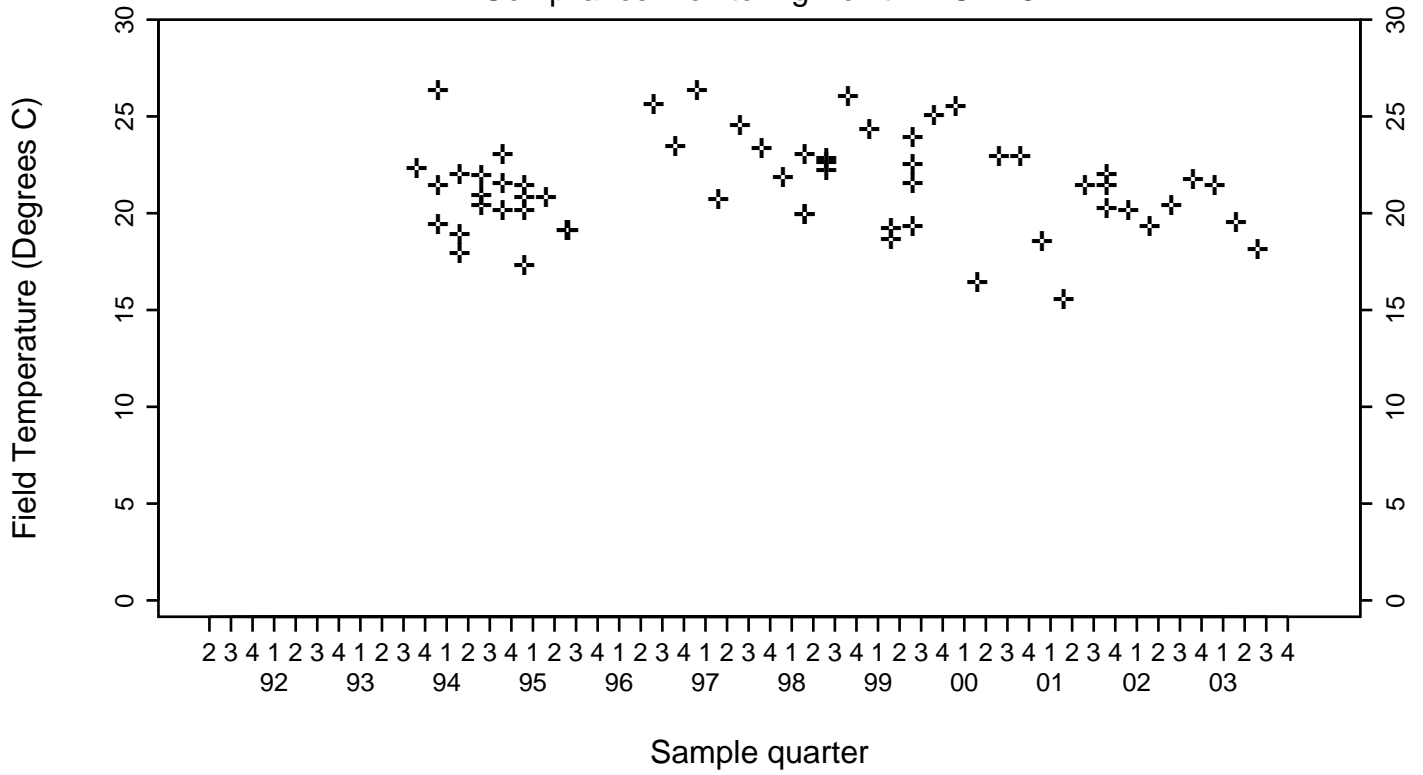
Compliance Monitoring Point K7-10



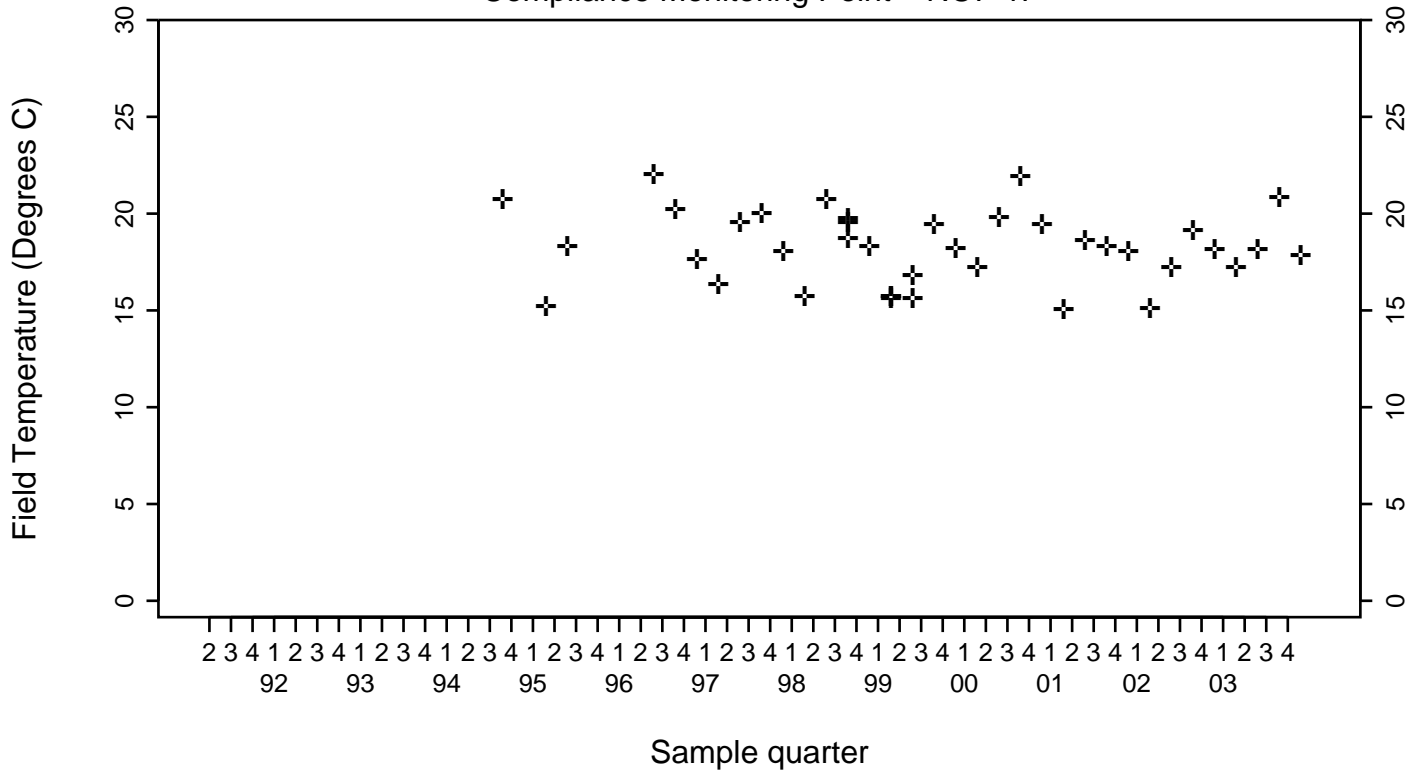
Compliance Monitoring Point NC7-25



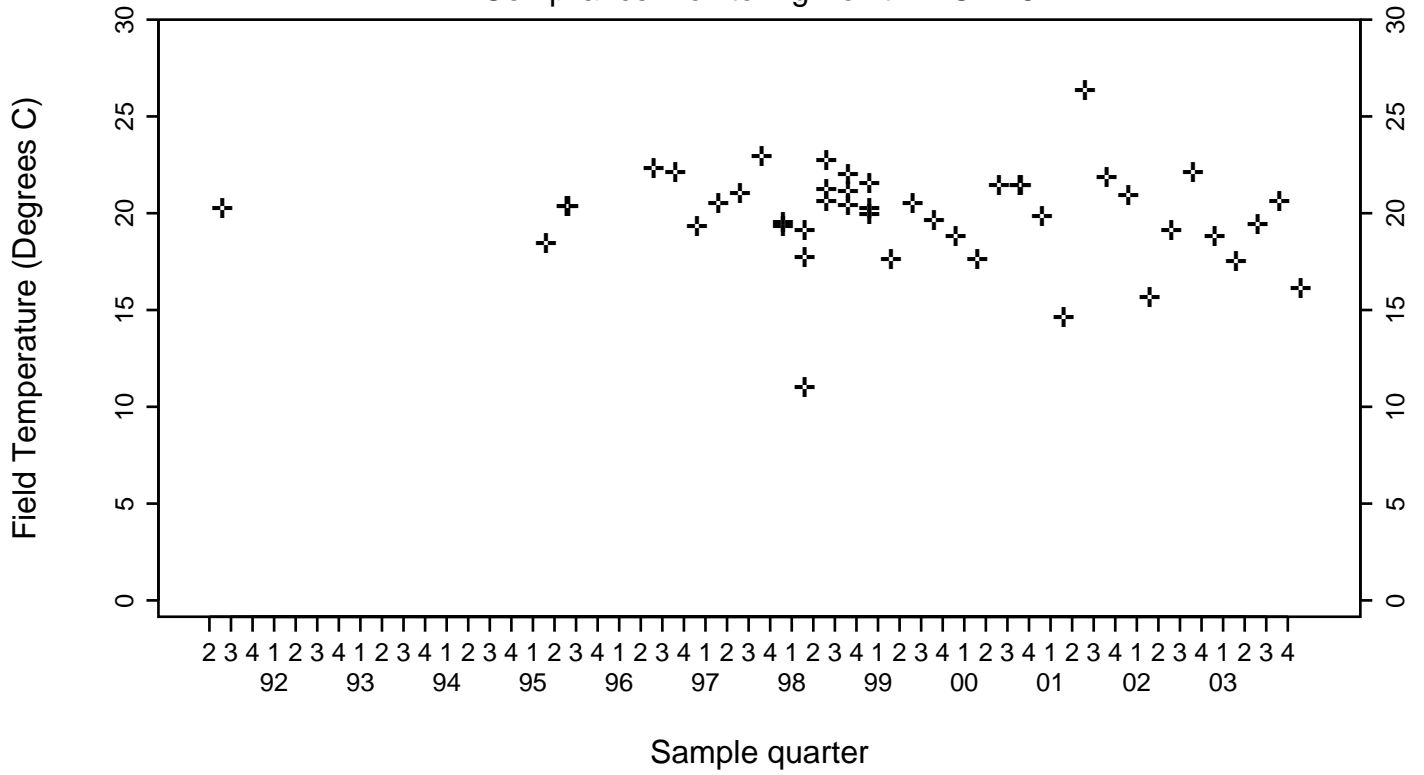
Pit 7 Complex Field Temperature (Degrees C) Compliance Monitoring Point NC7-26



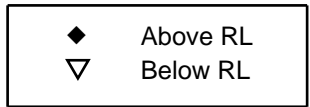
Compliance Monitoring Point NC7-47



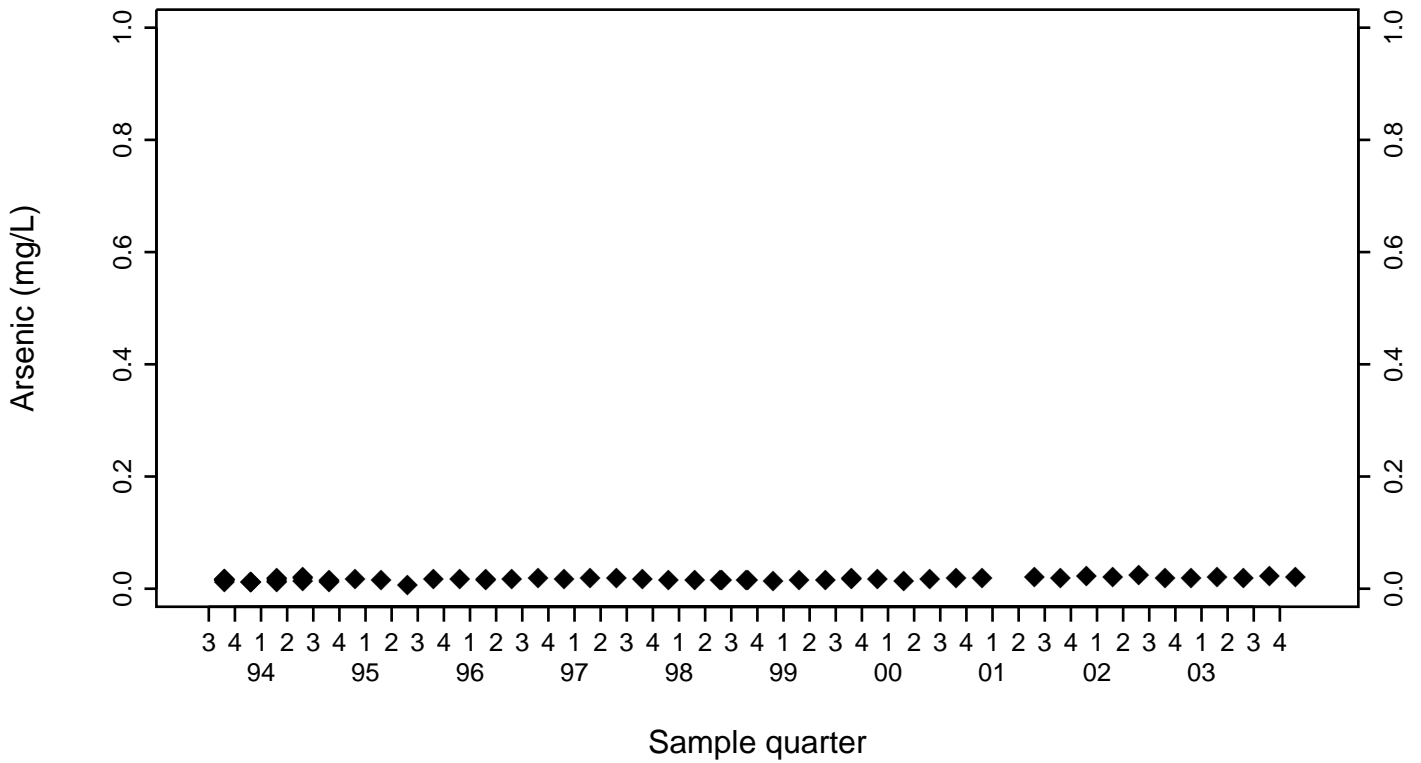
Pit 7 Complex
Field Temperature (Degrees C)
Compliance Monitoring Point NC7-48



Pit 7 Complex Arsenic (mg/L)

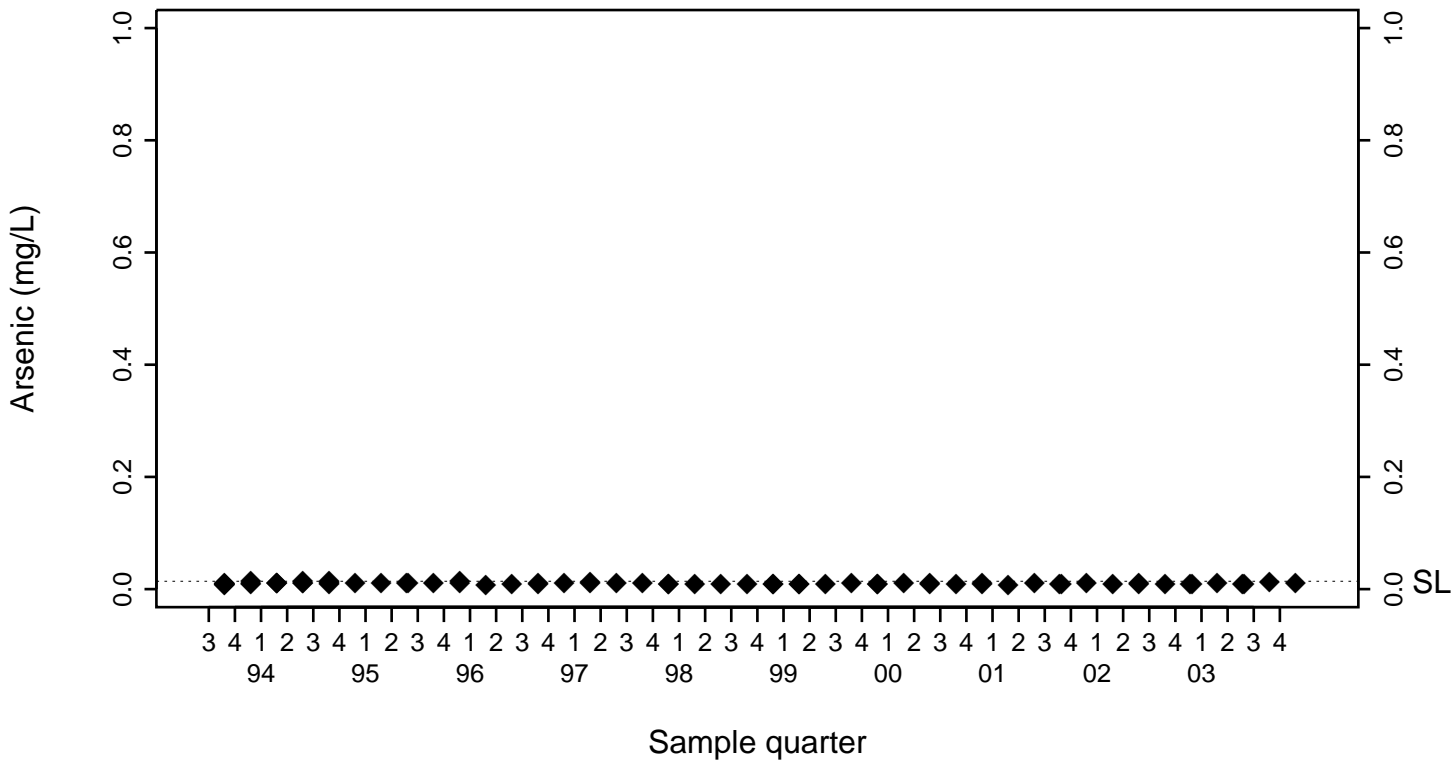


Background Monitoring Point K7-06



SL=0.014

Compliance Monitoring Point K7-01

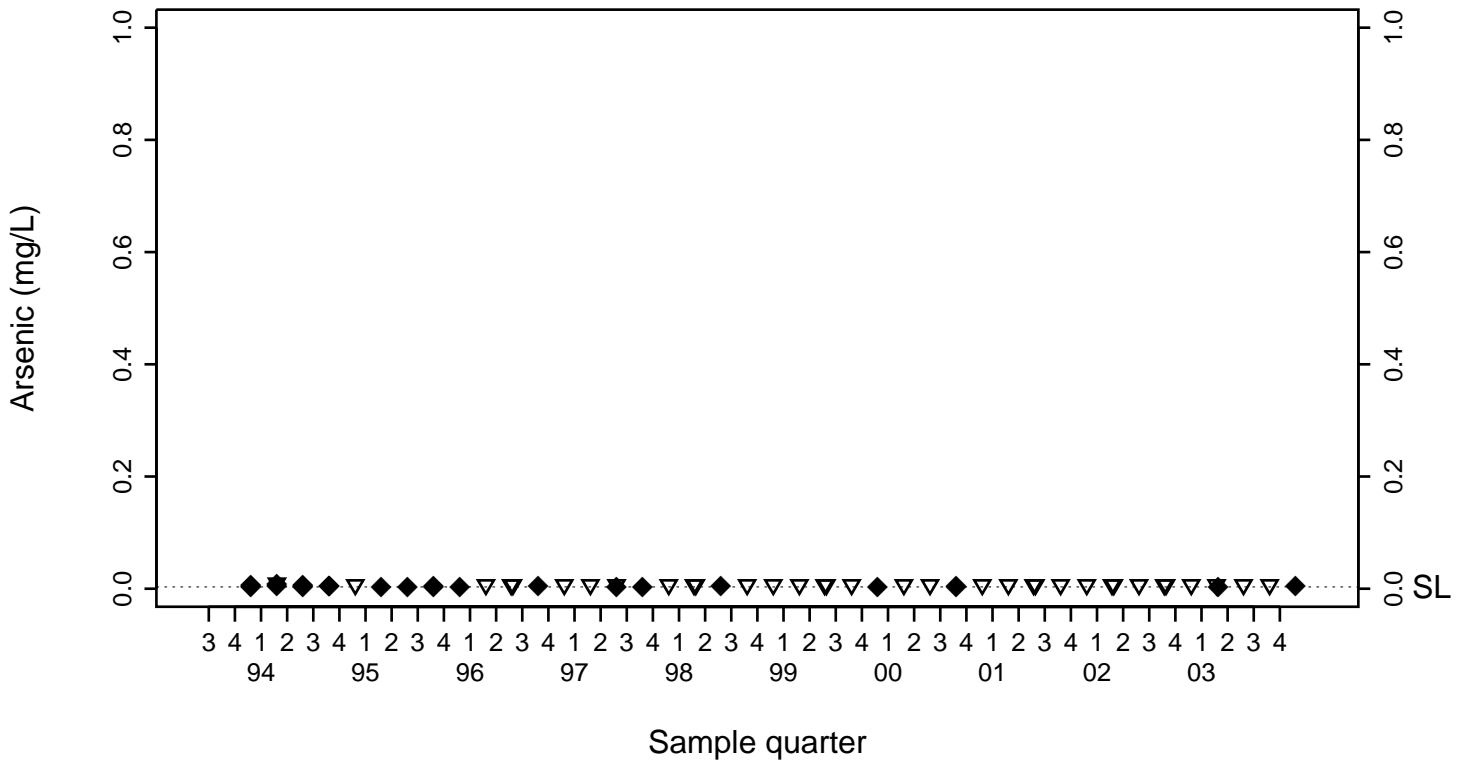


Pit 7 Complex Arsenic (mg/L)

SL=0.0032

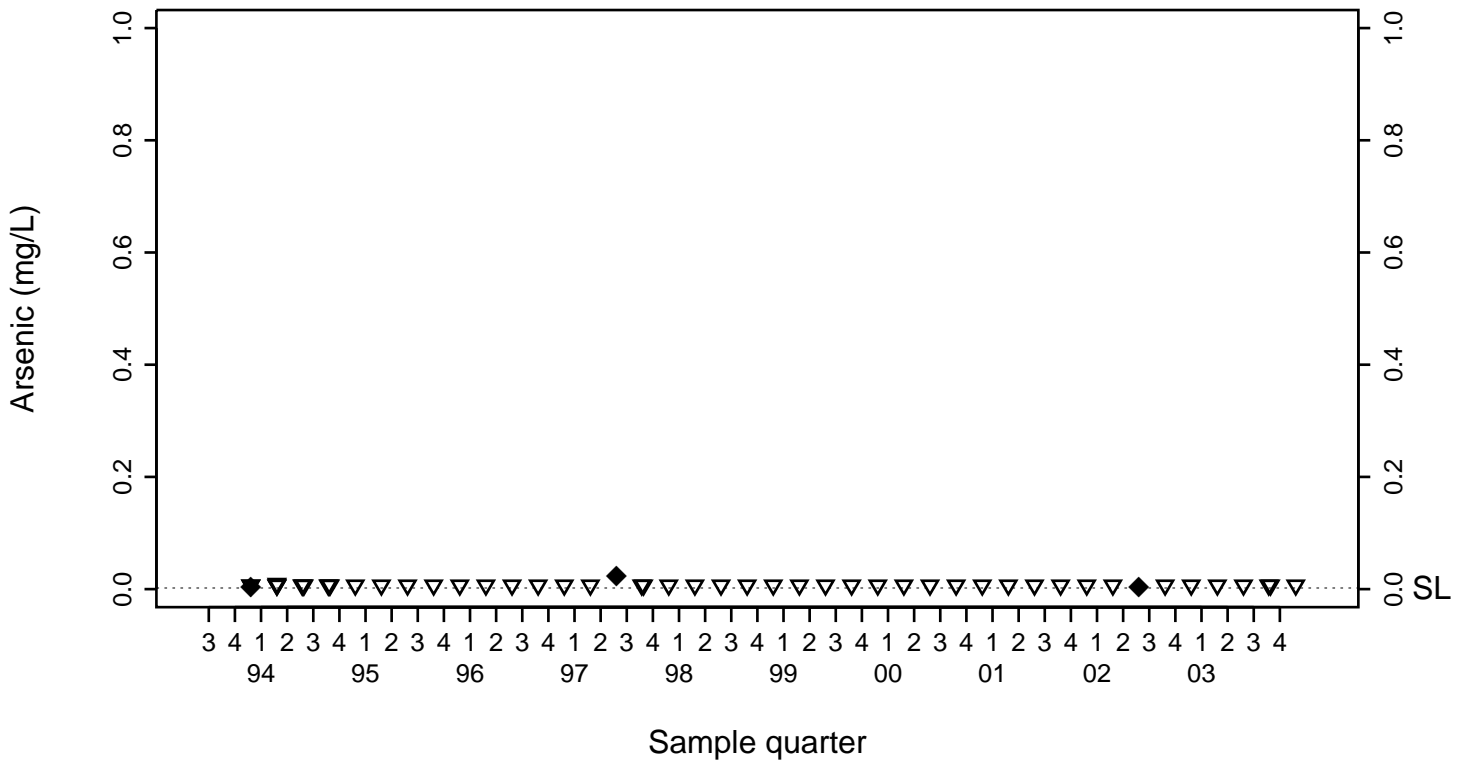
◆ Above RL
▽ Below RL

Compliance Monitoring Point K7-03



SL=0.002

Compliance Monitoring Point K7-09

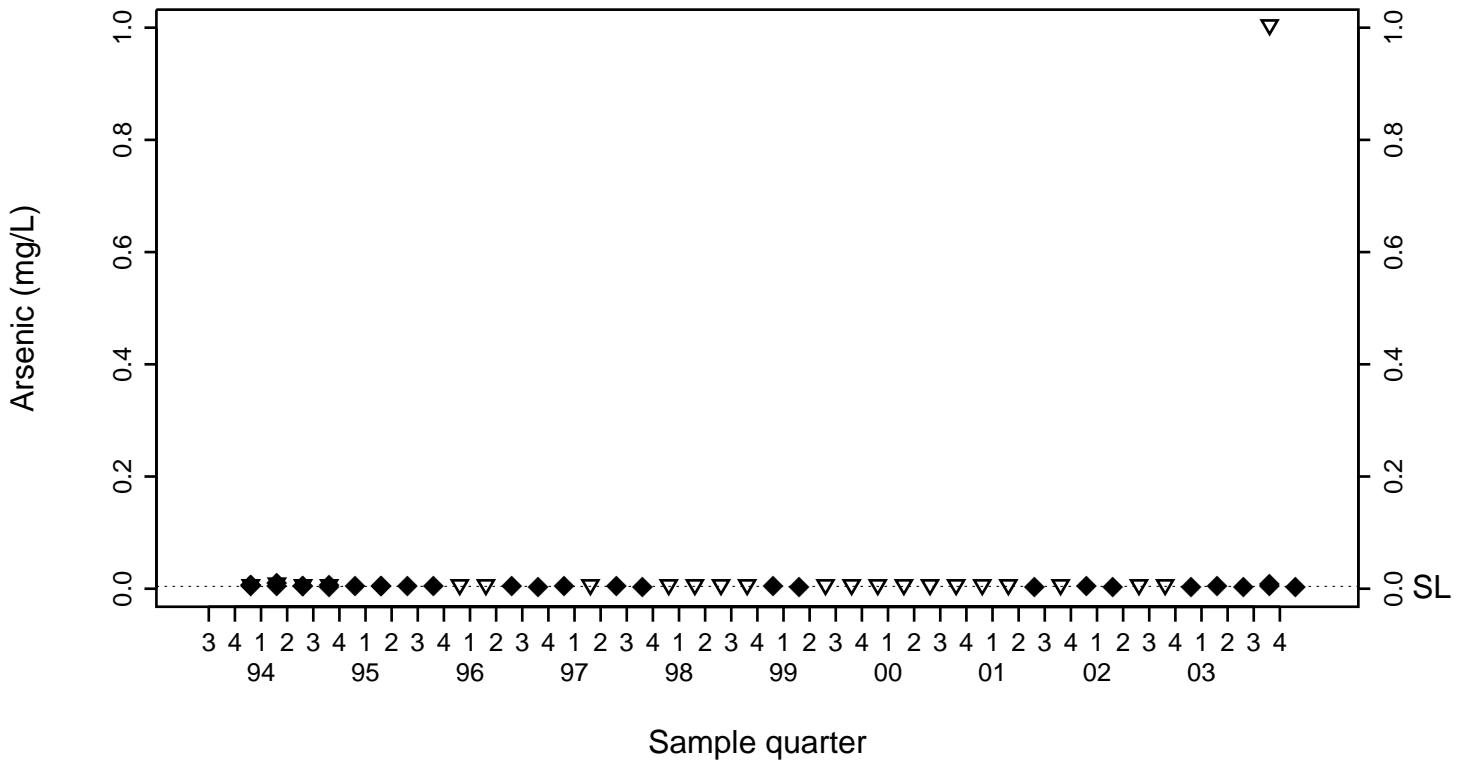


Pit 7 Complex Arsenic (mg/L)

SL=0.0042

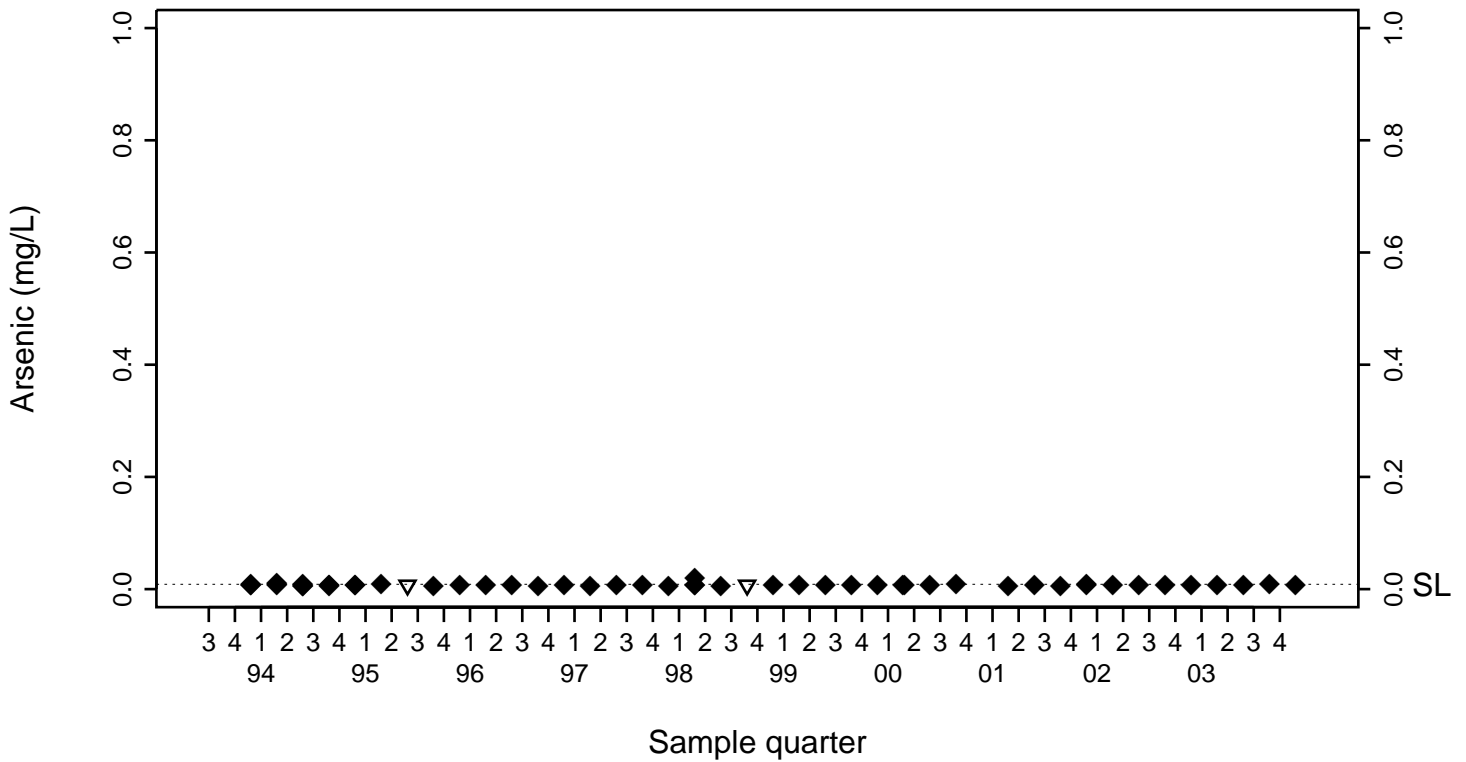
◆ Above RL
▽ Below RL

Compliance Monitoring Point K7-10



SL=0.0086

Compliance Monitoring Point NC7-25

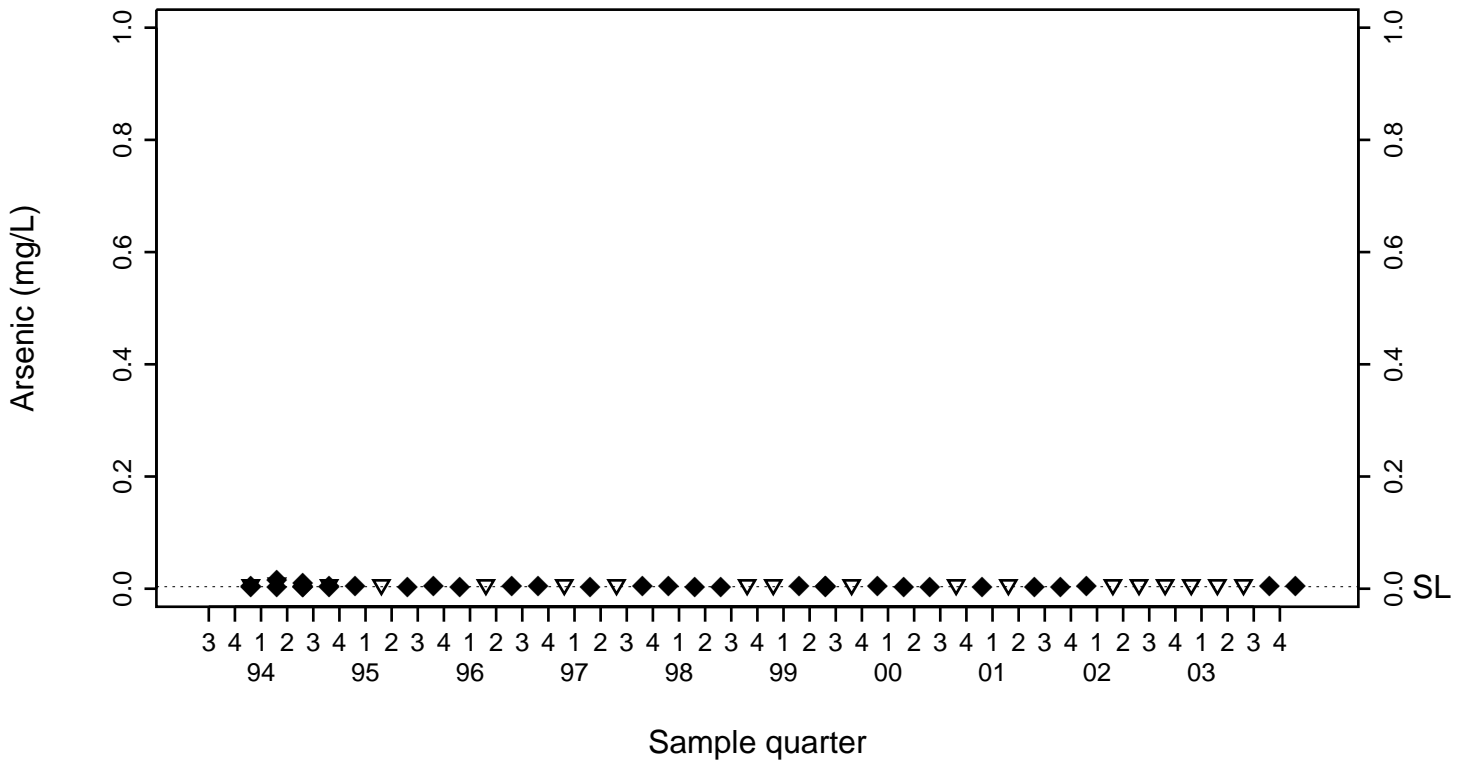


Pit 7 Complex Arsenic (mg/L)

SL=0.0036

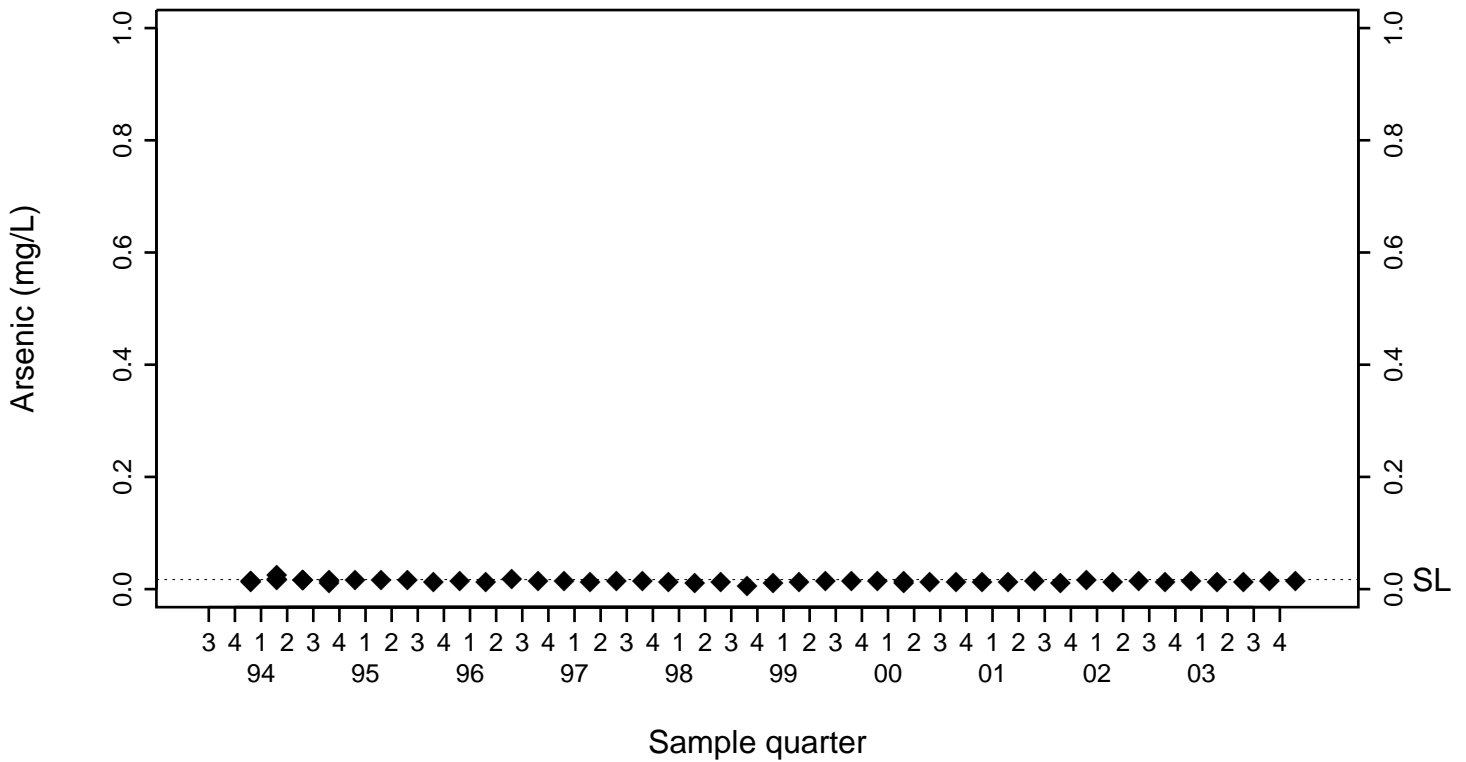
Compliance Monitoring Point NC7-26

◆ Above RL
▽ Below RL



SL=0.017

Compliance Monitoring Point NC7-47

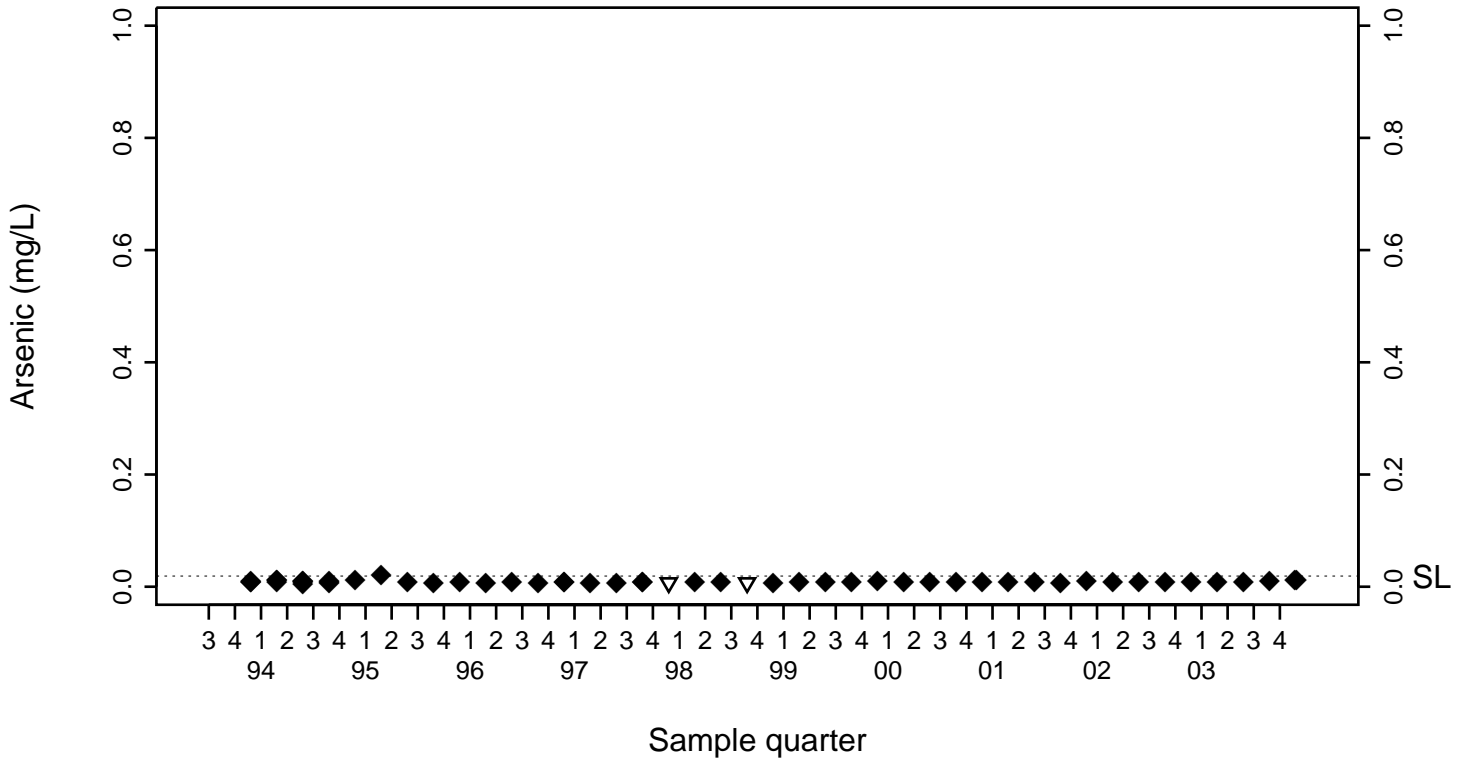


Pit 7 Complex Arsenic (mg/L)

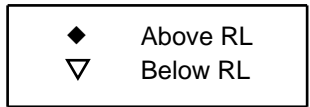
SL=0.019

◆ Above RL
▽ Below RL

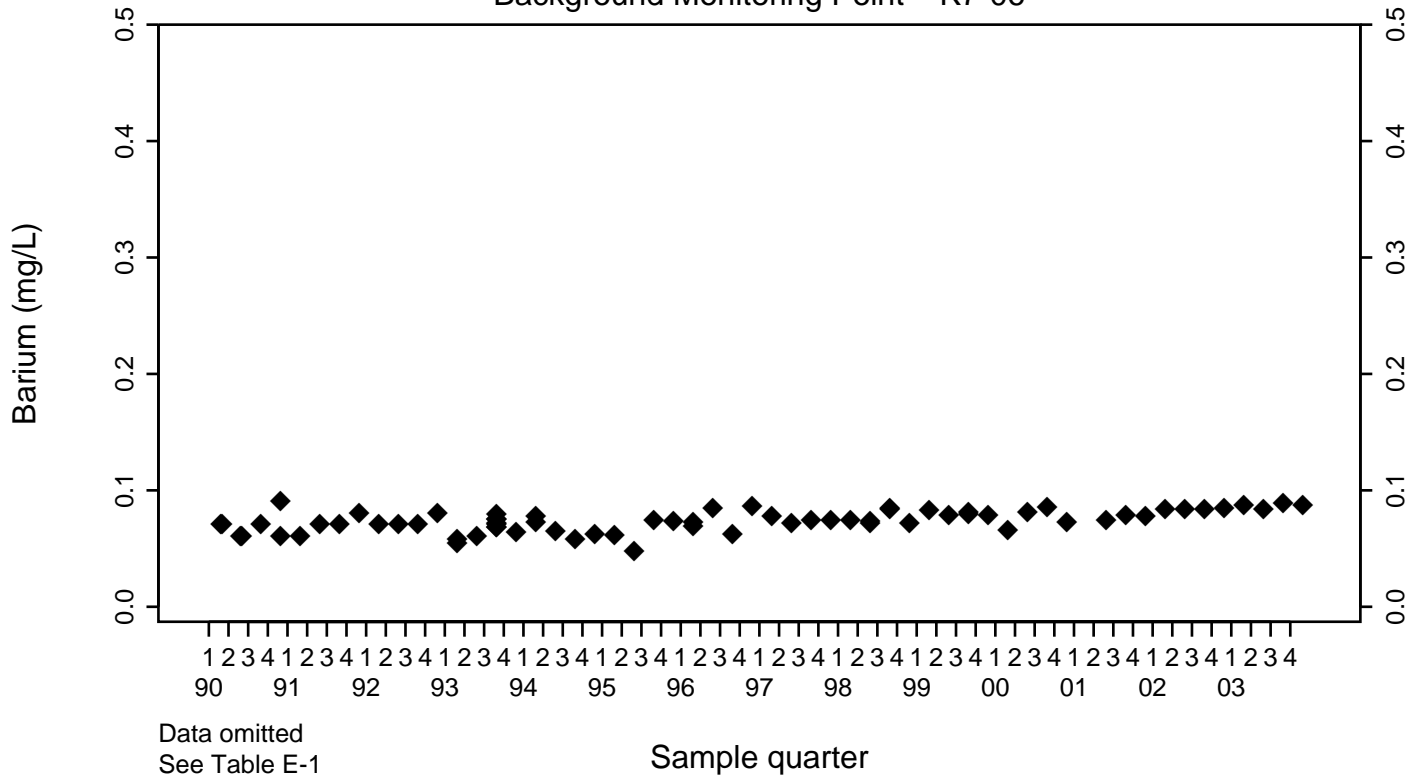
Compliance Monitoring Point NC7-48



Pit 7 Complex Barium (mg/L)

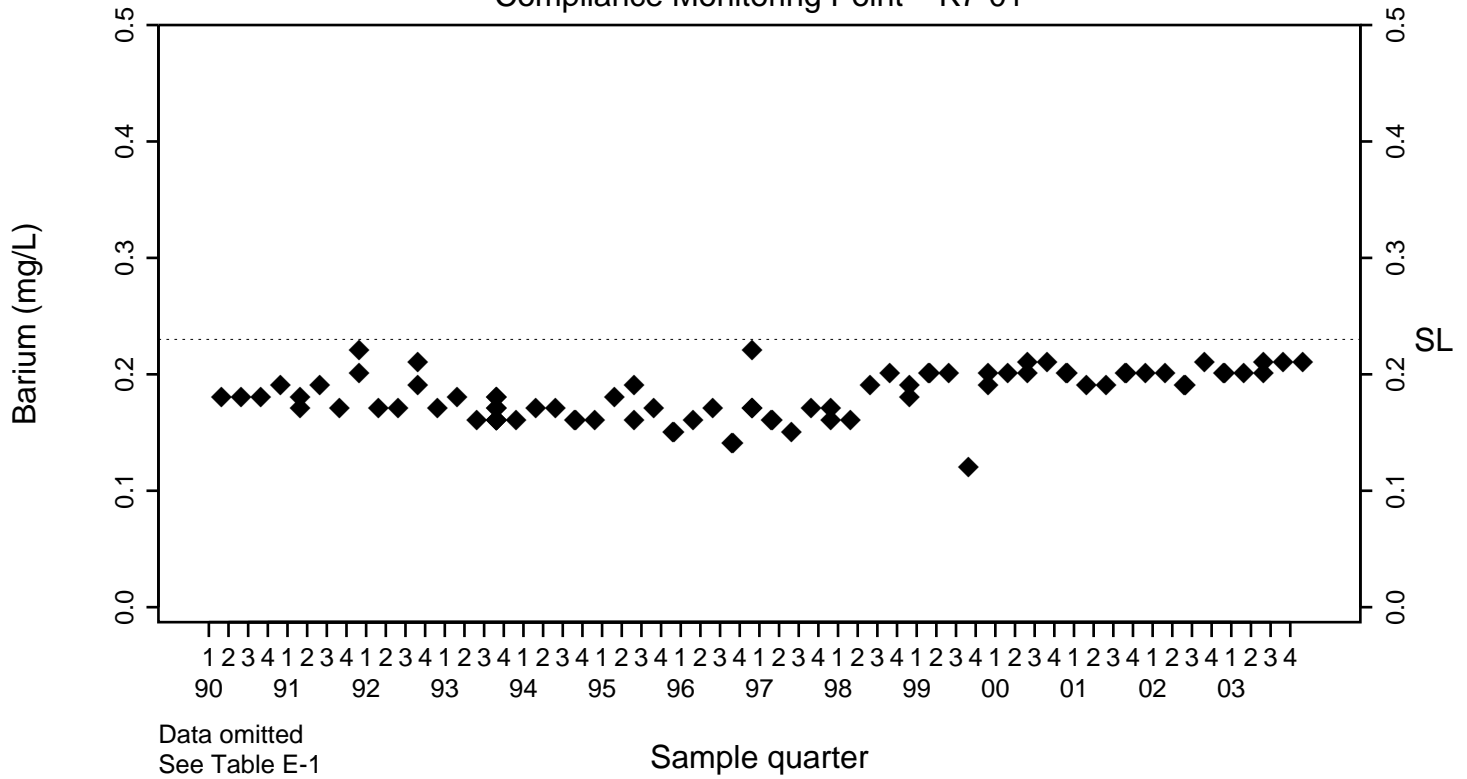


Background Monitoring Point K7-06



SL=0.23

Compliance Monitoring Point K7-01

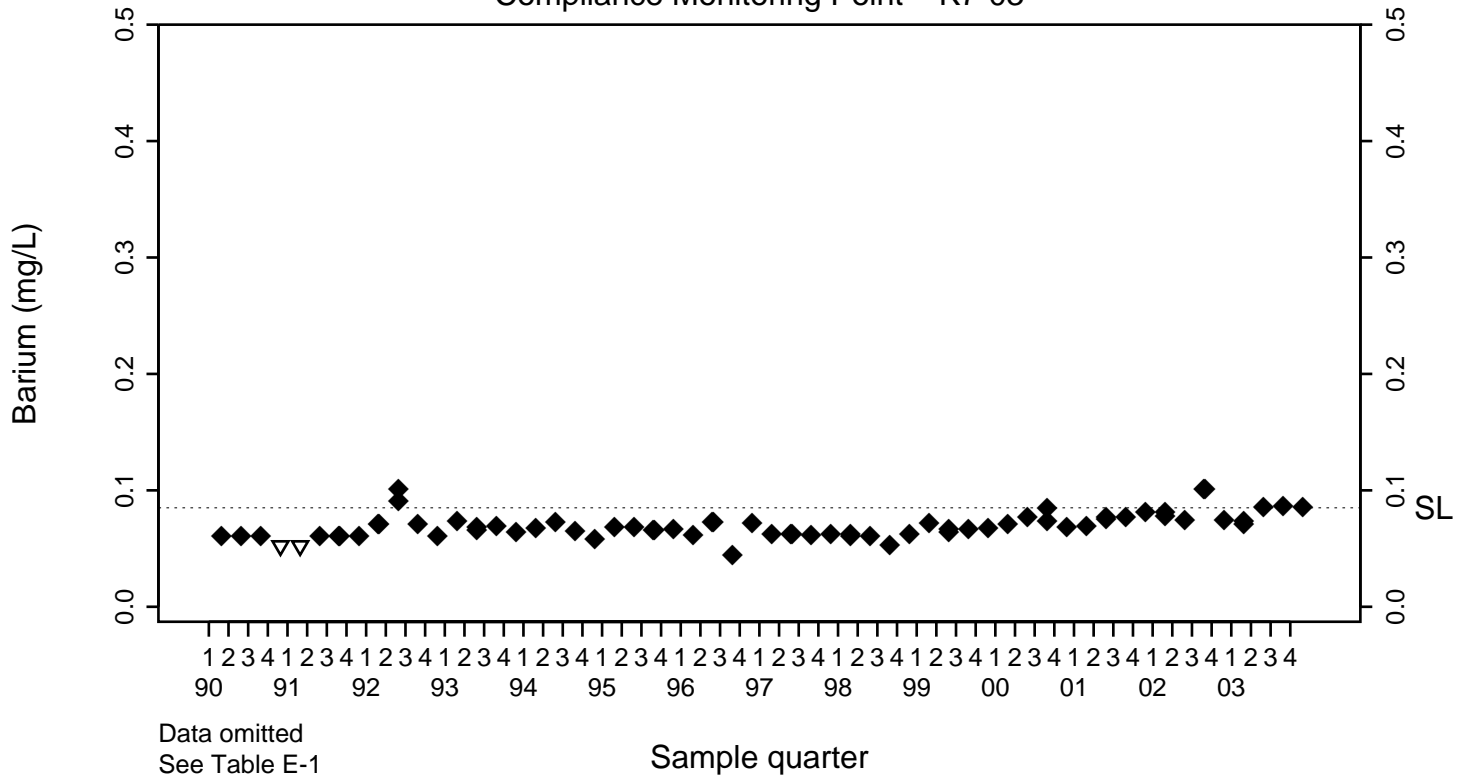


Pit 7 Complex Barium (mg/L)

◆	Above RL
▽	Below RL

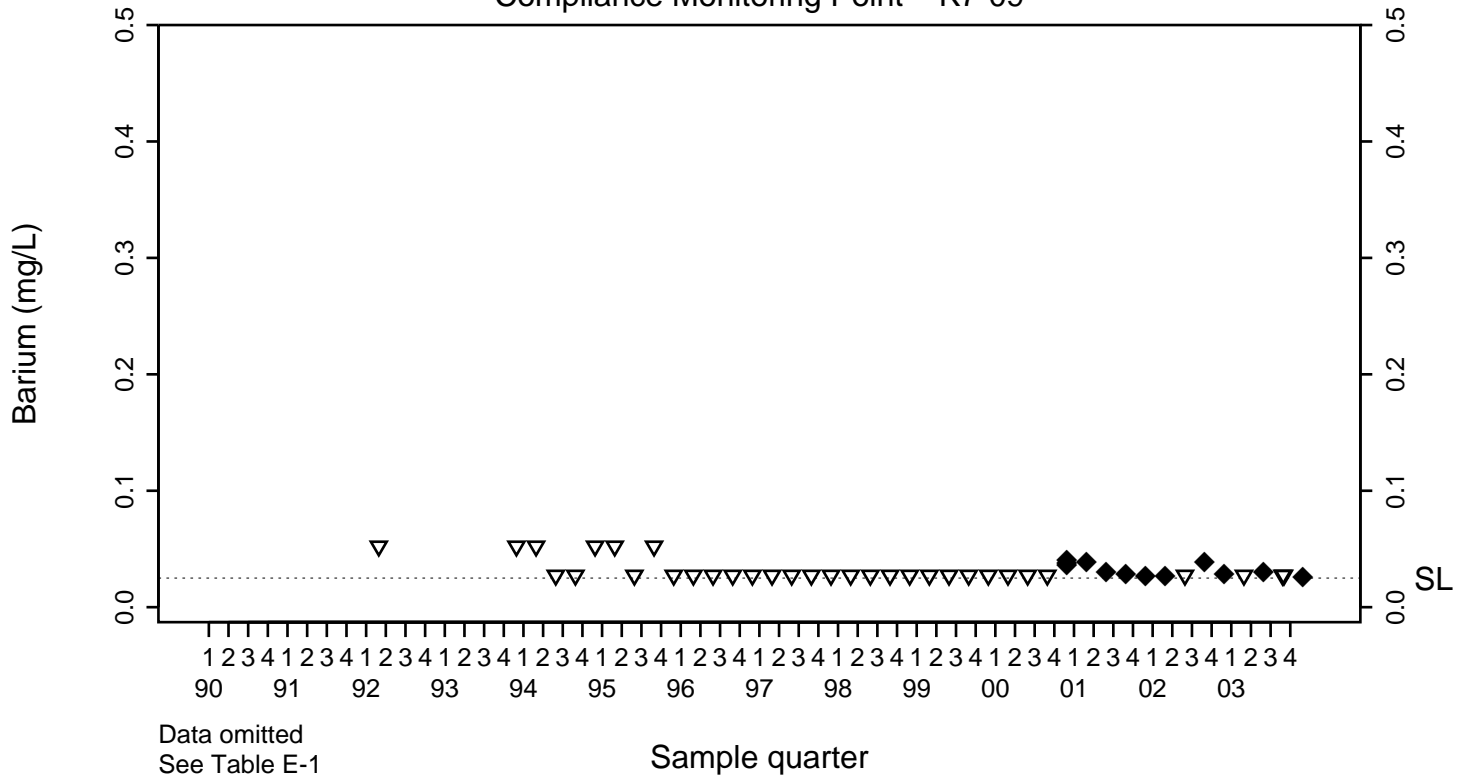
SL=0.085

Compliance Monitoring Point K7-03



SL=0.025

Compliance Monitoring Point K7-09

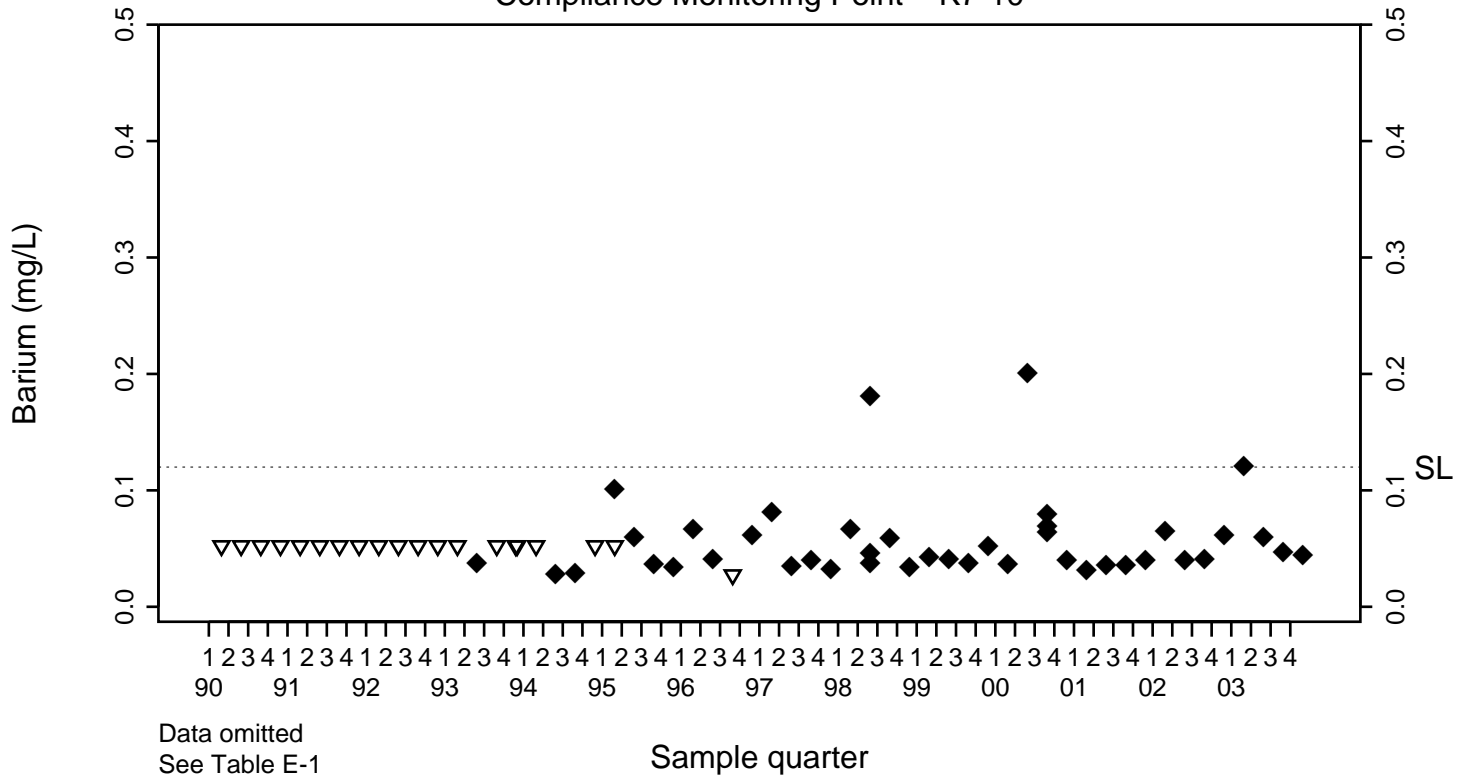


Pit 7 Complex Barium (mg/L)

◆	Above RL
▽	Below RL

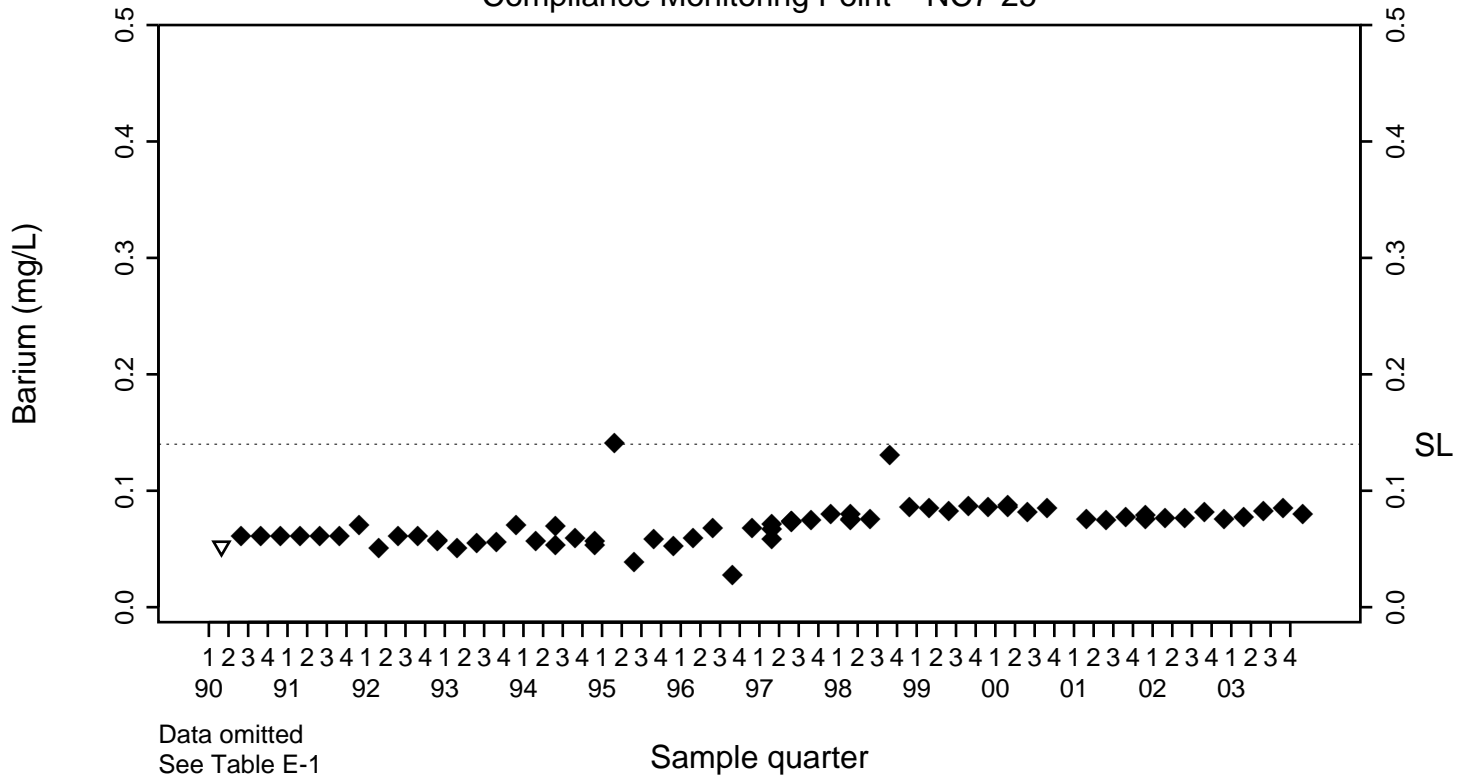
SL=0.12

Compliance Monitoring Point K7-10



SL=0.14

Compliance Monitoring Point NC7-25

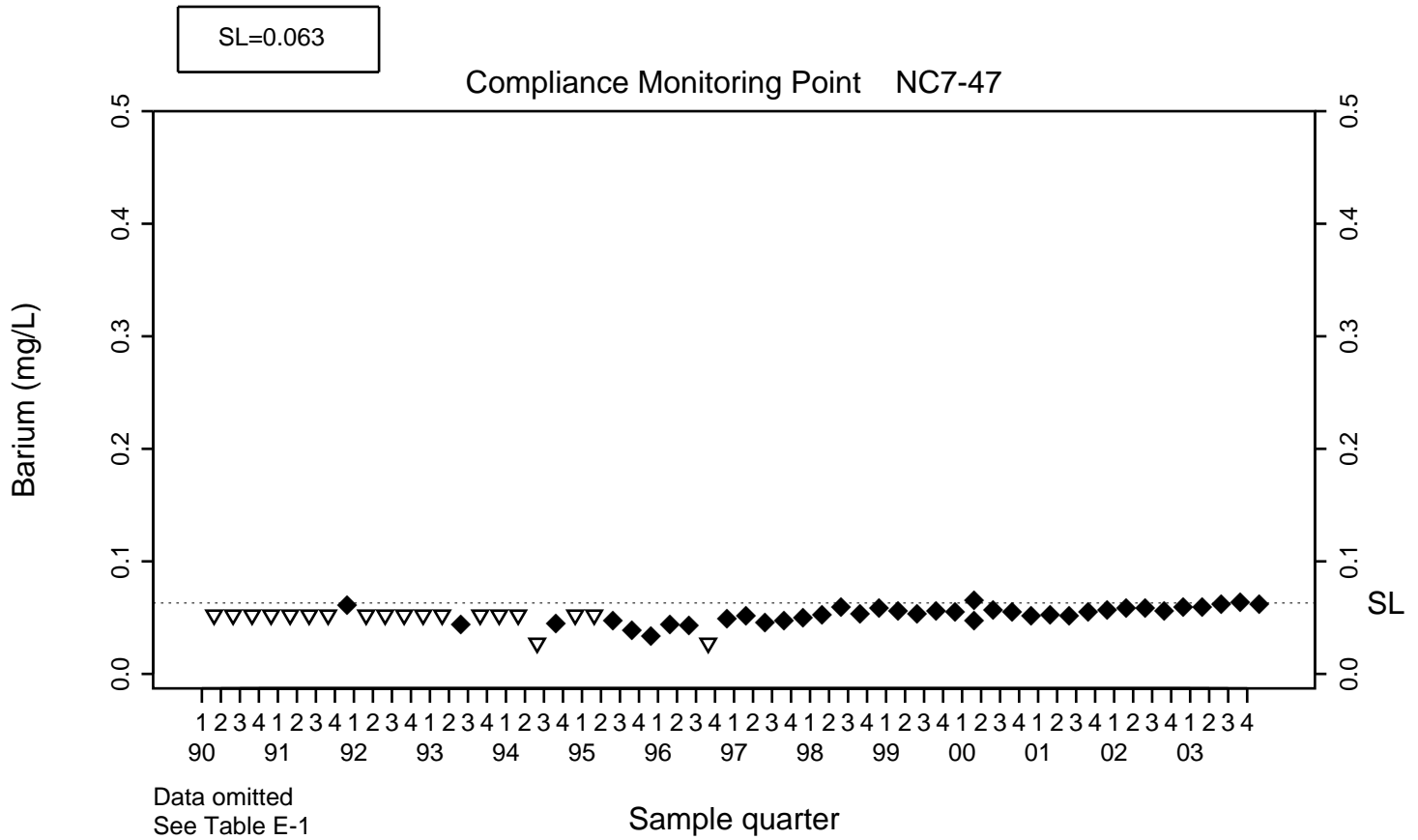
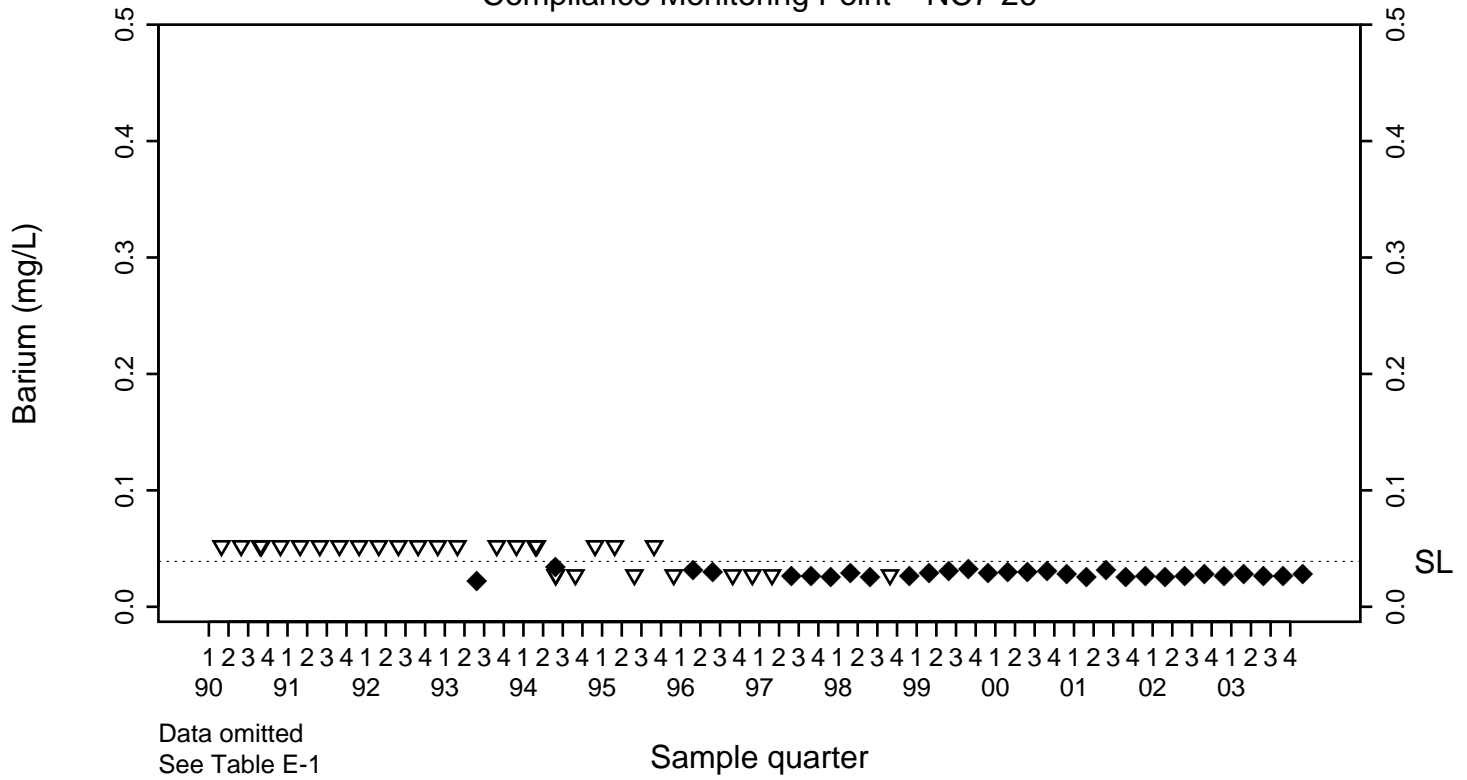


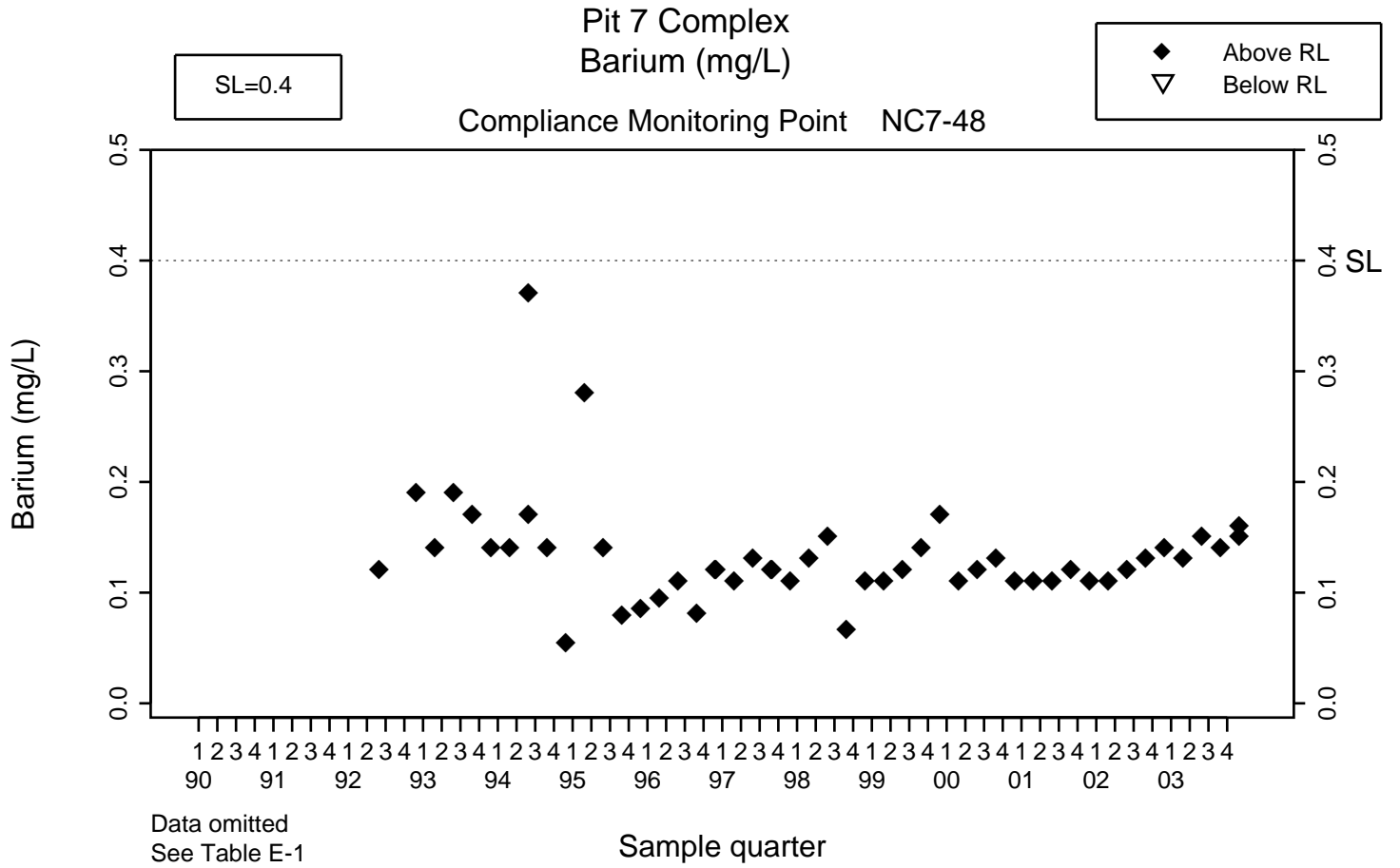
Pit 7 Complex Barium (mg/L)

◆	Above RL
▽	Below RL

SL=0.039

Compliance Monitoring Point NC7-26



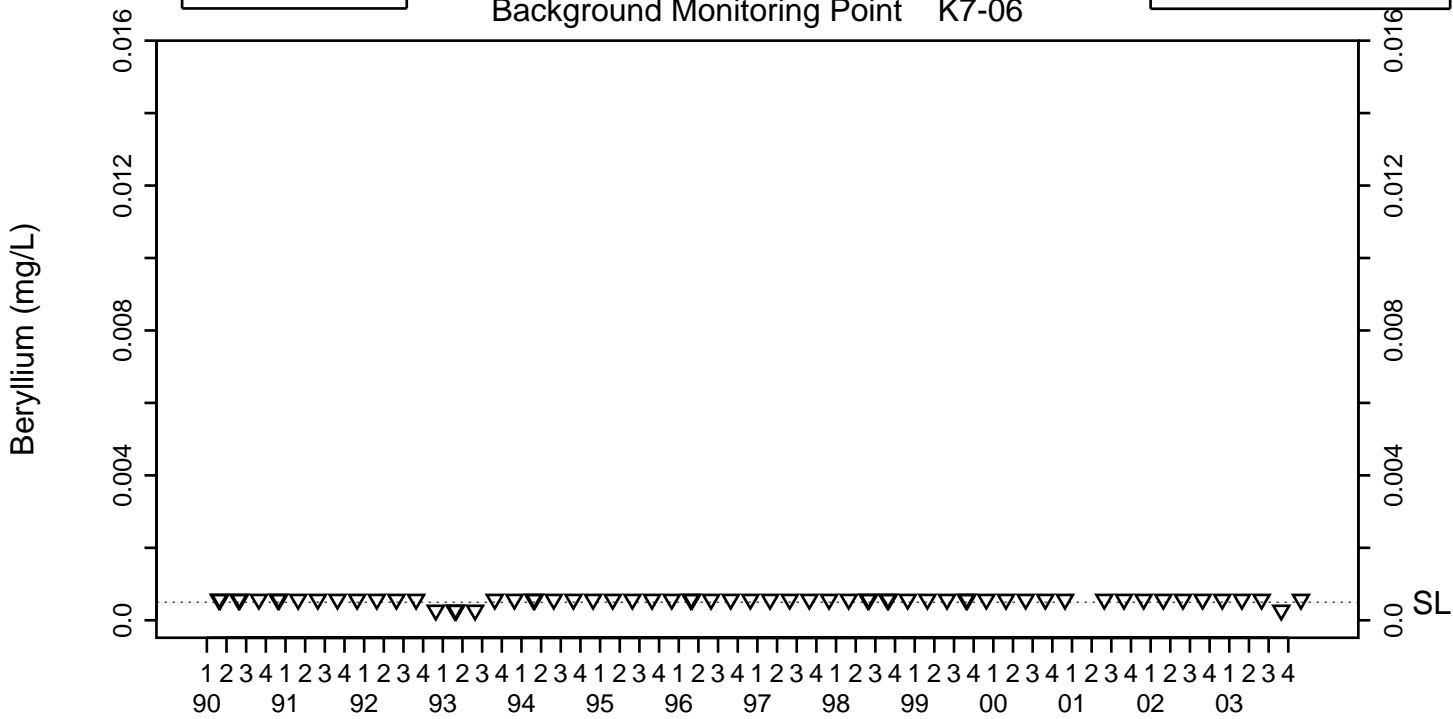


Pit 7 Complex Beryllium (mg/L)

◆ Above RL
▽ Below RL

SL=0.0005

Background Monitoring Point K7-06

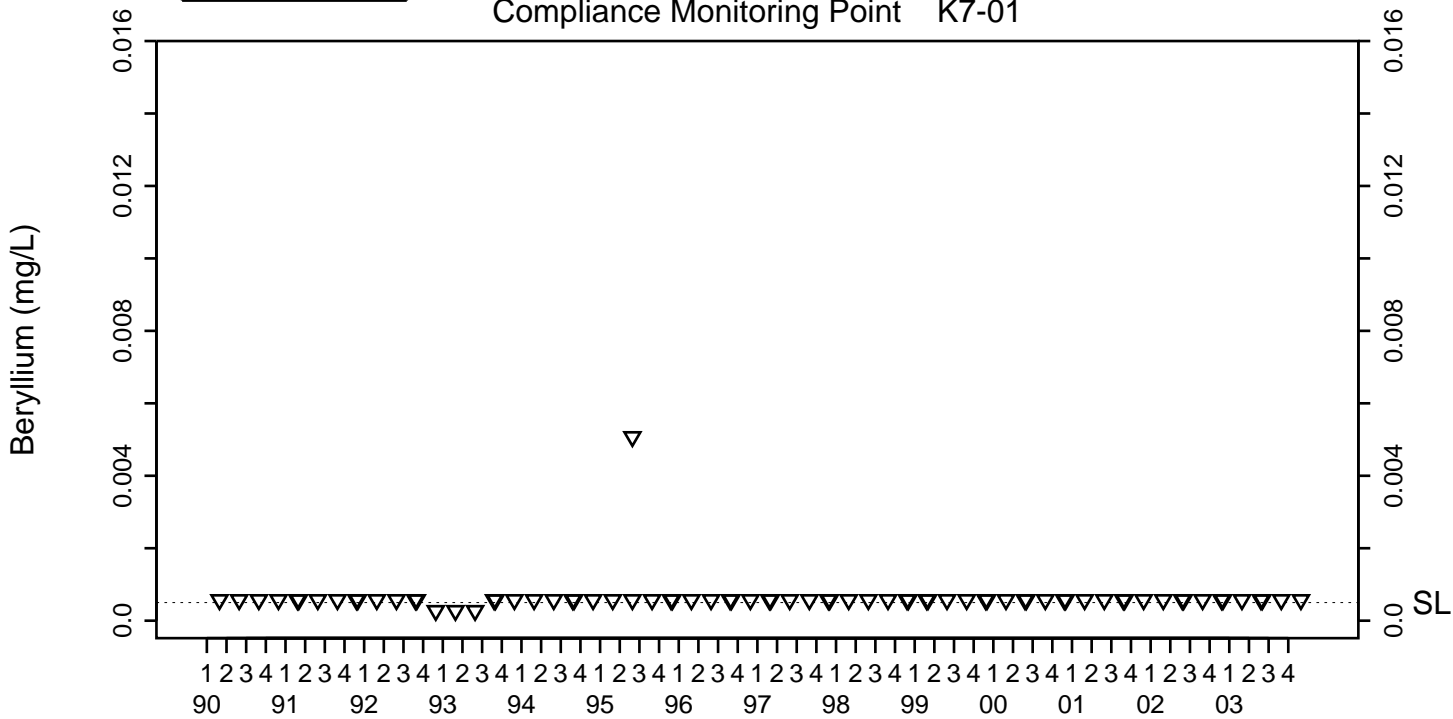


Data omitted
See Table E-1

Sample quarter

SL=0.0005

Compliance Monitoring Point K7-01



Data omitted
See Table E-1

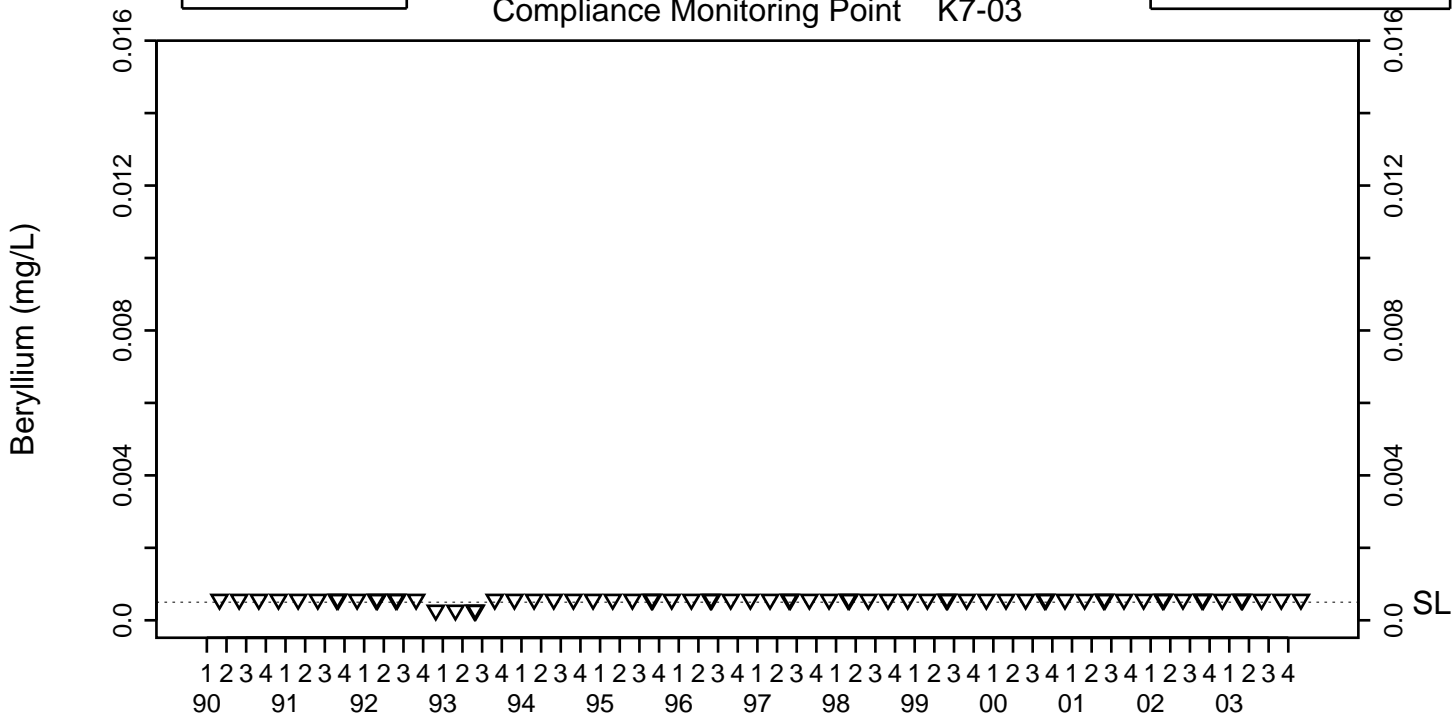
Sample quarter

Pit 7 Complex Beryllium (mg/L)

◆ Above RL
▽ Below RL

SL=0.0005

Compliance Monitoring Point K7-03

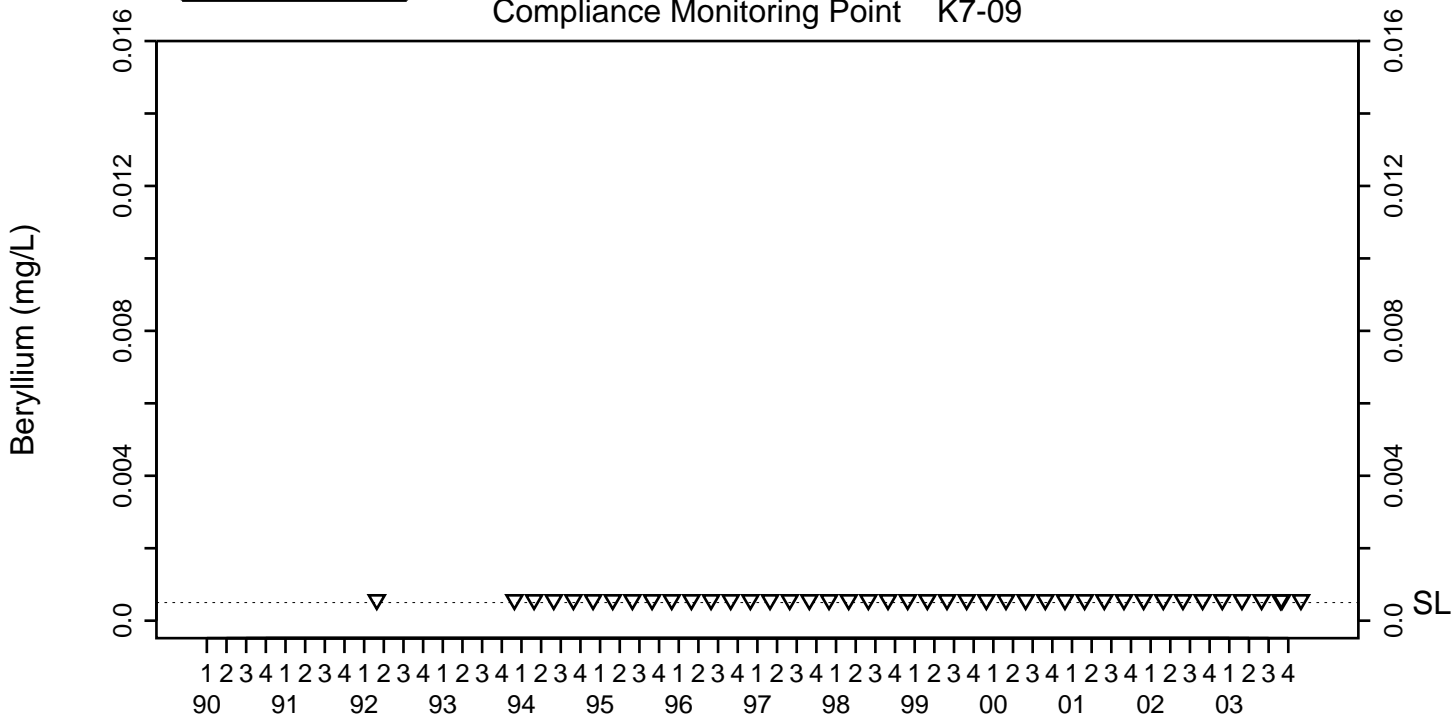


Data omitted
See Table E-1

Sample quarter

SL=0.0005

Compliance Monitoring Point K7-09



Data omitted
See Table E-1

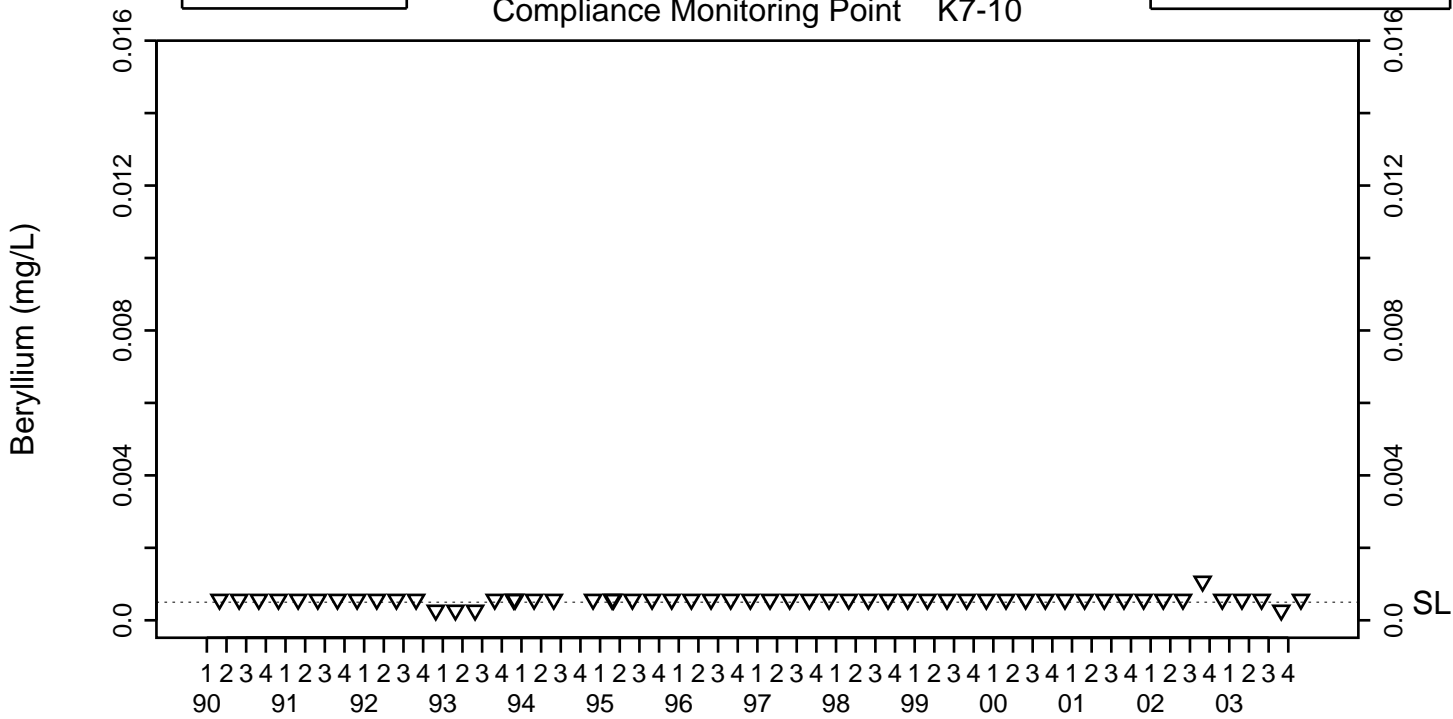
Sample quarter

Pit 7 Complex Beryllium (mg/L)

◆	Above RL
▽	Below RL

SL=0.0005

Compliance Monitoring Point K7-10

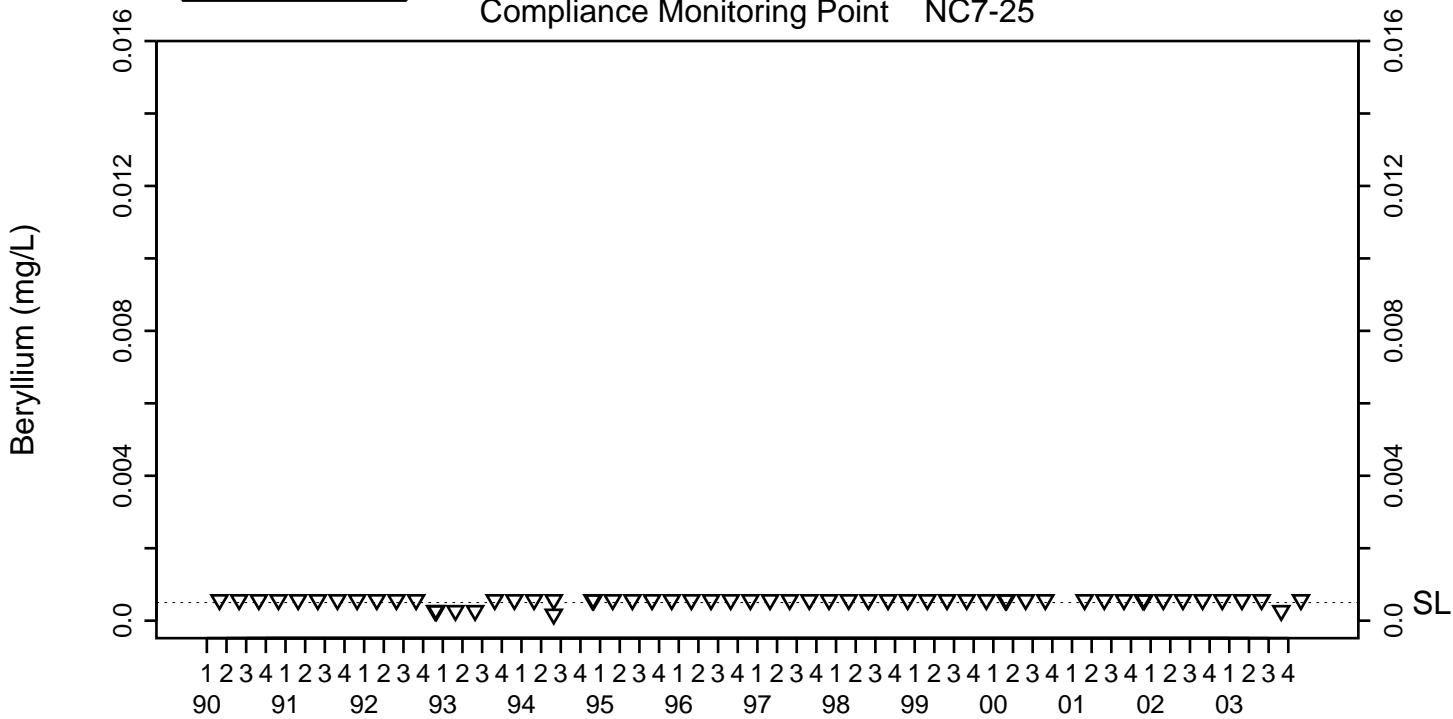


Data omitted
See Table E-1

Sample quarter

SL=0.0005

Compliance Monitoring Point NC7-25



Data omitted
See Table E-1

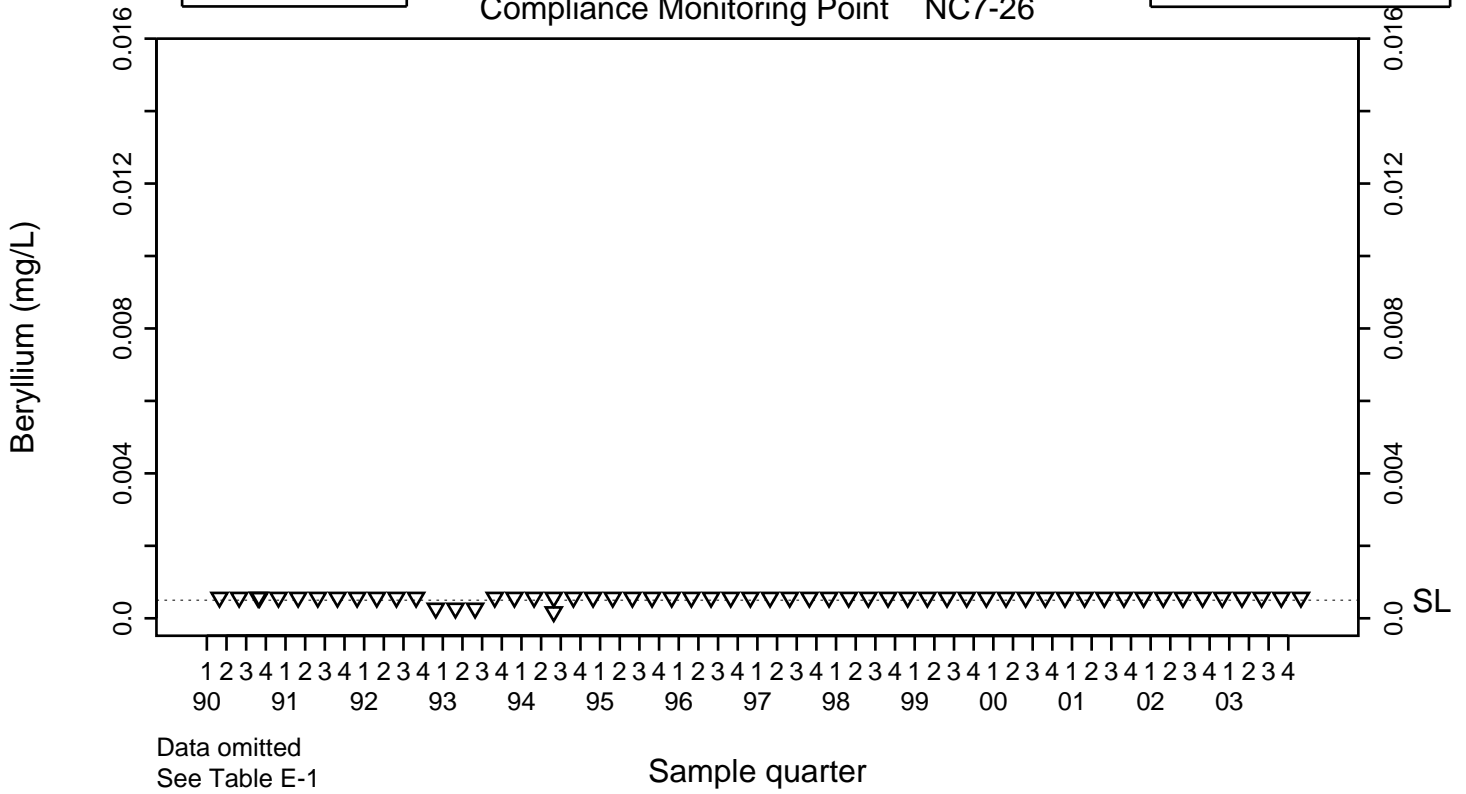
Sample quarter

Pit 7 Complex Beryllium (mg/L)

Compliance Monitoring Point NC7-26

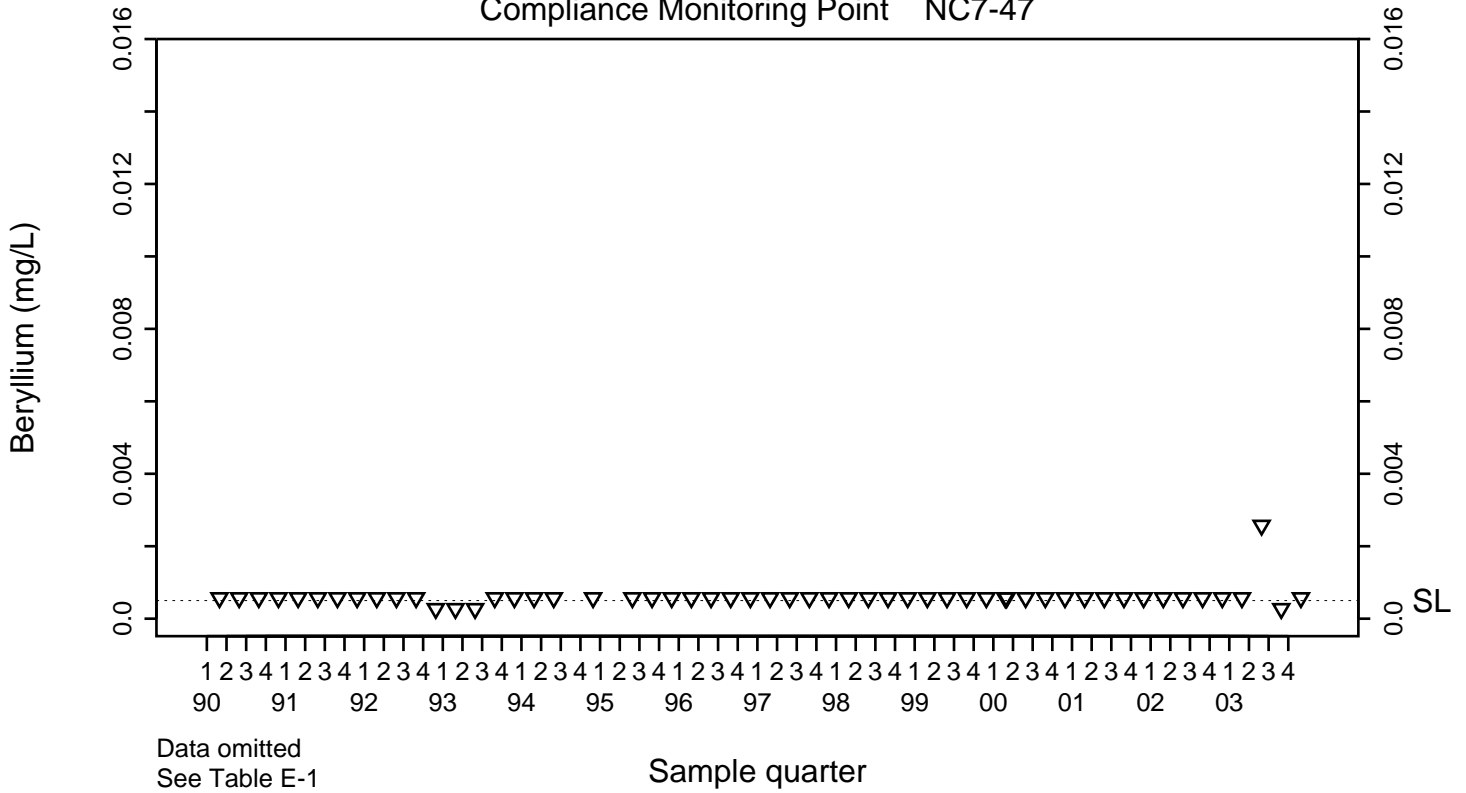
SL=0.0005

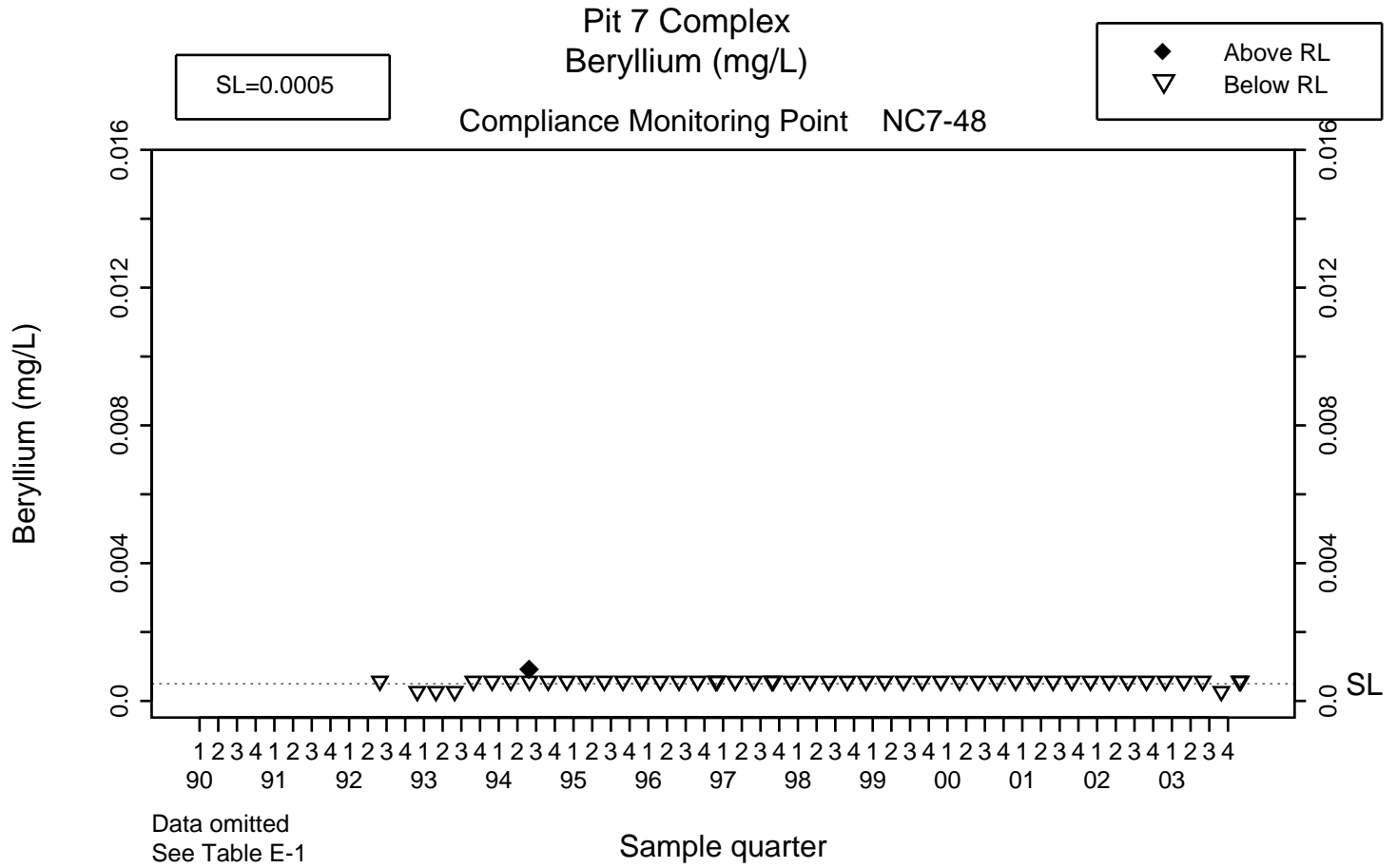
◆ Above RL
▽ Below RL



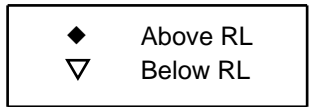
Compliance Monitoring Point NC7-47

SL=0.0005

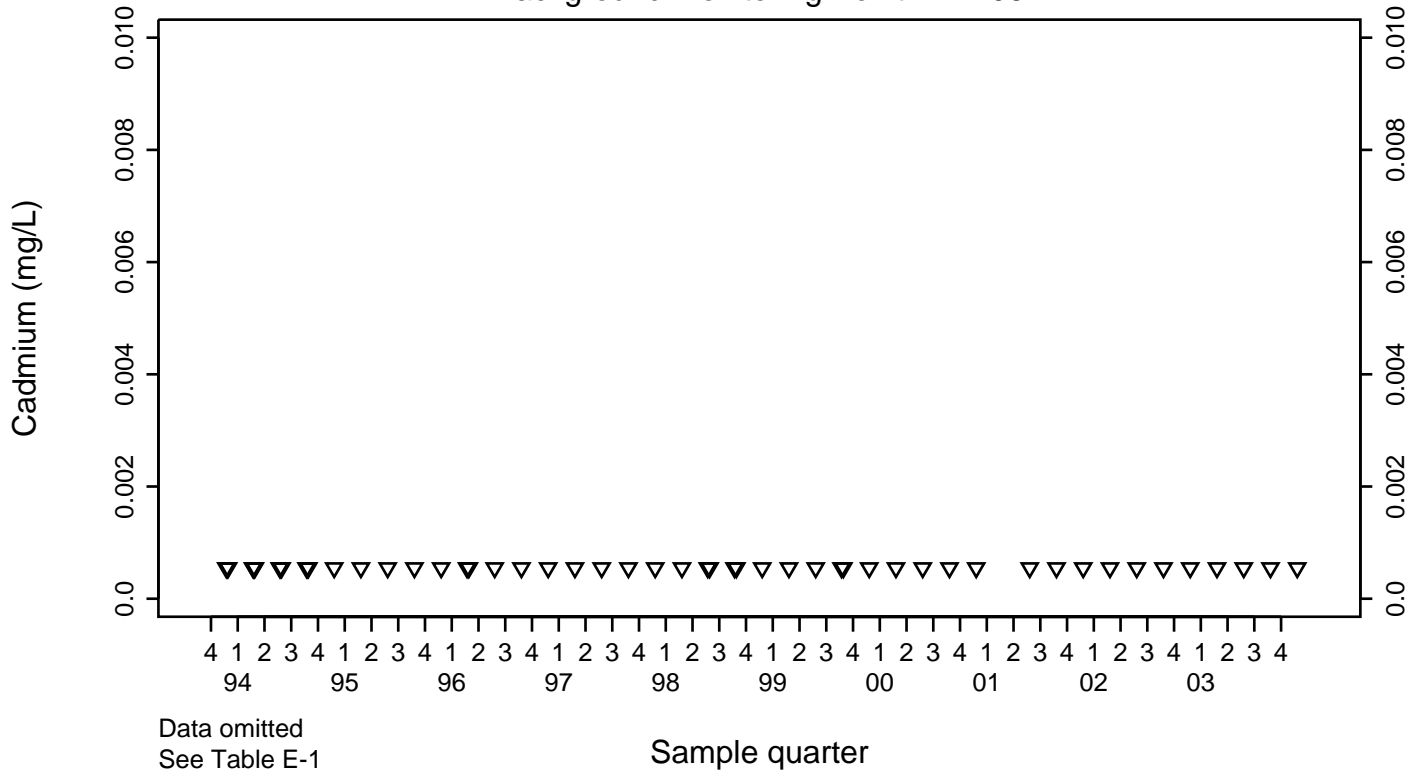




Pit 7 Complex Cadmium (mg/L)

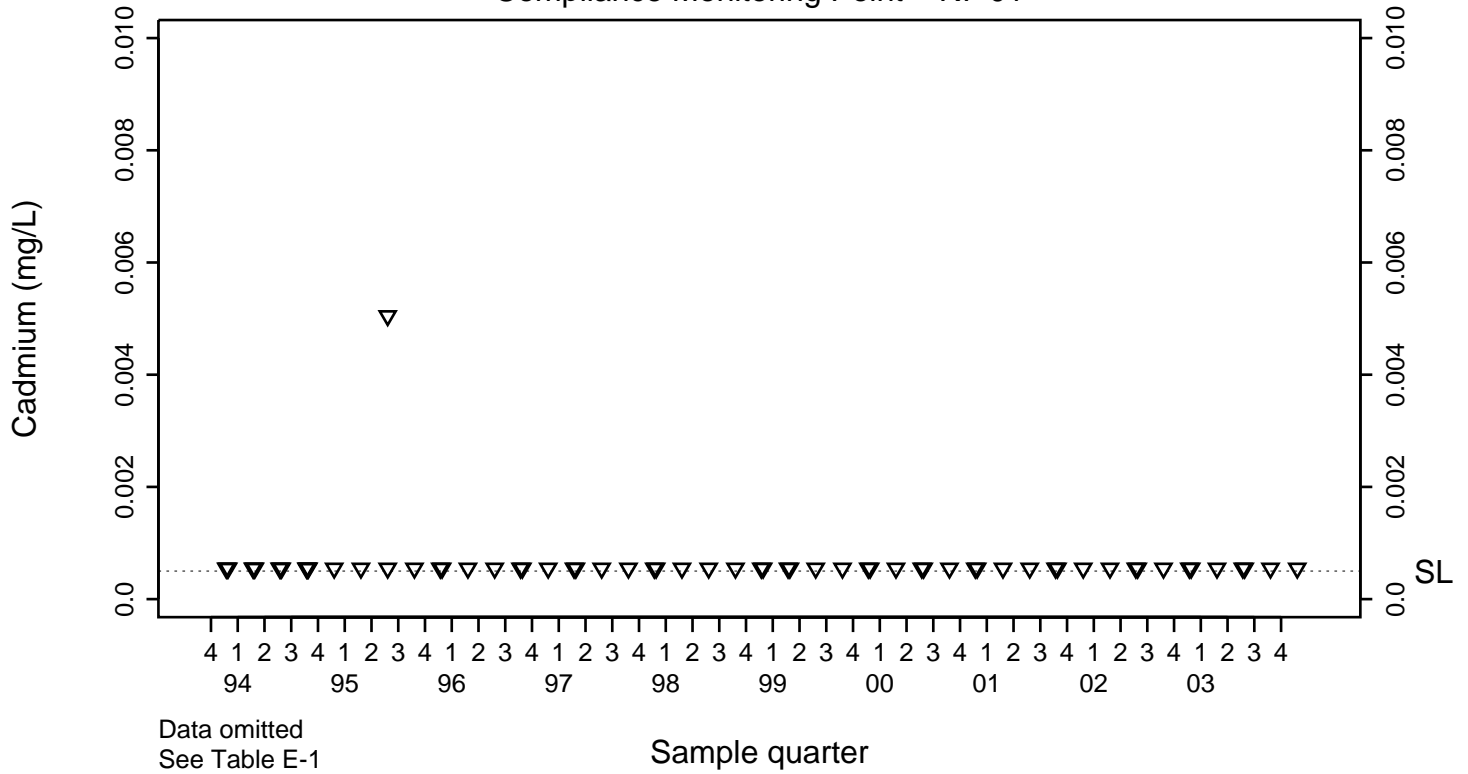


Background Monitoring Point K7-06



SL=0.0005

Compliance Monitoring Point K7-01

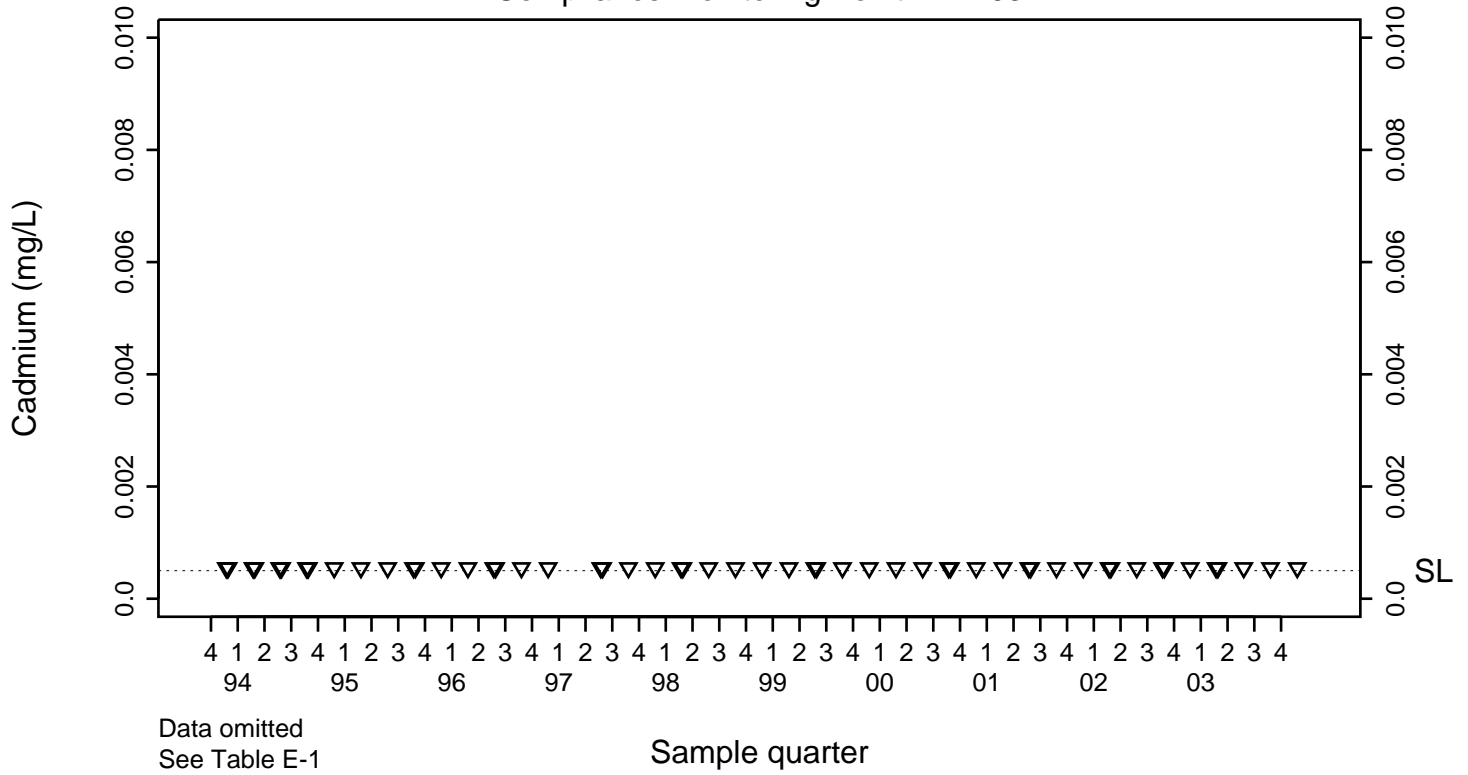


Pit 7 Complex Cadmium (mg/L)

◆ Above RL
▽ Below RL

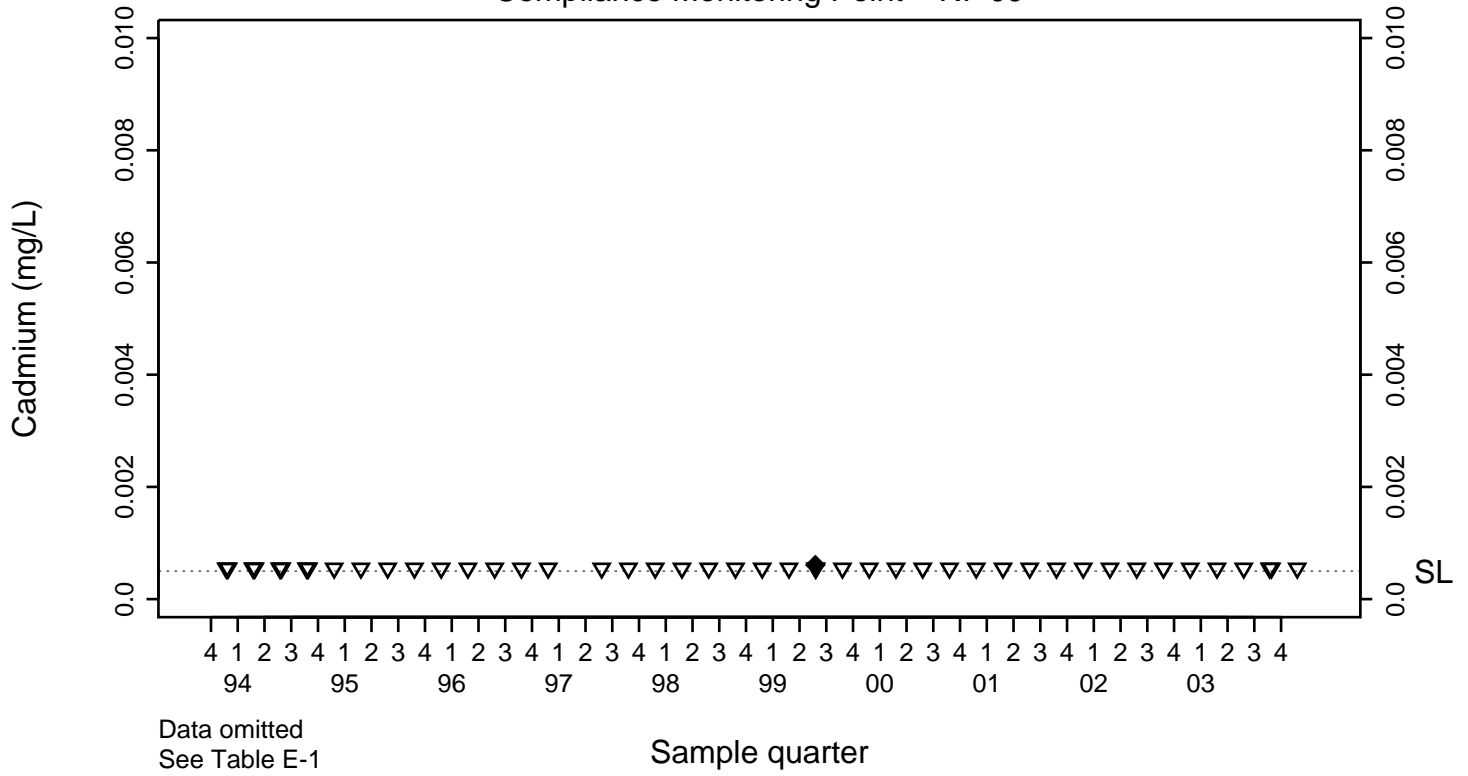
SL=0.0005

Compliance Monitoring Point K7-03



SL=0.0005

Compliance Monitoring Point K7-09

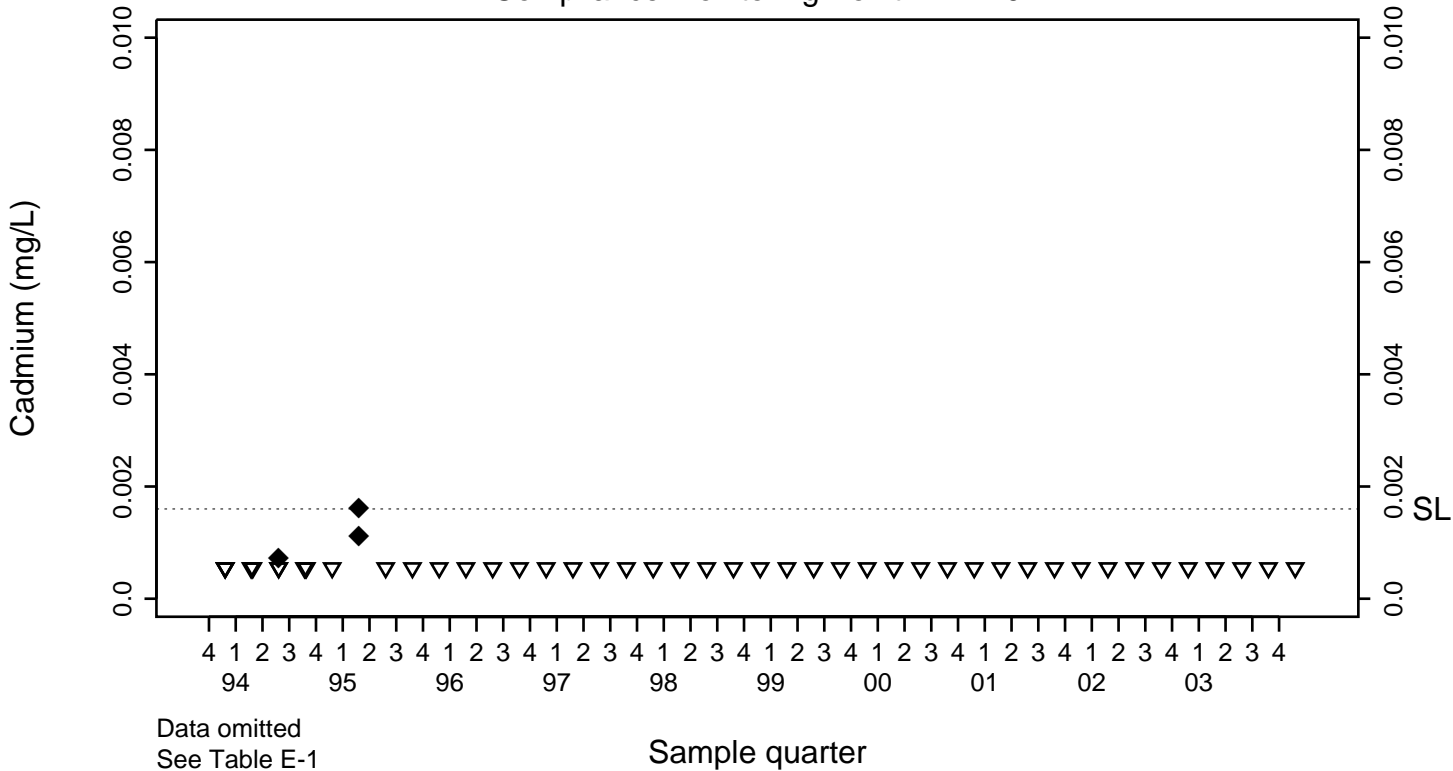


Pit 7 Complex Cadmium (mg/L)

◆ Above RL
▽ Below RL

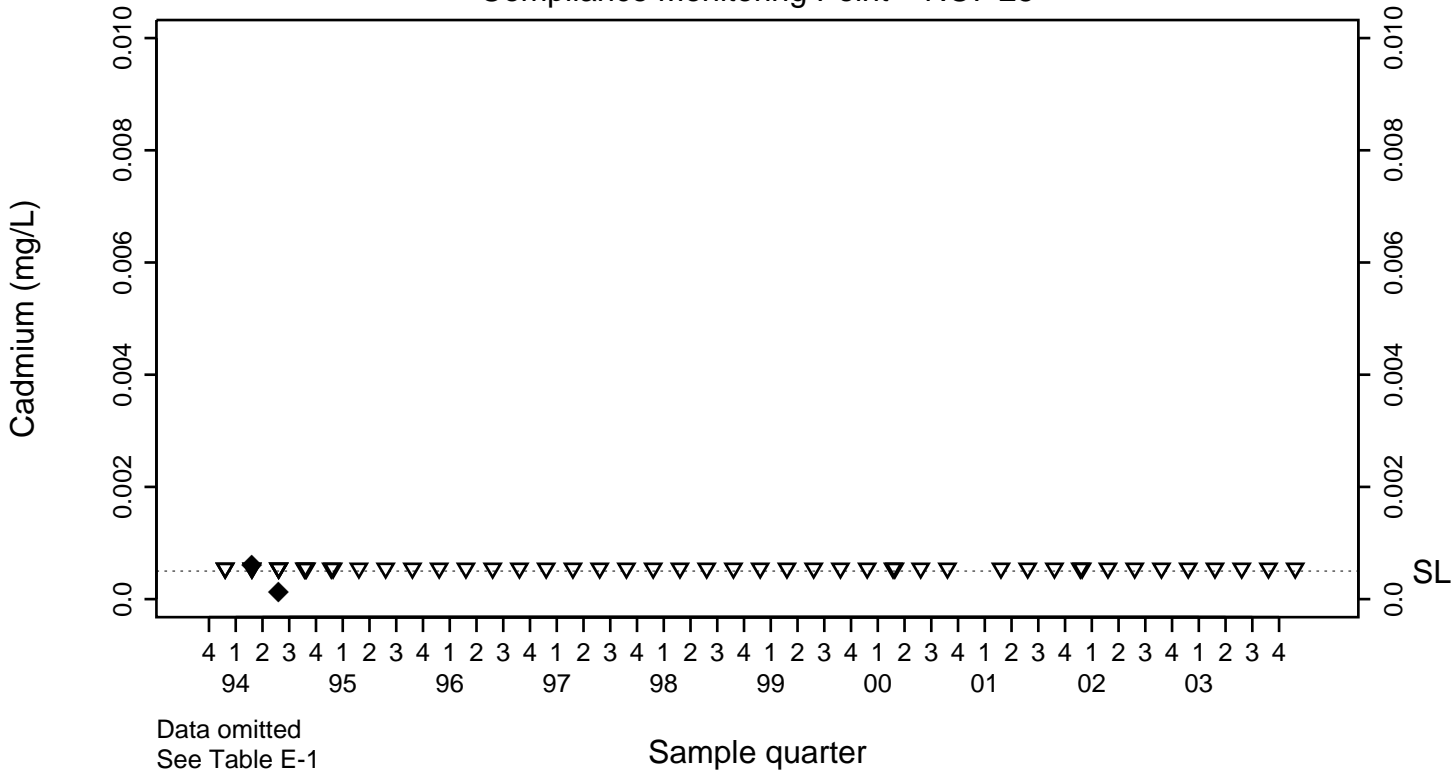
SL=0.0016

Compliance Monitoring Point K7-10



SL=0.0005

Compliance Monitoring Point NC7-25

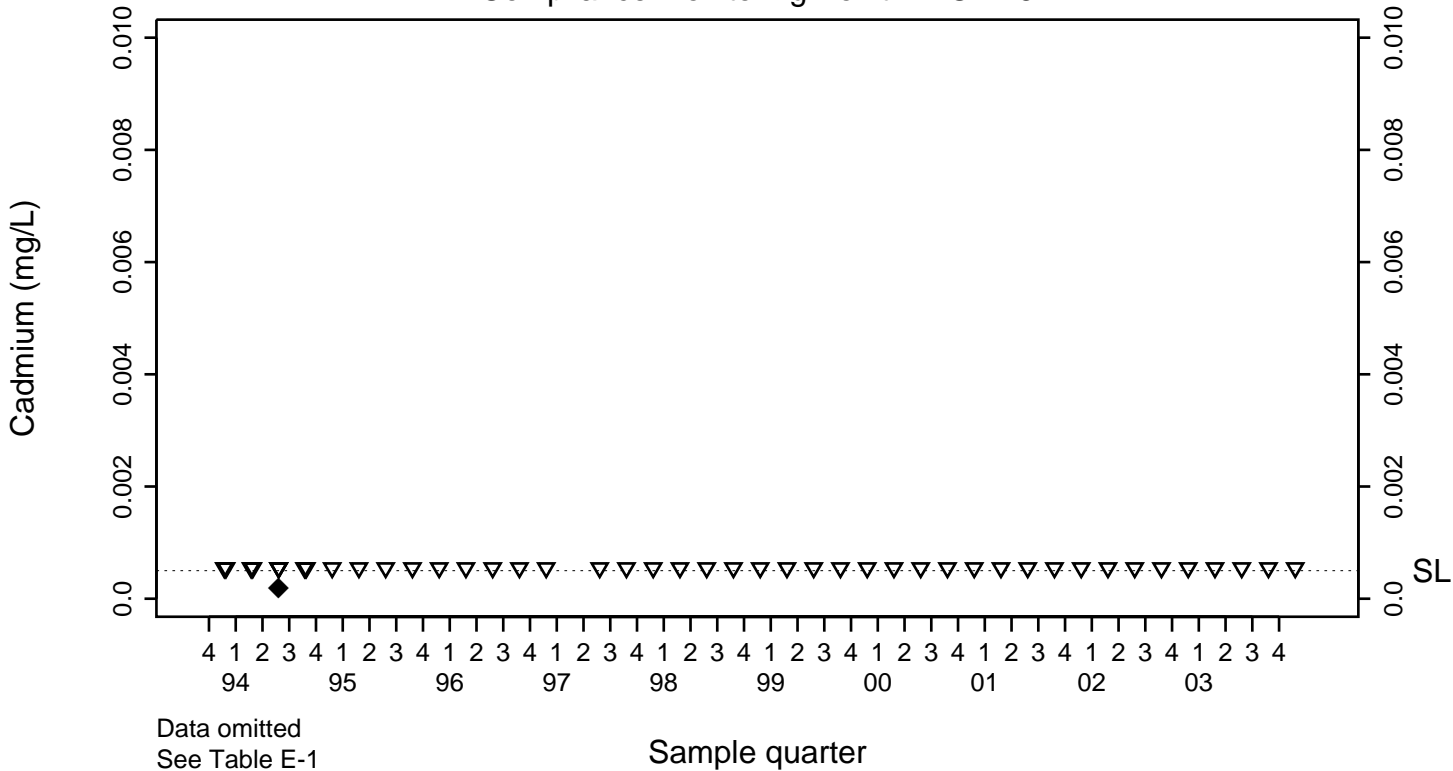


Pit 7 Complex Cadmium (mg/L)

◆ Above RL
▽ Below RL

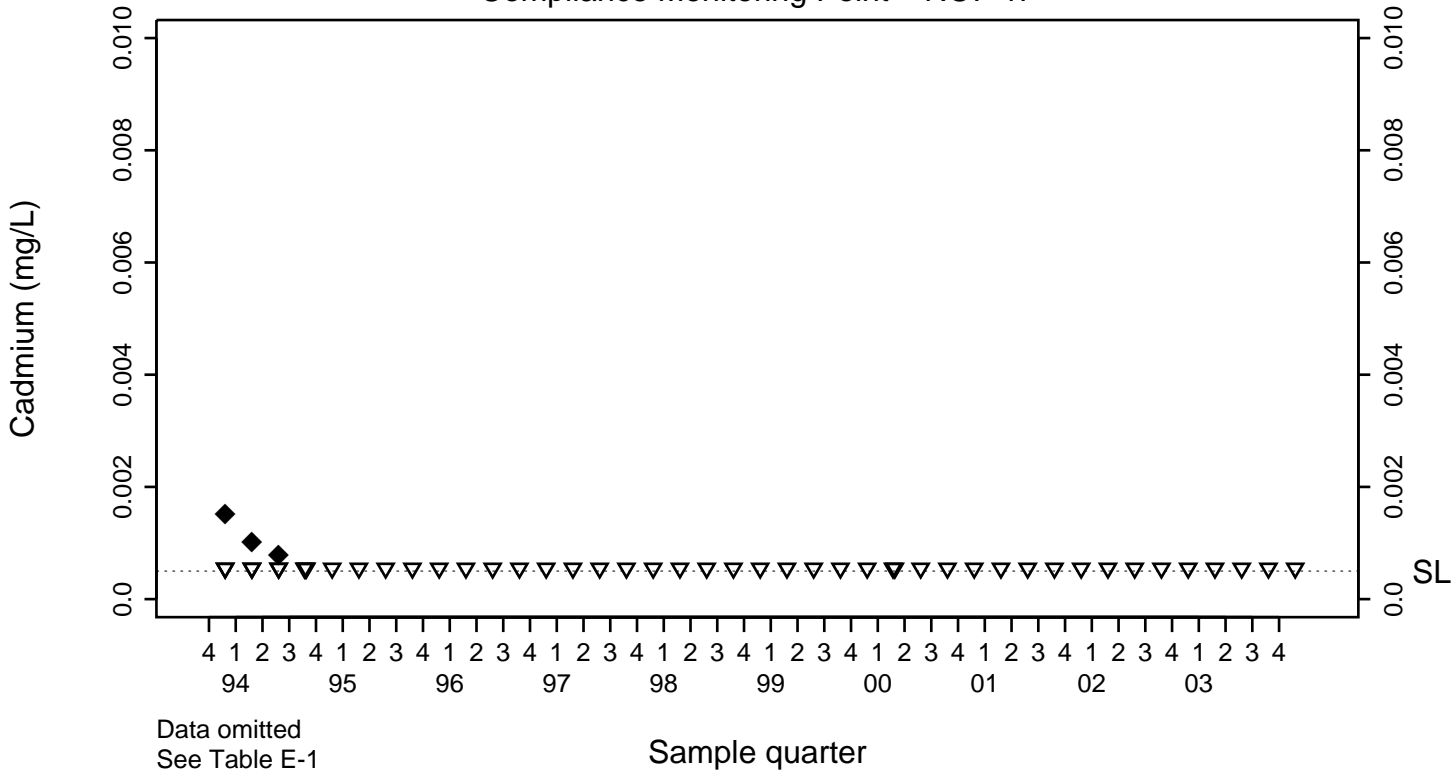
SL=0.0005

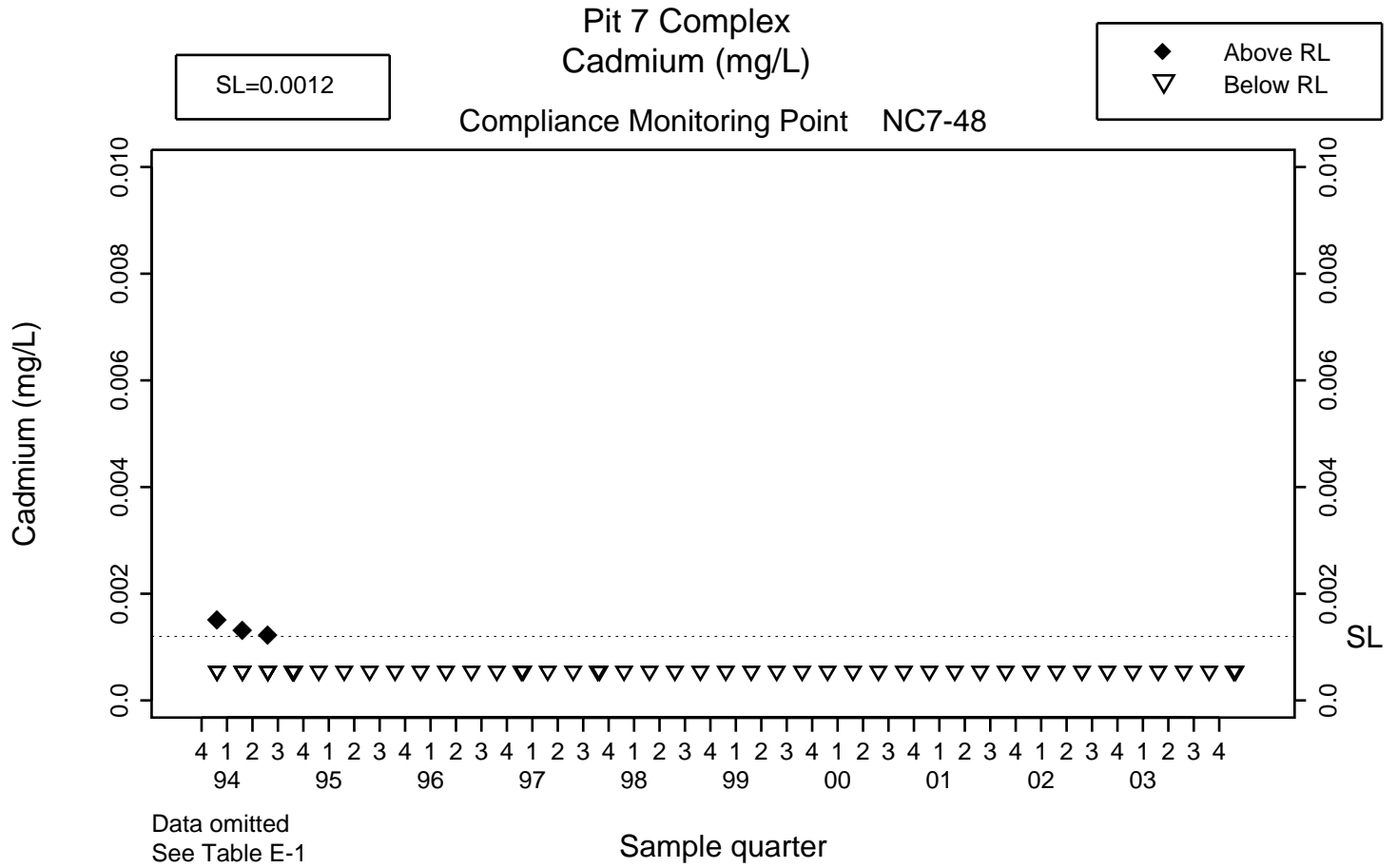
Compliance Monitoring Point NC7-26



SL=0.0005

Compliance Monitoring Point NC7-47



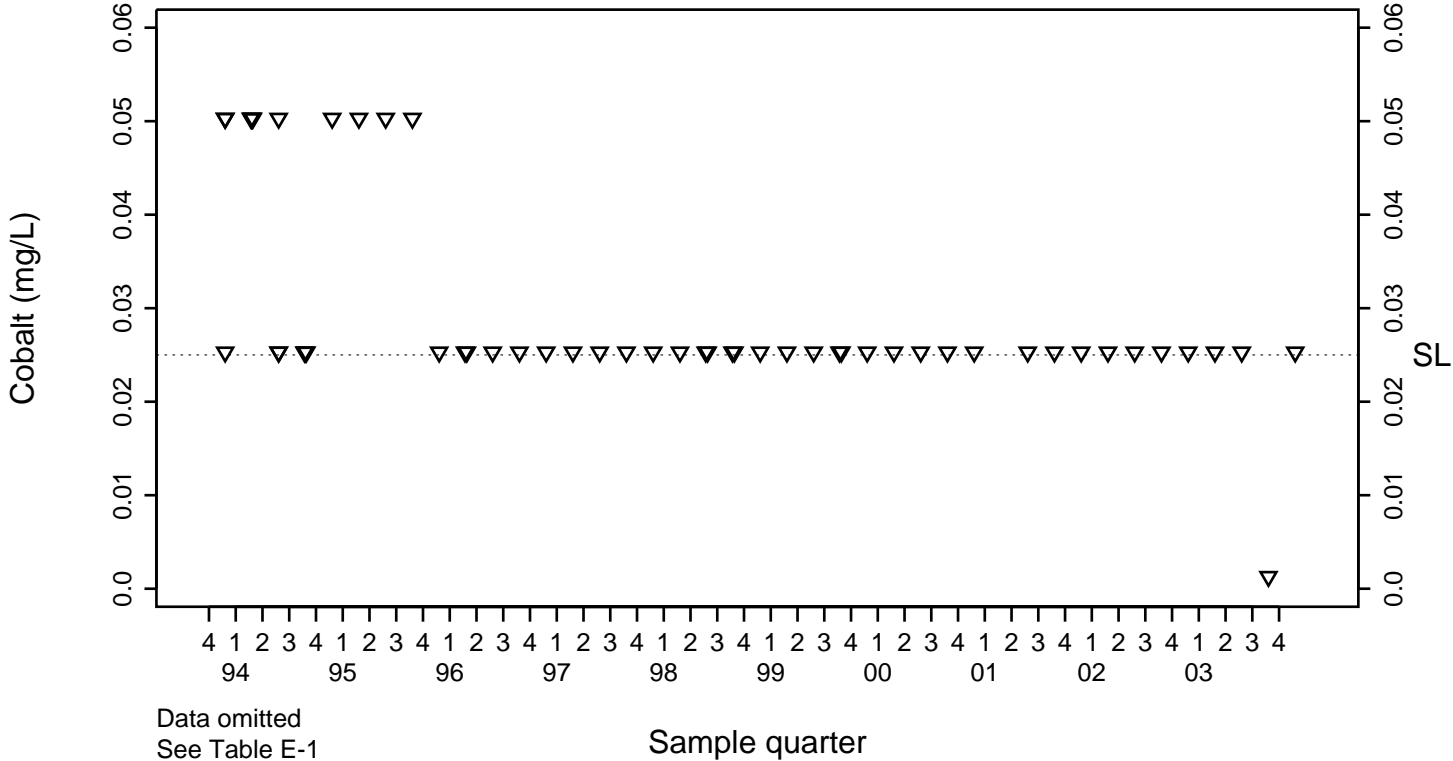


Pit 7 Complex Cobalt (mg/L)

◆ Above RL
▽ Below RL

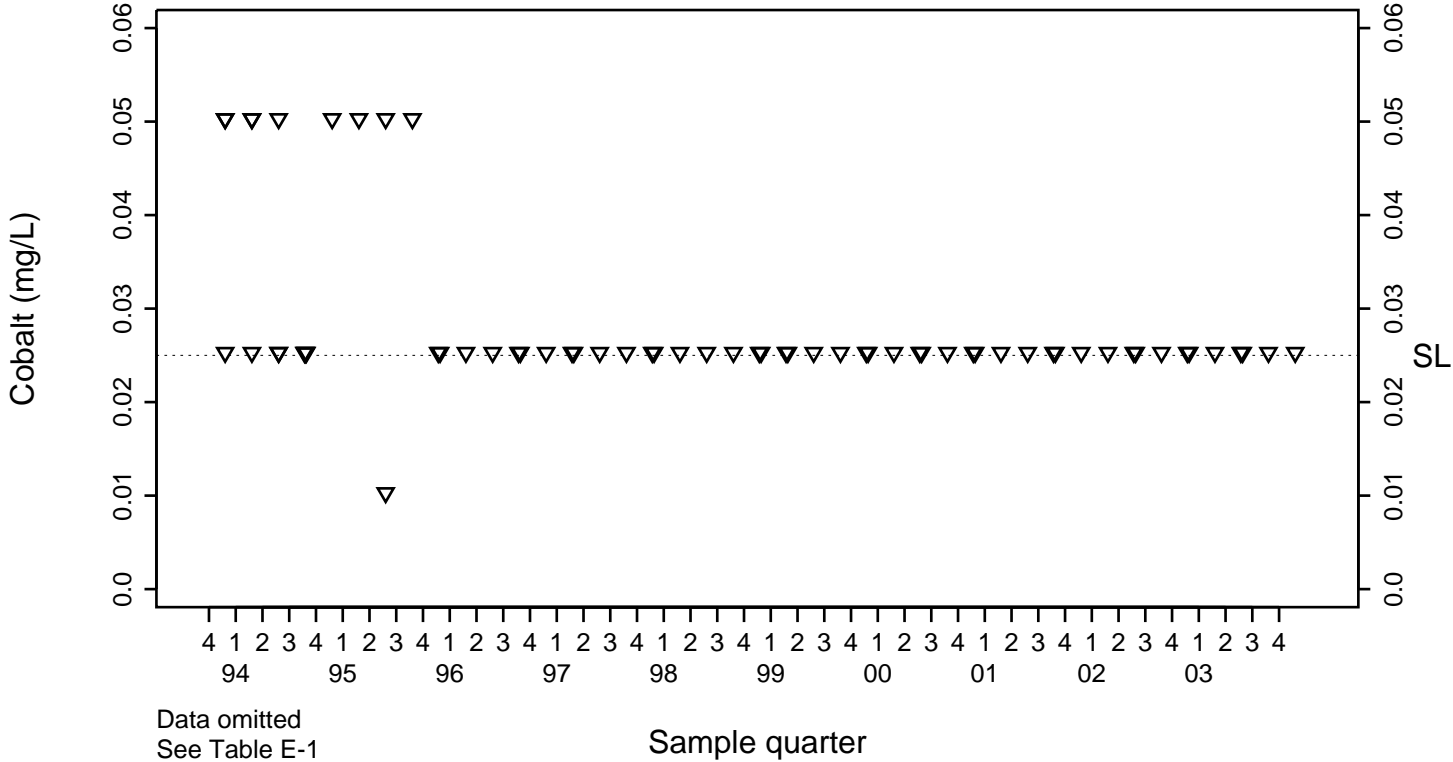
SL=0.025

Background Monitoring Point K7-06



SL=0.025

Compliance Monitoring Point K7-01

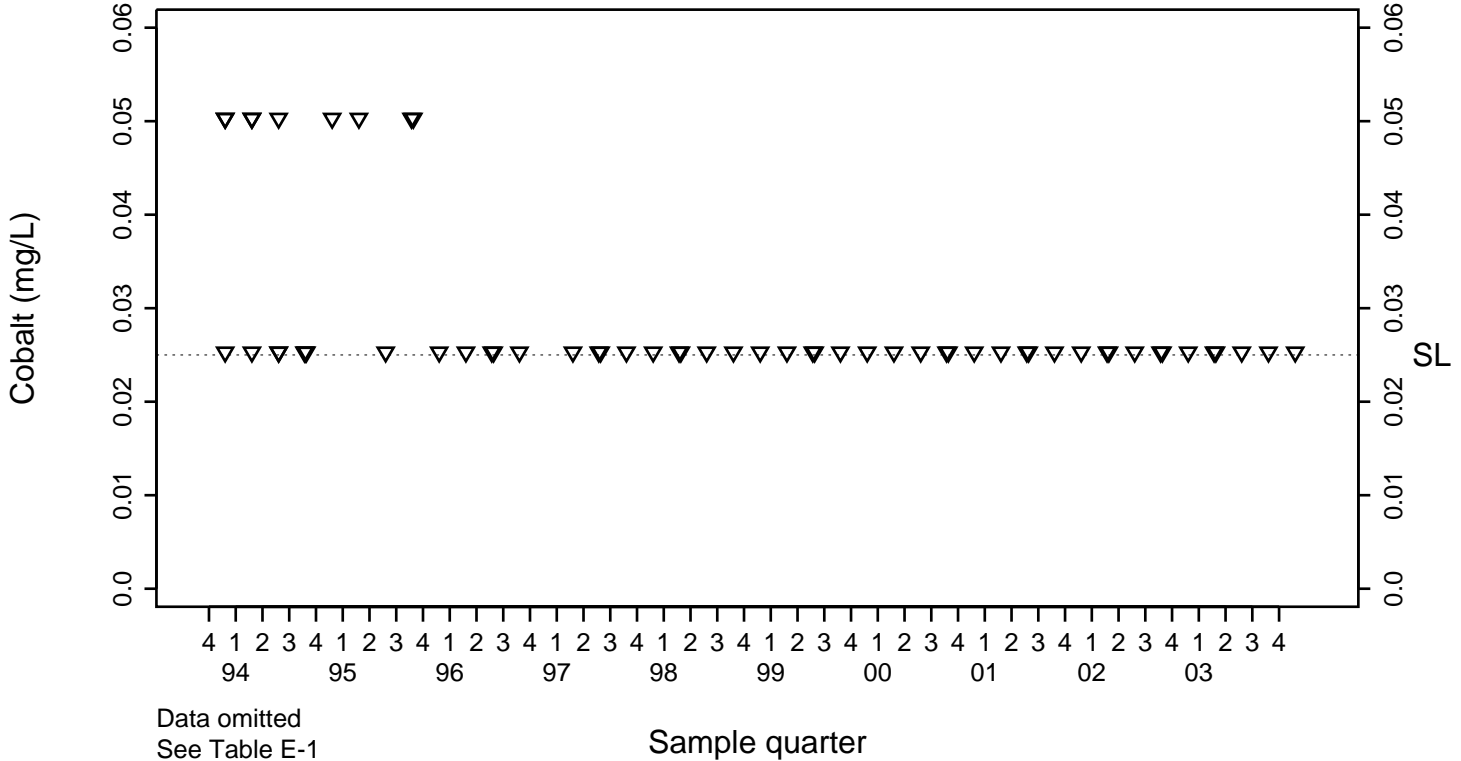


Pit 7 Complex Cobalt (mg/L)

◆	Above RL
▽	Below RL

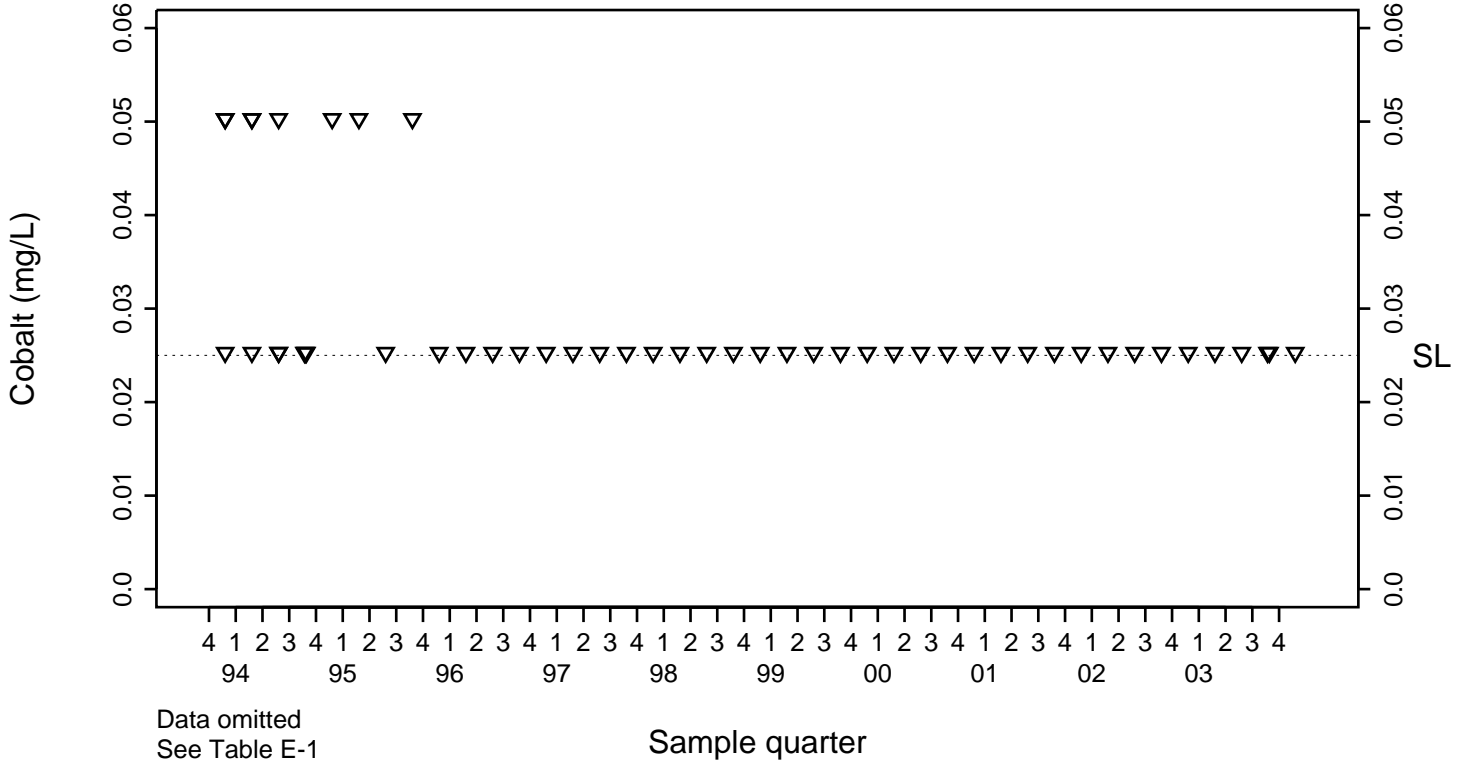
SL=0.025

Compliance Monitoring Point K7-03



SL=0.025

Compliance Monitoring Point K7-09

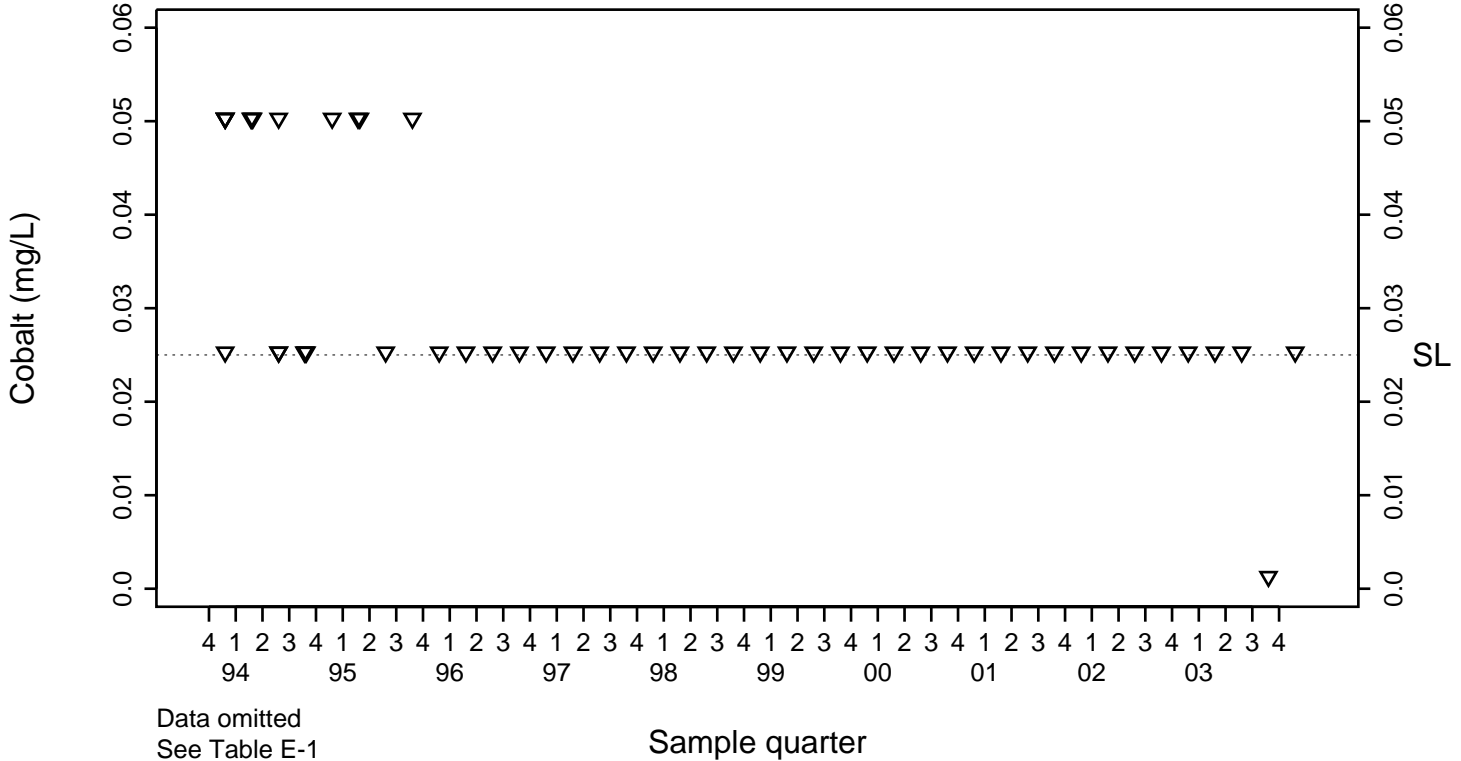


Pit 7 Complex Cobalt (mg/L)

◆ Above RL
▽ Below RL

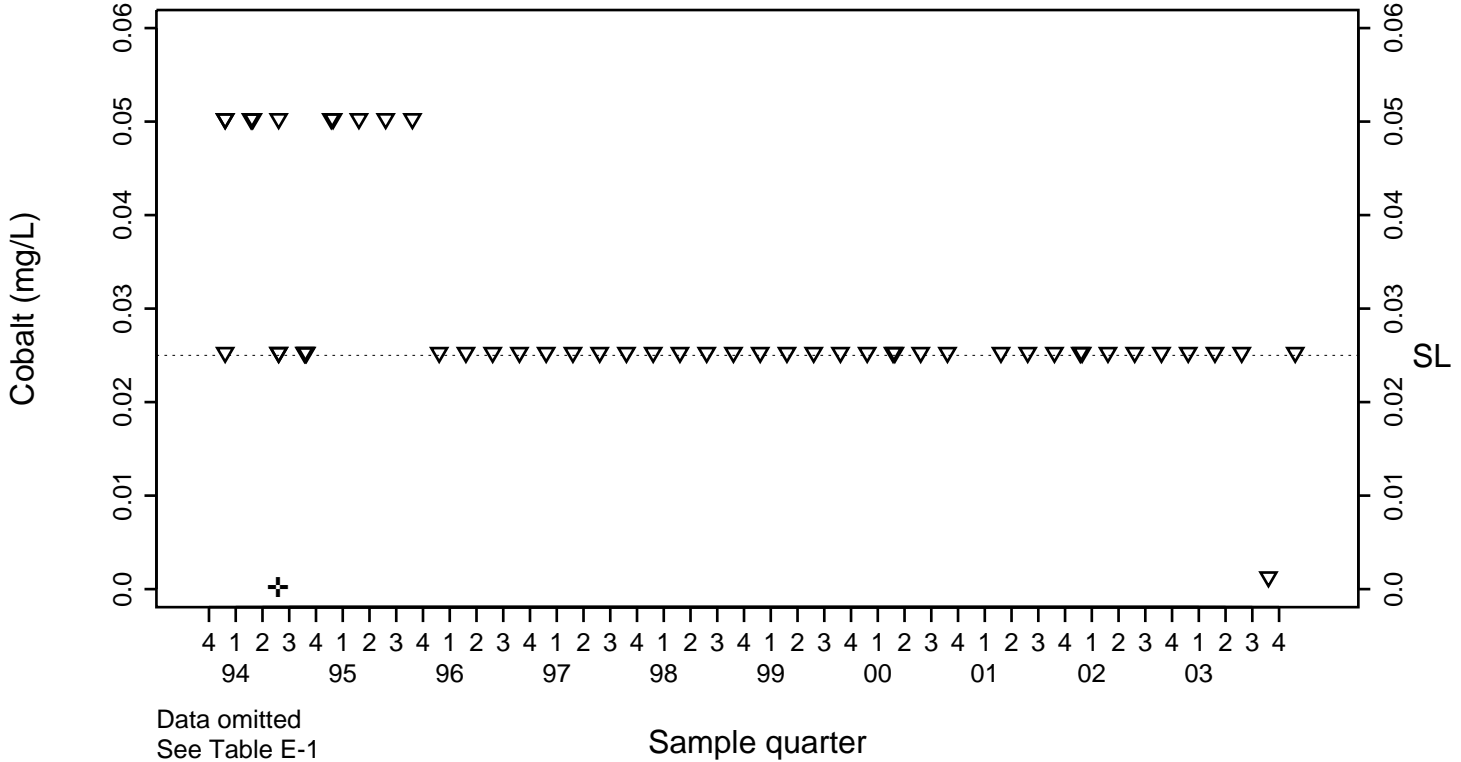
SL=0.025

Compliance Monitoring Point K7-10



SL=0.025

Compliance Monitoring Point NC7-25

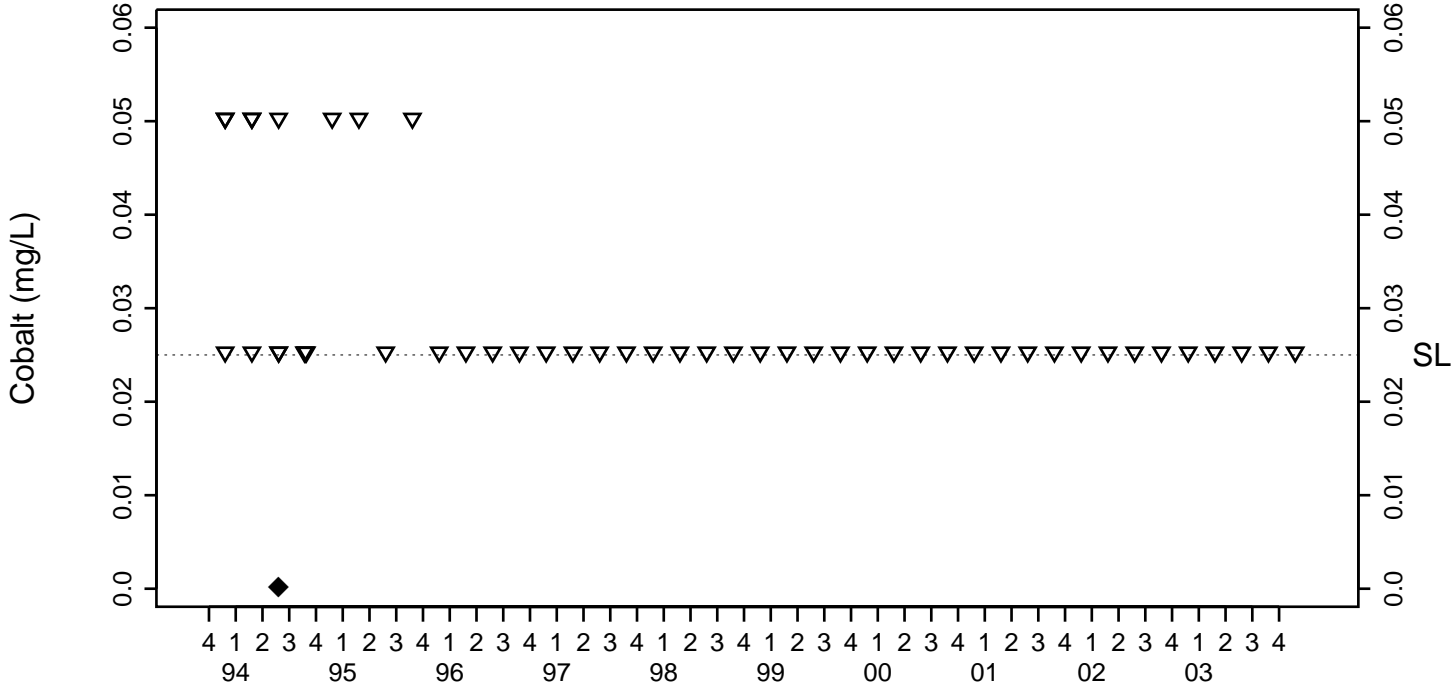


Pit 7 Complex Cobalt (mg/L)

◆ Above RL
▽ Below RL

SL=0.025

Compliance Monitoring Point NC7-26

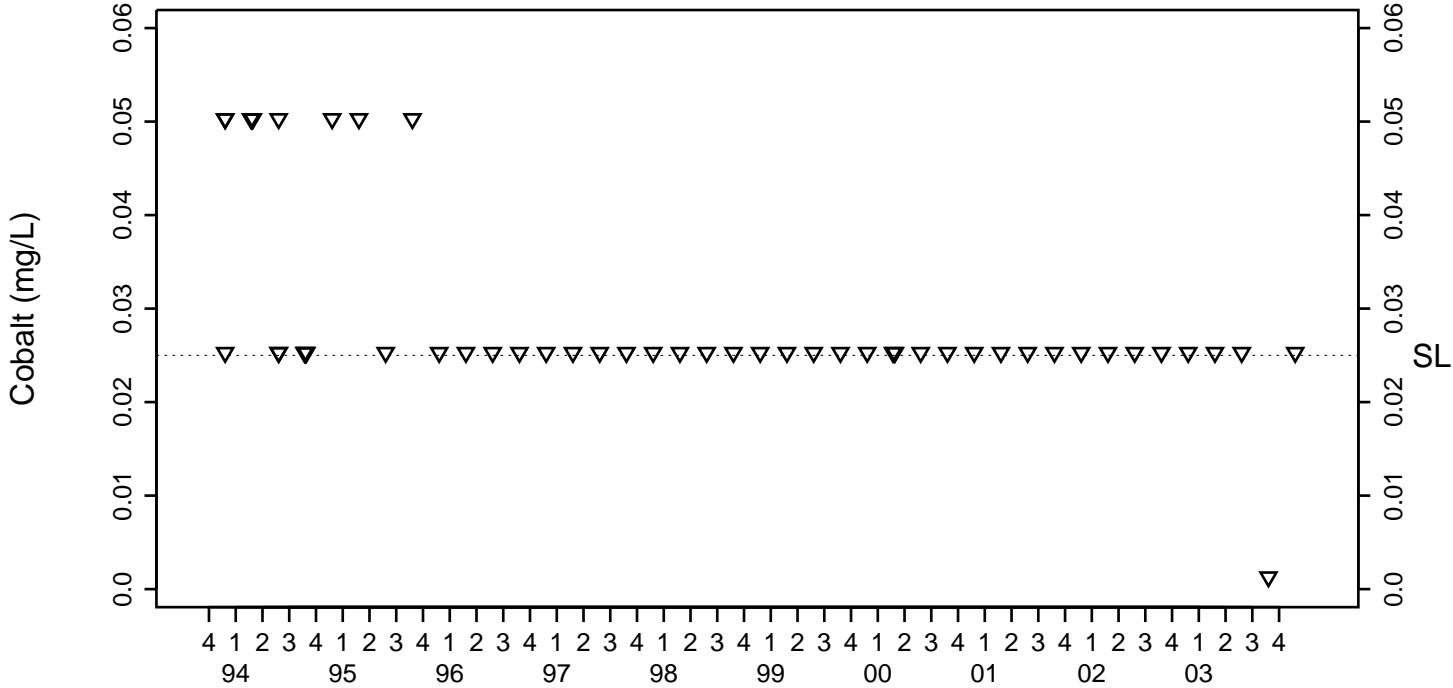


Data omitted
See Table E-1

Sample quarter

SL=0.025

Compliance Monitoring Point NC7-47



Data omitted
See Table E-1

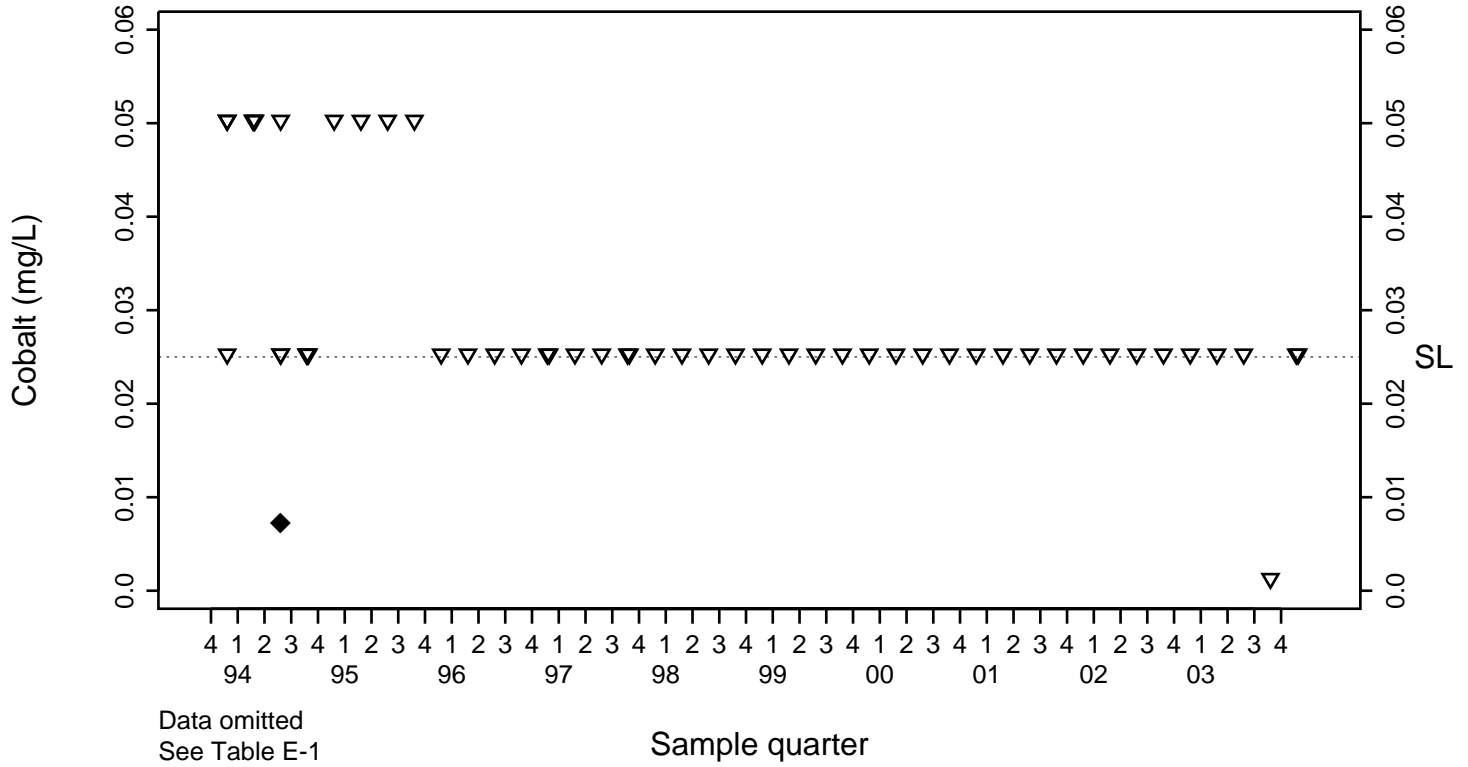
Sample quarter

Pit 7 Complex Cobalt (mg/L)

Compliance Monitoring Point NC7-48

SL=0.025

◆ Above RL
▽ Below RL

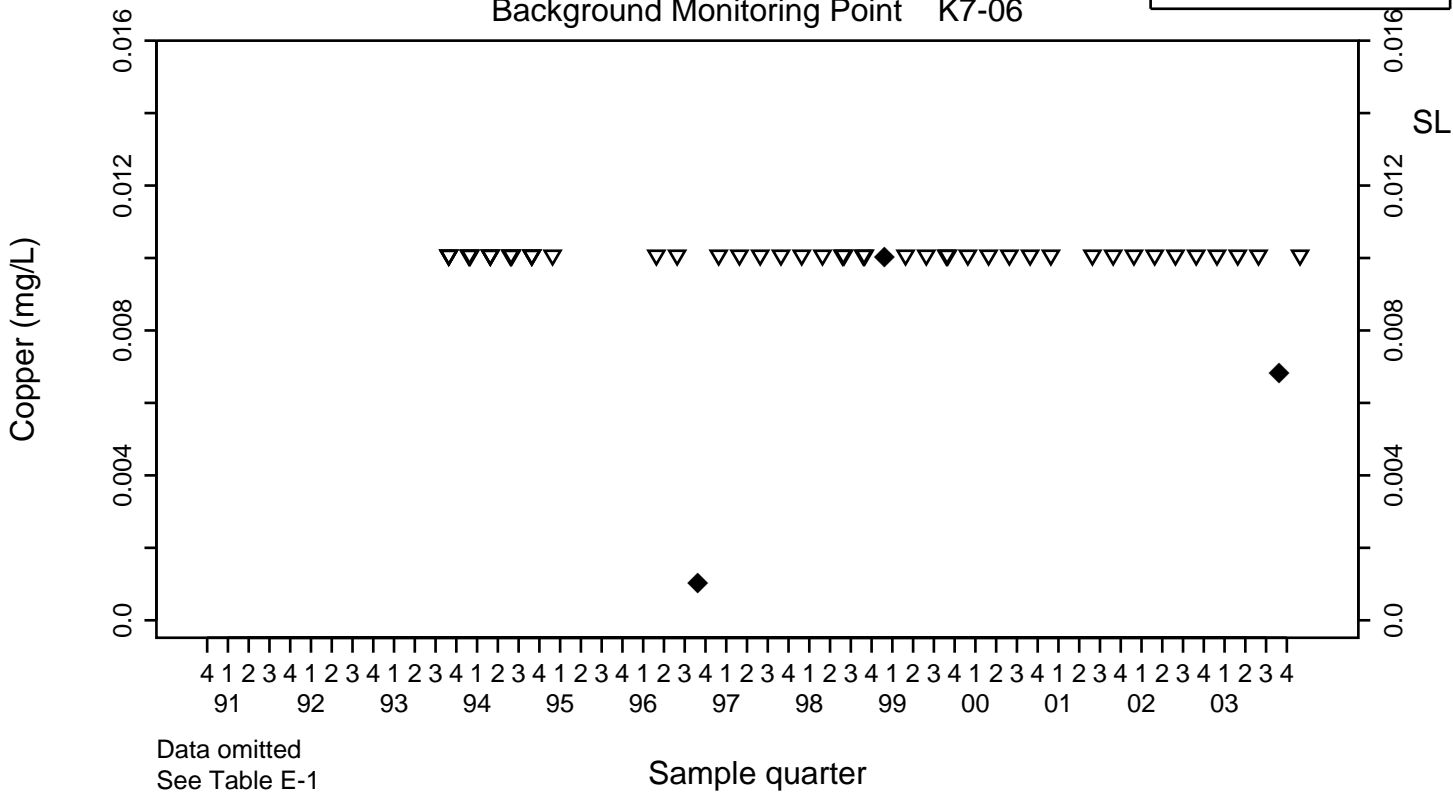


Data omitted
See Table E-1

Pit 7 Complex Copper (mg/L)

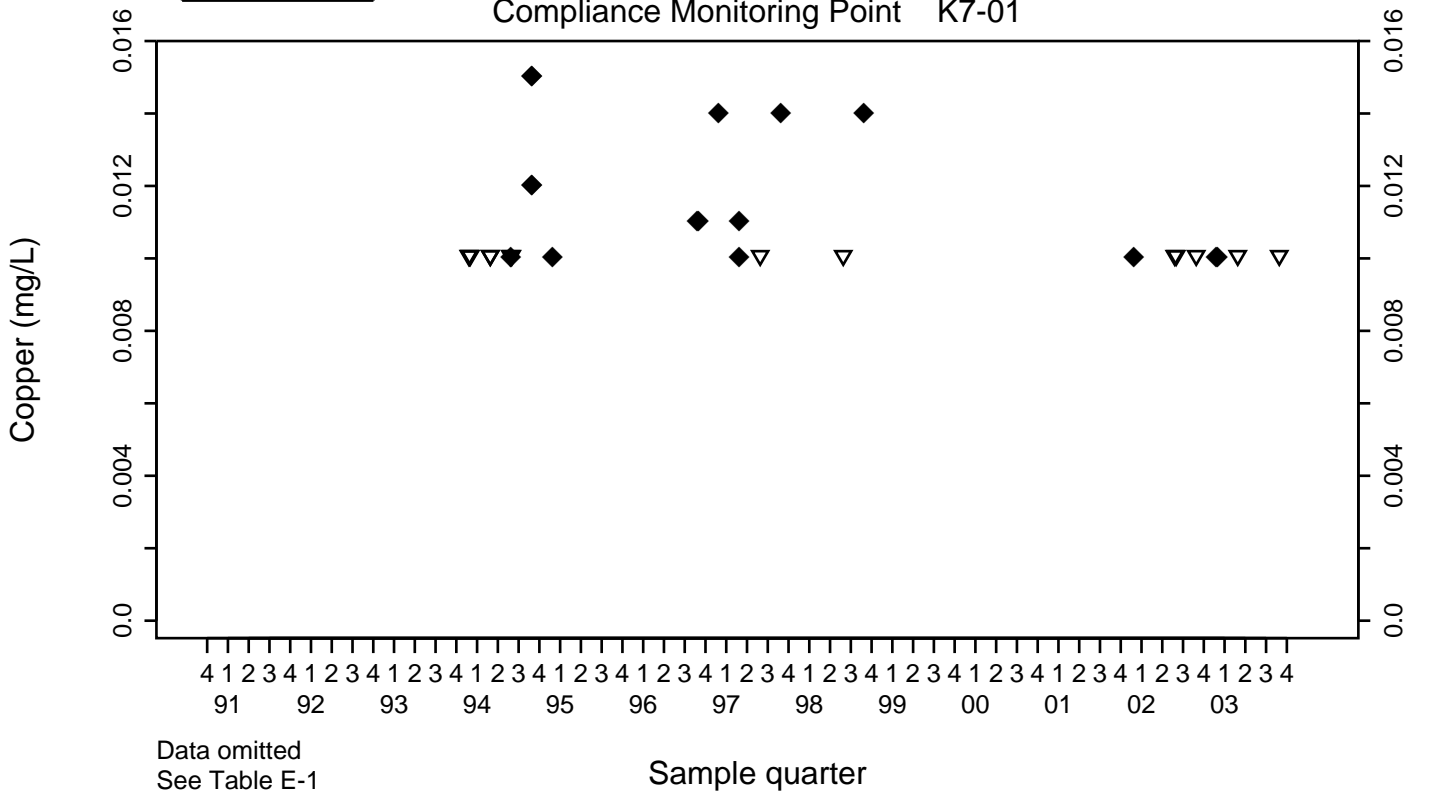
◆	Above RL
▽	Below RL

Background Monitoring Point K7-06



SL=0.04

Compliance Monitoring Point K7-01

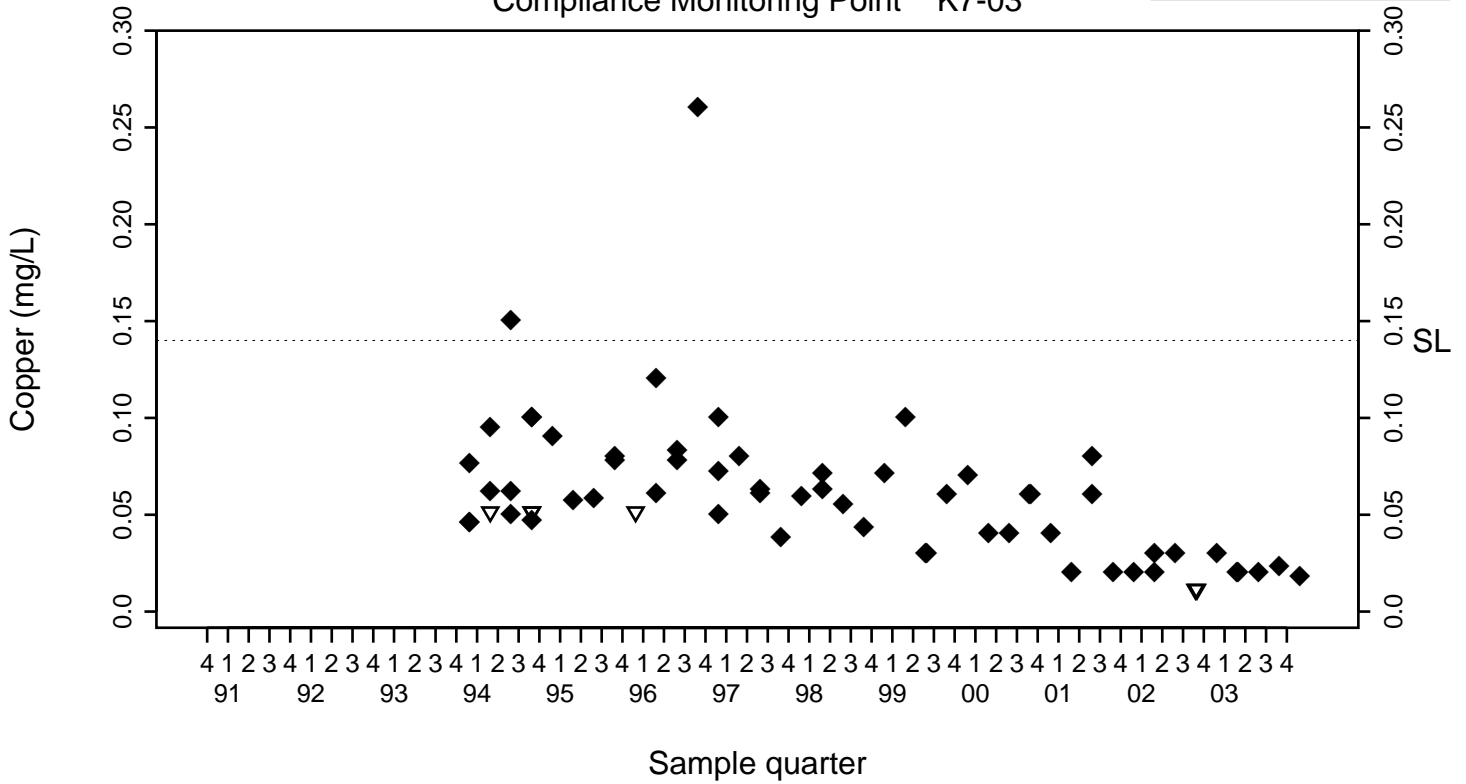


Pit 7 Complex Copper (mg/L)

SL=0.14

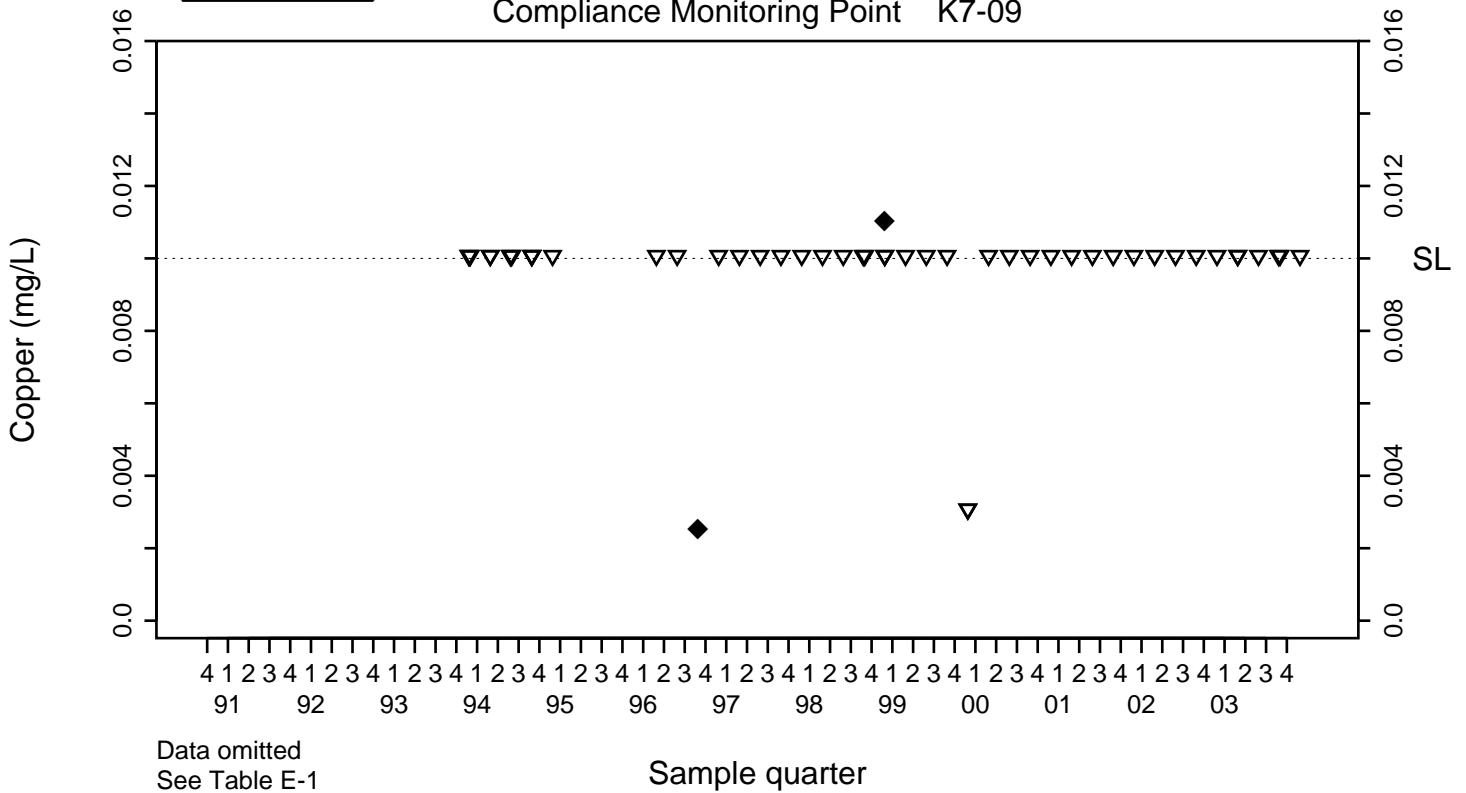
◆ Above RL
▽ Below RL

Compliance Monitoring Point K7-03



SL=0.01

Compliance Monitoring Point K7-09



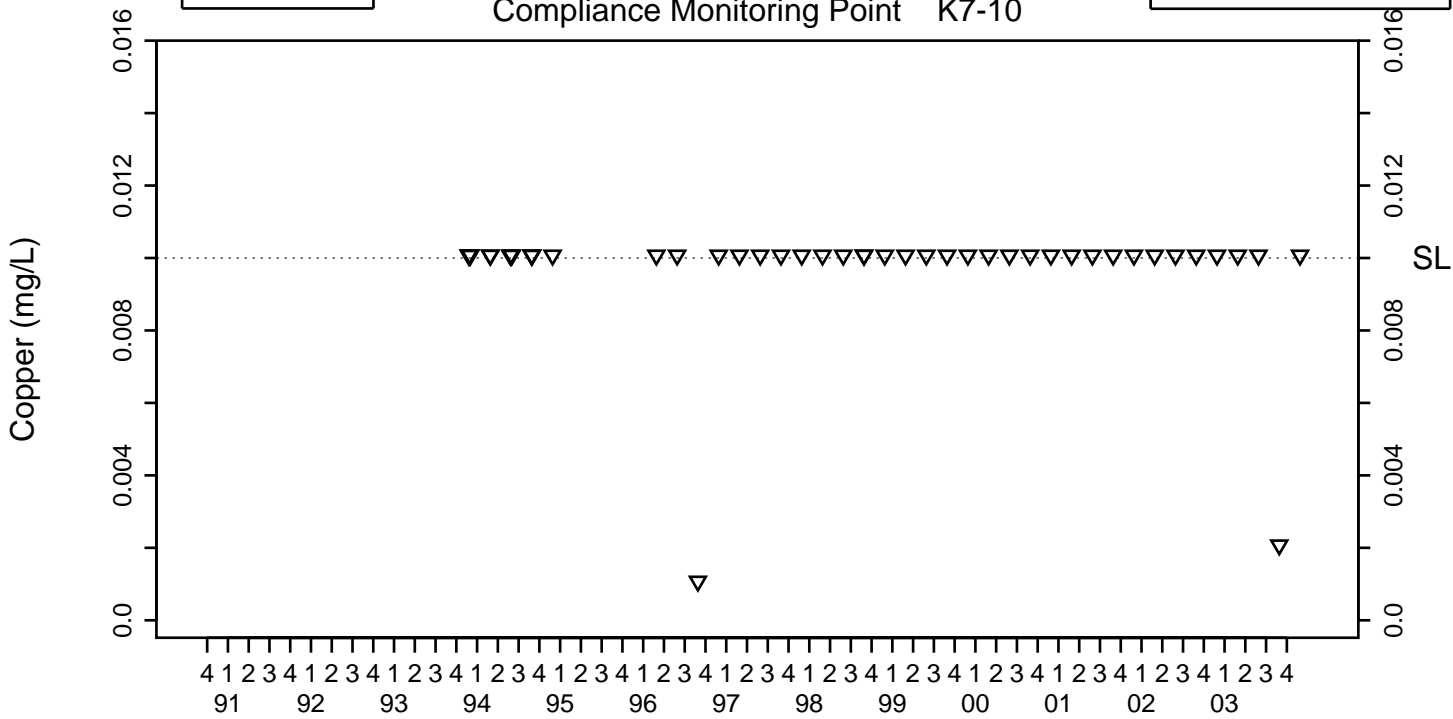
Data omitted
See Table E-1

Pit 7 Complex Copper (mg/L)

Compliance Monitoring Point K7-10

◆	Above RL
▽	Below RL

SL=0.01

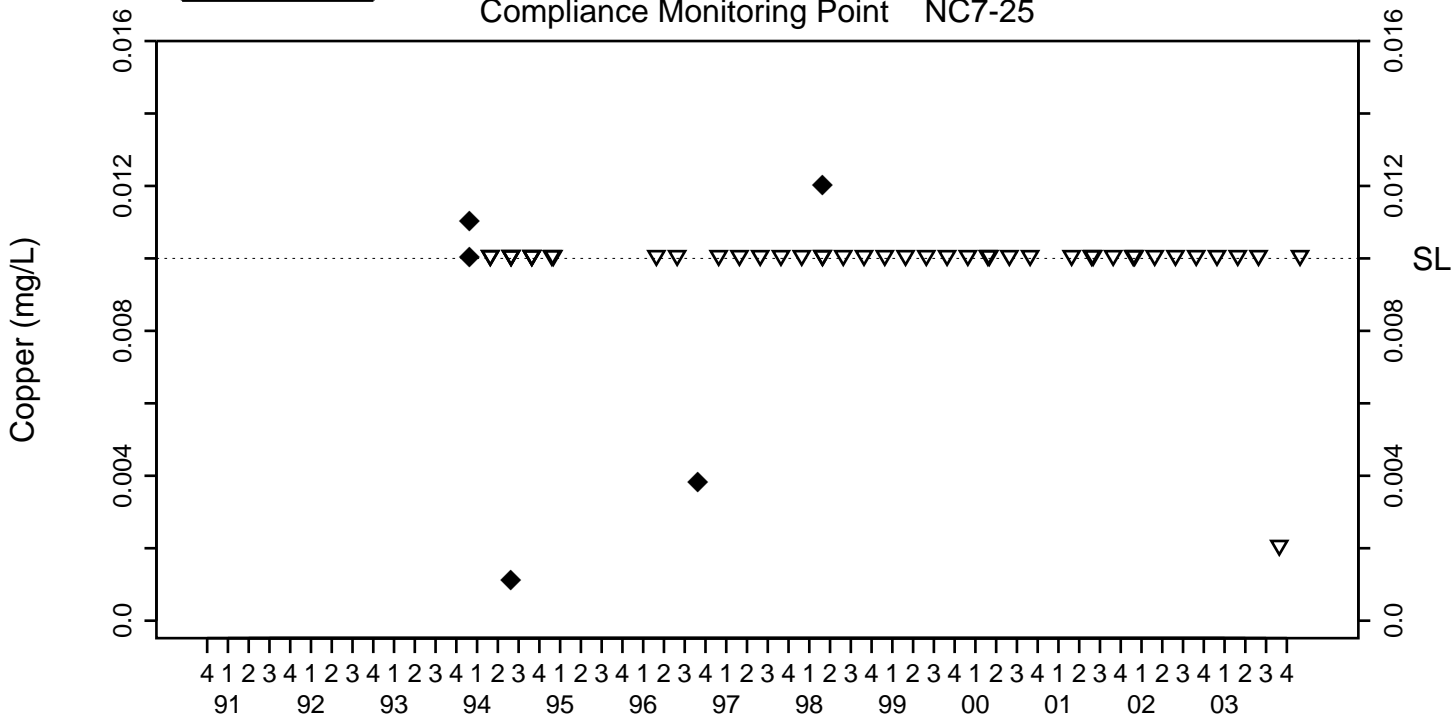


Data omitted
See Table E-1

Sample quarter

SL=0.01

Compliance Monitoring Point NC7-25



Data omitted
See Table E-1

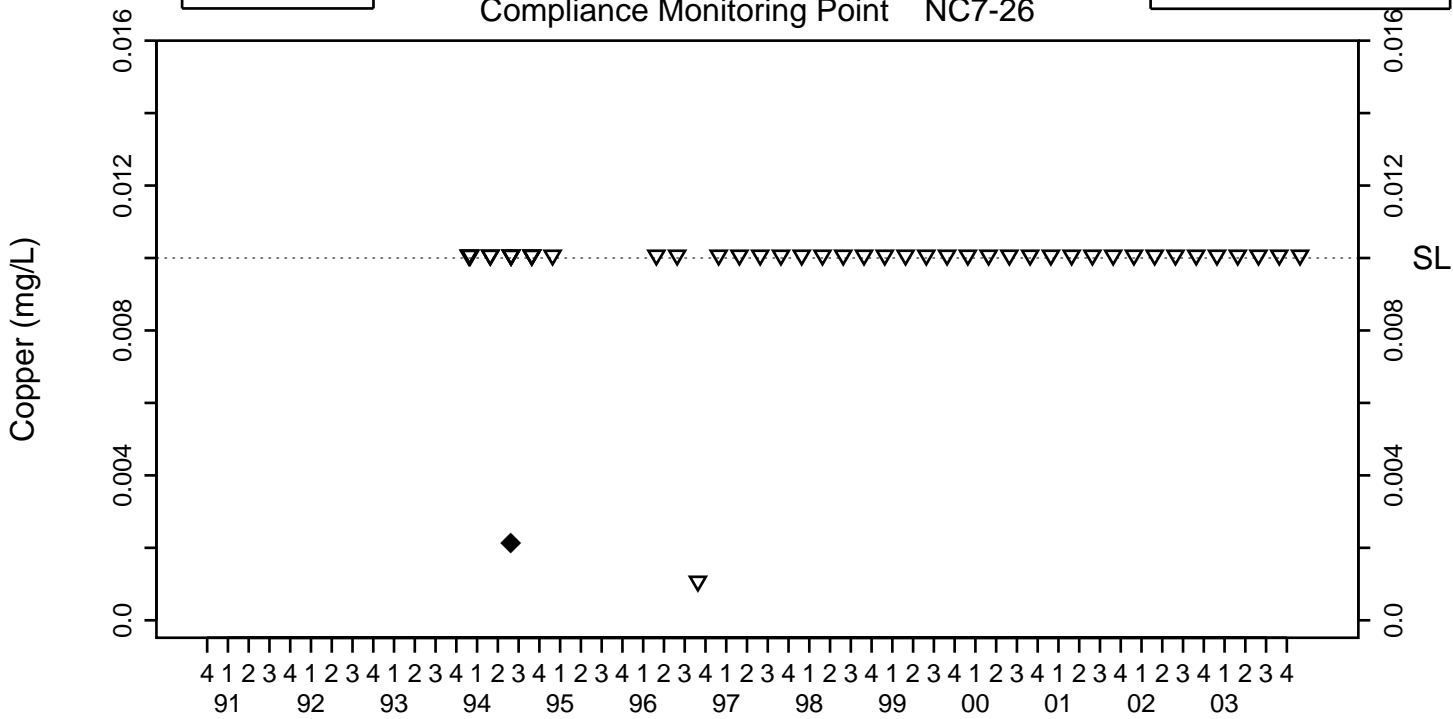
Sample quarter

Pit 7 Complex Copper (mg/L)

Compliance Monitoring Point NC7-26

◆	Above RL
▽	Below RL

SL=0.01

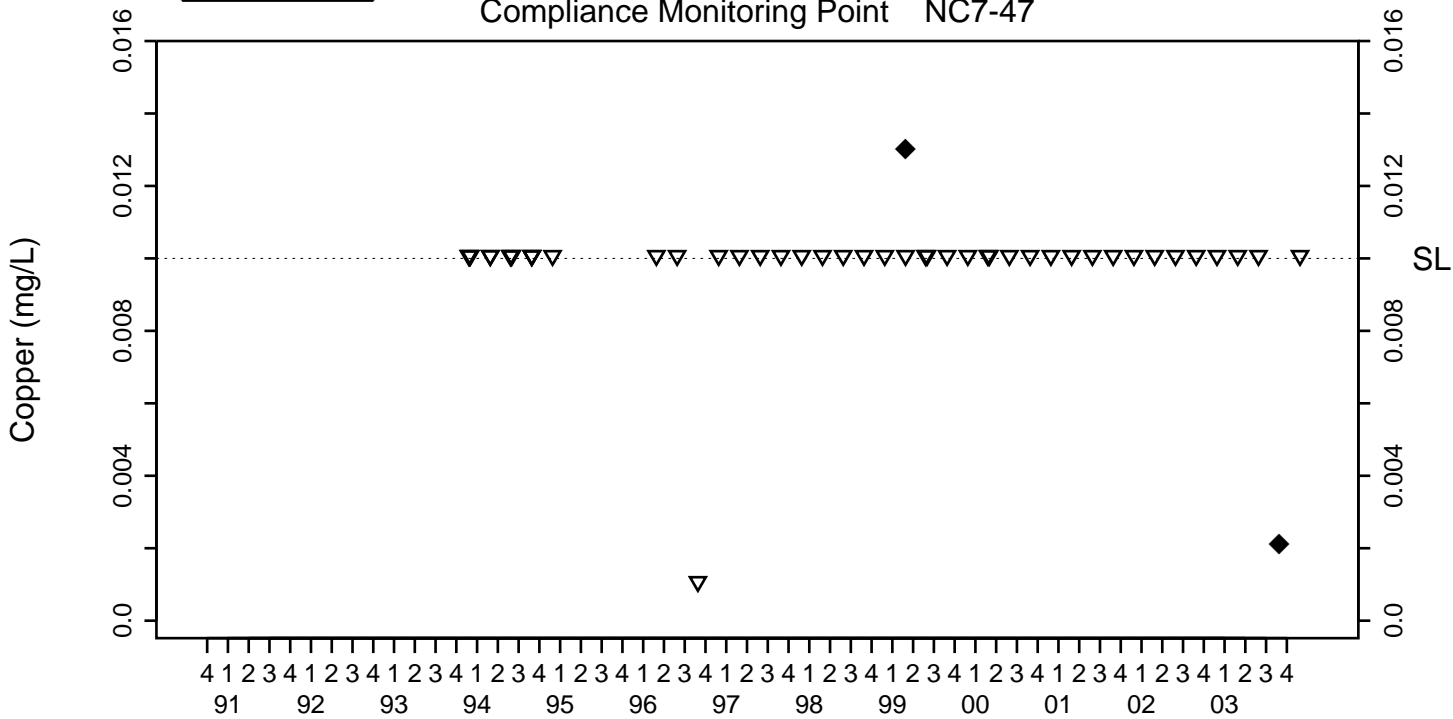


Data omitted
See Table E-1

Sample quarter

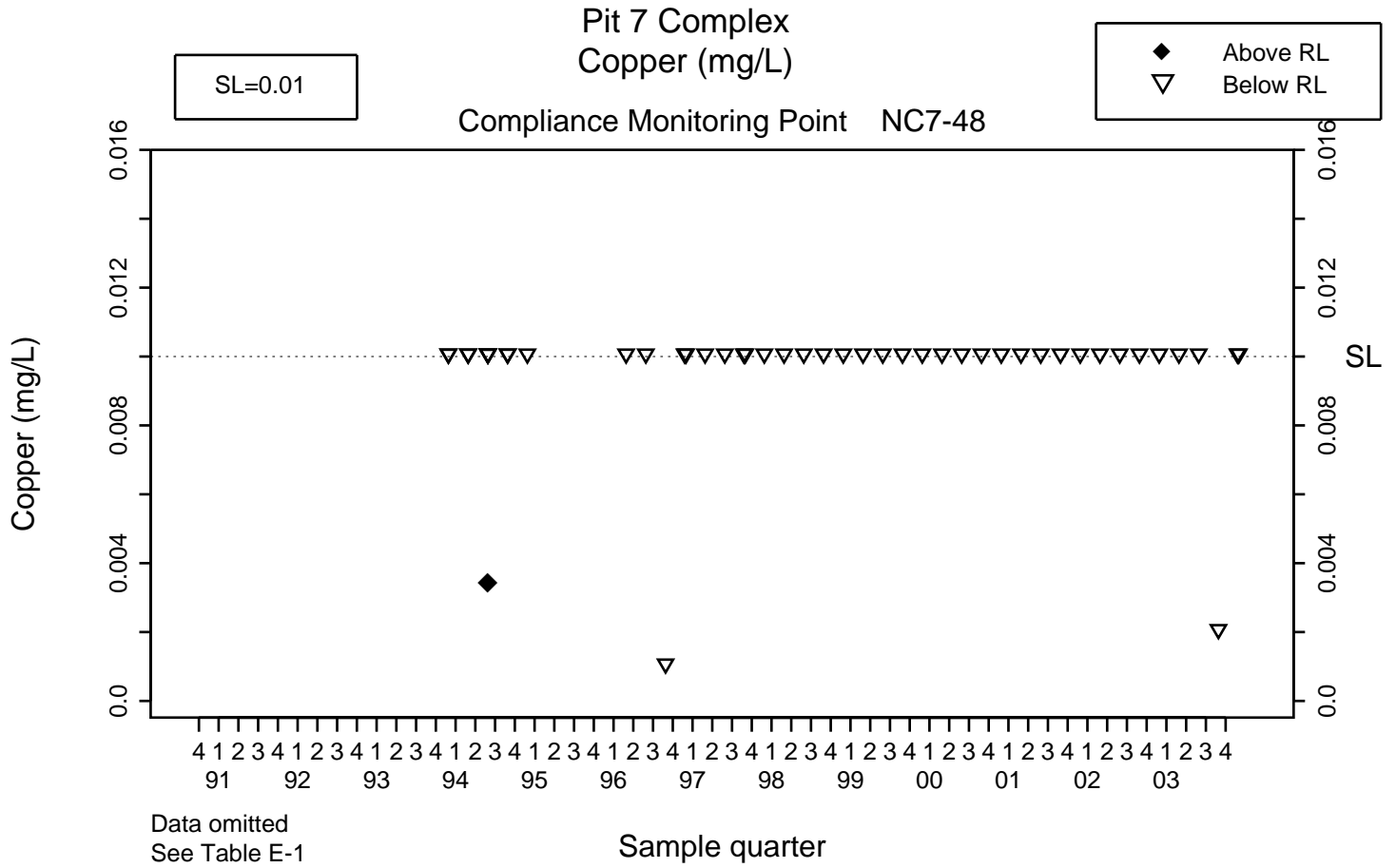
Compliance Monitoring Point NC7-47

SL=0.01

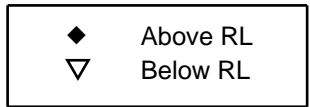


Data omitted
See Table E-1

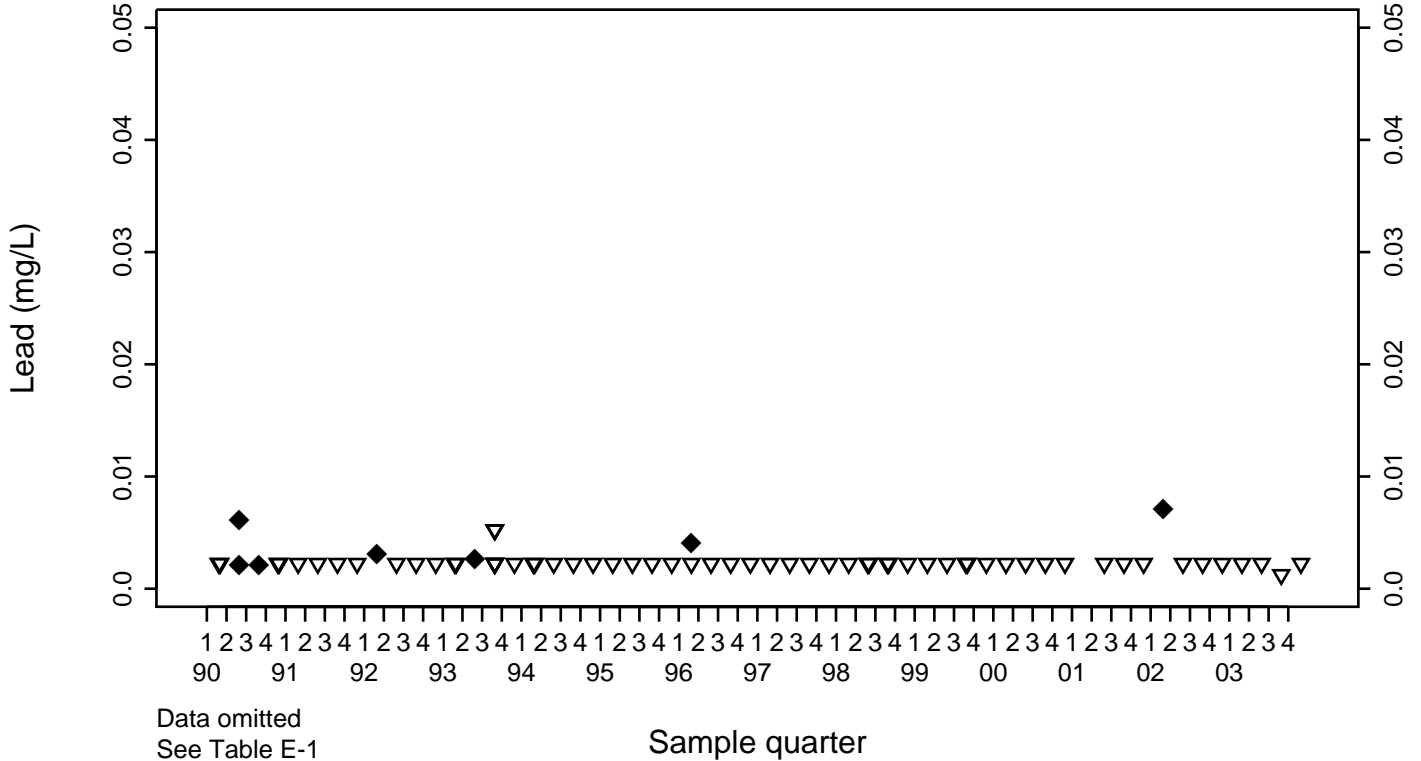
Sample quarter



Pit 7 Complex Lead (mg/L)

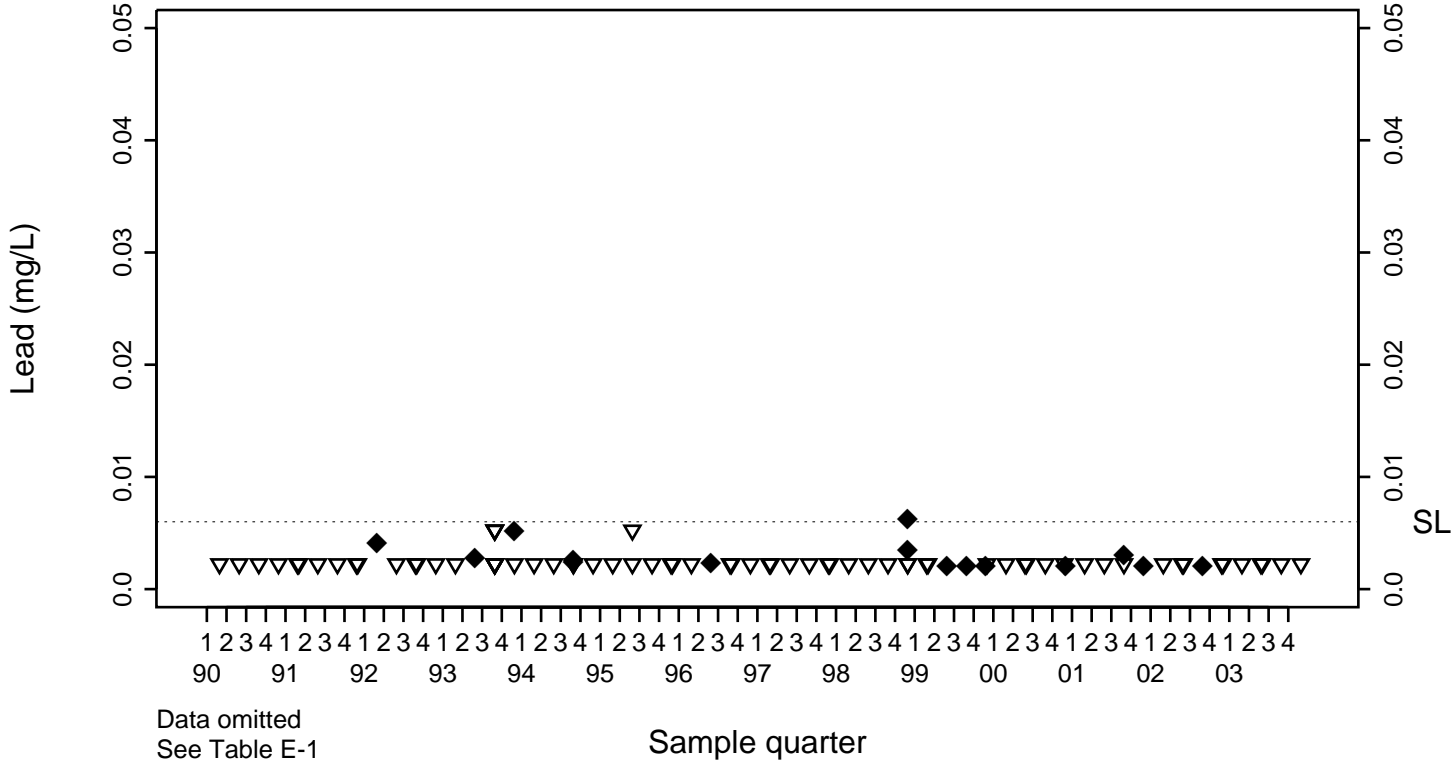


Background Monitoring Point K7-06



SL=0.006

Compliance Monitoring Point K7-01

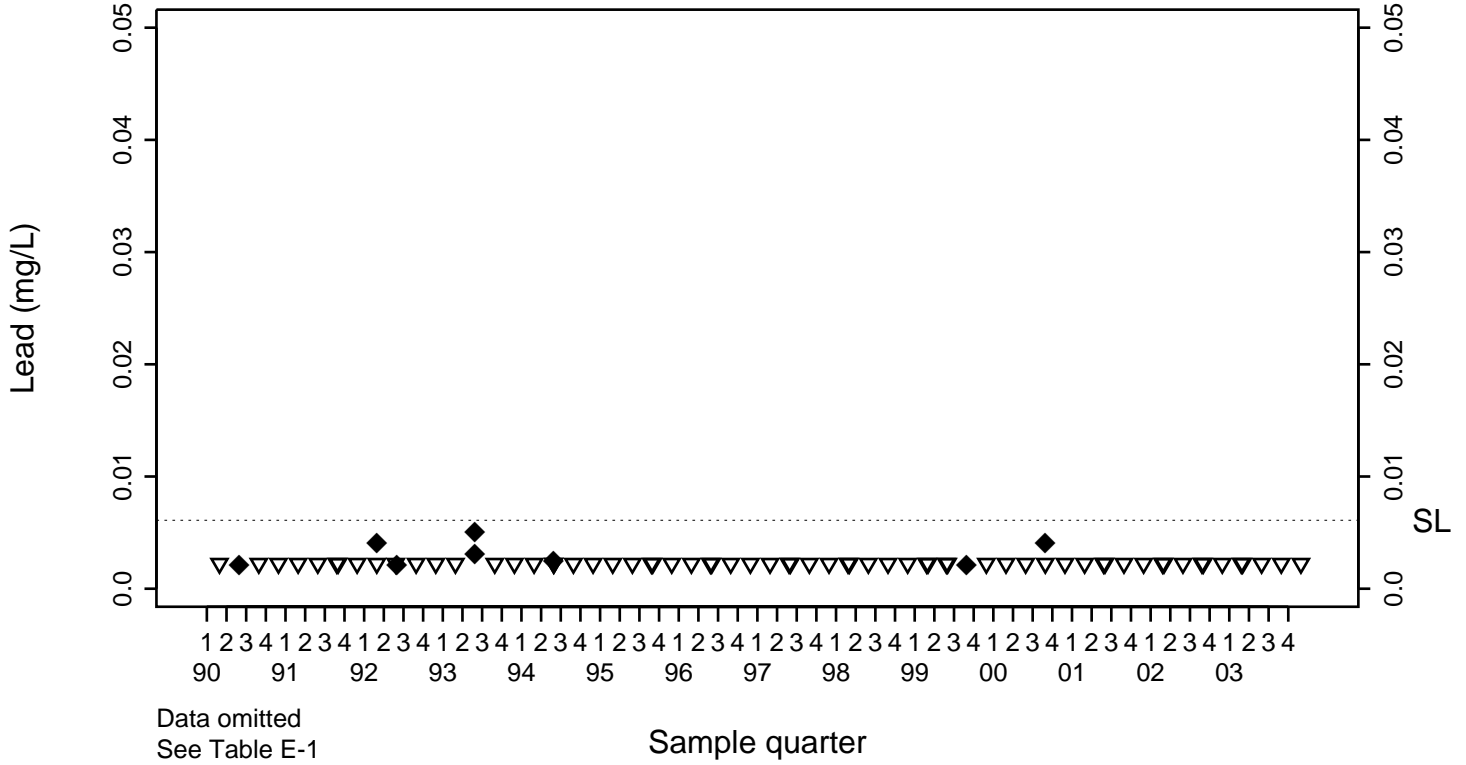


Pit 7 Complex Lead (mg/L)

SL=0.0061

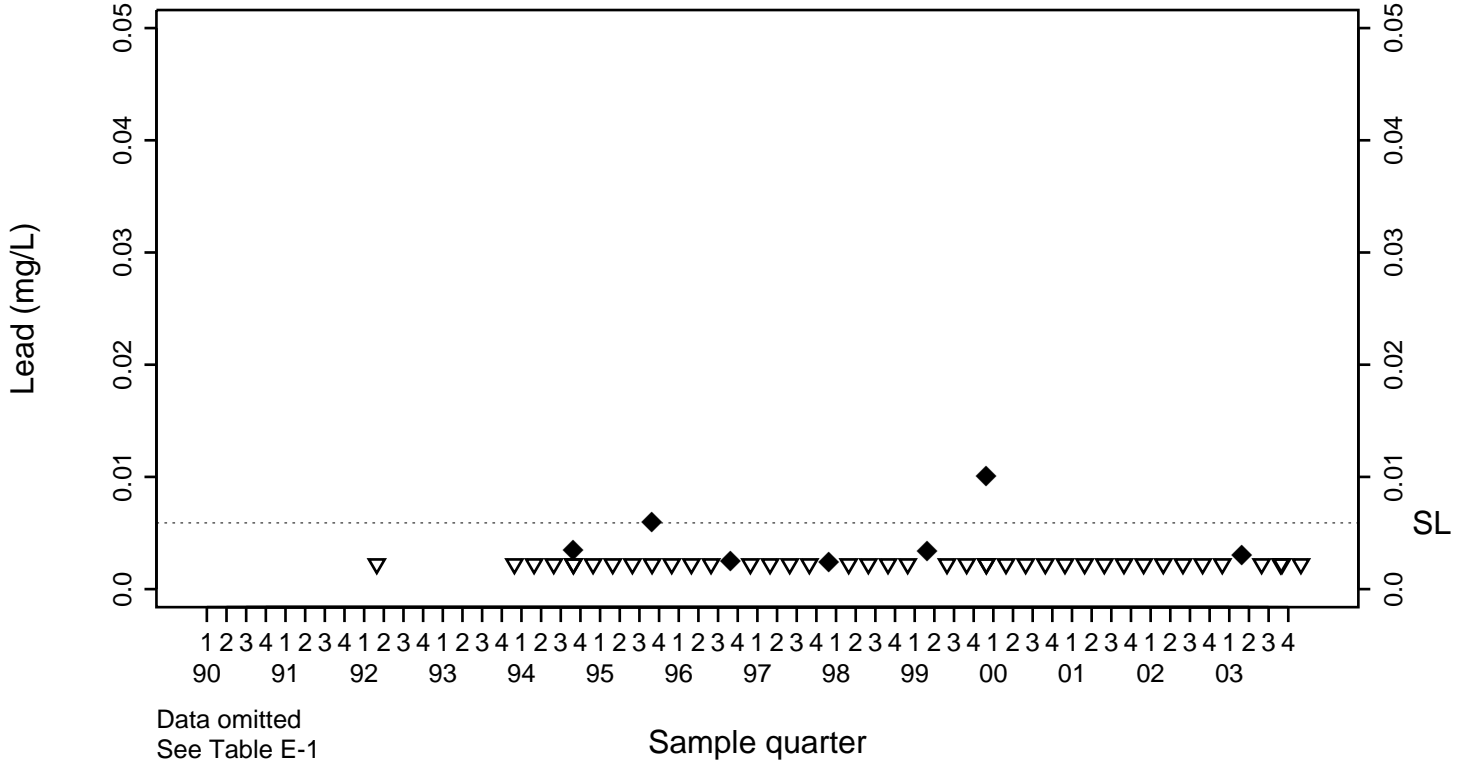
◆ Above RL
▽ Below RL

Compliance Monitoring Point K7-03



SL=0.0059

Compliance Monitoring Point K7-09

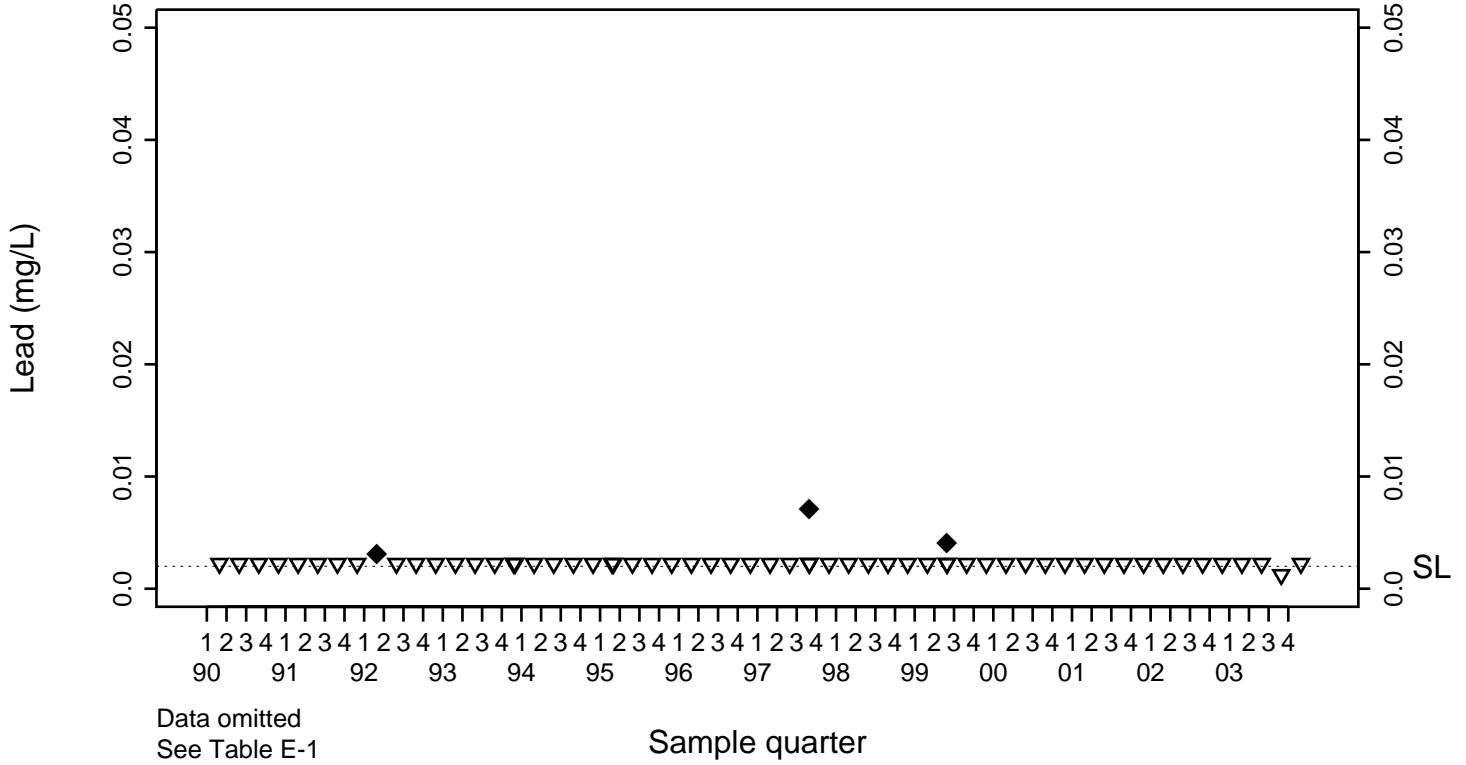


Pit 7 Complex Lead (mg/L)

SL=0.002

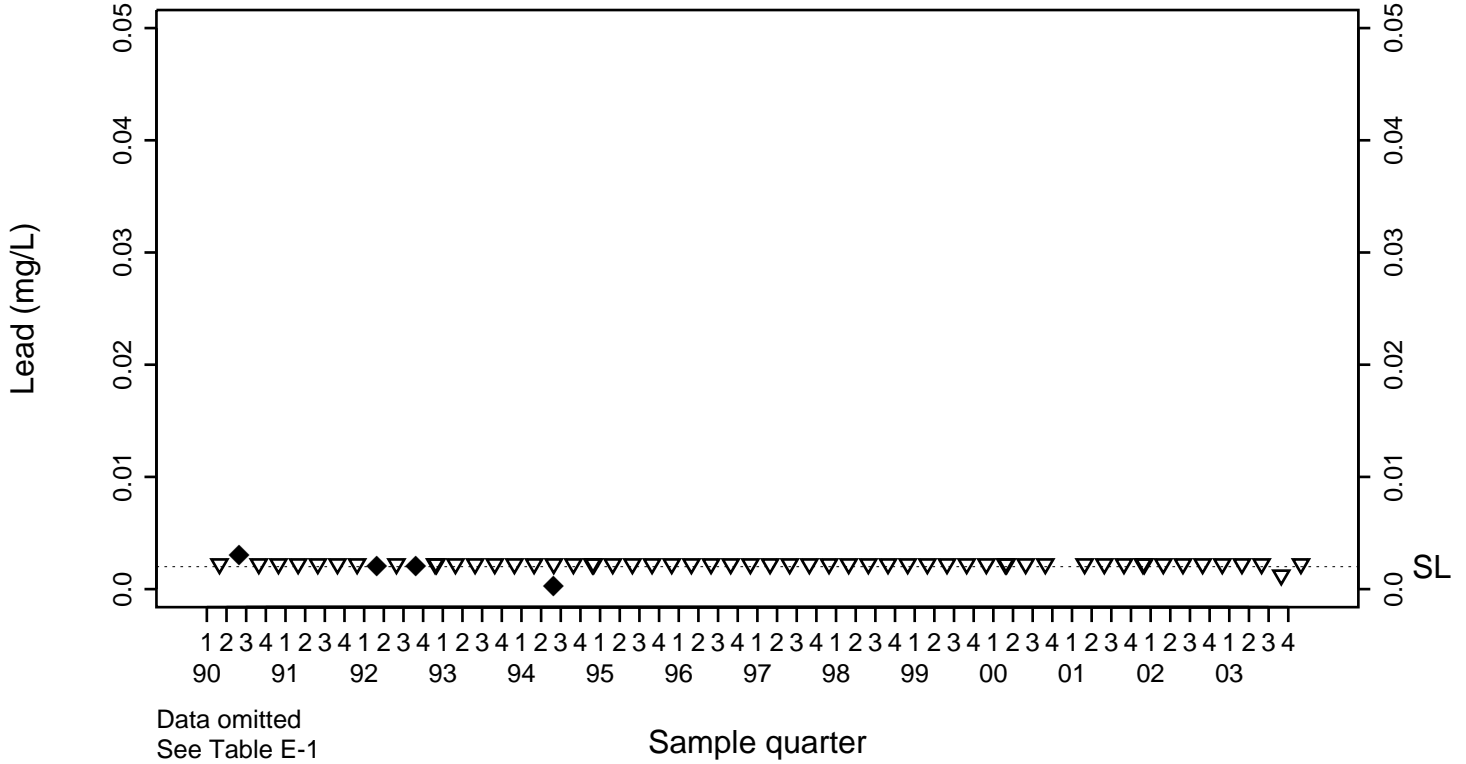
◆ Above RL
▽ Below RL

Compliance Monitoring Point K7-10



SL=0.002

Compliance Monitoring Point NC7-25

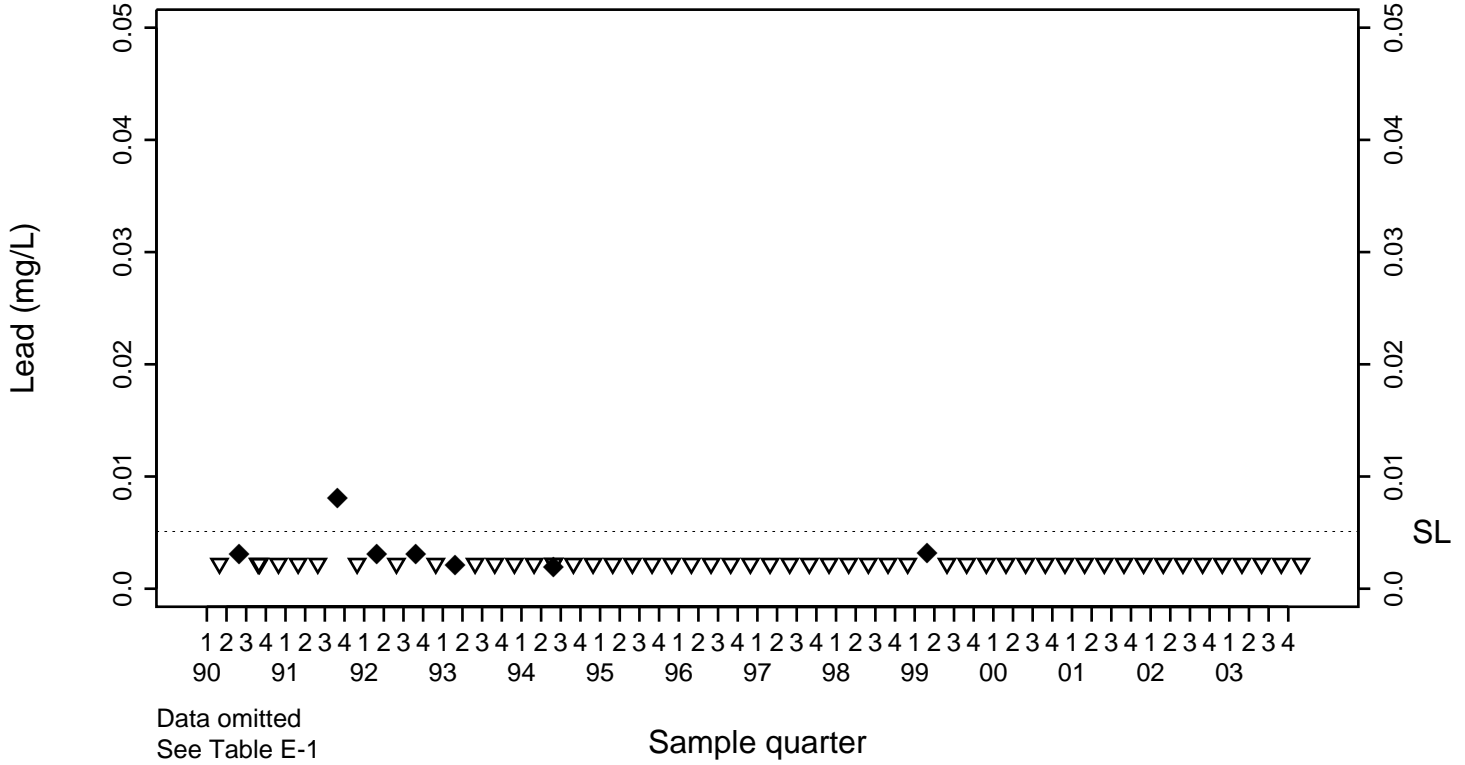


Pit 7 Complex Lead (mg/L)

SL=0.0051

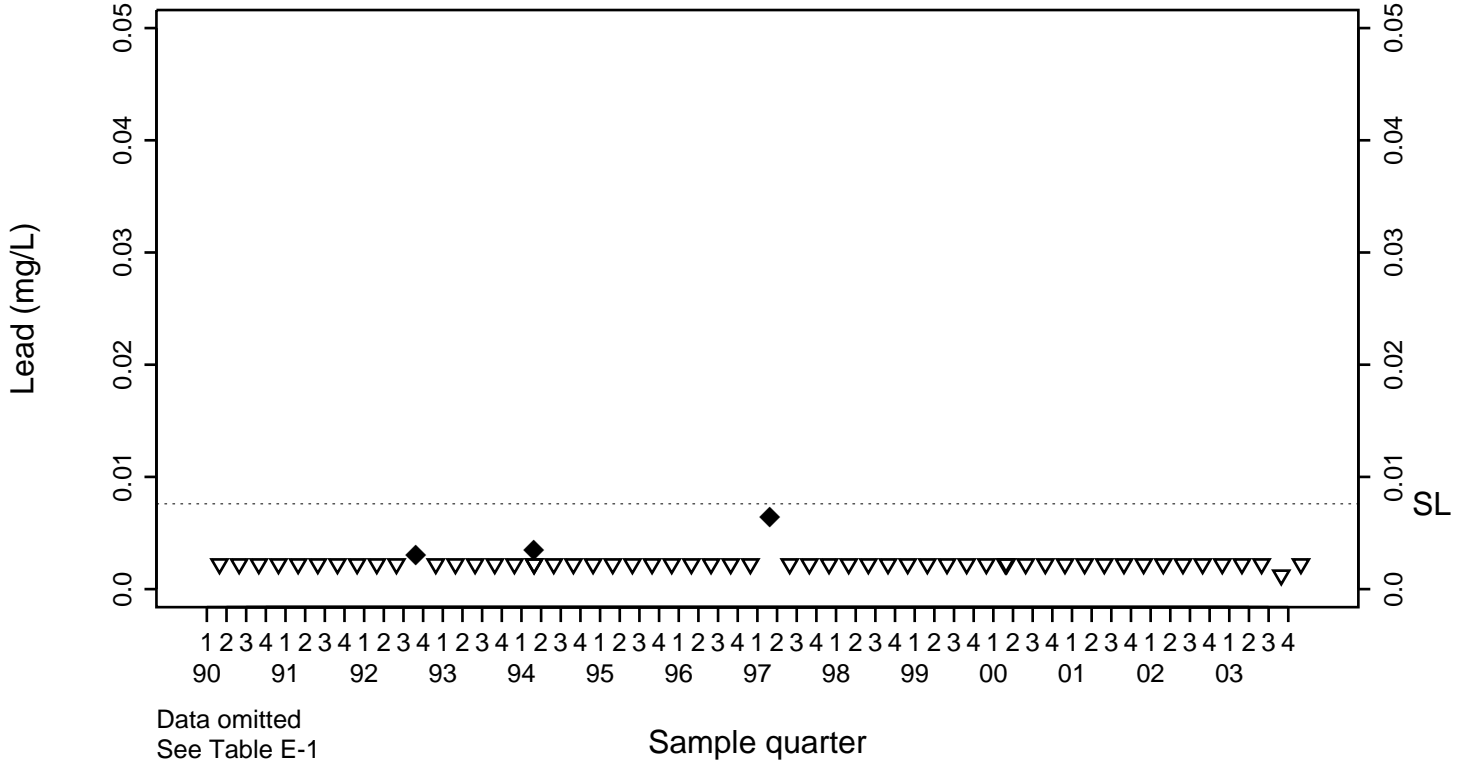
◆ Above RL
▽ Below RL

Compliance Monitoring Point NC7-26



SL=0.0076

Compliance Monitoring Point NC7-47

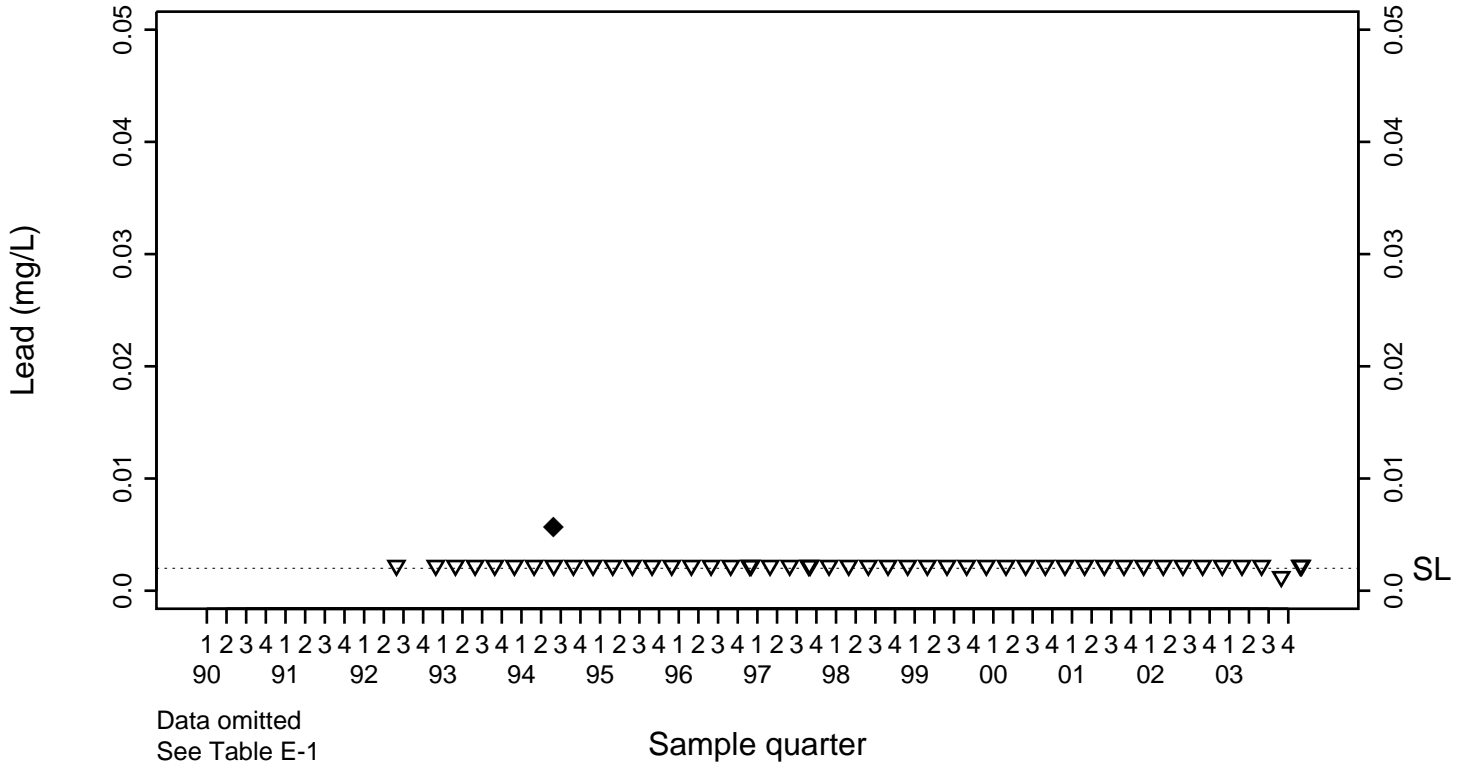


Pit 7 Complex Lead (mg/L)

Compliance Monitoring Point NC7-48

SL=0.002

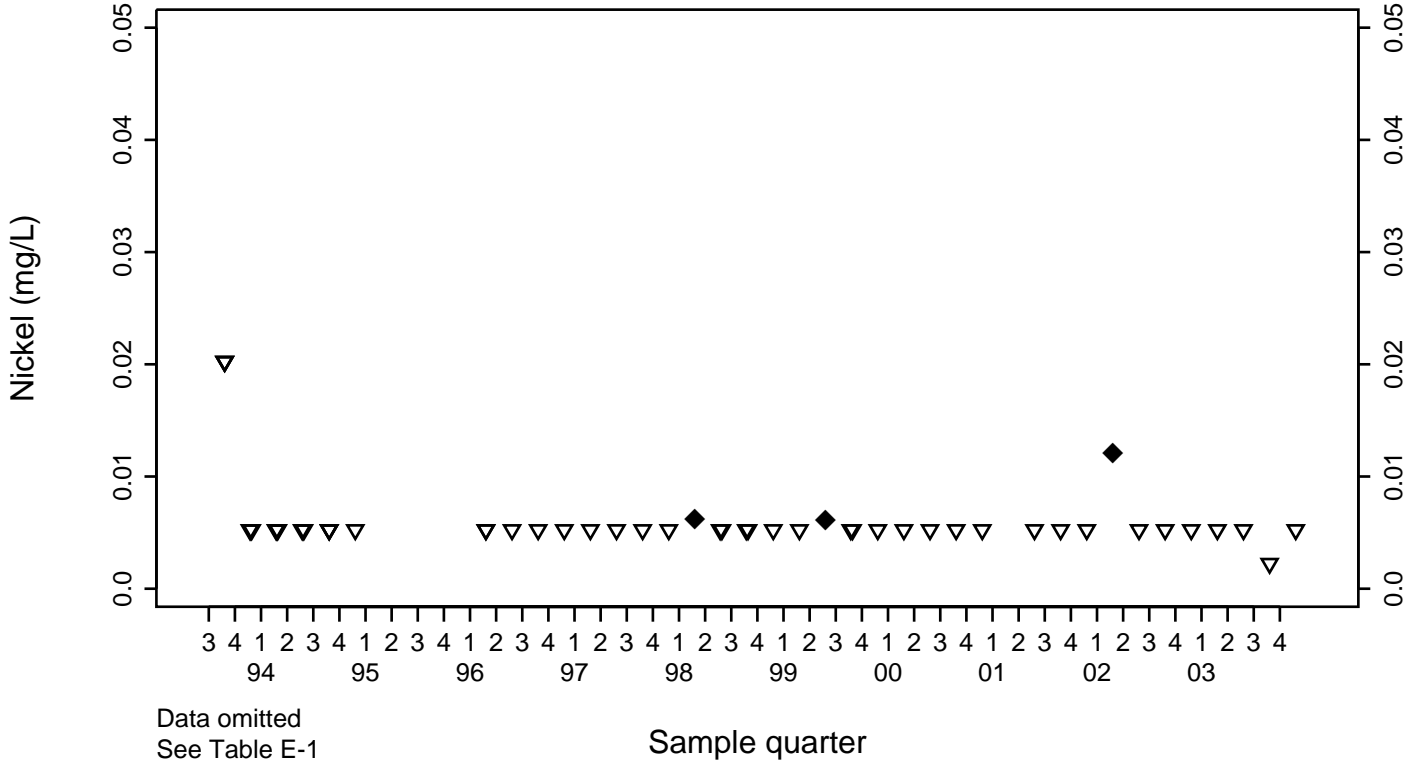
◆ Above RL
▽ Below RL



Pit 7 Complex Nickel (mg/L)

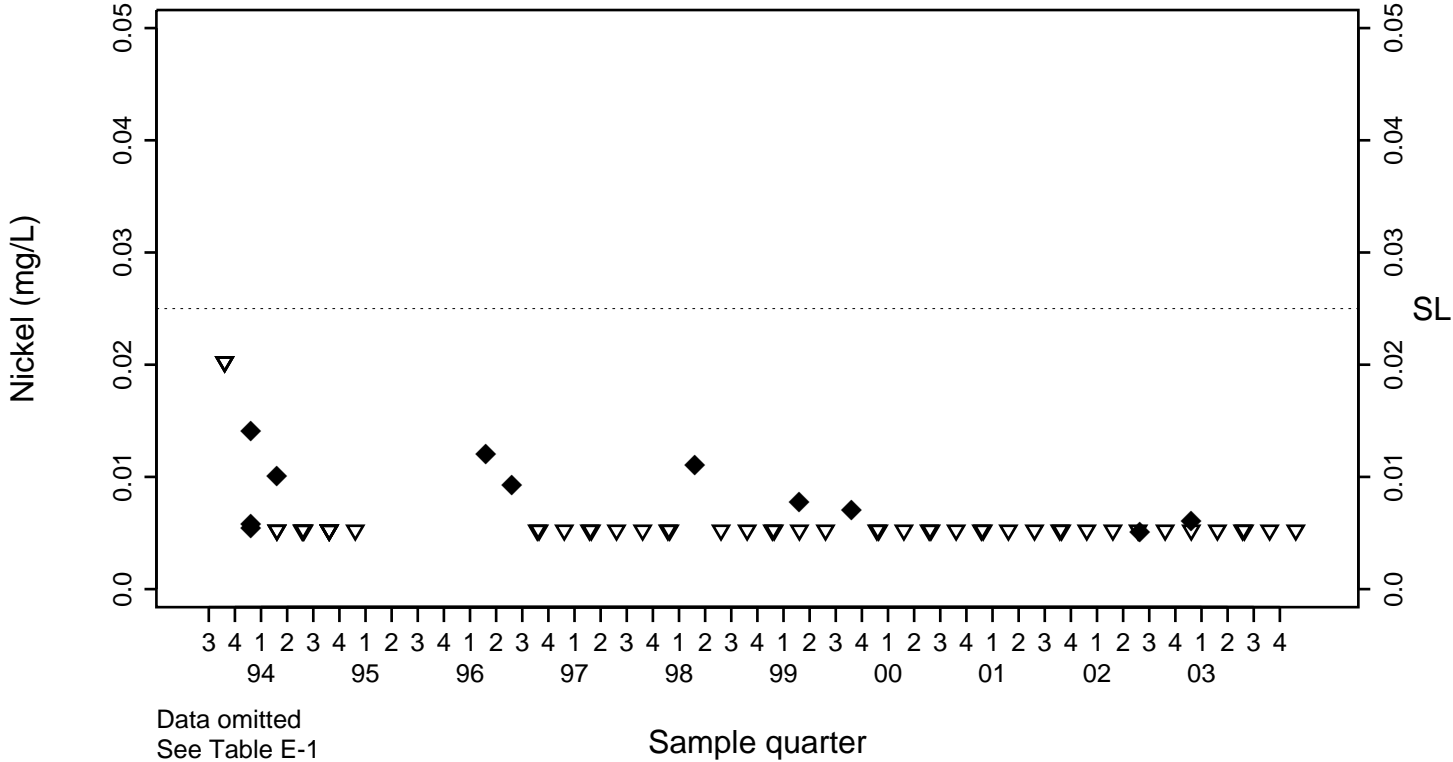
◆	Above RL
▽	Below RL

Background Monitoring Point K7-06



SL=0.025

Compliance Monitoring Point K7-01

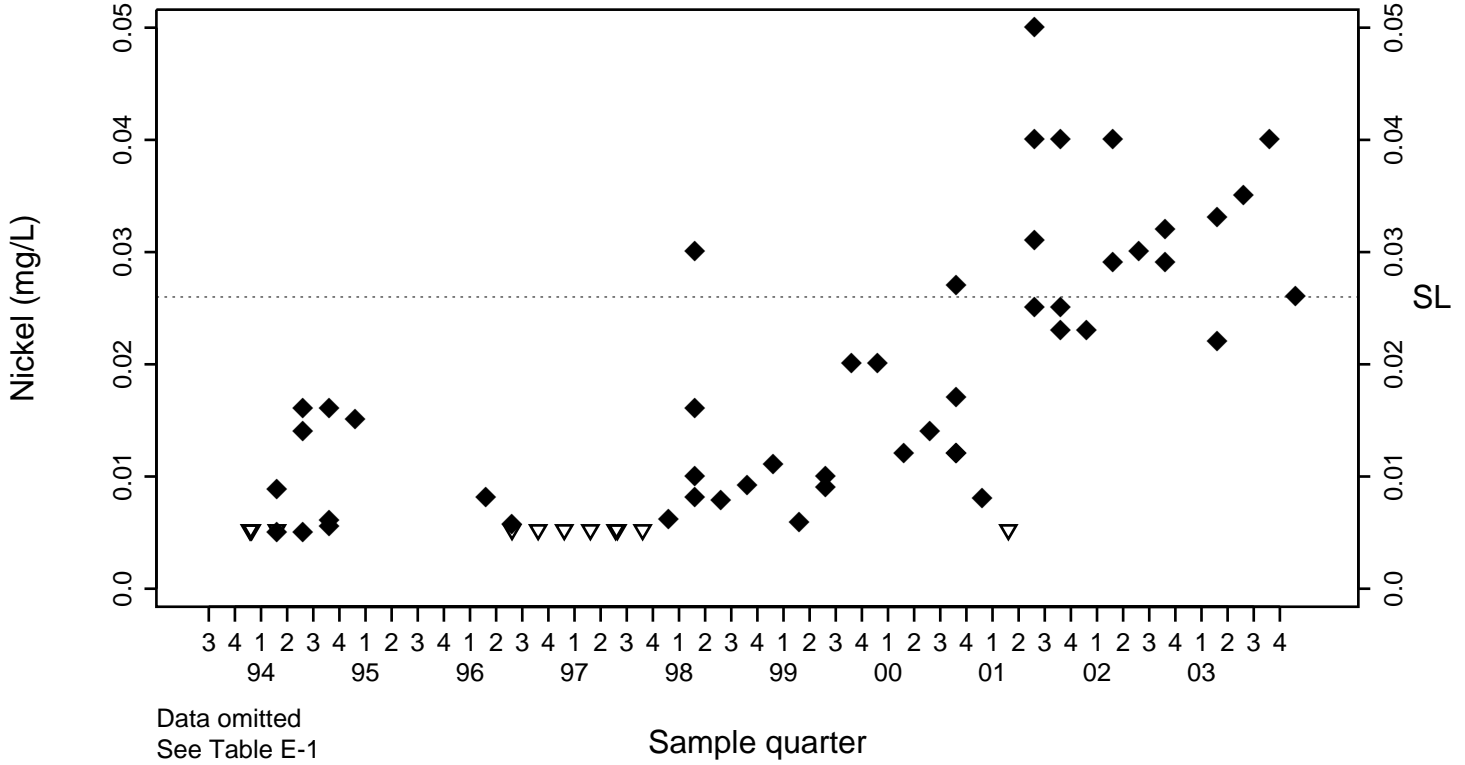


Pit 7 Complex Nickel (mg/L)

SL=0.026

◆ Above RL
▽ Below RL

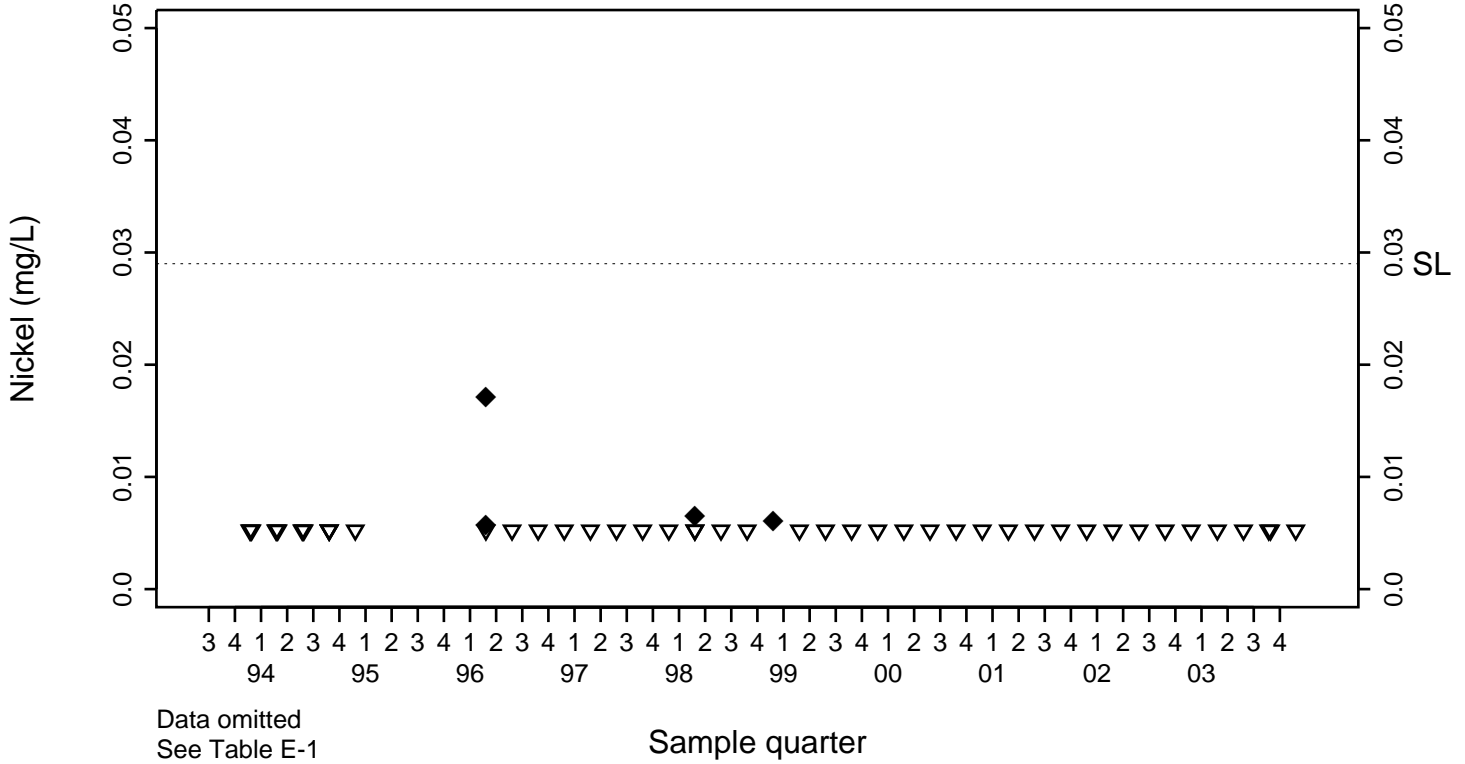
Compliance Monitoring Point K7-03



Data omitted
See Table E-1

SL=0.029

Compliance Monitoring Point K7-09



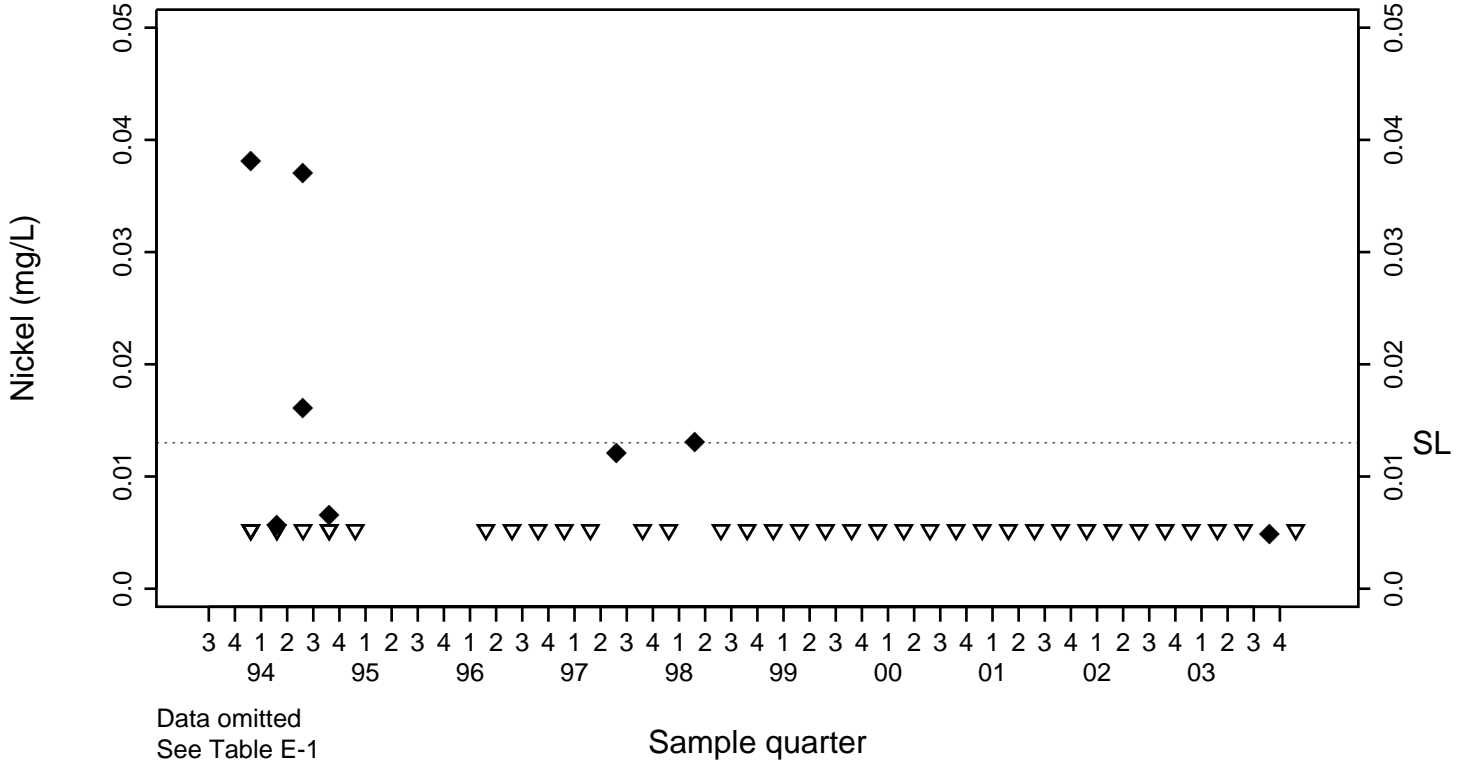
Data omitted
See Table E-1

Pit 7 Complex Nickel (mg/L)

SL=0.013

◆ Above RL
▽ Below RL

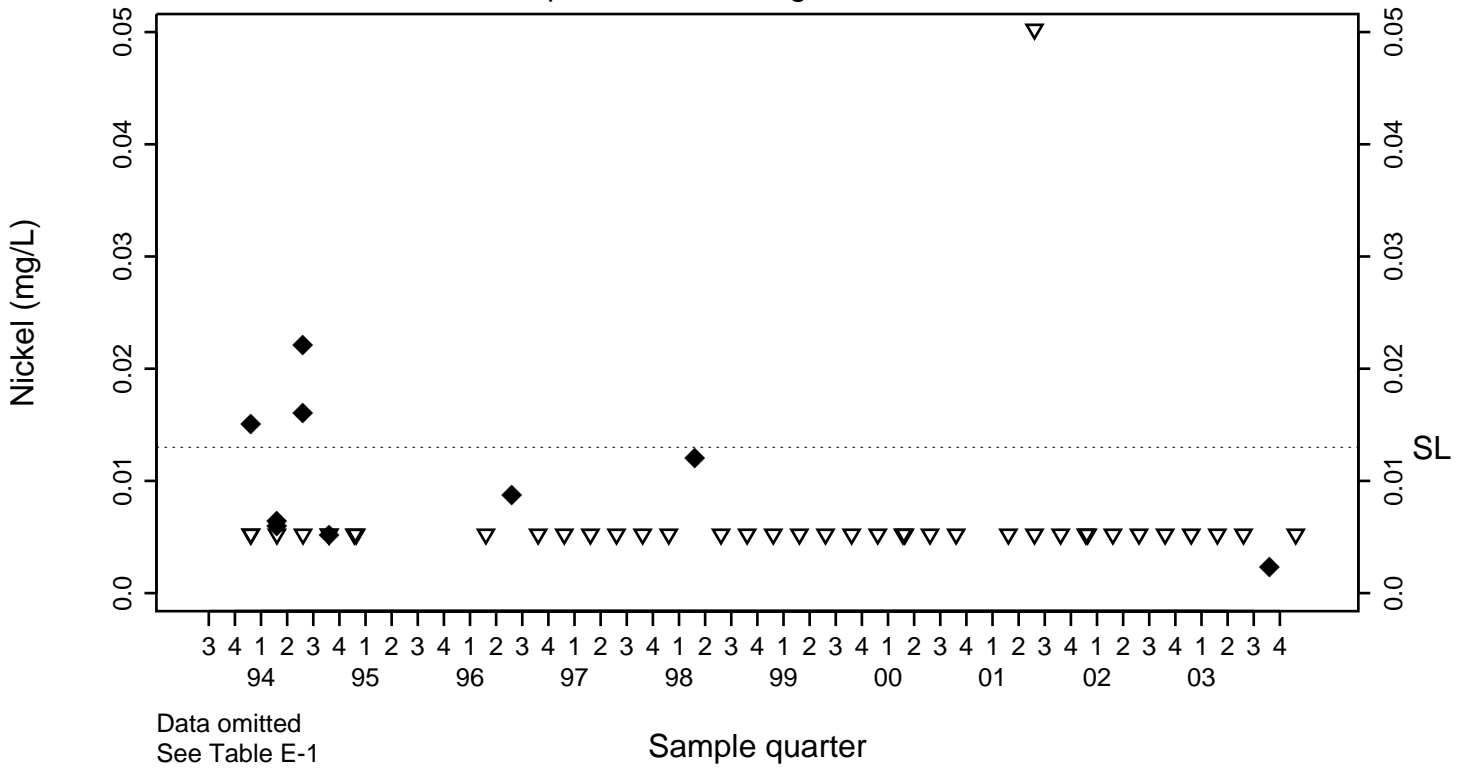
Compliance Monitoring Point K7-10



Data omitted
See Table E-1

Compliance Monitoring Point NC7-25

SL=0.013



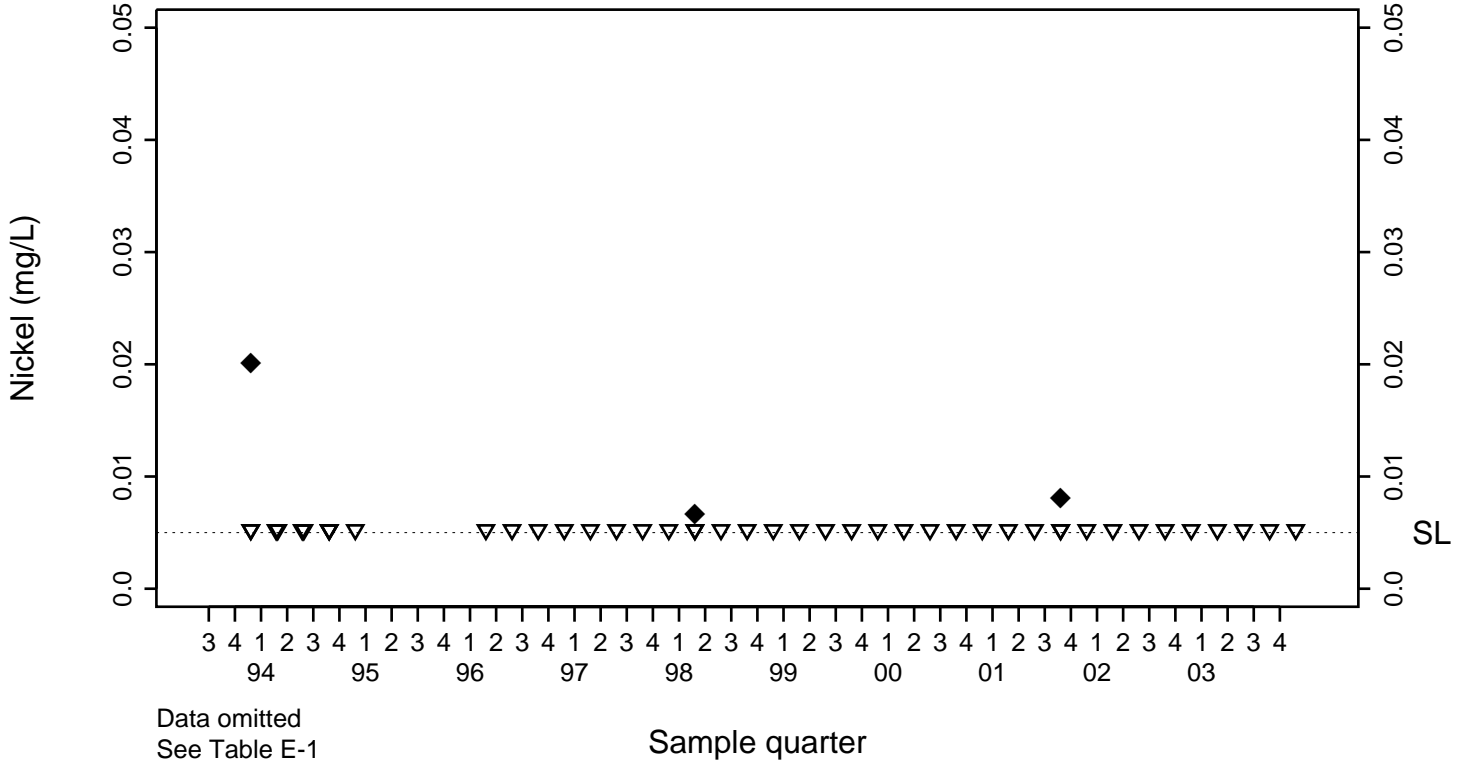
Data omitted
See Table E-1

Pit 7 Complex
Nickel (mg/L)

Compliance Monitoring Point NC7-26

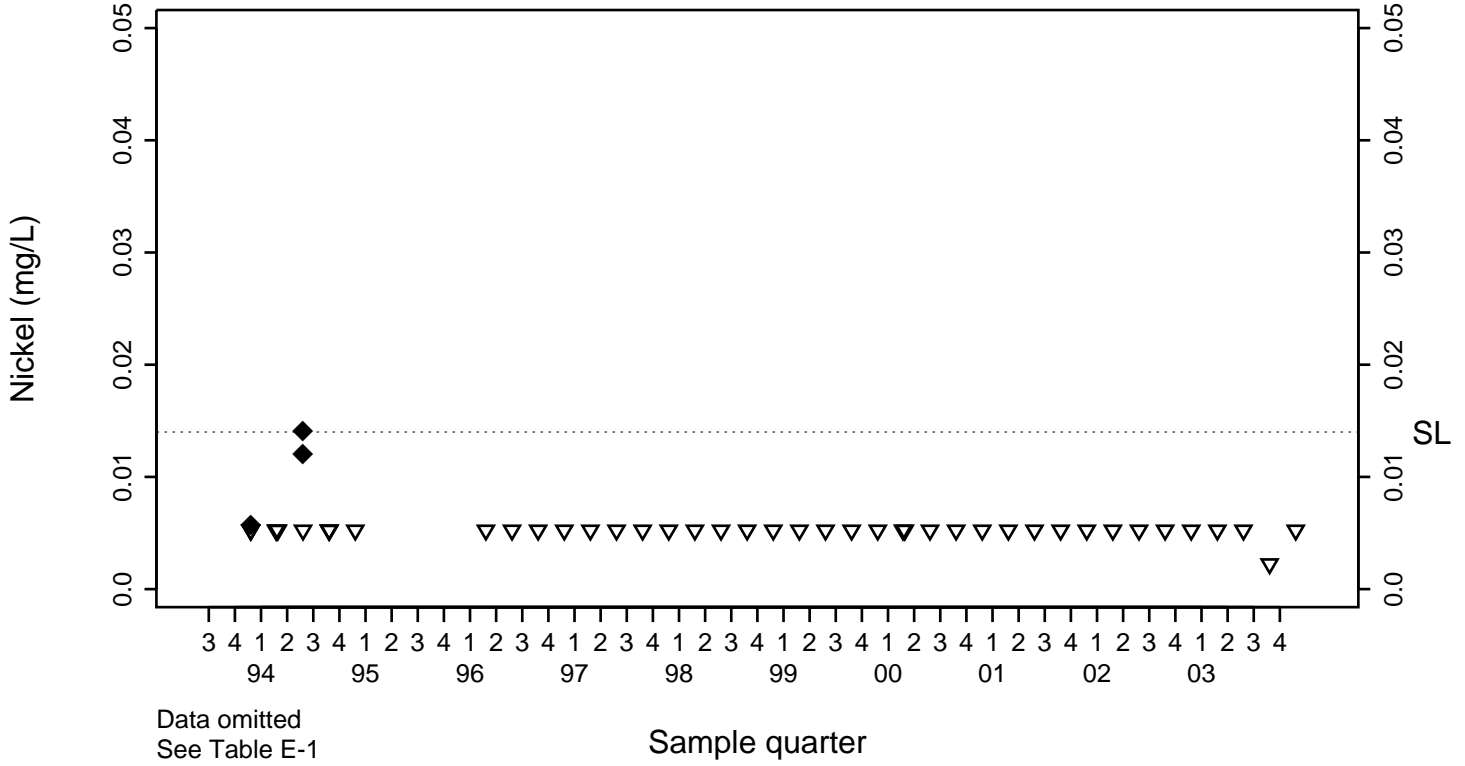
SL=0.005

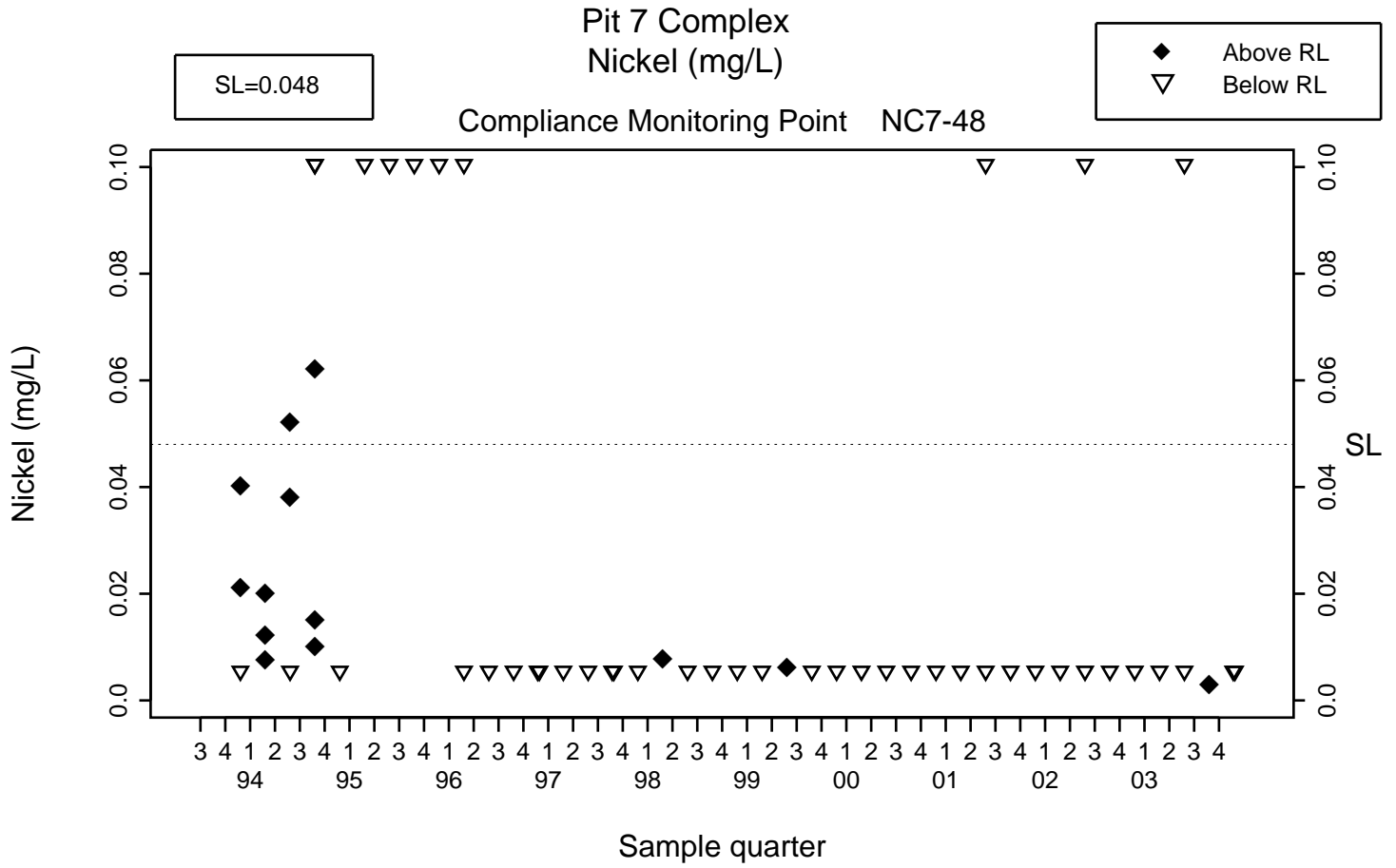
◆ Above RL
▽ Below RL



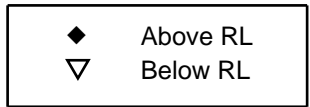
SL=0.014

Compliance Monitoring Point NC7-47

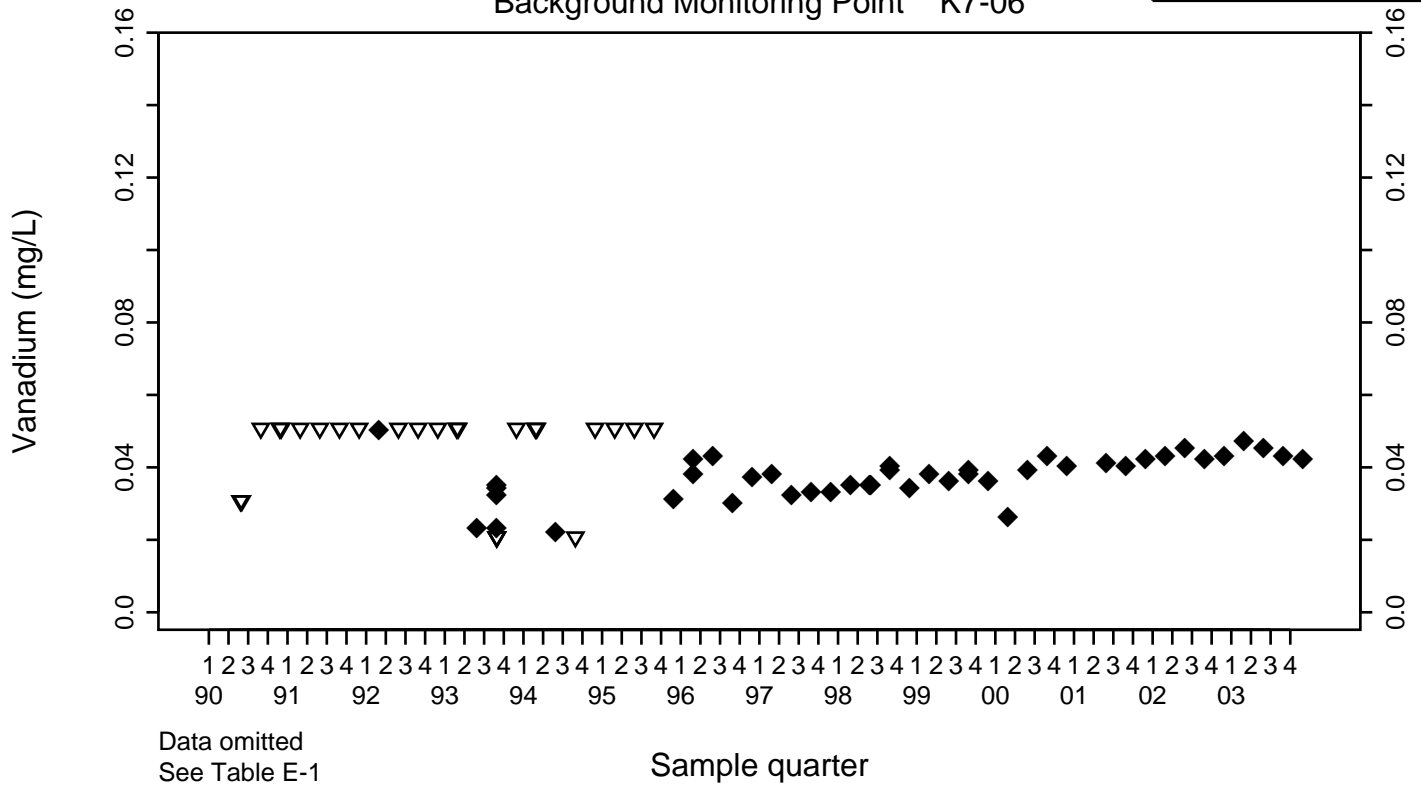




Pit 7 Complex Vanadium (mg/L)

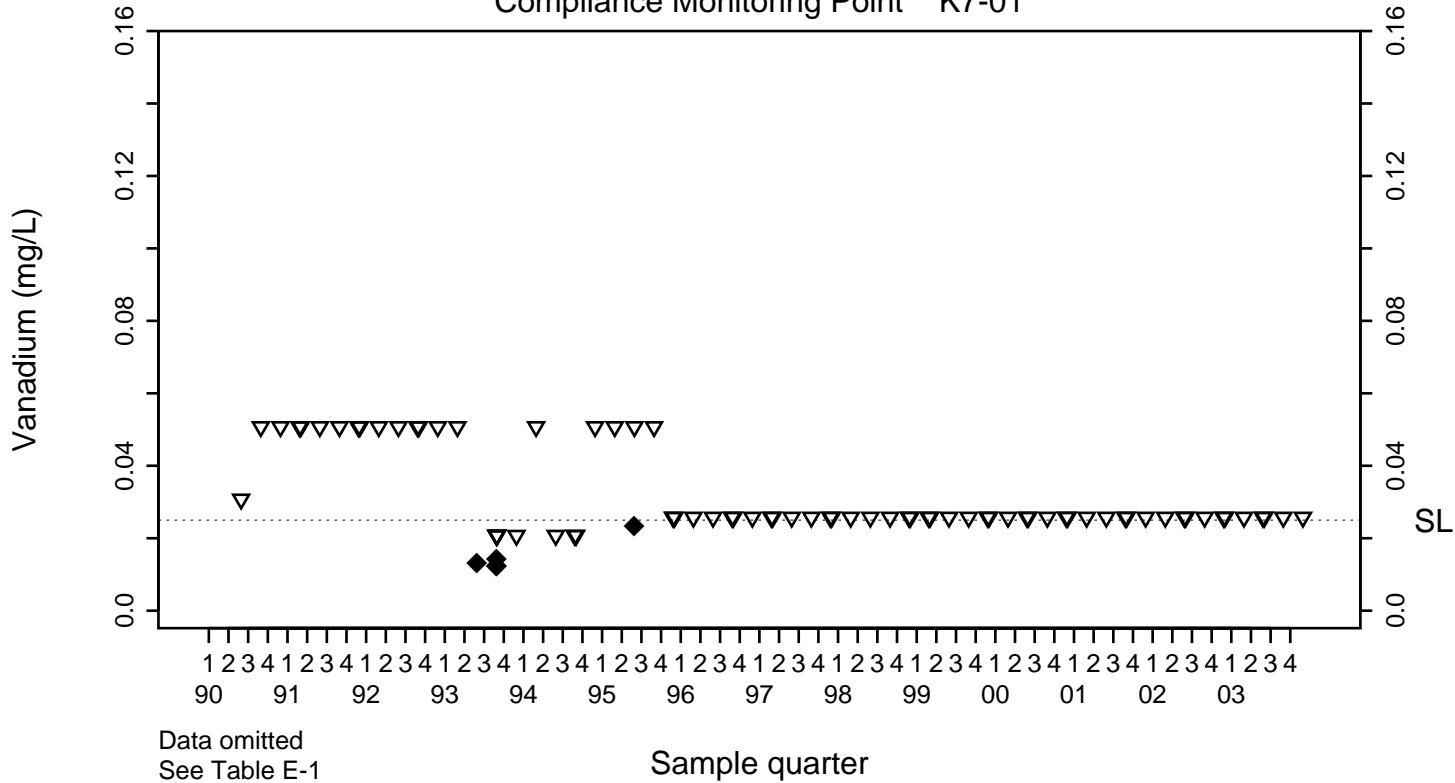


Background Monitoring Point K7-06



SL=0.025

Compliance Monitoring Point K7-01

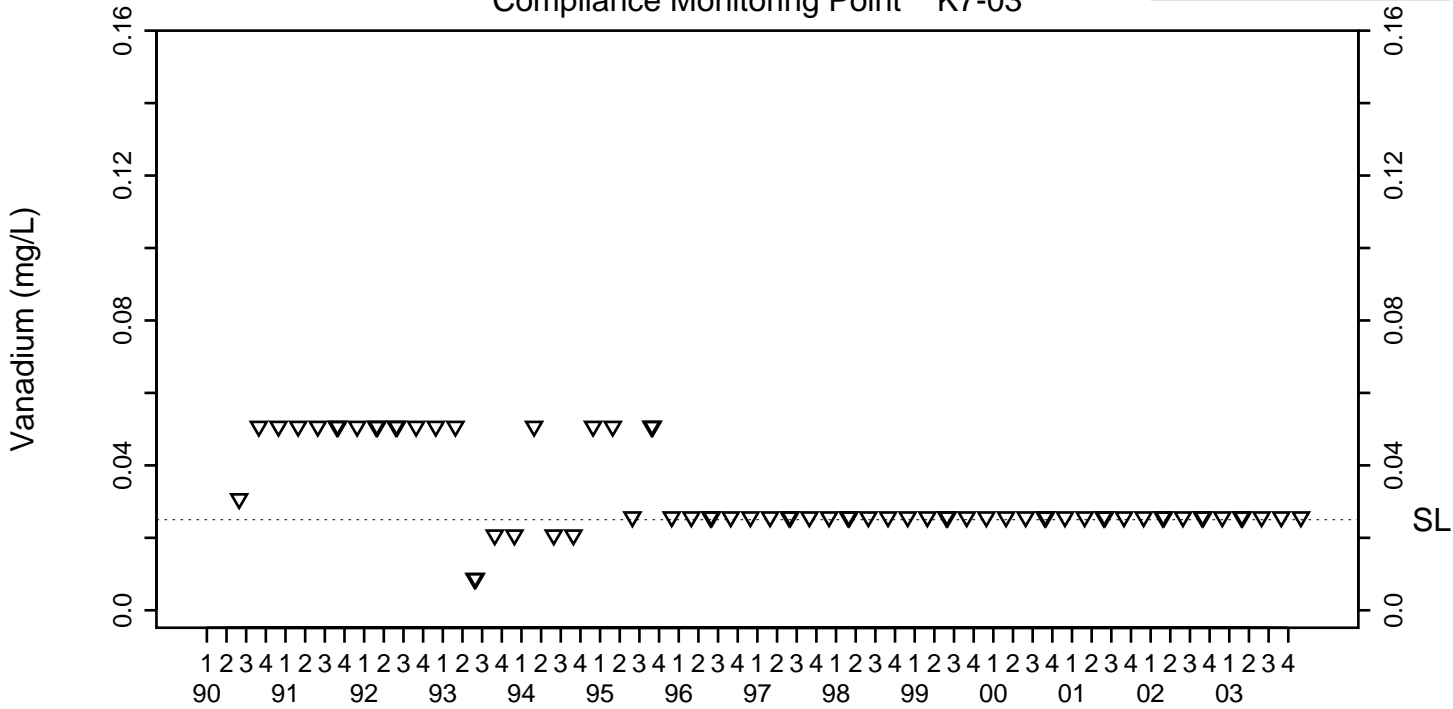


Pit 7 Complex Vanadium (mg/L)

◆ Above RL
▽ Below RL

SL=0.025

Compliance Monitoring Point K7-03

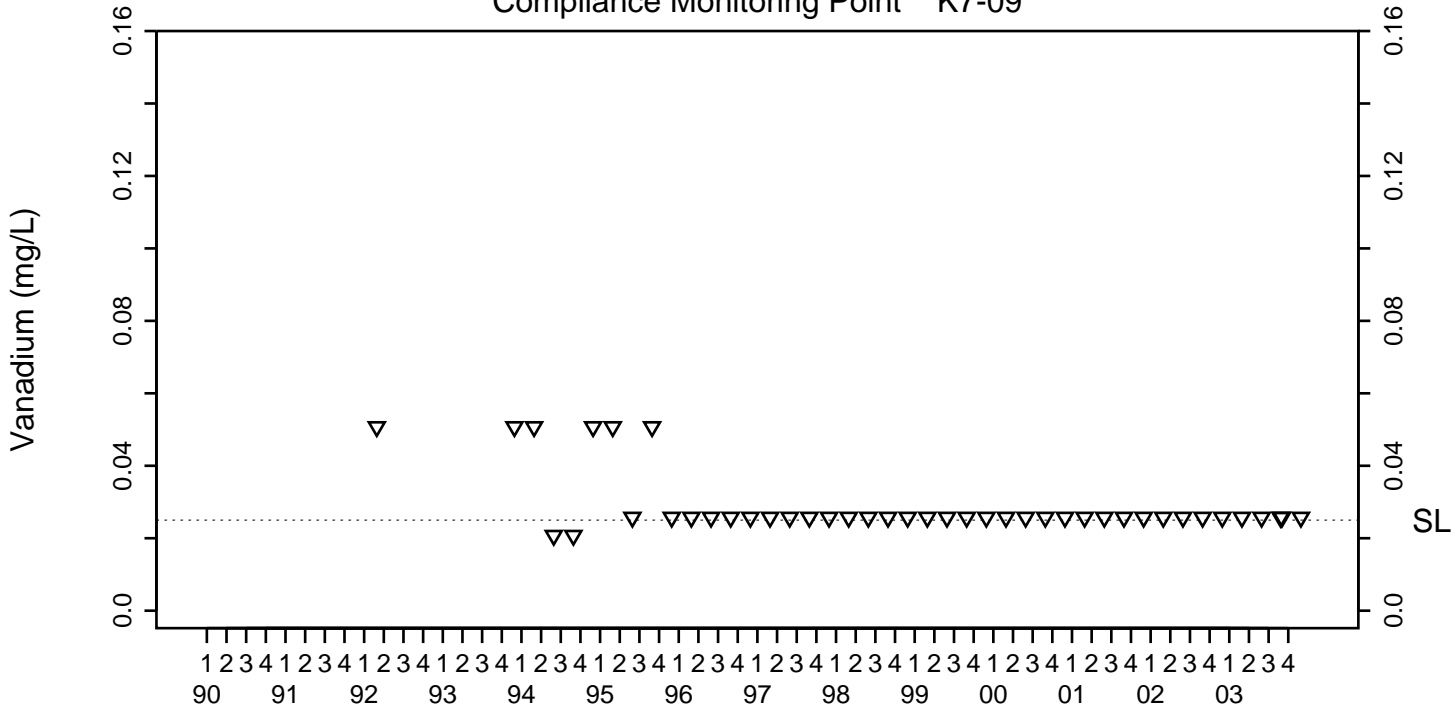


Data omitted
See Table E-1

Sample quarter

SL=0.025

Compliance Monitoring Point K7-09



Data omitted
See Table E-1

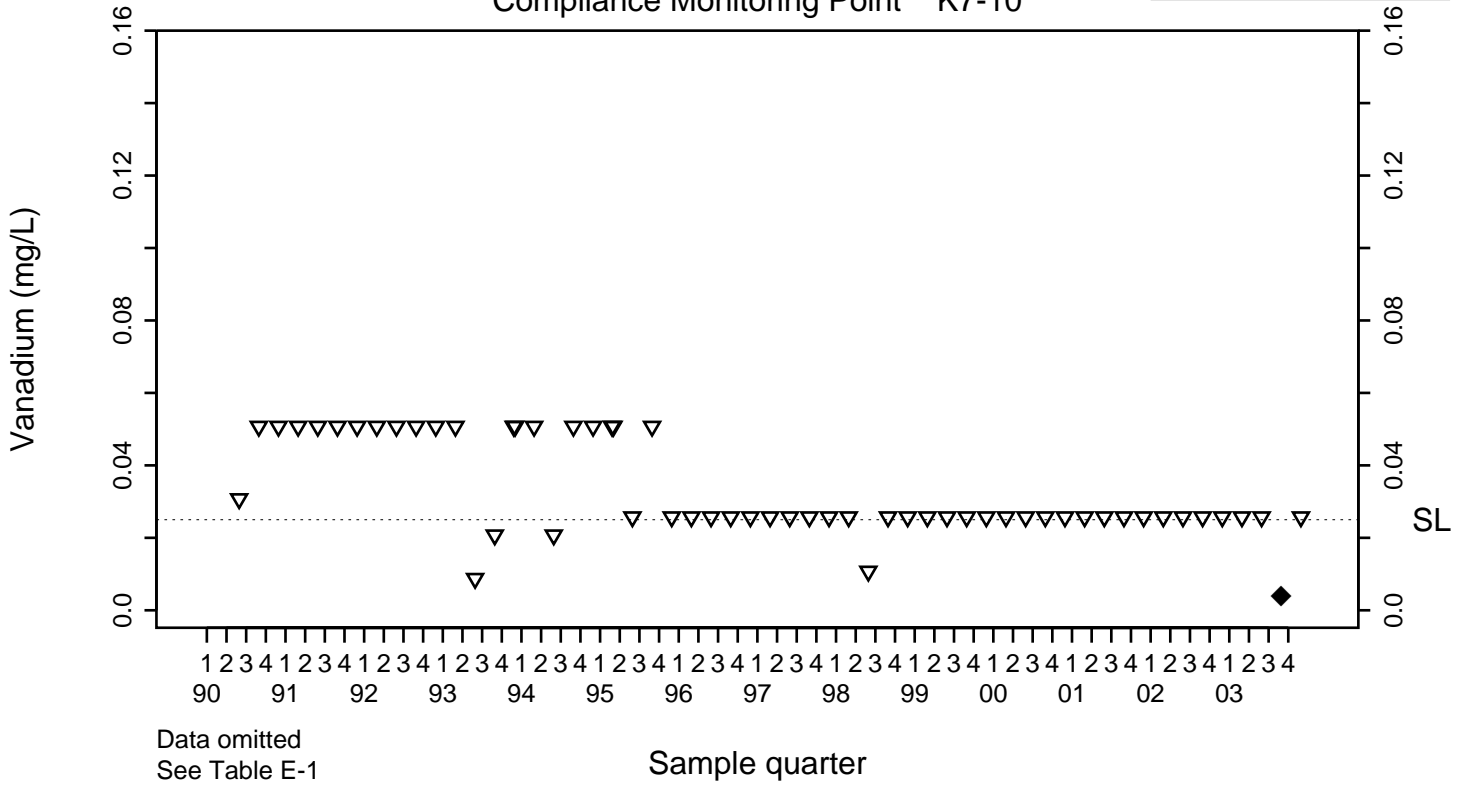
Sample quarter

Pit 7 Complex Vanadium (mg/L)

◆	Above RL
▽	Below RL

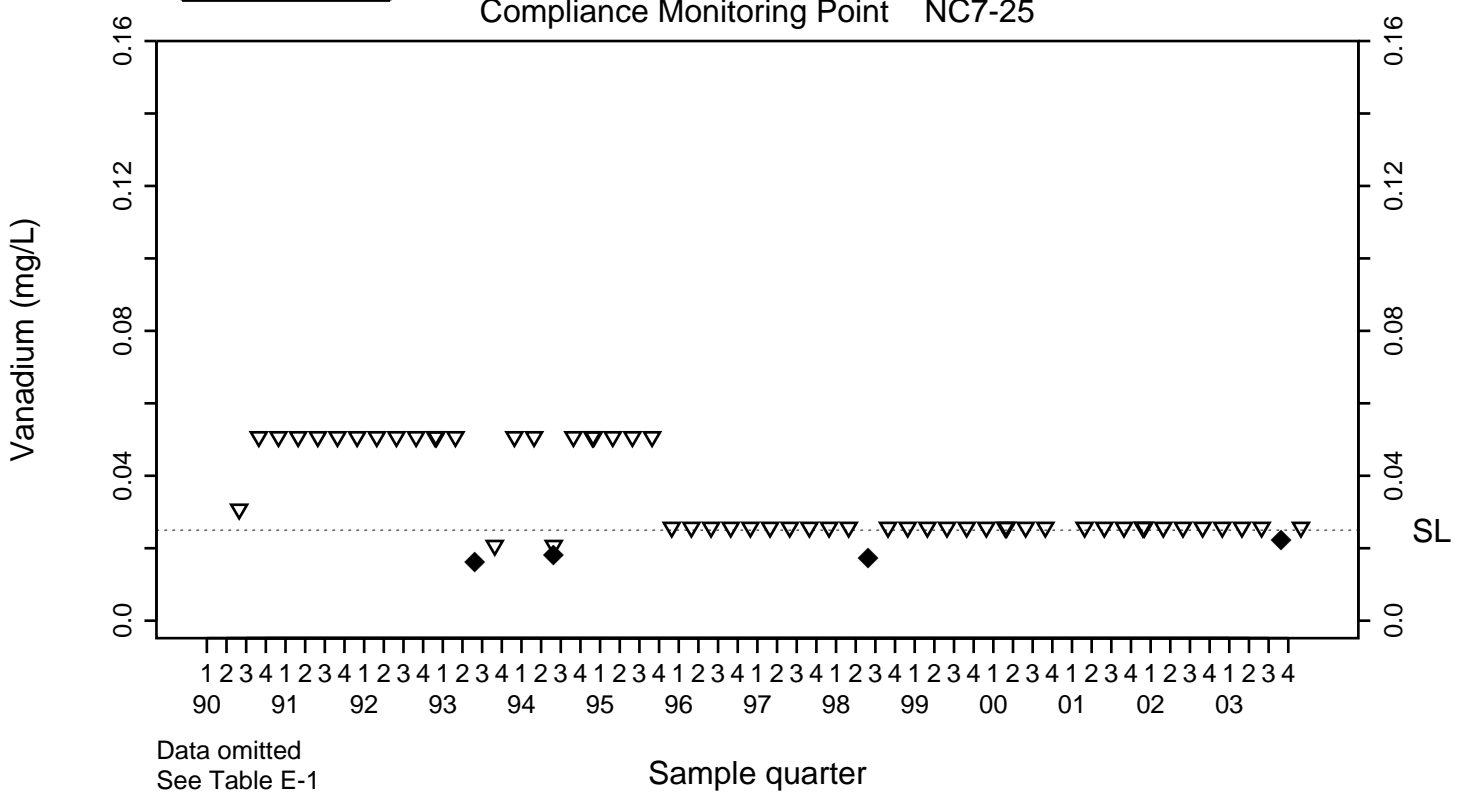
SL=0.025

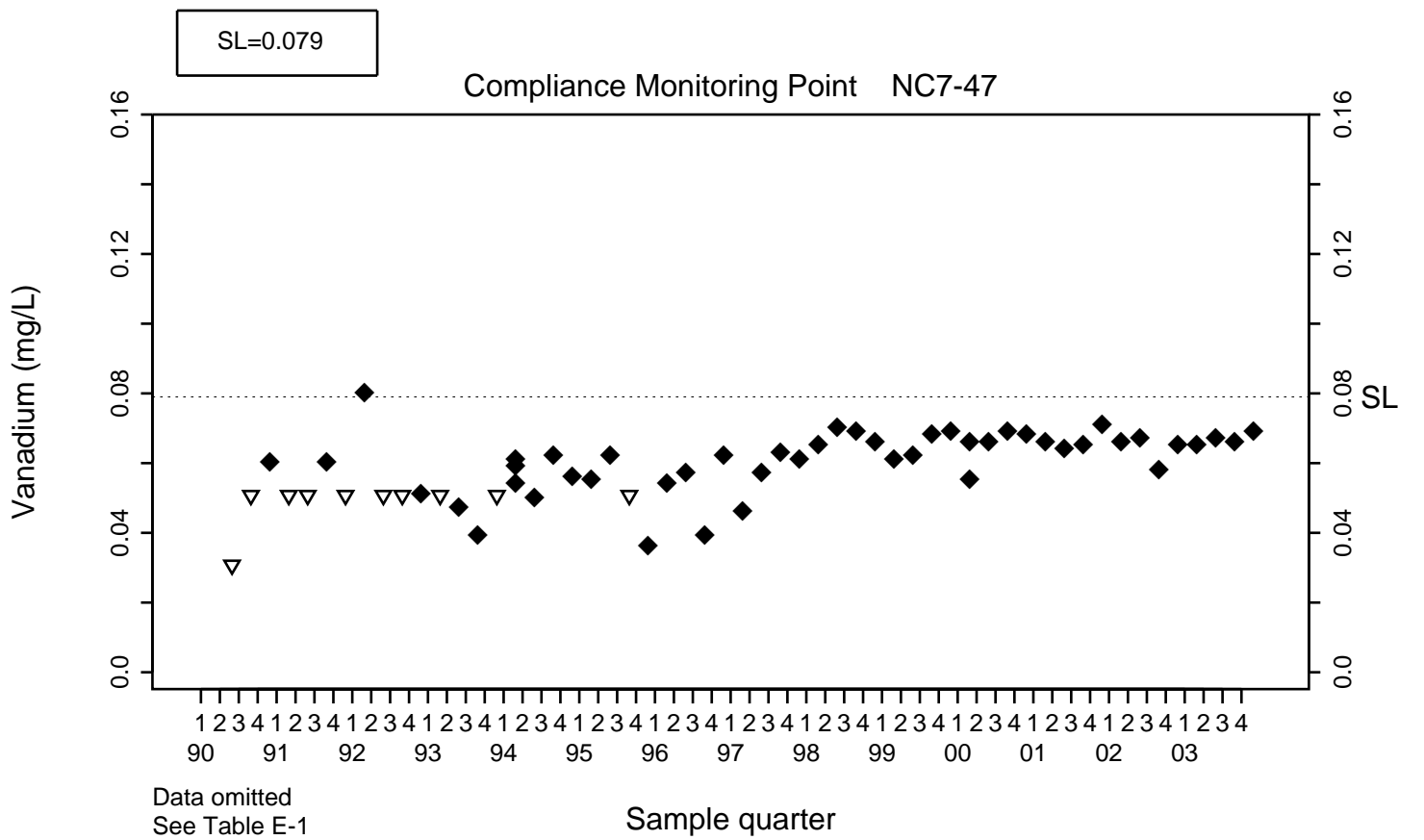
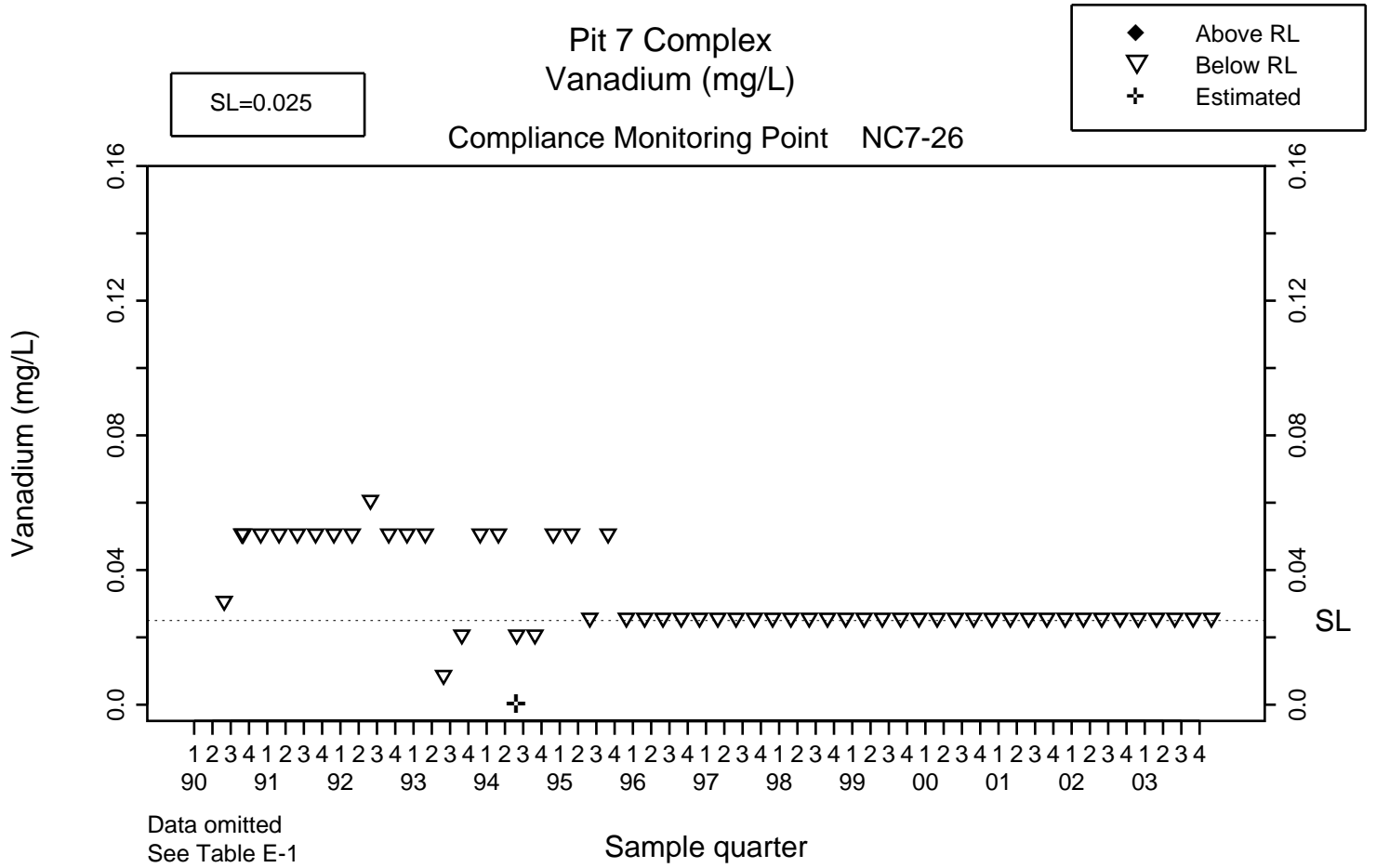
Compliance Monitoring Point K7-10

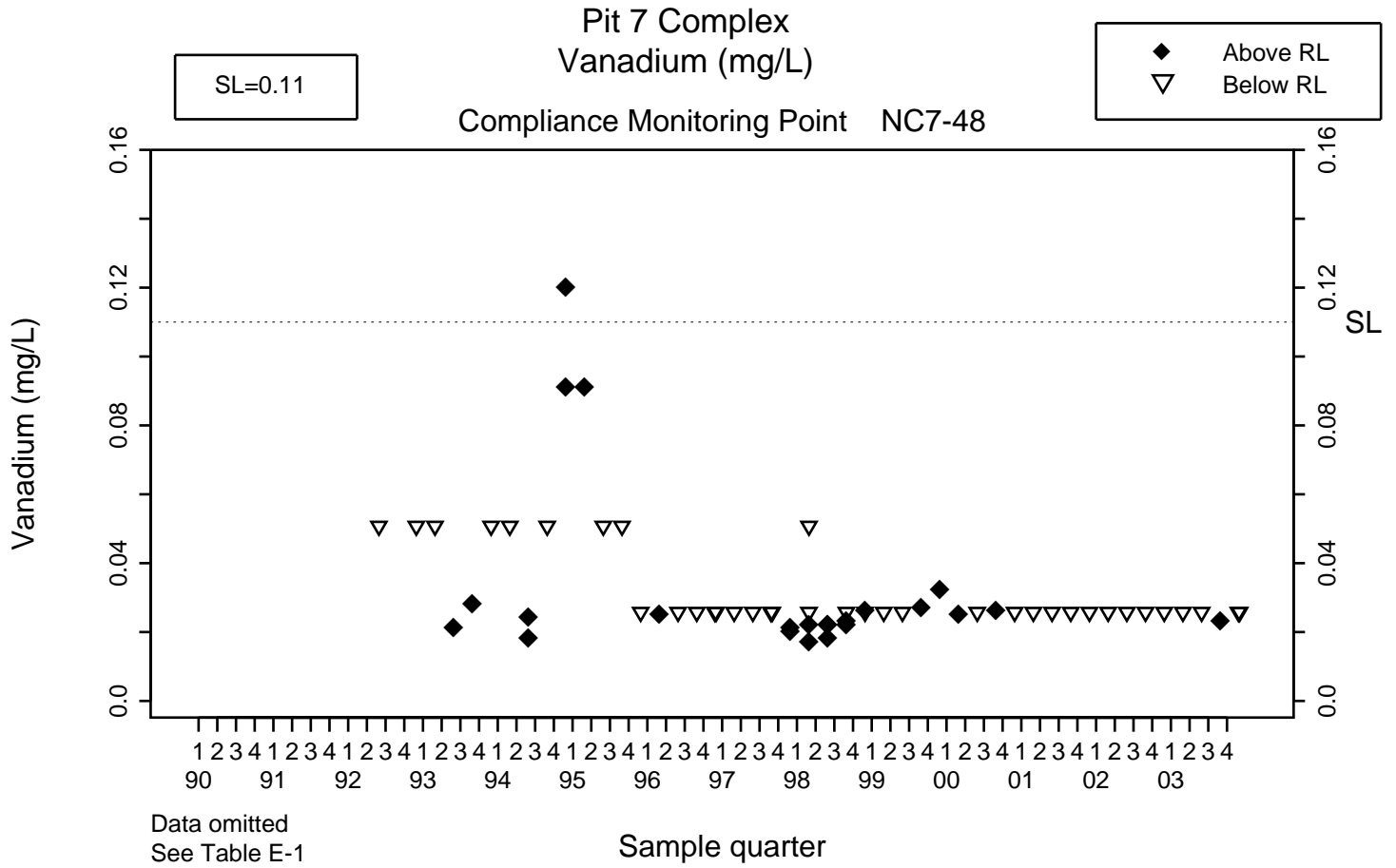


Compliance Monitoring Point NC7-25

SL=0.025



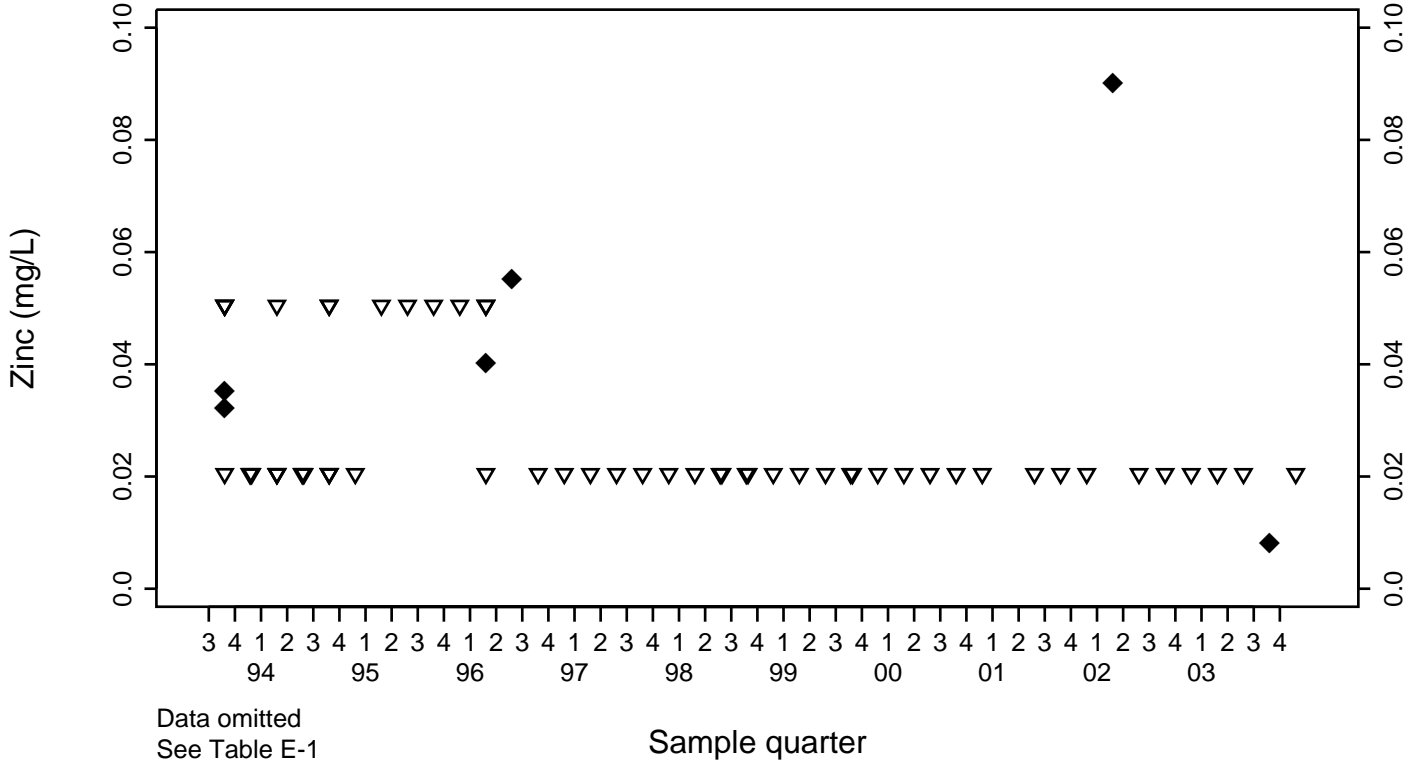




Pit 7 Complex Zinc (mg/L)

◆	Above RL
▽	Below RL

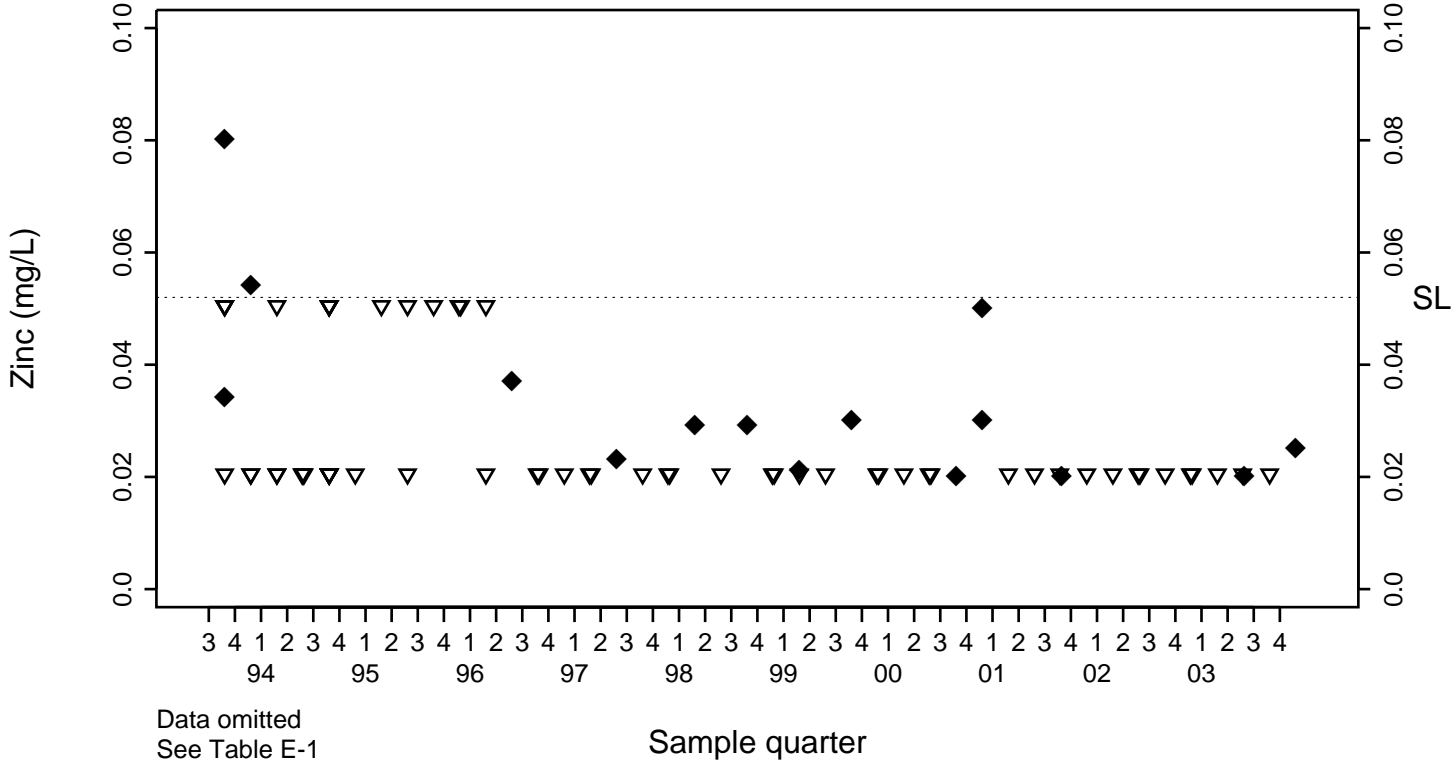
Background Monitoring Point K7-06



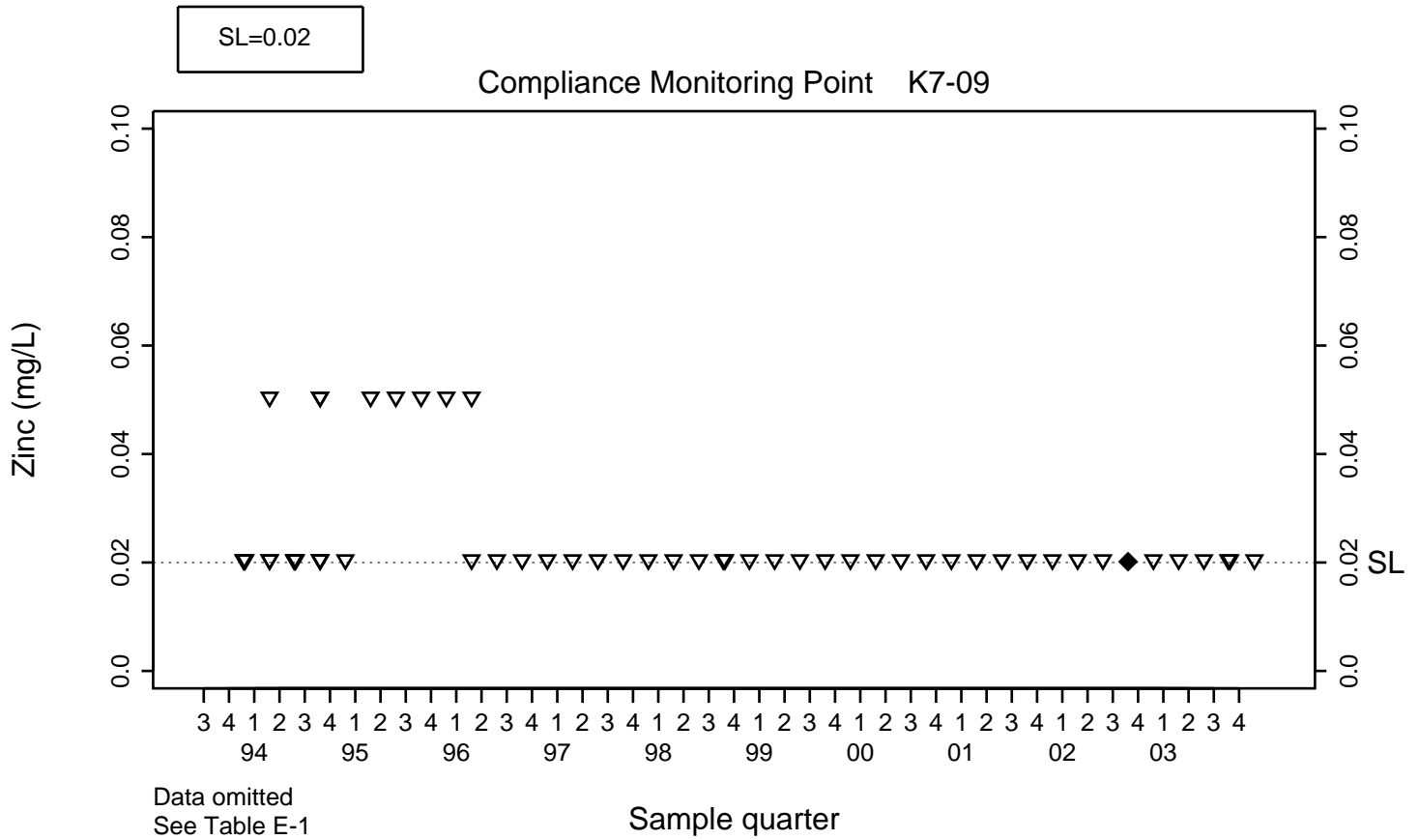
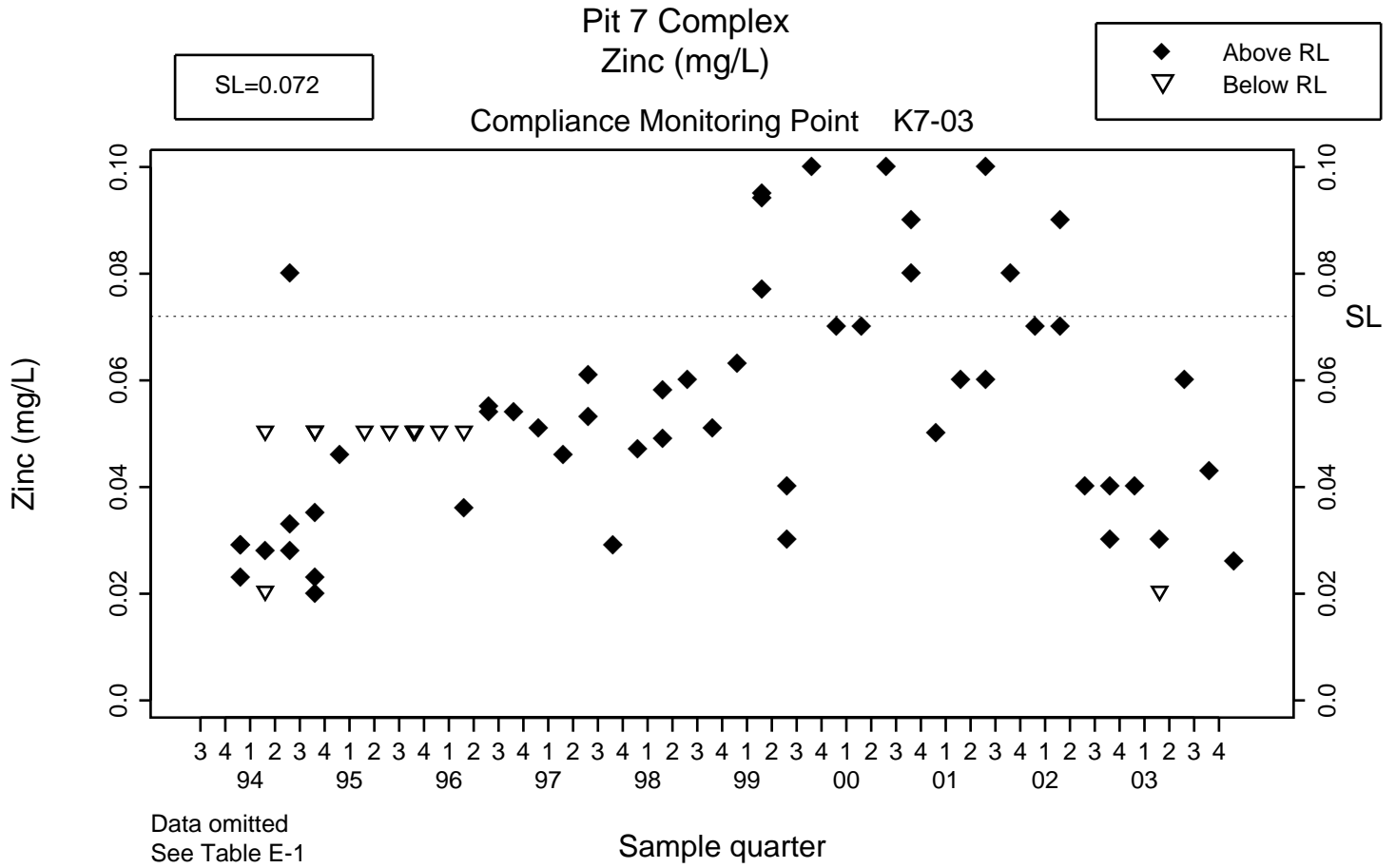
Data omitted
See Table E-1

SL=0.052

Compliance Monitoring Point K7-01



Data omitted
See Table E-1

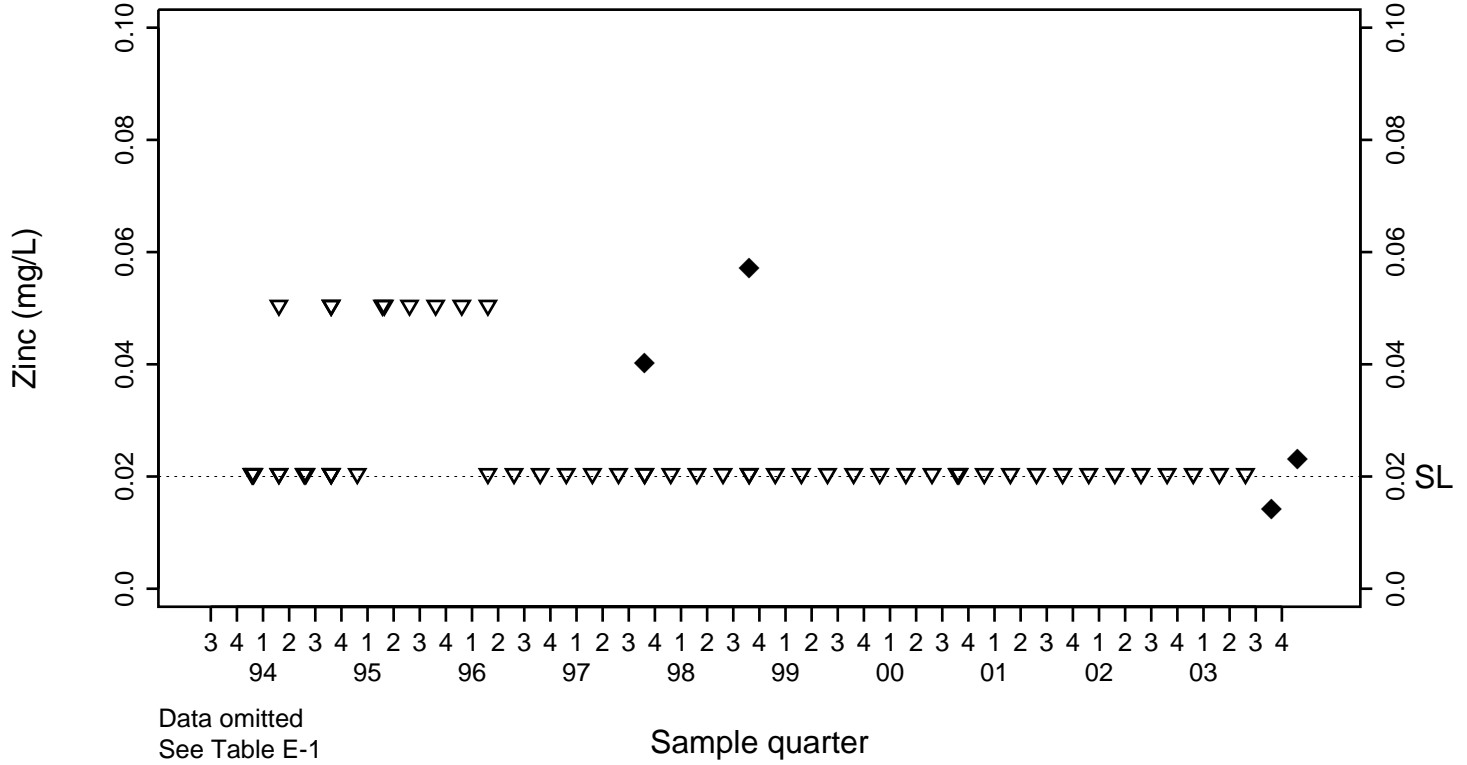


Pit 7 Complex Zinc (mg/L)

SL=0.02

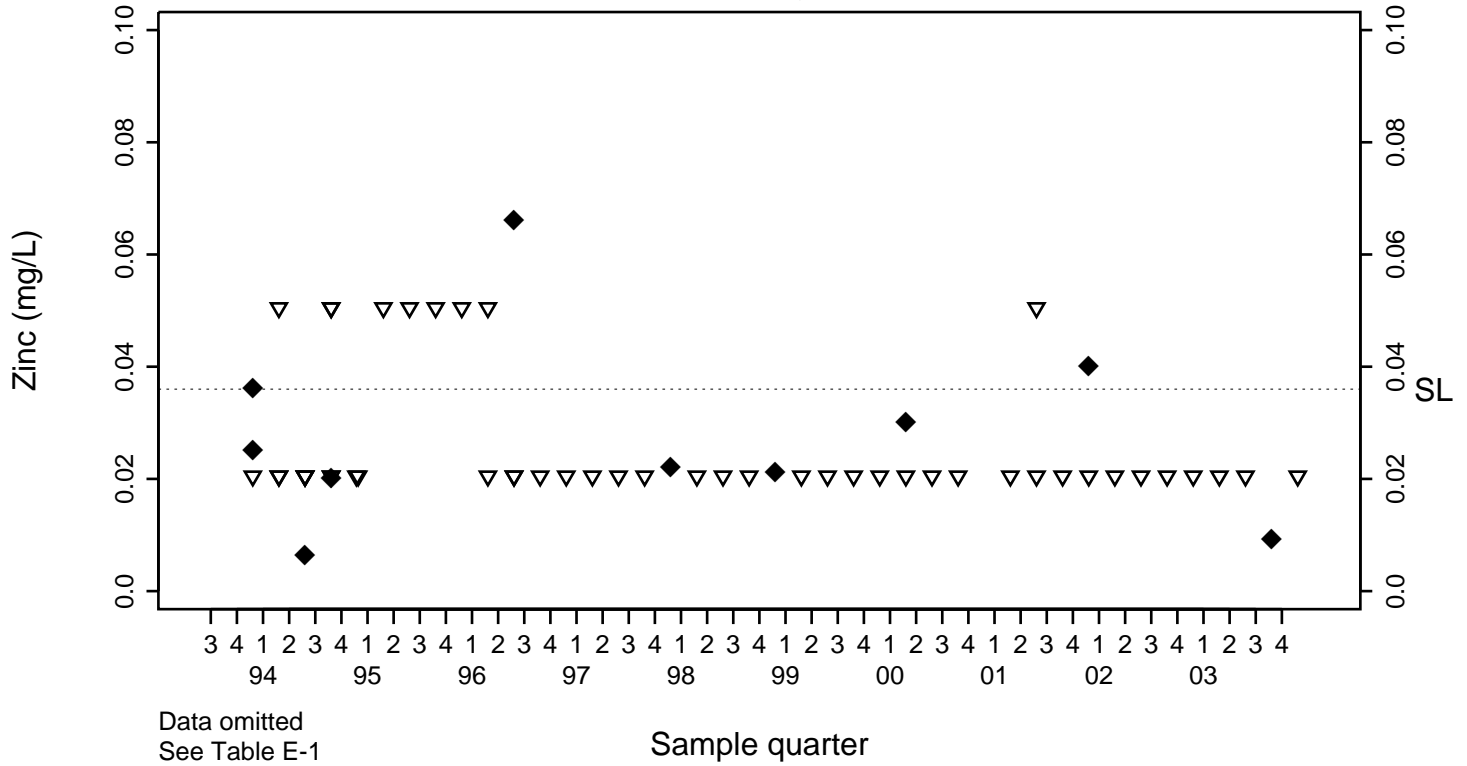
◆ Above RL
▽ Below RL

Compliance Monitoring Point K7-10



SL=0.036

Compliance Monitoring Point NC7-25

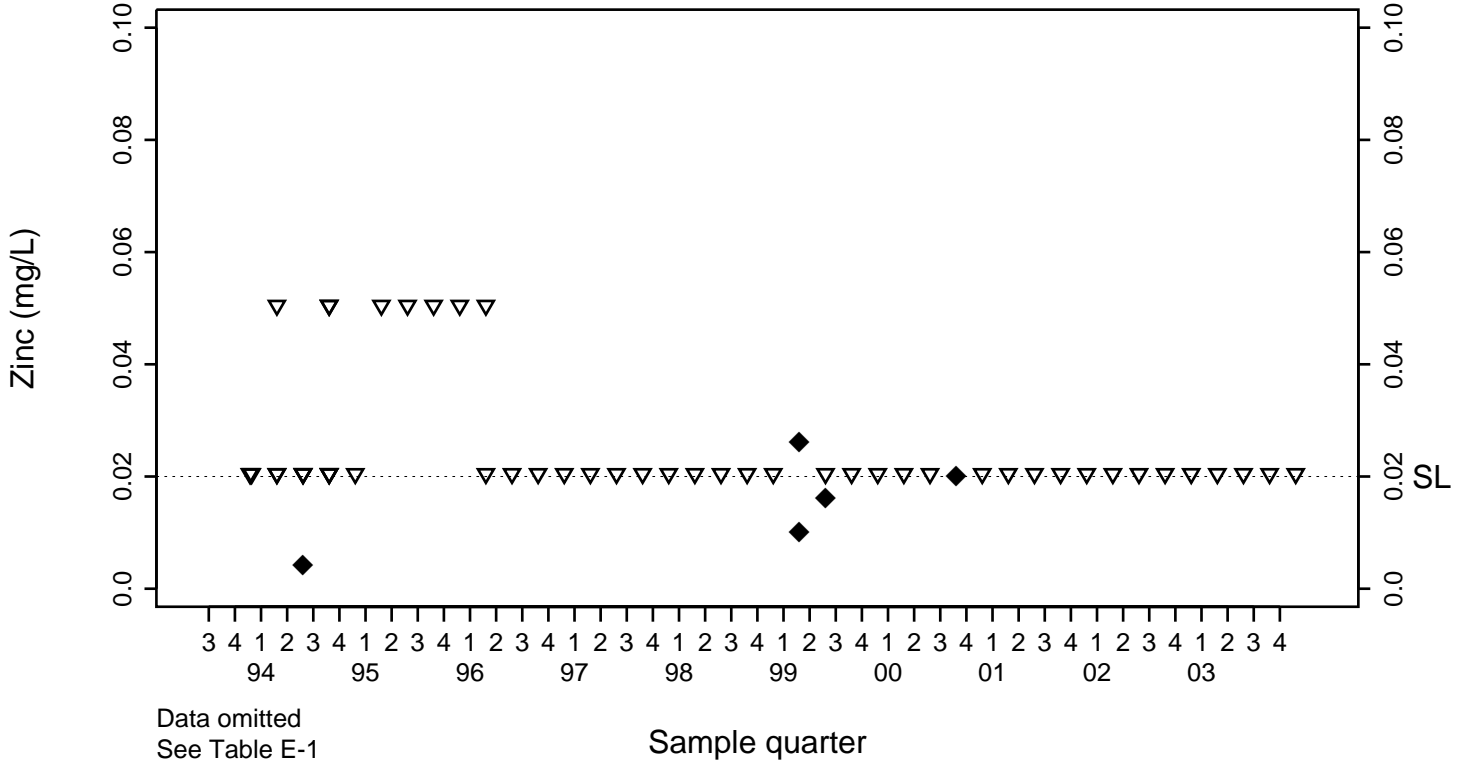


Pit 7 Complex Zinc (mg/L)

SL=0.02

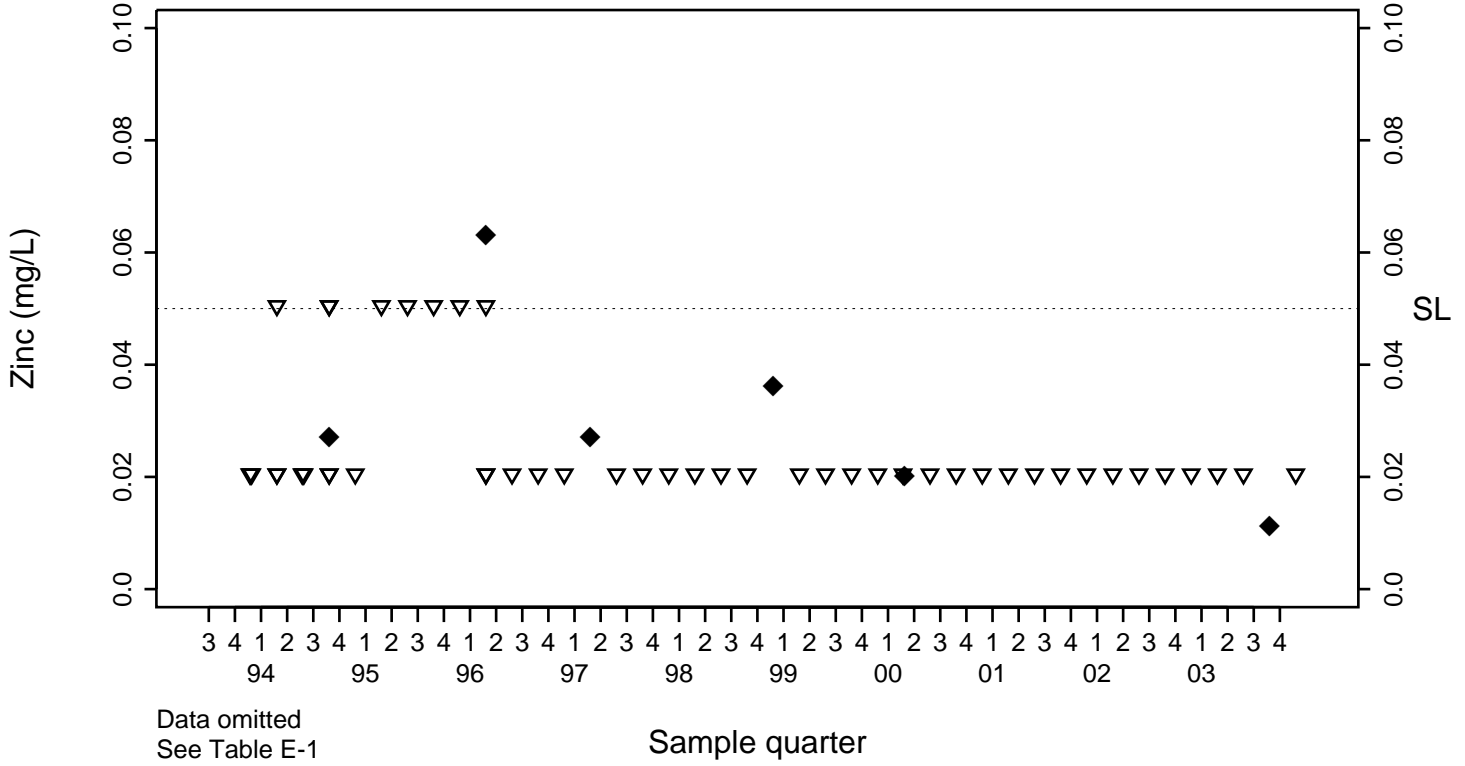
◆ Above RL
▽ Below RL

Compliance Monitoring Point NC7-26



SL=0.05

Compliance Monitoring Point NC7-47

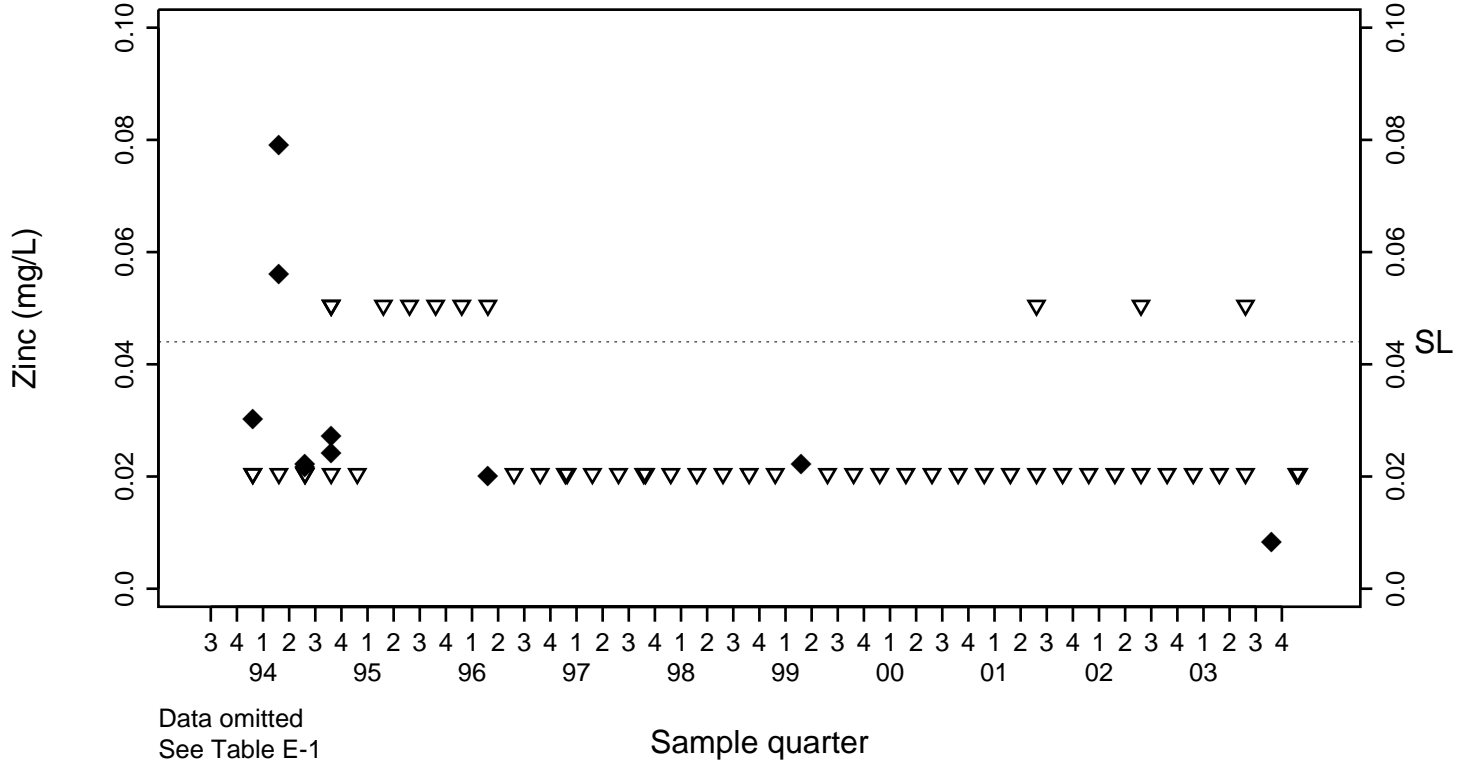


Pit 7 Complex Zinc (mg/L)

SL=0.044

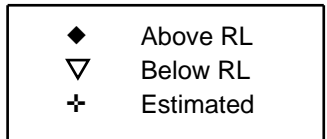
◆ Above RL
▽ Below RL

Compliance Monitoring Point NC7-48

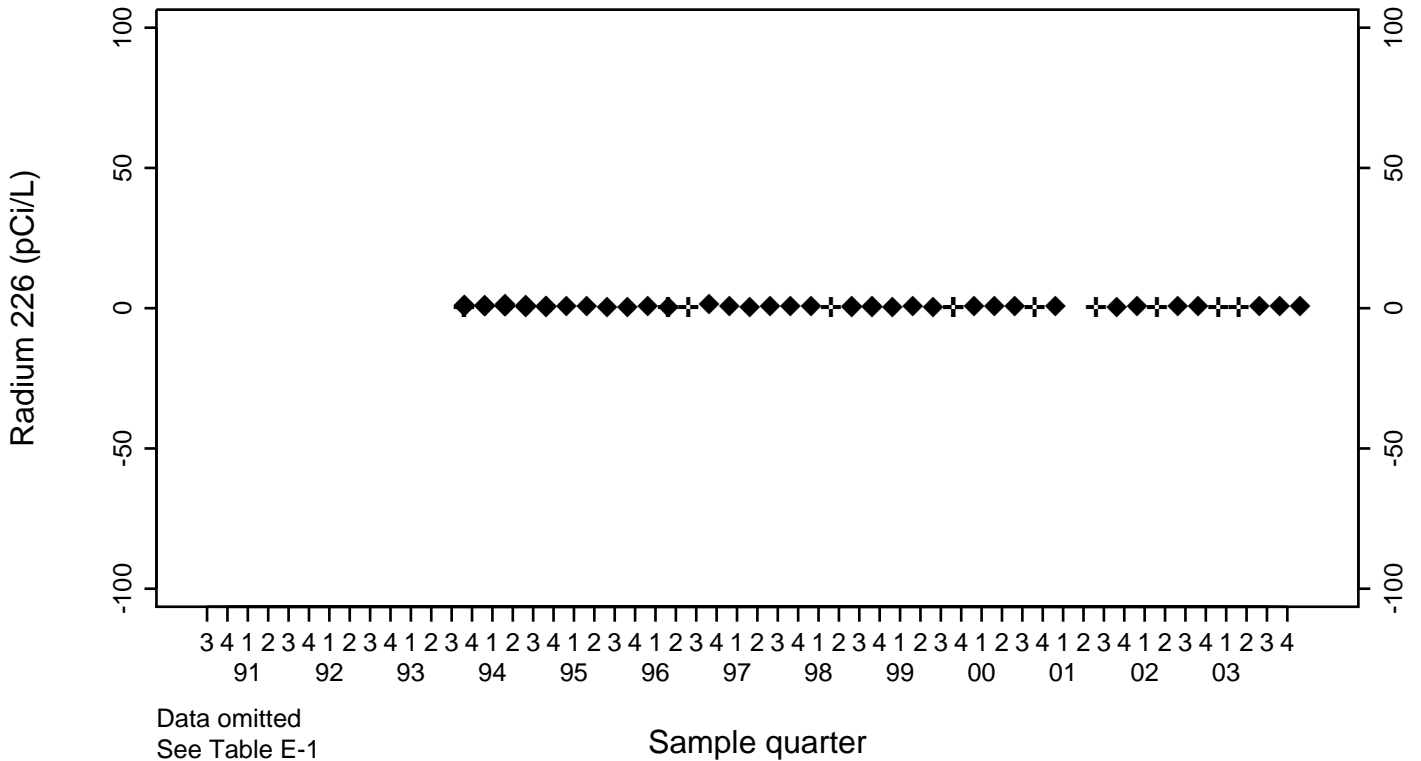


Data omitted
See Table E-1

Pit 7 Complex Radium 226 (pCi/L)

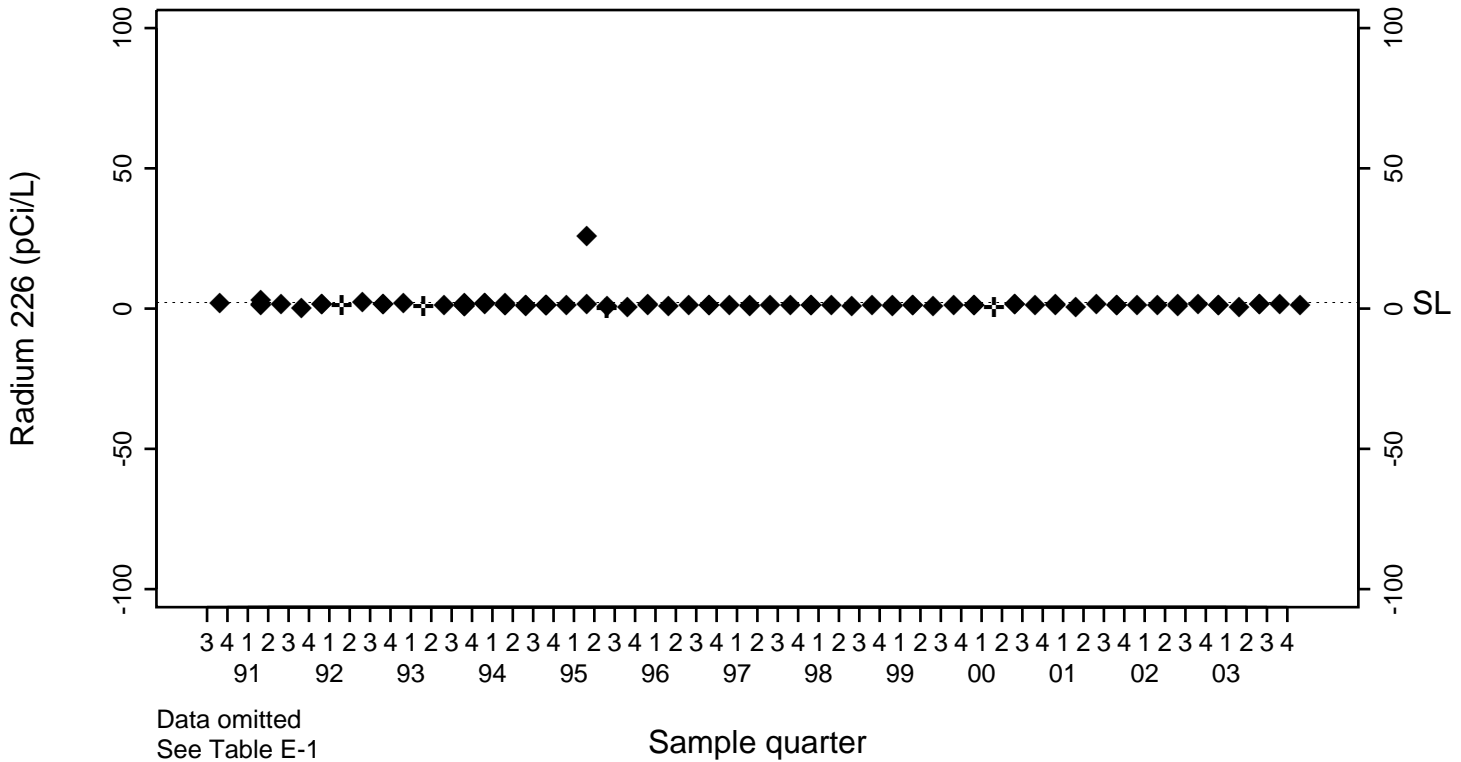


Background Monitoring Point K7-06



SL=2.17

Compliance Monitoring Point K7-01

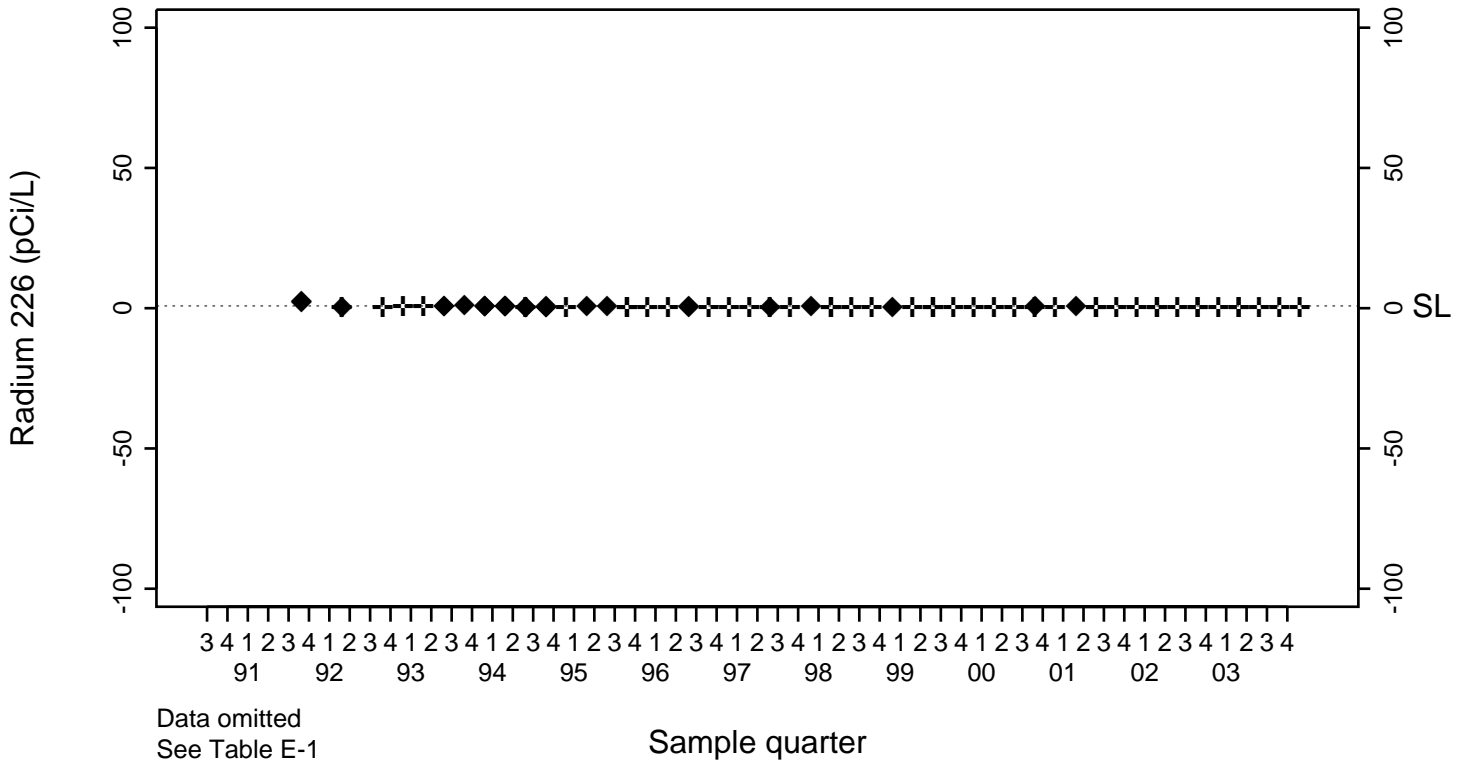


Pit 7 Complex Radium 226 (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

SL=0.8

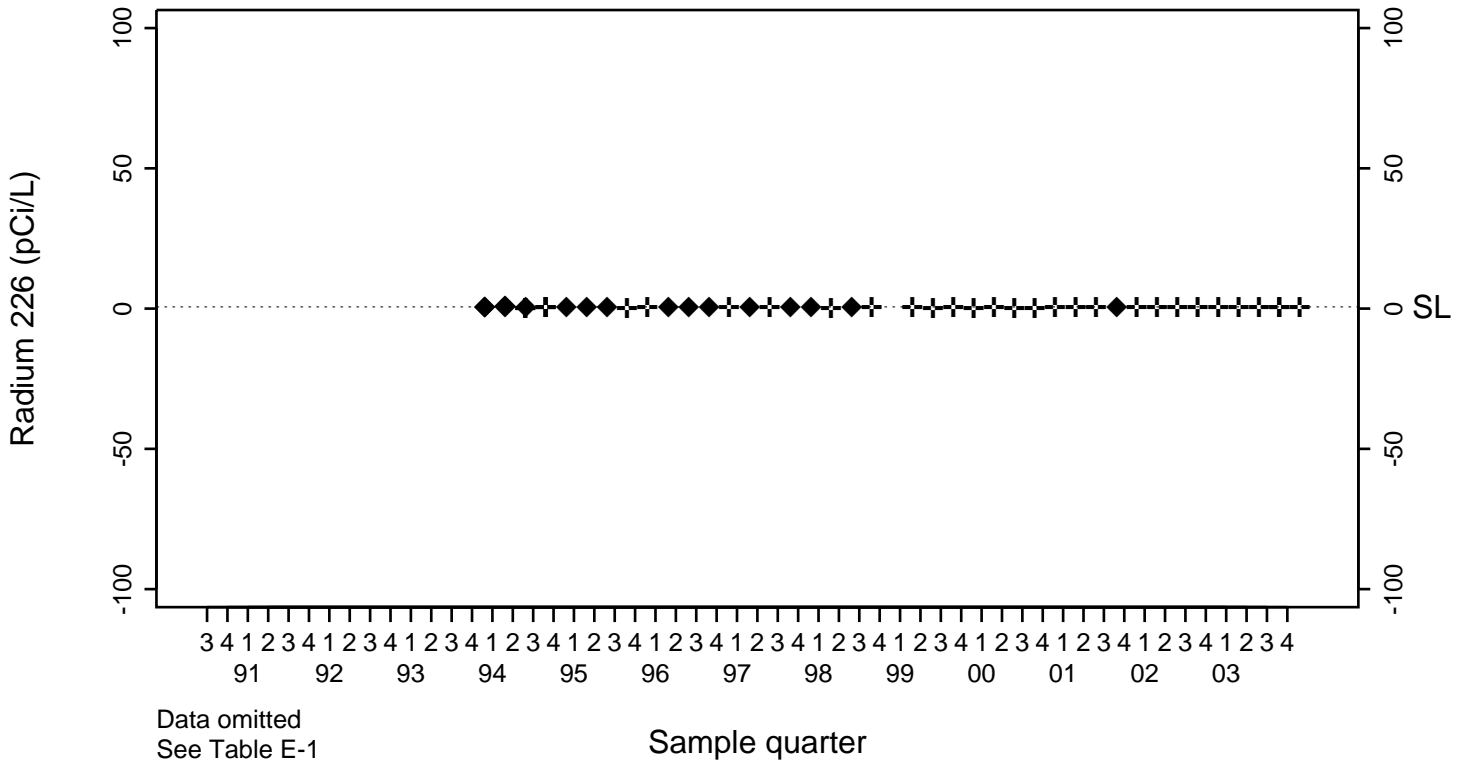
Compliance Monitoring Point K7-03



Data omitted
See Table E-1

SL=0.61

Compliance Monitoring Point K7-09



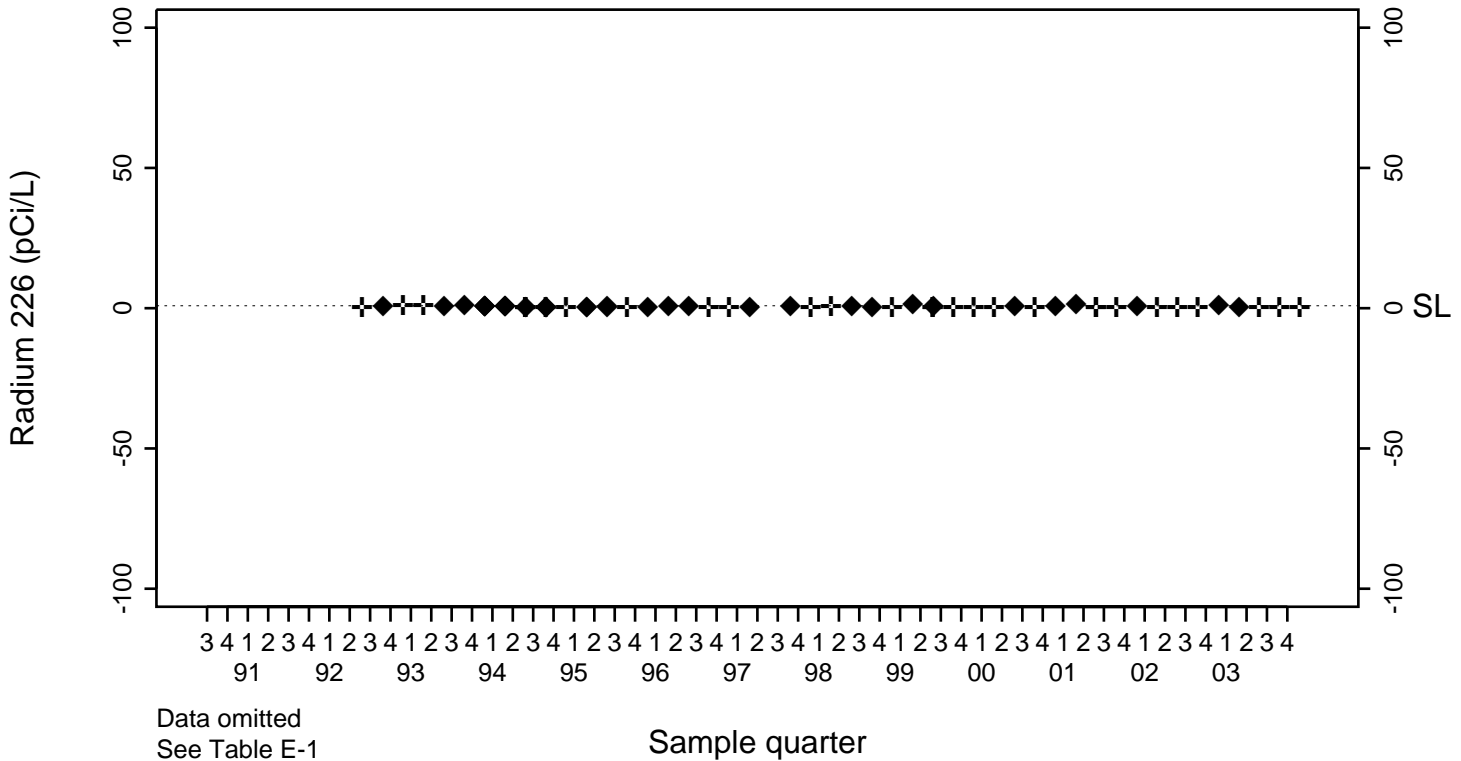
Data omitted
See Table E-1

Pit 7 Complex Radium 226 (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

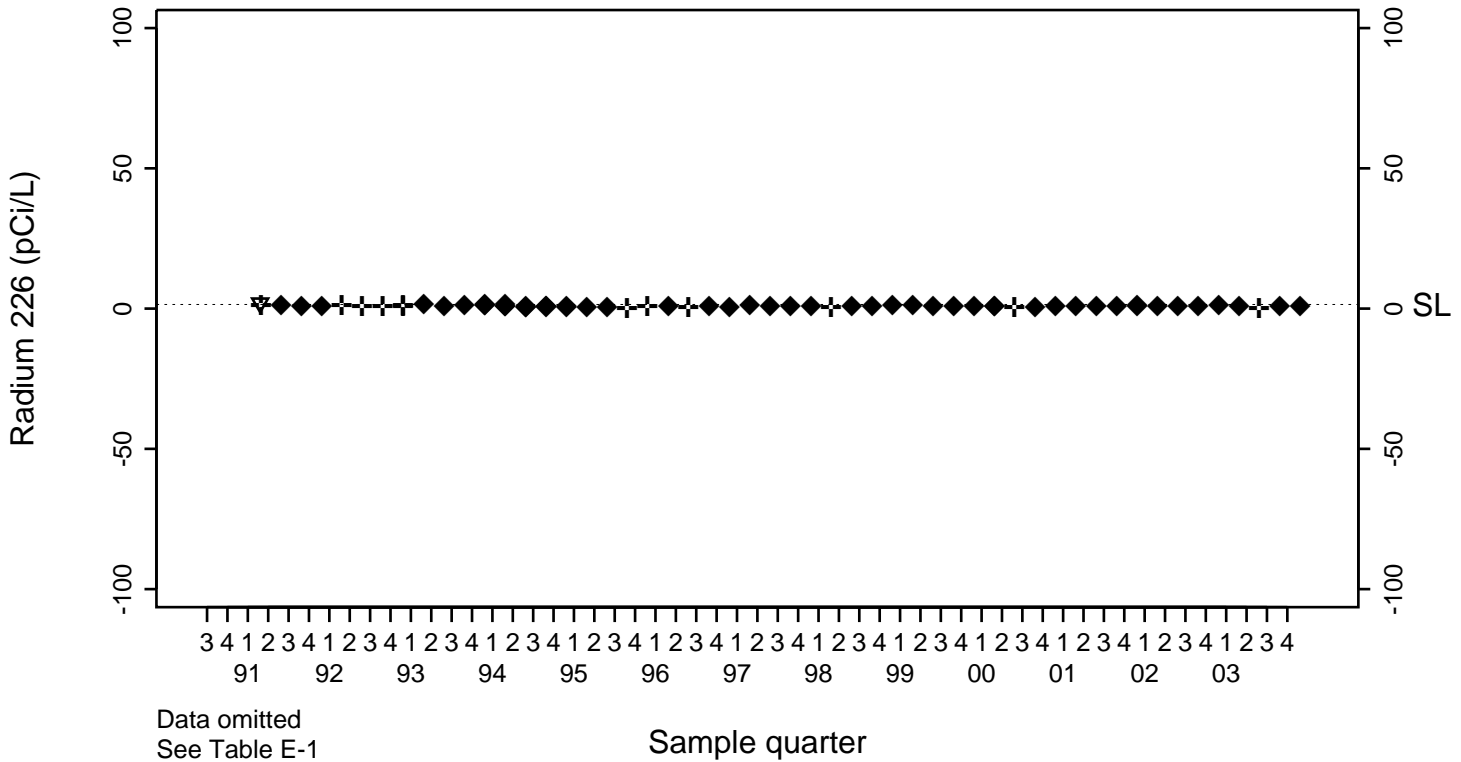
SL=0.87

Compliance Monitoring Point K7-10



SL=1.47

Compliance Monitoring Point NC7-25

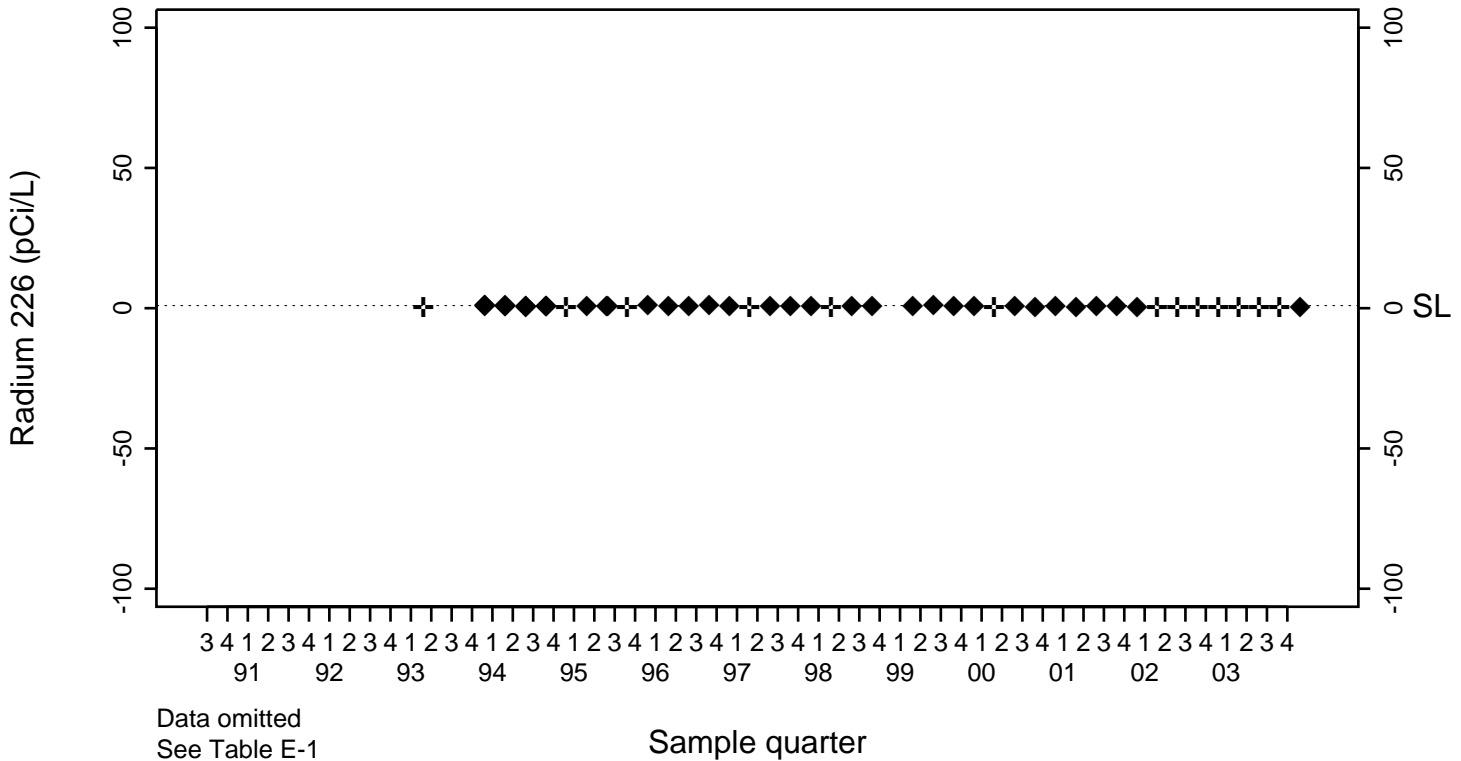


Pit 7 Complex Radium 226 (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

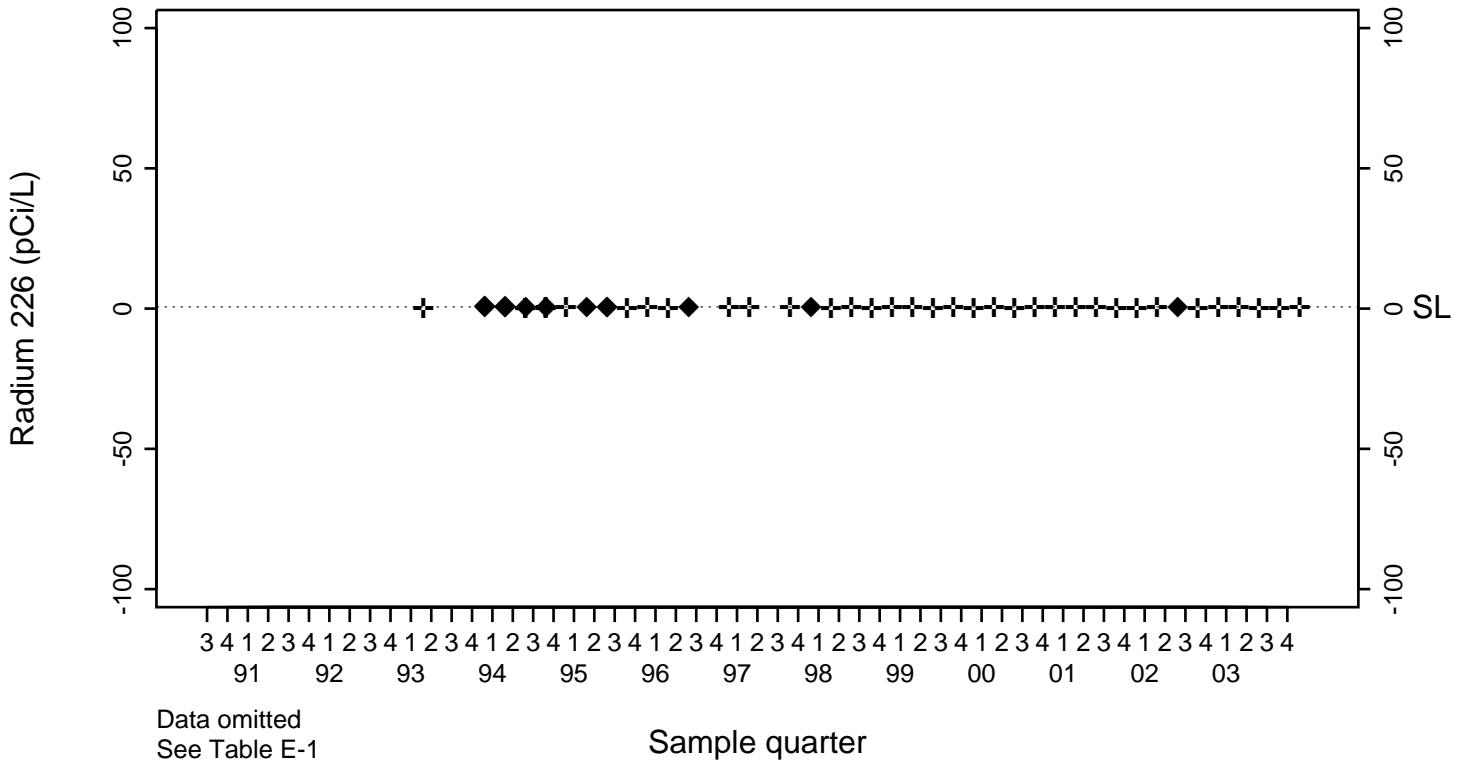
SL=0.92

Compliance Monitoring Point NC7-26



SL=0.6

Compliance Monitoring Point NC7-47

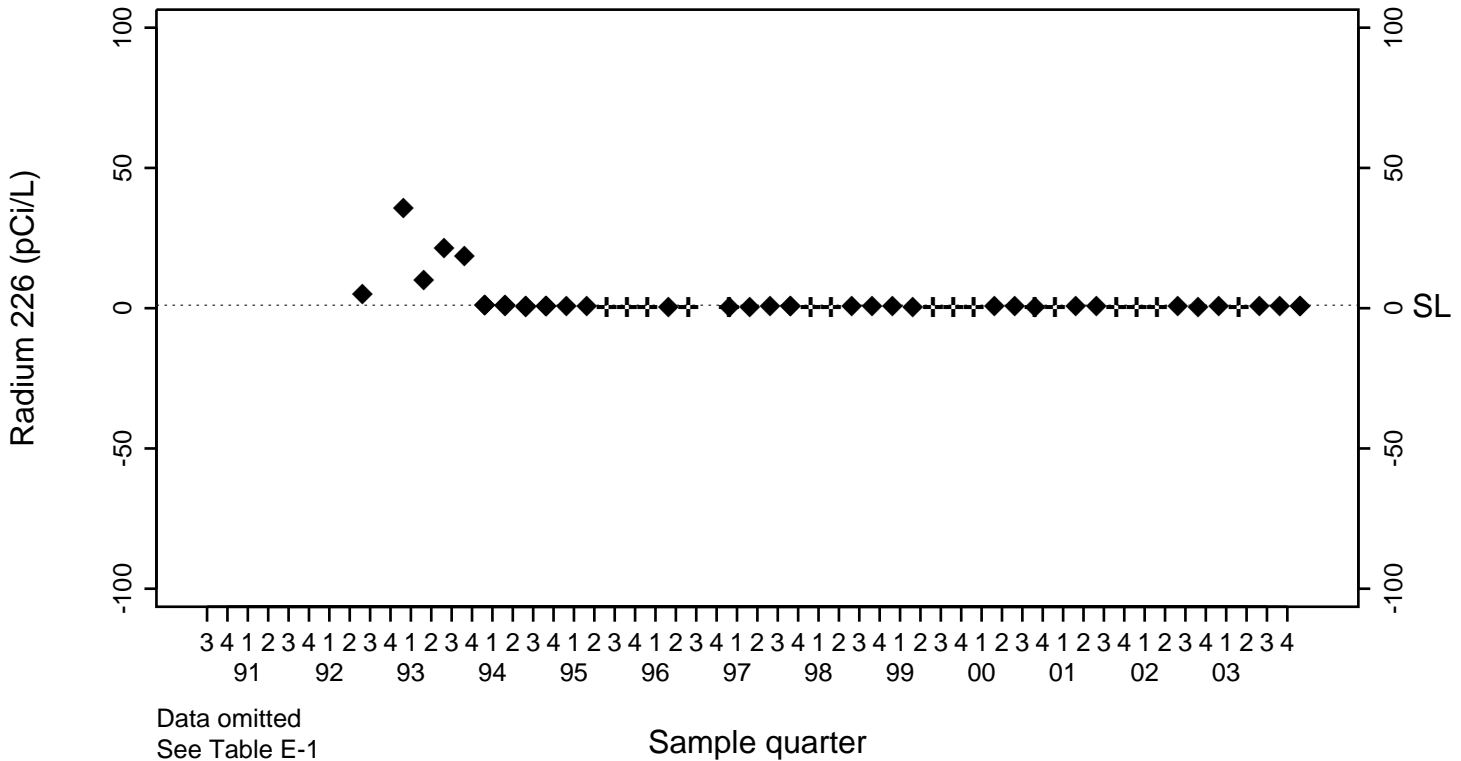


Pit 7 Complex Radium 226 (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

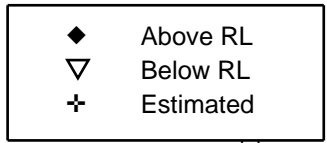
SL=1.08

Compliance Monitoring Point NC7-48

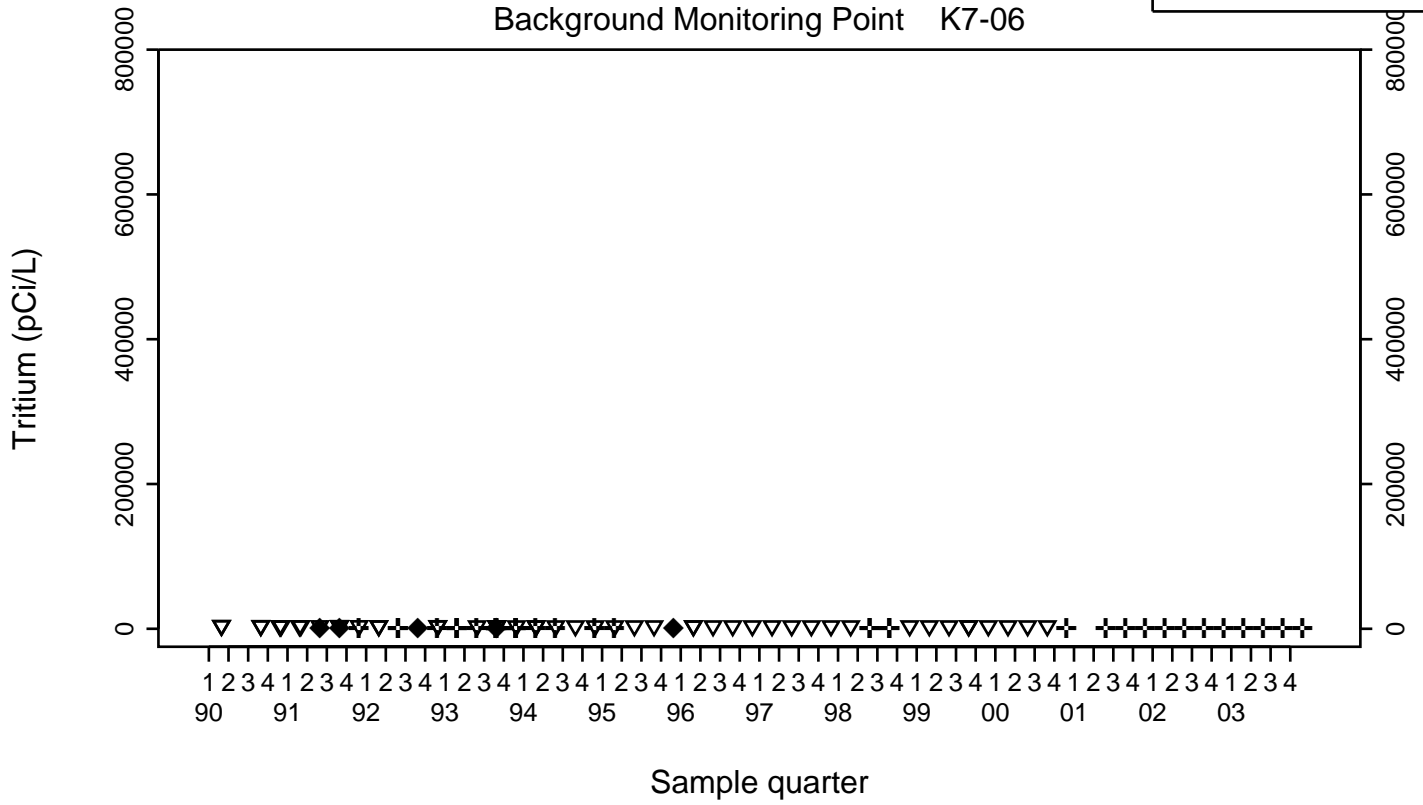


Data omitted
See Table E-1

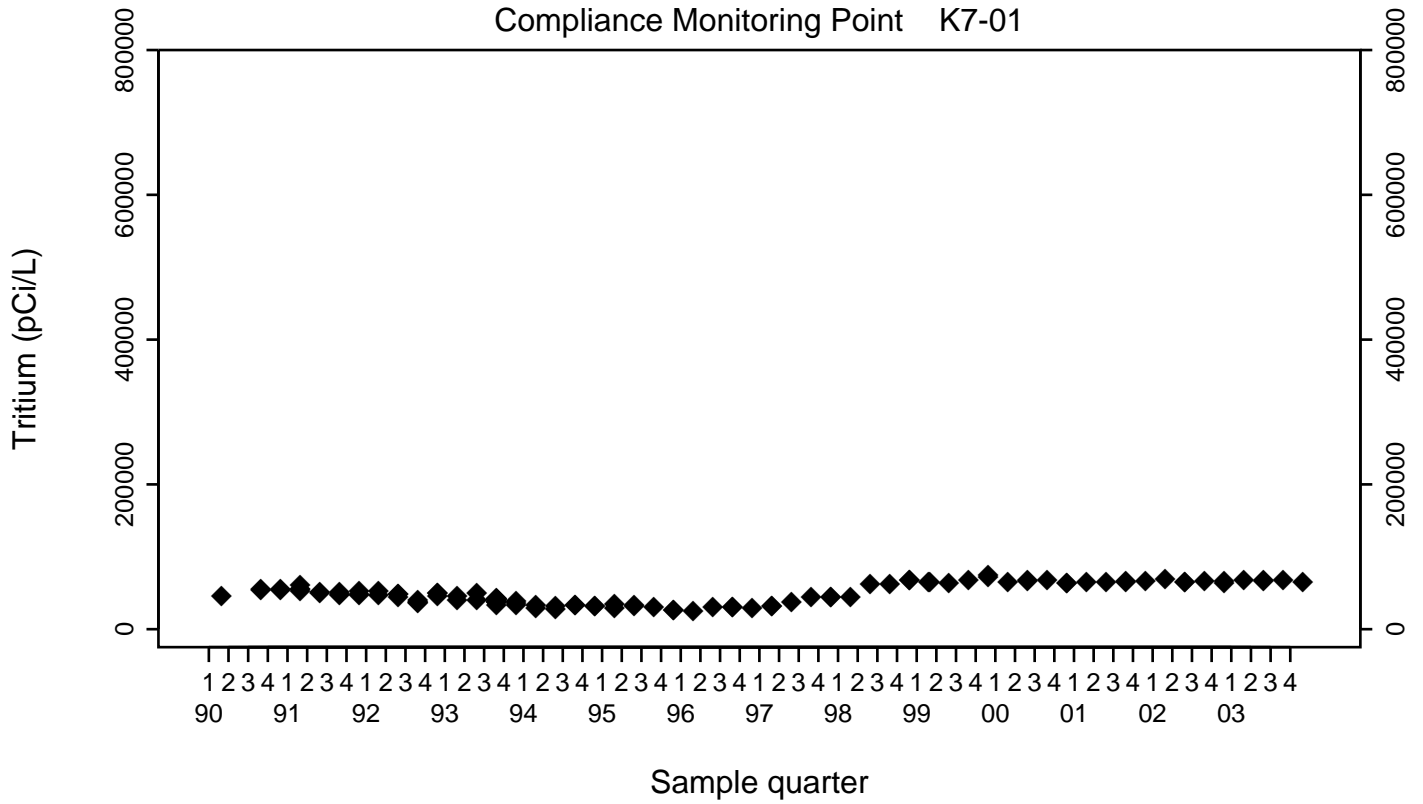
Pit 7 Complex
Tritium (pCi/L)



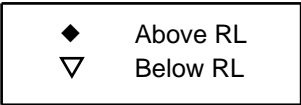
Background Monitoring Point K7-06



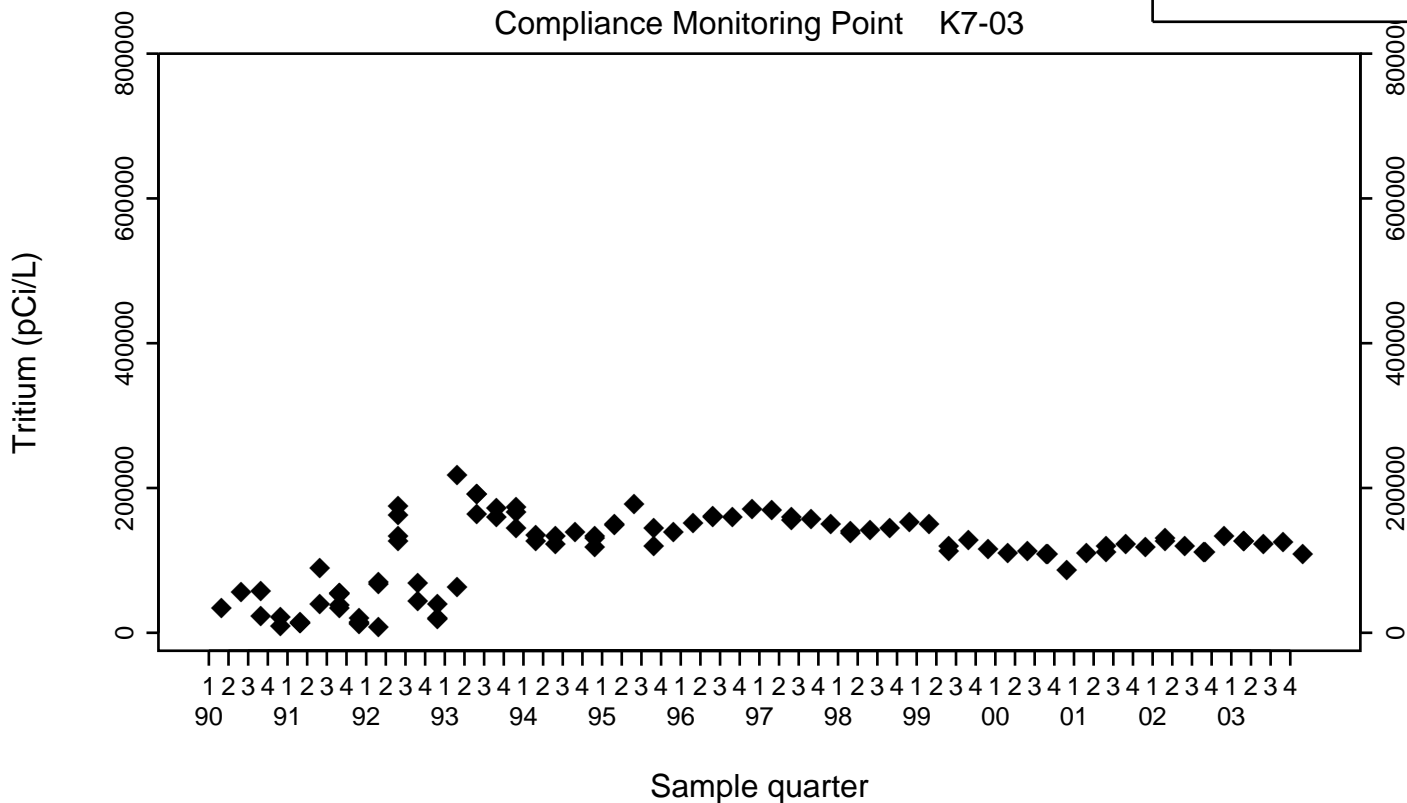
Compliance Monitoring Point K7-01



Pit 7 Complex
Tritium (pCi/L)

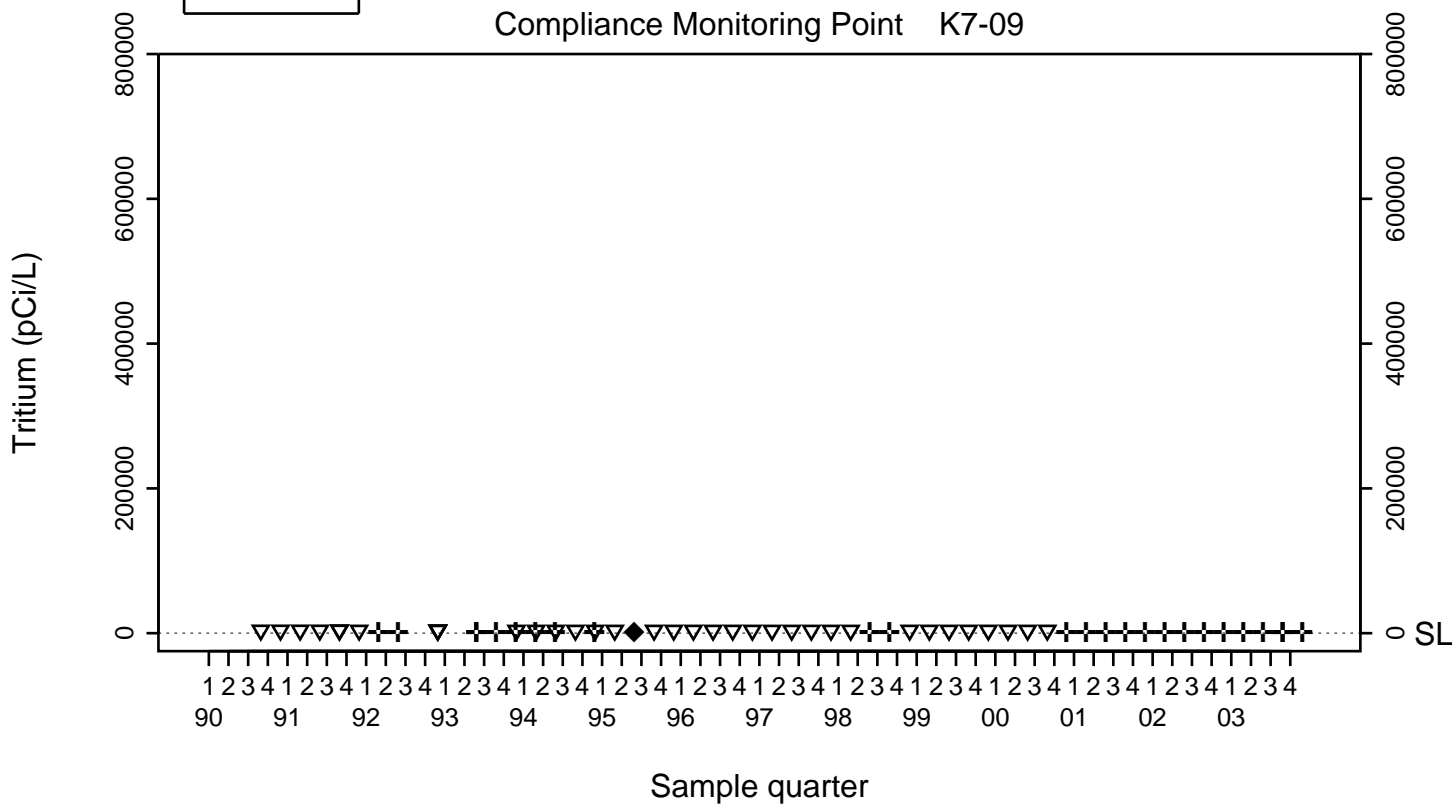


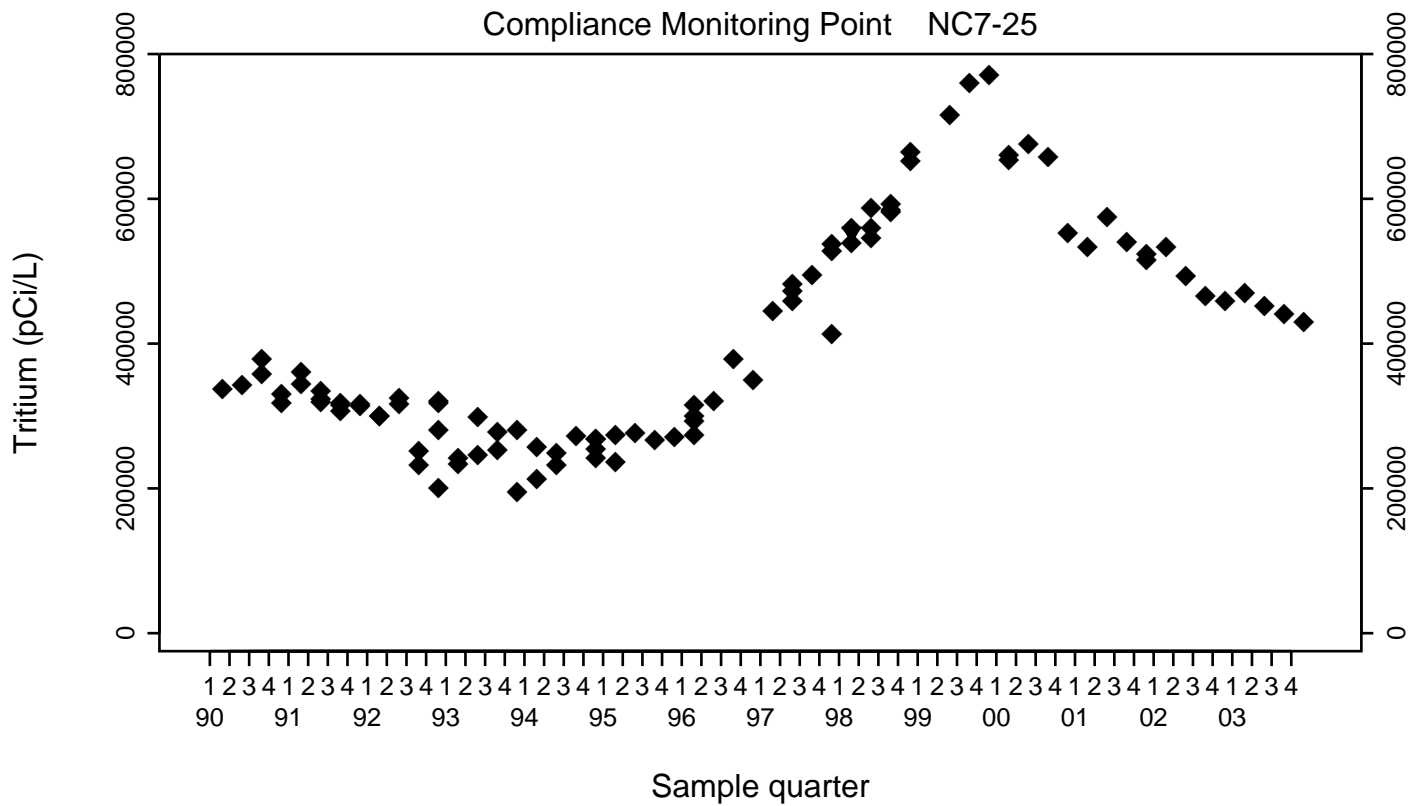
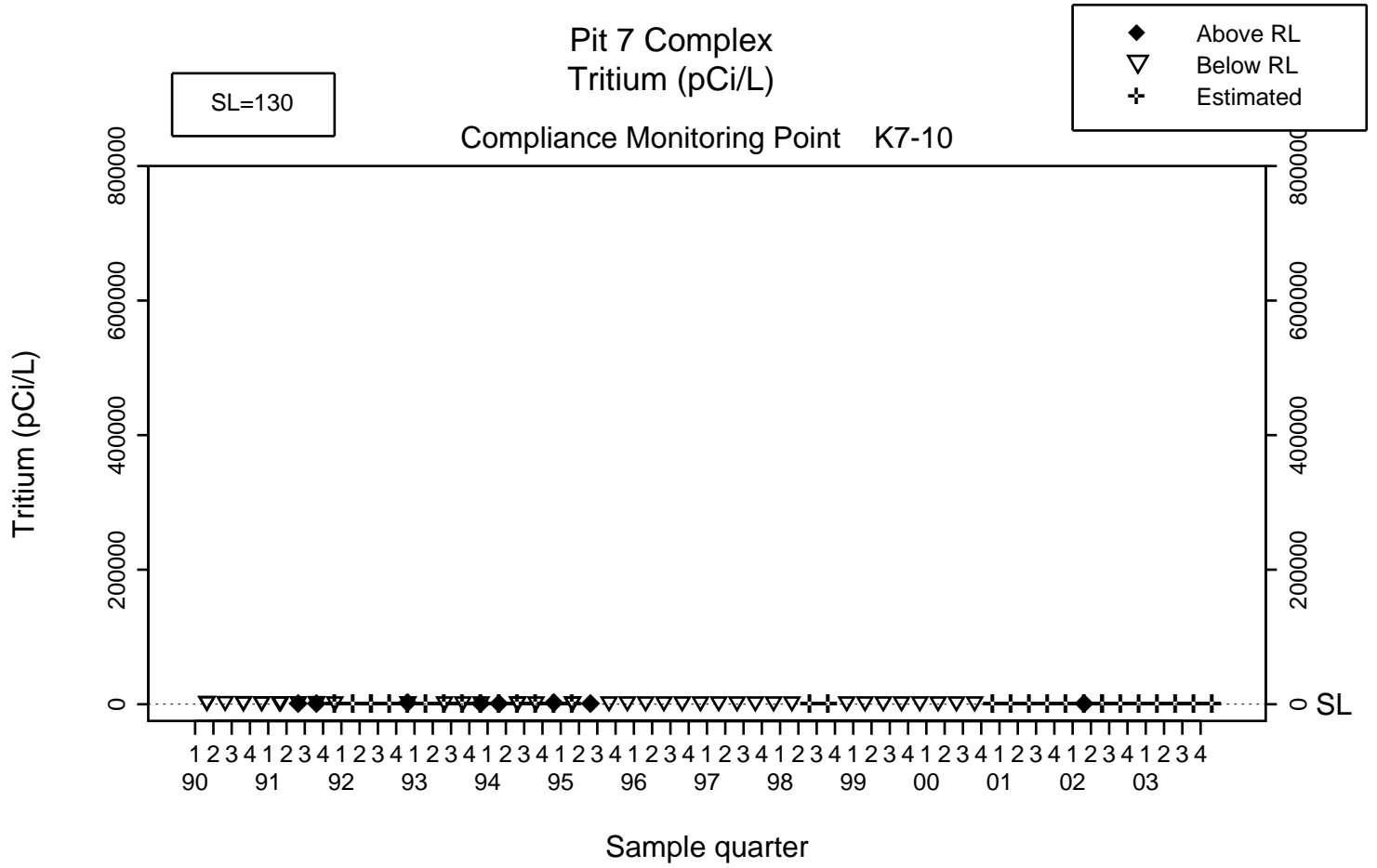
Compliance Monitoring Point K7-03



SL=130

Compliance Monitoring Point K7-09

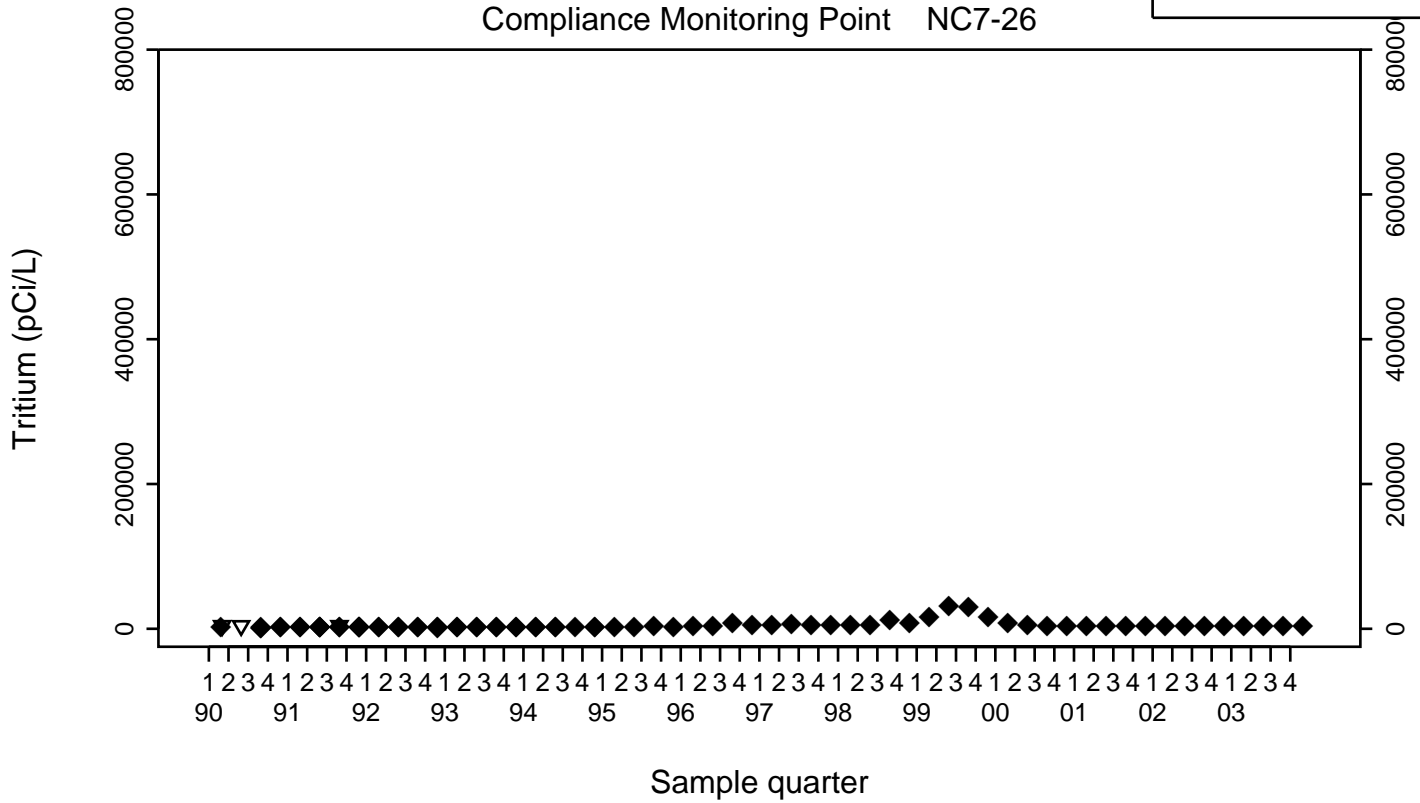




Pit 7 Complex Tritium (pCi/L)

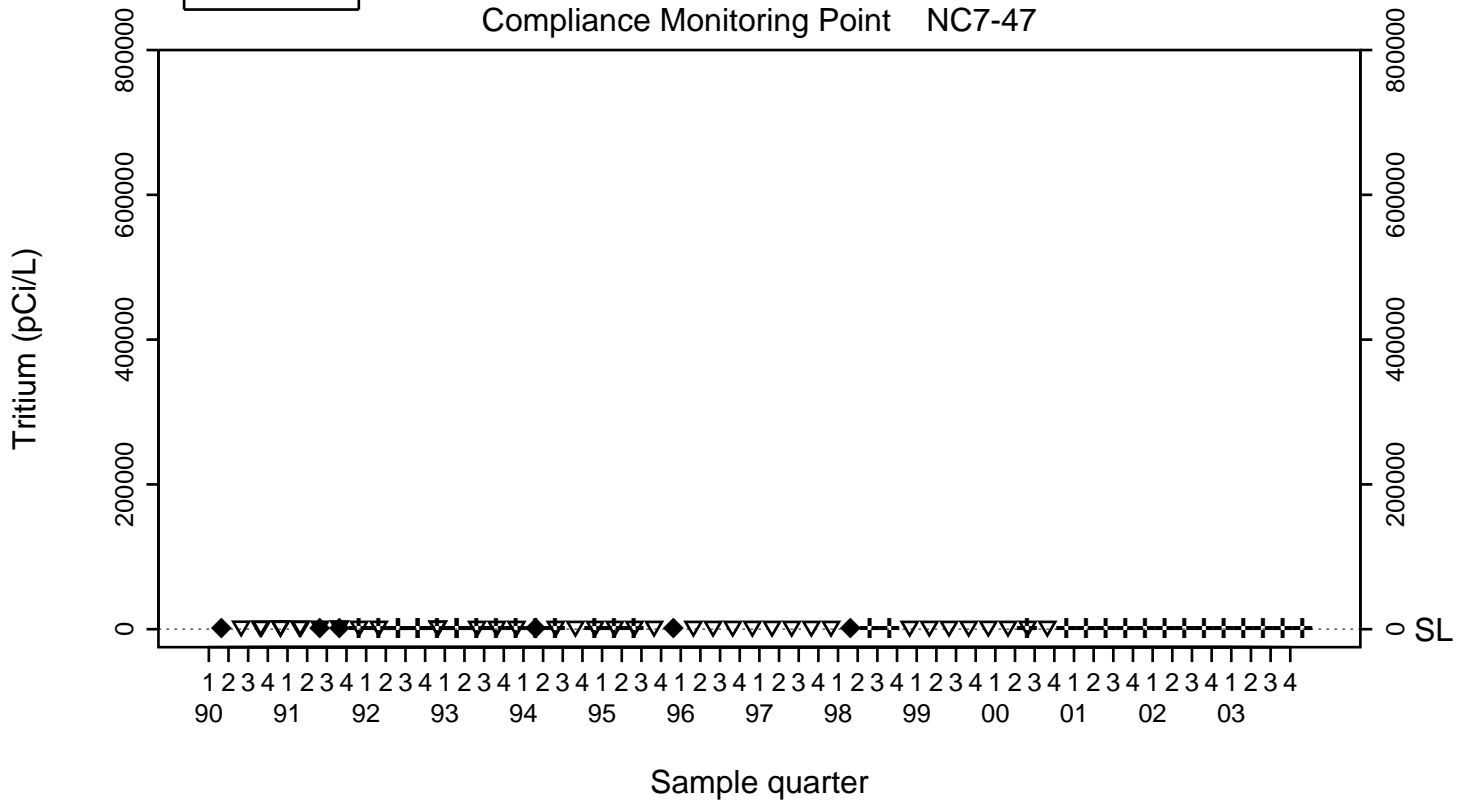
Compliance Monitoring Point NC7-26

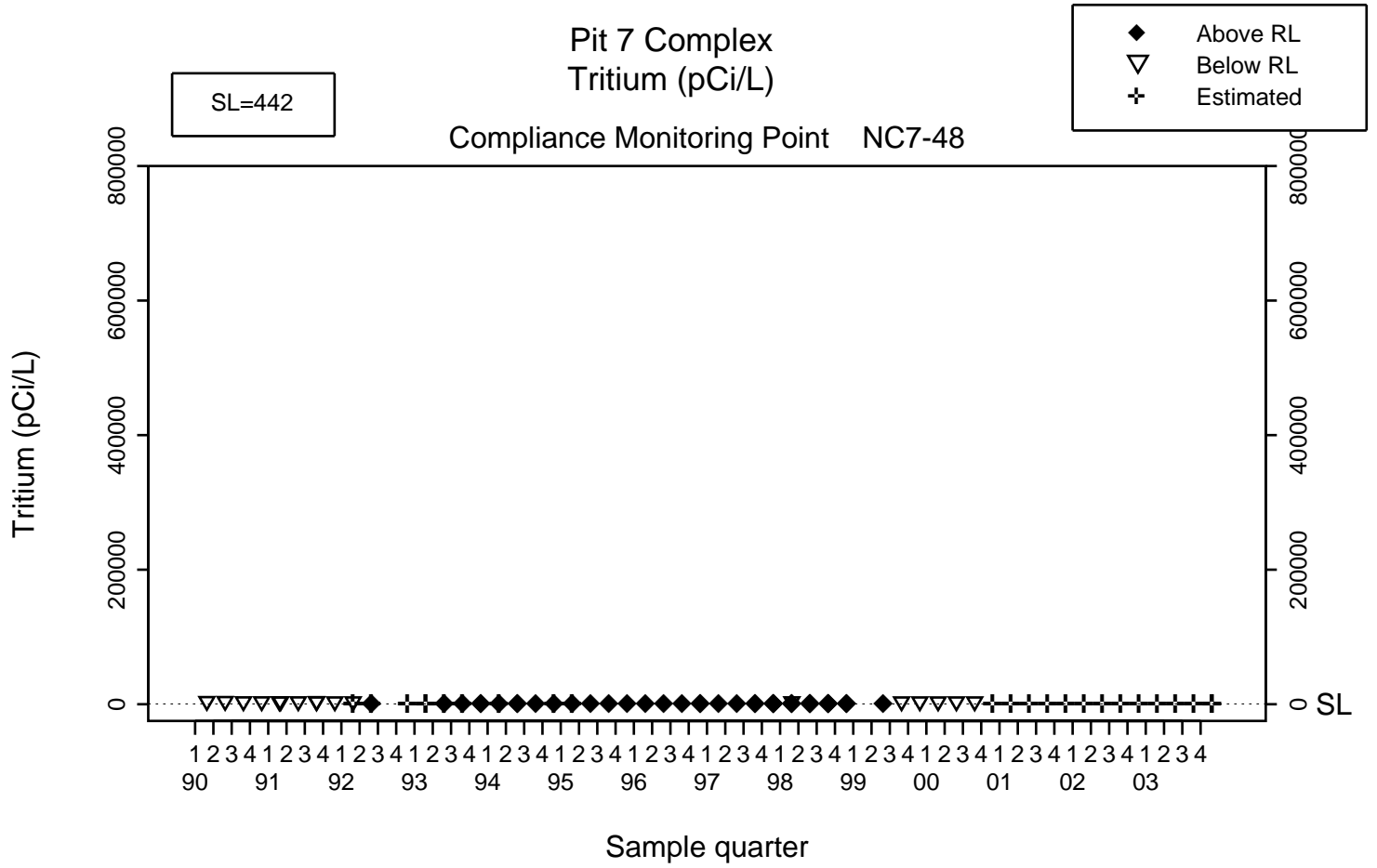
◆	Above RL
▽	Below RL



SL=130

Compliance Monitoring Point NC7-47

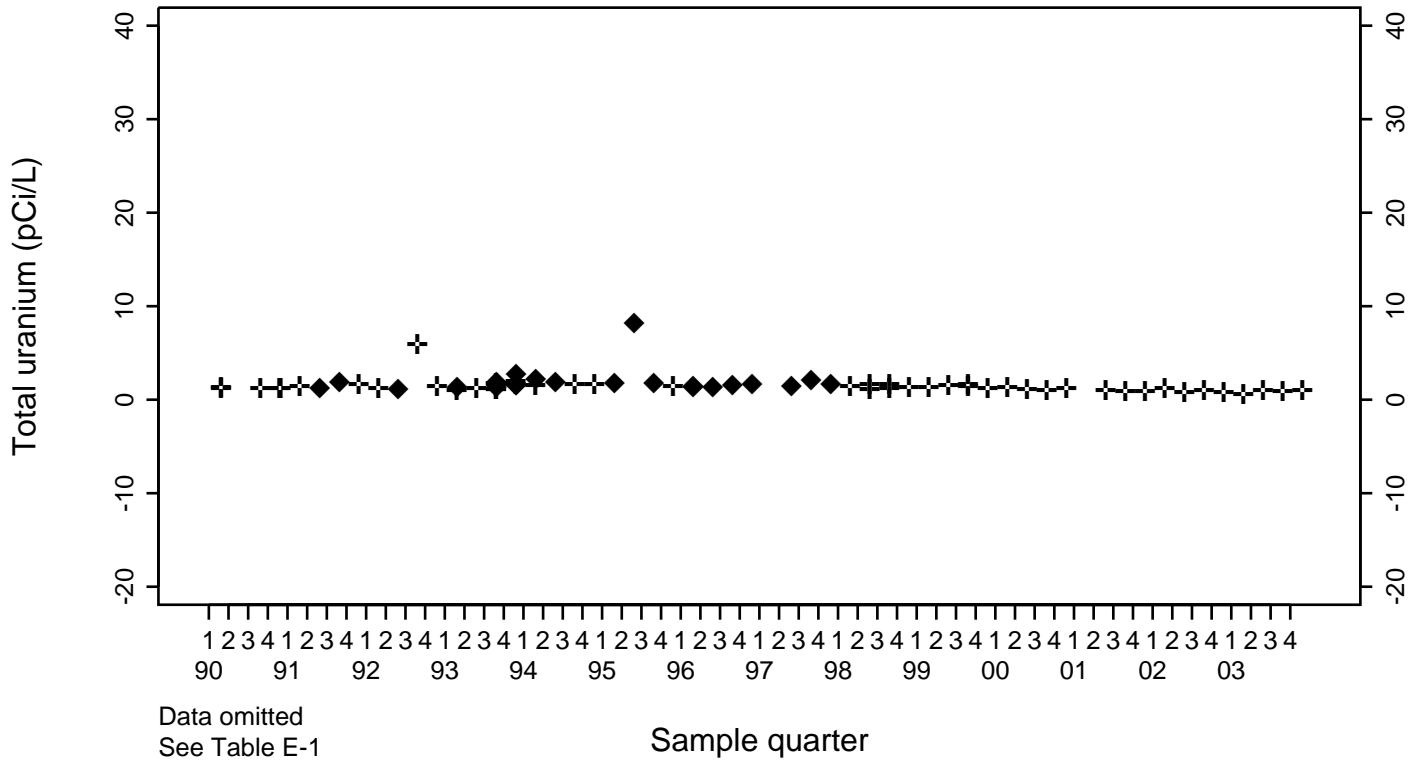




Pit 7 Complex Total uranium (pCi/L)

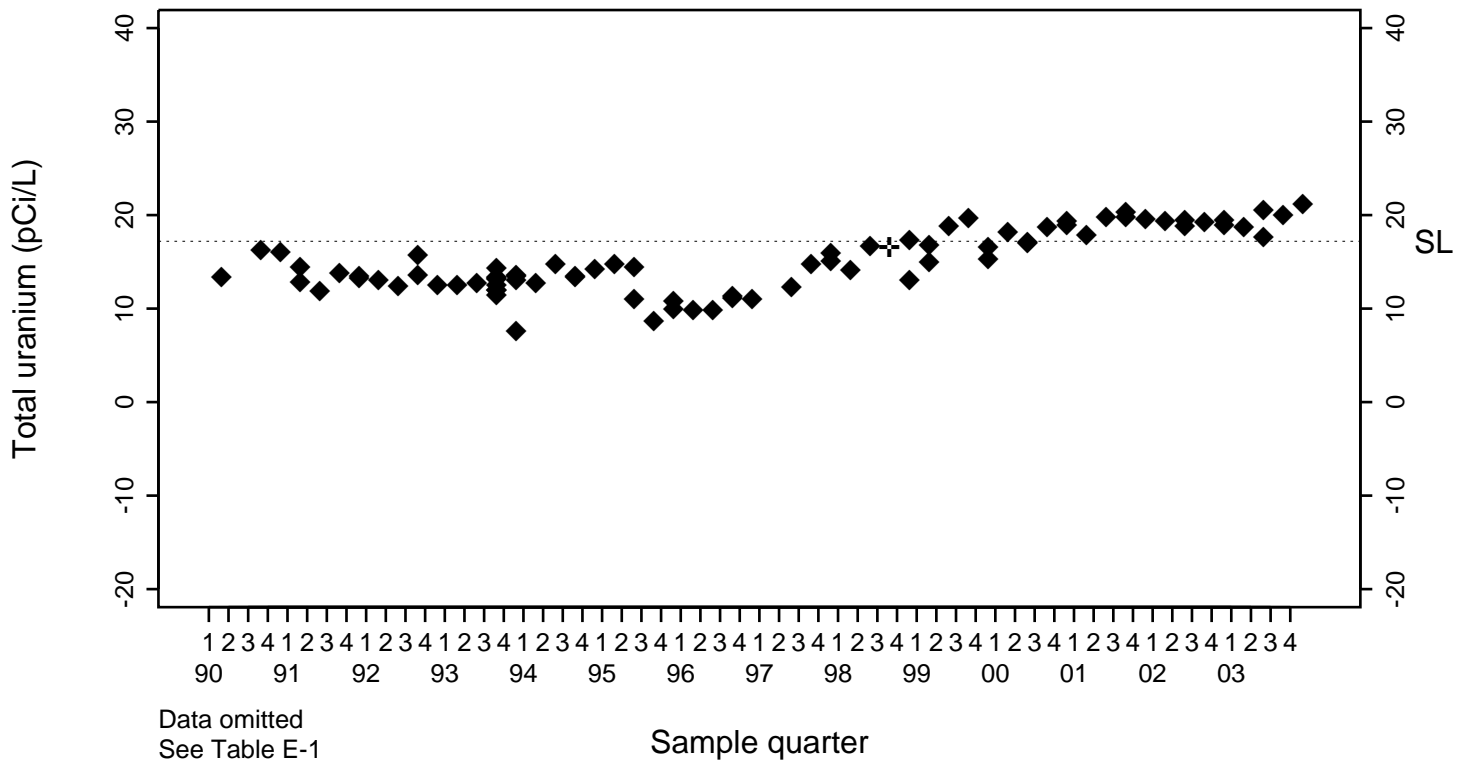
◆	Above RL
▽	Below RL
+	Estimated

Background Monitoring Point K7-06



SL=17.2

Compliance Monitoring Point K7-01

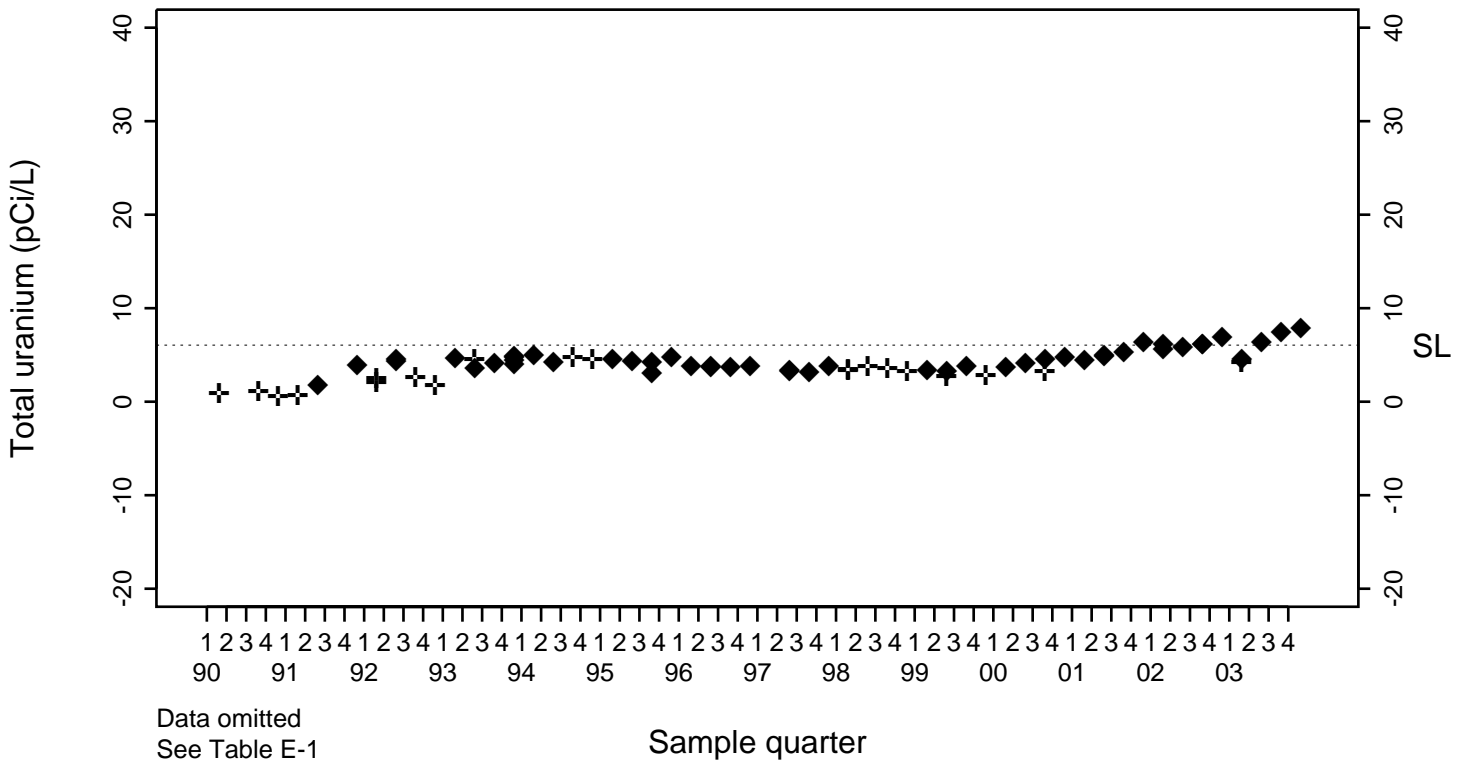


Pit 7 Complex Total uranium (pCi/L)

- ◆ Above RL
- ▽ Below RL
- + Estimated

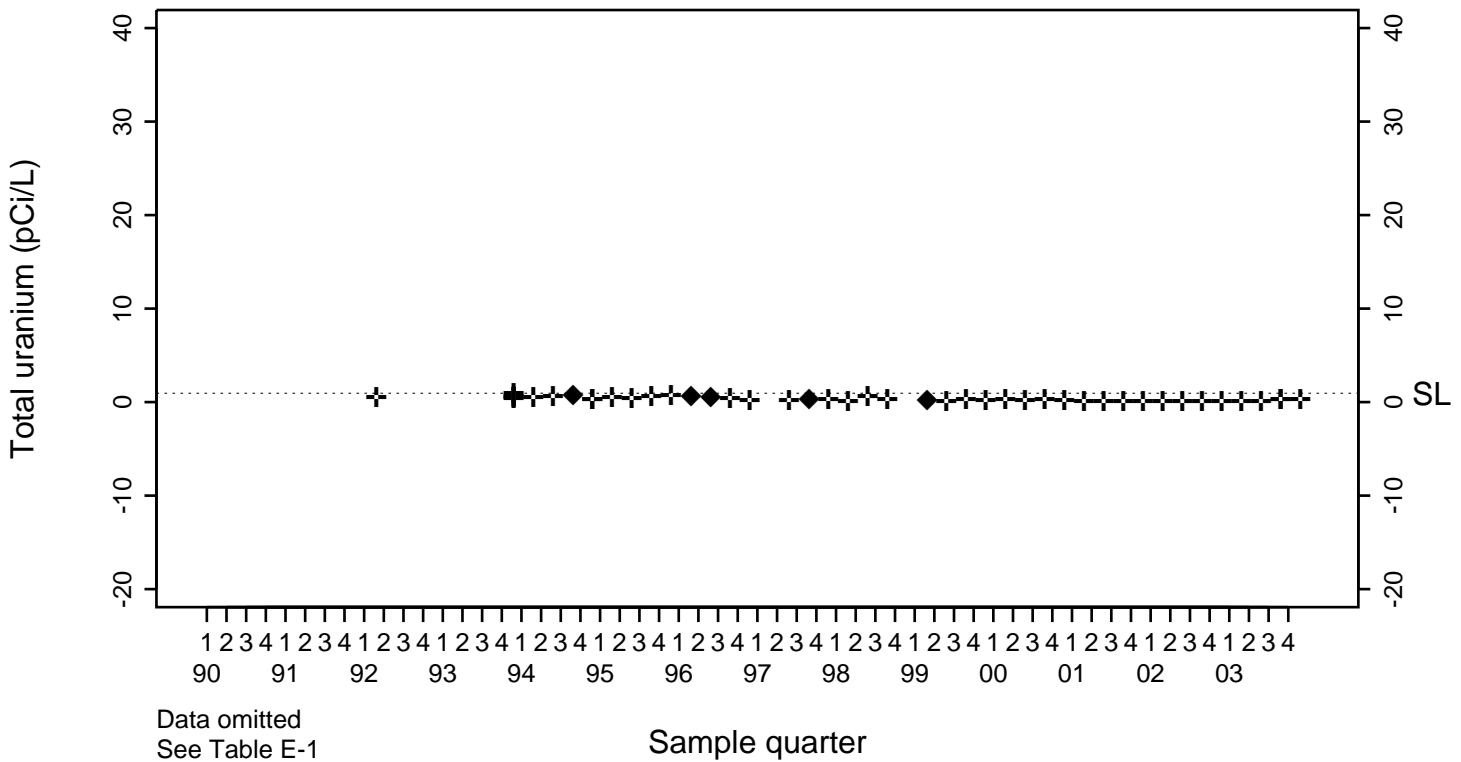
SL=6.05

Compliance Monitoring Point K7-03



SL=0.95

Compliance Monitoring Point K7-09

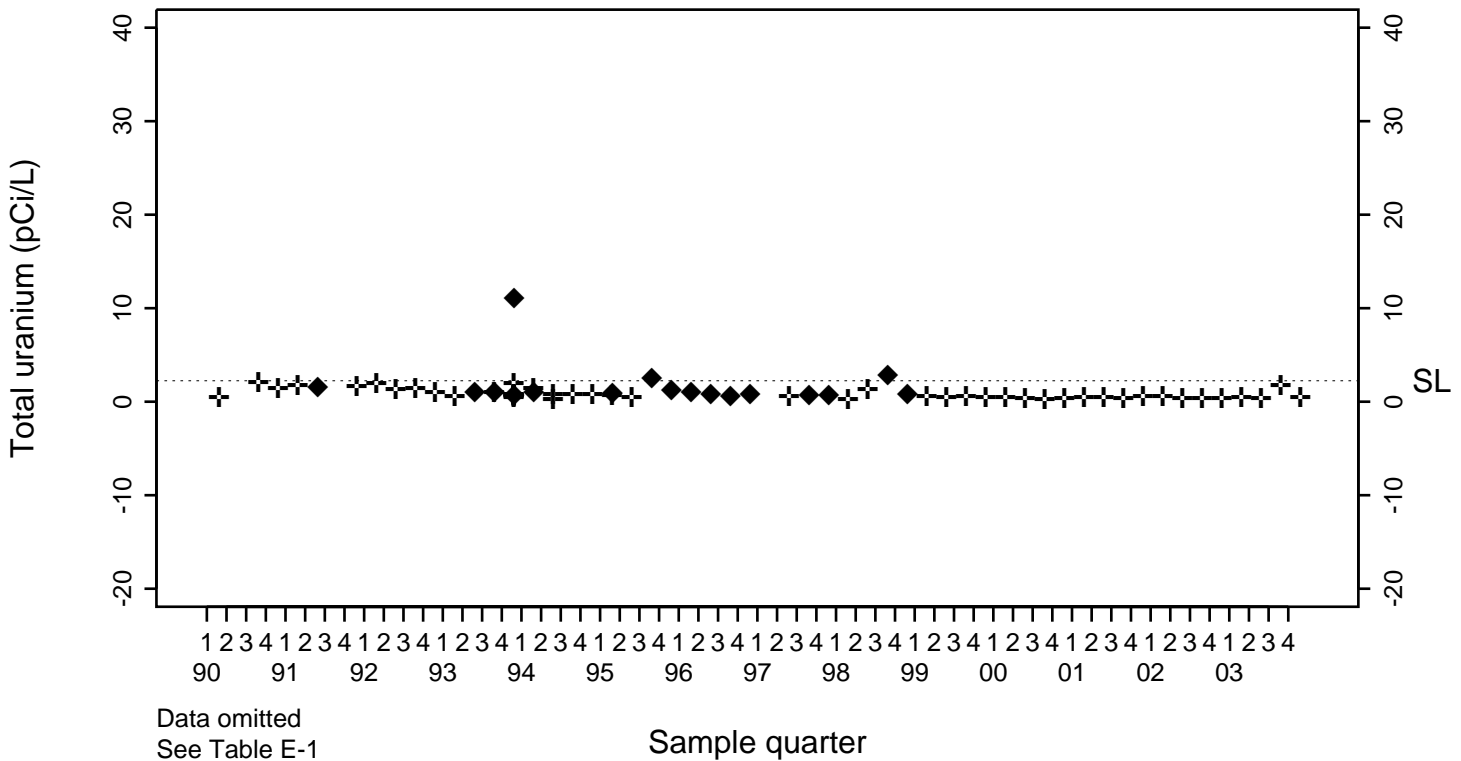


Pit 7 Complex Total uranium (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

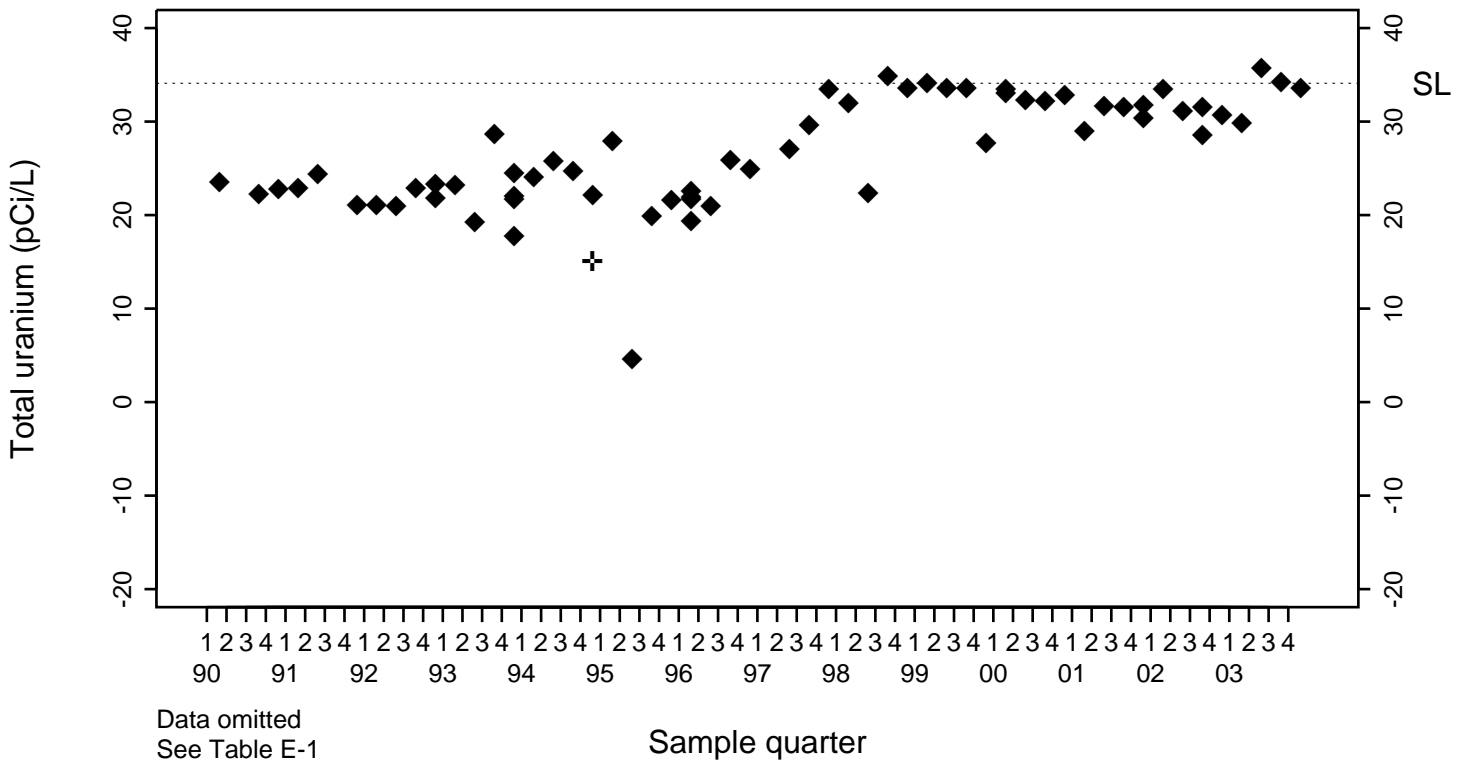
SL=2.24

Compliance Monitoring Point K7-10



SL=34.1

Compliance Monitoring Point NC7-25

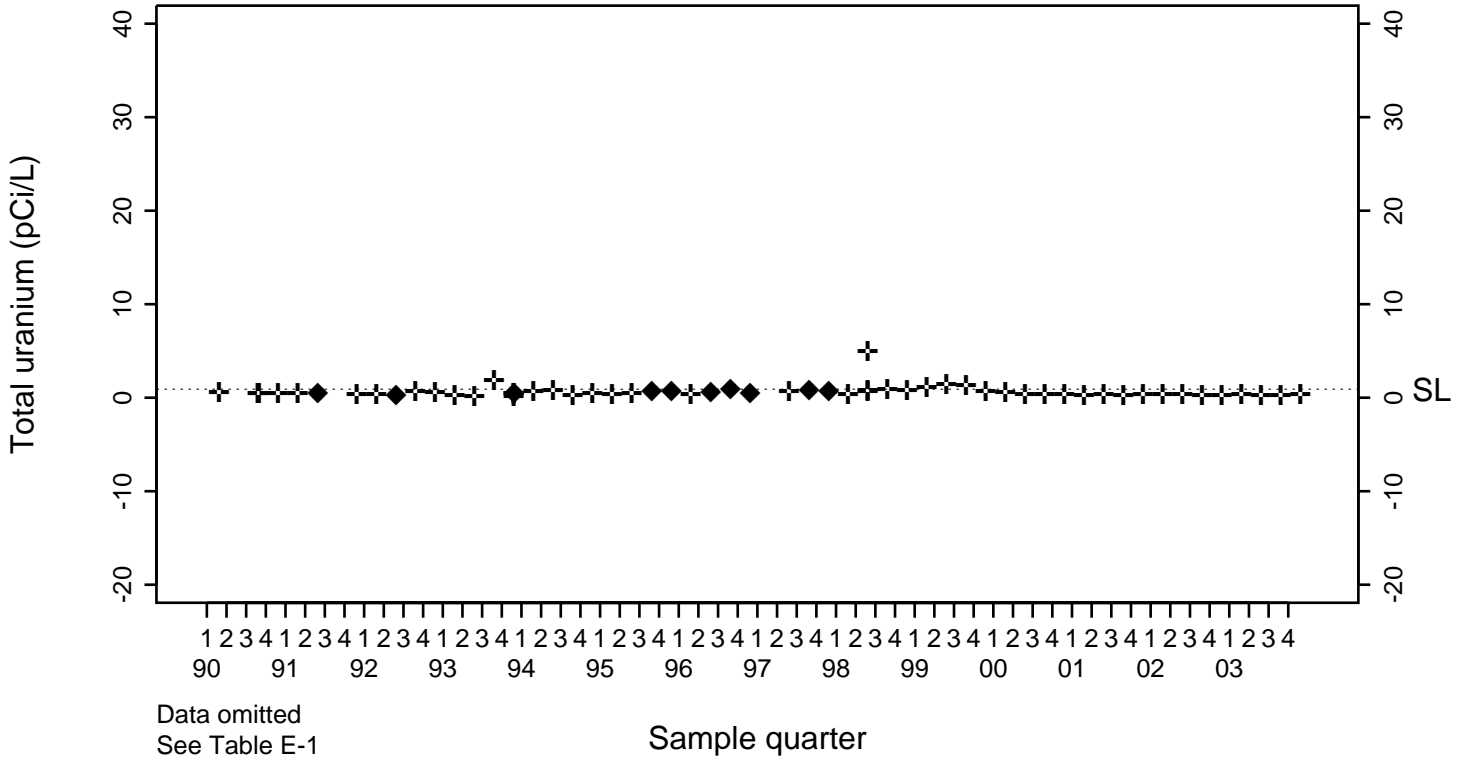


Pit 7 Complex Total uranium (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

SL=0.91

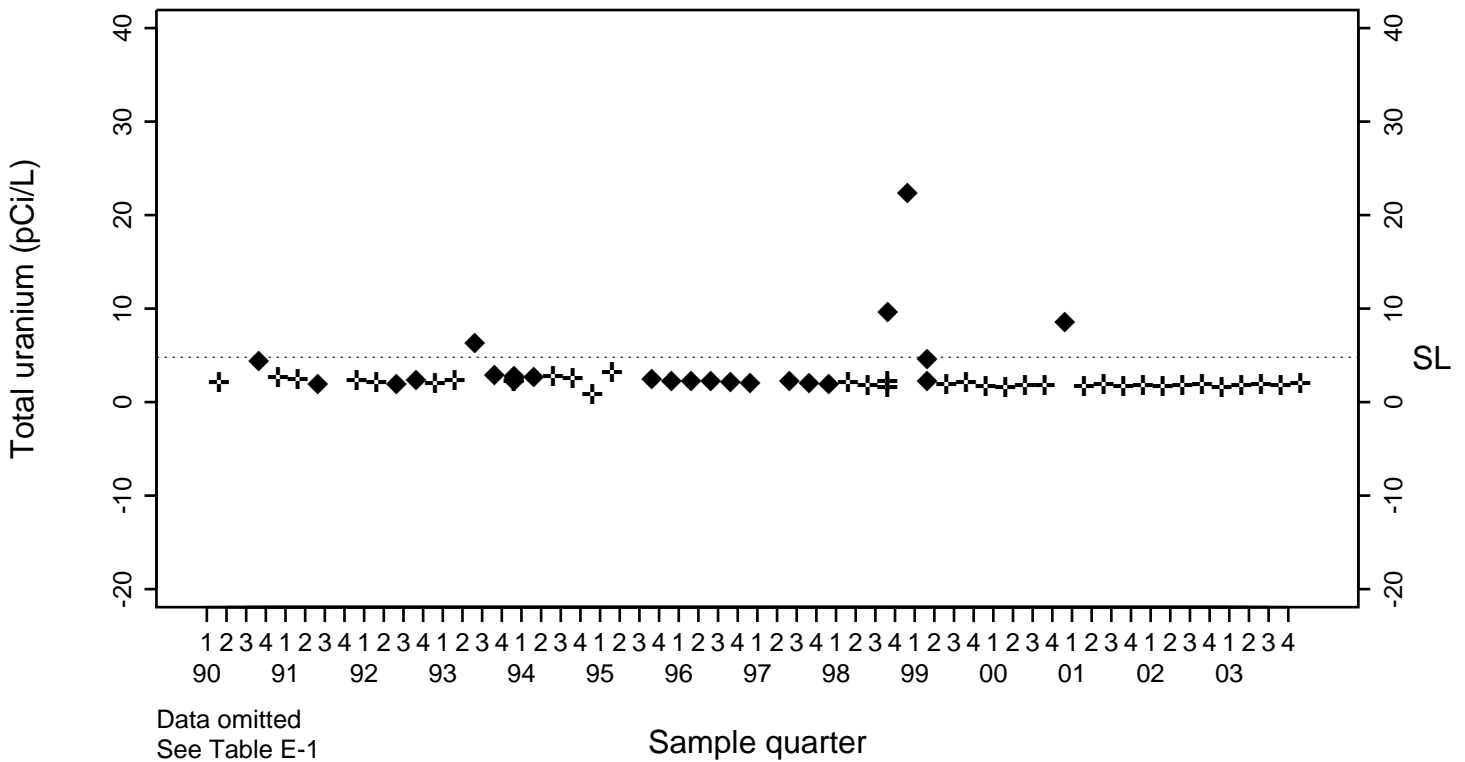
Compliance Monitoring Point NC7-26



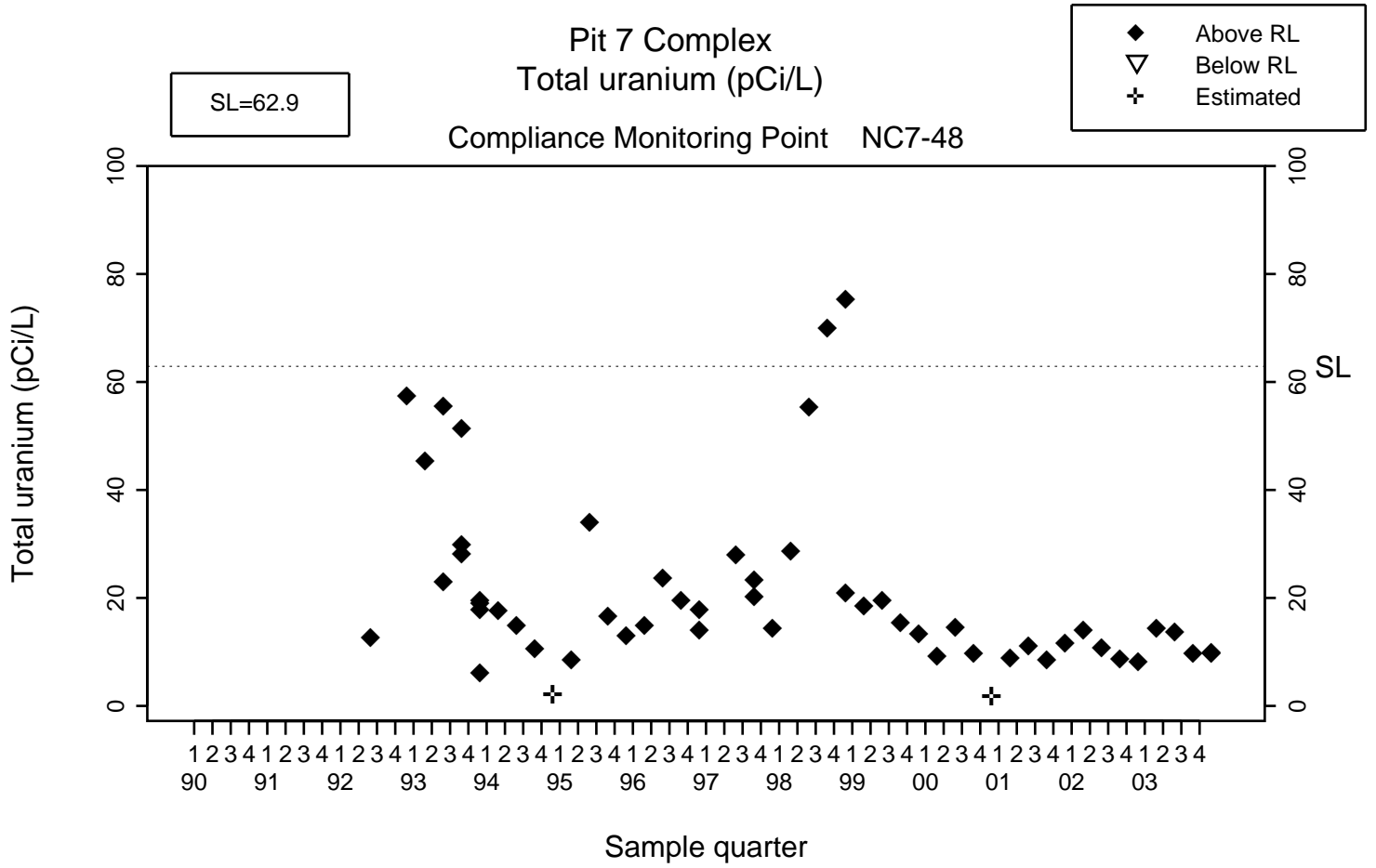
Data omitted
See Table E-1

SL=4.8

Compliance Monitoring Point NC7-47



Data omitted
See Table E-1

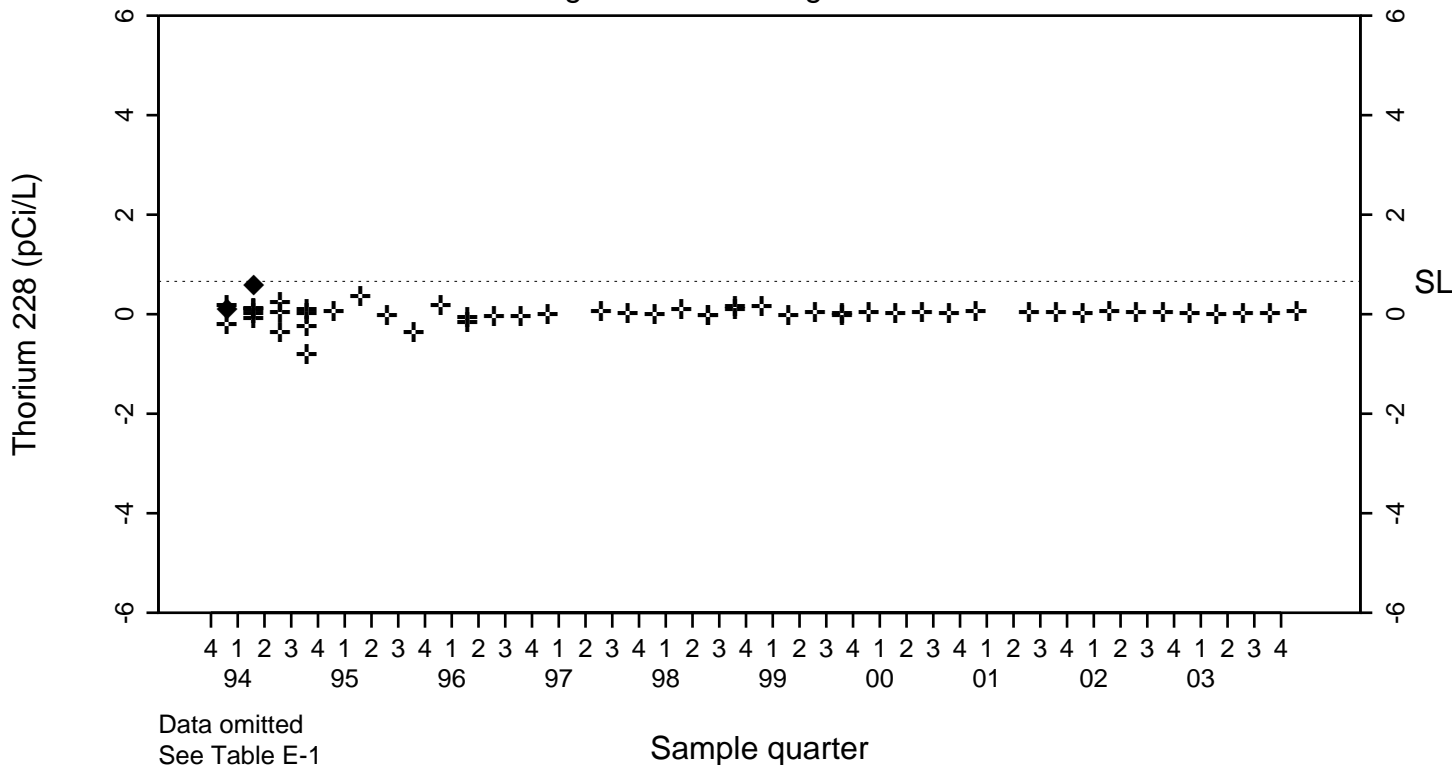


Pit 7 Complex Thorium 228 (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

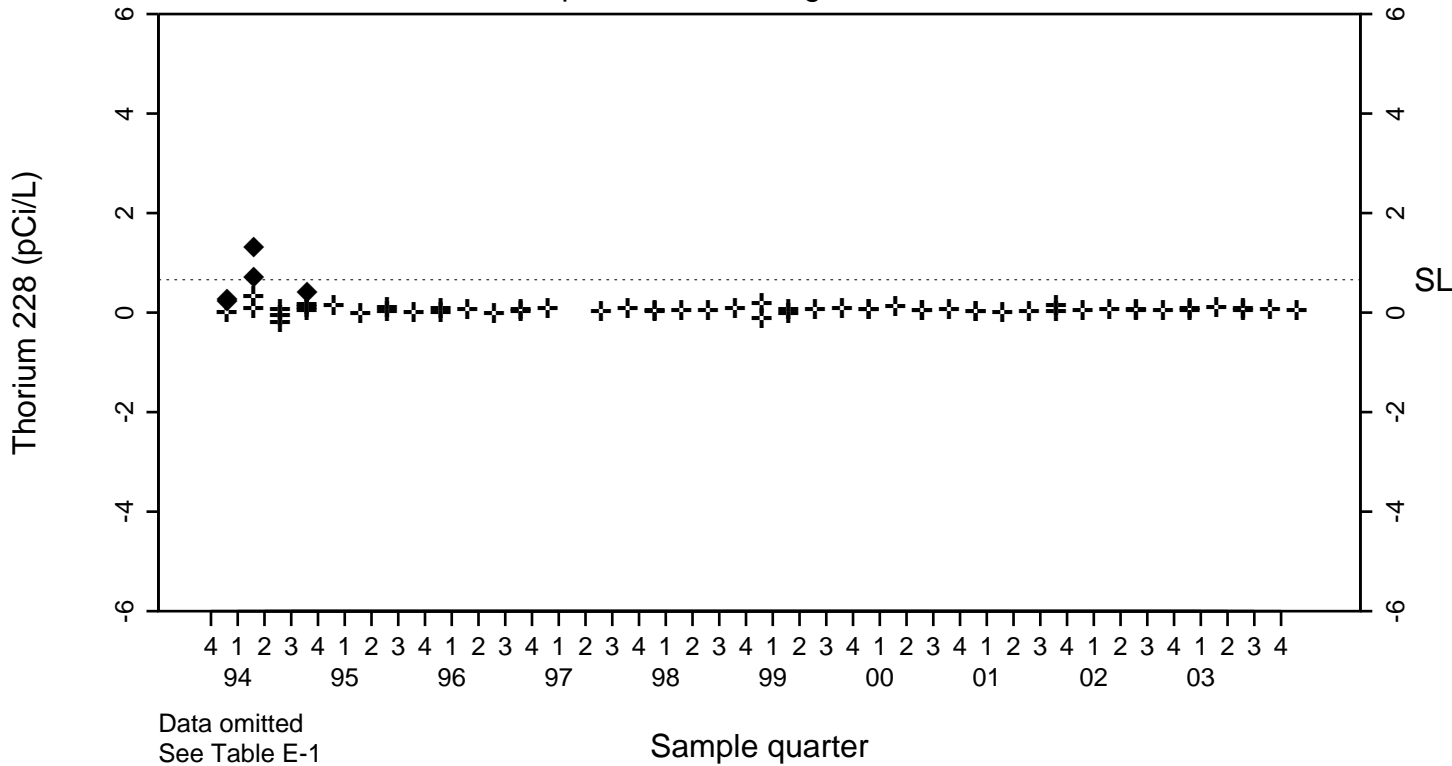
SL=0.66

Background Monitoring Point K7-06



SL=0.66

Compliance Monitoring Point K7-01

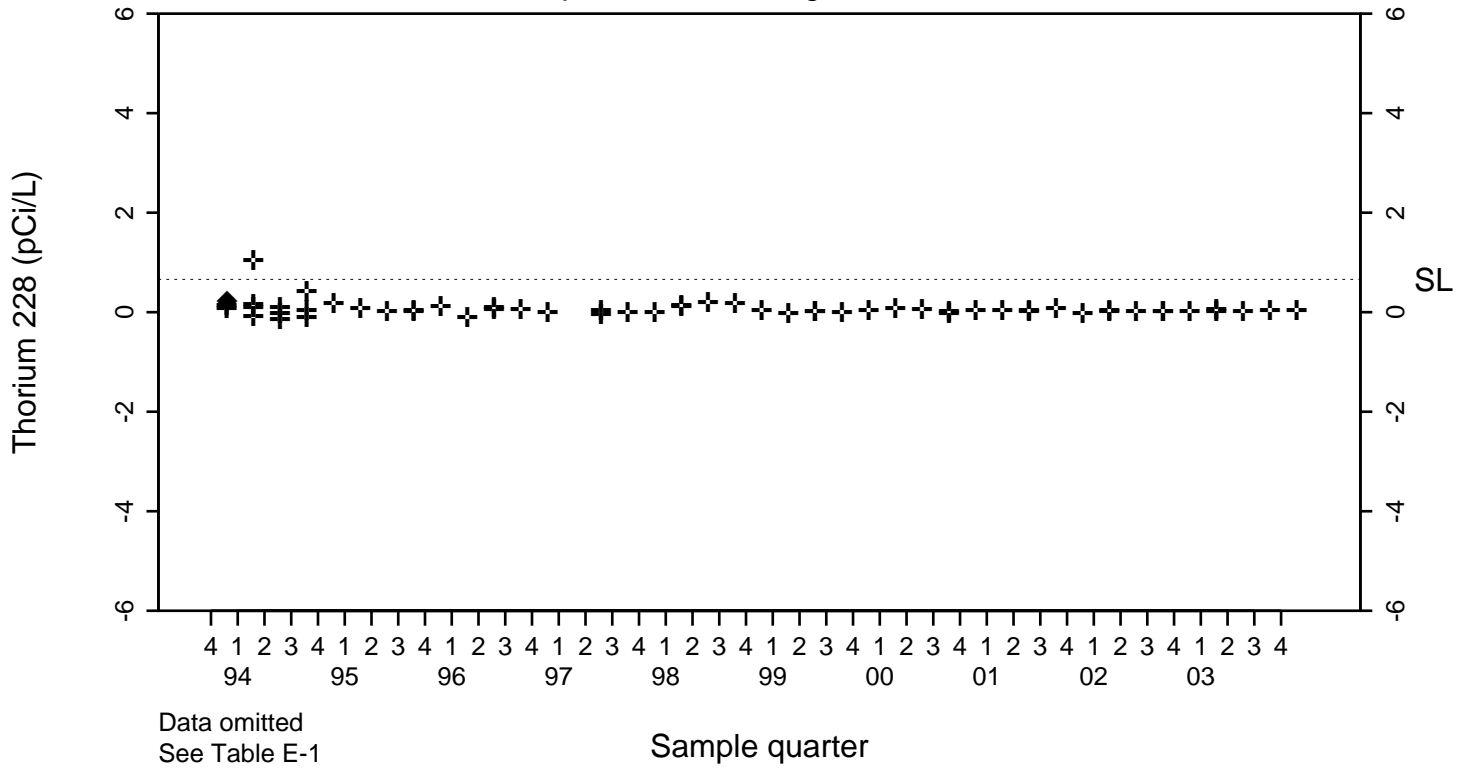


Pit 7 Complex Thorium 228 (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

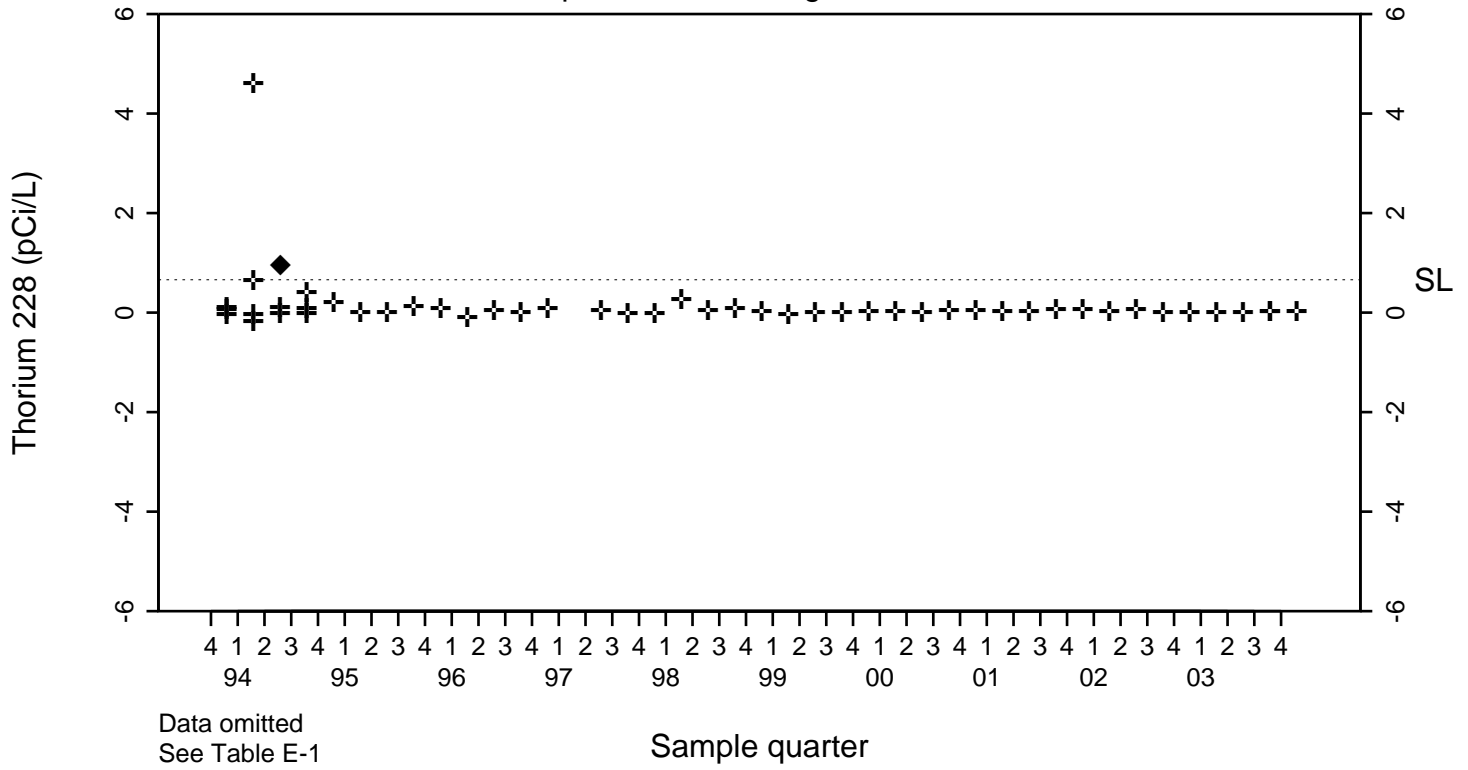
SL=0.66

Compliance Monitoring Point K7-03



SL=0.66

Compliance Monitoring Point K7-09

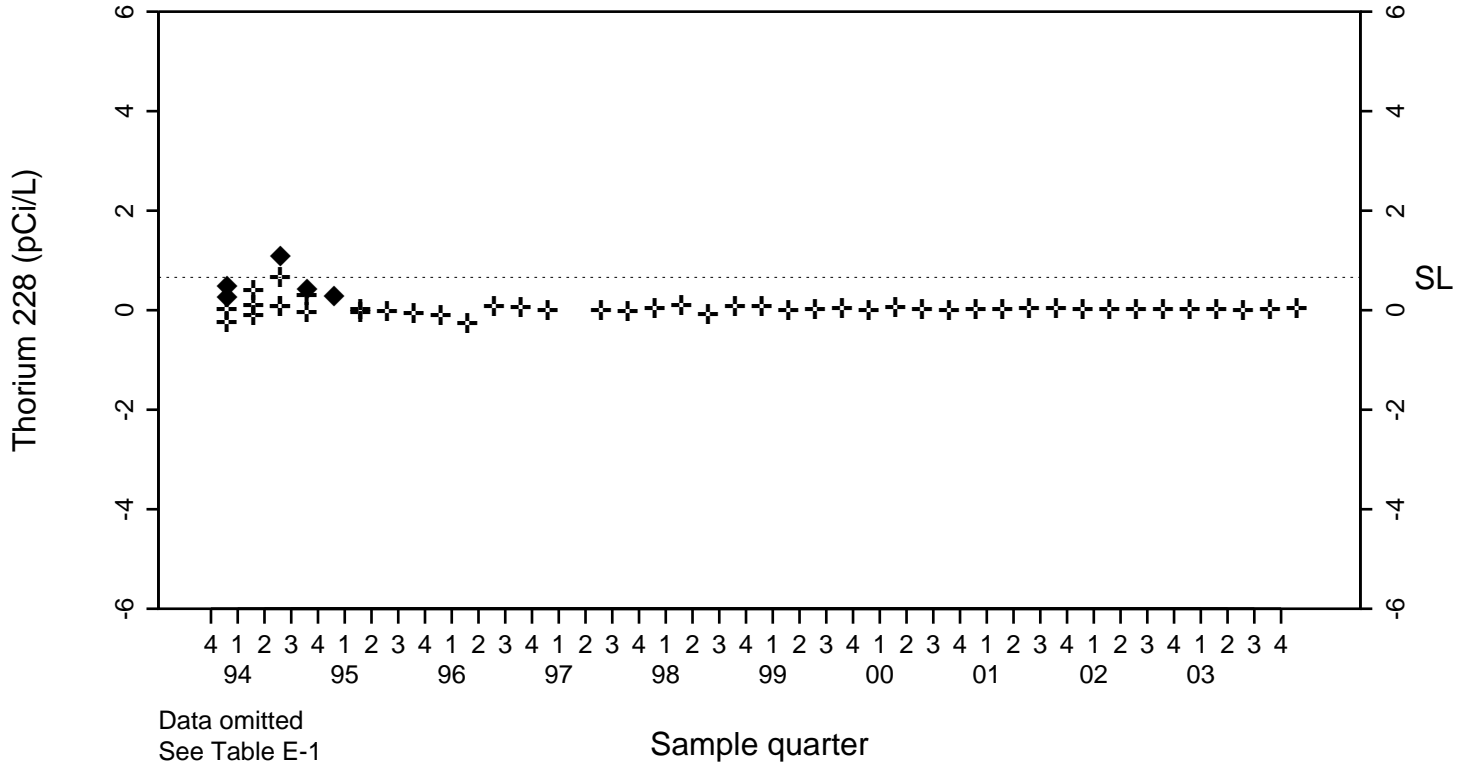


Pit 7 Complex Thorium 228 (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

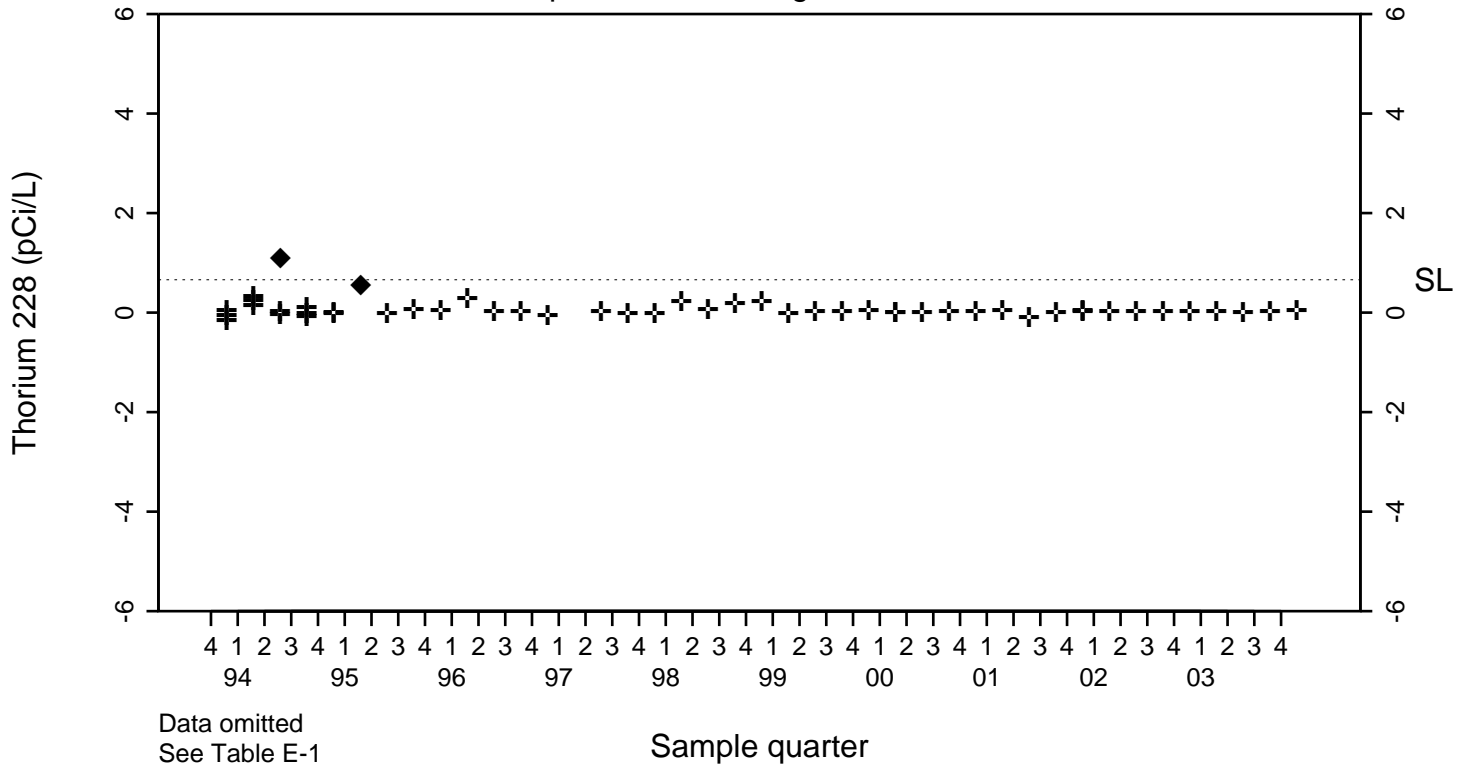
SL=0.66

Compliance Monitoring Point K7-10



SL=0.66

Compliance Monitoring Point NC7-25

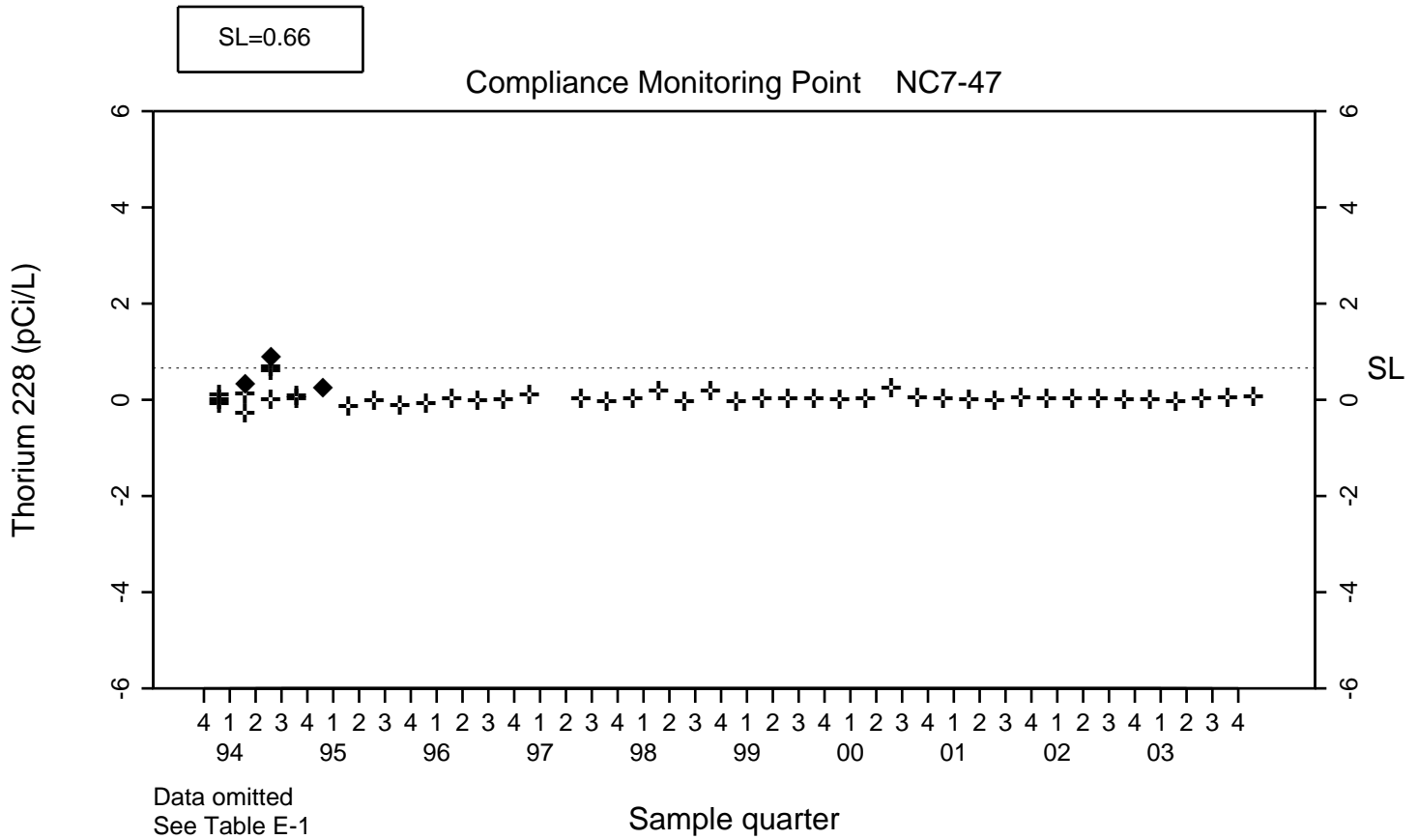
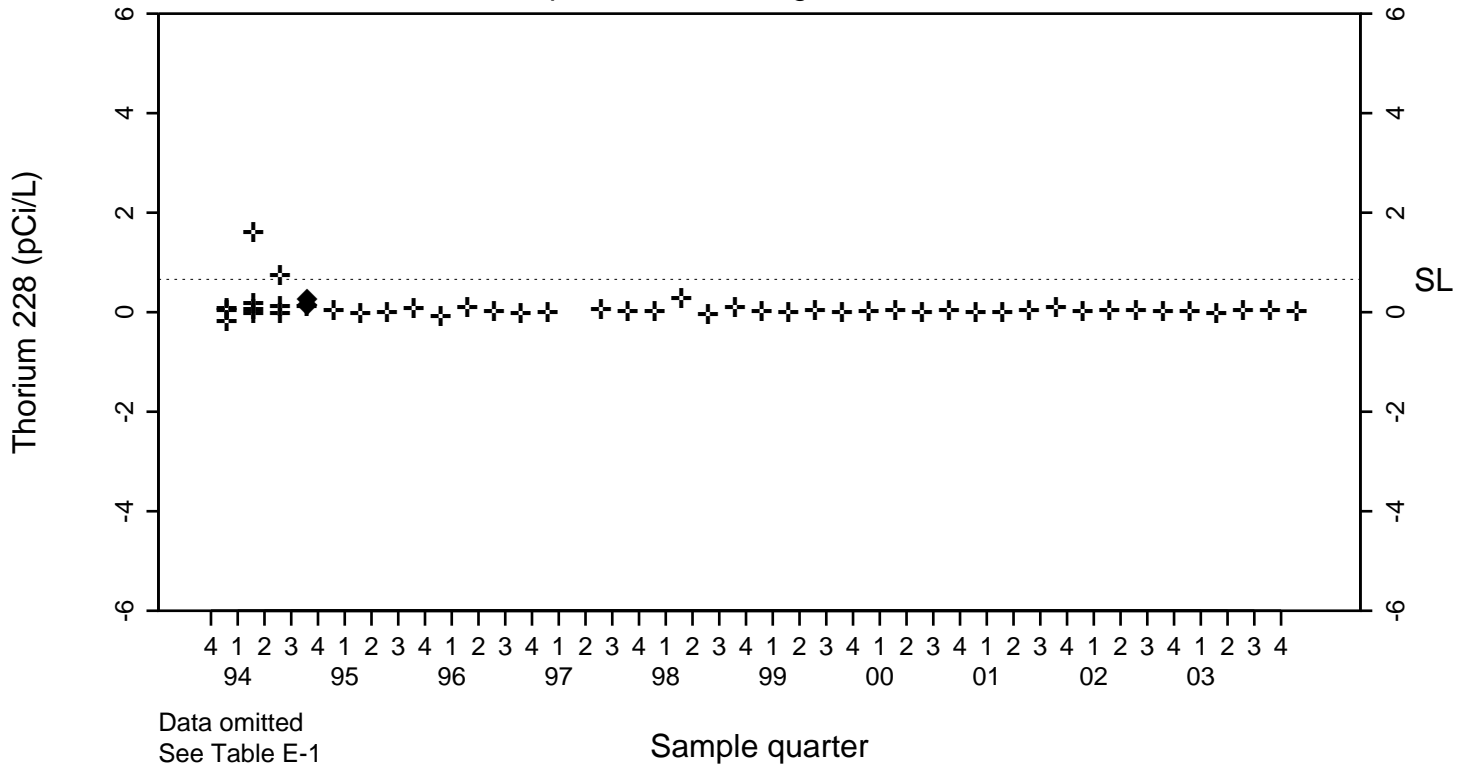


Pit 7 Complex Thorium 228 (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

SL=0.66

Compliance Monitoring Point NC7-26

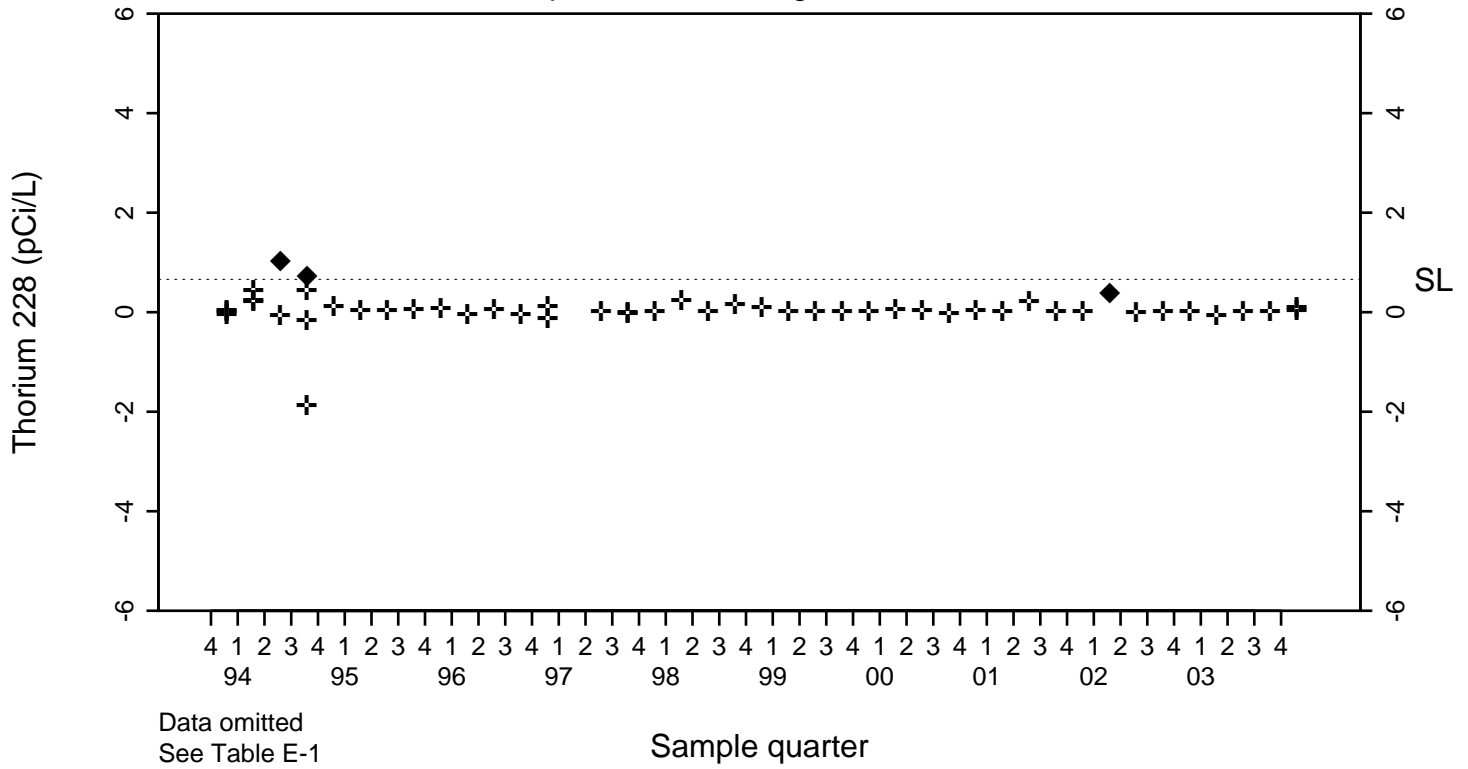


Pit 7 Complex Thorium 228 (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

SL=0.66

Compliance Monitoring Point NC7-48

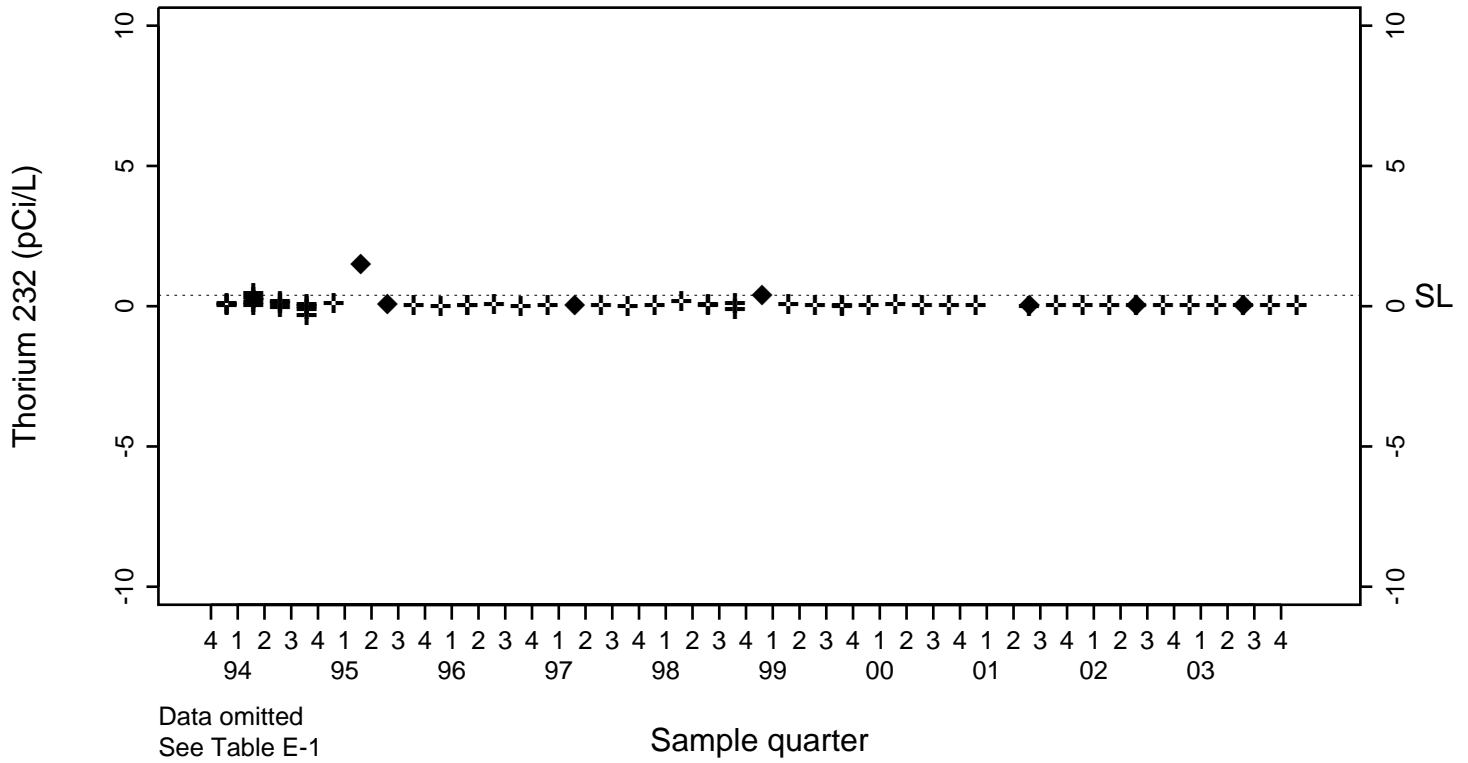


Pit 7 Complex Thorium 232 (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

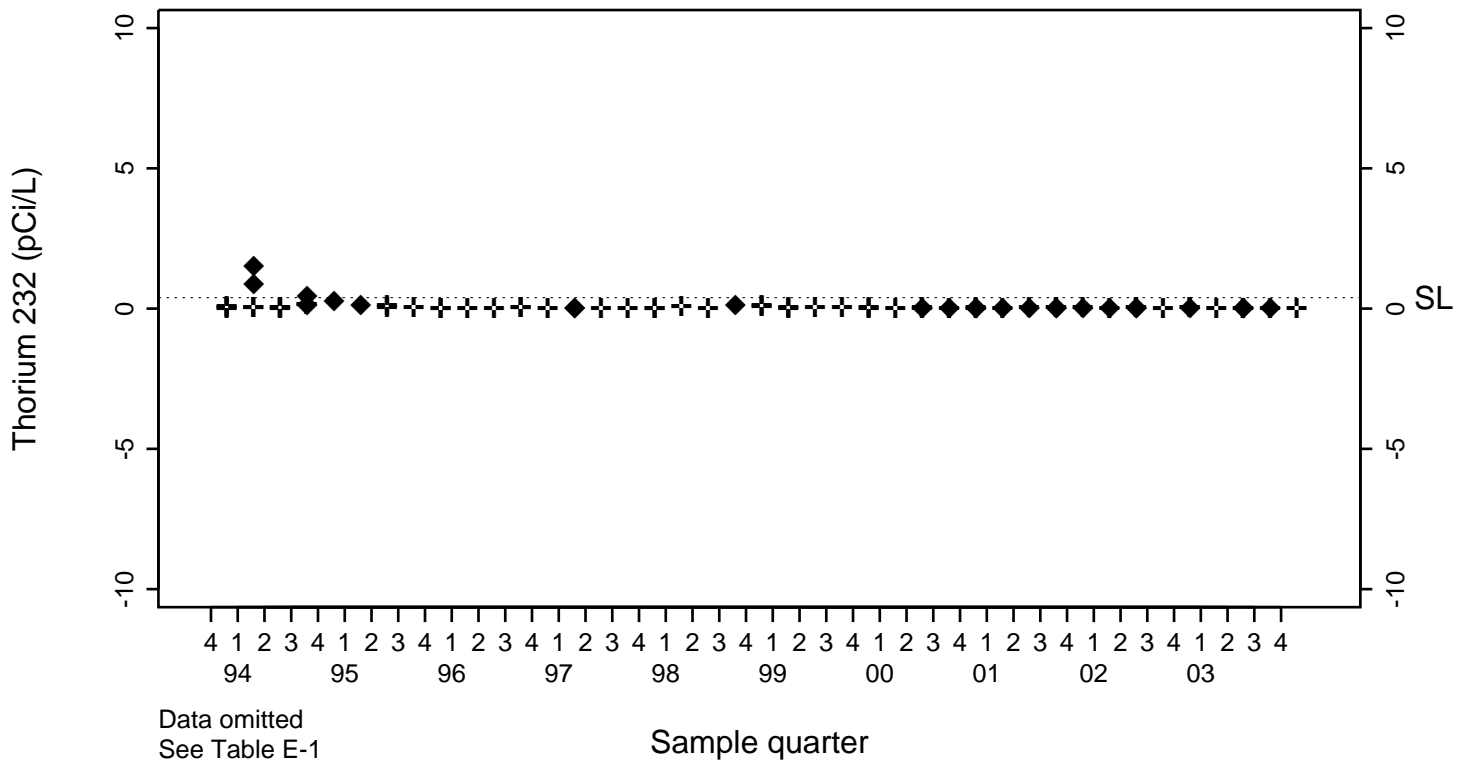
SL=0.39

Background Monitoring Point K7-06



SL=0.39

Compliance Monitoring Point K7-01

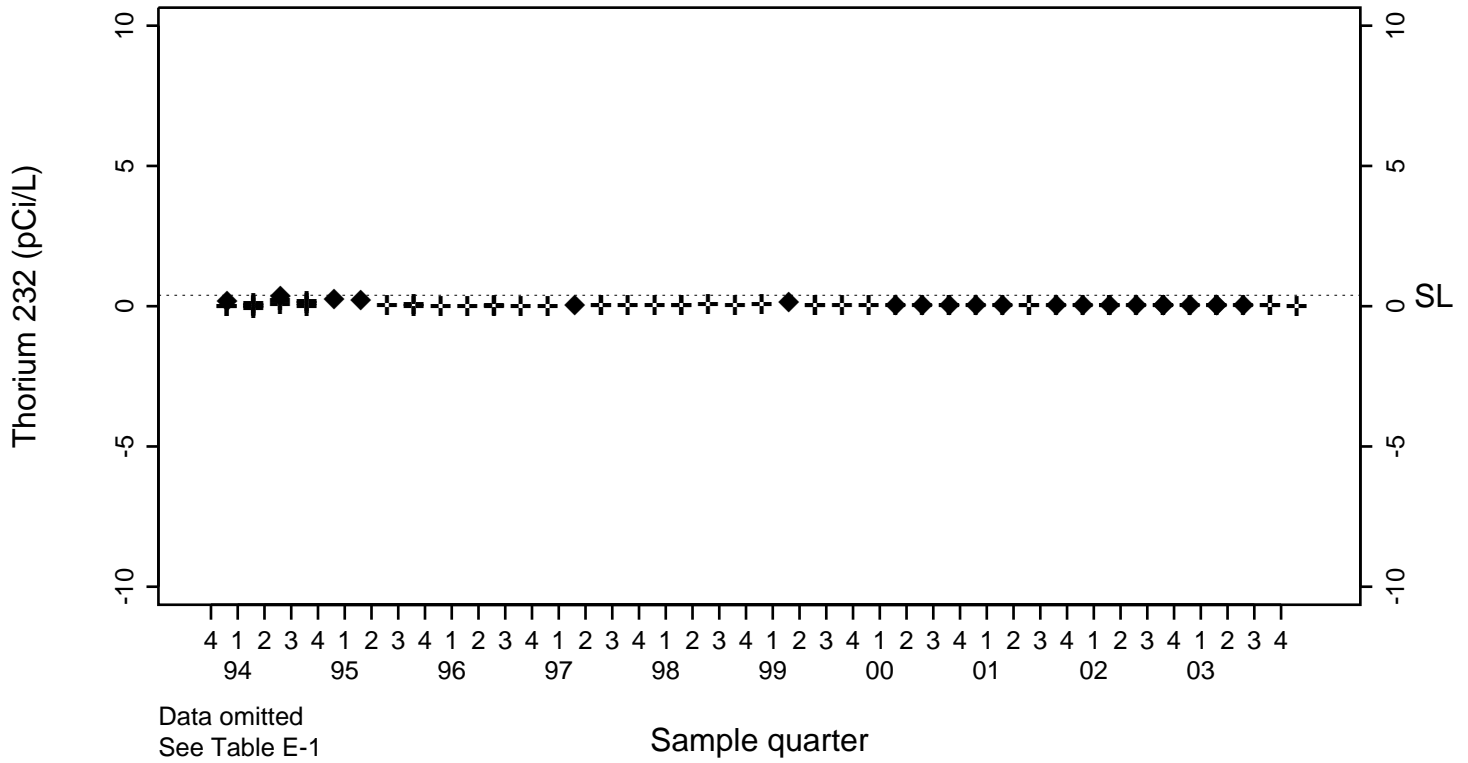


Pit 7 Complex Thorium 232 (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

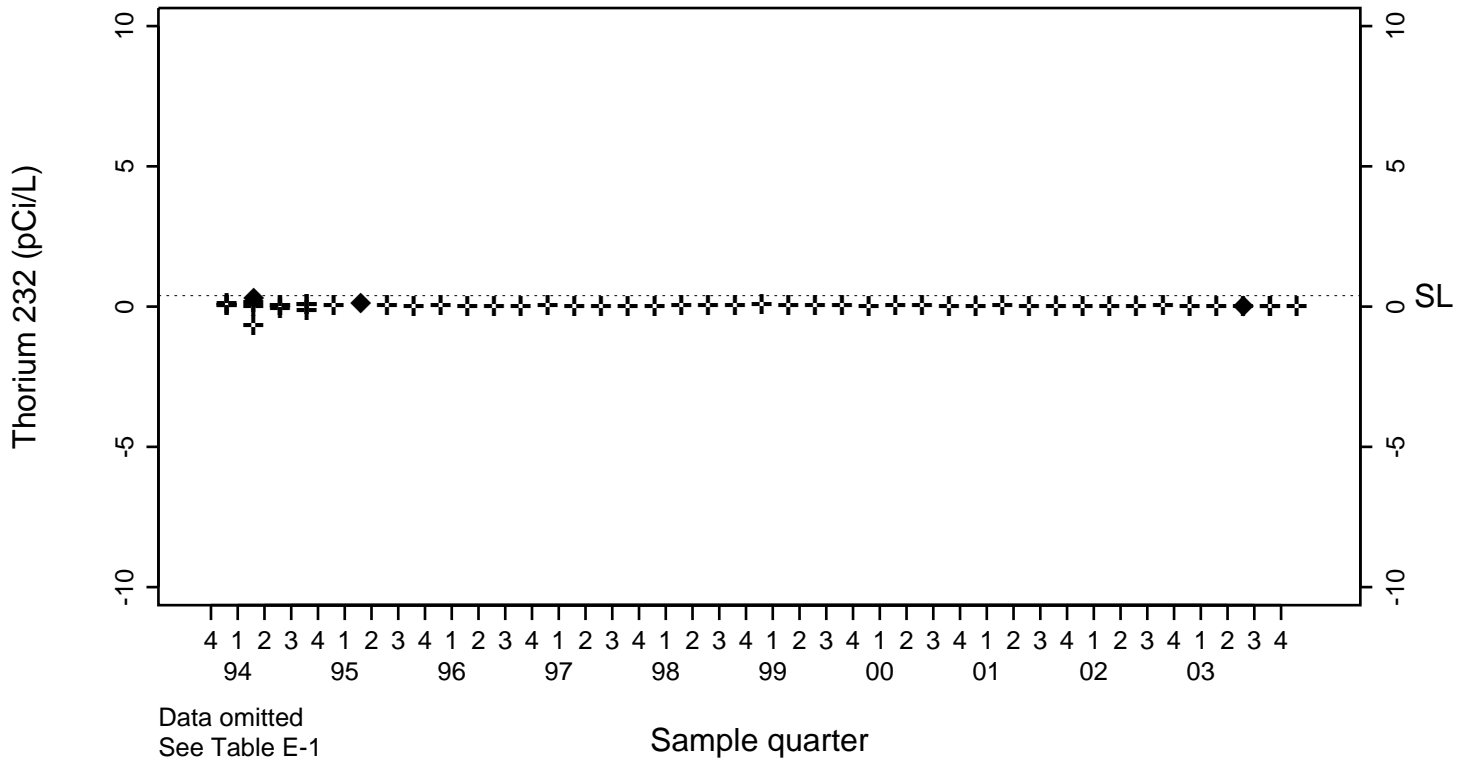
SL=0.39

Compliance Monitoring Point K7-03



SL=0.39

Compliance Monitoring Point K7-09

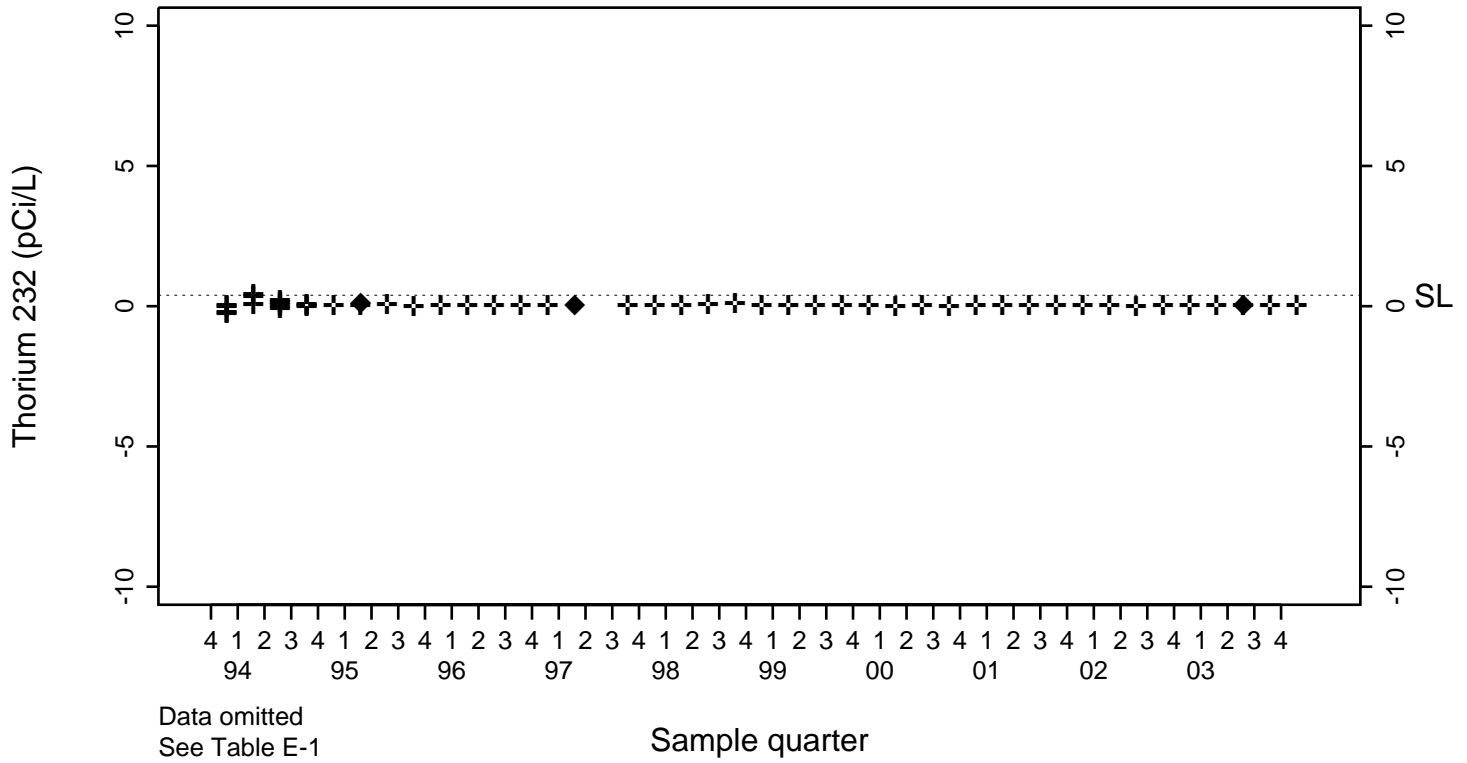


Pit 7 Complex Thorium 232 (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

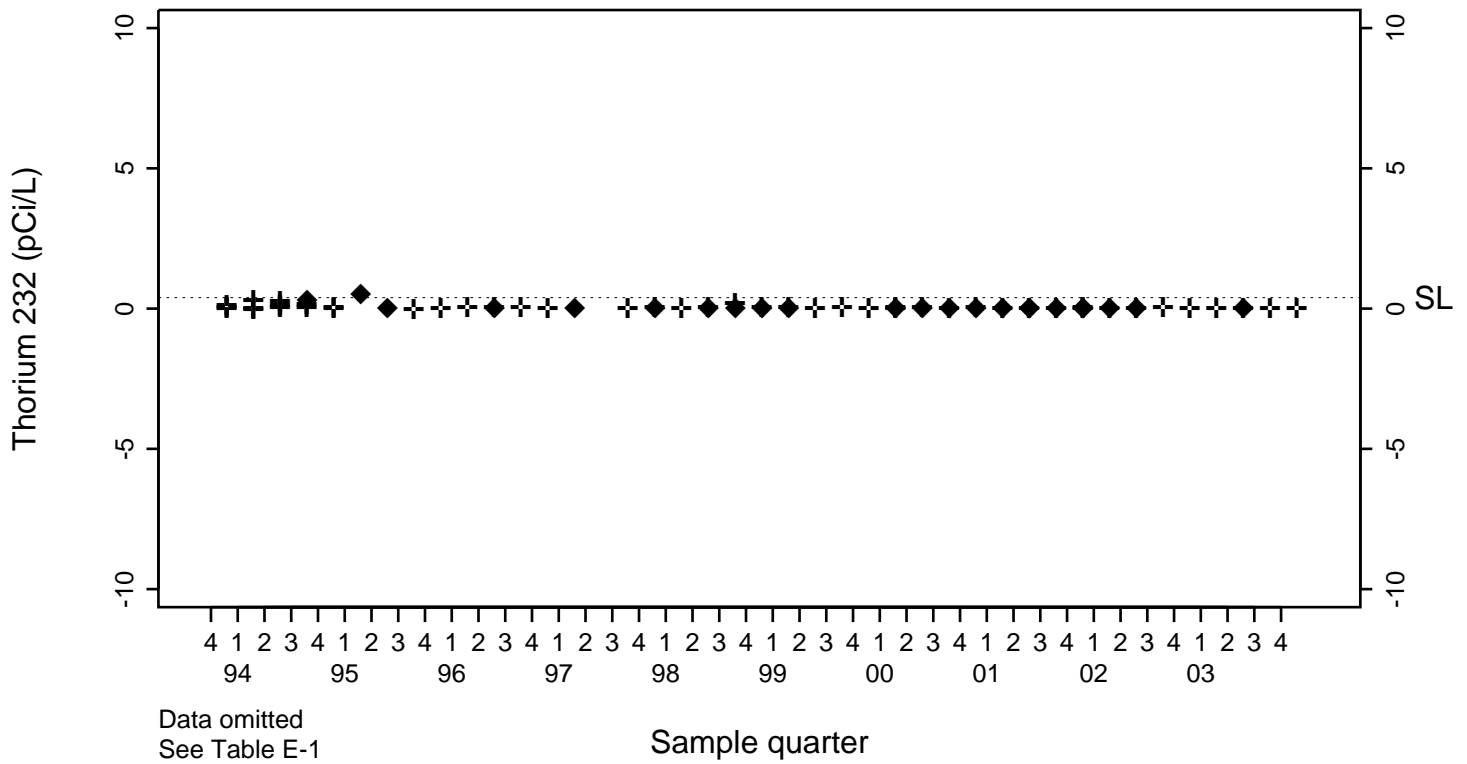
SL=0.39

Compliance Monitoring Point K7-10



SL=0.39

Compliance Monitoring Point NC7-25

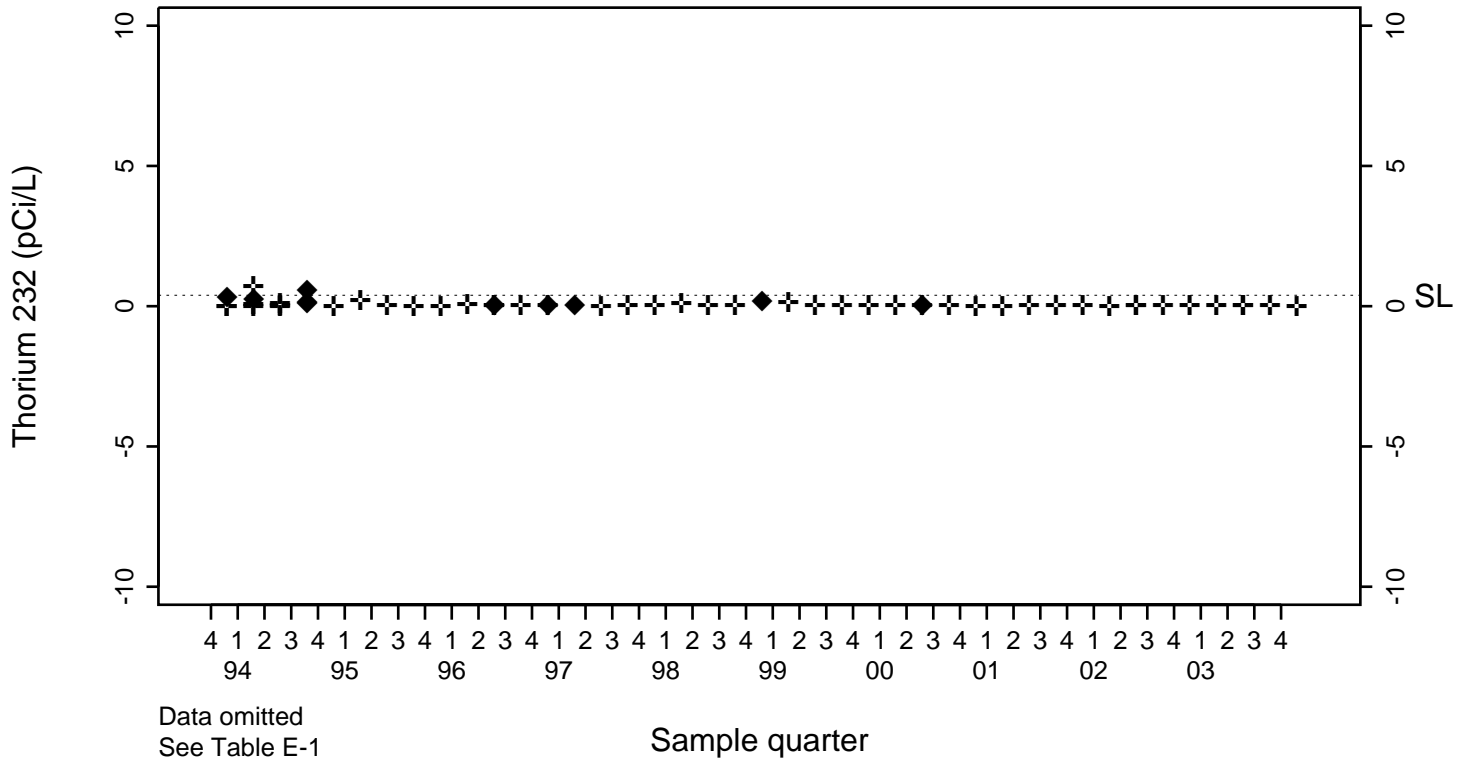


Pit 7 Complex Thorium 232 (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

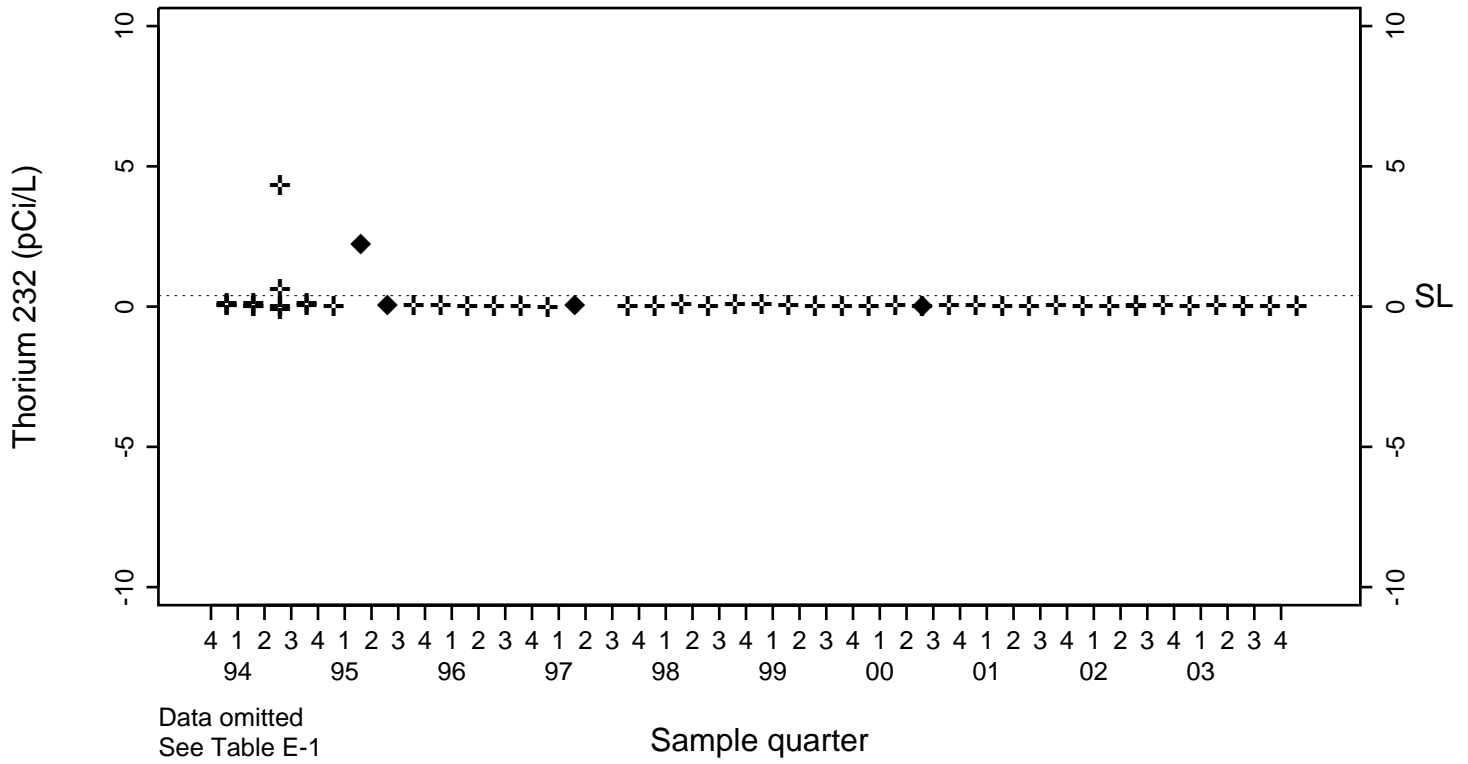
SL=0.39

Compliance Monitoring Point NC7-26



SL=0.39

Compliance Monitoring Point NC7-47

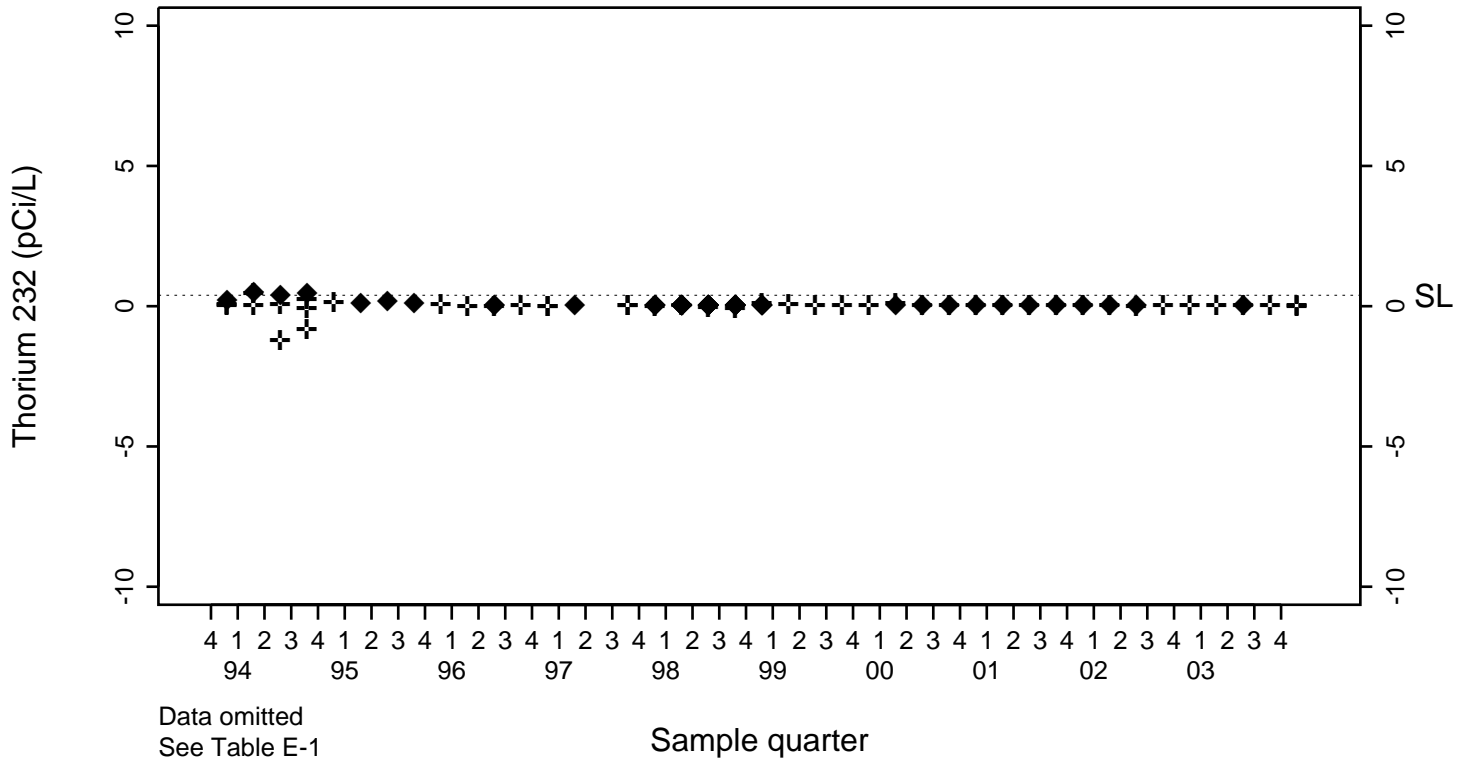


Pit 7 Complex Thorium 232 (pCi/L)

◆	Above RL
▽	Below RL
+	Estimated

SL=0.39

Compliance Monitoring Point NC7-48

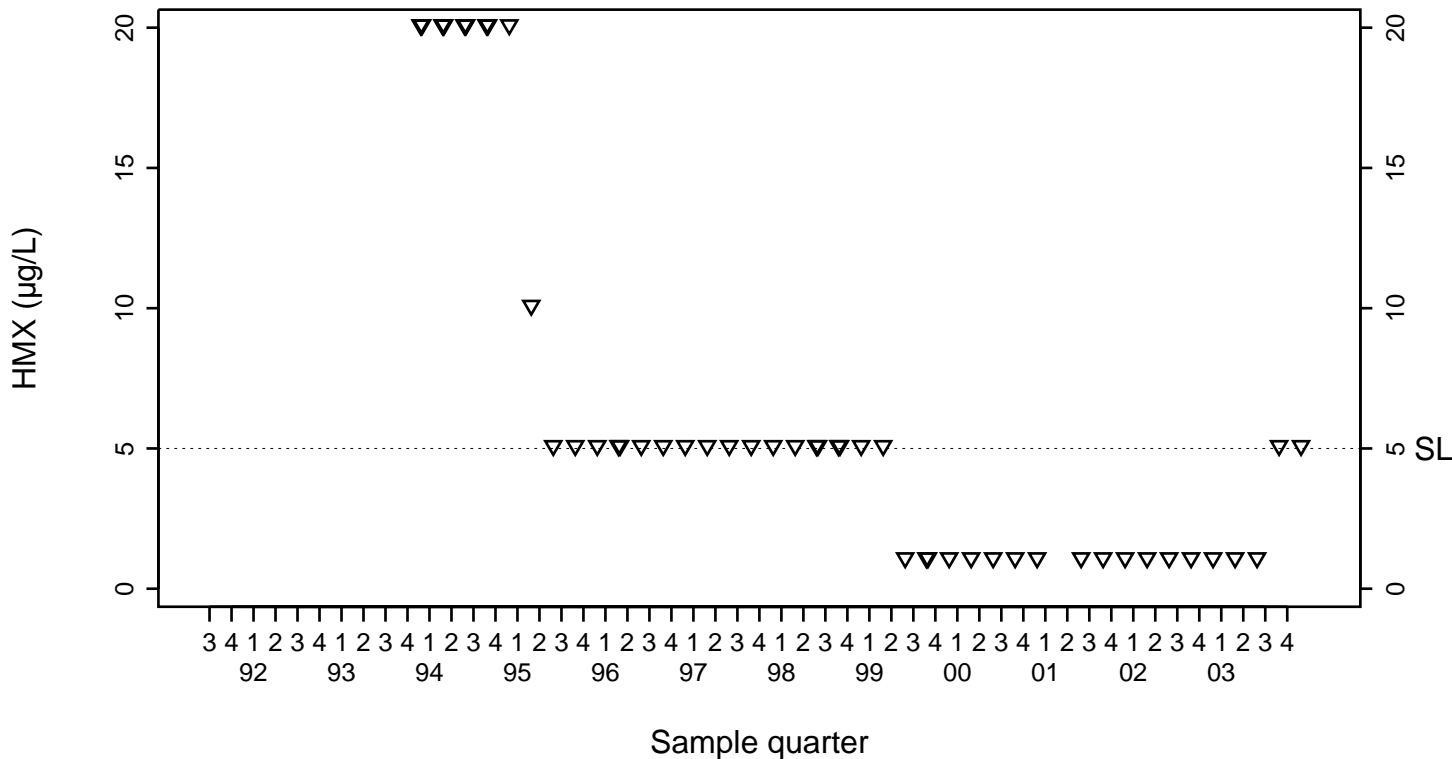


Pit 7 Complex HMX ($\mu\text{g/L}$)

SL=5

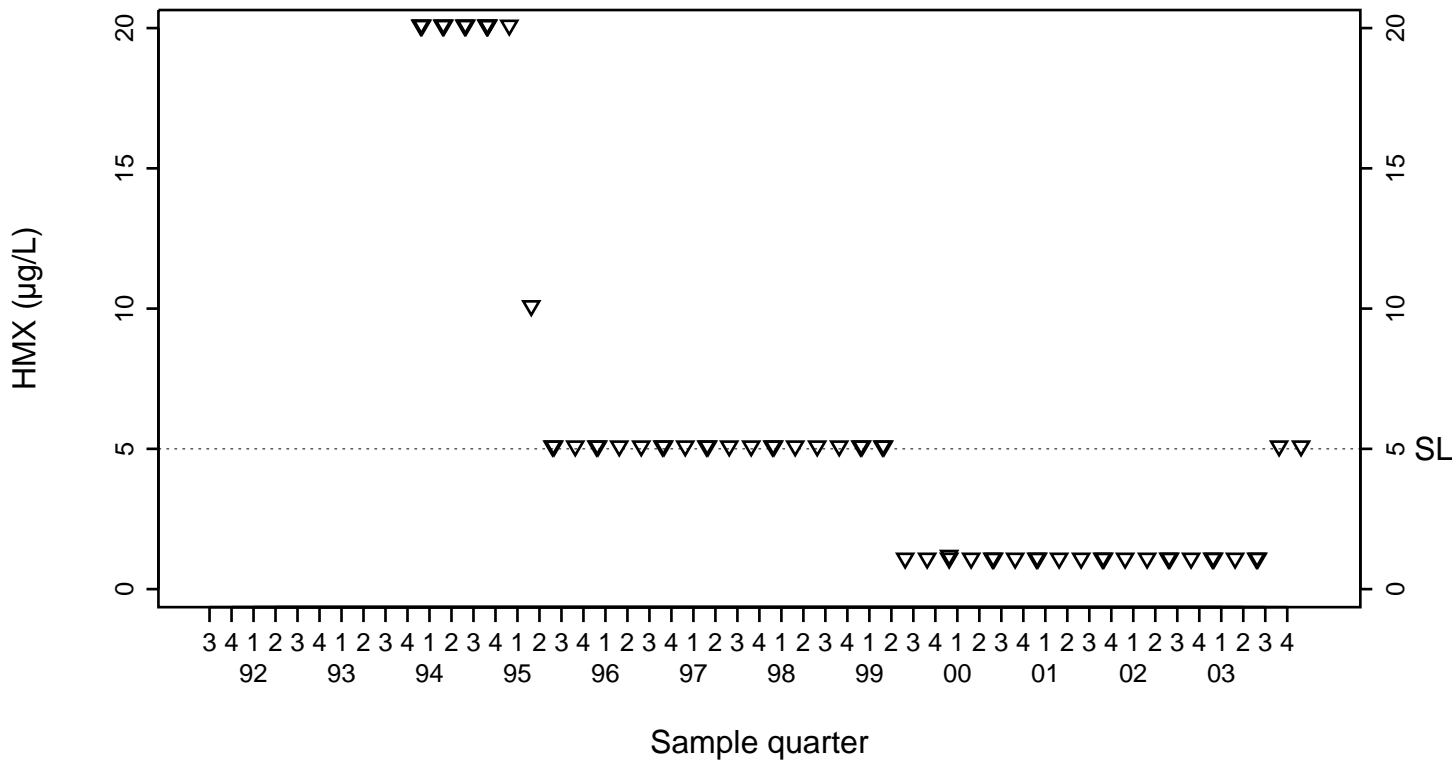
◆ Above RL
▽ Below RL

Background Monitoring Point K7-06



SL=5

Compliance Monitoring Point K7-01

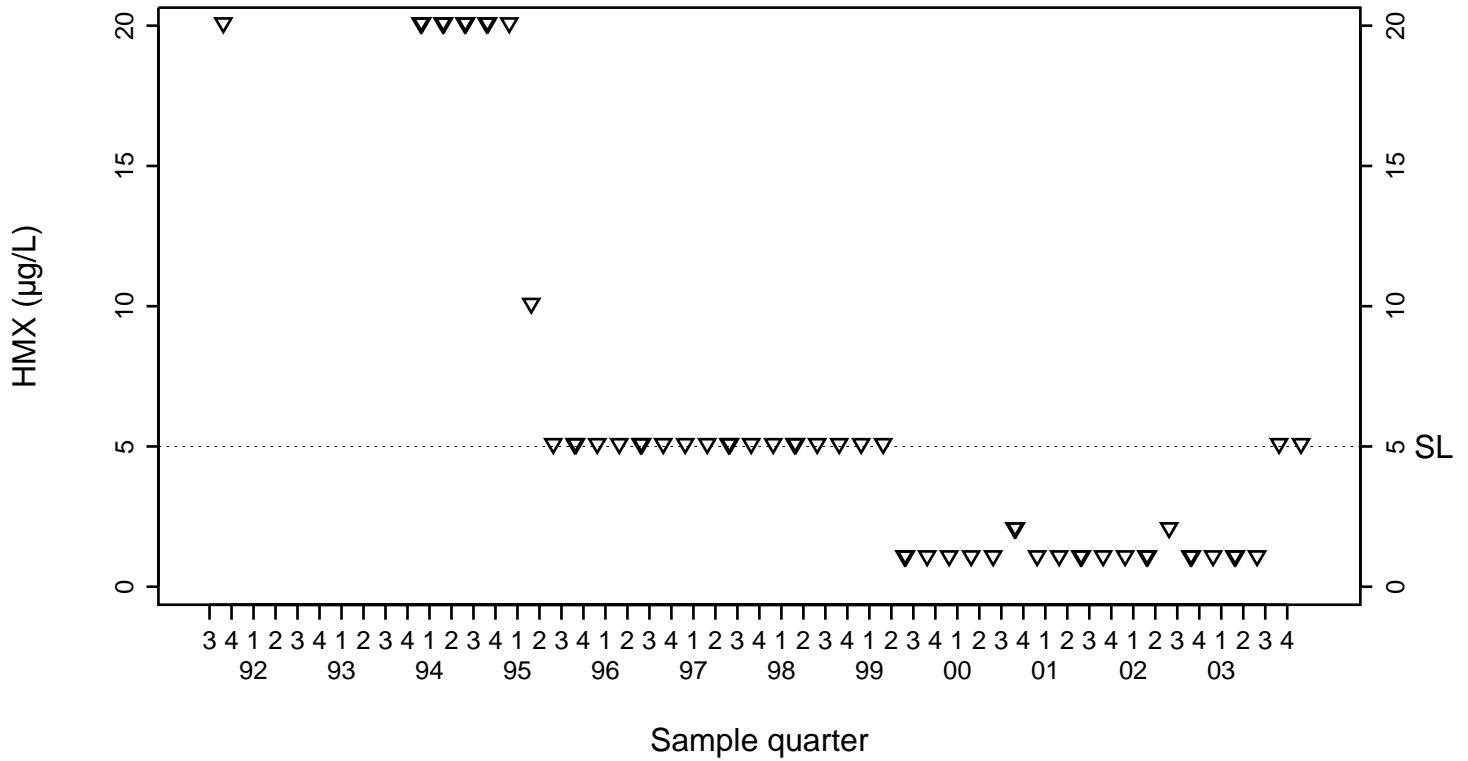


Pit 7 Complex HMX ($\mu\text{g/L}$)

SL=5

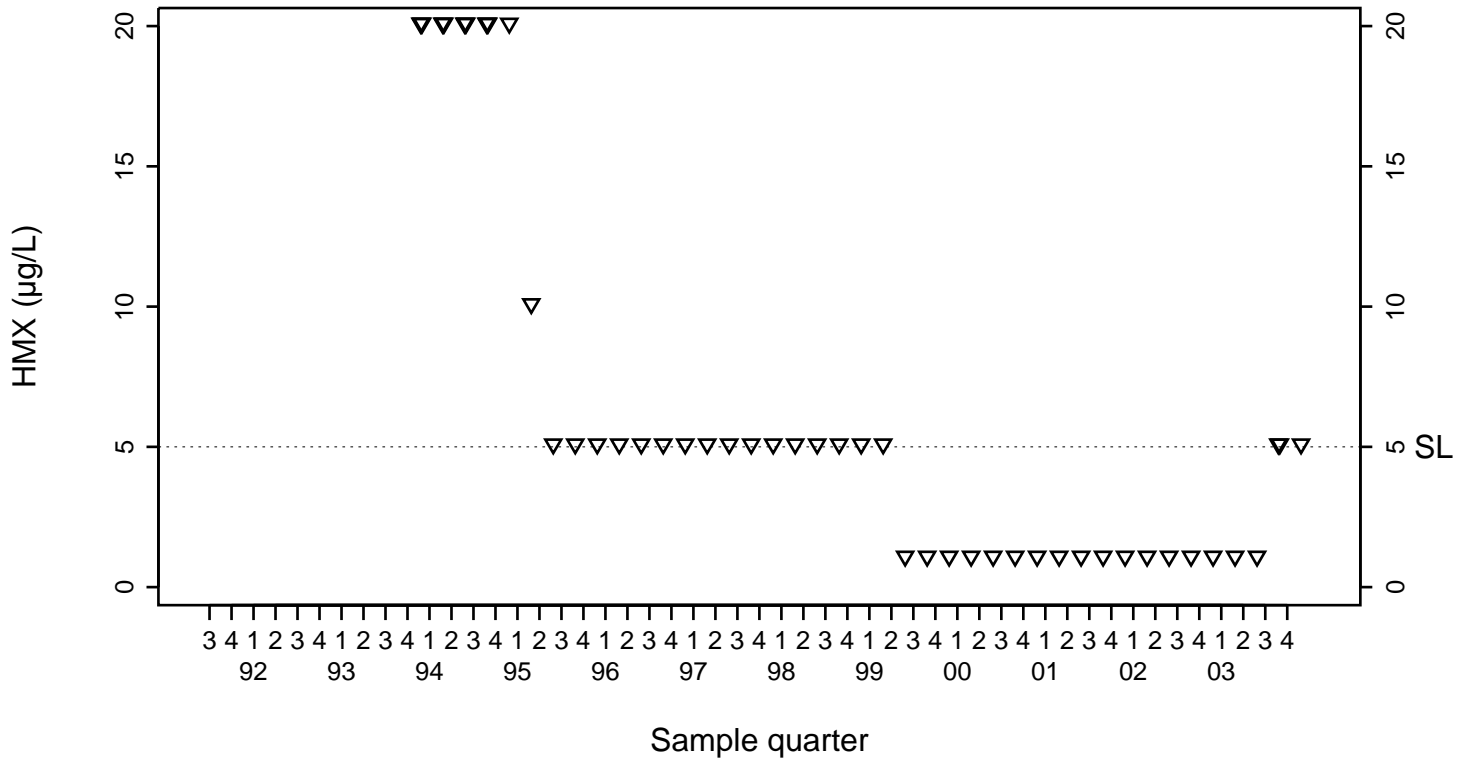
◆ Above RL
▽ Below RL

Compliance Monitoring Point K7-03



SL=5

Compliance Monitoring Point K7-09

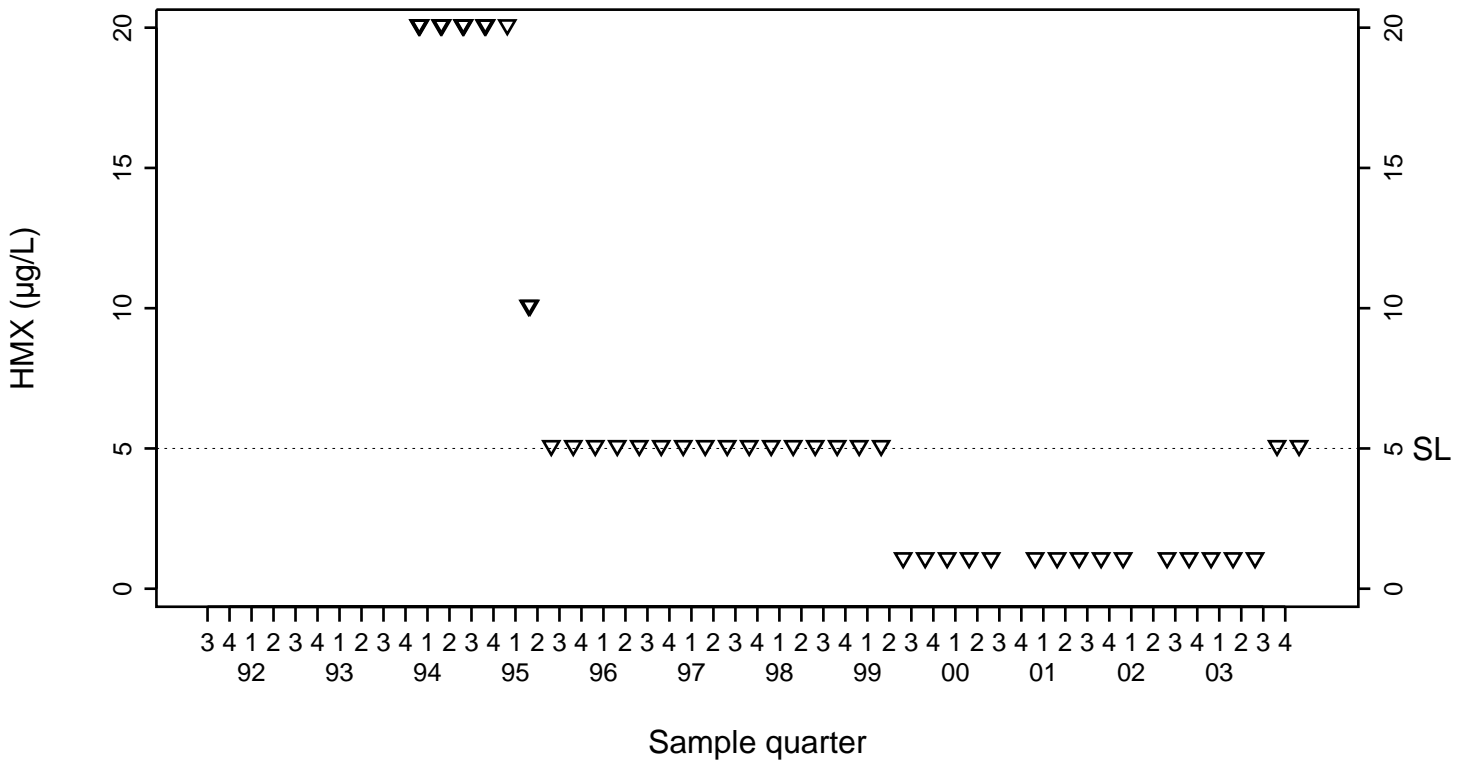


Pit 7 Complex HMX ($\mu\text{g/L}$)

SL=5

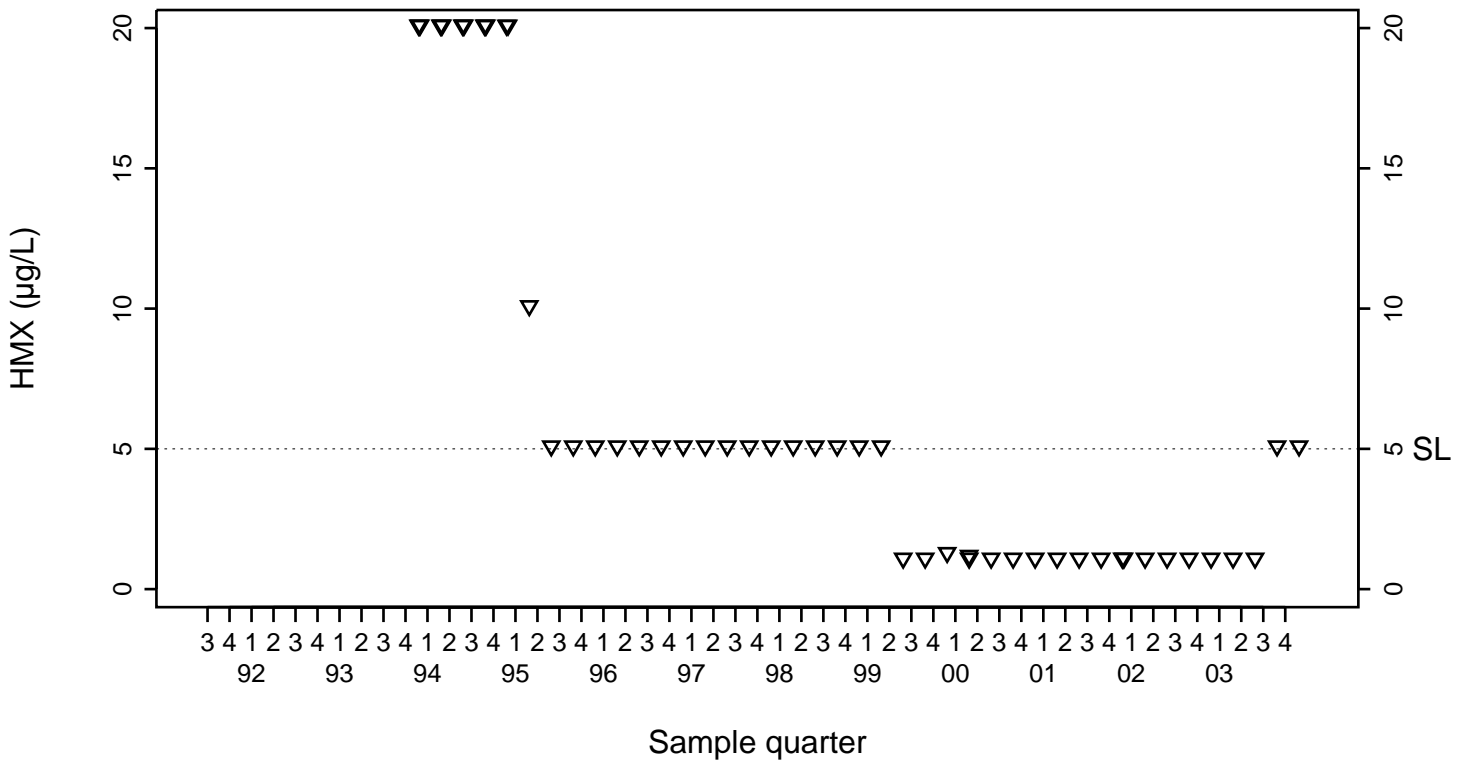
◆ Above RL
▽ Below RL

Compliance Monitoring Point K7-10



SL=5

Compliance Monitoring Point NC7-25

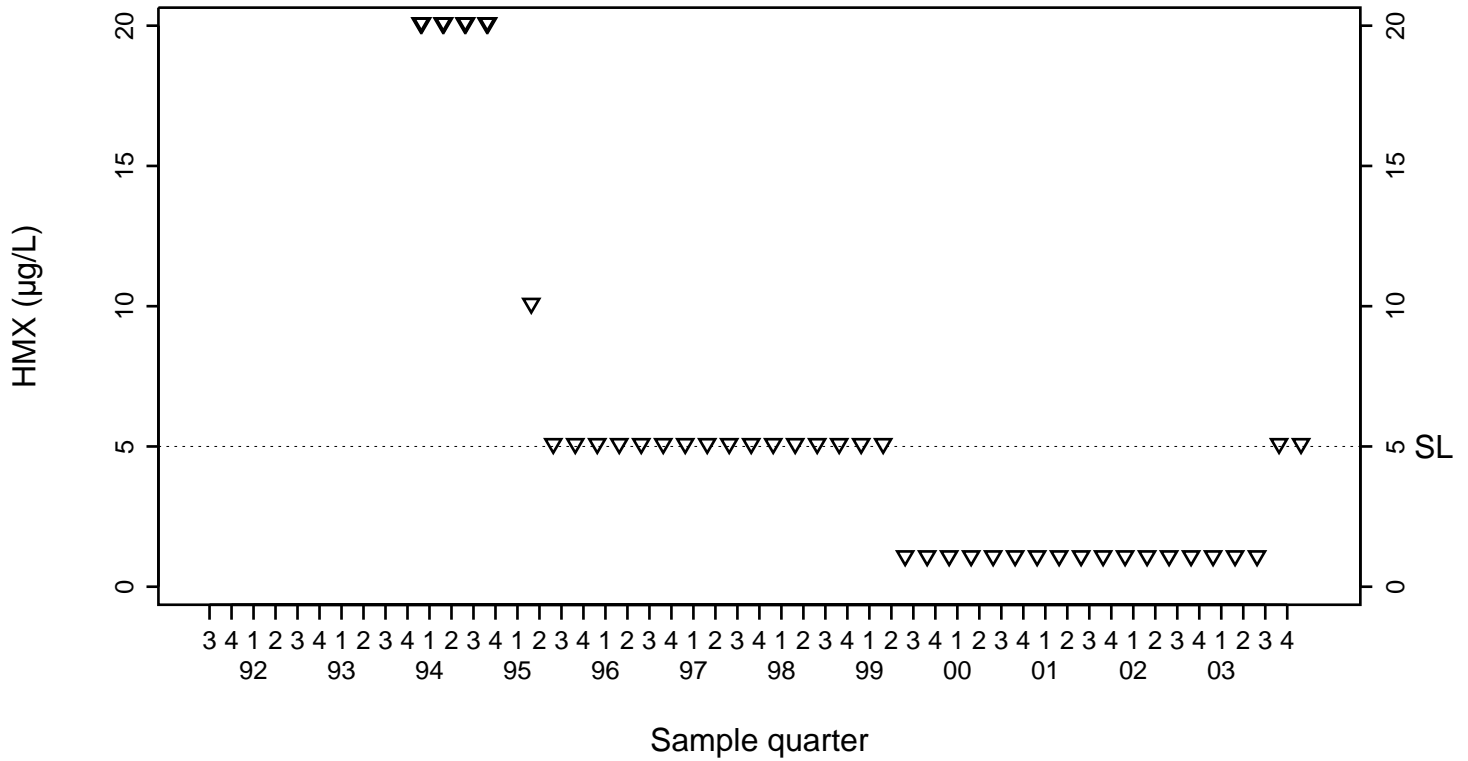


Pit 7 Complex HMX ($\mu\text{g/L}$)

Compliance Monitoring Point NC7-26

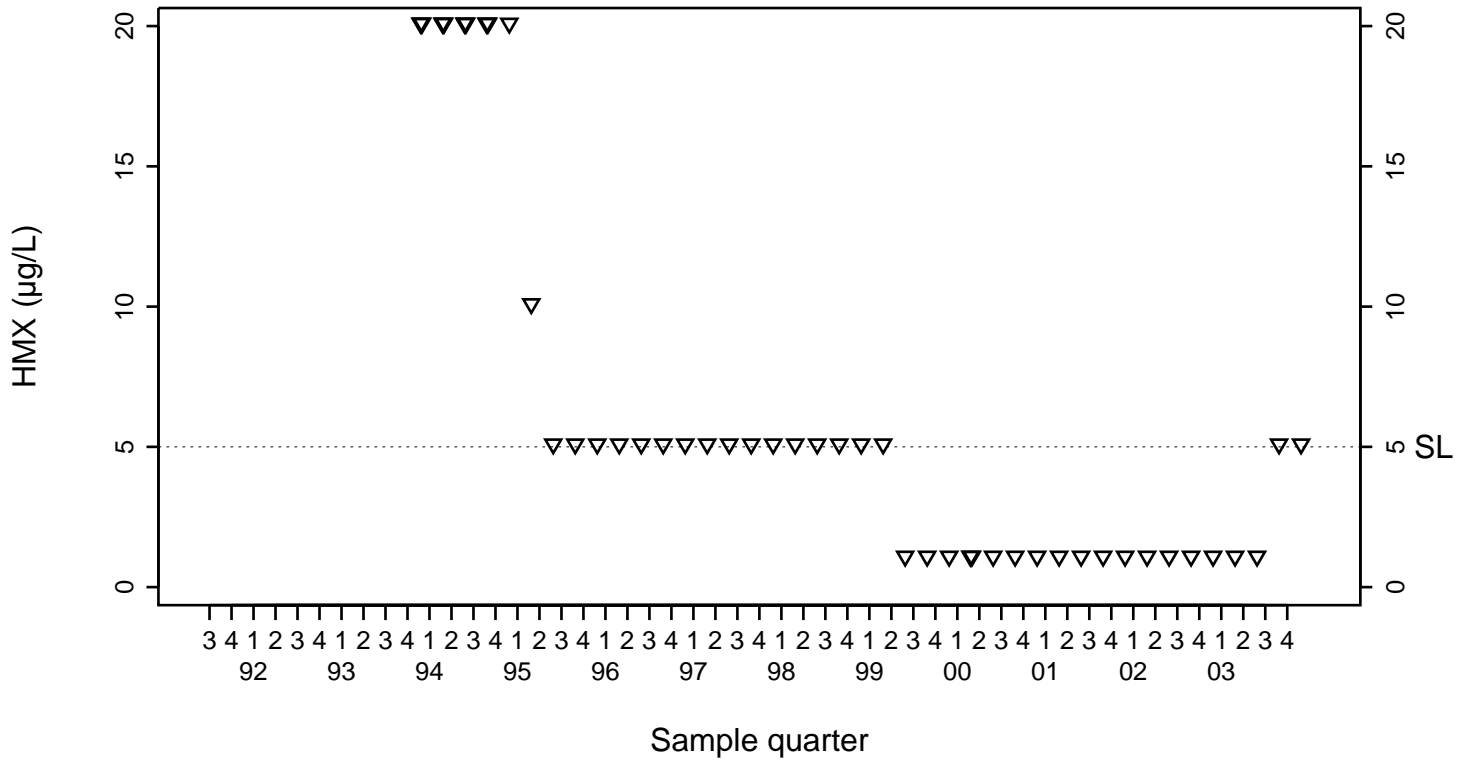
SL=5

◆ Above RL
▽ Below RL



Compliance Monitoring Point NC7-47

SL=5

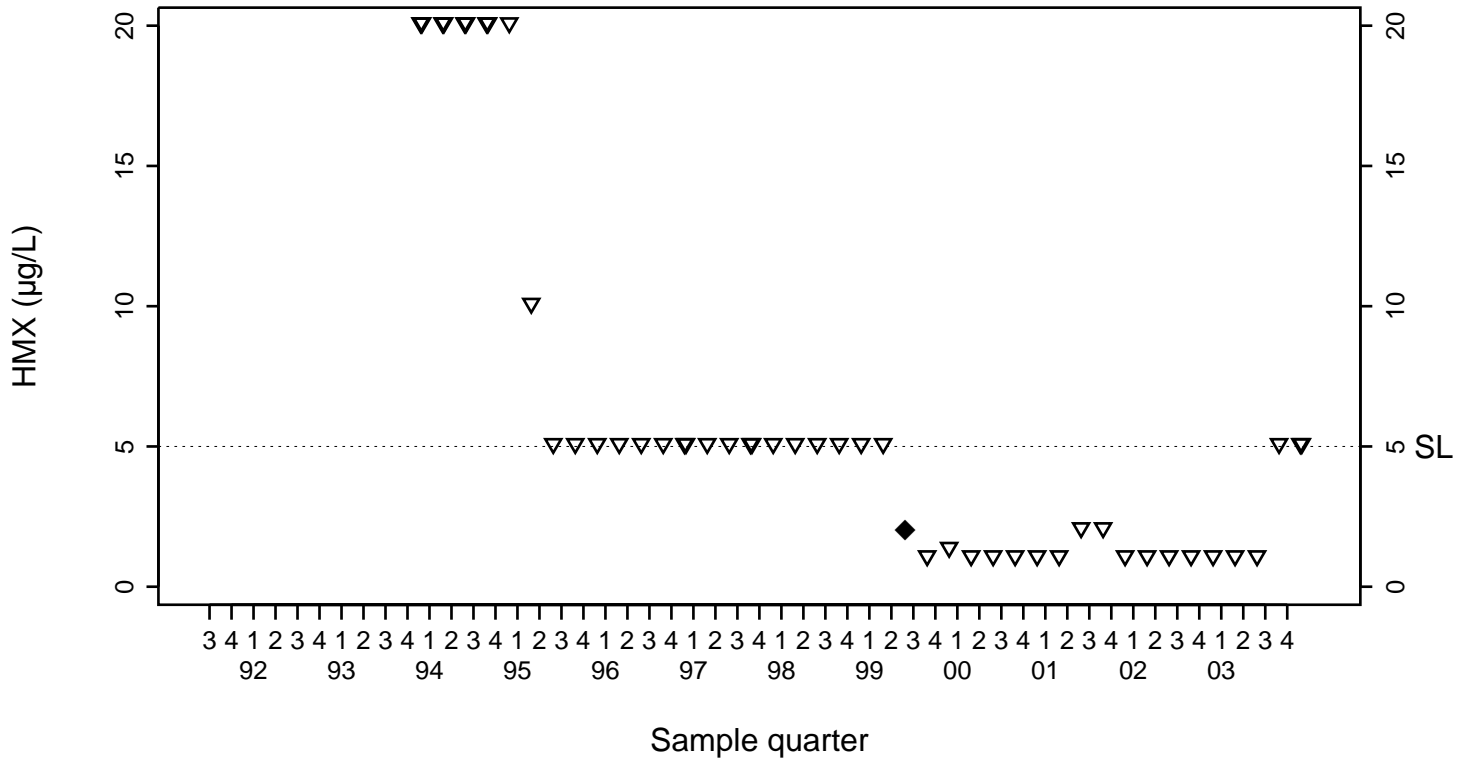


Pit 7 Complex HMX ($\mu\text{g/L}$)

SL=5

Compliance Monitoring Point NC7-48

◆	Above RL
▽	Below RL

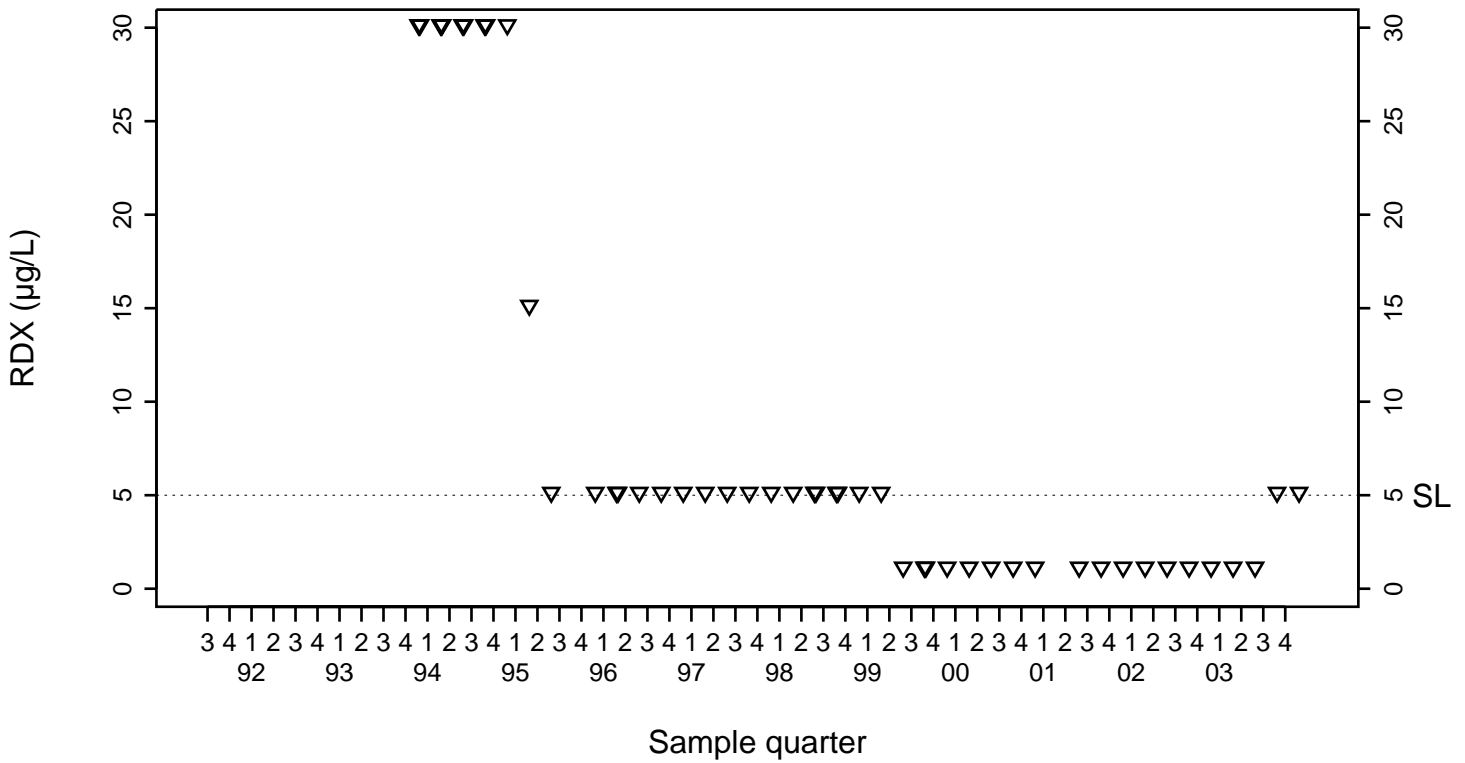


Pit 7 Complex RDX ($\mu\text{g/L}$)

SL=5

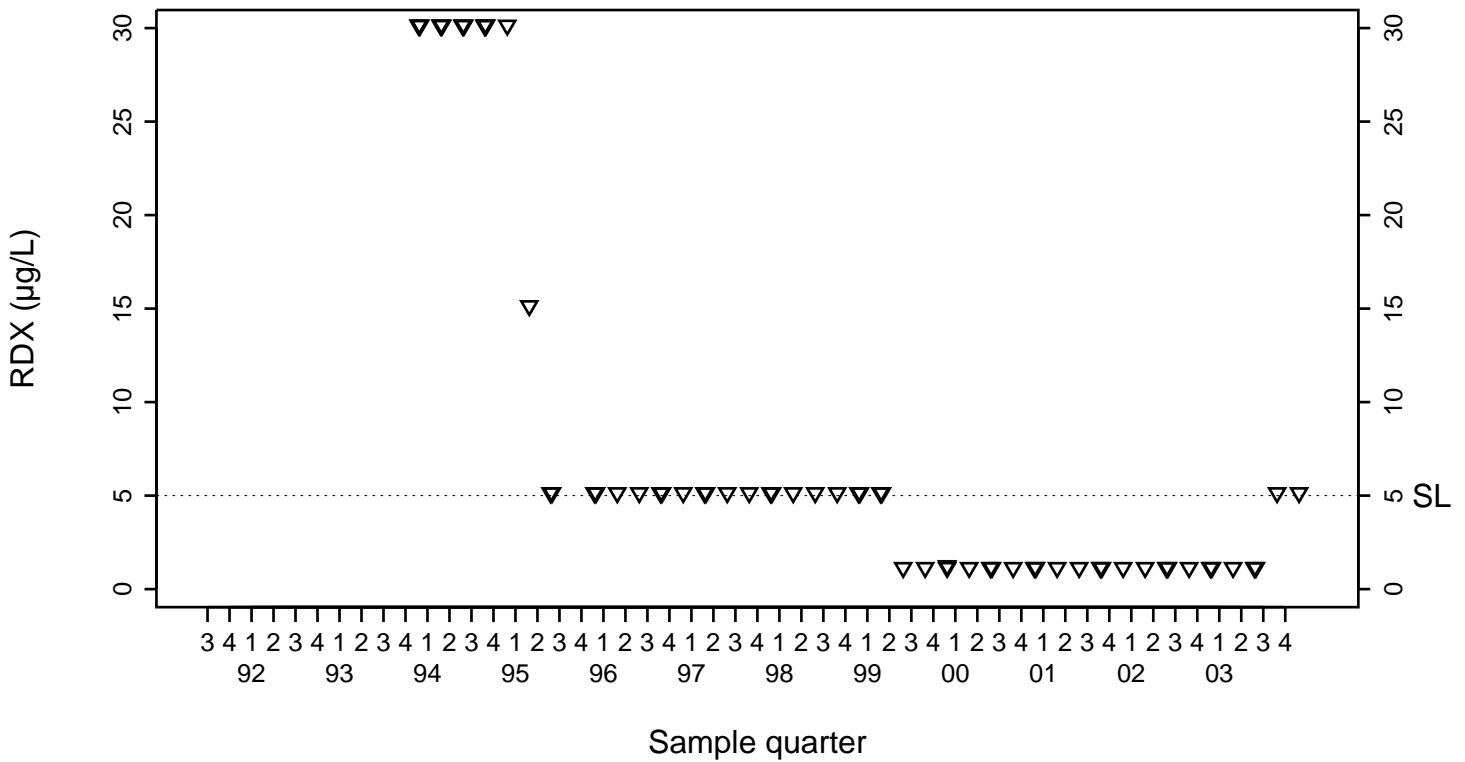
◆ Above RL
▽ Below RL

Background Monitoring Point K7-06



SL=5

Compliance Monitoring Point K7-01

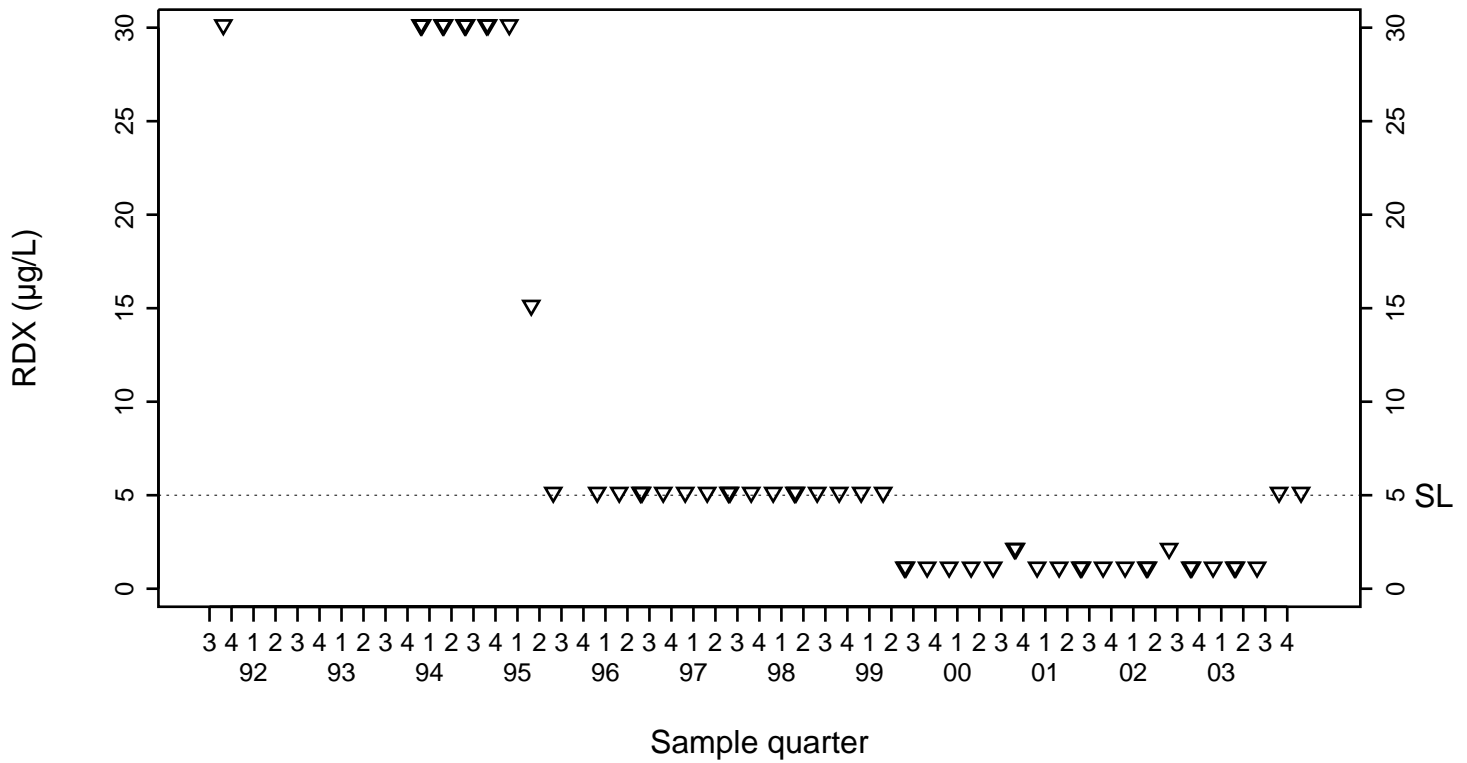


Pit 7 Complex RDX ($\mu\text{g/L}$)

SL=5

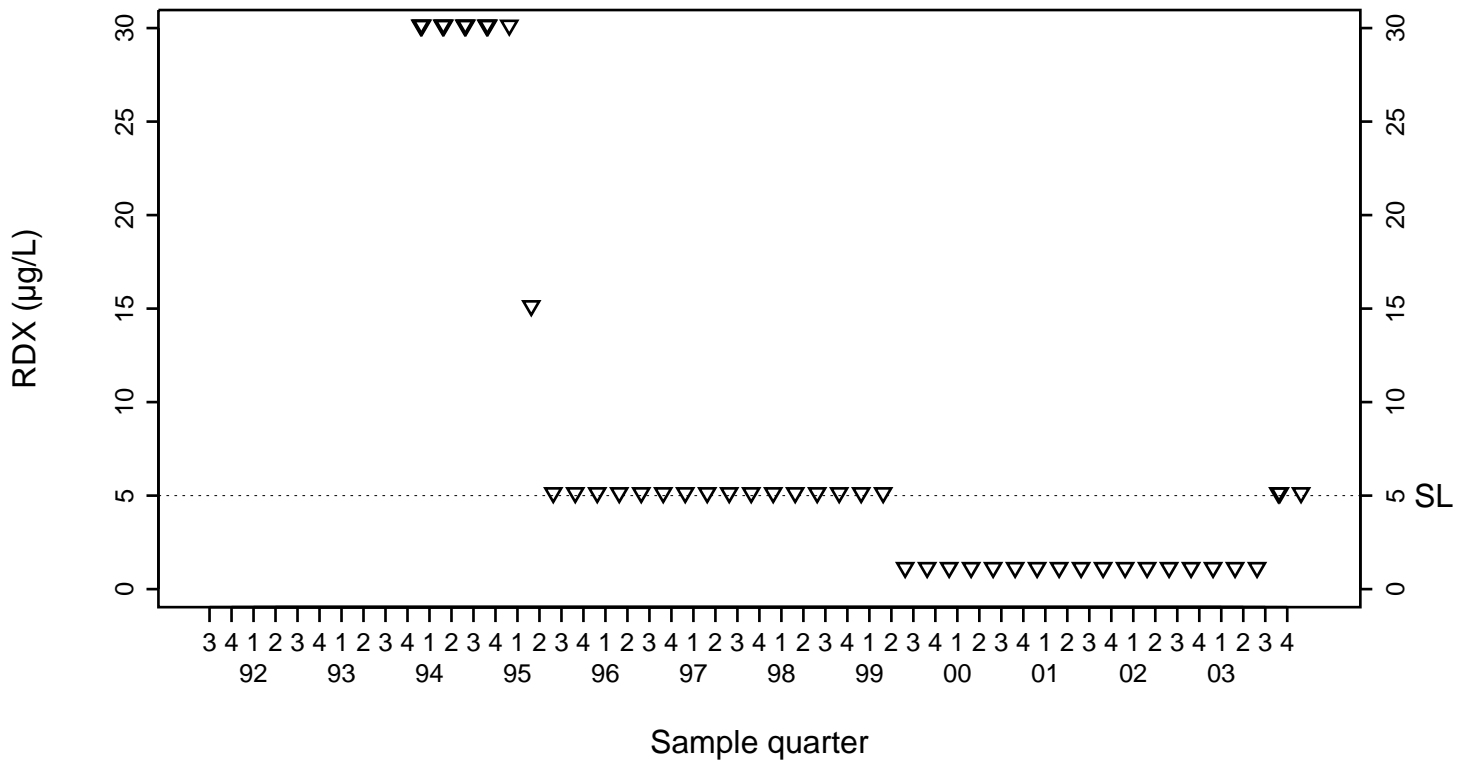
◆ Above RL
▽ Below RL

Compliance Monitoring Point K7-03



SL=5

Compliance Monitoring Point K7-09

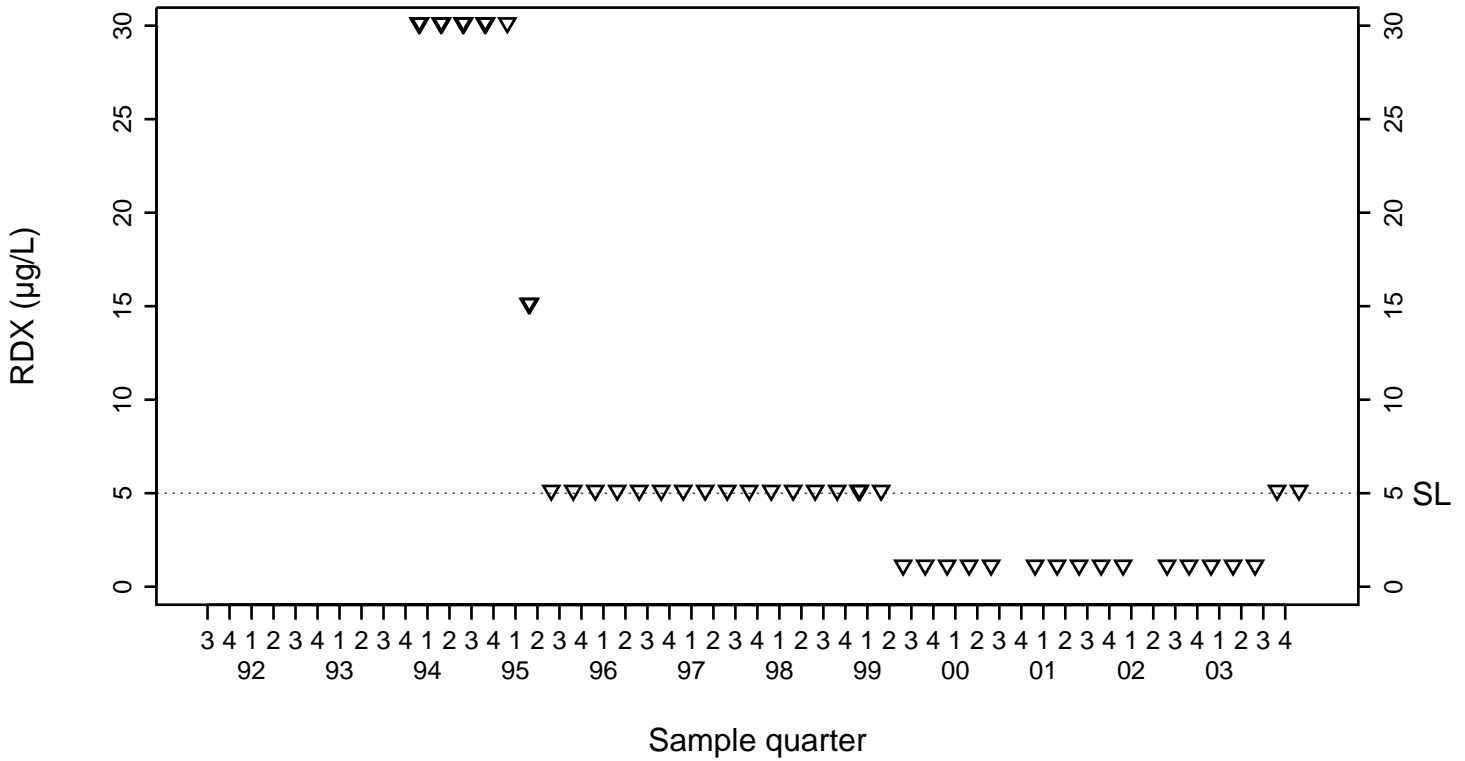


Pit 7 Complex RDX ($\mu\text{g/L}$)

SL=5

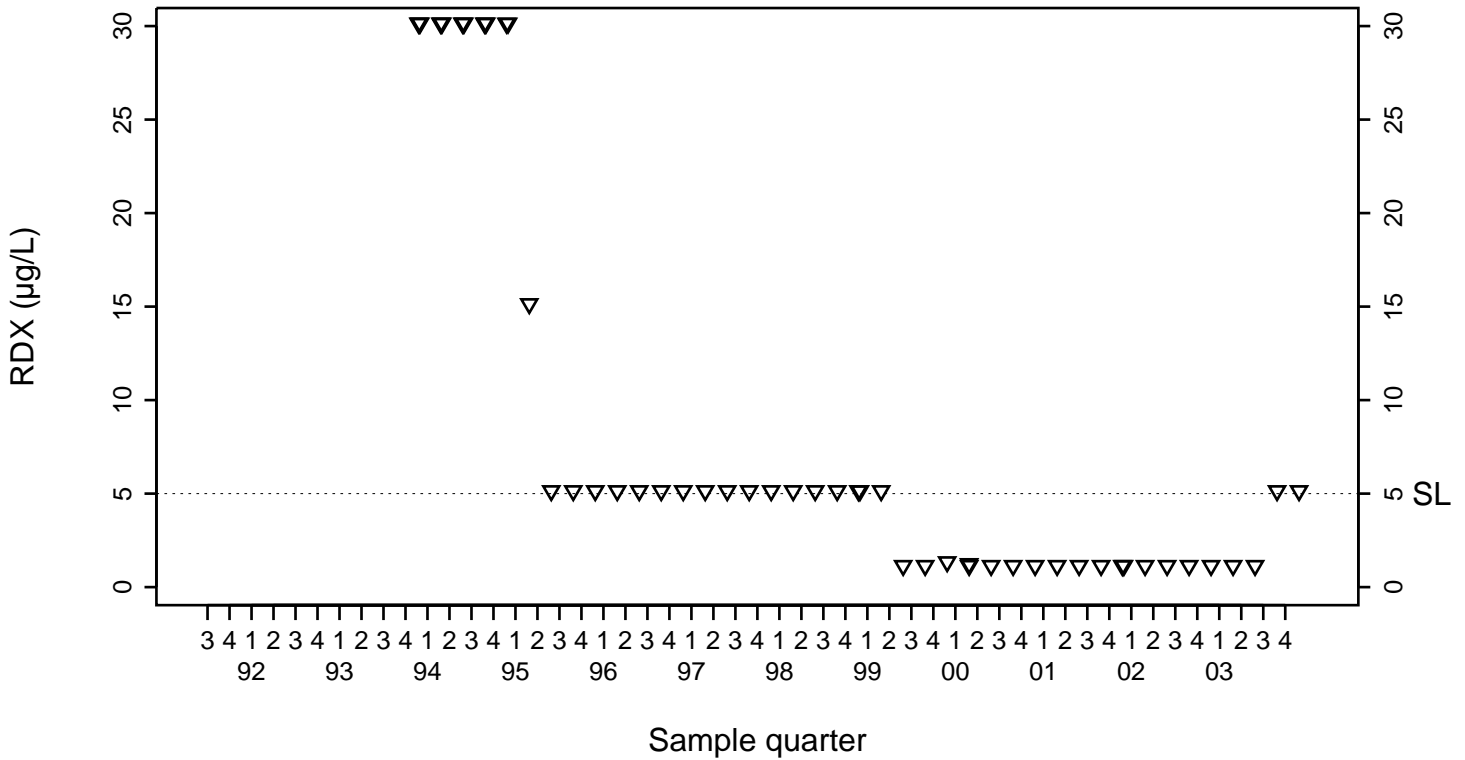
◆ Above RL
▽ Below RL

Compliance Monitoring Point K7-10



SL=5

Compliance Monitoring Point NC7-25

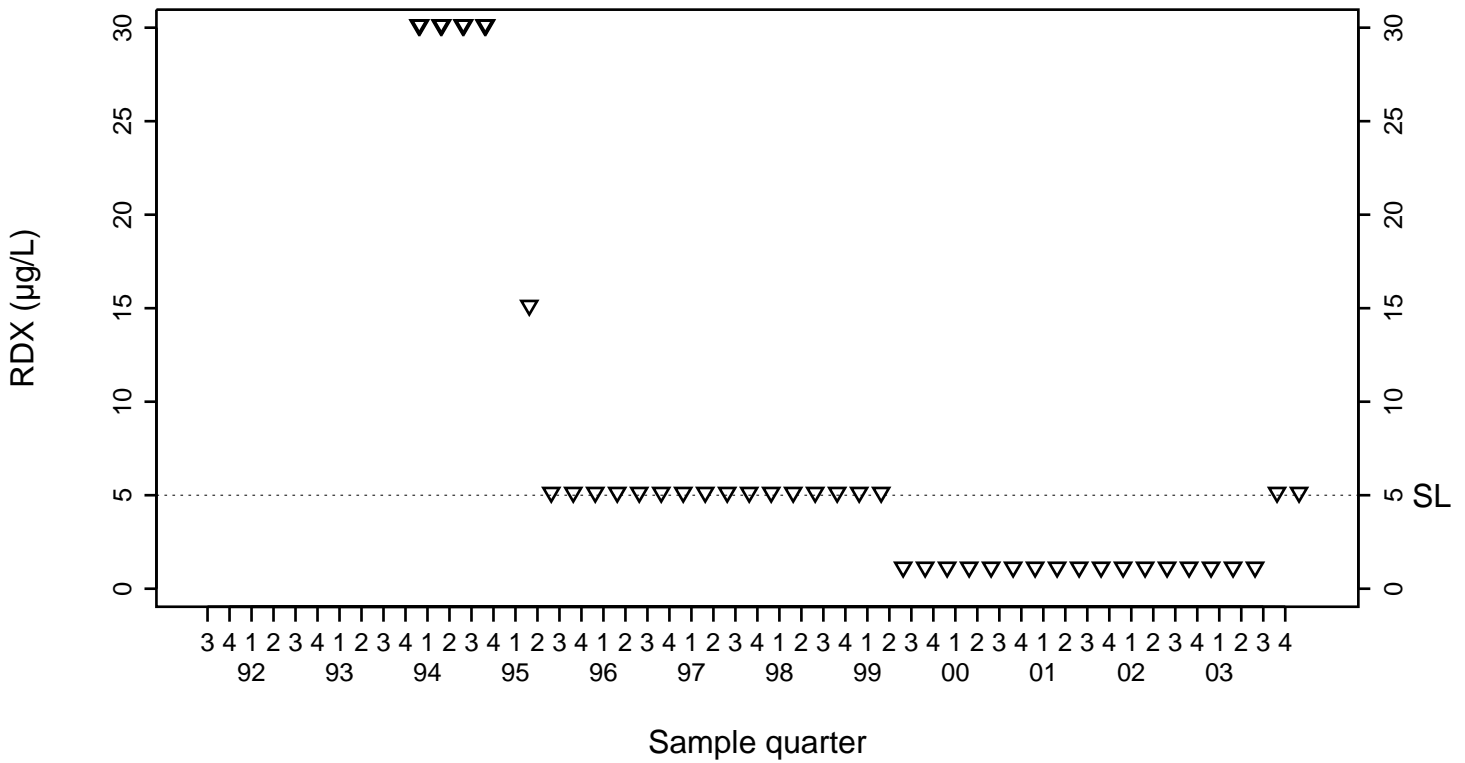


Pit 7 Complex RDX ($\mu\text{g/L}$)

SL=5

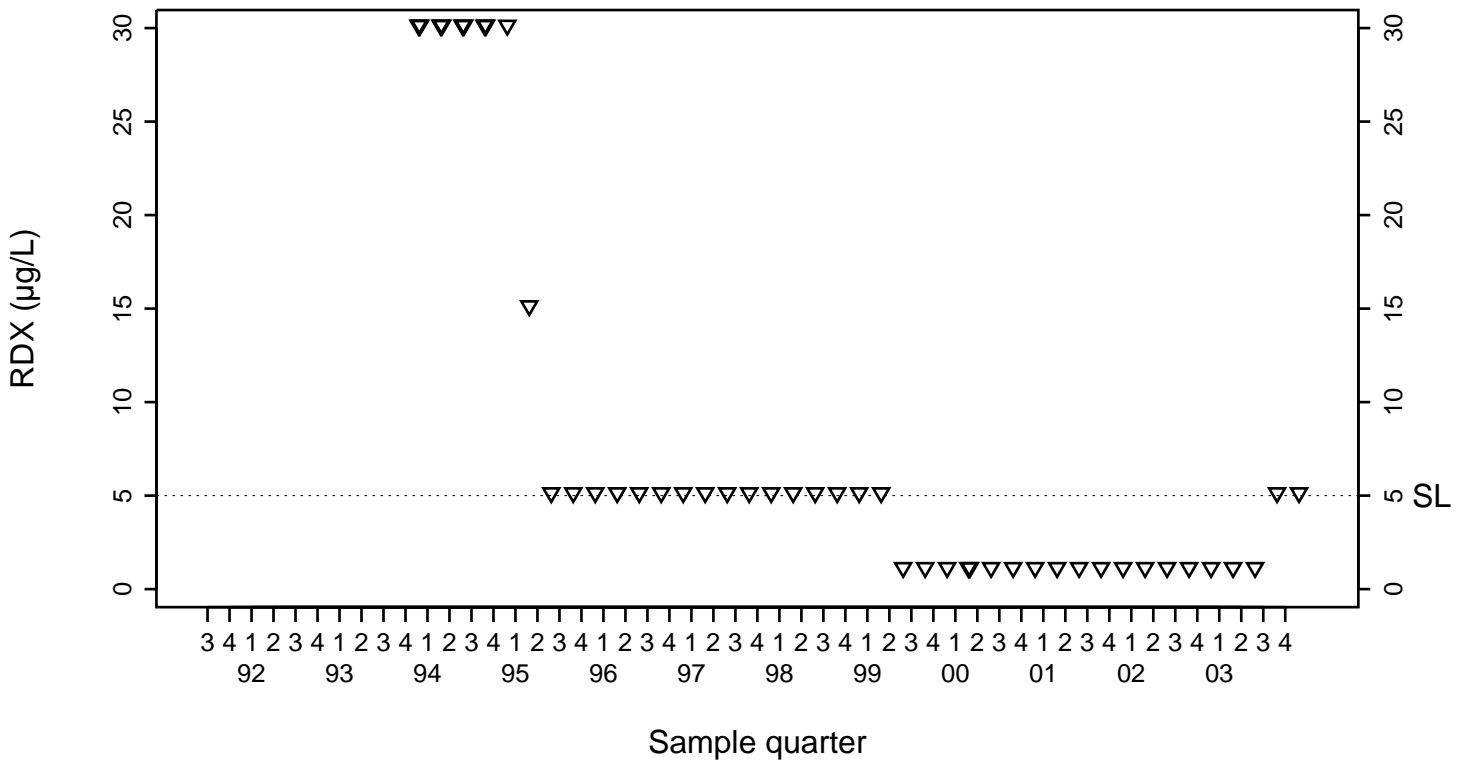
◆ Above RL
▽ Below RL

Compliance Monitoring Point NC7-26



SL=5

Compliance Monitoring Point NC7-47

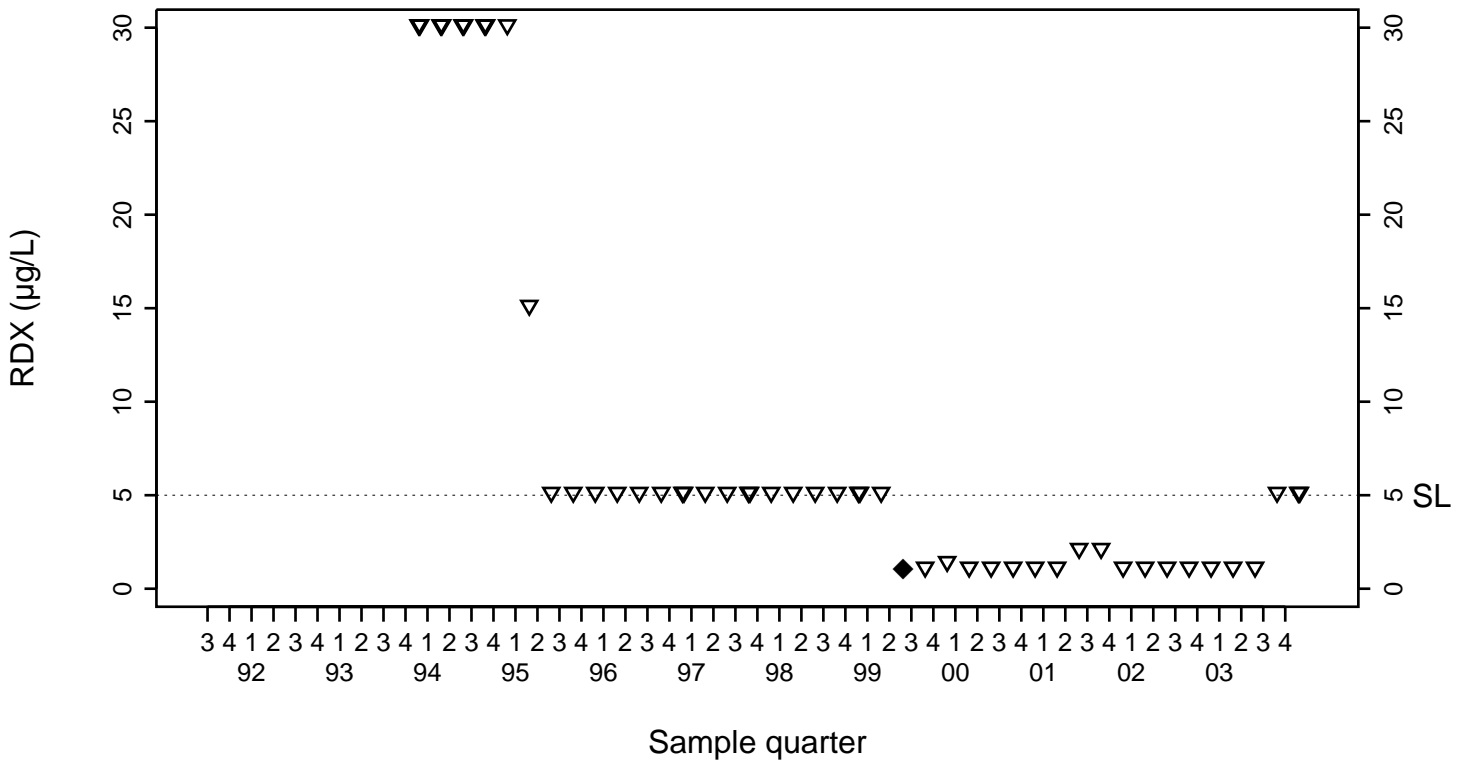


Pit 7 Complex RDX ($\mu\text{g/L}$)

SL=5

Compliance Monitoring Point NC7-48

◆	Above RL
▽	Below RL



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