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Revision 0

# Resource Conservation And Recovery Act Groundwater Quarterly Report For Calendar Year July Through September 2012

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

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Plateau Remediation Company
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Richland, Washington 99352

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G. M. Hanson
CH2M Hill

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# Terms

| | |
|---|---|
| CERCLA | *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* |
| CHPRC | CH2M HILL Plateau Remediation Company |
| CFR | Code of Federal Regulations |
| DOE | U.S. Department of Energy |
| DWS | drinking water standard |
| Ecology | Washington State Department of Ecology |
| FLEDG | field logging and electronic data gathering system |
| HEIS | Hanford Environmental Information System |
| LLWMA | Low-Level waste management area |
| RCRA | *Resource Conservation and Recovery Act of 1976* |
| RDR | request for data review |
| S&GRP | Soil and Groundwater Remediation program |
| SST | single Shell Tank |
| TOX | total organic halides |
| TOC | total organic carbon |
| TSD | treatment, storage, and disposal |
| WAL | well access list |
| WMA | waste management area |
| WSCF | Waste Sampling and Characterization Facility |

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# 1 Introduction

This document describes sampling performed in accordance with the *Resource Conservation and Recovery Act of 1976* (RCRA) during the July through September 2012 reporting period. The Soil and Groundwater Remediation program (S&GRP) presents data in a project document to more efficiently disseminate information not readily presented in the previous presentation format.

Quarterly information is provided to status sampling, summarize recent and pending changes in monitoring, and report statistical exceptions. Analytical data described in this report reflect data available at the end of the reporting period. Outstanding results will be discussed in the next report. Groundwater monitoring result highlights and site maps are provided only if changes are determined to be significant. Data are officially reported and accessed through the Environmental Dashboard Application at **http://environet.hanford.gov/EDA/**

Sections two and three identify any quality control or laboratory issues, and sampling and analysis status for the reporting period. Sections four (Inactive Waste Sites), five (Groundwater Monitoring Single Shell Tank Farm Waste Management Areas), and six (Active Waste Management Areas) present a general status update including, sampling activity, significant results, and applicable site maps and trend charts.

# 2 Quality Control and Laboratory Issues

Recent nitrite detected results underwent further review by the Waste Sampling and Characterization Facility (WSCF) Laboratory and CH2M Hill Plateau Remediation Company (CHPRC) Sample Management group. Further investigation included CHPRC derived blind standards for analysis by WSCF, WSCF review of analytical instruments, CHPRC review of Oxidation-Reduction and dissolved oxygen field measurements and procedures.

After comprehensive review the laboratory determined the low level nitrite detections were real and resulted from instrument maintenance and a change in ion chromatography columns. These changes resulted in improved chromatographic resolution which allowed the instrument to detect levels of nitrite not previously observed. In addition, they determined that at high chloride concentrations, peak tailing was contributing to the nitrite concentrations. After working with the instrument manufacturer, the lab implemented a new integration protocol which eliminates the interference from the chloride peak. Previously reported nitrite values which were impacted by the chloride tailing were re-integrated and the corrected values were reported in HEIS.

# 3 Sampling and Analysis Status

Documentation provided for status and effects on sampling resulting from delays or stop work orders.

## 3.1 Missed Sampling

Table 1 presents samples not collected during the quarter. The table includes the site, scheduled period that was not collected, frequency of sampling, and any comments.

**Table 1. Sampling Not Completed**

| Well | Site | Scheduled | Frequency | Comments |
|---|---|---|---|---|
| 299-E25-26 | A-29 Ditch | April | Semiannually | Powerlines need shielding to repair downhole pump |
| 699-25-34D | NRDWL | July | Semiannually | Access prohibited - extreme fire danger |

## 3.2 Sampling Completed After Quarter

For this reporting period there were no missed sampling trips completed after the end of the quarter.

## 3.3 Stop Work

Previously reported stop work on use of the Field Logging and Electronic Data Gathering (FLEDG) system for wells water level measurements was lifted July 24th, when actions to correct FLEDG database and software were complete.

# 4 Inactive Waste Management Areas

Each inactive, non-operational unit is designated as a treatment, storage, and disposal (TSD) unit because it received nonradioactive dangerous waste regulated by 40 *Code of Federal Regulations* (CFR) 261. Units are monitored under a groundwater contamination indicator evaluation monitoring program that will detect any adverse impact from past operations on groundwater quality and accordingly, update constituents and monitoring based on knowledge from recent monitoring data collected. Summary status and monitoring highlights of results by exception are provided by area for the quarterly reporting period.

## 4.1 1301-N Liquid Waste Disposal Facility (Interim, Detection)

All five wells were sampled as scheduled in September. Contamination indicator parameter results were loaded into HEIS and did not exceed critical mean values. Next scheduled sampling event is March.

## 4.2 1324-N/NA Facilities (Interim, Detection)

All five wells were sampled as scheduled in September. Contamination indicator parameter results were loaded into HEIS. Next scheduled sampling event is March.

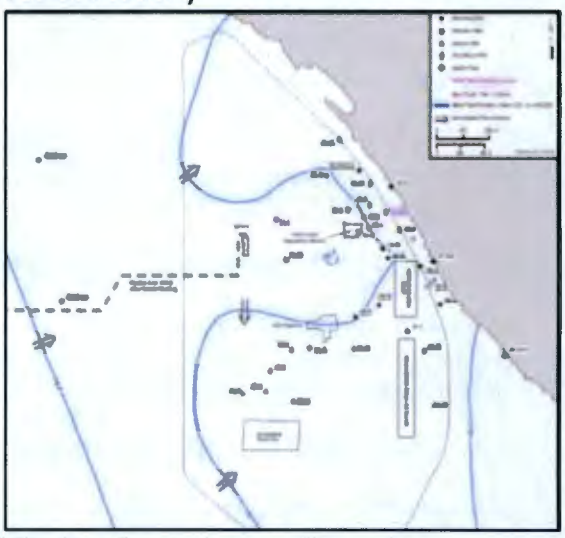
Average specific conductance values in downgradient Wells 199-N-72, 199-N-73, and 199-N-165 exceeded the critical mean value (584.64µS/cm) for 2012 (Figure 1). A previous groundwater quality assessment indicated the high specific conductance is caused by the non-regulated constituents sulfate and sodium (WHC-SD-EN-EV-003, *Results of Groundwater Quality Assessment Monitoring at the 1301-N and 1324-N/NA Facilities*). September 2012 data are consistent with this conclusion. Other results did not exceed critical mean values for 2012 or limits of quantitation (for TOC and TOX).

## 4.3 1325-N Liquid Waste Disposal Facility (Interim, Detection)

All five wells were sampled as scheduled in September. Results were loaded into HEIS. Next scheduled sampling event is March.

Average specific conductance values in downgradient Wells 199-N-41 and 199-N-81 exceeded critical mean value (463.45µS/cm) for 2012. Average values of specific conductance in samples from these wells first exceeded critical mean values in 1999. Assessment report (00-GWVZ-054, *Results of Assessment at the 1325-N Facility*) concluded exceedances were caused by past discharges of non-regulated contaminants to other facilities (e.g., the120-N-1 Percolation Pond). September data are consistent with this conclusion. Other results did not exceed critical mean values or limits of quantitation (for TOC and TOX). [*Note: The critical mean for TOC could not be calculated because the proportion of non-detects was greater than 50 percent. The LOQ was used for comparison.*]

## 4.4 183-H Solar Evaporation Basins (Final, Corrective Action)

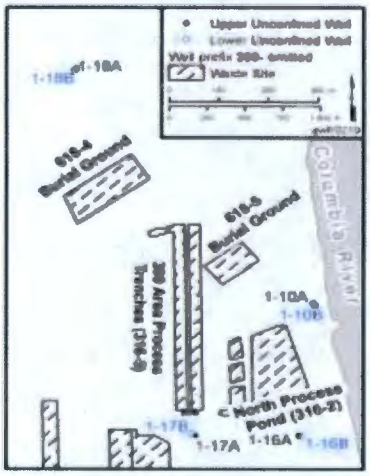


September scheduled sampling was conducted successfully at Well 199-H4-3. Concentrations of hexavalent chromium increased in September to 65.60µg/L (Figure 2). A concentration increase in September appears typical however, this was higher than expected. Sampling at other well locations is scheduled for November.

The RCRA groundwater monitoring network includes Wells 199-H4-3, 199-H4-8, 199-H4-12A, and 199-H4-12C. Due to planned remediation of waste sites, a permit modification is being drafted to remove Well 199-H4-3 from the monitoring network and add Well 199-H4-84. Well 199-H4-84 is an RI/FS characterization well drilled through the center of the basins west-southwest of Well 199-H4-3. The new well was cleared through Industrial Hygiene for routine sampling and was sampled July 24. The sampling schedule may require adjustment into September to accommodate source area remediation and possible future well replacement. Changes will be coordinated through DOE with Ecology concurrence. A permit modification is being drafted to remove Well 199-H4-3 from the monitoring network and add Well 199-H4-84.

Hexavalent chromium in Well 199-H4-12C, resulting from historical releases, remain above permit concentration limits and *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) remedial action objectives. With addition of 199-H4-12C to the pump and treat system, corrective action through the CERCLA interim action remains effective.

## 4.5 300 Area Process Trenches (Final, Corrective Action)




All wells scheduled for sampling during the quarter were sampled successfully with one exception. Well 399-1-10B was not sampled in July because of equipment malfunction; and was collected in August. Results have been loaded into HEIS and were consistent with trends. Next scheduled sampling event is December.

The concentration of cis-1,2-dichloroethene continues to exceed the 70µg/L drinking water standard (DWS) at Well 399-1-16B (200µg/L in July, 140µg/L and 200µg/L August, and170µg/L in September), which is screened in the lower unconfined aquifer (Figure 3). The origin for cis-1,2- dichloroethene is attributed to degradation of trichloroethene disposed to the 300 Area Process Trenches and/or North Process Pond.

The concentration of uranium continued to exceed the 30µg/L DWS at Well 399-1-17A (838µg/L in July, 235µg/L in August, and 217µg/L in September) at the southern end of process trenches (Figure 4). The elevated concentration of uranium at this well in July corresponds to an elevated water table elevation; the result is consistent with the conceptual model identifying a continuing source of uranium in the deep vadose zone and periodically rewetted zone. The concentration of uranium also exceeded the 30µg/L DWS at well 399-1-10A (36.1µg/L in September), east of the process trenches, and well 399-1-16A (52.2µg/L in September), southeast of the process trenches. Concentrations at wells near the Columbia River increase in autumn with the arrival of uranium that has been remobilized upgradient.

## 4.6 216-A-29 Ditch (Interim, Detection)

No wells were scheduled for sampling during the quarter. The most recent semiannual sampling was in April and in July, specifically for 699-43-45. Next scheduled sampling event is October.

299-E25-26 has not been sampled for October 2011, or April 2012, or anytime between May through September 2012, due to the well needing a new pump. The installation of a new pump and well sampling has been delayed because of the location of electrical utility lines close to the well.

## 4.7 216-B-3 Pond (Interim, Detection)

All four 216-B-3 Pond monitoring wells were sampled in July as scheduled. Field indicator parameters, pH, and specific conductance, were loaded into HEIS during the quarter, and there were no exceedances. Next scheduled sampling event is January.

## 4.8 216-B-63 Trench (Interim, Detection)

No sampling was scheduled during the quarter. Next scheduled sampling event is October.

## 4.9 216-S-10 Pond and Ditch (Interim, Detection)

The only well scheduled for sampling during the quarter was 299-W27-2, which is completed deep in the unconfined aquifer and not used for statistical comparisons. This well was sampled successfully during August. Results were loaded into HEIS and all were on trend. The metals chromium, iron, nickel, and manganese continue to be elevated due to well corrosion. Hexavalent chromium was not detected, as expected. Next scheduled sampling event is November.

## 4.10 NRDWL (Interim, Detection)

Eight of nine wells scheduled in July were successfully sampled except Well 699-25-34D, because well access was prohibited due to EXTREME Fire Danger Level. Next scheduled sampling event is January.

Results were loaded into HEIS for wells sampled and are on trend. Quadruplicate indicator parameter results were loaded into HEIS and compared to derived critical mean values for 2012. No results exceeded critical mean values except TOC in Well 699-25-34B. A request for data review (RDR) has been submitted for the off trend result.

## 4.11 216-A-36B Crib (Interim, Indicator Evaluation)

Wells scheduled for sampling during July were sampled ahead of schedule during late June, as previously reported. Next scheduled sampling event is January.

Quadruplicate indicator parameter results from June sampling for TOC and TOX were loaded into HEIS for upgradient Well 299-E17-19, and downgradient Wells 299-E17-14, 299-E17-16 and 299-E17-18. Results were compared to the derived critical mean values for 2012 and there were no exceedances.

## 4.12 216-A-37-1 Crib (Interim, Indicator Evaluation)

Wells scheduled for sampling during July were sampled ahead of schedule during late June, as previously reported. Sampling of Well 299-E25-19 was unsuccessful on June 25th and 26$^{th}$, because of a tripped pump breaker, but was successfully sampled July 25$^{th}$. Next scheduled sampling event is January.

Results for semi-volatile analytes, metals, anions, gross alpha, gross beta, iodine-129, and tritium from June and July sampling events were loaded into HEIS for Wells 299-E25-47 and 299-E25-19 and are on

trend. Quadruplicate indicator parameter results from June sampling were loaded into HEIS, and were compared to the derived critical mean values for 2012. There were no exceedances except for pH for Well 299-E25-19. The result was less than the critical mean range, data is currently being evaluated and verification sampling for this parameter has been scheduled.

RDRs have been submitted for the following off trend results: Chloride, nitrate, and sulfate for Well 299-E25-47. The RDRs are still being dispositioned.

# 5 Groundwater Monitoring Single Shell Tank (SST) Farm Waste Management Areas

RCRA units not currently incorporated into a permit require interim status monitoring until an approved operating permit for each unit is issued. Single shell tank farms are all monitored under RCRA groundwater assessment and are designated as WMAs. Summary status and monitoring highlights of results by exception are provided for each area for the reporting period.

## 5.1 SST WMA A-AX (Interim, Assessment)

All nine wells were sampled in September as scheduled. Next scheduled sampling event is December.

Analytical result comparisons between June and September for Well 299-E25-236 indicated significant metal increases. Filtered nickel increased from 22.6 to 80.3µg/L, unfiltered chromium increased from 41.4 to 190µg/L, and filtered manganese increased from non-detect to 17.9µg/L. The increases appeared to be associated with casing degradation and a television survey of the well was completed verifying the casing corrosion. This is the third well to have accelerated casing corrosion occur in this area. The other two wells were 299-E24-19 and 299-E25-46.

Elsewhere, nitrate and sulfate concentrations continue to decline at Well 299-E25-93. Elevated specific conductance at this well resulted in assessment monitoring in 2005. However, nitrate and sulfate are increasing in wells in the north portion of this WMA, as a result of migrating plumes from the north. Neither of these constituents exceeded the DWS except at Well 299-E25-93 (nitrate only).

## 5.2 SST WMA B-BX-BY (Interim, Assessment)

All wells were sampled as scheduled in August except Well 299-E33-26 which was successfully sampled at the reattempt on September 12th. Next scheduled sampling event is November. Below describes the revised groundwater flow calculations for WMA B/BX/BY, and determination of cyanide (a dangerous waste constituent) drainage into groundwater from the 241-B tank farm, and the new assessment plan.

Effects from high Columbia River Spring Stages were observed in the 14 well low-gradient monitoring network in this area in July. The wells are located within the WMA B/BX/BY monitoring network and to the northwest, west, southwest, and south. The groundwater flow direction changed from an azimuth of 192.8° to 163° between mid June and mid August. In addition, the gradient increased from 1.92E-5 to 3.21E-5. The calculated flow velocity increased from 0.18 to 0.31 m/day based on August hydraulic data. The calculation is based on a hydraulic conductivity of 1050 meters/day and a porosity of 0.11(PNNL-19277,*Conceptual Models for Migration of Key Groundwater Contaminants Through the Vadose Zone and Into the Unconfined Aquifer Below*

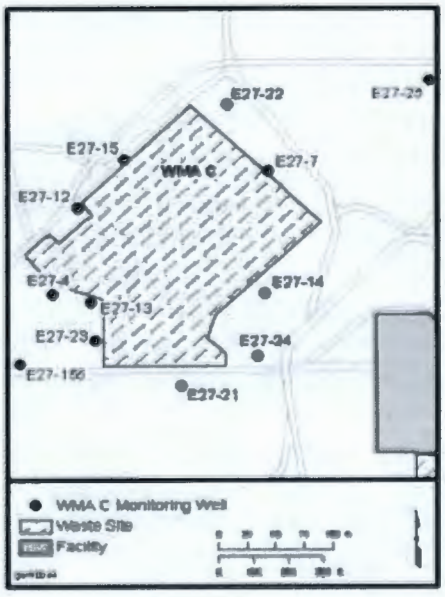
*the B-Complex*). The hydraulic conductivity presented above varies slightly from the hydraulic conductivity presented in PNNL-19277 because only the wells beneath and adjacent the WMA B/BX/BY were selected to derive the above hydraulic conductivity. In addition, the hydraulic conductivity above was derived only by those wells with a draw down equal to or greater than 0.61 cm (0.02 feet), whereas PNNL-19277 used draw downs of 0.31 cm (0.01 feet) even though this level of measurement had considerable error and required a greater than sign be associated with the calculated transmissivity.

Cyanide continued to increase at Well 299-E33-47. This well is located along the east side of the 241-B Tank Farm. The cyanide concentration in this well is significantly more elevated than in upgradient wells to the north (299-E33-20) and northwest (299-E33-18). Figure 5 shows the extent of the cyanide plume in 2009. Figure 6 shows the historical concentration trend plots for three Wells 299-E33-47, 299-E33-18, and 299-E33-20. As seen in Figure 6, cyanide concentrations in Well 299-E33-47 have recently increased between one and two orders of magnitude more than the upgradient wells. Because the northern cyanide plume originating from the BY Cribs, and shown in Figure 5, has an extensive east-west areal foot print, cyanide concentrations were expected to increase in upgradient Wells 299-E33-18 and 299-E33-20 before reaching Well 299-E33-47. Another reason why cyanide in Well 299-E33-47 is not considered to be associated with the BY cribs is because of the migration pattern for the chromium plume originating from the 216-B-8 Crib. The chromium plume, which also has an extensive east-west areal foot print, showed increases at Wells 299-E33-18 and 299-E33-20 prior to the increase at Well 299-E33-47. The cyanide increase source is determined to be from the 241-B Tank Farm.

A new WMA B/BX/BY Assessment Plan, DOE/RL-2012-35, released in early November, describes among other things, the operational history for the 241-B-BX-BY tank farms, geology and hydrogeology, and past groundwater monitoring results. Based on this framework, a conceptual model is developed providing sufficient information to make a determination that the dangerous waste constituent, cyanide, has impacted groundwater beneath the 241-B tank farm. In addition, because of the flow direction change over the past year the monitoring network was changed. As a result of the DQO process, a thorough assessment process was designed to evaluate volatile, semi volatile, and inorganic constituents in accordance with the requirements of RPP-23403, Single-Shell Tank Component Closure Data Quality Objective, and 40 CFR 264, Appendix IX, as described in Section 3.1 of the plan. Reporting requirements continue to be through the annual report.

## 5.3 SST WMA C (Interim, Detection)

All twelve wells were sampled in September as scheduled. Next scheduled sampling event is December.




Dangerous waste/dangerous waste constituent cyanide continues to be detected in groundwater at Wells 299-E27-14 and 299-E27-24. Concentrations are significantly lower than the DWS of 200µg/L. The September sample results received from the laboratory were 8.48 and 9.81µg/L, respectively. The other WMA C wells were less than detection limit for cyanide, indicating the plume migrated though the groundwater from the north to northwest of Wells 299-E27-14 and 299-E27-24. However, the plume may have originated closer to Well 299-E27-7 because of the greater concentrations at this well in the past (Figure 7). Because cyanide was present in the groundwater prior to the current retrieval efforts the cyanide is presumed to be associated with leaks before 1998.

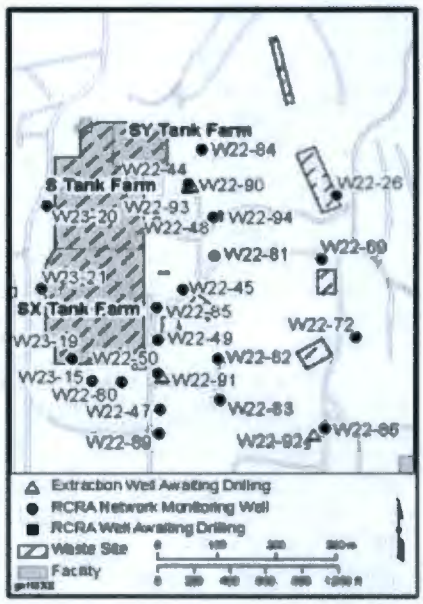
Nitrate results for September significantly increased in Well 299-E27-14. The concentrations received were 118mg/L. This

is 2.6 times higher than the DWS of 45mg/L. This nitrate concentration is the highest historically recorded nitrate concentration at this well and for the WMA. The next highest concentration for this well was in September 2009 and was 2.5 mg/L lower. Historical nitrate trend results at this well indicate a fall seasonal increase for the past seven years. The seasonal increases may be associated with spring aquifer flow reductions in this area. The other WMA C monitoring wells are approximately at the DWS or less, except for Well 299-E27-24, with a September nitrate concentration of 72.2mg/L. The elevated nitrate in this well originates from the same source as Well 299-E27-14 and is probably a co-contaminant with cyanide.

Elevated September sulfate from Well 299-E27-14 are similar to the nitrate results described above. The concentration received from the laboratory was 333mg/L and is the highest sulfate concentration received to date for this well. The sulfate is not as elevated in comparison with upgradient wells as for nitrate, but is still significantly higher. The sulfate also appears to be a co-contaminant with nitrate and cyanide.

## 5.4 SST WMA S-SX (Interim, Assessment)

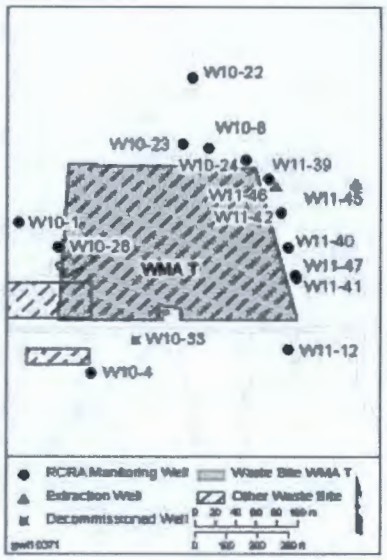
Four wells were sampled as scheduled in September. All results loaded were on trend. Next scheduled sampling event is December.




June sampling results were loaded into HEIS during the quarter. During December 2011, iodine-129 was detected in 299-W23-19 (inside the SX Tank Farm) under sampling conducted for CERCLA. The result was 2.03pCi/L, which is above the 1pCi/L DWS. Additional sampling for iodine-129 in many of the network monitoring wells was conducted during June to confirm this result, and if confirmed, to determine the extent of iodine-129 in groundwater at WMA S-SX. Of 15 wells sampled, iodine-129 was detected at only 5 wells, and there were only two exceedances of the 1pCi/L DWS. The highest concentration was in 299-W23-19 at 2.27pCi/L, which confirmed the earlier detection. The results from the upgradient wells were non-detects, confirming that the tank farm is the source. However, concentrations above the DWS are limited to the source area - no downgradient wells had a concentration exceeding the DWS. The highest concentrations in wells immediately downgradient of the SX Tank Farm were 0.753pCi/L in 299-W22-83 and 0.50pCi/L in 299-W22-47 (average of duplicate samples). The only other DWS exceedance was at far downgradient Well 299-W22-72 (1.4 pCi/L) which is located near the 216-S-7 Crib, a known source of iodine-129. There were no detections of iodine-129 immediately downgradient of the S Tank Farm. *In short, iodine-129 is present in the groundwater at the SX Tank Farm, but the extent of contamination above the DWS is limited to the source area. There is no detectable iodine-129 contamination associated with the S Tank Farm.*

Chromium concentrations increased at 299-W22-26, a far downgradient well for the S Tank Farm. Unfiltered chromium was above the DWS at 110µg/L, while the filtered concentration was 88µg/L (Figure 8). Concentrations in this well stopped increasing and began fluctuating during 2010. The other tank waste constituents declined. The nitrate concentration declined to 76mg/L from 90mg/L last December, and technetium-99 declined to 4,150pCi/L from 4,700pCi/L.

## 5.5 SST WMA T (Interim, Assessment)




All four wells scheduled for sampling in August were successfully sampled. Sample results were loaded in HEIS. Next scheduled sampling event is November.

The GW flow rate was approximately 144-227ft/yr (44-69 m/yr); 0.39-0.62ft/day (0.12-0.19 m/day) prior to 200 West operations (DOE/RL-2011-118). T Tank Farm was within the capture zone of extraction Wells 299-W11-45 and 299-W11-46 until they were taken offline in 2012 and is within the capture zone of downgradient 200 West extraction Well 299-W11-50. Since 2007, groundwater from 299-W11-45 and 299-W11-46 was transferred via pipeline to the LERF basins in the 200 East area, treated at the ETF for removal of technetium-99, metals (including chromium), nitrate and VOCs, then discharged at the State-Approved Land Disposal Site north of 200 West.

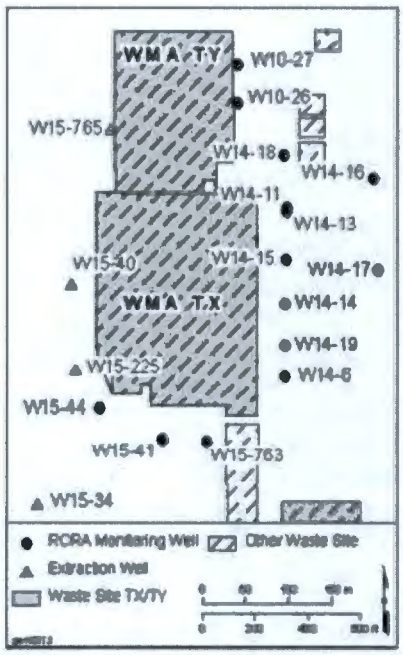
Chromium is a dangerous waste constituent monitored under the RCRA assessment program. Average chromium concentrations in 2012 are compared to average chromium concentrations in 2011 in the table below along with other parameters of interest. Chromium concentrations in 2012 increased in 299-W10-1, 299-W10-23, 299-W10-4, 299-W10-8, 299-W11-40, and 299-W11-41. The increase is attributed to a lack of extraction pumping. A 200 West extraction well, installed adjacent to 299-W11-46 (the offline extraction well), is sending water to the new facility for treatment. Concentration changes in all analytes are expected as a result of the new well extracting contaminated groundwater downgradient of WMA T.

**Table 2. WMA T Select Constituent Concentrations in 2012 Compared to 2011 Concentrations**

| | Chromium | | Hexavalent chromium | | pH | | Specific Conductance | |
|---|---|---|---|---|---|---|---|---|
| **Well Name** | **2012** | **2011** | **2012** | **2011** | **2012** | **2011** | **2012** | **2011** |
| 299-W10-1 | 28 | 17 | <3.7 | 6.3 | 8.06 | 8.10 | 512 | 540 |
| 299-W10-23 | 42 | 36 | 29 | 29 | 8.60 | 8.49 | 643 | 701 |
| 299-W10-24 | 51 | 58 | 42 | 52 | 8.63 | 8.54 | 822 | 866 |
| 299-W10-28 | 117 | 231 | 122 | 181 | 7.67 | 7.54 | 2462 | 3023 |
| 299-W10-4 | 447 | 357 | 4.4 | 2 | 7.14 | 7.29 | 5262 | 4437 |
| 299-W10-8 | 295 | 68 | 35 | 20 | 8.95 | 8.56 | 723 | 743 |
| 299-W11-39 | 61 | 62 | 60 | 60 | 8.30 | 8.29 | 905 | 912 |
| 299-W11-40 | 179 | 129 | 144 | 146 | 7.79 | 7.88 | 1559 | 1496 |
| 299-W11-41 | 174 | 166 | 166 | 156 | 7.65 | 7.69 | 1658 | 1577 |
| 299-W11-42 | 102 | 140 | 81 | 140 | 7.98 | 7.95 | 1323 | 1691 |
| 299-W11-45* | 130 | 133 | 135 | 149 | 7.24 | 7.67 | 1152 | 1154 |
| 299-W11-46+ | 102 | 115 | 107 | 119 | 7.86 | 7.67 | 1180 | 1267 |
| 299-W11-47 | 82 | 104 | 83 | 110 | 7.80 | 7.74 | 888 | 977 |

*299-W11-45 was not sampled as scheduled due to mechanical failure. This interim system extraction well was taken offline permanently (and unavailable for sampling) in February 2012, but is in the process of being converted to a monitoring well.
+299-W11-46, an interim system extraction well, was taken offline permanently (and unavailable for sampling) in May 2012.

## 5.6 SST WMA TX-TY (Interim, Assessment)



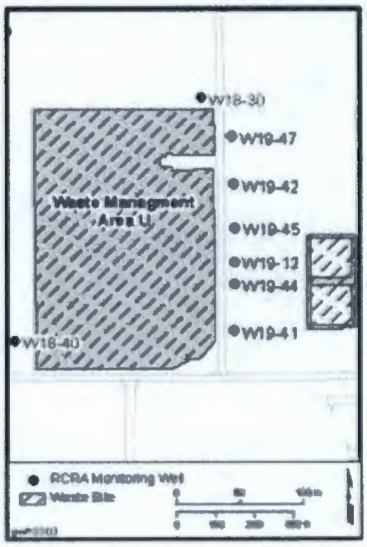

All six wells scheduled for sampling in August were successfully sampled and sample results were loaded into HEIS. Sample results in 2012 for 299-W10-26, 299-W14-13, and 299-W14-14 show a slight increase in chromium concentration along with corresponding increases in specific conductance, whereas, the remaining wells had stable or decreasing chromium concentrations. Next scheduled sampling event is November.

Chromium is a dangerous waste constituent monitored under the RCRA assessment program. Average chromium concentrations for 2012 are compared to chromium concentrations in 2011 in the table below along with other parameters of interest. Two new extraction wells, one installed upgradient adjacent to 299-W15-765 and one installed downgradient between 299-W14-13 and 299-W14-14, are sending water to the new 200West pump and treat for contaminant removal. Hydraulic conductivities (determined during hydrologic characterization tests) range between 0.23 and 65.3ft/d or 0.07 and 19.9m/d with a geometric mean of 7.22ft/d (2.20 m/d). Groundwater flow rates and direction vary widely due to the presence of pump and treat extraction wells upgradient, downgradient, and south of the WMA. Changes in concentrations of all analytes are expected as a result of the new wells extracting contaminated groundwater upgradient and downgradient of WMA TX-TY. Upgradient 299-W15-765 is in process of being converted from the interim system's extraction well to a monitoring well.

**Table 3. WMA TX-TY Select Constituent Concentrations in 2012 Compared to 2011 Concentrations**

| | Chromium | | Hexavalent chromium | | pH | | Specific Conductance | |
|---|---|---|---|---|---|---|---|---|
| **Well Name** | **2012** | **2011** | **2012** | **2011** | **2012** | **2011** | **2012** | **2011** |
| 299-W10-26 | 92 | 89 | 90 | 73 | 7.75 | 7.80 | 1381 | 1246 |
| 299-W10-27 | 113 | 119 | 85 | 87 | 7.80 | 7.81 | 1814 | 1865 |
| 299-W14-11 | 53 | 65 | 54 | 61 | 7.70 | 7.70 | 975 | 1056 |
| 299-W14-13 | 256 | 224 | 242 | 237 | 7.97 | 7.98 | 1056 | 1004 |
| 299-W14-14 | 26 | 24 | 16 | 11 | 8.04 | 8.14 | 581 | 522 |
| 299-W14-15 | 42 | 45 | 48 | 30 | 7.87 | 7.86 | 700 | 667 |
| 299-W14-16 | 16 | 15 | 3 | 3.7 | 7.92 | 7.89 | 617 | 619 |
| 299-W14-17 | 21 | 24 | 5 | 3.7 | 8.16 | 8.21 | 649 | 664 |
| 299-W14-18 | 5 | 5.7 | 4 | 9 | 7.67 | 7.68 | 575 | 758 |
| 299-W14-19 | 26 | 33 | 5 | 3.7 | 7.84 | 7.84 | 616 | 588 |
| 299-W15-44 | 8 | 10 | 5 | 5 | 7.82 | 7.75 | 622 | 685 |
| 299-W15-763 | 18 | 22 | 3 | 3.7 | 7.86 | 7.88 | 1271 | 1272 |

## 5.7 SST WMA U (Interim, Assessment)




All network monitoring wells were sampled as scheduled in July. Results were loaded into HEIS and all were on trend except those discussed below. Next scheduled sampling event is October.

Field parameters for the July sampling of Wells 299-W19-41 and 299-W19-47 were loaded into HEIS. The results were on trend, except that oxidation/reduction (REDOX) potential was low at two wells (85.4mV for 299-W19-41, and 86.8mV for 299-W19-47). However, these results may not be representative of aquifer conditions because of issues associated with obtaining accurate REDOX potentials by field measurement.

The technetium-99 concentration at 299-W19-45 began increasing substantially in January 2011. After reaching 3,000pCi/L in July 2011, the concentration declined slightly in February 2012 to 2,800pCi/L. However, the result from July sampling was the highest yet at 3,400pCi/L. Thus, the increasing trend continues (Figure 9).

# 6 Active Waste Management Areas

Permitted WMAs are monitored to determine whether dangerous waste or dangerous waste constituents from the waste sites have entered the groundwater. Summary status and monitoring highlights of results by exception are provided for each area for the quarterly reporting period.

## 6.1 Integrated Disposal Facility (Final, Detection)

No sample collection was scheduled during this quarter, nor any results received. Next scheduled sampling event is January.

## 6.2 Liquid Effluent Retention Facility (Final, Detection)

All monitoring wells were sampled in July as scheduled. Semi-annual analytical results received in August included: volatile organics (VOAs), semi-volatile organics (SVOAs), anions, alkalinity, ammonium ion, metals, total organic carbon, and total organic halides. In addition, AEA results included: alpha, beta, gamma constituents, I-129, and tritium. Next scheduled sampling event is January.

The flow direction at this site has been determined as southeast for several years. The flow is based on 3 wells, which have been corrected for deviation and barometric effects. In addition, the wells were resurveyed to a common marker in a closed loop. However, the highest groundwater elevation is from Well 299-E26-11, located within the Ringold semi-confined aquifer. The confined Ringold formation has higher groundwater elevations than the unconfined due to the low permeability Ringold mud and retained mounding from releases associated with B Pond. Contrary to this flow direction is the migration of nitrate and sulfate from the west. Thus, wells along the west boundary of the LERF basin appear to be upgradient based on the migration of nitrate and sulfate, originating near Well 299-E34-7 in the mid 1990s.

**VOAs:** Twenty-six different constituents were analyzed and one constituent, methylene chloride, was detected in groundwater from two wells; 299-E26-14 (new upgradient well) and 299-E26-79 (well south of LERF basins). The results were 1.6 and 1.8μg/L, respectively. The results are just above detection limit and the first time this constituent was detected in either well. This constituent is a common lab contaminant and based on the low result could be associated with lab contamination.

**SVOAs**: Thirty-three different constituents were analyzed and two constituents, bromacil (herbicide) and n-heptane (alkane, $C_7H_{16}$), were detected in groundwater from Well 299-E26-77 (located to east of the LERF basins). The results were 3.9 and 4.5μg/L, respectively. The alkane results may be associated with contaminant migration from the same plume associated with anions, metals and TOC discussed below.

**Anions:** Nitrate and chloride began to decrease slightly in Well 299-E26-10. The concentrations are comparable to results to the west, in Well 299-E27-10 during 2010 or 2006 and 2007. It appears the unplanned release associated with the 216-B-2-2 Ditch is the probable source of elevated nitrate and chloride. The unplanned release appears to be associated with ion exchange and high level solidifiable waste from the B Plant fractionation process. The ion exchange waste contained elevated chloride and the high level solidifiable waste contained organic complexing agents discussed further for metals section below. The origin of the infiltration appears to be near the now dry Well 299-E34-7. Chloride was considerably more concentrated in Well 299-E34-7 than in Well 299-E26-10 (Figure 10). Unfortunately, Well 299-E34-7 has been sample dry since 2005 because of decreased aquifer elevation with relationship to the basalt elevation. Sulfate also began to decrease at Well 299-E26-10. However, farther to the southeast, in Well 299-E26-79, nitrate and chloride concentrations are increasing. This indicates a southeast migration pathway from Well 299-E26-10 (Figure11).

**Metals:** Elevated nickel showed a decrease from January sampling in Well 299-E26-10, 11.2 to 5.6μg/L. The background concentration for nickel is 1.98μg/L. It appears the nickel is also associated with the unplanned release from the 216-B-2-2 Ditch. Nickel has been shown to be complexed by organic complexing agents EDTA and HEDTA, which are associated with the high level solidifiable waste. Unfortunately, these organics do not appear in normal VOA or SVOA analyses. Strontium levels are also elevated in Well 299-E26-10. Concentrations have been nearly double the background levels in the past (2009). However, the concentrations are much less than past results at Well 299-E27-10, located to the west. It appears the complexed nickel does not migrate as fast or as far north as the nitrate and chloride.

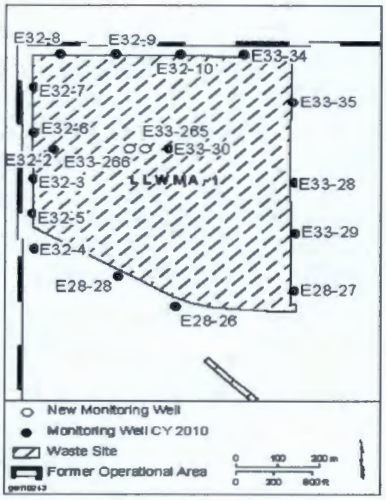
**TOC:** may have peaked in 2011 in Well 299-E26-11. The result decreased in January 2012 and again in July. They are now at 1420 μg/L. This is the highest concentration in the current monitoring network. However, results are significantly lower than past results at Well 299-E34-7, which peaked at 6500μg/L.

**AEA:** The gamma results were all non-detect. Tritium and iodine-129 results were all non-detect except for Well 299-E26-11, which is associated with past migration from B Pond. Gross alpha and beta are slightly elevated in Wells 299-E26-14, 299-E26-77, and 299-E26-79. Normally, gross alpha is associated with uranium; however, uranium is not collected or analyzed for at these wells. Elevated gross alpha and beta have been seen to the west of these wells.

## 6.3 LLWMA-1 (Interim, Assessment)

All assessment sampling was collected as scheduled in July and results were received in August including: volatile organics (VOAs), semi-volatile organics (SVOAs), polychlorinated dibenzofurans and dioxins, pesticides, herbicides, polychlorinated biphenyls, petroleum hydrocarbons, anions, alkalinity, metals, total organic carbon and total organic halides. Also, coliform bacteria, total petroleum hydrocarbons for gasoline, diesel, and kerosene were included in the assessment. In addition, AEA results included: I-129, technetium-99, tritium, and uranium. Next scheduled sampling event is October.

An assessment plan for the TOC exceedance found only at Well 299-E33-265 (Figure 12) was approved by Ecology and the sample collection and analyses conform to (DOE/RL-2012-35, *First Determination RCRA Groundwater Quality Assessment Plan for Low-Level Burial Grounds Low-Level Waste*




*Management Area-1*). The assessment plan required sampling of Appendix IX dangerous waste and dangerous waste constituents at Well 299-E33-265, and two adjacent, Wells 299-E33-30 and 299-E33-266. The remaining wells continued to be sampled for standard detection monitoring constituents associated with DOE/RL-2009-75, *Interim Status Groundwater Monitoring Plan for the LLBG WMA-1*. Below are summaries of assessment findings.

**TOC:** One criteria of the plan was to evaluate TOC to determine if it was still elevated in Well 299-E33-265. As can be seen in Figure 12, the TOC is still elevated compared with the January 2012 critical mean of 1330µg/L.

**Total Petroleum Hydrocarbons – Diesel Range**: Degraded long chained diesel components were detected in Wells 299-E33-265 and 299-E33-266. The concentrations were just above detection limits at 140µg/L, however, because of the decay it was not possible to identify the constituents. The chromatograph of the decayed hump or unresolved complex mixture could include branched and cyclic alkanes and polar transformation products. Note that these diesel results do not account for the elevated TOC at Well 299-E33-265. By comparison, Well 299-E33-266 only had an average TOC concentration of 152µg/L. Thus, the diesel is determined not to be the source of the elevated TOC.

**SVOAs**: 127 different constituents were analyzed from groundwater collected at three target Wells 299-E33-30, 299-E33-265, and 299-E33-266. All results were non-detect. However, two SVOAs were tentatively identified and could be associated with the following three non-dangerous waste constituents: Acetaldehyde, N-Methylallylamine, and 1-nitroso-azetidine. *Note: acetaldehyde is a degradation product of several diesel constituents. However, the concentration for these constituents does not account for the elevated TOC in Well 299-E33-266.*

**VOAs:** 56 different constituents were analyzed from groundwater collected at three target Wells 299-E33-30, 299-E33-265, and 299-E33-266. Two constituents, acetone and chloroform, were detected. Acetone, a common lab contaminant, was detected from groundwater collected at Wells 299-E33-30 and 299-E33-266. Chloroform was detected in Well 299-E33-265. Both results were detected just above the detection limit and flagged "J", as estimated results. The acetone results were 1.5 and 1.0µg/L, respectively. The chloroform result was 0.13µg/L. Chloroform has been detected randomly at several wells throughout the 200-BP-5 OU and recent investigation for the cause may be associated with the sample vial. The vial is only certified for less than 0.5µg/L, meaning concentrations above this level would not be associated with the vial. Thus, these constituents are determined not to be associated with groundwater contamination.

**Polychlorinated dibenzofurans and dioxins**: Eight different congeners were analyzed from groundwater collected at three target Wells 299-E33-30, 299-E33-265, and 299-E33-266. Only two congeners were detected, octachlorodibenzo-p-dioxin and octachlorodibenzofuran. The octachlorodibenzo-p-dioxin was detected in both the QC blank and samples from all three wells. The octachlorodibenzofuran was detected at 1.1E-6µg/L and 1.7E-6µg/L in Wells 299-E33-30 and 299-E33-266. The octachlorodibenzofuran appears to be at natural background concentrations, and literature review indicated it is found at low levels naturally. Thus, neither of these constituents are determined to be dangerous waste constituents.

**Chromium and Cyanide:** These two constituents were found above the background levels in one or more of the three target wells. Chromium was only detected from groundwater collected at Well 299-E33-30 with a concentration of 6µg/L. Based on spatial distribution and concentration of chromium in the aquifer it is determined the chromium is from the 216-B-8 Crib. Likewise cyanide detected in all three of the target wells is determined to be from the BY Cribs based on the spatial distribution and concentration of cyanide in the unconfined aquifer.

**Other metals, anions, and PCBs:** All metals were either non-detect or below background concentrations. Anions were consistent with past results and for those exceeding background or DWS, they are attributed to the same source areas to the east and south as discussed in annual reports previously. All PCBs were non-detect.

**Coliform bacteria**: The results were non-detect.

**Pesticides, herbicides, and total organic halides:** Results for these constituents were non-detect. Based on results of this assessment, the site has been determined to not have caused an impact to groundwater. No dangerous wastes or dangerous waste constituents were found associated with LLWMA-1 and the site will return to detection monitoring in January. Because October sampling had to be scheduled prior to receipt of July assessment results, an extra round of assessment sampling will be completed in October.

## 6.4 LLWMA-2 (Interim, Detection)

No sampling was conducted nor results received this quarter. Next scheduled sampling event is October.

## 6.5 LLWMA-3 (Interim, Detection)

Four wells scheduled for sample collection were successfully completed in September. Results for all wells were loaded into HEIS. Average concentrations for select constituents in fiscal year 2012 are included in table 4 below. Next scheduled sampling event is March.

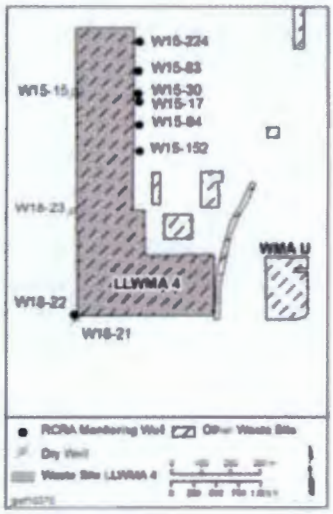
TOC results for 299-W9-2 (the new upgradient monitoring well) are under review as July and September results were 50-70 times higher than previous sample results (197µg/L). Elevated TOC concentrations were noted in the July sampling event (average of 9,479µg/L), which were above typical TOC concentrations in downgradient wells. A split sample (2 quadruplet samples) was requested and samples were sent to separate laboratories. Sample results confirmed elevated TOC concentrations: average TOC concentration was 12,400µg/L in samples sent to WSCF and 8,295µg/L in samples sent to Test America St. Louis. Because 299-W9-2 is a new upgradient monitoring well, samples taken in January, April, and July were analyzed for a suite of constituents to determine background levels. Constituents included volatile organic compounds, semi-volatile organic compounds, metals, anions, total organic carbon, total organic halides, and field parameters – pH, specific conductance, dissolved oxygen, turbidity, and temperature. Analytical results from the first two sampling events indicated no contamination and only TOC concentrations were elevated in the July and September sampling events. Based on past experience, the elevated TOC could be attributed to the significant amount of vegetable grease used during the well construction process to lubricate casing connections or due to the presence of natural organic material such as humic acid. If the vegetable oil is the source of the elevated TOC, concentrations are expected to decrease with each sampling event to background levels. A request for data review has been submitted and the data remain under review.

**Table 4. LLWMA-3 Average concentration for select constituents in wells in FY 2012**

| Well | Alkalinity | Dissolved oxygen | Nitrate | pH Measurement | Specific Conductance | TOC | TOX | Sampled as Scheduled? |
|---|---|---|---|---|---|---|---|---|
| 299-W10-29 | 110000 | 9416 | 27800 | 7.95 | 378 | 239 | 13.5 | Y |
| 299-W10-30 | 120000 | 9794 | 33800 | 7.88 | 420 | 185 | 11.5 | Y |
| 299-W10-31 | 100000 | 9118 | 74400 | 7.87 | 606 | 311 | 24 | Y |
| 299-W9-2 | 110000 | 6741 | 21125 | 7.98 | 381 | 197* | 6.9 | Y |

Source: Environmental Dashboard Application, 2012. Available at: http://environet.hanford.gov/eda/
*September data under review.

## 6.6 LLWMA-4 (Interim, Detection)




Seven wells scheduled for sample collection in July were successfully sampled. Next sampling event is scheduled for January.

Additional sampling occurred in September except for split samples collected in 299-W15-83 to determine TOC concentrations. A request for data review was submitted on July TOC sample results, which were ten times higher than any previous sample result. Per regulations, split quad samples were collected from 299-W15-83 on September 13th, and sent to two different labs for analyses. The results from one set of quad samples analyzed at WSCF were on trend, with an average TOC concentration of 394µg/L. Results from the second set of quad samples sent to the outside lab were high with an average concentration of 4075µg/L. The split sample data are inconclusive and data review continues. Average concentrations for select constituents in fiscal year 2012 are included in Table 5.

Well 299-W18-21 was not sampled as scheduled in January 2012 because the well was reported as dry and dropped from the LLWMA-4 schedule. However, 299-W18-21 was successfully sampled in February under another program for all constituents (results entered in the table above) including carbon tetrachloride, trichloroethene, chloroform, and other volatile organic compounds. Sample results from the February 2012 sample event for VOCs were undetectable (<1µg/L). Results in 2011 for TOX in 299-W18-21 were undetectable (<5µg/L).

**Table 5. LLWMA-3 Average concentration for select constituents in wells in FY 2012**

| Well | Alkalinity | Dissolved oxygen | Nitrate | pH Measurement | Specific Conductance | TOC | TOX | Sampled as Scheduled? |
|---|---|---|---|---|---|---|---|---|
| 299-W15-152 | 100000 | 8886 | 127500 | 7.75 | 555 | 265 | 16 | Y |
| 299-W15-17 | 125000 | 7188 | 17050 | 7.84 | 365 | <100 | 6 | Y |
| 299-W15-224 | 110000 | 8916 | 114000 | 7.68 | 538 | 345 | 18 | Y |
| 299-W15-30 | 110000 | 7521 | 124000 | 8.02 | 546 | 248 | 31 | Y |
| 299-W15-83 | 110000 | 7717 | 124500 | 7.85 | 552 | 429* | 11 | Y |
| 299-W15-94 | 110000 | 8934 | 119000 | 7.87 | 545 | 328 | 14 | Y |
| 299-W18-21 | 110000 | 7760 | 113000 | 7.59 | 521 | 144 | <1 | N |
| 299-W18-22 | 136667 | 7688 | 18833 | 7.90 | 384 | <100 | 7 | Y |

Source: Environmental Dashboard Application, 2012. Available at: http://environet.hanford.gov/eda/
*Average of January 2012 sample results; July 2012 data under review.

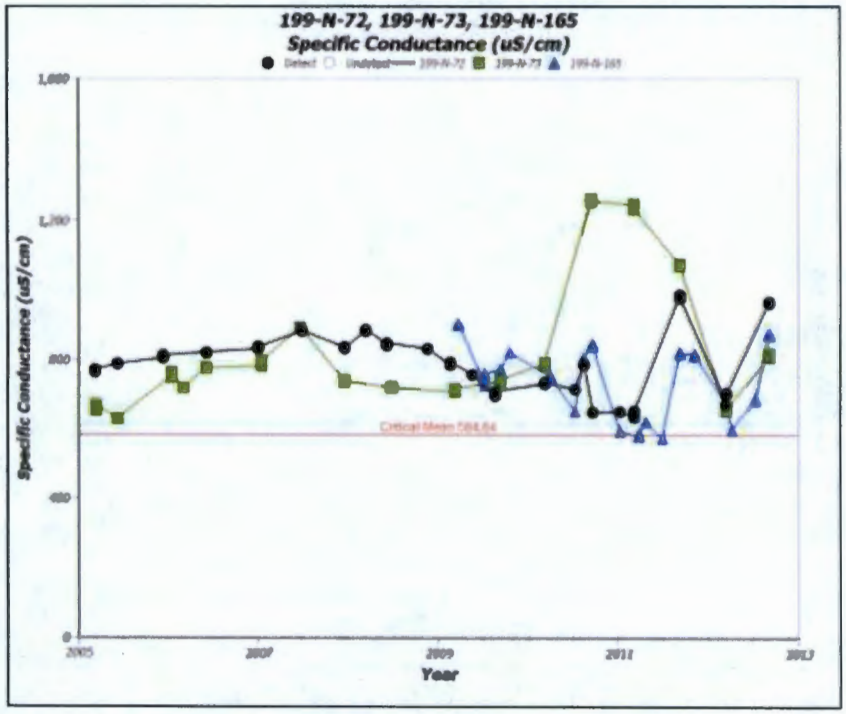



Figure 1. Wells 199-N-72, 199-N-73, 199-N-165 Specific Conductance

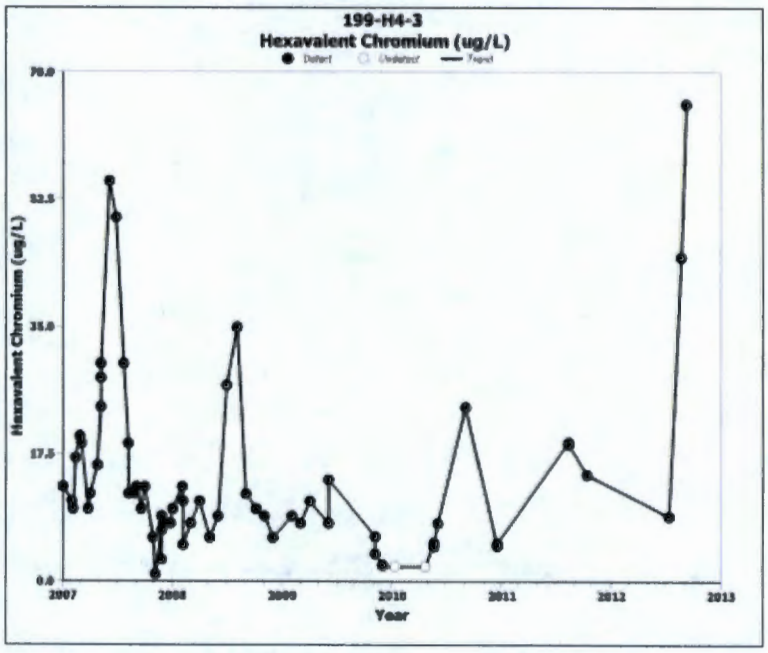



Figure 2. Well 199-H4-3 Hexavalent Chromium

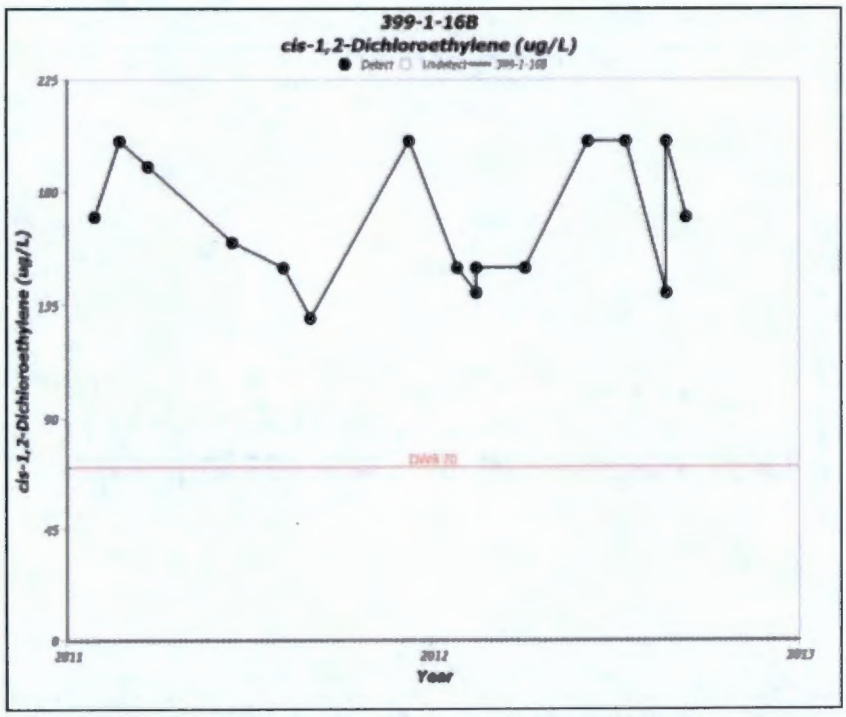



Figure 3. Well 399-1-16B cis-1,2-dichloroethylene

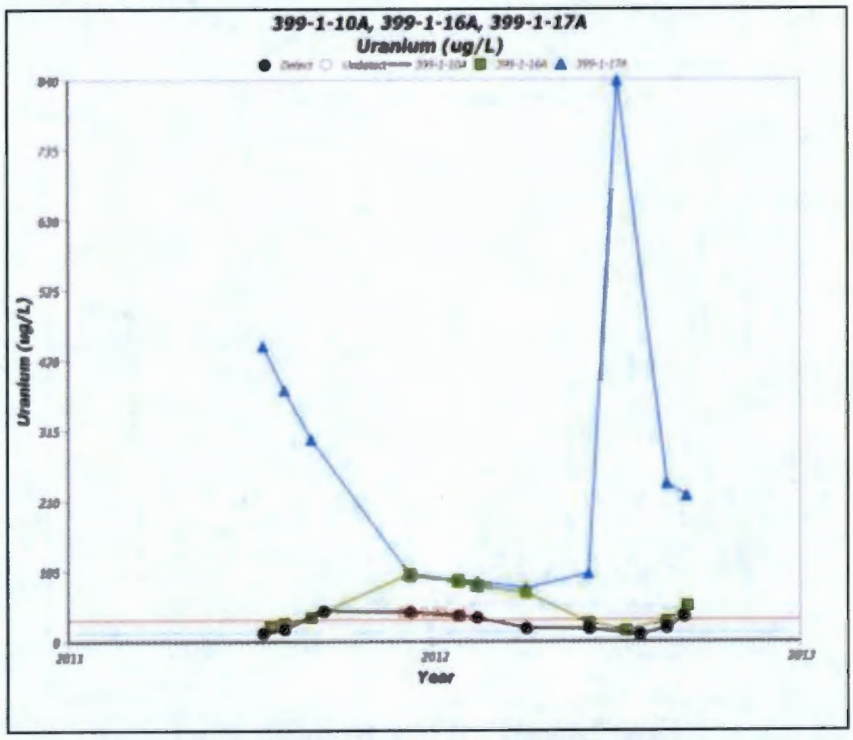



Figure 4. Wells 399-1-10A, 399-1-16A, and 399-1-17A Uranium

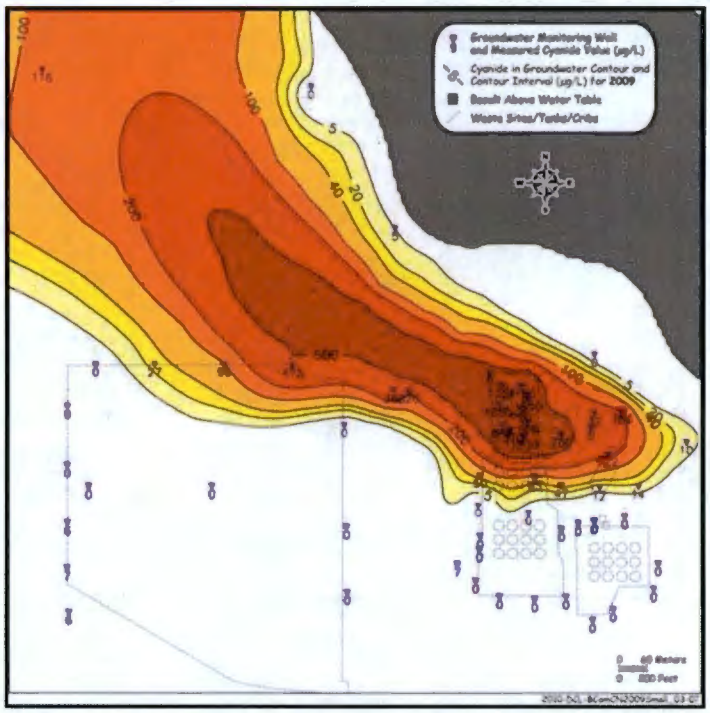



**Figure 5. Wells 299-E33-47, 299-E33-18 and 299-E33-20 Cyanide Concentration Plume 2009**

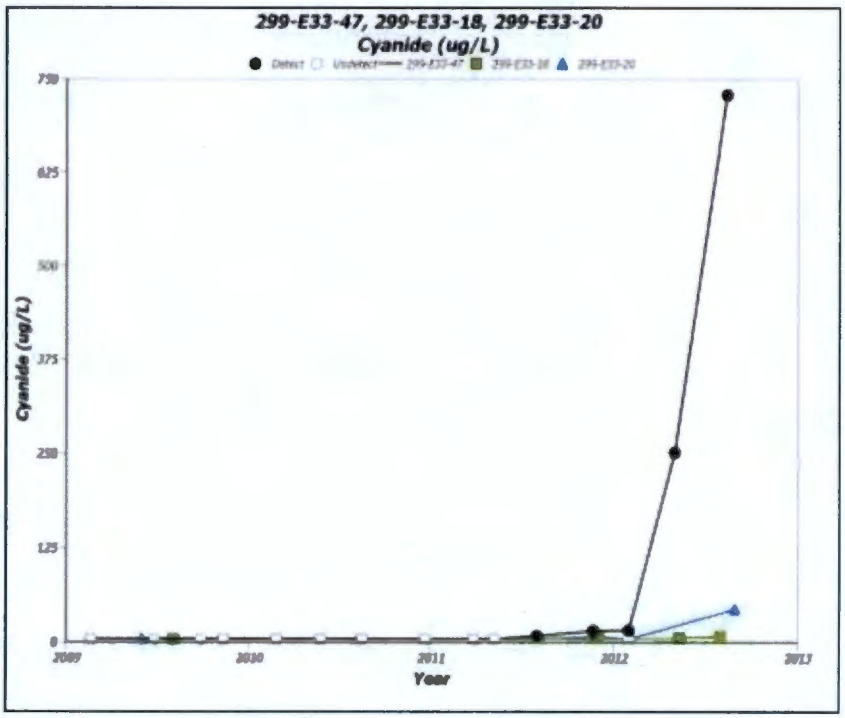



**Figure 6. Wells 299-E33-47, 299-E33-18, and 299-E33-20 Cyanide**

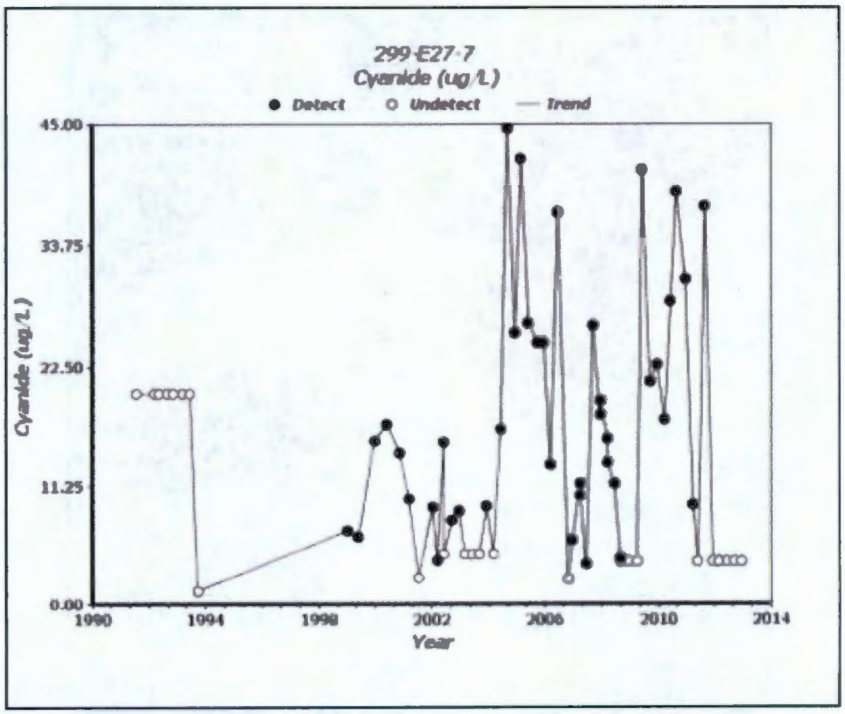



**Figure 7. WMA C Cyanide Plot**

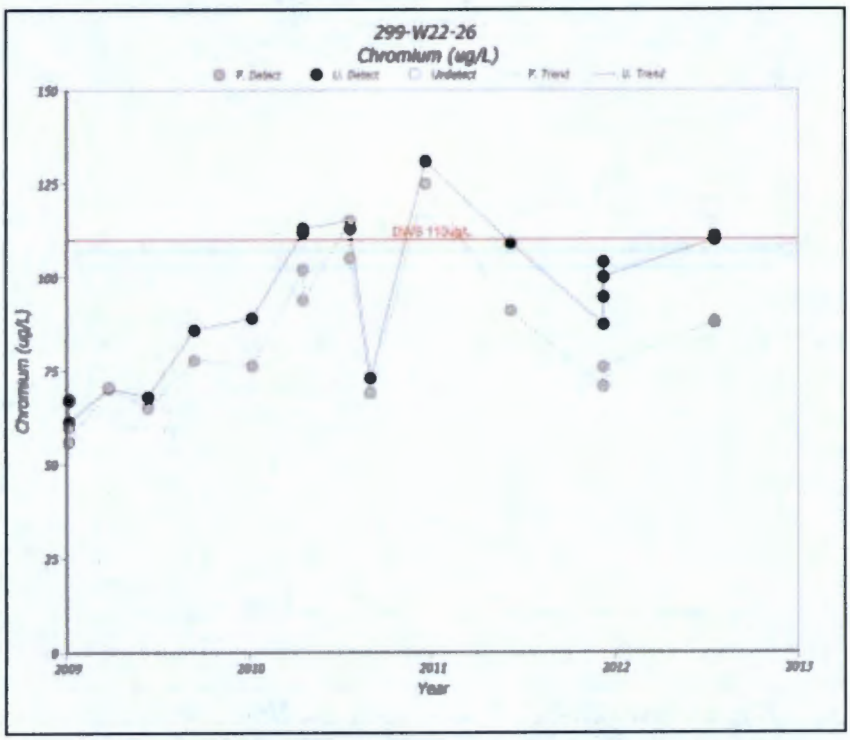



**Figure 8. Well 299-W22-26 Chromium (Filtered and Unfiltered)**

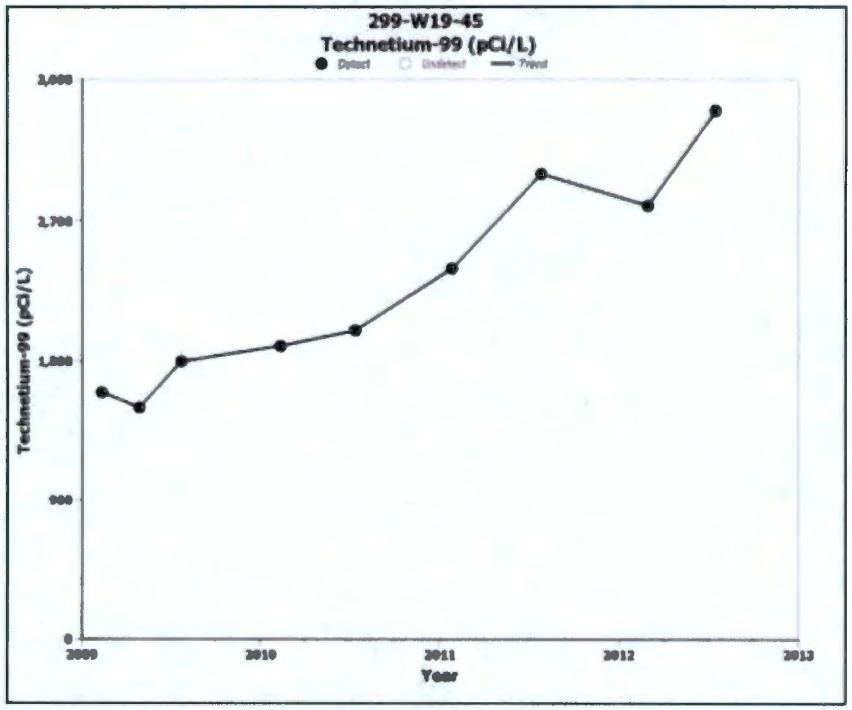



Figure 9. Well 299-W19-45 Technetium-99

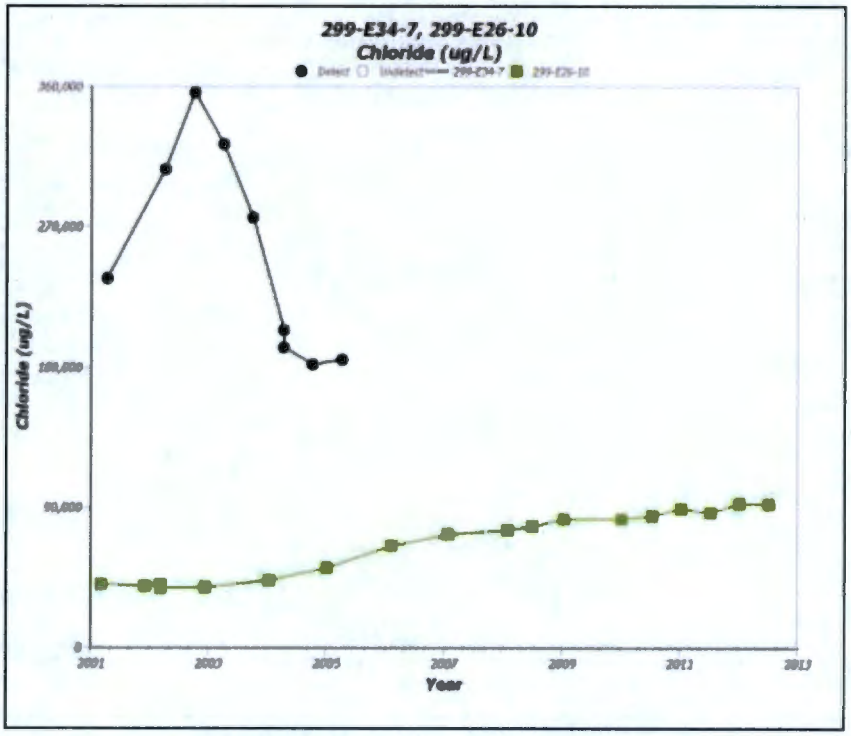



Figure 10. Wells 299-E34-7 and 299-E26-10 Chloride

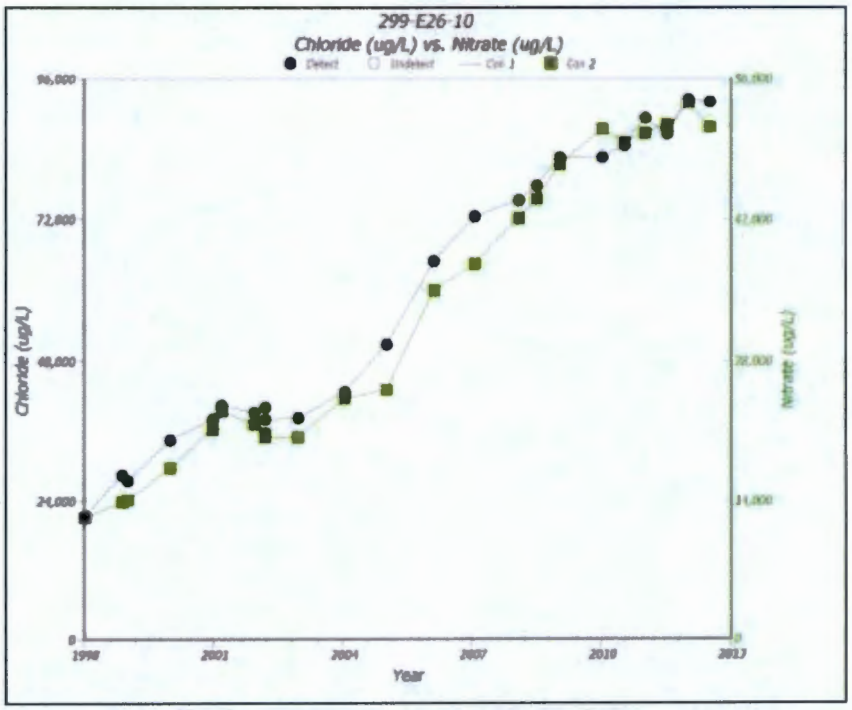



Figure 11. Well 299-E26-10 Chloride vs. Nitrate

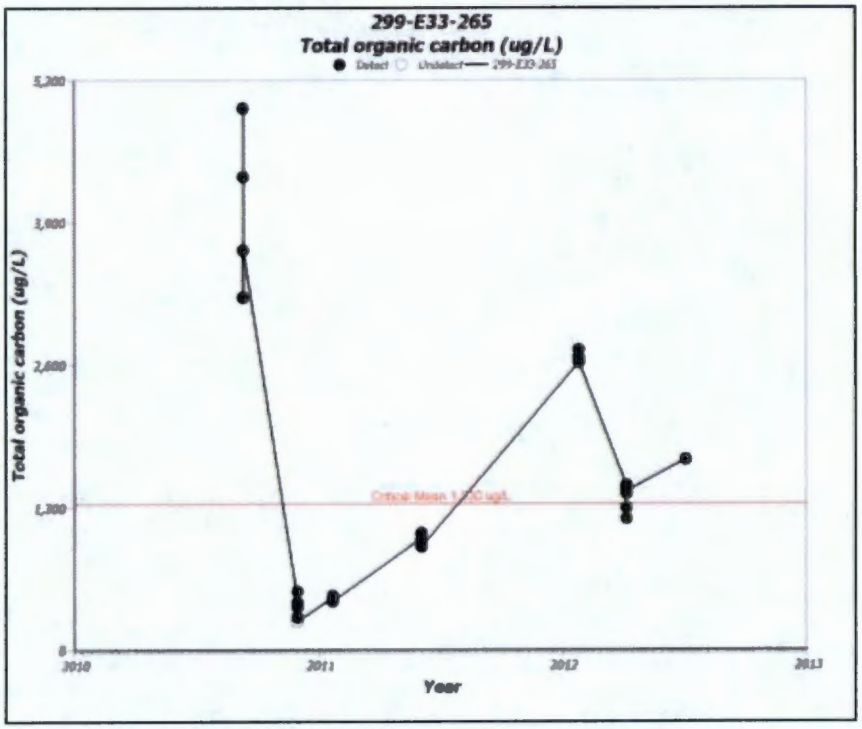



Figure 12. Well 299-E33-265 TOC

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