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Pacific Northwest
National Laboratory
Operated by Battelle for the
U.S. Department of Energy

Quarterly RCRA Groundwater Monitoring Data for the Period April through June 2006

M. J. Hartman

November 2006

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

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Richland, Washington 99352

Summary

This report provides information about RCRA groundwater monitoring for the period April through June 2006. Seventeen *Resource Conservation and Recovery Act* (RCRA) sites were sampled during the reporting quarter.

Acronyms

AEA	*Atomic Energy Act*
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act*
DOE	U.S. Department of Energy
EB	equipment blank
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FTB	full trip blank
FXR	field transfer blank
HEIS	Hanford Environmental Information System
ICP	inductively coupled plasma
ICP-MS	inductively coupled plasma-mass spectrometry
Lionville Laboratory	Lionville Laboratory, Incorporated, Lionville, Pennsylvania
MDL	method detection limit
PE	performance evaluation
PNNL	Pacific Northwest National Laboratory
QC	quality control
RCRA	*Resource Conservation and Recovery Act*
RPD	relative percent difference
RSD	relative standard deviation
STL Richland	Severn Trent Laboratories, Incorporated, Richland, Washington
STL St. Louis	Severn Trent Laboratories, Incorporated, St. Louis, Missouri
TSD	treatment, storage, and/or disposal
WMA	Waste management area

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1.0 Introduction

Seventeen *Resource Conservation and Recovery Act* (RCRA) sites[1] were sampled during the reporting quarter, as listed in Table 1.1. Sampled sites include seven monitored under groundwater indicator evaluation ("detection") programs [40 CFR 265.93(b)], eight monitored under groundwater quality assessment programs [40 CFR 265.93(d)], and two monitored under final-status programs [WAC 173-303-645].

Groundwater monitoring objectives of RCRA, the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA), and the *Atomic Energy Act* (AEA) often differ slightly and the contaminants monitored are not always the same. For RCRA regulated units, monitoring focuses on non-radioactive dangerous waste constituents. Radionuclides (source, special nuclear and by-product materials) may be monitored in some RCRA unit wells to support objectives of monitoring under the AEA and/or CERCLA. Please note that pursuant to RCRA, the source, special nuclear and by-product material component of radioactive mixed waste are not regulated under RCRA and are regulated by the U.S. Department of Energy (DOE) acting pursuant to its AEA authority. Therefore, while this report may be used to satisfy RCRA reporting requirements, the inclusion of information on radionuclides in such a context is for information only and may not be used to create conditions or other restrictions set forth in any RCRA permit.

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[1] A site is a treatment, storage, and/or disposal (TSD) unit or a waste management area associated with a TSD unit.

Table 1.1. Status of RCRA Sites, April - June 2006

Site	Routine Sampling?	DG Statistical Exceedance?	Comments
Detection Sites [40 CFR 265.93(b)] (sampled semiannually)			
1301-N Liquid Waste Disposal Facility[(a)]	No	Not sampled	
1325-N Liquid Waste Disposal Facility[(a)]	No	Not sampled	
1324-N/NA Facilities[(a)]	Yes	Yes[(b)]	See text.
216-B-3 Pond	No	Not sampled	
216-A-29 Ditch	Yes	Yes[(b)]	See text.
216-B-63 Trench	Yes	Yes[(b)]	See text.
216-S-10 Pond and Ditch	Yes	No	Current network 2 shallow and 1 deep DG wells[(c)]
LERF	No	Not applicable	Current network 1 UG and 1 DG well. No statistical evaluation per Ecology.
LLWMA 1	Yes	Yes[(b)]	See text.
LLWMA 2	Yes	No	Wells monitoring the north part of the LLWMA are dry.[(c)]
LLWMA 3	No	Not sampled	Statistical comparisons suspended until new background baseline established.
LLWMA 4	No	Not sampled	
SST WMA C	Yes	No	
NRDWL	No	Not sampled	
Groundwater Quality Assessment Sites [40 CFR 265.93(d)] (sampled quarterly)			
Eight sites[(d)]	Yes	Not required	See updates in text.
Sites under a WAC 173-303-645 monitoring program			
Integrated Disposal Facility	Yes	Not applicable	Establishing background chemistry.
300 Area Process Trenches	Yes	Not applicable[(e)]	
183-H Solar Evaporation Basins	No	Not sampled	

CM = Critical mean value(s).
DG = Downgradient.
LERF = Liquid Effluent Retention Facility.
LLWMA = Low-level WMA.
NRDWL = Nonradioactive Dangerous Waste Landfill.
SST = Single-shell tanks.
UG = Upgradient.
WMA = Waste management area.

(a) These sites are incorporated into Part V of the Hanford Facility RCRA Permit, but continue to be monitored under interim-status programs, as specified in the Permit.
(b) No indication of dangerous waste contamination from site; see text for explanation.
(c) Well installation needs are addressed each year as part of the M-24 milestone process.
(d) U-12 Crib, PUREX Cribs, SST WMAs A-AX, B-BX-BY, S-SX, T, TX-TY, and U.
(e) Site has entered corrective action monitoring because of previous exceedances.

2.0 Comparison to Concentration Limits

Contamination indicator parameter data (pH, specific conductance, total organic halides, and total organic carbon) from downgradient wells were compared to background values at sites monitored under interim-status, detection requirements, as described in 40 CFR 265.93. Results of the comparisons are listed in Table 1.1. Additional explanation is provided in the following sections.

2.1 1324-N/NA Facilities

Critical mean values were revised based on one upgradient well and three downgradient wells because we were able to sample downgradient well 199-N-59, which could not be sampled since September 2002 because of low water levels. Average specific conductance in all three downgradient wells continued to exceed the revised critical mean of 491 µS/cm in June. Groundwater quality assessment (Hartman 1992) conducted at this site attributed the high specific conductance to sulfate and sodium.

2.2 216-A-29 Ditch

The average specific conductance in three downgradient wells, 299-E25-35 (396.5 µS/cm), 299-E25-48 (481.2 µS/cm), and 299-E26-13 (275 µS/cm), continued to exceed the critical mean value of 273 µS/cm in April. Previous exceedances were reported earlier; the rise in specific conductance was attributed to sulfate, calcium, and sodium[2] and the site reverted to indicator evaluation monitoring. The critical mean will likely be updated and revised, to a higher value, because of the regional increasing trend of specific conductance in groundwater in this part of the 200-East Area.

2.3 216-B-63 Trench

Average pH in downgradient wells 299-E33-36 (8.61) and 299-E34-8 (8.51), and upgradient well 299-E27-11 (8.47) exceeded the upper limit of the critical range [7.70, 8.38] during the reporting period. Prior pH exceedances were noted and reported. Because the exceedances occurred in both upgradient and downgradient wells, it does not indicate contamination from the facility.

In addition, total organic halides concentrations (16.2, 14.1, 52.6, and 79 µg/L) in downgradient well 299-E33-37 averaged 40.5 µg/L and exceeded the calculated critical mean (19.1 µg/L) as well as the quantitation limit (29.7 µg/L) for the reporting quarter. The high variability of the quadruplicate samples makes the results suspect. Scheduled verification sampling was delayed because sampling crews were prohibited from sampling off-road wells due to a fire danger level of "extreme." Total organic halides data collected from this well during the next sampling event (October 2006) will serve as the verification results.

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[2] Letter from K. Michael Thompson (U. S. Department of Energy, Richland Operations Office) to Jane Hedges (Washington State Department of Ecology), *Notification of Specific Conductance Exceedances at the 216-A-29 Ditch*, dated April 26, 2000 (00-GWVZ-038).

2.4 Low-Level Waste Management Area 1

Downgradient well 299-E32-2 was not sampled during the reporting quarter. On the first attempt, the pump would not bring water to the surface. Further attempts were delayed because of a fire danger level of “extreme.” Critical mean values were revised because no samples could be collected from that well. Specific conductance in downgradient well 299-E33-34 (1,460.3 μS/cm) continued to exceed the critical mean of 777 μS/cm in June. Specific conductance in another nearby well, 299-E32-10 (725 μS/cm), showed an upward trend. The specific conductance exceedance in well 299-E33-34 and the upward trend in well 299-E32-10 were reported earlier.[3] Nitrate, sulfate, calcium, and sodium are all elevated in well 299-E33-34 and follow trends similar to specific conductance. Because there is a known nitrate plume from an upgradient source and the elevated specific conductance results are attributed to that upgradient source, detection monitoring will continue.

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[3] Letter from MJ Furman (U. S. Department of Energy, Richland Operations Office) to S Leja (Washington State Department of Ecology), *Notification of Specific Conductance Exceedance at Low-Level Waste Management Area 1 (218-E-10)*, dated March 18, 1999 (CCN#067035).

3.0 Wells Not Sampled

The wells listed in Table 3.1 were not sampled as scheduled. Wells that were delayed from their original sampling date are listed only if the successful sample date was beyond the end of the reporting quarter. The table does not include wells that were reported dry in previous quarterly or annual reports.

Table 3.1. Wells Not Sampled as Scheduled During the Reporting Period

Well	RCRA Site	Date Scheduled	Date Sampled	Comment
299-E33-4[(a)]	WMA B-BX-BY	05/2006	7/25/2006	Very little water. Required several attempts with different sampling methods.
299-W22-50	WMA S-SX	06/2006	08/04/2006	No water to surface.
299-E32-2	LLWMA-1	06/2006	--	Lost water to surface; then sampling delayed because of extreme fire danger level.

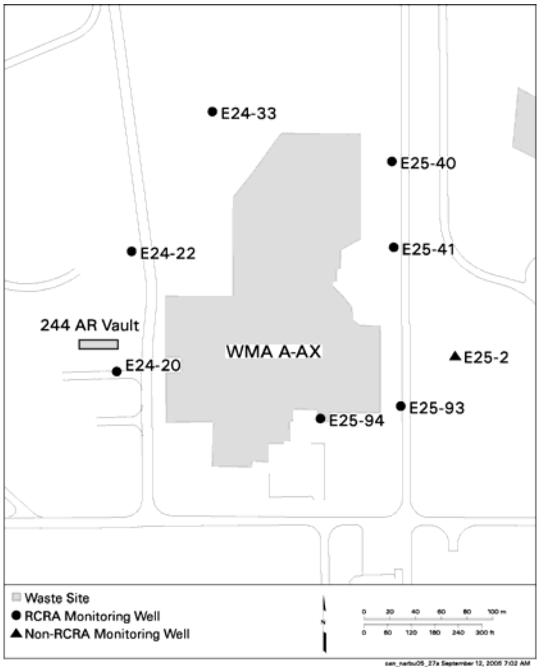
(a) Well 299-E33-4 is not listed in the WMA B-BX-BY assessment plan (PNNL-13022) but was sampled for supporting information. It is listed here because it was listed in previous quarterly reports and results are discussed in this report.

LLWMA = Low-level waste management area.
RCRA = *Resource Conservation and Recovery Act*.
WMA = Waste management area.

4.0 Status of Assessment Programs

This section describes the eight RCRA sites currently monitored under groundwater quality assessment.

4.1 Single-Shell Tank Waste Management Area A-AX



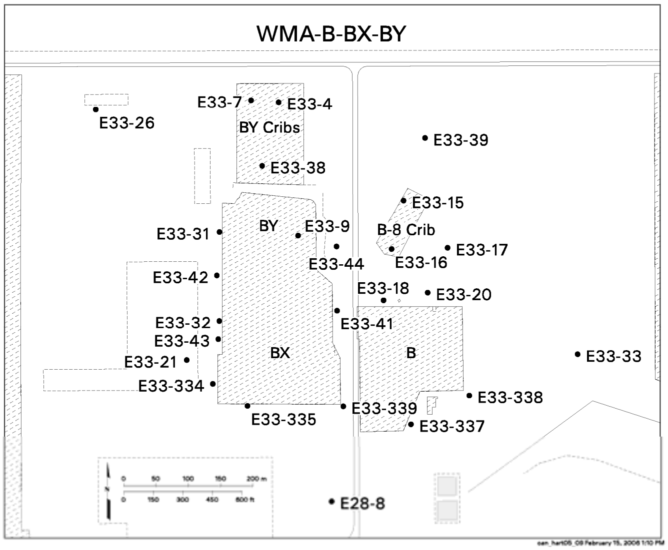
The groundwater flow direction, based on local hydrographs and in situ flow measurements, is east-southeast to southeast (Hartman et al. 2006). The aquifer thickness is ~27 meters, and although the water table has declined ~9 centimeters in the past year, there have been no observable changes in flow direction or rate this quarter.

The primary contaminants observed at this site are nitrate, sulfate and technetium-99. Nitrate concentrations were below the drinking water standard (45 mg/L) during the reporting period except in downgradient well 299-E25-93, where the value increased from 44.3 mg/L to 47.8 mg/L.

Technetium-99 results in June 2006 varied from 10.9 pCi/L in well 299-E25-40 to 7,740 pCi/L in well 299-E25-93, an increase from 7,130 pCi/L in March. Technetium-99 concentrations in well 299-E25-93 are much higher than in nearby wells, where concentrations ranged from 445 to 488 pCi/L during the reporting period. A technetium-99 value was not reported during this quarter for upgradient well 299-E24-33 because the sample bottle was dropped at the laboratory. An analysis will be done using sample left from another bottle.

Sulfate concentrations also are elevated across the site. The concentration in upgradient well 299-E24-33 rose slightly to 108 mg/L in June 2006 from 102 mg/L in March. Concentrations also rose slightly in well 299-E25-41, from 107 mg/L in March to 110 mg/L in June, and in well 299-E25-93, from 103 mg/L to 113 mg/L. An elevated coliform bacteria count was observed this quarter in well 299-E24-22 at 7.4 Col/100ml. During drilling of well 299-E24-33, a perched water zone was found between 78.3 and 78.6 meters (257 and 258 feet) below ground surface. The perched water along with the presence of coliform bacteria and elevated anion chemistry may indicate a local source or sources for the contamination at this area.

4.2 Single-Shell Tank Waste Management Area B-BX-BY



The aquifer is slowly receding back to pre-Hanford water levels along the basalt surface, which will leave the area under the BY cribs, the BY Tank Farm, most of the BX Tank Farm, and possibly the north part of the B Tank Farm with no unconfined aquifer. Because the aquifer is thin, ranging from zero to 3.4 meters thick, local relief on the basalt surface may affect flow. At the south boundary of the tank farms, where the basalt drops into the Cold Creek Syncline, the aquifer thickens to ~4.3 meters. There has been no change in flow direction or rate since the last quarterly report.

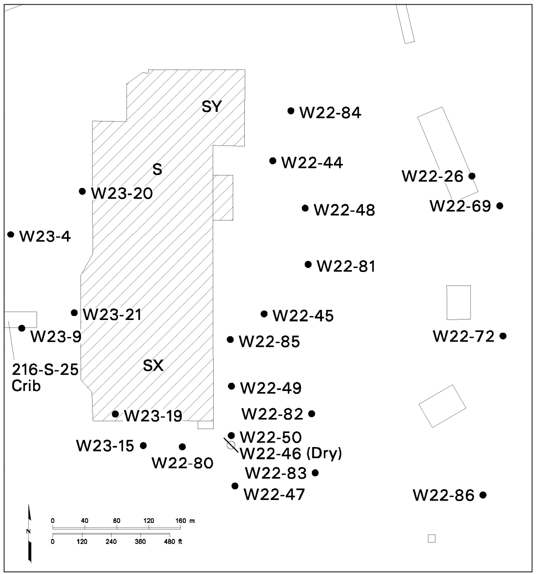
All the wells in the assessment network were sampled this quarter. Well 299-E33-4, a supplemental well scheduled for May sampling, was sampled in July using a bottom-filling bailer. A comparison of water levels with nearby wells and the lack of drawdown in the well after sampling indicated the well is in communication with the aquifer even though there is insufficient water to sample with a conventional pump. Results of the July sampling are included in this section.

Groundwater in this area is contaminated with nitrate, nitrite, sulfate, technetium-99, uranium, cyanide, tritium and cobalt-60. Also, elevated values of chloride and sodium are found. Contamination is attributed to several source areas, including Waste Management Area (WMA) B-BX-BY and the surrounding cribs. Elevated nitrate, sulfate, cyanide, cobalt-60, technetium-99, uranium and tritium are found under the BY cribs. Beneath the BY Tank Farm, results show nitrate, sulfate, technetium-99, uranium, and tritium concentrations increasing while east of the BY Tank Farm the sharply increasing nitrate, technetium-99 and sulfate have corresponding decreases in uranium. Cyanide, associated with uranium recovery waste and hence, the BY cribs, is also generally increasing east of the BY Tank Farm. The increasing nitrate, technetium-99 and cyanide with decreasing uranium may indicate movement of BY crib waste into the area. North of the B Tank Farm, nitrate, technetium-99 and sulfate have also been increasing while uranium is decreasing but there is no detectable cyanide. Based on recent gamma logging that shows large increases in uranium concentrations in a perching zone just above the groundwater, this area may also be sourcing contaminants into the groundwater. However, as indicated by the very high uranium in the groundwater, a contaminant center continues to be located under the BY Tank Farm. Long-term increasing trends of technetium-99 and uranium are observed along the south and southwest boundary of the WMA at levels above background but below drinking water standards.

Nitrate concentrations increased sharply in all sampled wells beneath the BY cribs, especially in well 299-E33-4. The July 2006 concentration in this well, 3,150 mg/L, was a new historical maximum for the region. Although nitrate concentrations decrease towards the south, levels, in general, are still increasing. For example, the May 2006 value at well 299-E33-18, located in the center of the WMA, was 536 mg/L in April, up from 236 mg/L the previous quarter. At the B-8 crib, in well 299-E33-16, the nitrate concentration increased during the reporting quarter from 784 mg/L to 881 mg/L. On the west side on the WMA, concentrations increased from 163 to 214 ug/L and from 124 to 150 ug/L in wells 299-E33-42 and 299-E33-32, respectively. The co-varying constituents associated with the nitrate varies with the wells' proximity to various waste sites or farms, but generally, the highest nitrate levels are associated with non-tank farm facilities.

Like nitrate, the major source of technetium-99 contamination in the groundwater appears to be associated with the cribs. Technetium-99 levels increased during the reporting period not only beneath the BY cribs but under and around the WMA. Prior to recent sampling, the highest level observed in the region was 23,100 pCi/L in the BY cribs in November 2004 in well 299-E33-4. The most recent value for this well was 42,900 pCi/L, a new maximum for the area. During the reporting quarter, the concentrations in other wells in the BY cribs were 16,100 and 15,800 pCi/L in wells 299-E33-7 and 299-E33-38, respectively. As with nitrate, lower but increasing concentrations are observed to the south. For example, east of BY Tank Farm in well 299-E33-44, technetium-99 levels rose from 7,780 pCi/L in May 2005 to 10,200 pCi/L this quarter but uranium dropped from 252 to 184 µg/L over the same time period. This increasing technetium-99 and nitrate is associated with cyanide and cobalt-60, both uranium recovery contaminants, currently found in the groundwater under the BY cribs. As noted above, the technetium-99/nitrate increases under the BY Tank Farm are associated with increasing uranium, which reached a new regional maximum of 804 µg/L in June 2006. Contrasted with the decreasing uranium trends outside the farm in wells 299-E33-44 (184 µg/L) and 299-E33-18 (387 µg/L) and the stagnant trend in the BY cribs in well 299-E33-38 (337 µg/L in May 2004 and 323 µg/L in 2006), the region under the BY Tank Farm continues to be a center of groundwater contamination. Long-term increases continue in technetium-99 and uranium in the southwest and south portions of the WMA at levels above background but below drinking water standards.

4.3 Single-Shell Tank Waste Management Area S-SX



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Groundwater beneath this site is contaminated with hexavalent chromium, nitrate, and technetium-99 attributed to two general source areas within the WMA. In addition, tritium and carbon tetrachloride are present in groundwater beneath the WMA, but their sources are from adjacent facilities.

Water-level measurements during the reporting quarter indicate that the water table has continued to decline at a rate between 0.2 and 0.3 meter per year. The gradient and flow direction are stable, with flow to the east-southeast over the general area of the WMA, based on water level and contaminant migration data. All wells but one, well 299-W22-50, were sampled during the quarter. The well not sampled during the quarter was sampled in early August 2006, and the results are included in this report.

Constituent concentrations in the north contaminant plume, with a source in S Tank Farm, changed little from the previous quarter. The exception was well 299-W22-48, where concentrations of a number of the major groundwater constituents changed sharply from their respective trends. While hexavalent chromium, nitrate, and technetium-99 concentrations remained on trend, calcium and magnesium decreased and sodium, chloride, and sulfate all increased sharply. At the same time, the sample turbidity was extremely high, 333 NTU, where it was normally less than 5 NTU. Because of the high turbidity, all samples were filtered in the field. Quality checks on the analysis indicated that the cations and anions were only slightly out of balance, +5.15 %, and the data were consistent with the specific conductance measured in the field, therefore, the analysis was likely correct. At this time, it appears that these changes may be due to contamination of the well with bentonite seal material. There is approximately 1.5 meters of water left in the well and sampling may either be stirring up bentonite that has settled to the bottom of the well or there may have been a recent intrusion of bentonite material from the well seal. Whatever the source, the high turbidity and its “milky” appearance suggest that bentonite may be the source. Constituent concentrations in wells 299-W22-26 and 299-W22-69 during the quarter confirmed the results of the previous quarter and indicate that the S Tank Farm plume has spread at least that far downgradient from the tank farm.

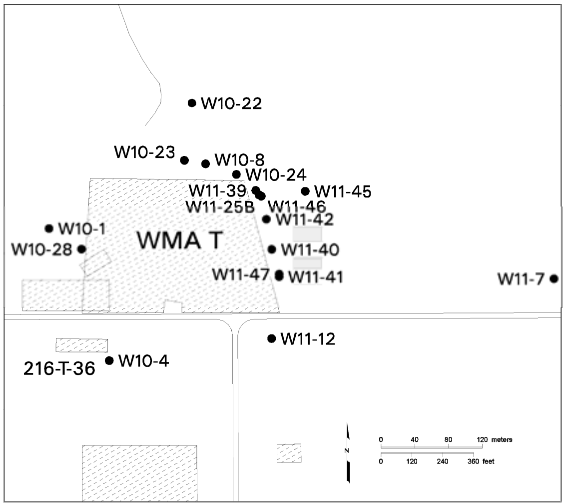
Concentrations of the constituents of interest continued to decrease in the south plume source area represented by well 299-W23-19. While concentrations of chromium, nitrate, and technetium-99 decreased, they are well above their respective drinking water standards, as shown in Table 4.1. In the mid-plume region, as represented by well 299-W22-50, concentrations of the same three constituents remained at about the same level as in the previous quarter, with nitrate and technetium-99 exceeding their drinking water standards. At this location in the plume, chromium is below its 100 µg/L drinking water standard. Concentrations in the downgradient location (well 299-W22-83) increased slightly and were above their drinking water standards, higher than in the mid-plume area. These data may indicate that the axis of the plume is south of well 299-W22-50. This hypothesis is supported by the fact that concentrations of the same three constituents are about two times higher in well 299-W22-47 than in well 299-W22-50. At the far downgradient well 299-W22-86, concentrations of all three constituents of interest are lower, with only technetium-99 exceeding its drinking water standard.

Table 4.1. SX Tank Farm Plume Concentrations

Constituent (units)	DWS	Location in the Plume			
		Source 299-W23-19 June 2006	**Mid-Plume 299-W22-50 August 2006**	**Downgradient 299-W22-83 June 2006**	**Far Downgradient 299-W22-86 June 2006**
Chromium (µg/L)	100	608	93.8	158	25
Nitrate (mg/L)	45	365	68.6	101	23.5
Technetium-99 (pCi/L)	900	42,900	7,480	15,100	1,950
DWS = Drinking water standard.					

4.4 Single-Shell Tank Waste Management Area T

The monitoring network for WMA T includes fourteen wells that are sampled quarterly and two wells sampled semiannually. The first routine samples were collected from two new wells, 299-W11-45 and 299-W11-47, during the reporting period. Well 299-W11-45 was drilled approximately 80 meters downgradient of well 299-W11-39 and is screened between 8.5 and 13.1 meters below the water table (at the time of construction). Well 299-W11-47 was drilled adjacent to well 299-W11-41 and screened between 9.4 and 18.9 meters below the water table (at the time of construction). All wells in the monitoring network were sampled as scheduled during the second quarter of 2006.



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The groundwater flow direction at WMA T is between east-northeast and east-southeast at a rate of between ~0.0007 and 0.029 meter per day.

Chromium, carbon tetrachloride, and trichloroethene continued to be the dangerous waste constituents found in the groundwater beneath WMA T. The source of the carbon tetrachloride and trichloroethene was liquid disposal associated with processes at the Plutonium Finishing Plant and not WMA T. Carbon tetrachloride and trichloroethene are monitored as part of the 200-ZP-1 Operable Unit. Nitrate and fluoride are also found in groundwater beneath the facility. In addition to the dangerous waste constituents, technetium-99, tritium and cobalt-60, non-RCRA-regulated constituents, are found in groundwater at the WMA.

Chromium concentrations exceeded the drinking water standard (100 μg/L) in seven wells during routine sampling at WMA T in May 2006. The plume exceeding the drinking water standard extends to wells both upgradient and downgradient of the WMA, indicating the possibility of upgradient source(s) of chromium. Although the chromium concentrations changed only slightly from previous quarter's values, the extent of the plume is now known to extend farther downgradient and deeper than previously thought. Well 299-W11-45, located about 80 meters downgradient of well 299-W11-39 and screened between 8.5 and 12 meters below the water table, contained 118 μg/L chromium in April 2006. This was the first quarterly sample from the well and shows that the chromium plume extends at least 80 meters downgradient of the WMA T. Also, the chromium concentration in well 299-W11-46, located adjacent to well 299-W11-39 and screened between 6 and 12 meters below the water table, was 293 μg/L in May 2006. Data collected during drilling along with these results from 299-W11-45 and 299-W11-46 show that the maximum downgradient chromium concentrations are at about 10 meters below the water table.

As in the past, the highest chromium concentration was in well 299-W10-4, located south of the southwest corner of the WMA near the 216-T-36 crib. The concentration of chromium in the well was 565 μg/L, similar to but slightly less than recent past concentrations. The concentration of chromium in upgradient well 299-W10-28 was 136 μg/L in May 2006. The chromium concentration in both of these wells has been slowly decreasing since mid to late 2004. The chromium concentrations exceeding the drinking water standard in downgradient water table wells at WMA T were between 138 and 167 µg/L, similar to the previous quarter's concentrations.

There is a local, high nitrate plume beneath WMA T and within the regional 200 West Area plume centered southwest and west (upgradient) and extending east (downgradient) of the WMA. Although the nitrate concentrations remained above the 45 mg/L drinking water standard in all wells in the WMA T network during the reporting period, the local, high nitrate plume exceeds ten times the drinking water standard in both upgradient and downgradient wells along the south part of the WMA. The highest concentration of nitrate was in well 299-W10-4, where it decreased slightly from 3,000 mg/L in February 2006 to 2,870 mg/L during the reporting period. The nitrate concentration in upgradient well 299-W10-28 was 1,820 mg/L, essentially unchanged from the previous quarter.

Nitrate concentrations in downgradient monitoring wells during the reporting quarter remained fairly consistent with the previous quarter. Concentrations in downgradient wells were between 239 mg/L and 1,040 mg/L. There does not appear to be any significant change from the previous quarter in the extent of the nitrate plume as indicated in water able wells at WMA T. However, the nitrate concentration in well 299-W11-45 was 739 mg/L showing that the nitrate plume at WMA T extends at least 80 meters downgradient of the WMA at about 10 meters below the water table.

There is a technetium-99 plume downgradient of WMA T. The plume extends at least 80 meters downgradient to new well 299-W11-45, which had a maximum technetium-99 concentration of 20,800 pCi/L in May 2006 (the well is screened between 8.5 and 12 meters below the water table). The greatest technetium-99 concentration at the water table was 23,900 pCi/L in well 299-W11-39 during routine sampling in May 2006; similar to the previous quarter's concentration of 23,200 pCi/L. Well 299-W11-46, located about 9 meters from well 299-W11-39 and screened between 6 and 12 meters below the water table had 63,200 pCi/L technetium-99 in May 2006. The technetium-99 concentration in this well has been increasing steadily from 36,000 pCi/L in August 2005 when the well was first sampled. The technetium-99 plume extends at least as far south as well 299-W11-41, located at the southeast corner of the WMA, where the concentration was 7,260 pCi/L in May 2006.

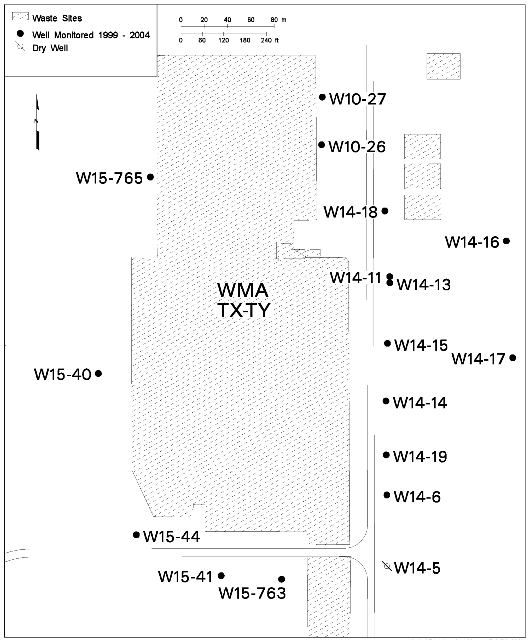
The fluoride concentration exceeded the primary drinking water standard of 4 mg/L in one well, well 299-W10-23, north of the WMA in May 2006. The concentration was 4.1 mg/L. Fluoride concentrations exceeded the 2 mg/L secondary standard in 9 wells at WMA T in the reporting quarter. Wells with fluoride between 2 and 4 mg/L are located north, southwest and east of the WMA. The configuration of the plume has not changed appreciably during the quarter.

Tritium exceeded the drinking water standard in well 299-W11-12, located at the southeast corner of the WMA. The maximum tritium concentration was 40,400 pCi/L, down somewhat from 46,500 pCi/L during the previous quarter. The source of the tritium is not known for certain.

In addition to the above contaminants, manganese and pH exceeded limits during the quarter. The manganese concentration was 102 µg/L in well 299-W11-39. This is the third quarter in a row that manganese exceeded the 50 µg/L secondary drinking water standard in the well although the concentration has been decreasing slowly since the first exceedance. Manganese concentration also exceeded the standard in new wells 299-W11-45 and 299-W11-47. The elevated manganese concentrations are probably the result of the drilling process and do not represent the ambient water quality. High manganese concentrations are common in the first several samples from new wells drilled by cable tool. The pH slightly exceeded the drinking water standard (8.5) in well 299-W10-24 (8.78). pH values between 8.5 and 9.1 have been common in the well throughout its sampling history. Finally, cobalt-60 was detected in well 299-W11-46 at 19.5 pCi/L, well below the drinking water standard of 100 pCi/L. This is the second consecutive quarter that cobalt-60 has been found in the well.

4.5 Waste Management Area TX-TY

The monitoring network for WMA TX-TY includes sixteen wells that are sampled quarterly. The groundwater flow direction at varies from the north to the south part of the WMA. Three wells in the WMA TX-TY monitoring network were added to the 200-ZP-1 pump-and-treat system as extraction wells in July 2005. The wells are 299-W15-765, 299-W15-40, and 299-W15-44 and include the upgradient wells for the WMA. Although not yet shown by the latest water table map, groundwater flow direction is changing in the north part of the WMA to a westward direction due to the new extraction wells. This is evident by the increasing contaminant concentrations in the wells since July 2005.



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All monitoring wells in the WMA TX-TY monitoring network were successfully sampled during the reporting period.

Chromium, carbon tetrachloride, iodine-129, nitrate, technetium-99, trichloroethene, and tritium continued to be detected in the groundwater beneath WMA TX-TY. The source of the carbon tetrachloride and trichloroethene was liquid disposal associated with processes at the Plutonium Finishing Plant and not WMA TX-TY. Carbon tetrachloride and trichloroethene are monitored as part of the 200-ZP-1 Operable Unit.

Chromium concentration exceeded the 100 µg/L drinking water standard in two wells during the reporting period. The chromium plume is restricted to the vicinity of well 299-W14-13 and adjacent well 299-W14-11, located along the central part of the east (downgradient) side of the WMA. The chromium concentration has not exceeded the drinking water standard in wells located north, south, or east of this area. The highest chromium concentration (759 µg/L) is near the water table in well 299-W14-13; adjacent well 299-W14-11, screened between 6.7 and 9.8 meters below the water table had 116 µg/L chromium in May 2006.

Nitrate continued to exceed the 45 mg/L drinking water standard in all wells in the WMA TX-TY monitoring network during the reporting quarter. The highest nitrate concentration was 500 mg/L in well 299-W14-13 in the central part of the east side of the WMA. This was an increase from 452 mg/L during the previous quarter. The regional nitrate plume at WMA TX-TY is attributed to past disposal practices throughout the 200 West Area. The relatively local high nitrate concentration at well 299-W14-13 may be due to one or a combination of nearby liquid disposal facilities and/or WMA TX-TY.

Nitrate and technetium-99 concentrations in upgradient wells 299-W15-765 (Figure 1) and 299-W15-40 began to increases abruptly in September 2005, shortly after the wells were converted to extraction wells for the 200-ZP-1 pump-and-treat operation in July 2005. The increases are attributed to contaminants being drawn to the wells from beneath the WMA.

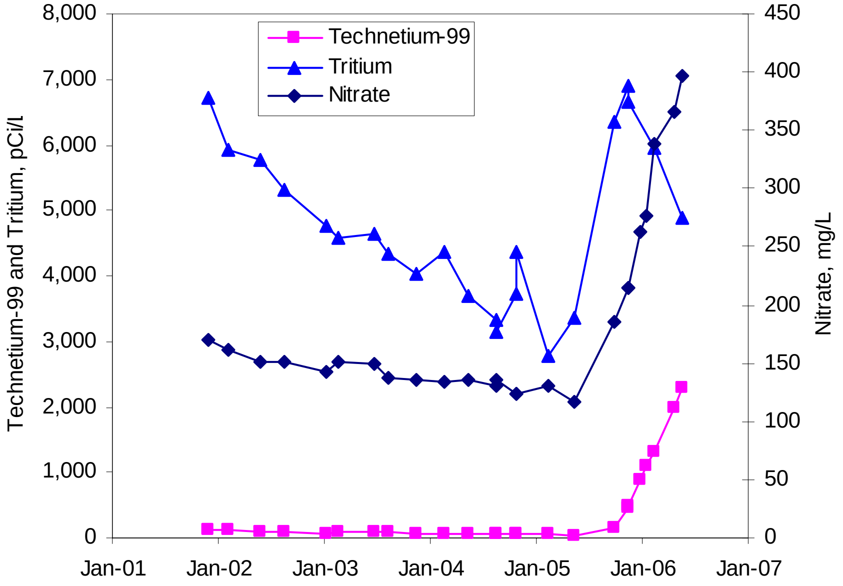


Figure 1. Concentration of Selected Constituents in Extraction Well 299-W15-765, West of WMA TX-TY

Technetium-99 exceeded the 900 pCi/L drinking water standard in 7 wells at WMA TX-TY during the reporting period. The highest technetium-99 concentration was 7,730 pCi/L in well 299-W14-13. The technetium-99 concentration in the adjacent well 299-W14-11, screened between 6.7 and 9.8 meters below the water table, was 2,870 pCi/L. This concentration in water table well 299-W14-13 remained essentially unchanged from the previous quarter's concentration but the concentration in the deeper well increased from 1,720 during February 2006. The technetium-99 plume east of WMA TX-TY that previously was seen only at well 299-W14-13 may be spreading south to well 299-W14-15 because the technetium-99 concentration in the latter well has been generally increasing since May 2005. The technetium-99 concentration in well 299-W14-15 was 1,250 pCi/L in June 2006.

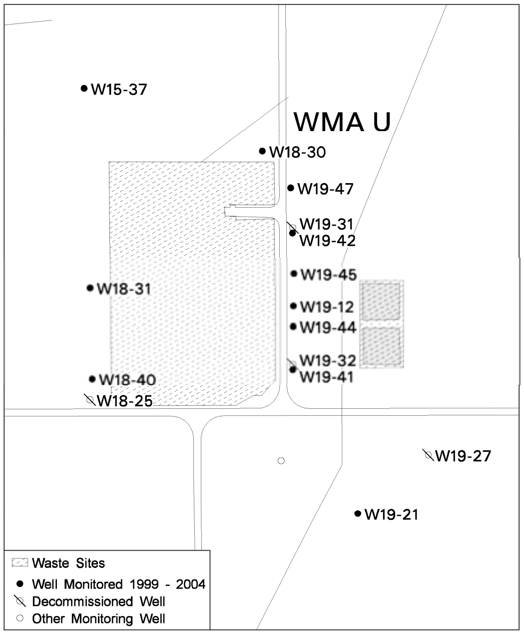
Technetium-99 concentrations also exceeded the drinking water standard in wells 299-W15-41, 299-W15-44, 299-W15-763, and 299-W15-765. All of these wells are affected by the 200-ZP-1 pump-and-treat system, and the technetium-99 found in these wells probably is drawn toward the wells due to extraction operations (wells 299-W15-44 and 299-W14-765 are extraction wells).

Tritium exceeded the 20,000 pCi/L drinking water standard in three wells during the reporting period at WMA TX-TY. The highest tritium concentration was 1,670,000 pCi/L in well 299-W14-13, essentially unchanged from the previous quarter. The tritium concentration in adjacent well 299-W14-11 was 247,000 pCi/L, up substantially from the previous quarter (155,000 pCi/L). Tritium also exceeded the drinking water standard in well 299-W14-15 (62,600 pCi/L), located south of well 299-W14-13.

Manganese exceeded the 50 µg/L secondary drinking water standard in well 299-W10-27 in May 2006 with a concentration of 233 µg/L. This well has a history of high manganese concentrations since it was drilled in 2001.

Iodine-129 exceeded the 1 pCi/L drinking water standard in well 299-W14-13 in May 2006. The concentration of iodine-129 in well 299-W14-13 was 39.6 pCi/L, up more than 50% from 24.5 pCi/L found during the previous quarter.

4.6 Single-Shell Tank Waste Management Area U



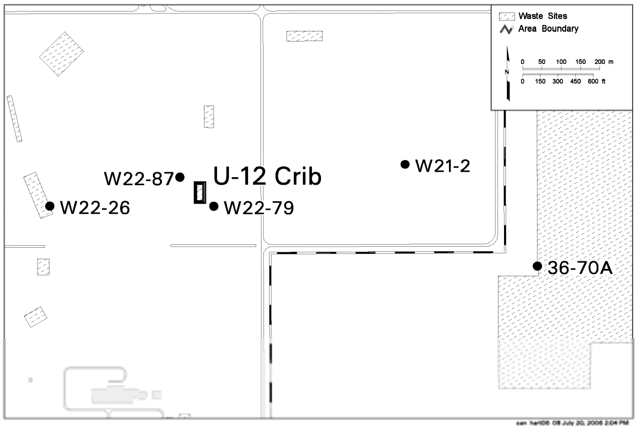
This WMA, which has been in assessment monitoring since 1999, has affected groundwater quality with elevated concentrations of chromium, nitrate, and technetium-99. In the past, contamination was limited to the south half of the downgradient (east) side of the WMA, but in the last half of 2004, technetium-99 concentrations began to rise rapidly in several of the downgradient wells in the north half of the WMA. Carbon tetrachloride also is present beneath the WMA at concentrations above the drinking water standard in all monitoring wells in the network. The carbon tetrachloride is associated with the regional plume with sources upgradient of the WMA. All wells in the monitoring network were sampled as scheduled during the reporting quarter.

Water-level measurements indicate that the water table has continued to decline at a rate of about 0.3 meter per year. All of the wells responded similarly so the gradient and flow direction as determined from water levels are stable, with the interpreted flow direction to the east at a rate of 0.008 to 0.2 meter per day.

While chromium has exceeded the 100 µg/L drinking water standard in the past, no samples from the reporting quarter contained chromium at concentrations above 10 µg/L. Technetium-99 and nitrate trends remained similar to those reported previously. These constituents are present beneath the WMA from three sources: a nitrate source and a technetium-99 source within the WMA and a nitrate source upgradient (west) of the WMA. The highest nitrate concentrations and the only two that exceeded the 45 mg/L drinking water standard were in wells 299-W19-41 and 299-W19-44. The highest technetium-99 concentration was 1,310 pCi/L in well 299-W19-47. The 900 pCi/L technetium-99 drinking water standard was exceeded in only two wells, 299-W19-47 and 299-W19-45, located on the north half of the downgradient margin of the WMA. It appears that the plume is still migrating to the northern wells on the downgradient side of the WMA.

4.7 216-U-12 Crib

The groundwater monitoring network for this crib has been revised again (Williams and Chou 2006), effective March 10th 2006, updating the network by removing the old existing non-compliant upgradient well, 299-22-26, and replacing it with a new RCRA-compliant upgradient well that is located much nearer to the crib (299-W22-87). The site is in assessment for elevated specific conductance and nitrate and is sampled quarterly. Three wells were sampled in June 2006; one was sampled in late May.



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In May 2005, DOE requested that the 216-U-12 crib be administratively closed. Two draft Tri-Party Agreement (Ecology et al. 1989) change requests to reclassify the crib as a past-practice unit are currently being reviewed. If this decision is approved, RCRA groundwater monitoring will be discontinued at the time the RCRA Part A Permit Application is closed out. The groundwater in the vicinity of the crib would continue to be monitored as part of the 200-UP-1 Operable Unit.

Based on data from a regional network of wells, the groundwater flow direction beneath the crib has remained relatively unchanged, toward the east-southeast for years. Water levels continued to decline around the 216-U-12 Crib but the rate of decline appears to be decreasing as the regional water table drops. The most recent measured rate of decline was ~0.13 to 0.2 meter per year.

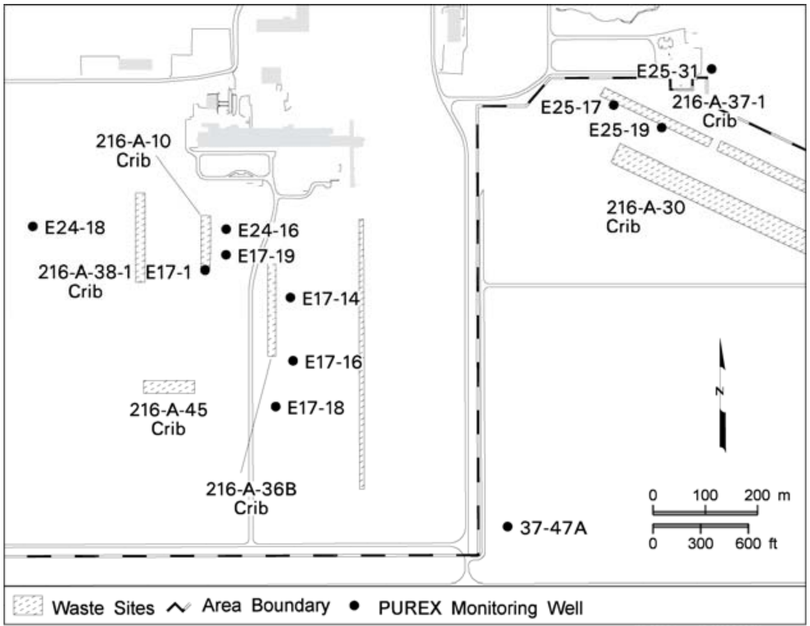
In downgradient well 299-W22-79, nitrate continued a one-year increasing trend, but at 28.8 mg/L, remained below the 45 mg/L drinking water standard and much lower than concentrations in previous years. Specific conductance was measured at 282 μS/cm in June, about the same as in March.

In downgradient well 699-36-70A, farthest from the 216-U-12 Crib, the nitrate concentration was 60.2 mg/L in June, continuing a generally decreasing trend. Specific conductance in this well was reported at 453 μS/cm and continues to decrease on trend.

In downgradient well 299-W21-2 nitrate was up slightly to 72.2 mg/L. Specific conductance declined slightly to 493 μS/cm. There are not enough data for this well to determine long-term trends. This well is located between the 216-U-12 Crib and well 699-36-70A. The regional plume maps suggest that the tail of the nitrate plume is passing through this area.

The first samples from new upgradient well 299-W22-87 showed nitrate at 2.1 mg/L and specific conductance at 453 μS/cm.

4.8 PUREX Cribs (216-A-10, 216-A-36B, and 216-A-37-1)



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All 11 of the near-field network wells were sampled as scheduled during the reporting quarter (April 1 through June 30, 2006), although four of them were sampled a day early on March 31, 2006. PUREX Cribs network wells are sampled quarterly as required by 40 CFR 265.93 [d][7][i] to determine if there are any changing contaminant conditions near the three PUREX cribs. Water levels were measured at each well at the time of sampling. Nitrate was the only non-radioactive constituent in groundwater that exceeded its drinking water standard (45 mg/L) in one or more of the wells sampled. Radioactive constituents (not regulated under RCRA) that continued to exceed drinking water standards included iodine-129, strontium-90, gross alpha and beta, and tritium. Results of sampling the far-field wells during the reporting quarter will be included in the Hanford Site groundwater annual report.

Differences in water table elevations from well to well at the PUREX cribs are very small because of the extremely low gradient of the water table. During the reporting period the greatest difference in water level elevation was 0.23 meter between wells 299-E17-19 and 299-E25-17 (a distance of about 800 meters). The gradient between these two well is 0.00029, which is too low to determine groundwater flow rate or flow direction reliably. However, groundwater flow directions determined from the movement of groundwater contamination plumes indicate that the regional flow is toward the southeast.

Nitrate was reported at levels greater than the 45 mg/L drinking water standard at the wells monitoring the 216-A-36B and 216-A-10 cribs. The highest concentration during the reporting period was 107 mg/L at well 299-E17-14, located near the 216-A-36B crib. The trend at this well is generally stable. One well at the 216-A-10 crib (299-E24-16) and nearby upgradient well 299-E24-18 have increasing trends for nitrate (Figure 2).

Individual closure plans were submitted in April 2006 for the PUREX cribs in order to meet Tri-Party Agreement milestone M-20-33. The closure plan for 216-A-10 crib requested that the unit be administratively closed. The closure plan for 216-A-36B identified ammonia as the sole dangerous constituent (WAC 173-303-645(4)(a)). Nitrate is not a dangerous constituent for the 216-A-36B crib.

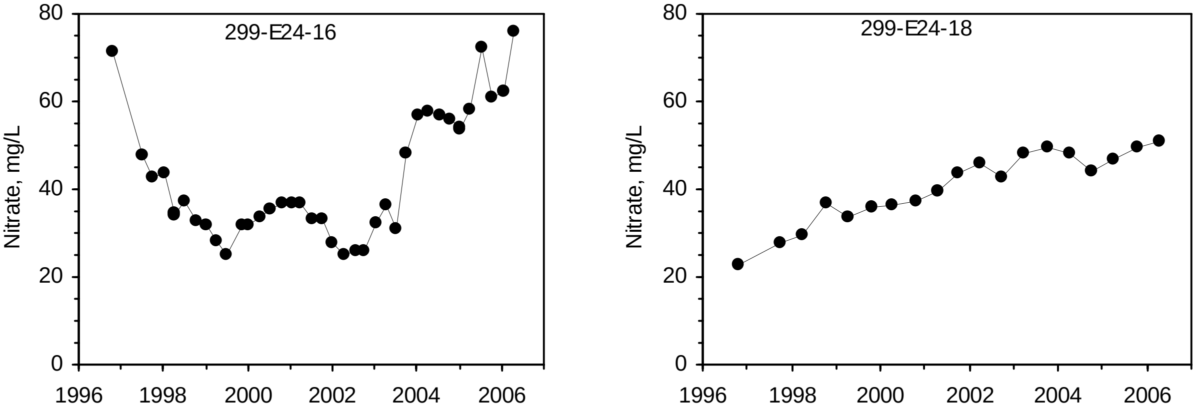

Figure 2. Nitrate in Wells 299-E24-16 (216-A-10 Crib) and Upgradient Well 299-E24-18

5.0 Quality Control

Highlights of the groundwater project's quality control (QC) program for April-June 2006 are summarized in the following list. The appendix to this report contains more specific QC information. Data related to QC issues have been flagged in the database or are undergoing further review.

- Twenty-eight results were flagged with an H due to missed holding times. Nitrate, nitrite, and total organic carbon account for most of the flagged results.
- Most of the field duplicate results demonstrated good precision, although the relative percent differences for six pairs of results failed to meet the acceptance criteria. Chemical oxygen demand, nitrogen in ammonia, iron, potassium, and iodine-129 were the constituents with out-of-limit results.
- Approximately 4% of the field blank results exceeded the QC limits. Methylene chloride, chloride, and total organic halides had the greatest number of out-of-limit results. Overall, the field blank results should have little impact on the interpretation of groundwater data.
- Laboratory performance on the analysis of blind standards was good overall. Severn Trent St. Louis had unacceptable results for carbon tetrachloride and total organic halides. Severn Trent Richland failed to detect iodine-129 in samples spiked very close to the drinking water standard (1 pCi/L).
- Performance-evaluation study results were available from one RadCheM Proficiency Testing Study and one Water Pollution study this quarter. The majority of the labs' results were within the acceptance limits, indicating good performance overall.
- Approximately 98% of the laboratory QC results for this quarter were within the acceptance limits, suggesting that most of the analyses were in control and reliable data were generated.

6.0 References

40 CFR 265.93(b), Subpart F. "Interim Status Standards for Owners of Hazardous Waste Treatment, Storage, and Disposal Facilities; Ground-Water Monitoring." U.S. Environmental Protection Agency, *Code of Federal Regulations*.

AEA – *Atomic Energy Act of 1954*. 1954. Public Law 83-703, as amended, 68 Stat. 919, 42 USC 2011 et seq.

CERCLA – *Comprehensive Environmental Response, Compensation, and Liability Act*. 1980. Public Law 96-150, as amended, 94 Stat. 2767, 42 USC 9601 et seq.

Ecology – Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy. 1989. *Hanford Federal Facility Agreement and Consent Order*. Document No. 89-10, as amended (The Tri-Party Agreement), Olympia, Washington.

Hartman MJ. 1992. *Results of Ground Water Quality Assessment Monitoring at the 1301-N Liquid Waste Disposal Facility and 1324-N/NA Facilities.* WHC-SD-EN-EV-003, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Hartman MJ, LF Morasch, and WD Webber, editors. 2006. *Hanford Site Groundwater Monitoring for Fiscal Year 2005.* PNNL-15670. Pacific Northwest National Laboratory, Richland, Washington.

Williams BA and CJ Chou. 2006. *Interim Change Notice for Monitoring Plan for RCRA Groundwater Assessment at the 216-U-12 Crib*. PNNL-14301-Rev2-ICN-1, Pacific Northwest National Laboratory, Richland, Washington.

RCRA – *Resource Conservation and Recovery Act*. 1976. Public Law 94-580, as amended, 90 Stat. 2795, 42 USC 6901 et seq.

WAC 173-303-645. "Dangerous Waste Regulations; Releases from Regulated Units." *Washington Administrative Code*, Olympia, Washington.

Appendix

Quality Control Report
April to June, 2006

Appendix

Quality Control Report
April 1 to June 30, 2006

A.1 Highlights

- Twenty-eight results were flagged with an H due to missed holding times. Nitrate, nitrite, and total organic carbon account for most of the flagged results.

- Most of the field duplicate results demonstrated good precision, although the relative percent differences for six pairs of results failed to meet the acceptance criteria. Chemical oxygen demand, nitrogen in ammonia, iron, potassium, and iodine-129 were the constituents with out-of-limit results.

- Approximately 4% of the field blank results exceeded the quality control (QC) limits. Methylene chloride, chloride, and total organic halides had the greatest number of out-of-limit results. Overall, the field blank results should have little impact on the interpretation of second quarter groundwater data.

- Laboratory performance on the analysis of blind standards was good overall. Severn Trent Laboratories, Incorporated, St. Louis, Missouri (STL St. Louis) had unacceptable results for carbon tetrachloride and total organic halides. Severn Trent Laboratories, Incorporated, Richland, Washington (STL Richland) failed to detect iodine-129 in samples spiked very close to the drinking water standard (1 pCi/L).

- Performance-evaluation study results were available from one RadCheM Proficiency Testing Study and one Water Pollution study this quarter. The majority of the laboratory's results were within the acceptance limits, indicating good performance overall.

- Approximately 98% of the laboratory QC results for this quarter were within the acceptance limits, suggesting that most of the analyses were in control and reliable data were generated.

This QC report presents information on laboratory performance and field QC sample results for the second quarter of calendar year 2006. Routine chemical and radiochemical analyses were performed by STL St. Louis and STL Richland for Hanford Groundwater Performance Assessment Project samples. Supplemental analyses of blind standards were performed by Lionville Laboratory, Incorporated, Lionville, Pennsylvania (Lionville Laboratory) and Eberline Services (Richmond, California). STL, Lionville Laboratory, and Eberline Services operate under contract with Fluor Hanford, Inc. Groundwater sampling was conducted by Fluor Hanford, Inc. nuclear chemical operators under the direction of Duratek Federal Services of Hanford, Inc. The tasks conducted by the samplers and Duratek Federal Services of Hanford, Inc. included bottle preparation, sample set coordination, field measurements, sample collection, sample transport and shipping, well pumping, and coordination of purge water containment and disposal.

Tables A.1 and A.2 summarize the data completeness for the Hanford Groundwater Performance Assessment Project. The determination of completeness is made by dividing the number of results judged to be valid by the total number of results evaluated and multiplying by 100. Data judged to be valid are results that have not been flagged as suspect, rejected, having a missed holding time, or associated with out-of-limit method blanks or field QC samples. Eighty-nine percent of the second quarter's results were considered valid. This percentage is similar to that for the previous quarter (88%). Roughly 95% of this quarter's flags resulted from detection of total organic carbon, total organic halides, anions, metals, and volatile organic compounds in field and method blanks. The majority of these results were at levels near the method detection limits; thus, the overall impact of sample contamination or false-detection on data quality is believed to be minor.

A total of 28 results were flagged with an H this quarter to indicate the recommended holding time had been exceeded. All of the flagged data were from STL St. Louis. The constituents affected were anions (17), total organic carbon (8), total organic halides (1), mercury (1), and alkalinity (1). Most of the missed holding times were associated with samples being received outside of holding time. In some cases, this was caused by the necessity for radiological screening prior to delivery to the laboratory (for analytes with very short holding times).

Table A.1. Completeness Summarized by Project[(a)]

Project	Total Results	Suspect Results	Rejected Results	Field QC Flags	Missed Holding Times	Method Blank Qualifiers	Results Flagged
AEA	4144	3	0	101	4	362	431
PNNL CERCLA	1176	0	0	0	1	114	115
QC	233	0	0	7	0	5	12
RCRA	7655	18	0	88	23	854	957

(a) Wells that are co-sampled by multiple projects have shared results. As a result, the numbers in each column do not add up to the total number of results or flags for the quarter.

AEA = *Atomic Energy Act.*
CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act.*
PNNL = Pacific Northwest National Laboratory.
QC = Quality control.
RCRA = *Resource Conservation and Recovery Act.*

Table A.2. Completeness Summarized by Method

HEIS Method Name	Total Results	Suspect Results	Rejected Results	Field QC Flags	Missed Holding Times	Method Blank Qualifiers	Results Flagged
General Chemical Parameters							
120.1_CONDUCT	3	0	0	0	0	0	0
120.1_CONDUCT_FLD	530	1	0	0	0	0	1
170.1_TEMP_FLD	530	0	0	0	0	0	0
180.1_TURBIDITY_FLD	450	0	0	0	0	0	0
310.1_ALKALINITY	216	0	0	0	1	0	1
360.1_OXYGEN_FLD	221	0	0	0	0	0	0
410.4_COD	12	0	0	12	0	0	12
9020_TOX	241	5	0	16	1	0	22
9060_TOC	289	11	0	8	8	23	47
9223_COLIFORM	15	0	0	0	0	0	0
PH_ELECT_FLD	530	1	0	0	0	0	1
REDOX_PROBE_FLD	130	0	0	0	0	0	0
Ammonia and Anions							
300.0_ANIONS_IC	1,475	1	0	57	17	298	326
350.1_AMMONIA	22	0	0	2	0	0	2
9012_CYANIDE	67	0	0	0	0	0	0
Metals							
6010_METALS_ICP	4,440	1	0	22	0	978	990
6020_METALS_ICPMS	39	0	0	0	0	25	25
7470_HG_CVAA	4	0	0	0	1	1	2
CR6_HACH_M	35	0	0	0	0	0	0
Volatile Organic Compounds							
8260_VOA_GCMS	2002	0	0	73	0	10	79
WTPH_GASOLINE	1	0	0	0	0	0	0
Semivolatile Organic Compounds							
8040_PHENOLIC_GC	119	0	0	0	0	0	0
8081_PEST_GC	19	0	0	0	0	0	0
WTPH_DIESEL	4	0	0	0	0	0	0
Radiological Parameters							
906.0_H3_LSC	186	1	0	0	0	0	1
9310_ALPHABETA_GPC	344	0	0	0	0	0	0
AMCMISO_EIE_PLT_AEA	5	0	0	0	0	0	0
BETA_GPC	3	0	0	0	0	0	0
C14_LSC	2	0	0	0	0	0	0
GAMMA_GS	50	0	0	0	0	0	0
GAMMALL_GS	720	0	0	0	0	0	0
I129LL_ETVDSK_SEP_GS	2	0	0	0	0	0	0
I129LL_SEP_LEPS_GS	72	0	0	2	0	0	2
NI63_LSC	1	0	0	0	0	0	0

Table A.2. (contd)

HEIS Method Name	Total Results	Suspect Results	Rejected Results	Field QC Flags	Missed Holding Times	Method Blank Qualifiers	Results Flagged
NP237_LLE_PLATE_AEA	5	0	0	0	0	0	0
PUISO_PLATE_AEA	34	0	0	0	0	0	0
SRISO_SEP_PRECIP_GPC	56	0	0	0	0	0	0
TC99_ETVDSK_LSC	150	0	0	0	0	0	0
TC99_SEP_LSC	24	0	0	0	0	0	0
TRITIUM_ELECT_LSC	14	0	0	0	0	0	0
UISO_PLATE_AEA	9	0	0	0	0	0	0
UTOT_KPA	137	0	0	4	0	0	4

HEIS = Hanford Environmental Information System.
QC = Quality control.

A.2 Field QC Data

Field QC samples include field duplicates, split samples, and field blanks. Quadruplicate samples collected at many wells for total organic carbon and total organic halides analyses also provide useful QC data. Field blanks collected during the second quarter of 2006 included full trip blanks and field transfer blanks. In general, the desired collection frequency for field duplicates and full trip blanks is one sample per 20 well trips. The target collection frequency for field transfer blanks is one blank on each day in which routine well samples are collected for analysis of volatile organic compounds. Equipment blanks are normally collected once per 10 well trips for portable Grundfos pumps or as needed for special projects. Split samples are also collected on an as-needed basis. Table A.3 lists the number of QC samples and their frequencies of collection for this quarter. Results from each type of QC sample are summarized below.

A.2.1 Field Duplicates

Field duplicates provide a measure of the overall sampling and analysis precision. Evaluation of field-duplicate data is based on the relative percent difference (RPD) statistic, which is calculated for each matching pair of results. Field duplicates with at least one result greater than five times the method detection limit (MDL) or minimum detectable activity must have RPDs less than 20% to be considered acceptable. Duplicates with RPDs outside this range are flagged with a Q in the database.

Sixteen field duplicates were collected and analyzed during the second quarter of 2006 to produce 344 pairs of results. Overall, the results demonstrate good sampling and analysis precision. Six pairs of qualifying duplicate results had RPDs greater than 20%. Table A.4 lists the pairs of results with poor precision. The high chemical oxygen demand, nitrogen in ammonia, and iron results from well 699-22-35 are outliers based on historical data; reanalyses have been requested from the laboratories for nitrogen in ammonia and iron.

Table A.3. Quality Control Samples for Second Quarter 2006

QC Samples	Number of Well Trips	Number of QC Samples(a)	Frequency
Field duplicates	213	16	8%
Split samples	0(b)	0	NA
TOC quadruplicates	85(c)	65	76%
TOX quadruplicates	63(c)	57	90%
Full trip blanks	213	15	7%
Field transfer blanks	VOC samples collected on 10 days	10	100%(d)
Equipment blanks	1(e)	0	0%

(a) Values listed do not include field duplicates, split samples, and blanks collected for interim-action groundwater monitoring or non-routine sampling events (i.e., special projects).
(b) Number of well trips scheduled for split samples.
(c) Number of well trips in which TOC and/or TOX samples were collected.
(d) Number of days with field transfer blanks divided by the number of days that VOC samples were collected (i.e., 10/10).
(e) Number of routine sampling events in which non-dedicated sampling equipment was used (1 well and 0 equipment blanks were collected with a portable Grundfos pump).

QC = Quality control.
TOC = Total organic carbon.
TOX = Total organic halides.
VOC = Volatile organic compounds.

Table A.4. Field Duplicate Results that Exceeded Quality Control Limits

Constituent	Well	Method	Filtered	Result 1		Result 2		RPD
General Chemistry Parameters								
Chemical oxygen demand	699-22-35	EPA 410.4	N	48,000 µg/L		9,200 µg/L	U	136%
Ammonia and Anions								
Nitrogen in ammonia	699-22-35	EPA 350.1	N	69.2 µg/L		6.69 µg/L	U	165%
Metals								
Iron	699-22-35	EPA 6010	Y	50.5 µg/L	BN	158 µg/L	N	103%
Potassium	699-22-35	EPA 6010	Y	8,530 µg/L		10,500 µg/L		21%
Potassium	299-W11-41	EPA 6010	Y	8,630 µg/L		6,940 µg/L		22%
Radiological Parameters								
Iodine-129	299-E33-35	Lab specific	N	3.79 pCi/L		2.94 pCi/L		25%

BN = Analyte detected between MDL and contractually required limit.
EPA = U.S. Environmental Protection Agency.
MDL = Method detection limit.
N = Associated matrix spike was outside acceptance limits.
RPD = Relative percent difference.
U = Undetected.

A.2.2 Total Organic Carbon and Total Organic Halides Quadruplicates

Samples for total organic carbon and total organic halides analyses are normally collected in quadruplicate in accordance with RCRA requirements. While these samples are not intended as QC samples, quadruplicates may provide useful information about the overall sampling and analysis precision for organic indicator parameters. For the purposes of this discussion, total organic carbon and total organic halides quadruplicate data were evaluated based on the relative standard deviation (RSD) for each set of quadruplicate results. Each quadruplicate set having an RSD greater than 20% and at least one result greater than 5 times the method detection limit was considered to have poor precision.

For the second quarter, two out of 65 total organic carbon quadruplicates and ten out of 57 total organic halide quadruplicates failed to meet the evaluation criteria (Table A.5). Five of the quadruplicates in the table appeared to contain an outlier (shaded values in the table). Removing the outlier either drops the RSD below the QC limits or produces a set of results that is below quantifiable levels. The three high values for the failed total organic carbon quadruplicate in well 299-E24-20 are out of trend; the data have been flagged in HEIS. In addition, the elevated results from well 299-E33-36 and the high full trip blank result associated with well 299-E33-36 were from the same analytical batch. Since all of the results in that batch were anomalously high while sample replicates analyzed in other batches were non-detected, the elevated results will be flagged with an R in the database.

Table A.5. Total Organic Carbon and Total Organic Halides Quadruplicates with Low Precision

Well	MDL (µg/L)	Result 1 (µg/L)		Result 2 (µg/L)		Result 3 (µg/L)		Result 4 (µg/L)		RSD
Total Organic Carbon										
299-E24-20	470	470	UY	2300	Y	2400	Y	1900	Y	50%
299-E32-5	470	470	U	470	U	2500	N	2700	N	80%
Total Organic Halides										
299-E25-32P	2.6	7.6		13.8		15.5		17.2		31%
299-E27-12	2.6	2.6	UY	6.7	Y	11.6	Y	15.2	Y	61%
299-E27-16	2.6	5.3		9.9		10.3		13.2		34%
299-E27-22	2.6	11.1		11.8		15.3		17.8		22%
299-E32-9	2.6	2.6	U	2.6	U	2.6	U	13.3		101%
299-E33-36	2.6	2.6	UQ	2.6	UQ	16.7	Q	18.6	Q	86%
299-E33-37	2.6	14.1		16.2		52.6	D	79	D	77%
299-E34-12	2.6	2.6	U	5.1		5.5		27.5		114%
FTB[a]	2.6	2.6	UQ	2.6	UQ	2.6	UQ	19.5	Q	124%
FTB[b]	2.6	2.6	UQ	2.6	UQ	15.1	Q	15.2	Q	82%

[a] Full trip blank associated with well 299-E33-36

[b] Full trip blank associated with well 299-W26-13

MDL = Method detection limit.
RSD = Relative standard deviation.
U = Undetected
Y = Suspect result; undergoing further review.

A.2.3 Field Blanks

Full trip blanks, field transfer blanks, and equipment blanks are used to check for contamination resulting from field activities and/or bottle preparation. Definitions of full trip blanks, field transfer blanks, and equipment blanks are provided in Section A.4 of this Appendix. In general, the QC limit for blank results is two times the MDL or instrument detection limit for chemistry methods and two times the minimum detectable activity for radiochemistry methods. For common laboratory contaminants such as acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the QC limit is five times the MDL. Blank results that exceed these limits may indicate a contamination or false-detection problem for regular groundwater samples. Results from groundwater samples that are associated with an out-of-limit field blank are flagged with a Q in the database.

A total of 949 results were produced from the second quarter field blank samples. Approximately 3.8% of the results (i.e., 36 results) exceeded the QC limits for field blanks. The percentage of out-of-limit results was about the same as the value from last quarter (3.6%). Table A.6 lists the second quarter field blank results that were greater than the QC limits. Results that exceeded the QC limits by a factor of 5 or more are shaded in gray. Most of the flagged results were for methylene chloride, chloride, and total organic halides; however, results were also flagged for chemical oxygen demand, total organic carbon, magnesium, vanadium, carbon tetrachloride, and uranium. The potential impacts on the data are minor in most cases. For example, although chloride and magnesium had field blank results that were greater than the QC limits, the blank concentrations were significantly lower than the levels of these constituents in most of this quarter's groundwater samples.

Table A.6. Field Blank Results that Exceeded Quality Control Limits

Constituent Name	Blank Type[(a)]	Result	QC Limit	Result/QC Limit
General Chemistry Parameters				
Chemical Oxygen Demand	FTB	30,000 µg/L	18,400 µg/L	1.6
Chemical Oxygen Demand	FTB	34,000 µg/L	18,400 µg/L	1.8
Total organic carbon	FTB	1,000 µg/L	940 µg/L	1.1
Total organic carbon	FTB	1,000 µg/L	940 µg/L	1,1
Total organic halides	FTB	15.1 µg/L	5.2 µg/L	2.9
Total organic halides	FTB	15.2 µg/L	5.2 µg/L	2.9
Total organic halides	FTB	19.5 µg/L	5.2 µg/L	3.8
Ammonia and Anions				
Chloride	FTB	51 µg/L	50 µg/L	1.0
Chloride	FTB	64 µg/L	50 µg/L	1.3
Chloride	FTB	110 µg/L	46 µg/L	2.4
Chloride	FTB	140 µg/L	46 µg/L	3.0
Chloride	FTB	160 µg/L	46 µg/L	3.5
Chloride	FTB	170 µg/L	46 µg/L	3.7
Metals				
Magnesium	FTB	328 µg/L	216 µg/L	1.5
Vanadium	FTB	13.2 µg/L	11.8 µg/L	1.1

Table A.6. (contd)

Constituent Name	Blank Type[(a)]	Result	QC Limit	Result/QC Limit
Volatile Organic Compounds				
Carbon tetrachloride	FXR	0.65 µg/L	0.3 µg/L	2.2
Methylene chloride	FTB	0.85 µg/L	0.5 µg/L	1.7
Methylene chloride	FXR	1,1 µg/L	0.5 µg/L	2.2
Methylene chloride	FXR	1.4 µg/L	0.5 µg/L	2.8
Methylene chloride	FTB	1.5 µg/L	0.5 µg/L	3.0
Methylene chloride	FXR	2.2 µg/L	0.5 µg/L	4.4
Methylene chloride	FXR	2.2 µg/L	0.5 µg/L	4.4
Methylene chloride	FXR	2.6 µg/L	0.5 µg/L	5.2
Methylene chloride	FXR	2.8 µg/L	0.5 µg/L	5.6
Methylene chloride	FXR	2.8 µg/L	0.5 µg/L	5.6
Methylene chloride	FXR	5.8 µg/L	0.5 µg/L	11.6
Methylene chloride	FXR	6.1 µg/L	0.5 µg/L	12.2
Methylene chloride	FTB	6.1 µg/L	0.5 µg/L	12.2
Methylene chloride	FTB	6.2 µg/L	0.5 µg/L	12.4
Methylene chloride	FXR	6.4 µg/L	0.5 µg/L	12.8
Methylene chloride	FXR	6.4 µg/L	0.5 µg/L	12.8
Methylene chloride	FXR	7.7 µg/L	0.5 µg/L	15.4
Methylene chloride	FXR	9.6 µg/L	0.5 µg/L	19.2
Methylene chloride	FXR	11 µg/L	0.5 µg/L	22.0
Methylene chloride	FXR	16 µg/L	0.5 µg/L	32.0
Radiological Parameters				
Uranium	FTB	0.429 µg/L	0.1814 µg/L	2.4

Shaded cells indicate results that exceeded the QC limits by a factor of 5 or more.
(a) FTB = Full trip blank, FXR = Field transfer blank, EB = Equipment blank.
QC = Quality control.

Two of the constituents (i.e., chloride and methylene chloride) that had out-of-limit field blank results also had out-of-limit method blank results. Consequently, some of the results in Table A.6 may have been caused by laboratory contamination or false-positive detection. Methylene chloride is a common laboratory contaminant that has been detected in previous quarters' method blanks. Low-level detection of these constituents in Hanford groundwater samples should be viewed as tentative.

A.3 Laboratory QC Data

A.3.1 Blind Standards

Double-blind standards containing known amounts of selected anions, organic compounds, and radionuclides were prepared and submitted to Severn Trent in February. Duplicates of the total organic carbon and gross beta standards were submitted concurrently to Lionville Laboratory and Eberline Services, respectively. In most cases, the standards were prepared using groundwater from background wells. However, the conductivity standards were prepared commercially in deionized water. Standards for indicator analyses were spiked using the following constituents: potassium hydrogen phthalate was used to prepare total organic carbon standards, 2,4,5-trichlorophenol was used to prepare total organic halides-phenol standards, and total carbon halides-volatile organic analysis standards were prepared using a mixture of carbon tetrachloride, chloroform, and trichloroethene. Gross alpha and gross beta standards were spiked with plutonium-239 and strontium-90, respectively. The standards' spiked concentrations and analytical results are listed in Table A.7. Shaded values in the tables were outside the QC limits, as described in the following paragraphs.

Table A.7. Blind Standard Results

Constituent	Spike Amount	Lab[a]	Result 1	Recovery	Result 2	Recovery	Result 3	Recovery	Mean	RSD
General Chemical Parameters										
Conductivity	445 µS/cm	SL	441	99%	468	105%	470	106%	460	4%
TOC[b]	1,495 µg/L	LL	1,500	100%	1,800	120%	1,600	107%	1,625	8%
TOC[c]	1,495 µg/L	SL	1,700	114%	1,500	100%	1,800	120%	1,650	8%
TOX (phenol)	13.2 µg/L	SL	17	129%	18.8	142%	18.2	138%	18.0	5%
TOX (VOA)[d]	13 µg/L	SL	20.5	158%	17.2	132%	16	123%	17.1	14%
Anions										
Cyanide	300 µg/L	SL	295	98%	313	104%	289	96%	299	4%
Fluoride	3,000 µg/L	SL	2,500	83%	2,700	90%	2,600	87%	2,600	4%
Nitrate as N	45,180 µg/L	SL	46,300	102%	46,200	103%	45,500	101%	46,000	1%
Volatile Organic Compounds										
Carbon tetrachloride	5.1 µg/L	SL	7.9	155%	6.4	125%	6.3	124%	6.9	13%
Chloroform	4.8 µg/L	SL	6	125%	5.5	115%	5.9	123%	5.8	5%
Trichloroethene	4.9 µg/L	SL	5.4	110%	5.3	108%	5.8	118%	5.5	5%
Radiological Parameters										
Cesium-137	210.8 pCi/L	RL	206	98%	210	100%	213	101%	210	2%
Cobalt-60	51.17 pCi/L	RL	56.9	111%	53	104%	49.3	96%	53.1	7%
Gross alpha	7.13 pCi/L	RL		81%	7.97	112%	8.27	116%	8.12	3%
Gross beta[e]	68.015 pCi/L	ES	59	87%	65.1	96%	64.3	95%	62.8	5%
Gross beta[e]	68.015 pCi/L	RL	61.5	90%	60.6	89%	60.4	89%	60.8	1%
Iodine-129	10.1 pCi/L	RL	9.72	96%	10.7	106%	9.99	99%	10.1	5%
Iodine-129	5.1 pCi/L	RL	5.15	101%	4.95	97%	4.89	96%	5.00	3%
Iodine-129	1.1 pCi/L	RL	ND	--	ND	--	ND	--	--	--
Plutonium-239	7.13 pCi/L	RL	6.86	96%	8.37	117%	5.64	79%	6.96	20%
Technetium-99	204.8 pCi/L	RL	210	103%	197	96%	187	91%	198	6%
Uranium-238	925.5 µg/L	RL	941	102%	912	99%	963	104%	939	3%

Shaded cells indicate values outside the QC limits.

(a) Lab codes: SL = Severn Trent St. Louis; RL = Severn Trent Richland; LL = Lionville Laboratory; ES = Eberline Services.

(b) TOC standards were submitted to LL in quadruplicate. The fourth result was 2,500 µg/L, and the recovery was 100%.

(c) TOC standards were submitted to SL in quadruplicate. The fourth TOC result was 2,900 µg/L, and the recovery was 116%.

(d) High-level TOX VOA standards were submitted to SL in quadruplicate. The fourth result was 406 µg/L, and the recovery was 44%.

(e) The gross beta spike amount is based on equal contributions from Sr-90 and Y-90 and has been corrected by adding the average gross beta activity of the source-water well (699-49-100C) to the original spiked amount. The average gross beta activity of well 699-49-100C was calculated from quarterly measurements made since the first quarter of last year.

QC = Quality control.
RSD = Relative standard deviation.
TOC = Total organic carbon.
TOX = Total organic halides.
VOA = Volatile organic analysis.

The acceptance limits for blind standard recoveries are generally 75%–125% except for radionuclides, which have a ±30% acceptance range. Most of the results were acceptable, indicating good performance overall. STL St. Louis had out-of-limit results for carbon tetrachloride and total organic halides. STL Richland had three unacceptable results for iodine-129. All of the results from Lionville Laboratory (total organic carbon) and Eberline Services (gross beta) were acceptable.

Five out of seven of STL St. Louis' total organic halides results were out of limits; all of the results were biased high. The standards were spiked at relatively low concentrations (i.e., ~5 times the MDL), which probably accounts for the variability in the results. In general, the results are similar to those from previous quarters that also had low-level standards (e.g., last quarter and the second quarter of calendar year 2005). This suggests a high bias may also exist for groundwater sample results in the same general concentration range (<15 µg/L).

Volatile organic compound results from STL St. Louis were improved over those from the past three quarters. All of the results were biased high, and one result for carbon tetrachloride was outside the acceptance limits. The reasons for the bias are unknown. STL St. Louis' results from the latest Water Pollution study (WP-138) were acceptable for carbon tetrachloride, chloroform, and trichloroethene. A special study comparing the analytical performance STL St. Louis and Fluor Hanford, Inc.'s Waste Sampling Characterization Facility and mobile laboratories was conducted during the third quarter. The focus of the study was on carbon tetrachloride, and the results should provide additional information about the relative accuracy of STL's results for volatile organic compounds.

Three sets of blind standards containing low levels of iodine were submitted to STL Richland this quarter. The samples spiked at 5.1 and 10.1 pCi/L had acceptable results, but iodine-129 was not detected in the 1.1 pCi/L standards. This may be a result of STL's conservative approach to detection, which requires measurable counts at three distinct gamma energies. The reported non-detected concentrations are reasonable based on the low spiking level. Nonetheless, these results highlight the difficulty in reliably measuring iodine-129 at or below the drinking water standard (1 pCi/L).

A.3.2 Environmental Resources Associates Water Supply/Water Pollution Programs

STL St. Louis and Lionville Laboratory participate in the U.S. Environmental Protection Agency sanctioned Water Supply/Water Pollution Performance Evaluation studies conducted by Environmental Resources Associates. Every month, standard water samples are distributed as blind standards to participating laboratories. These samples contain specific organic and inorganic analytes at concentrations unknown to the participating laboratories. After analysis, the laboratories submit their results to the study administrator. Regression equations are used to determine acceptance and warning limits for the study participants. The results of these studies, expressed in this report as a percentage of the results that the performance evaluation (PE) provider found acceptable, independently verify the level of laboratory performance.

A report from one Water Pollution study (WP-138) was received from STL St. Louis this quarter. The percentage of acceptable results was 98.8%. Values were high for total organic halides and benzene in gasoline range organics (by two methods). Values were low for fluoride and volatile solids.

An investigative report from one Water Pollution study (WP-132) was received from STL St. Louis this quarter. The laboratory identified several causes for failure:

- The laboratory incorrectly reported hardness as total hardness rather than calcium hardness.

- The laboratory did not report 1,2,3-trichloropropane and hexachlorobutadiene; however, results for these compounds would have been acceptable.

- Operator error resulted in poor results for residual chlorine, total solids, and oil and grease; these analyses were performed with acceptable results after operator retraining.

- For several analytes, the cause of failure was identified and corrected, and a reanalysis yielded acceptable results:

    - acidity (probe failure corrected by purchasing a new probe and instituting an auto-calibration tolerance check)
    - ammonia and nitrate/nitrite (degradation of reagent corrected by preparing fresh reagent and shortening the shelf life)
    - ortho-phosphate (interference isolated to one instrument corrected by using a different instrument)
    - total Kjeldahl nitrogen (poor matrix matching of calibration standards and samples corrected by matrix matching)
    - total phosphorus (insufficient heating during digestion corrected by visual verification that the sample boils during digestion)
    - fluoride (inadequate integration of the peak corrected by utilizing the expanded screen to integrate)
    - tin (dilution with nitric acid corrected by using hydrochloric acid).

A cause was not determined for the low value for volatile solids; however, this method is not used for Hanford groundwater samples. No cause was found for the unacceptable results for conductivity, hexavalent chromium, chloromethane, or iron; the laboratory is monitoring performance of these methods to assess whether there are systematic issues that need to be corrected.

A.3.3 Mixed Analyte Performance Evaluation Program

The Mixed Analyte Performance Evaluation Program is conducted by the U.S. Department of Energy independent of the Hanford Groundwater Performance Assessment Project. In this program, samples containing metals, volatile and semivolatile organic compounds, and radionuclides are sent to participating laboratories in January and July.

No new Mixed Analyte Performance Evaluation Program results were available this quarter.

A.3.4 InterLaB RadCheM Proficiency Testing Program Studies

The InterLaB RadCheM Proficiency Testing Program is conducted by Environmental Resources Associates. Control limits are based on the National Standards for Water Proficiency Testing Studies Criteria Document, December 1998.

The results from one RadCheM PE study were received from STL Richland this quarter (RAD-65). Unacceptable results were reported for cesium-137 and radium-226. The following were analyzed with acceptable results: barium-133, cesium-134, cobalt-60, gross alpha, gross beta, iodine-131, radium-226, radium-228, strontium-89, strontium-90, tritium, uranium, and zinc-65.

A.3.5 Multi-Media Radiochemistry Proficiency Testing Studies

The Multi-Media Radiochemistry Proficiency Testing Program is conducted by Environmental Resources Associates and is designed to evaluate the performance of participating laboratories through the analysis of air filter, soil, vegetation, and water samples containing radionuclides. Only the water results are considered in this report. Control limits are based on the guidelines contained in the U.S. Department of Energy report , *Analysis of EML QAP Data from 1982–1992: Determination of Operational Criteria and Control Limits for Performance Evaluation Purposes* (Pan 1995).

No new results were available this quarter.

A.3.6 Laboratory QC Data from Severn Trent Laboratories

Laboratory QC data provide a means of assessing laboratory performance and the suitability of a method for a particular sample matrix. These data are not currently used for in-house validation of individual sample results unless the laboratory is experiencing unusual performance problems with an analytical method. Laboratory QC data include the results from method blanks, laboratory control samples, matrix spikes, matrix spike duplicates, surrogates, and matrix or laboratory duplicates.

Different criteria are used to evaluate the various laboratory QC parameters. Results for method blanks are evaluated based on the frequency of detection above the blank QC limits. In general, these limits are two times the MDL for chemical constituents and two times the minimum detectable activity for radiochemistry components. For common laboratory contaminants such as acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the QC limit is five times the MDL. Results for laboratory control samples, matrix spikes, and surrogates are evaluated by comparing the recovery percentages with minimum and maximum control limits. For matrix duplicates, only those samples with values five times greater than the MDL or minimum detectable activity are considered. Quantifiable matrix duplicates are evaluated by comparing the RPD with an acceptable RPD maximum for each constituent.

As an aid in identifying the most problematic analytes, a distinction has been made between QC data that were slightly out of limits and QC data that were “significantly out-of-limits.” For method blanks, “significantly out-of-limits” was defined to mean results were greater than twice the QC limit. For laboratory control samples, matrix spikes, and duplicates, “significantly out-of-limits” means the results were outside the range of the QC limits plus or minus 10 percentage points (e.g., if the QC limits are 80%–120%, significantly out-of-limits would mean less than 70% or greater than 130%).

Most of the second quarter laboratory QC results were within acceptance limits, suggesting that the analyses were in control and reliable data were generated. Table A.8 provides a summary of the QC data by listing the percentage of QC results that were out of limits for each analyte category and QC parameter. Table A.9 lists the individual constituents that had out-of-limit method blanks, including the

Table A.8. Percentage of Out-of-Limit QC Results by Category

	General Chemistry Parameters	Ammonia and Anions	Metals	VOC	SVOC	Radiological Parameters	Total
Method blanks	0	11.6	0.6	0.2	0	0	1.7
Lab control samples	0	0.3	1.0	3.4	0	1.0	1.4
Matrix spikes	6.7	21.6	0.7	6.3	0.7	6.5	4.7
Matrix duplicates	0.7	1.1	0.2	1.1	6.9	1.8	1.1
Surrogates	—	—	—	0.3	0	—	0.3

SVOC = Semivolatile organic compounds.
VOC = Volatile organic compounds.

Table A.9. Method Blanks with Out-of Limit Results

Constituent	Number Out of Limits[(a)]	Number of Analyses	Concentration Range of Detections
Ammonia and Anions			
Chloride	33(12)	58	0.047 – 0.19 mg/L
Sulfate	4(1)	58	0.13 – 0.4 mg/L
Metals			
Arsenic	1	16	4.5 μg/L
Calcium	2	53	24.3 – 42.1 μg/L
Mercury	1	2	0.2 μg/L
Sodium	1	53	304 μg/L
Zinc	1	50	12.4 μg/L
Volatile Organic Compounds			
Methylene chloride	1	18	1.8 μg/L

(a) Numbers in parentheses are the number of results that were significantly out of limits as defined in the text.

concentration range for method blanks above the detection limit. Table A.10 summarizes the out-of-limit results for the other QC parameters. The number of significantly out-of-limit results is also indicated in Tables A.9 and A.10. Finally, Table A.11 lists the constituents, analysis dates, and wells having data associated with the significantly out-of-limit QC results. Groundwater sample data associated with blank results that are out of limits could have a contamination or false-detection problem. Groundwater sample data associated with laboratory control samples or matrix spikes that are out of limits should be evaluated for potential biases. It should be noted that these tables incorporate all QC data that were reported for the quarter, including QC results for both original and reanalysis data. However, when samples are reanalyzed, only one set of results (i.e., either the original results or the reanalysis results) are retained in

Table A.10. Laboratory Spikes and Duplicates with Out-of-Limit Results

Constituent	Number Out of Limits[(a)]	Number of Analyses
Laboratory Control Samples		
Ammonia and Anions		
Phosphate	1	6
Metals		
Barium	3	53
Potassium	3	52
Strontium (elemental)	4	52
Volatile Organic Compounds		
1,1-Dichloroethene	1	18
1,4-Dioxane	1	15
1-Butanol	3(2)	15
2-Butanone	1	18
Acetone	1(1)	18
Acrolein	3(2)	4
Allyl chloride	1(1)	4
Bromomethane	2	4
Carbon disulfide	4	18
cis-1,2-Dichloroethylene	1	18
trans-1,4-Dichloro-2-butene	1(1)	4
Radiological Parameters		
Iodine-129	3(2)	25
Matrix Spikes and Matrix Spike Duplicates		
General Chemistry Parameters		
Conductivity	1	1
Total organic carbon	5(3)	40
Total organic halides	1(1)	37
Ammonia and Anions		
Chloride	11(5)	63
Cyanide	6(3)	17
Fluoride	12(4)	63
Nitrogen in ammonia	2	9
Nitrogen in nitrate	10(3)	64
Nitrogen in nitrite	27(15)	63
Phosphate	1(1)	5
Sulfate	6(1)	63
Metals		
Cadmium	3	102
Iron	1(1)	100
Manganese	2(2)	100

Table A.10. (contd)

Constituent	Number Out of Limits[(a)]	Number of Analyses
Silver	1	102
Sodium	6(1)	102
Volatile Organic Compounds		
1,1-Dichloroethene	2	39
1,4-Dioxane	4(2)	35
1-Butanol	7(5)	35
Acetone	12(12)	39
Acrolein	4(4)	10
Allyl chloride	2(2)	10
Bromomethane	2(1)	10
Carbon disulfide	14(13)	39
Ethyl cyanide	2	35
Ethylbenzene	6	39
Iodomethane	3	10
Tetrachloroethene	6	39
Tetrahydrofuran	2(2)	35
Toluene	6	39
trans-1,2-Dichloroethylene	3	39
Vinyl acetate	2(2)	10
Vinyl chloride	1	39
Semivolatile Organic Compounds		
2,4-Dimethylphenol	1	6
Radiological Parameters		
Technetium-99	1(1)	28
Uranium	2(2)	18
Duplicates		
General Chemistry Parameters		
Total organic halides	1(1)	33
Ammonia and Anions		
Fluoride	4(2)	119
Nitrogen in nitrate	1(1)	120
Nitrogen in nitrite	1(1)	119
Sulfate	1(1)	119
Metals		
Iron	1(1)	50
Mercury	1(1)	2
Volatile Organic Compounds		
1,4-Dioxane	6(1)	32
1-Butanol	5(2)	32

Table A.10. (contd)

Constituent	Number Out of Limits[a]	Number of Analyses
2-Butanone	1	37
Tetrahydrofuran	1	32
Semivolatile Organic Compounds		
2,3,4,6-Tetrachlorophenol	2	3
2-Nitrophenol	1	5
4-Nitrophenol	2	3
Phenol	1	5
Radiological Parameters		
Cobalt-60	1	20
Gross beta	1	23
Iodine-129	4(2)	23
Potassium-40	1(1)	20
Surrogates		
Volatile Organic Compounds		
Dibromofluoromethane	2	234
o-Terphenyl	1	16

(a) Numbers in parentheses are the number of results that were significantly out of limits as defined in the text.

Table A.11. Wells Associated with Laboratory QC Parameters with Significantly Out-of-Limit Results

Constituent	Analysis Date	Wells with Associated Data
Method Blanks		
Chloride	4/20/06	299-W15-7, 299-W15-30, 299-W22-26, 699-36-70B, 699-43-45, 699-49-57A, 699-49-79
	4/25/06	299-E13-5, 299-E26-12, 299-E26-13, 299-E34-9, 699-36-93, 699-37-47A
	05/04/06	199-K-111A
	05/18/06	299-W11-41, 299-W13-1, 299-W19-49, 699-19-88
	05/23/06	299-W10-26, 299-W11-46, 299-W11-47, 299-W14-11, 299-W14-6, 299-W15-15
	05/24/06	299-W15-40, 299-W15-43, 299-W15-44, 299-W15-46, 299-W15-49
	06/01/06	699-22-35, 699-23-34A, 699-23-34B, 699-24-33, 699-24-34A, 699-24-34B, 699-24-34C, 699-24-35, 699-26-35A
	06/06/06	199-K-111A, 199-K-130, 199-N-103A, 199-N-105A, 199-N-106A
	06/07/06	199-D4-15, 199-N-67
	06/13/06	299-E32-4, 299-E32-5, 299-E32-6, 299-E32-8, 299-E32-9, 299-E33-9, 299-E33-28, 299-E33-29
	06/16/06	299-E27-7, 299-E33-30, 299-E33-34, 299-E33-35, 299-W21-2, 299-W22-26, 299-W22-44, 299-W22-45, 299-W22-47, 299-W22-48, 299-W22-49
	06/22/06	299-W22-80, 299-W22-83, 299-W22-84, 299-W23-15, 299-W23-19, 299-W23-20
Sulfate	06/20/06	199-N-119, 299-E25-2, 299-E28-13
Laboratory Control Samples		
1-Butanol	05/24/06	299-W15-15
	06/07/06	699-22-35, 699-23-34A, 699-23-34B
Acetone	04/25/06	499-S1-8J, 699-49-79, 699-S28-E0, 699-S36-E13A, 699-S38-E12A, 699-S43-E12
Acrolein	04/24/06	699-36-70B
	05/23/06	299-W13-1
Allyl chloride	05/23/06	299-W13-1
trans-1,4-Dichloro-2-butene	05/23/06	299-W13-1
Iodine-129	07/12/06	299-W14-11
	07/24/06	299-E16-1, 299-E16-2, 299-E25-42, 299-E26-8
Matrix Spikes or Matrix Spike Duplicates		
Total organic carbon	06/22/06	199-N-59, 199-N-77, 299-E25-40, 299-E25-93, 299-E25-94, 299-E32-10
	06/26/06	299-E32-4, 299-E32-5, 299-E32-8, 299-E32-9, 299-E33-28, 299-E33-29
Total organic halides	06/27/06	299-W26-14
Chloride	03/31/06	199-K-30, 199-K-32A, 199-K-34, 199-K-110A, 299-E27-12, 299-E27-15, 699-S6-E4L
	06/21/06	299-E28-26, 299-E28-27, 299-E28-28, 299-E32-3, 299-E32-7, 299-W22-69, 299-W22-72, 299-W22-79, 299-W22-87
	06/24/06	399-1-2, 399-1-6, 399-1-7, 399-1-16A, 399-1-16B, 399-1-17A, 399-1-17B, 399-1-21A, 399-1-21B, 1199-39-16D

Table A.11. (contd)

Constituent	Analysis Date	Wells with Associated Data
	06/27/06	299-E27-14, 299-W22-82, 399-2-1, 399-2-2, 399-3-1, 399-3-10
	08/03/06	199-K-34, 299-W15-41, 299-W15-44, 299-W15-765, 299-W18-30
Cyanide	05/12/06	299-E28-8, 299-E33-15, 299-E33-16, 299-E33-17, 299-E33-21, 299-E33-26, 299-E33-31, 299-E33-32, 299-E33-33, 299-E33-334, 299-E33-335, 299-E33-337, 299-E33-338, 299-E33-339
	05/17/06	299-E33-38, 299-E33-39, 299-E33-42, 299-E33-43, 299-E33-47, 299-E33-48
Fluoride	04/07/06	299-W19-47
	04/28/06	199-D4-15
	06/01/06	299-W14-14, 299-W14-19, 299-W15-41, 299-W15-45, 299-W15-50, 299-W18-23, 299-W18-30, 299-W21-2, 699-50-59, 699-53-55B
	06/21/06	299-E28-26, 299-E28-27, 299-E28-28, 299-E32-3, 299-E32-7, 299-W22-69, 299-W22-72, 299-W22-79, 299-W22-87
Nitrogen in Nitrate	03/31/06	199-K-30, 199-K-32A, 199-K-34, 199-K-110A, 299-E27-12, 299-E27-15, 699-S6-E4L
	06/21/06	299-E28-26, 299-E28-27, 299-E28-28, 299-E32-3, 299-E32-7, 299-W22-69, 299-W22-72, 299-W22-79, 299-W22-87
	08/08/06	299-E33-18
Nitrogen in Nitrite	03/30/06	299-W23-19, 699-S6-E4A, 699-S20-E10, 699-S31-E10A, 699-S31-E10D, 699-S31-E11, 699-S41-E12
	04/01/06	299-E17-1, 299-E17-14, 299-E17-16, 299-E17-18, 299-E17-22, 299-E17-23, 299-E17-25
	04/07/06	299-W19-47
	04/20/06	299-W15-7, 299-W15-30, 299-W22-26, 699-36-70B, 699-43-45, 699-49-57A, 699-49-79
	04/25/06	299-E13-5, 299-E26-12, 299-E26-13, 299-E34-9, 699-36-93, 699-37-47A
	04/29/06	299-E25-22, 299-E33-1A, 299-E33-2, 299-E33-3, 299-E33-20
	05/02/06	199-K-111A
	05/05/06	199-H4-9
	05/13/06	299-W10-1, 299-W10-8, 299-W10-22, 299-W10-28, 299-W11-12
	05/23/06	299-W10-26, 299-W11-46, 299-W11-47, 299-W14-6, 299-W14-11, 299-W15-15
	05/25/06	299-W15-763, 299-W15-765, 299-W18-16
	06/09/06	299-E25-40, 299-E25-93, 299-E25-94, 299-E27-4, 299-E27-12, 299-E27-13, 299-E27-15, 299-E27-22, 299-E27-23
	06/13/06	299-E32-4, 299-E32-5, 299-E32-6, 299-E32-8, 299-E32-9, 299-E33-9, 299-E33-28, 299-E33-29
	06/27/06	299-E27-14, 299-W22-82, 399-2-1, 399-2-2, 399-3-1, 399-3-10
	07/29/06	299-E33-18
Phosphate	06/07/06	199-N-67
Sulfate	06/21/06	299-E28-26, 299-E28-27, 299-E28-28, 299-E32-3, 299-E32-7, 299-W22-69, 299-W22-72, 299-W22-79, 299-W22-87
Iron	06/06/06	699-22-35, 699-23-34A, 699-23-34B, 699-24-33, 699-24-34A, 699-24-34B, 699-24-34C, 699-24-35, 699-26-35A

Table A.11. (contd)

Constituent	Analysis Date	Wells with Associated Data
Manganese	07/31/06	199-N-128, 199-N-129, 299-W15-83, 299-W18-21, 299-W18-22, 299-W18-23, 399-1-12
Sodium	08/01/06	199-N-128, 199-N-129, 299-W15-83, 299-W18-21, 299-W18-22, 299-W18-23, 399-1-12
1,4-Dioxane	05/16/06	299-W10-22
1-Butanol	05/30/06	299-W15-40, 299-W15-43, 299-W15-44, 299-W15-46, 299-W15-49, 299-W15-763, 299-W15-765, 299-W18-16, 299-W19-101
	06/27/06	299-W22-83, 299-W23-21
	06/27/06	299-W22-83, 299-W23-21, 399-1-1, 399-1-10A, 399-1-10B, 399-1-11, 399-1-15, 399-1-18A, 399-1-18B
Acetone	04/24/06	299-W15-7, 299-W15-30, 699-36-70B
	04/25/06	499-S1-8J, 699-49-79, 699-S28-E0, 699-S36-E13A, 699-S38-E12A, 699-S43-E12
	05/30/06	299-W15-40, 299-W15-43, 299-W15-44, 299-W15-46, 299-W15-49, 299-W15-763, 299-W15-765, 299-W18-16, 299-W19-101
	06/05/06	299-W15-45, 299-W15-50, 299-W19-48, 299-W21-2, 699-36-70B, 699-38-70B, 699-50-85
	06/07/06	299-W18-23, 299-W19-101, 699-24-33, 699-24-34A, 699-24-34B, 699-24-34C, 699-24-35, 699-26-35A, 699-38-70C, 699-40-65
Acrolein	04/24/06	699-36-70B
	05/23/06	299-W13-1
Allyl chloride	05/23/06	299-W13-1
Bromomethane	05/23/06	299-W13-1
Carbon disulfide	06/27/06	299-W22-83, 299-W23-21, 399-1-1, 399-1-10A, 399-1-10B, 399-1-11, 399-1-15, 399-1-18A, 399-1-18B
	06/28/06	399-1-2, 399-1-6, 399-1-7, 399-1-8, 399-1-16A, 399-1-16B, 399-1-17B, 399-1-21A, 399-1-21B, 399-2-1, 399-2-2, 399-3-1, 399-3-10
	06/30/06	399-1-17A, 399-3-2, 399-3-6, 399-3-9, 399-3-18, 399-4-1, 399-4-9, 399-4-12, 399-5-4B, 399-8-5A
	07/07/06	699-30-66, 699-S27-E9A, 699-S27-E14
Tetrahydrofuran	05/30/06	299-W15-40, 299-W15-43, 299-W15-44, 299-W15-46, 299-W15-49, 299-W15-763, 299-W15-765, 299-W18-16, 299-W19-101
Vinyl acetate	04/24/06	699-36-70B
Technetium-99	07/20/06	299-E25-40, 299-E25-93, 299-E25-94, 299-E27-4, 299-E27-12, 299-E27-13, 299-E27-15, 299-E27-22, 299-E27-23, 299-E28-2, 299-E32-10, 299-E33-9
Uranium	06/29/06	299-E33-7, 299-E33-13, 299-E33-14, 299-E33-36, 299-E33-41, 299-E33-44, 299-E33-49, 299-W19-49
	07/13/06	299-W18-23, 299-W19-48, 299-W19-101, 699-36-70B, 699-38-70B, 699-38-70C
Duplicates		
Total organic halides	04/24/06	299-E25-32P, 299-E25-35, 299-E25-48
Fluoride	04/07/06	299-W19-47
	04/28/06	199-D4-15
Nitrogen in Nitrate	08/08/06	299-E33-18
Nitrogen in Nitrite	06/27/06	299-E27-14, 299-W22-82, 399-2-1, 399-2-2, 399-3-1, 399-3-10

Table A.11. (contd)

Constituent	Analysis Date	Wells with Associated Data
Sulfate	03/31/06	199-K-30, 199-K-32A, 199-K-34, 199-K-110A, 299-E27-12, 299-E27-15, 699-S6-E4L
Iron	06/06/06	699-22-35, 699-23-34A, 699-23-34B, 699-24-33, 699-24-34A, 699-24-34B, 699-24-34C, 699-24-35, 699-26-35A
Mercury	05/05/06	299-E33-18
1,4-Dioxane	07/28/06	299-W15-31A, 299-W15-83, 299-W18-21, 299-W18-22, 299-W18-23, 399-1-10A, 399-1-12
1-Butanol	05/30/06	299-W15-40, 299-W15-43, 299-W15-44, 299-W15-46, 299-W15-49, 299-W15-763, 299-W15-765, 299-W18-16, 299-W19-101
	06/30/06	399-1-17A, 399-3-2, 399-3-6, 399-3-9, 399-3-18, 399-4-1, 399-4-9, 399-4-12, 399-5-4B, 399-8-5A
Iodine-129	05/25/06	299-E24-18, 299-E25-31
	07/18/06	299-E28-25, 299-E32-4, 299-E32-5, 299-E32-6, 299-E32-8, 299-E32-9, 299-E33-28, 299-E33-29
Potassium-40	07/20/06	199-N-67, 199-N-103A, 199-N-105A, 199-N-106A

the Hanford Environmental Information System. Thus, it is possible that some of the QC data described in this report may no longer be associated with current results in the Hanford Environmental Information System.

Some of the more significant findings from the laboratory QC data are summarized below. Substantial differences between data for last quarter and this quarter are noted for constituent classes; if no comments are made, the data are reasonably similar. To make it easier to compare results between this quarter and the previous quarter, constituents that were cited for the same reason in both quarters are italicized.

- The relative number of out-of-limit results (2.2%) was about the same as that for last quarter (2.2%). This quarter showed an increase in the number of out-of-limit laboratory control samples for metals and volatile organic compounds, matrix spikes for metals and volatile organic compounds, and duplicates for radiological parameters. There was a decrease in the number of out-of-limit blanks for metals, laboratory control samples for anions and semivolatile organic compounds, matrix spikes for semivolatile organic compounds, duplicates for general chemistry parameters and semivolatile organic compounds, and surrogates.

- Two or more method blank results exceeded the QC limits for *chloride*, *sulfate*, and *calcium*.

- Out-of-limit blank results for chloride, sulfate, calcium, and sodium were, in general, not significant because results for most Hanford groundwater samples were significantly higher (at least five times) than the blank values. Many sample results for other constituents with out-of-limit blank results were comparable to the blank values.

- Relative to last quarter, fewer ammonia and anions and semivolatile organic compounds, but more metals and volatile organic compounds had laboratory control samples that were out of limits. Laboratory control samples were significantly out of limits for 1-butanol, acetone, acrolein, allyl chloride, trans-1,4-dichloro-2-butene, and iodine-129. Table A.11 indicates which wells have data associated with laboratory control sample results that were significantly out of limits.

- Compared to last quarter, fewer semivolatile organic compounds but more metals and volatile organic compounds had matrix spike results that were out of limits. Total organic carbon, *total organic halides*, *chloride*, *cyanide*, *fluoride*, *nitrogen in nitrate*, *nitrogen in nitrite*, phosphate, *sulfate*, iron, manganese, *sodium*, 1,4-dioxane, 1-butanol, *acetone*, acrolein, allyl chloride, bromomethane, carbon disulfide, tetrahydrofuran, vinyl acetate, *technetium-99*, and *uranium* had matrix spike results that were significantly out of limits.

- Matrix duplicates had more radiological parameters and fewer general chemistry parameters and semivolatile organic compounds with out-of-limit results compared to last quarter. Matrix duplicates were significantly out of limits for *total organic halides*, *fluoride*, nitrogen in nitrate, *nitrogen in nitrite*, *sulfate*, iron, mercury, 1,4-dioxane, 1-butanol, iodine-129, and potassium-40.

- Surrogates were significantly out of limits for *dibromofluoromethane* and *o-terphenyl*.

A.3.7 Laboratory QC Data from Eberline Services and Lionville Laboratory

Second quarter QC data from Lionville Laboratory are limited to total organic carbon. Second quarter QC data from Eberline Services are limited to gross beta. All of the QC data were within limits.

Project scientists requiring additional information about the laboratory QC data are encouraged to contact Debbie Sklarew or Chris Thompson at Pacific Northwest National Laboratory, Richland, Washington.

A.4 Field Blank Definitions

Full Trip Blank (FTB) – A field blank sample that is used to check for sample contamination resulting from sample bottles, preservatives, and sample storage and handling. FTBs are initially prepared in the laboratory by filling a preserved bottle set with Type II reagent water. After the bottles have been sealed, they are transported to the field in the same storage container that will be used for groundwater samples collected that day. FTBs are not removed from the storage container until they have been delivered to the laboratory. Normally, FTBs are analyzed for the same constituents as the samples from an associated well.

Field Transfer Blank (FXR) – A field blank sample that is used to check for in-the-field sample contamination by volatile organic compounds. FXRs are prepared near a well sampling site by filling preserved volatile organic analysis sample bottles with Type II reagent water that has been transported to the field. FXRs are normally prepared at the same time volatile organic analysis samples are being collected from the well. After collection, the FXR bottles are sealed and placed in the same sample storage container as the rest of the samples. FXRs are not removed from the storage container until they have been delivered to the laboratory.

Equipment Blank (EB) – A field blank sample that is used to check for sample contamination caused by unclean sampling equipment or the sampling equipment itself. Generally, equipment blanks are only collected at wells that are sampled using non-dedicated pumps. EBs are prepared by passing Type II reagent water through the pump or manifold after the equipment has been decontaminated (sometimes just prior to sampling a well) and collecting the rinsate in preserved bottles. EBs are placed in the same container as other field samples and are not removed from the container until they have been delivered to the laboratory. Typically, EBs are analyzed for the same constituents as the samples from the associated well.

A.5 References

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