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**Quarterly RCRA Groundwater
Monitoring Data for the
Period April through June 2005**

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A Letter Report Prepared by
M. J. Hartman
Pacific Northwest National Laboratory
Richland, Washington

November 2005

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

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Quarterly RCRA Groundwater Monitoring Data for the Period April through June 2005

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This letter report has been prepared to provide the U.S. Department of Energy, U.S. Environmental Protection Agency, Washington State Department of Ecology, and Hanford Site contractors with updated groundwater monitoring information. It is not intended for general distribution beyond that audience.

INTRODUCTION

Eighteen *Resource Conservation and Recovery Act* (RCRA) sites¹ were sampled during the reporting quarter, as listed in Table 1. Sampled sites include nine monitored under groundwater indicator evaluation ("detection") programs [40 CFR 265.93(b)], seven monitored under groundwater quality assessment programs [40 CFR 265.93(d)], and two monitored under final-status programs [WAC 173-303-645].

Please note that source, special nuclear and by-product materials, as defined in the *Atomic Energy Act of 1954* (AEA), are regulated at U. S. Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. These materials are not subject to regulation by the state of Washington. All information contained herein and related to, or describing AEA-regulated materials and processes in any manner, may not be used to create conditions or other restrictions set forth in any permit, license, order, or any other enforceable instrument. DOE asserts that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear and by-product materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

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 detection requirements, as described in 40 CFR 265.93. Results of the comparisons are listed in Table 1. Additional explanation, if needed, is provided below.

1324-N/NA Facilities. The sampling schedule for this unit was changed from March and September to June and December beginning this period in an effort to collect samples from downgradient well 199-N-59 when the water table was seasonally high. However, the well could not be sampled in June because it continued to be dry. The well can be sampled when the water table rises with increased river stage. Average specific conductance at downgradient wells 199-N-72 (789 $\mu\text{S}/\text{cm}$) and 199-N-73 (631 $\mu\text{S}/\text{cm}$) continued to exceed the critical mean value (454 $\mu\text{S}/\text{cm}$) in June (critical means were calculated based on one upgradient well and two downgradient wells because downgradient well 199-N-59 was dry). Groundwater quality assessment monitoring in 1992 (Hartman 1992) indicated that the high specific conductance is caused by the non-listed constituents sulfate and sodium.

The average of quadruplicate results for total organic halides in downgradient well 199-N-72 (23.95 $\mu\text{g}/\text{L}$) exceeded the critical mean value (21.8 $\mu\text{g}/\text{L}$) in June. However, the data showed a large variability among replicates: 16.8, 17.9, 27.7, and 33.4 $\mu\text{g}/\text{L}$. The two high values are out of trend. Project-wide data indicate laboratory problems with total organic halides analyses, so the two high values were flagged as suspect and no confirmation sampling was scheduled. The site will remain in detection monitoring.

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

Table 1. Status of RCRA Sites, April-June 2005

Site	Routine Sampling?	DG Statistical Exceedance?	Comments
Detection Sites [40 CFR 265.93(b)] (sampled semiannually)			
1301-N Liquid Waste Disposal Facility	No	Not sampled	
1325-N Liquid Waste Disposal Facility	No	Not sampled	
1324-N/NA Facilities	Yes	Yes ^a	See text.
216-B-3 Pond	No	Not sampled	
216-A-29 Ditch	Yes	Yes ^a	See text.
216-B-63 Trench	Yes	Yes ^a	See text.
216-S-10 Pond and Ditch	Yes	No	Current network 2 shallow and 1 deep DG wells(b)
LERF	Yes	Not applicable	Current network 1 UG and 1 DG well. No statistical evaluation per Ecology.
LLWMA 1	Yes	Yes ^a	See text.
LLWMA 2	Yes	Yes ^a	See text. Wells monitoring the north part of the LLWMA are dry ^(b) .
LLWMA 3	No	Not sampled	12 of 20 wells in original network are dry ^(b)
LLWMA 4	No	Not sampled	Only one shallow DG well ^(b) . See text.
SST WMA A-AX	Yes	Yes	Specific conductance. Changed to assessment. See text.
SST WMA C	Yes	No	
NRDWL	No	Not sampled	See text.
Groundwater Quality Assessment Sites [40 CFR 265.93(d)] (sampled quarterly)			
Seven sites ^c	Yes	Not required	See updates in text.
Final Status Sites [WAC 173-303-645]			
Integrated Disposal Facility	Yes	Not applicable	Establishing background chemistry.
300 Area Process Trenches	Yes	Yes ^d	
183-H Solar Evaporation Basins	No	Not sampled	
CM = Critical mean value(s)		NRDWL = Nonradioactive Dangerous Waste Landfill	
DG = Downgradient		SST = Single-Shell Tanks	
LERF = Liquid Effluent Retention Facility		UG = upgradient	
LLWMA = Low-Level WMA		WMA = Waste Management Area	

^aNo indication of dangerous waste contamination from facility; see text for explanation.

^b Well installation needs are addressed each year as part of the M-24 milestone process.

^c U-12 Crib, PUREX Crib, SST WMAs B-BX-BY, S-SX, T, TX-TY, and U.

^d Site has entered corrective action monitoring because of previous exceedances.

216-A-29 Ditch. The average specific conductance in two downgradient wells, 299-E25-35 (386.2 $\mu\text{S}/\text{cm}$) and 299-E25-48 (491 $\mu\text{S}/\text{cm}$), continued to exceed the critical mean value of 312 $\mu\text{S}/\text{cm}$ in April. Previous exceedances were reported earlier, and the rise in specific conductance has been attributed to non-listed constituents sulfate, calcium, and sodium.²

The average total organic halides concentration in two downgradient wells, 299-E25-32P (34.6 $\mu\text{g}/\text{L}$) and 299-E25-48 (33.0 $\mu\text{g}/\text{L}$), exceeded the comparison value³ of 21.1 $\mu\text{g}/\text{L}$ in April, but the results were not consistent with historical trends. Verification sampling was conducted in August and September. Results from the primary and secondary laboratories were below the comparison value, indicating that the original exceedances were due to laboratory errors. Detection monitoring will continue.

216-B-63 Trench. Average pH in downgradient well 299-E33-36 (8.4075) slightly exceeded the upper limit of the critical range (7.75, 8.40) in April. The difference, 0.0075, is within the uncertainty limit 0.01 for the instrument and pH values were consistent with historical data so verification sampling was not necessary.

The average total organic halides concentration from upgradient well 299-E34-10 (32.8 $\mu\text{g}/\text{L}$) exceeded the comparison value³ of 21.1 $\mu\text{g}/\text{L}$ in April. Verification sampling was conducted in August. Results from the primary and secondary laboratories were below the comparison value, indicating that the initial exceedance was due to a laboratory error. Detection monitoring will continue.

Low-Level Waste Management Area 1. The average specific conductance in two downgradient wells, 299-E33-34 (1,359.3 $\mu\text{S}/\text{cm}$) and 299-E32-10 (726.8 $\mu\text{S}/\text{cm}$) exceeded the critical mean of 710 $\mu\text{S}/\text{cm}$ in June (critical mean values were revised to reflect that one upgradient well, 299-E28-27, was not sampled in this quarter). The specific conductance exceedance in 299-E33-34 and an upward trend noted in 299-E32-10 were reported earlier.⁴ 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, verification sampling is not necessary and detection monitoring will continue.

Low-Level Waste Management Area 2. The average specific conductance (1,869 $\mu\text{S}/\text{cm}$) and total organic halides (36.2 $\mu\text{g}/\text{L}$) in upgradient well 299-E34-7 continued to exceed the critical mean values (1,337 $\mu\text{S}/\text{cm}$ and 21.1 $\mu\text{g}/\text{L}$, respectively). Total organic carbon in this well was also elevated (3,250 $\mu\text{g}/\text{L}$), but below the critical mean value. The upward trends were reported earlier. The rise in specific

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).

³ Upgradient/downgradient comparison value is the limit of quantitation, calculated from blanks data and excluding those blanks that had highly elevation concentrations of total organic halides.

⁴ 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).

conductance is attributed to sulfate, calcium, chloride, and nitrate. Contributors to the elevated total organic carbon and total organic halides are under continuing investigation.

The average total organic halides concentration from downgradient well 299-E34-10 (32.8 µg/L) exceeded the comparison value⁵ of 21.1 µg/L in April (this well also serves as an upgradient well for the B-63 Trench). Verification sampling was conducted in August. Results from the primary and secondary laboratories indicated that the exceedance was due to laboratory error, so detection monitoring will continue.

Waste Management Area A-AX. Quadruplicate measurements of specific conductance in downgradient well 299-E25-93 averaged 536 µS/cm in June, which exceeded the critical mean value of 522 µS/cm. Verification sampling in July 2005 confirmed that the exceedance was statistically significant. DOE notified Washington State Department of Ecology (Ecology) and transmitted a groundwater-quality assessment monitoring plan. This waste management area (WMA) is discussed further in the following section "Status of Assessment Programs."

WELLS NOT SAMPLED AS SCHEDULED

The wells listed in Table 2 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 2. Wells Not Sampled as Scheduled During the Reporting Period

Well	RCRA Site	Date Scheduled	Date Sampled	Comment
199-N-59	1324-N/NA	6/2005	--	Dry. Can only be sampled when water table high.
299-E33-9	WMA B-BX-BY		--	Restricted access; safety concerns.
299-E25-34	216-A-29 Ditch	4/11/2005	7/28/2005	Pump needed maintenance.
299-E28-21	WMA B-BX-BY	6/7/2005	7/28/2005	Pump not working
299-E28-27	LLWMA 1	6/6/2005	8/30/2005	Needed to reinstall pump.
299-E33-35	LLWMA 1	6/6/2005	7/11/2005	No water to surface.
299-W22-44	WMA S-SX	6/8/2005	7/7/2005	Pump intake above water; pump lowered.
299-W22-46	WMA S-SX	6/2005	--	Dry. Replaced by 299-W22-50.
299-W26-14	216-S-10 Pond	6/10/2005	8/1/2005	Electrical problem.

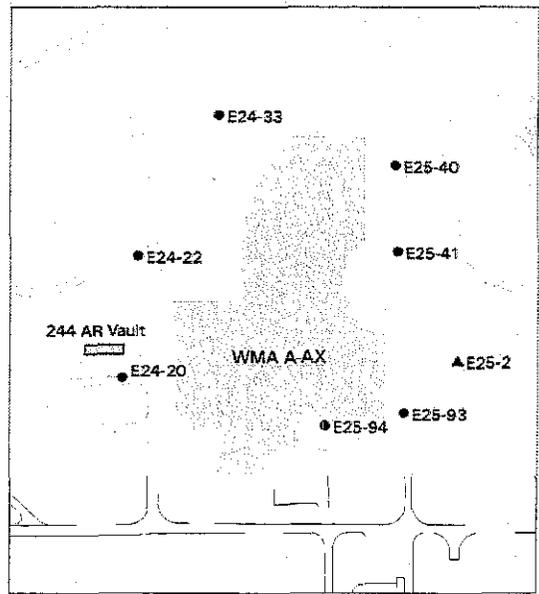
⁵ Upgradient/downgradient comparison value is the limit of quantitation, calculated from blanks data and excluding those blanks that had highly elevation concentrations of total organic halides.

STATUS OF ASSESSMENT PROGRAMS

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

Single-Shell Tank WMA A-AX. A draft assessment plan (Narbutovskih and Chou 2005) was prepared and sent for review to DOE, Ecology and contractors. The document will be distributed when all review comments have been received and resolved. Quarterly sampling is scheduled to begin December 2005.

The groundwater flow direction beneath WMA A-AX is toward the east-southeast to southeast, based on local water-level elevations and in situ flow measurements (Hartman et al. 2004). The aquifer is 27 meters thick, and although the water-table declines ~9 centimeters per year, there have been no changes in flow direction or rate at this site since the last annual groundwater report (Hartman et al. 2005) was published.



In downgradient well 299-E25-93, specific conductance (536 $\mu\text{S}/\text{cm}$) reflects elevated sulfate (93.8 mg/L), nitrate (39.8 mg/L) and calcium (61 mg/L). The drinking water standard for nitrate is 45 mg/L. However, nitrate concentrations also are elevated in upgradient well 299-E24-20 (50.5 mg/L). In addition sulfate concentrations upgradient are similar to those downgradient, with 90.7 mg/L in February 2005 and ~70 mg/L in June 2005 in upgradient wells. In recent years, there appears to be a regional increase in both sulfate and nitrate in parts of the 200 East Area. Because these constituents are elevated in upgradient wells, the high values of nitrate and sulfate found at this site may be associated with regional trends. Technetium-99 concentrations in the upgradient wells ranged from 697 pCi/L to 45.4 pCi/L during the reporting period (drinking water standard = 900 pCi/L). Downgradient, levels ranged from 15 pCi/L to 8,350 pCi/L for the quarter. Long-term trends in groundwater chemistry have not been established in the four recently installed wells, 299-E24-22, 299-E24-33, 299-E25-93 and 299-E25-94, with only a few months to less than two years of data collected since the wells were installed.

Two wells on the south side of WMA A-AX were decommissioned in 2004 because the casing above the screen was corroded. The groundwater chemistry at these wells historically showed elevated chromium, manganese, and nickel and low pH, with no corresponding radionuclide contamination. Recently, sampling results from another well, 299-E25-40, installed in 1989, show elevated chromium (34 $\mu\text{g}/\text{L}$ in a filtered sample). In November 2004, a borehole video survey confirmed that the casing and possibly upper screen are beginning to corrode in this well. In June 2005, analyses were made to compare the difference between filtered and unfiltered samples for chromium, manganese, nickel and iron. The results are presented in Table 3. The difference between the filtered and unfiltered values indicates there are particulates in the groundwater consistent with stainless steel corrosion. Eventually it may be necessary to replace this well as the corrosion progresses.

Table 3. Trace Metals in Well 299-E25-40, June 2005

Metal	Filtered (µg/L)	Unfiltered (µg/L)
Chromium	34	153
Manganese	166	177
Nickel	620	667
Iron	60.9	297

During the last year, coliform bacteria were found in the groundwater around WMA A-AX, with values ranging from 116 col/100mL to 24.6 col/100mL. Although not a tank-associated contaminant, the presence of these bacteria in the groundwater may indicate that liquid has migrated from near the surface to the groundwater in the vicinity. The specific source of the coliform bacteria is unknown.

Single-Shell Tank WMA B-BX-BY.

Based on in situ measurements, the groundwater is nearly stagnant in the north part of the WMA, flowing slowly to the southwest. Prior to Hanford operations, this region was dry, with the natural boundary between the aquifer and the basalt subcrop extending along a southeast/northwest line approximately through the BX and B Tank Farms. At the south boundary of the tank farms, the groundwater appears to flow toward the south-southeast and southeast with a faster flow rate. This southward flow direction is supported by comparing local hydrographs (Hartman et al. 2005) and time series mapping of nitrate data. However, there remains high uncertainty

regarding the groundwater flow conditions beneath this WMA. There has been no significant change in flow direction or rate since the last quarterly report. Well 299-E33-9, located in the BY Tank Farm has not been sampled since March 2004 due to tank farm safety issues, restricting access to the well.

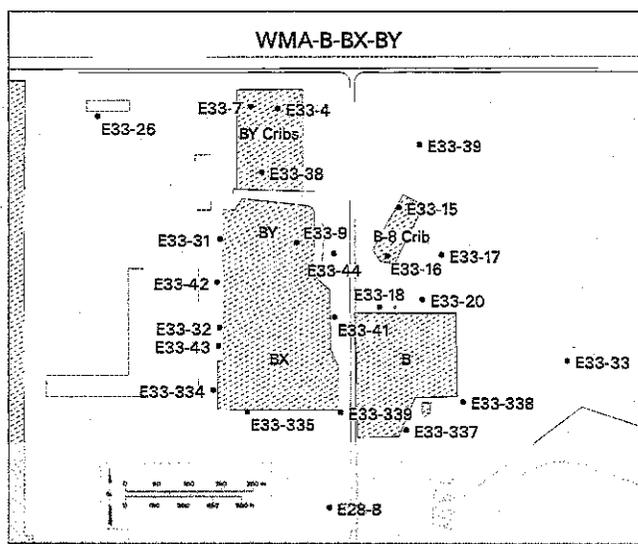


Table 4. Selected Contaminant Concentrations in Well 299-E33-4

Constituent	Units	May 2005	November 2004	Drinking Water Standard
Technetium-99	pCi/L	16,800	23,100	900
Nitrate	mg/L	1,890	1,590	45
Tritium	pCi/L	68,300	45,300	20,000
Cyanide	µg/L	376	757	200
Cobalt-60	pCi/L	132	200	100
Sulfate	mg/L	208	208	250 (secondary)
Uranium	ug/L	3.81	4.71	30

Technetium-99 concentrations decrease from north to south, but trends continue to increase sharply (Figure 1). For example, in well 299-E33-44, east of the BY Tank Farm, technetium-99 levels increased to 7,780 pCi/L May 2005. Technetium-99 concentrations tripled over the last three years, from 761 pCi/L to 2,590 pCi/L in well 299-E33-18 and from 87 pCi/L to 328 pCi/L in well 299-E33-20. Along the south boundary of the WMA, the technetium-99 level nearly quadrupled in the last 1.5 years.

Nitrate concentrations showed similar trends, with the highest values in the north at the BY Cribs, decreasing from north to south. In well 299-E33-44, nitrate levels more than doubled over the last two years from 178 mg/L to 428 mg/L (Figure 2). In well 299-E33-41, nitrate concentrations nearly doubled over the last three years, from 28 mg/L to over 52 mg/L. In well 299-E33-17, nitrate increased by 50 % from 186 mg/L to 278 mg/L. Along the south boundary of the WMA, the nitrate level doubled from 13.7 mg/L in 2000 to nearly 32 mg/L in 2005.

The uranium plume, centered on well 299-E33-9 in the BY Tank Farm, had a maximum concentration of 678 µg/L in 2001. During the past year, the uranium concentration in well 299-E33-44, located east the plume center, decreased from 350 µg/L to 252 µg/L. Farther south, uranium concentrations quadrupled in well 299-E33-18 from 88 µg/L in 2002 to 454 µg/L in February 2005. The level dropped to 314 µg/L in May. Conversely, the uranium concentrations to the north appear to be steady or decreasing slightly in well 299-E33-38 from 330 µg/L to 323 µg/L over the last year. However, the long-term trend continues to show increasing levels of uranium.

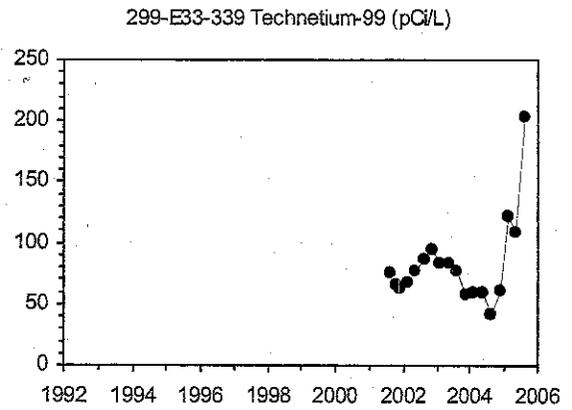
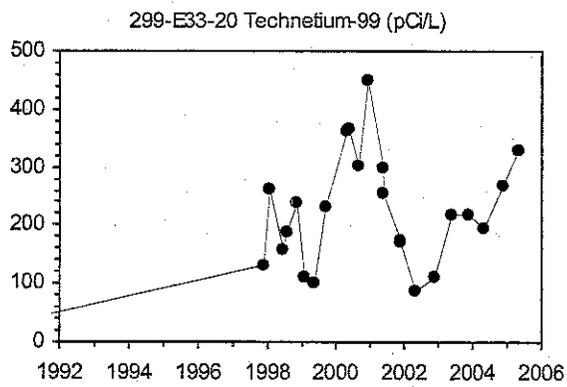
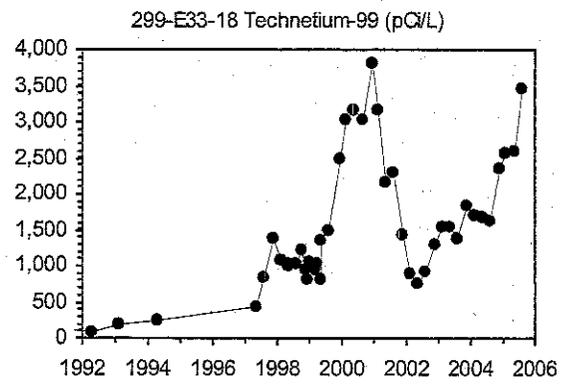
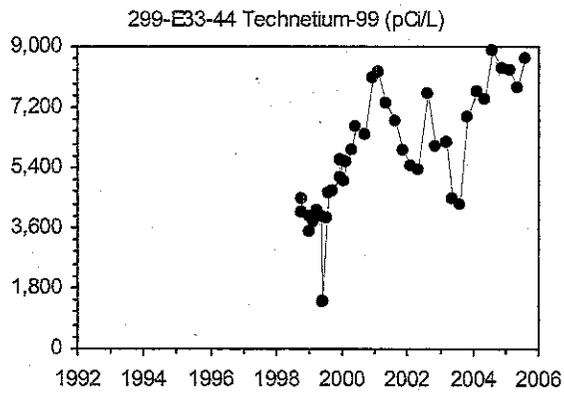


Figure 1. Technetium-99 Concentrations in WMA B-BX-BY Wells

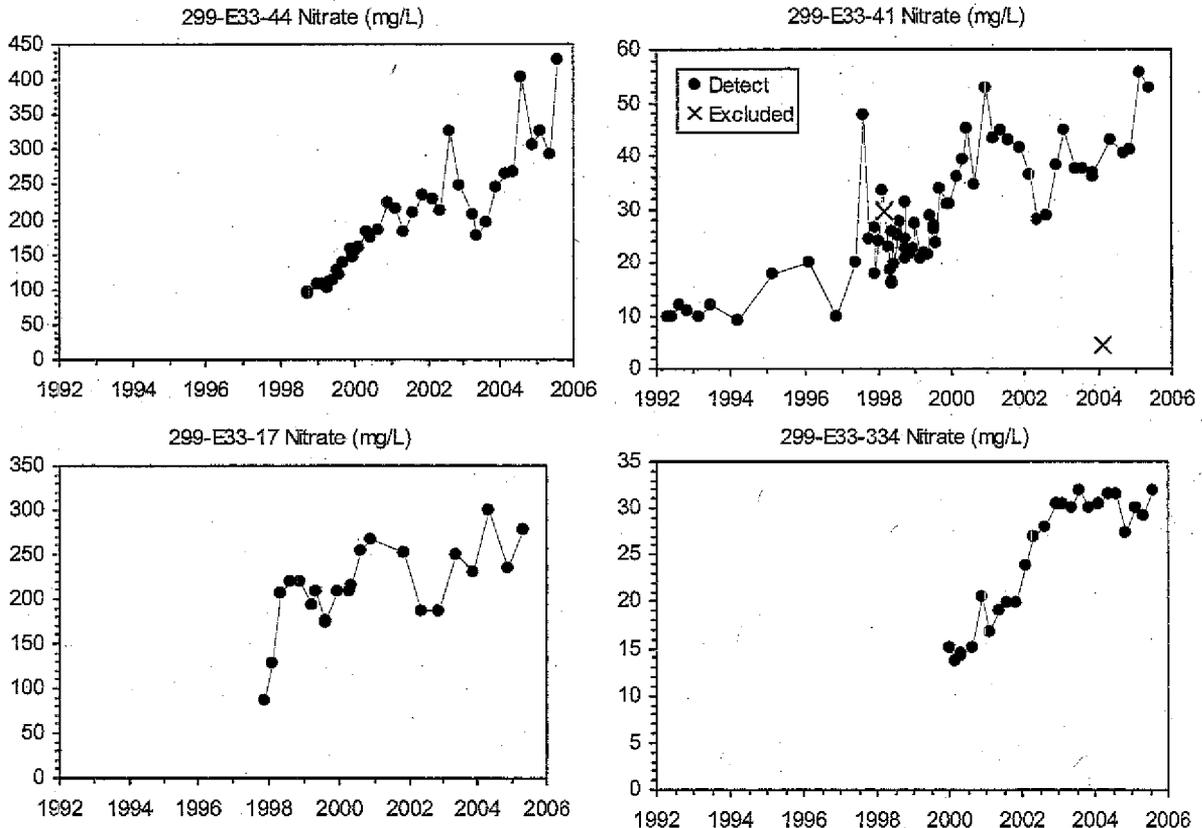
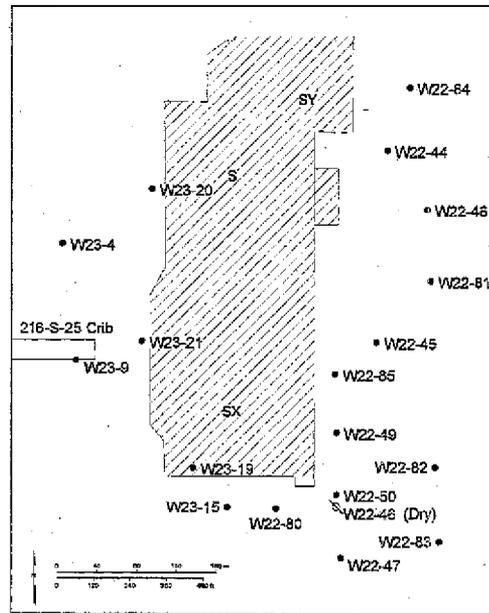


Figure 2. Nitrate Concentrations in WMA B-BX-BY Wells

Single-Shell Tank WMA S-SX. 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 WMA S-SX, but their sources are from upgradient facilities.

Water-level measurements during the quarter indicate that the water table has continued to decline at a steady rate of ~0.3 meter per year; this rate of decline has remained the same since about 2000. The gradient and flow direction are stable, with flow to the east over the general area of the WMA, based on water level and contaminant migration data. All water levels measured during the quarter were consistent with the falling water table trend. Well 299-W22-46 was not sampled during the quarter because the water level dropped below the pump intake, which was set at its lowest possible position in the well. There is less than 1 meter of water



left in the well. This situation was anticipated several years ago, and well 299-W22-50 was drilled ~15 meters to the north to replace the drying well. Well 299-W22-46 was removed from the monitoring network. Well 299-W19-44 was not sampled until early July, but the data were evaluated as part of this report.

Contaminant concentrations in the northern plume, with an apparent source in S Tank Farm, are on the decline. In recent past quarters, the plume had been expanding to the north in well 299-W22-44 as indicated by increasing concentrations of chromium, nitrate, and technetium-99. During this reporting quarter, concentrations of these three constituents decreased in well 299-W22-44, although the nitrate concentration decreased more than would be expected by the specific conductance and the charge balance and, therefore, is considered a suspect result. The defining constituents for this plume have decreased in concentration or remained at about the same levels. Chromium is well below the drinking water standard (100 µg/L) at ~20 µg/L, nitrate has fallen below the drinking water standard (45 mg/L) at ~38 mg/L, and technetium-99 remains at twice the drinking water standard (900 pCi/L) at ~1,800 pCi/L.

The contaminant plume migrating from the SX Tank Farm in the south portion of the WMA continued to spread downgradient as indicated by increasing concentrations of chromium and technetium-99 in farthest downgradient well 299-W22-83. The plume contains elevated concentrations of chromium, nitrate, and technetium-99. Chromium concentrations in the source area (represented by well 299-W23-19) increased again during the quarter by about 60% (Figure 3). The chromium concentration rose to 1,110 µg/L in June, an increase of 424 µg/L from the previous quarter, and is greater than 10 times the drinking water standard (100 µg/L). During this quarter, the technetium-99 concentration in well 299-W23-19 increased by 85% from ~69,000 pCi/L to ~128,000 pCi/L (Figure 3). Specific conductance correlates closely with technetium-99 levels. Specific conductance, and by inference, technetium-99, increased steadily during the reporting period between sampling events (Figure 4).

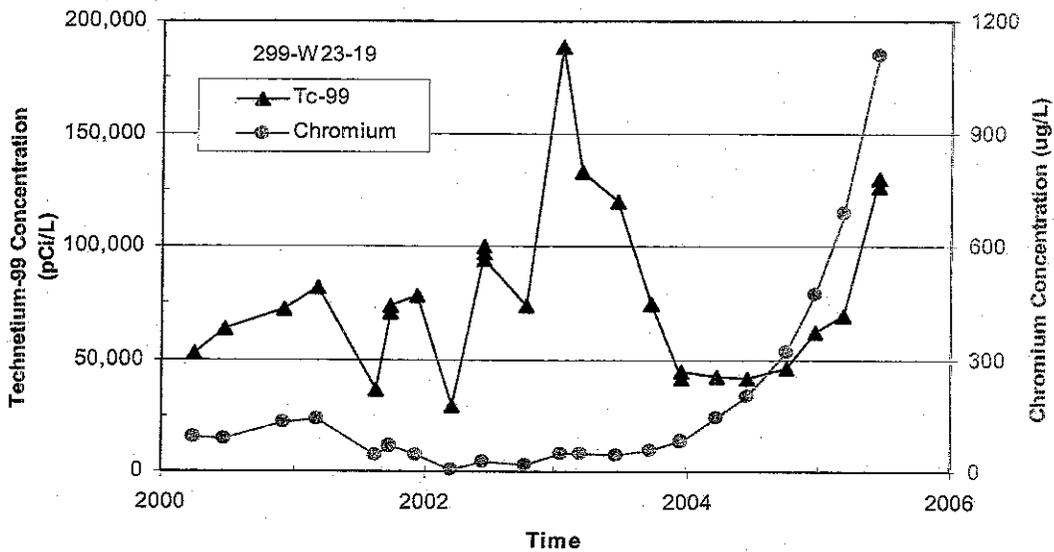


Figure 3. Technetium-99 and Chromium Concentrations in Well 299-W23-19

299-W23-19 Specific Conductance - Fiscal Year 2005

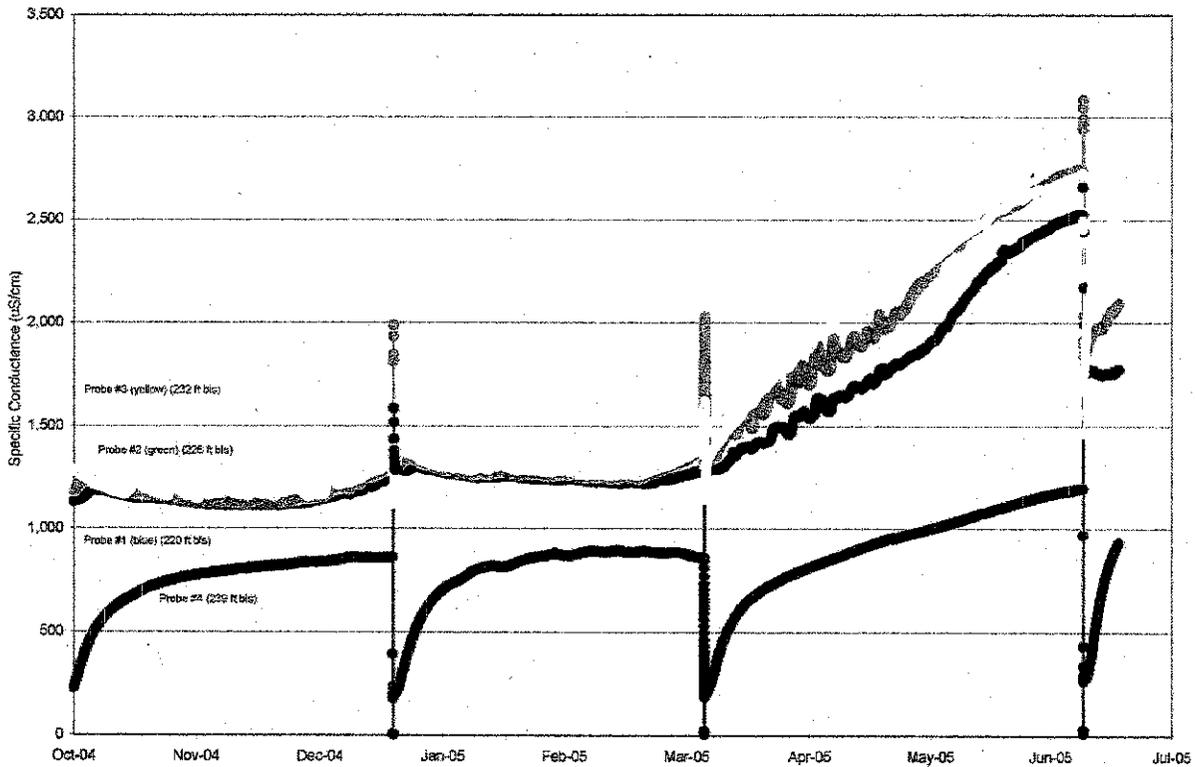


Figure 4. Specific Conductance in Well 299-W23-19 During FY 2005

As reported last quarter, concentrations of contaminants in downgradient regions of the south plume have peaked in well 299-W22-50 and continued to increase in well 299-W22-83 (Figure 5). In the mid-plume area (as represented by well 299-W22-50), both technetium-99 and chromium concentrations have stabilized. On the distal margin of the plume (as indicated by well 299-W22-83), technetium-99 and chromium concentrations continued to increase so that in June their concentrations were higher than in well 299-W22-50. Data for well 299-W22-82 are included in Figure 5 to show that the plume is limited on the north as indicated by the relatively low concentrations of technetium-99 and chromium in the well. Data for well 299-W22-47 are presented to show that the plume is present at higher concentrations south of well 299-W22-50, indicating that the plume axis may be farther south than previously thought.

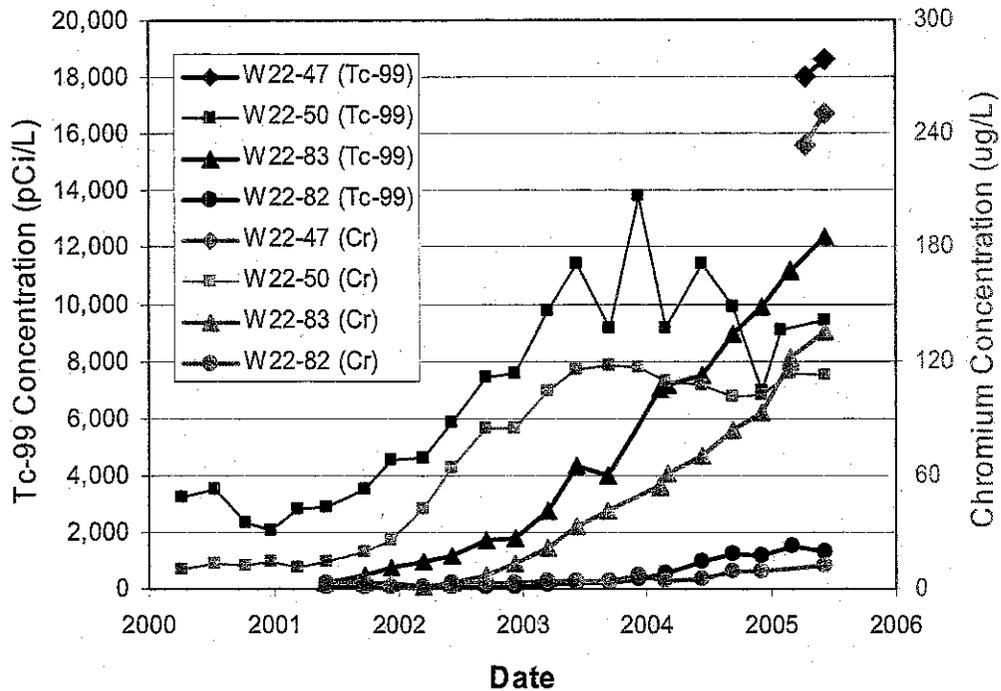
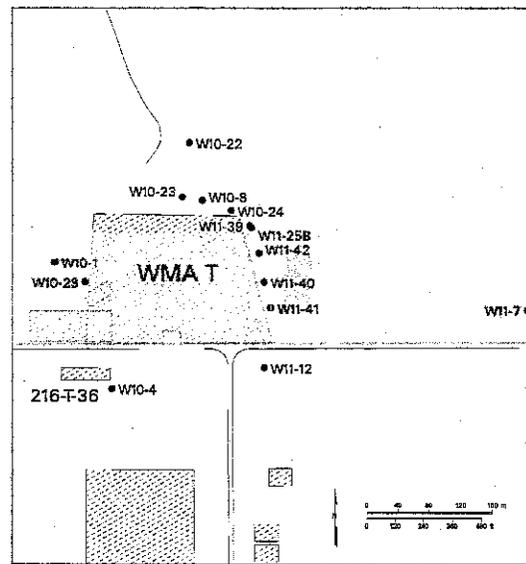


Figure 5. Technetium-99 and Chromium in Downgradient Wells at WMA S-SX.

Single-Shell Tank WMA T. Water levels in wells near WMA T continued to decline during the reporting period. The measured amount of decline during the past year was between 0.3 and 0.4 meter. Groundwater flow direction at WMA T is between east-northeast and east-southeast at a rate of ~0.003 to 0.03 meter per day. All wells in the monitoring networks at WMA T were successfully sampled during the reporting period.

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 and tritium, non-RCRA-regulated constituents, are found in groundwater at the WMA.



Chromium concentrations exceeded the drinking water standard (100 µg/L) in five wells at WMA T in May. The plume exceeding the drinking water standard extends to wells both upgradient and

downgradient of the WMA. Although concentrations of chromium have changed slightly in some wells since the previous quarter, the overall extent of the plume remains unchanged. However, the lack of wells downgradient of the wells just east of the WMA T boundary precludes detailed evaluation of the extent of the plume to the east.

The highest chromium concentrations were in wells 299-W10-4, located south of the southwest corner of the WMA, and in 299-W10-28 located upgradient of the WMA (Figure 6). The concentration of chromium in well 299-W10-4 was 685 $\mu\text{g/L}$. Chromium concentrations have been increasing in this well since 1997 but the concentration has more than doubled during the past two years. The concentration of chromium in well 299-W10-28 in May was 258 $\mu\text{g/L}$. The concentrations of chromium in this well were generally increasing since the well was drilled at the end of 2001 until May 2004, when concentrations began to decrease slightly (see Figure 6).

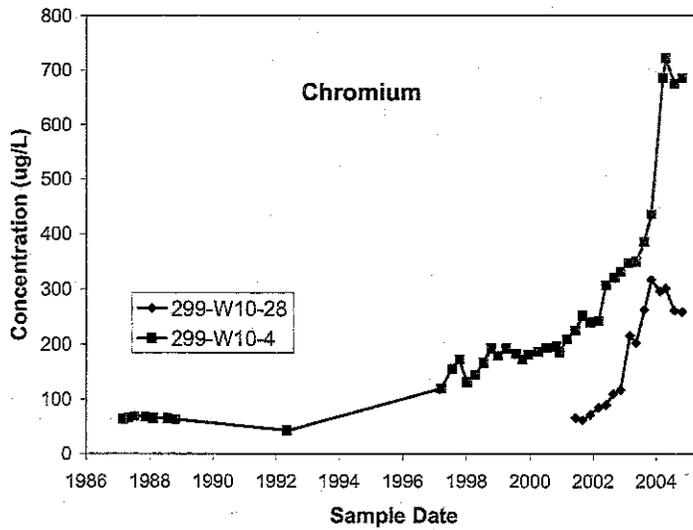


Figure 6. Chromium Concentrations in Wells 299-W10-4 and 299-W10-28 at

Chromium concentrations exceeded the drinking water standard in three downgradient wells at WMA T (Figure 7). The highest concentration was 176 $\mu\text{g/L}$ in well 299-W11-42, essentially unchanged from the previous quarter. Chromium concentrations in this well and in well 299-W11-41 have increased steadily, but slowly, since about mid 2002.

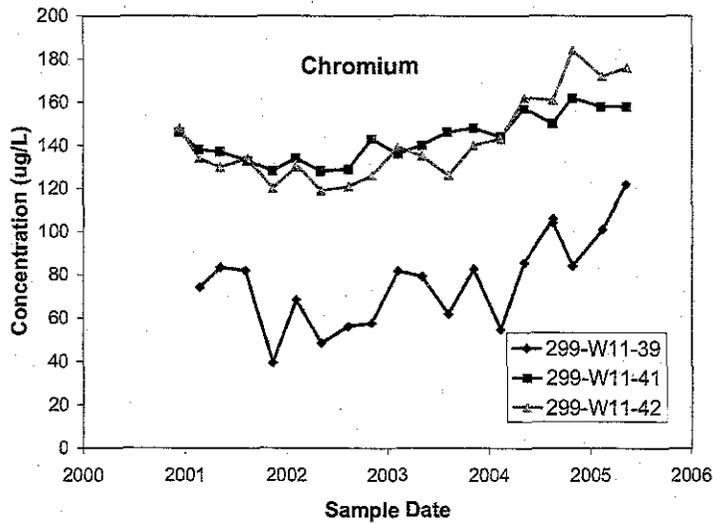


Figure 7. Chromium Concentrations in Selected Downgradient Wells at WMA T

There is a local, high nitrate plume beneath WMA T and within the regional 200 West Area plume. Although the nitrate concentrations remained above the drinking water standard (45 mg/L) in all wells in the WMA T network during the reporting period, the local, high nitrate plume exceeds ten times the drinking water standard. The highest concentration of nitrate was in well 299-W10-4, where it increased from 2,420 mg/L in February 2005 to 3,090 mg/L during the reporting period (Figure 8). This is a substantial increase over the previous quarter's concentration. The concentrations of most major cations and anions also have undergone large increases in this well during the last couple of years. The specific reason for the increases is not known.

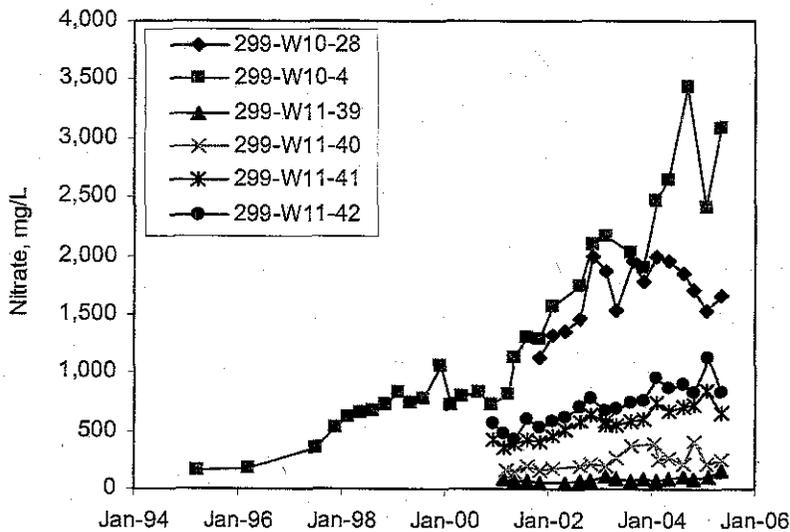


Figure 8. Nitrate Concentrations in Selected Wells AT WMA T

Nitrate concentrations in downgradient monitoring wells during the reporting quarter remained fairly constant or increased slightly from the previous quarter (see Figure 8). Concentrations in downgradient wells were between 157 mg/L (well 299-W11-39) and 832 mg/L (well 299-W11-42). There does not appear to be any significant change from the previous quarter in the extent of the nitrate plume beneath WMA T. However, the eastern extent of the plume is not well defined with the existing monitoring well network.

Fluoride concentrations exceeded the drinking water standard of 4 mg/L in two wells at WMA T during the reporting period. These were well 299-W10-23, in which the fluoride concentration was essentially unchanged from the previous quarter at 4.5 mg/L, and well 299-W10-4 in which the fluoride concentration increased from 3.6 mg/L in November 2004 to 4.1mg/L in May 2005 (the February 2005 fluoride concentration of 10.5 mg/L is probably not a good analytical result and has been flagged in the database). In addition, the fluoride concentration exceeded the 2 mg/L secondary standard in 5 other wells at WMA T in May. The fluoride concentration in one of these wells, well 299-W10-8, had been above the primary drinking water standard in November 2004 but has subsequently decreased to below 4 mg/L in May 2005. The source of fluoride has not been identified.

There is a technetium-99 plume downgradient of WMA T. The lateral extent of the plume is not known because of the lack of wells east of the existing downgradient wells. The greatest technetium-99 concentration was 27,400 pCi/L in well 299-W11-39, which is more than double the previous concentration of 12,200 pCi/L in February 2005 (Figure 9). Although the technetium-99 concentration in well 299-W11-39 has been fairly erratic during the past 2 to 3 years, the current technetium-99 concentration is generally on the long-term trend for well. However, the technetium-99 concentration will be watched closely during the next quarter to determine whether the extreme concentration increase in May remains on trend and is representative of the groundwater in the well.

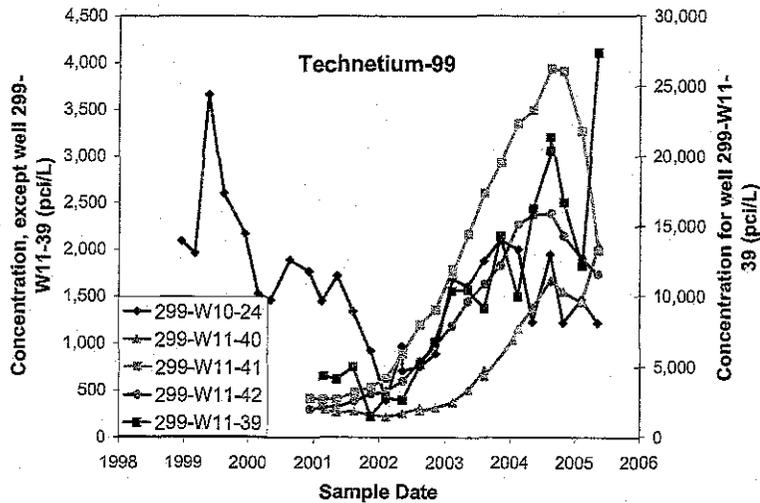


Figure 9. Technetium-99 Concentrations in Selected Wells Monitoring WMA T

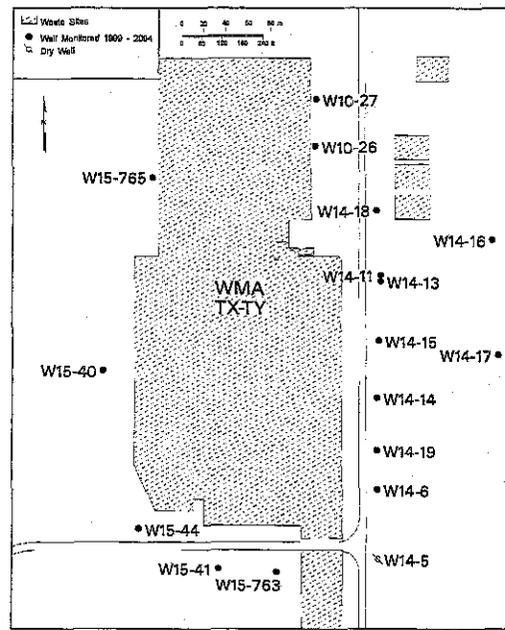
The concentrations of technetium-99 in downgradient wells 299-W11-41 and 299-W11-42 decreased in May (see Figure 9). This was the second consecutive quarter that the technetium-99 concentration decreased in the two wells.

Tritium exceeded the drinking water standard of 20,000 pCi/L in well 299-W11-12 at WMA T during the reporting period. The tritium concentration was 41,600 pCi/L in May, down slightly from 47,400 pCi/L during the previous quarter. The tritium concentration generally has been decreasing slightly since the well was first regularly sampled for tritium in late 1998.

Finally, the pH of the May 2005 sample from well 299-W10-24 equaled the drinking water standard of 8.5. The pH of samples from this well generally exceeds the drinking water standard by a small amount and the reason for the exceedance is not known.

Waste Management Area TX-TY. Water-level measurements in wells near WMA TX-TY showed between ~0.1 and 0.8 meter decline in the water table during the past year. However, the water levels in many wells at the WMA are perturbed by the 200-ZP-1 pump-and-treat system. The groundwater flow direction at WMA TX-TY varies from the north to the south part of the WMA. In the north, groundwater flow is east to southeast at a rate of ~0.001 to 0.1 meter per day. In the south, where groundwater flow has been greatly altered by the 200-ZP-1 pump-and-treat system, flow direction is to the south or south-southwest at ~0.3 meter per day.

All wells in the monitoring network at WMA TX-TY were successfully sampled during the reporting period. One new well, well 299-W14-11, was added to the monitoring network and the first routine, quarterly sample was collected in May 2005. Well 299-W14-11 is paired with already existing well 299-W14-13 and is screened between 11.3 and 14.3 meters below the May 2005 water table or 2.7 to 5.8 meters below the bottom of the screened interval in adjacent well 299-W14-13.



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 exceeded the drinking water standard (100 µg/L) in well 299-W14-13 at WMA TX-TY. The chromium concentration in that well was 621 µg/L during the reporting quarter, down from 768 µg/L the previous quarter. Chromium concentrations generally had been increasing in the well since May 2001. The nearest well to the south, 299-W14-15, also has elevated chromium (76.4 µg/L during the reporting quarter), but concentrations have never exceeded the drinking water standard. Wells north and

east of well 299-W14-13 show chromium concentrations near the detection limit. The most likely source for the chromium at WMA TX-TY is the WMA itself and/or the nearby TY cribs.

Nitrate continued to exceed the drinking water standard (45 mg/L) in all wells in the WMA TX-TY monitoring network during the reporting quarter. The highest nitrate concentration was found in well 299-W14-13 in the central part of the east side of the WMA. (Higher nitrate concentrations were found in samples collected during drilling of well 299-W14-11. Drilling related samples are discussed separately below.) The nitrate concentration in well 299-W14-13 was 351 mg/L in May 2005, compared to 474 mg/L 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 WMA TX-TY.

Manganese exceeded the secondary drinking water standard (50 µg/L) in wells 299-W10-27, and 299-W14-11 in May 2005. The manganese concentration in well 299-W14-11 was 61.2 µg/L. Well 299-W14-11 is a new well and the manganese concentration is commonly elevated in the first few samples collected from new wells. The manganese concentration was 235 µg/L in May in well 299-W10-27, up from 107 µg/L in February 2005. This well has a history of high manganese concentrations. Manganese concentrations have been decreasing since the well was drilled in August 2001, at which time the manganese concentration was 862 µg/L. Manganese concentrations in the well will be watched closely during the next quarter to determine whether the increase is a one-time fluctuation or represents a longer term trend.

Iodine-129 exceeded the drinking water standard (1 pCi/L) in two wells at WMA TX-TY in May 2005: 299-W14-13 and 299-W14-11 (discussed separately below). The concentration of iodine-129 in well 299-W14-13 was 16.5 and 11.2 pCi/L (duplicate samples), down from 26.1 pCi/L during the previous quarter (Figure 10). The iodine-129 concentration has fluctuated between 9.7 and 50 pCi/L since the well was drilled in late 1998.

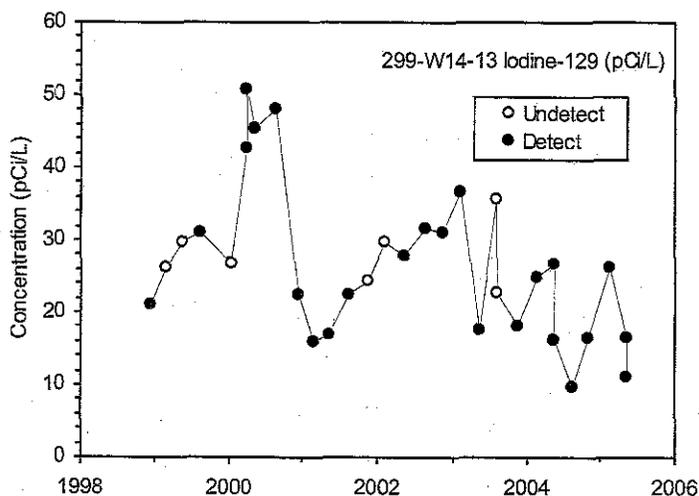


Figure 10. Iodine-129 Concentration in Well 299-W14-13 at WMA TX-TY

The concentration of technetium-99 was 6,520 pCi/L in well 299-W14-13 during May 2005, down slightly from 6,970 pCi/L in February. Technetium-99 concentrations have been greater than the drinking water standard (900 pCi/L) since the well was drilled in 1998 and generally increased with time until August 2004 when the concentration began to decrease. The technetium-99 plume is small and exceeds the drinking water standard only in well 299-W14-13, although concentrations had been increasing in well 299-W14-18, north of 299-W14-13, until August 2004.

Tritium exceeded the drinking water standard (20,000 pCi/L) in two downgradient wells at WMA TX-TY: 299-W14-13 and 299-W14-11. The tritium concentration was 1,180,000 pCi/L in well 299-W14-13 in May 2005, essentially unchanged from the previous quarter. The tritium concentration in well 299-W14-11 is discussed below.

Well 299-W14-11 was drilled during April and May 2005 at WMA TX-TY. The well is located ~3 to 4 meters from existing well 299-W14-13. The well was sampled during drilling by purge-and-pump methods at 6-meter intervals from the water table to 120 meters below the water table and by air lift methods at 1.5-meter intervals between the pumped samples. The samples were analyzed for nitrate, chromium, iodine-129, technetium-99, and tritium.

Figures 11 through 15 show the vertical distribution of several contaminants in well 299-W14-11 as determined from samples collected during drilling. Figure 11 shows the distribution of chromium with depth in the aquifer in well 299-W14-11; red points on the figure represent pumped samples and blue points represent air lifted samples. The highest chromium concentration was ~ 80 $\mu\text{g/L}$ at 12.8 meters below the water table. During drilling of well 299-W11-25B at WMA T, it was found that hexavalent chromium in the air lifted samples was reduced to trivalent during the time that the groundwater sat in contact with the fresh drill cuttings. In an attempt to overcome this problem, an aliquot of each air lifted sample from well 299-W14-11 was removed from contact with the drill cuttings as soon as possible after the sample was collected. The resulting data were mostly non-detects, suggesting that the hexavalent chromium was reduced to trivalent chromium despite removing the sample from the drill cuttings. Therefore, only chromium data from the pumped samples can be considered representative (red points on Figure 11). For comparison, the chromium concentration in the routine, May sample from the screened interval of adjacent well 299-W14-13 was 621 $\mu\text{g/L}$.

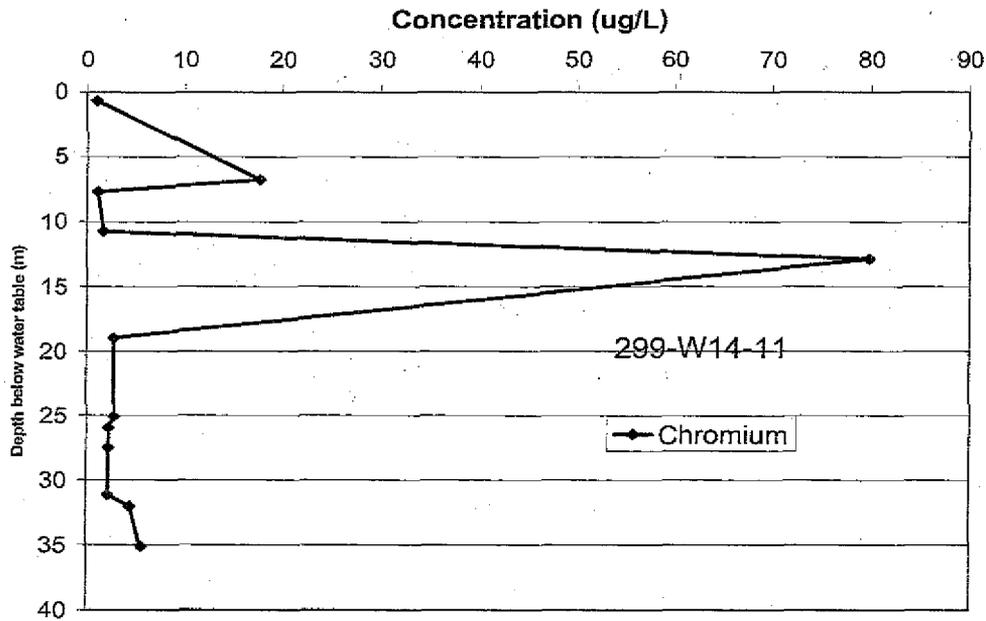


Figure 11. Chromium Concentration versus Depth in the Aquifer at Well 299-W14-11. Blue points are air lifted samples; red points are purge and pump samples.

Figure 12 shows the iodine-129 concentration versus depth below the water table in the aquifer at well 299-W14-11. All data are from pumped samples except the shallowest sample from 0.7 meter below the water table, which was air lifted. All iodine-129 concentrations from samples deeper than 25 meters below the water table were non-detect and are not shown on the Figure 12. The figure shows that the concentration of iodine-129 decreases with depth in the aquifer. Samples collected deeper than 25 meters below the water table yielded non-detectable concentrations. Note that the concentration of iodine-129 exceeds the 1 pCi/L drinking water standard to a depth of ~25 meters below the water table.

Figure 12 also shows the screened interval depths for wells 299-W14-11 and 299-W-14 13 and the latest iodine-129 concentration in the sample pumped from the screened interval. Based on the concentration versus depth curve for well 299-W14-11, the latest pumped sample from well 299-W14-13 yielded a lower than expected concentration.

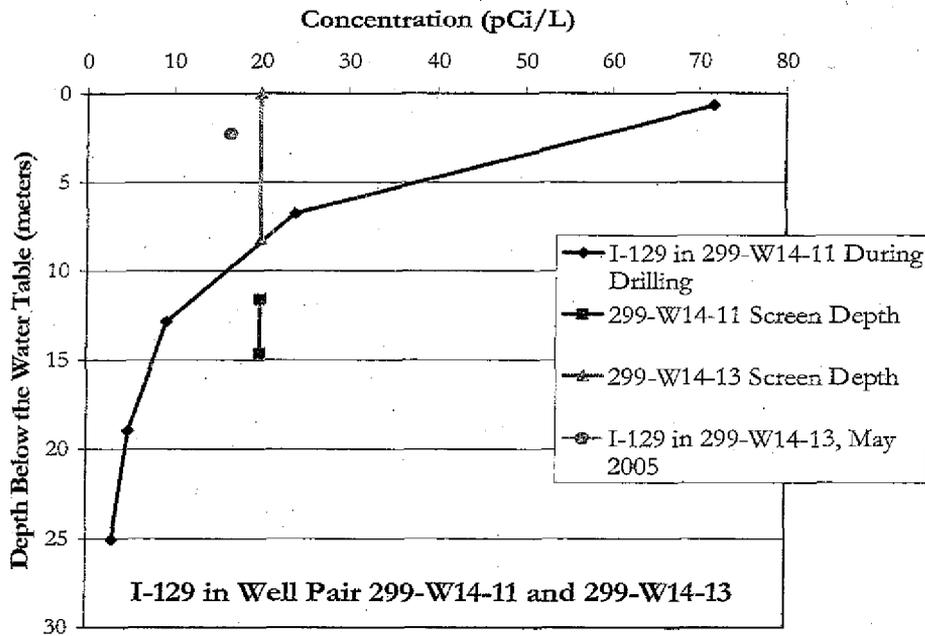


Figure 12. Iodine-129 Concentration versus Depth in the Aquifer at Well 299-W14-11. Also shown are the depths of the screened intervals in well 299-W14-11 and 299-W14-13 and the iodine-129 concentrations from May 2005 samples pumped from the screened intervals.

Nitrate concentrations versus depth in well 299-W14-11 are shown in Figure 13. The figure also shows the latest nitrate concentrations in pumped samples from wells 299-W14-11 and 299-W14-13. The nitrate concentration decreased from about 600 mg/L near the water table to between 100 and 200 mg/L below 12.2 meters depth in the aquifer. The figure also shows that the nitrate concentrations in the latest pumped samples from wells 299-W14-11 and 299-W14-13 were near what was expected based on the concentration versus depth curve. The pumped samples represent concentrations integrated over the entire screened interval, weighted by the relative permeability of aquifer strata across that interval.

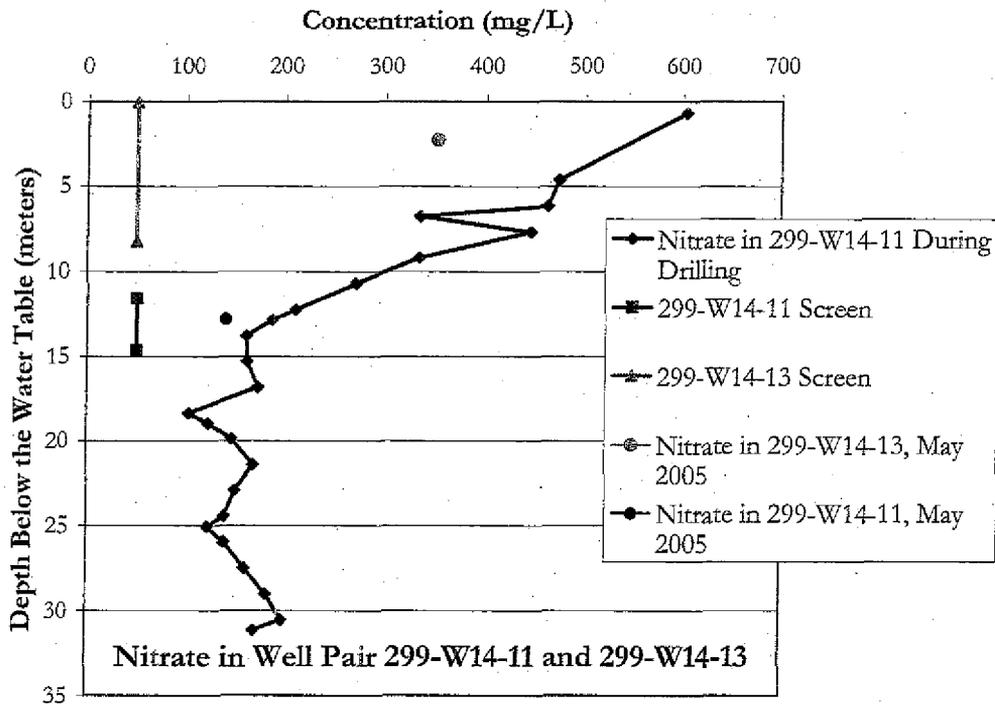


Figure 13. Nitrate Concentration versus Depth in the Aquifer at Well 299-W14-11. Also shown are the depths of the screened intervals in well 299-W14-11 and 299-W14-13 and the nitrate concentrations from May 2005 samples pumped from the screened intervals.

Technetium-99 concentrations versus depth in well 299-W14-11 are shown in Figure 14 along with the technetium-99 concentrations from the May 2005 pumped samples from wells 299-W14-11 and 299-W14-13. Those data show that the pumped values for technetium-99 corresponded fairly well with the technetium-99 versus depth curve; the pumped samples represent concentrations integrated over the entire screened interval, weighted by the relative permeability of aquifer strata over that interval. The maximum technetium-99 concentration found during drilling of well 299-W14-11 was 7,532 pCi/L at 4.6 meters below the water table. The technetium-99 concentration consistently exceeded the drinking water standard (900 pCi/L) to near 20 meters depth in the aquifer.

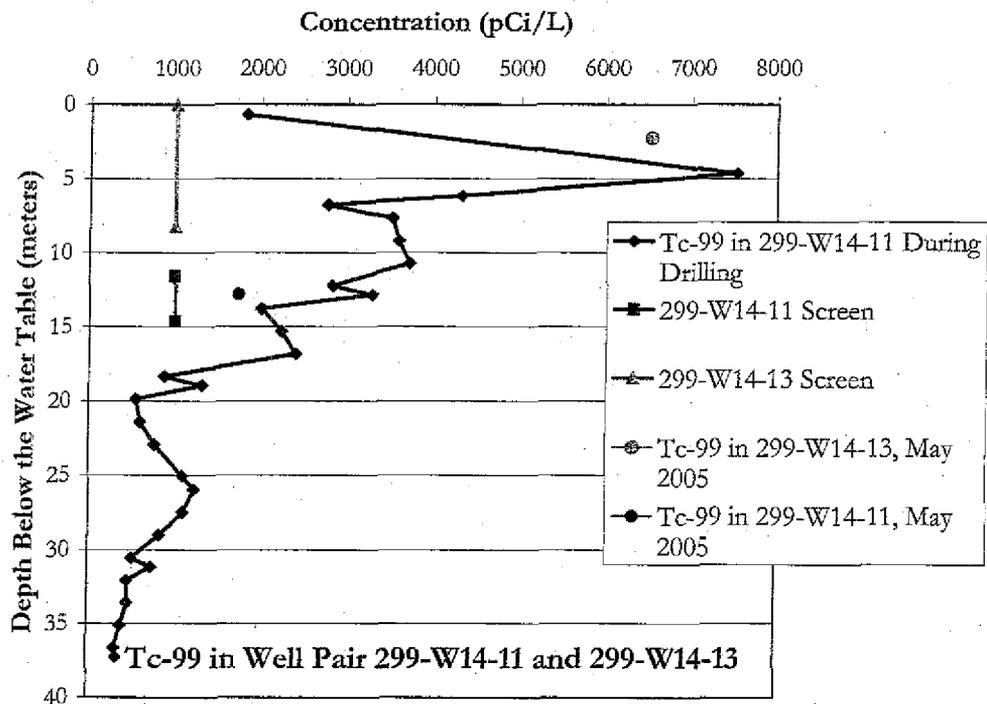


Figure 14. Technetium-99 Concentration versus Depth in the Aquifer at Well 299-W14-11. Also shown are the depths of the screened intervals in well 299-W14-11 and 299-W14-13 and the technetium-99 concentrations from May 2005 samples pumped from the screened intervals.

Finally, Figure 15 shows tritium concentrations versus depth in well 299-W14-11 along with the tritium concentrations from the May 2005 pumped samples from wells 299-W14-11 and 299-W14-13. Those data show that the pumped values for tritium corresponded very well with the tritium versus depth curve. The data for tritium are interpreted like those for the other constituents. That is, the pumped concentrations represent concentrations integrated over the entire screened interval, weighted by the relative permeability of aquifer strata over that interval. The highest tritium concentration was 2,150,000 pCi/L near the water table and concentrations decreased with depth in the aquifer.

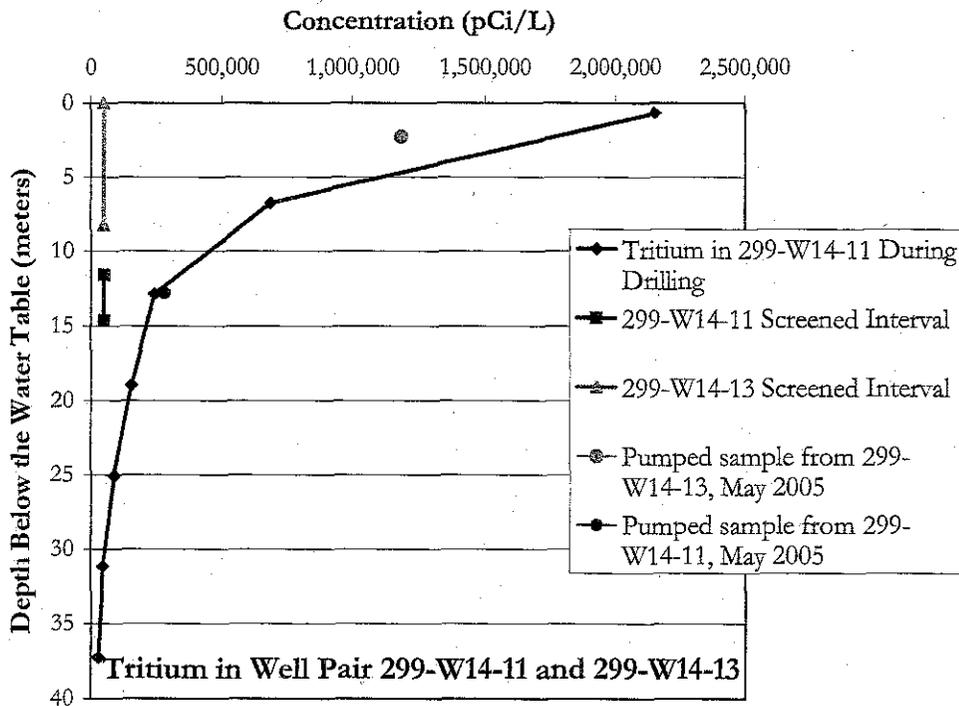
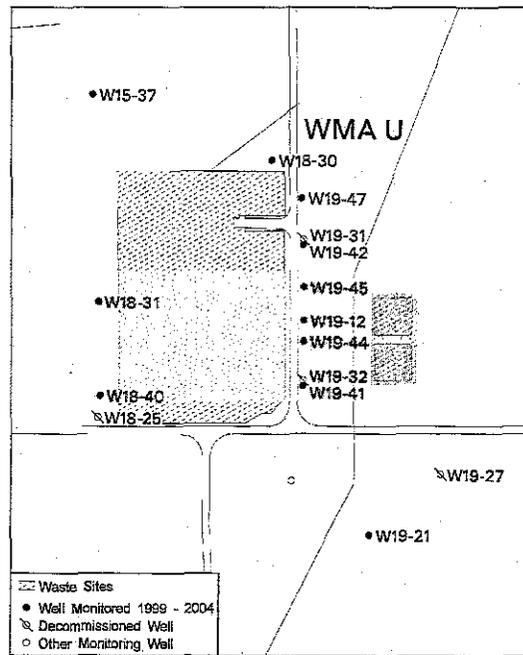


Figure 15. Tritium Concentration versus Depth in the Aquifer at Well 299-W14-11. Also shown are the depths of the screened intervals in well 299-W14-11 and 299-W14-13 and the tritium concentrations from May 2005 samples pumped from the screened intervals.

Single-Shell Tank WMA U. This WMA, which has been in assessment monitoring since 1999, has affected groundwater quality with elevated concentrations of chromium, nitrate, and technetium-99. The water table continued to decline during the reporting quarter at a rate of ~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.

In the past several years, chromium concentrations have decreased to near the detection limit so that now all reported chromium concentrations are less than 10 µg/L and qualified with a “B” qualifier, which indicates that the concentration was estimated at a level greater than the instrument detection limit but



less than the contract required detection limit. 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 is also 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.

Technetium-99 and nitrate trends remained the same as reported previously. These constituents are present beneath the WMA apparently from three sources. Figure 16 shows the nitrate/technetium-99 ratios for selected wells and tanks associated with WMA U. The tanks identified in the figure are the four tanks that are suspected or confirmed leakers, and the data reflect the approximate ratios for the tank contents. If one of the tanks is the source of contamination found in the groundwater, the ratio should be the same in the groundwater and the tank because nitrate and technetium-99 are assumed to be non-retarded and both would be diluted equally. When the WMA was first placed in assessment monitoring, the chemistry of water in well 299-W19-41 appeared to be on the dilution path for a waste source in either of two nearby tanks U-101 and U-104. Over time, the nitrate/technetium-99 ratios for water collected in well 299-W19-41 trended upward as shown in Figure 16, indicating that the source of contamination found in the well was changing and the source was not that of one of the tanks. The reason for the changing ratios was because nitrate concentrations continued to rise while technetium-99 concentrations fell. At the same time, the constituent ratios for water collected in well 299-W19-45 trended down to the levels that would suggest a possible tank source. This trend occurred because of rapidly increasing technetium-99 concentrations.

The third source of contamination is from source(s) upgradient (west) of the WMA. The major population of data representing this source is within the oval in Figure 16. This source is characterized by negligible technetium-99, much lower than in wells on the downgradient side of the WMA, and increasing concentrations of nitrate, but at levels at about half the drinking water standard.

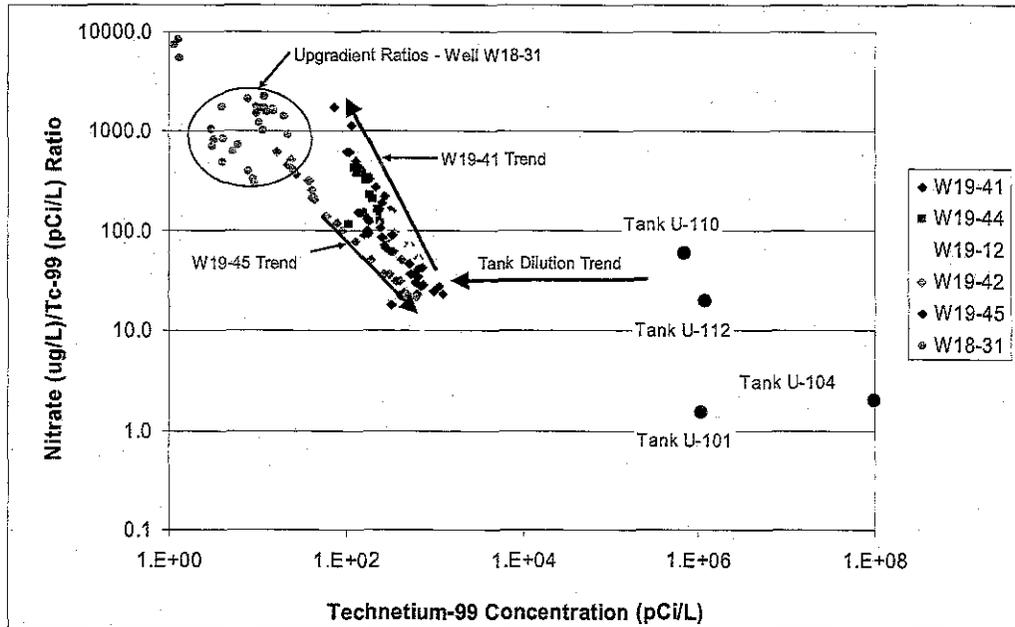
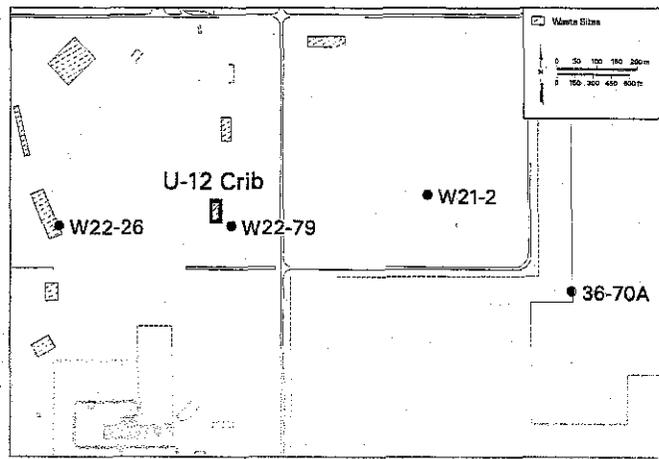


Figure 16. Nitrate/Technetium-99 Ratios Associated with WMA U

216-U-12 Crib. The groundwater monitoring network for this crib was recently revised (Williams and Chou 2005; effective September 2005), updating the network from two to four wells, including one upgradient well (299-W22-26), and three downgradient wells (299-W22-79, 699-36-70A, and 299-W21-2). The site is in assessment for elevated specific conductance, and nitrate and is sampled quarterly.



In May 2005, DOE requested that the 216-U-12 crib be administratively closed, following an interview of a former process engineer and review of waste disposal records for the unit. Two draft Tri-Party Agreement (Ecology et al. 1989) change requests to reclassify the crib as a past-practice unit are currently out for public comment until November 21, 2005. 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.

For downgradient well 299-W22-79, specific conductance and nitrate decreased in June, continuing a declining trend. Specific conductance was measured at 283 μ S/cm and nitrate was measured at ~23 mg/L, remaining below the 45 mg/L drinking water standard.

For downgradient well 699-36-70A, specific conductance remained the same in June 2005 and nitrate decreased slightly from the March results. Specific conductance was $\sim 477 \mu\text{S}/\text{cm}$ and nitrate decreased to $\sim 58.4 \text{ mg}/\text{L}$ from $96.1 \text{ mg}/\text{L}$ in March, remaining above the $45 \text{ mg}/\text{L}$ drinking water standard.

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 and vicinity at ~ 0.3 meter per year as the regional water table drops.

PUREX Cribs (216-A-10, 216-A-36B, and 216-A-37-1). All 11 of the near-field network wells were sampled during the reporting quarter (April through June 2005). Water levels were measured at each well at the time of sampling. Nitrate concentrations continued to exceed the drinking water standard ($45 \text{ mg}/\text{L}$) in one or more of the wells sampled. Radioactive constituents exceeding drinking water standards included iodine-129, strontium-90, gross beta, and tritium.

Beneath the PUREX cribs, the differences in water-table elevations from well to well are very small. Typically, the elevation difference between the lowest and highest levels is about 0.2 meter. During the reporting period the greatest water-level difference was 0.2 meter over the distance from well 699-37-47A to 299-E25-19 (a distance of about 830 meter). Therefore, the water-table gradient is too low to determine groundwater flow rate or flow direction reliably. However, the movement of groundwater contaminant plumes indicates that regional groundwater flow is toward the southeast.

Nitrate was reported at levels greater than the drinking water standard ($45 \text{ mg}/\text{L}$) at the wells monitoring the 216-A-36B and 216-A-10 cribs. The highest level during the reporting period was $103 \text{ mg}/\text{L}$ at well 299-E17-14, located near the 216-A-36B crib. At this well the trend was generally upward (since 2001) except for the last three reported values ($108, 106,$ and $103 \text{ mg}/\text{L}$) (Figure 17). Five of the six wells at the 216-A-10 and 216-A-36B cribs that have nitrate results exceeding the drinking water standard have trends that are increasing overall starting in 1996 to 2002. The reason for these increases is not known, but perhaps the end of liquid waste discharges at B Pond has caused shifting of the groundwater flow patterns in the southeastern part of the 200 East Area such that higher concentrations of nitrate in the aquifer are now flowing through the area beneath the two cribs. Another possible scenario is that increasing amounts of nitrate are entering the aquifer from the overlying vadose zone from various sources.

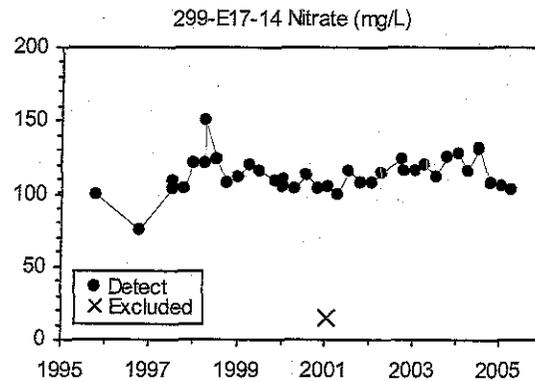
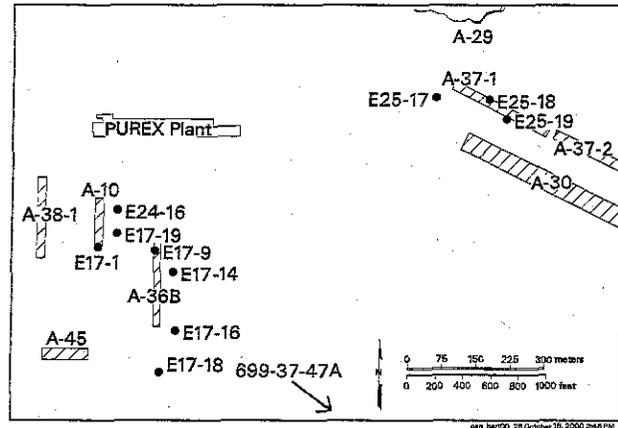


Figure 17. Nitrate at Well 299-E17-14.

Iodine-129 exceeded its drinking water standard (1 pCi/L) at six of the network wells, including representatives at all three of the cribs. The highest reported level was 6.7 pCi/L at well 299-E24-16, which is located near the 216-A-10 crib. The trend for iodine-129 in this well is relatively steady. In the other five wells with iodine-129 exceeding the drinking water standard, the trends are either holding steady or decreasing slightly.

Gross beta and strontium-90 (a beta-emitter) remained elevated at well 299-E17-14. Both exceeded their respective drinking water standards (50 and 8 pCi/L). The reported concentration of gross beta during the reporting period was 54.4 pCi/L and strontium-90 was 18.2 pCi/L. Although both constituents showed slightly upward trends prior to 2000, more recent results indicate that the trends have stabilized.

Tritium exceeded its drinking water standard (20,000 pCi/L) at nine of the network wells during the reporting quarter. Groundwater samples from four of the wells exceeded the drinking water standard by more than a factor of 10. The highest concentration was 459,000 pCi/L at well 299-E17-19 near the 216-A-10 crib. The trend in this well has been decreasing since 2001. However, at well 299-E24-16 (also near the 216-A-10 crib) the latest result was 324,000 pCi/L, and the trend has been slightly increasing since 2002. The only other network well showing an increase in tritium level was well 699-37-47A (located near the southeast corner of the 200 East Area). It has been increasing in concentration since 2000.

QUALITY CONTROL

Highlights of the groundwater project's quality control (QC) program for April to June 2005 are summarized below. 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.

- Due to missed holding times, 274 results were flagged with an H. Nitrate, nitrite, and volatile organic compounds account for most of the flagged results.
- The problem with elevated aluminum results at many sites continued this quarter. Aluminum results by the method used (EPA Method 6010; EPA 1986) do not appear to be reliable at the low levels found in most of the groundwater samples. A more sensitive method (EPA Method 6020; EPA 1986) will be used in the future for any samples in which aluminum is a constituent of concern.
- Total organic halides quadruplicates and field trip blanks have had a large number of out-of-limit results. A review of method blank and laboratory control sample results did not indicate a performance problem. To resolve this anomaly, a special set of performance evaluation samples has been planned for submittal to Severn Trent Laboratories, Inc. (STL) St. Louis and the Waste Sampling and Characterization Facility (WSCF) laboratory this fall.
- Most of the field duplicate results demonstrated good precision, although the relative percent differences for 16 pairs of results failed to meet the acceptance criteria. Bromide, nitrogen in nitrite, arsenic, copper, iron, manganese, nickel, zinc, acetone, methylene chloride, gross beta, iodine-129, tritium, and uranium were the constituents with out-of-limit results.

- Approximately 4% of the field blank results exceeded the QC limits. Methylene chloride, total organic halides, aluminum, and chloride 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. STL St. Louis had out-of-limit results for total organic halides and carbon tetrachloride. Lionville Laboratory had unacceptable results for total organic carbon. STL Richland had out-of-limit results for gross alpha and technetium-99. All of Pacific Northwest National Laboratory's results for technetium-99 were acceptable.
- Performance-evaluation study results were available from one Water Pollution study and investigative report and one InterLaB RadChem Proficiency Testing Program study this quarter. The majority of the laboratories' 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 the analyses were in control and reliable data were generated.

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Appendix
Quality Control Report

Appendix

Quality Control Report, April 1 to June 30, 2005

Highlights

- Due to missed holding times, 274 results were flagged with an H. Nitrate, nitrite, and volatile organic compounds account for most of the flagged results.
- The problem with elevated aluminum results at many sites continued this quarter. Aluminum results by the method used (EPA Method 6010; EPA 1986) do not appear to be reliable at the low levels found in most of the groundwater samples. A more sensitive method (EPA Method 6020; EPA 1986) will be used in the future for any samples in which aluminum is a constituent of concern.
- Total organic halogen quadruplicates and field trip blanks have had a large number of out-of-limit results. A review of method blank and laboratory control sample results did not indicate a performance problem. To resolve this anomaly, a special set of performance evaluation samples has been planned for submittal to Severn Trent Laboratories, Inc. (STL) St. Louis and the Waste Sampling and Characterization Facility (WSCF) laboratory in the fall 2005.
- Most of the field duplicate results demonstrated good precision, although the relative percent differences for sixteen pairs of results failed to meet the acceptance criteria. Bromide, nitrogen in nitrite, arsenic, copper, iron, manganese, nickel, zinc, acetone, methylene chloride, gross beta, iodine-129, tritium, and uranium were the constituents with out-of-limit results.
- Approximately 4% of the field blank results exceeded the quality control (QC) limits. Methylene chloride, total organic halides, aluminum, and chloride 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. STL St. Louis had out-of-limit results for total organic halides and carbon tetrachloride. Lionville Laboratory had unacceptable results for total organic carbon. STL Richland had out-of-limit results for gross alpha and technetium-99. All of Pacific Northwest National Laboratory's (PNNL's) results for technetium-99 were acceptable.
- Performance-evaluation study results were available from one Water Pollution study (Environmental Resource Associates 2005) and investigative report and one InterLaB RadCheM Proficiency Testing Program 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 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 (CY) 2005. Routine chemical and radiochemical analyses were performed by STL St. Louis and Richland for the Groundwater Performance Assessment Project (groundwater project) samples. Supplemental analyses of split samples and blind standards were performed by Lionville Laboratory (Lionville, PA) and Eberline Services (Richmond, CA). STL, Lionville Laboratory, and Eberline Services operate under contract with Fluor Hanford, Inc. Groundwater sampling was conducted by Fluor Hanford, Inc. nuclear chemical operators (NCOs) under the direction of Duratek Federal Services Incorporated. The tasks conducted by the samplers and Duratek included bottle preparation, sample set coordination, field measurements, sample collection, sample transport and shipping, well pumping, and coordination of purgewater containment and disposal.

Table A.1 summarizes the data completeness for the groundwater 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-two percent of the second quarter's results were considered valid. This percentage is about the same as that for the previous quarter (87%). Roughly 94% of the second quarter 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 274 results were flagged with an H this quarter to indicate the recommended holding time had been exceeded. For STL St. Louis, 4 results for total organic halides, 11 total organic carbon results, 62 anion results, 15 alkalinity results, 161 results for volatile organic compounds (159 of which were from five samples), and 2 oil and grease results were flagged. For STL Richland, 12 coliform and 1 hexavalent chromium results were flagged. For Lionville Laboratory, six anion results were flagged. Most of the samples with missed holding times (104 results) were part of a holding time study in which the samples were held longer on purpose. Most of the rest of the missed holding times were associated with sample re-analyses that were triggered by QC failures, or with the necessity for radiological screening (for analytes with very short holding times). A few were also caused by instrument problems.

Table A.1. 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	1	0	0	0	0	0	0
214A_TURBIDITY	454	0	0	0	0	0	0
310.1_ALKALINITY	237	1	0	0	13	0	14
360.1_OXYGEN_FLD	159	6	0	0	0	0	6
410.4_COD	9	0	0	8	0	0	8
413.1_OILGREASE	6	0	0	0	2	0	2
9020_TOX	251	80	0	45	4	52	150
9040_PH	515	0	0	0	0	0	0
9050_CONDUCT	515	1	0	0	0	0	1
9060_TOC	264	5	0	0	11	187	198
9223_COLIFORM	23	0	0	0	1	0	1
REDOX_PROBE_FLD	138	0	0	0	0	0	0
TEMP_FLD	514	2	0	0	0	0	2
Ammonia and Anions							
300.0_ANIONS_IC	1348	5	0	60	31	217	278
350.1_AMMONIA	23	0	0	0	0	0	0
9012_CYANIDE	55	0	0	0	0	0	0
Metals							
6010_METALS_ICP	4218	88	0	118	0	1608	1627
6020_METALS_ICPMS	70	0	0	2	0	33	33
7196_CR6	1	0	0	0	0	0	0
7470_HG_CVAA	29	0	0	0	0	4	4
CR6_HACH M	32	0	0	0	0	0	0
Volatile Organic Compounds							
8260_VOA_GCMS	1875	0	0	66	0	7	68
WTPH GASOLINE	8	0	0	0	0	0	0
Semivolatile Organic Compounds							
8040_PHENOLIC_GC	561	0	17	0	0	0	17
8081_PEST_GC	57	0	0	0	0	0	0
8082_PCB_GC	84	0	0	0	0	0	0
8151_HERBICIDE_GC	20	0	0	0	0	0	0
8270_SVOA_GCMS	447	0	0	0	0	0	0
8290_DIOXINS_GCMS	25	0	0	0	0	8	8
WTPH DIESEL	8	0	0	0	0	0	0
Radiological Parameters							
906.0_H3_LSC	187	1	0	2	0	0	3
9310_ALPHABETA_GPC	352	4	0	6	0	0	10
AMCMISO_EIE_PLT_A							
EA	1	0	0	0	0	0	0
C14_LSC	1	0	0	0	0	0	0
GAMMA_GS	10	0	0	0	0	0	0
GAMMALL_GS	775	1	0	0	0	0	1
I129LL_ETVDSK_SEP_GS	3	0	0	2	0	0	2

HEIS Method Name	Total Results	Suspect Results	Rejected Results	Field QC Flags	Missed Holding Times	Method Blank Qualifiers	Results Flagged
II29LL_SEP_LEPS_GS	57	0	0	0	0	0	0
NP237_LLE_PLATE_AE							
A	1	0	0	0	0	0	0
PUISO_PLATE_AEA	18	0	0	0	0	0	0
RATOT_AEAGEA	1	0	0	0	0	0	0
SE79_SEP_IE_LSC	2	0	0	2	0	0	2
SRISO_SEP_PRECIP_GP							
C	56	0	0	0	0	0	0
TC99_ETVDSK_LSC	154	1	0	11	0	0	12
TC99_SEP_LSC	7	0	0	0	0	0	0
TRITIUM_ELECT_LSC	11	0	0	1	0	0	1
UIISO_PLATE_AEA	6	0	0	0	0	0	0
UTOT KPA	158	0	0	2	0	0	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 2005 included full trip blanks, field transfer blanks and an equipment blank. 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.2 lists the number of QC samples and their frequencies of collection for the second quarter. Results from each type of QC sample are summarized below.

Table A.2. Quality Control Samples for Second Quarter 2005

QC Samples	Number of well trips	Number of QC samples ^(a)	Frequency
Field Duplicates	406	21	5%
Split Samples	0 ^(b)	0	NA
TOC Quadruplicates	85 ^(c)	67	79%
TOX Quadruplicates	71 ^(c)	66	93%
Full Trip Blanks	406	18	4%
Field Transfer Blanks	VOC samples collected on 20 days	20	100% ^(d)
Equipment Blanks	3 ^(e)	0 ^(f)	0%

^a Values listed do not include field duplicates, split samples, and blanks collected for interim-action groundwater monitoring or nonroutine 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., 20/20).

^e Number of routine sampling events in which non-dedicated sampling equipment was used.

^f An equipment blank was assigned to a well which had an unsuccessful sampling event.

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 5 times the method detection limit (MDL), instrument detection limit (IDL), or minimum detectable activity (MDA) must have RPDs less than 20% to be considered acceptable. Duplicates with RPDs outside this range are flagged with a Q in the database.

Twenty-one field duplicates were collected and analyzed during the second quarter of 2005 to produce 620 pairs of results. Overall, the results demonstrate good sampling and analysis precision. Sixteen pairs of qualifying duplicate results had relative percent differences greater than 20%. Re-analyses have been requested for eight result pairs. Acceptable precision was obtained for two result pairs after re-analyses were performed on samples with out-of-trend results for copper and nickel. Table A.3 lists the remaining 14 pairs of results with poor precision. The high nitrogen in nitrite result from well 299-E25-19 and the high acetone result from well 699-S43-E12 are obvious outliers based on historical data, but re-analyses would not be useful because of the instability of dissolved nitrite and volatile organics. Low concentrations probably account for the high RPDs for arsenic and methylene chloride because the concentrations were close to the methods' quantitation limits. Re-analyses have been requested for bromide for both samples from well 299-W23-19 and for gross beta for the sample with the higher concentration from well 299-W14-13; in both these cases, the original results are anomalous compared to historical data.

Table A.3. Field Duplicate Results that Exceeded Quality Control Limits

Constituent	Well	Method	Filtered	Result 1	Result 2	RPD
Ammonia and Anions						
Bromide	299-W23-19	EPA 300.0	N	26 µg/L U	190 µg/L B	152%
Nitrogen in Nitrite	299-E25-19	EPA 300.0	N	13.1 µg/L U	328 µg/L	185%
Metals						
Arsenic	299-E25-19	EPA 6020	Y	3.7 µg/L B	2.2 µg/L B	51%
Iron	299-W23-19	EPA 6010	Y	52.9 µg/L B	131 µg/L B	85%
Manganese	199-N-121	EPA 6010	Y	23.9 µg/L	29.8 µg/L	22%
Zinc	299-W23-19	EPA 6010	Y	6.6 µg/L BC	1.7 µg/L BC	118%
Zinc	699-S6-E4A	EPA 6010	Y	62.3 µg/L C	86 µg/L C	32%
Volatile Organic Compounds						
Acetone	699-S43-E12	EPA 8260	N	8.2 µg/L B	20 µg/L B	84%
Methylene chloride	699-S43-E12	EPA 8260	N	1.5 µg/L B	1 µg/L B	40%
Radiological Parameters						
Gross beta	199-K-109A	EPA 9310	N	3450 pCi/L	1840 pCi/L	61%
Gross beta	299-W14-13	EPA 9310	N	2070 pCi/L	4260 pCi/L	69%
Iodine-129	299-W14-13	Lab specific	N	16.5 pCi/L	11.2 pCi/L	38%
Tritium	199-K-109A	EPA 906.0	N	41200 pCi/L	50600 pCi/L	21%
Uranium	399-1-11	Lab specific	N	7.75 µg/L	9.59 µg/L	21%

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, quadruplicate samples 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 halide quadruplicate data were evaluated based on the relative standard deviation (RSD) for each set of quadruplicate sample 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, the precision for all qualifying total organic carbon quadruplicate samples was acceptable, but 43 out of 66 total organic halide quadruplicates failed to meet the evaluation criteria (Table A.4). Low sample concentrations probably account for the poor precision in the total organic halide quadruplicates from wells 299-E27-11, 299-E27-12, 299-E27-13, 299-E28-26, 299-E28-28, 299-E32-5, 299-E32-8, 299-E33-30, 299-E33-37, 299-E34-2, and 299-W26-13. Twenty-nine of the quadruplicate samples in the table contain at least one value marked as suspect (Y flag). Eleven of the quadruplicate samples in the table contain at least one value marked as having blank contamination (C flag). Twenty-two of the quadruplicates in the table appeared to contain an outlier (shaded values in the table). In ten cases, removing the outlier drops the RSDs below the QC limits.

Discussions have been initiated with the laboratory because of the number of total organic halogen quadruplicate samples that have failed to meet the evaluation criteria as well as the number of high field trip blank results for this constituent (see next section). A review of method blank and laboratory control sample results did not show any significant changes in performance between 2004 and 2005. A review of field sampling methodology also did not indicate a problem. To determine the cause of these anomalies, a special set of performance evaluation samples has been planned. Hanford groundwater that is known to be free of total organic halides will be spiked with known amounts of organic halides and submitted to STL St. Louis and the WSCF laboratory for analysis in the fall of 2005.

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 at the end of this appendix. In general, the QC limit for blank results is 2 times the MDL or IDL for chemistry methods and 2 times the minimum detectable activity (MDA) for radiochemistry methods. For common laboratory contaminants such as acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the QC limit is 5 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.

Table A.4. Total Organic Halides Quadruplicate Samples 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 Halides						
199-N-71	3.158	12.9	4.5 B	3.2 U	23.1 Y	84%
199-N-72	3.158	16.8	27.7 Y	17.9	33.4 Y	33%
299-E24-22	3.158	27.6 Y	11.4 Y	18.6 Y	9.7 Y	48%
299-E25-26	3.158	11.8 Y	7 Y	9 Y	27.8 Y	68%
299-E25-35	3.158	12 C	6.4 C	32.6 CY	3.2 U	97%
299-E25-40	3.158	4.5 B	9.9	17 Y	21.9 Y	58%
299-E25-41	3.158	12.6 C	12 C	29.6 Y	17.2 Y	46%
299-E25-48	3.158	32.4 Y	25.9	49.7	23.8 CY	36%
299-E25-93	3.158	24 Y	3.5 B	70.2 Y	4.9 B	121%
299-E25-94	3.158	9.4 Y	12.5 Y	5.3 Y	21 Y	55%
299-E26-12	3.158	19 CY	14.8 CY	12.4 CY	3.8 BC	51%
299-E27-11	3.158	8.1	3.2 U	3.2 U	26.4 Y	108%
299-E27-12	3.158	19 Y	3.2 U	3.2 U	10.2 Y	84%
299-E27-13	3.158	22.8 Y	9.6	12.6 Y	4.2 B	64%
299-E27-14	3.158	13.2 Y	18.5 Y	24 Y	13.4 CY	30%
299-E27-15	3.158	3.2 U	27.9 Y	8.9	12.8 Y	80%
299-E27-16	3.158	13.5	16.3	21.6 Y	11.7	27%
299-E27-17	3.158	3.2 U	10.1 Y	4.6 B	24.1 Y	91%
299-E27-18	3.158	19 Y	30.6 Y	7.9	22.5 Y	47%
299-E27-22	3.158	4.8 B	5.2	23.5 Y	22.9 Y	75%
299-E27-4	3.158	3.9 B	36.6 Y	29.6 Y	9.1	80%
299-E27-7	3.158	16.2 Y	15.7 Y	25.8 Y	37.9 Y	44%
299-E27-8	3.158	13.4 Y	8.3	17.4 Y	12.4 Y	29%
299-E27-9	3.158	20.3 Y	20.6 Y	16 Y	12.3 Y	23%
299-E28-26	3.158	6.7	9	19.5	3.2 U	73%
299-E28-28	3.158	8.2	3.2 U	6.7	27.8	97%
299-E32-10	3.158	14.2	25.4	23.4	7	49%
299-E32-2	3.158	12.9	14	24.3	16.4	30%
299-E32-3	3.158	18	4.8 BC	6.3 C	14.2 C	58%
299-E32-5	3.158	28.4	3.2 U	5.2	3.2 U	123%
299-E32-8	3.158	3.2 U	3.2 U	19	15.2	81%
299-E33-30	3.158	7.8	22.9	4.2 BC	3.3 BC	95%
299-E33-34	3.158	5.8	35.6 C	9.3 C	31 C	74%
299-E33-36	3.158	16.4 Y	20.2 Y	5.5	5.2	65%
299-E33-37	3.158	22.6 Y	14.5 Y	9.5	3.2 U	66%
299-E34-10	3.158	16.4 Y	24.7 Y	80.4 Y	9.7	99%
299-E34-12	3.158	9.1	17.4	16.2	19.4	29%
299-E34-2	3.158	18.7	4.1 B	3.2 U	4.2 B	99%
299-E34-7	3.158	39.1 H	58.4 H	24.5 H	22.7 H	46%
299-E34-8	3.158	3.9 B	18 Y	24.7 Y	10.4	63%
299-W26-13	3.158	25 C	19 C	8.3 C	8.8 C	53%
699-25-34D	3.158	3.2 U	14.3 Y	16.6 CY	10.8 CY	52%
299-W26-13 ^(a)	3.158	18.9 C	4.3 BC	3.2 U	4.4 B	97%

^a Full trip blank associated with well 299-W26-13.
 Shaded cells = Quadruplicate samples that appear to contain an outlier.

A total of 1,337 results were produced from the second quarter field blank samples. Approximately 4% of the results (i.e., 59 results) exceeded the QC limits for field blanks. The percentage of out-of-limit results was higher than the value from last quarter. Table A.5 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, total organic halides, aluminum, and chloride; however, results were also flagged for chemical oxygen demand, nitrogen in nitrate, calcium, iron, zinc, 1,4-dichlorobenzene, acetone, technetium-99, and tritium. The potential impacts on the data are minor in most cases. For example, although chloride and calcium 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 second quarter groundwater samples. The number of total organic halides with out of limit results was high this quarter; this issue was discussed in the section on quadruplicates.

Several of the constituents (i.e., chloride, aluminum, calcium, iron, zinc, 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.5 may have been caused by laboratory contamination or false-positive detection. Acetone and methylene chloride are common laboratory contaminants that have been detected in previous quarters' method blanks. Low-level detection of these constituents in Hanford groundwater samples should be viewed as tentative. Aluminum results by the method used (EPA Method 6010; EPA 1986) do not appear to be reliable at the low levels found in most of the groundwater samples; a more sensitive method (EPA Method 6020; EPA 1986) will be used in the future for any samples in which aluminum is a constituent of concern.

Table A.5. Field Blank Results that Exceeded QC Limits

Constituent Name	Blank Type ^(a)	Result	QC Limit	Result/QC Limit
General Chemistry Parameters				
Chemical oxygen demand	FTB	21 mg/L	7.1 mg/L	3.0
Total organic halides	FTB	7.8 µg/L	3.2 µg/L	2.4
Total organic halides	FTB	8.4 µg/L	3.2 µg/L	2.6
Total organic halides	FTB	9.3 µg/L	3.2 µg/L	2.9
Total organic halides	FTB	10.3 µg/L	3.2 µg/L	3.2
Total organic halides	FTB	11 µg/L	3.2 µg/L	3.4
Total organic halides	FTB	12 µg/L	3.2 µg/L	3.8
Total organic halides	FTB	12.4 µg/L	3.2 µg/L	3.9
Total organic halides	FTB	13.7 µg/L	3.2 µg/L	4.3
Total organic halides	FTB	18.9 µg/L	3.2 µg/L	5.9
Ammonia and Anions				
Chloride	FTB	0.051 µg/L	0.025 mg/L	2.0
Chloride	FTB	0.053 mg/L	0.025 mg/L	2.1
Chloride	FTB	0.053 mg/L	0.025 mg/L	2.1
Chloride	FTB	0.054 mg/L	0.025 mg/L	2.2
Chloride	FTB	0.055 mg/L	0.025 mg/L	2.2
Chloride	FTB	0.085 mg/L	0.025 mg/L	3.4
Chloride	FTB	0.11 mg/L	0.025 mg/L	4.4
Nitrogen in nitrate	FTB	0.15 mg/L	0.01 mg/L	15
Metals				
Aluminum	FTB	36.5 µg/L	16.6 µg/L	2.2
Aluminum	FTB	37.6 µg/L	16.6 µg/L	2.3
Aluminum	FTB	44.2 µg/L	16.6 µg/L	2.7
Aluminum	FTB	48 µg/L	16.6 µg/L	2.9
Aluminum	FTB	49.7 µg/L	16.6 µg/L	3
Aluminum	FTB	53.1 µg/L	16.6 µg/L	3.2
Aluminum	FTB	76.9 µg/L	16.6 µg/L	4.6
Calcium	FTB	22.9 µg/L	10.7 µg/L	2.1
Calcium	FTB	27 µg/L	10.7 µg/L	2.5
Calcium	FTB	39.7 µg/L	10.7 µg/L	3.7
Calcium	FTB	113 µg/L	10.7 µg/L	11
Iron	FTB	31 µg/L	12.6 µg/L	2.5
Zinc	FTB	2.6 µg/L	1.2 µg/L	2.2
Zinc	FTB	3.6 µg/L	1.2 µg/L	2.4
Zinc	FTB	3 µg/L	1.2 µg/L	2.5
Zinc	FTB	3.1 µg/L	1.2 µg/L	2.6
Zinc	FTB	3.2 µg/L	1.2 µg/L	2.7
Zinc	FTB	4.5 µg/L	1.2 µg/L	3.8
Volatile Organic Compounds				
1,4-Dichlorobenzene	FXR	0.26 µg/L	0.09 µg/L	2.9
1,4-Dichlorobenzene	FXR	0.26 µg/L	0.09 µg/L	2.9
1,4-Dichlorobenzene	FTB	0.31 µg/L	0.09 µg/L	3.4
Acetone	FXR	2.4 µg/L	0.21 µg/L	11
Acetone	FXR	5.3 µg/L	0.21 µg/L	25
Methylene chloride	FXR	0.73 µg/L	0.12 µg/L	6.1
Methylene chloride	FXR	0.73 µg/L	0.12 µg/L	6.1

Constituent Name	Blank Type ^(a)	Result	QC Limit	Result/QC Limit
Methylene chloride	FXR	0.81 µg/L	0.12 µg/L	6.8
Methylene chloride	FXR	0.87 µg/L	0.12 µg/L	7.3
Methylene chloride	FXR	1.3 µg/L	0.12 µg/L	11
Methylene chloride	FXR	1.4 µg/L	0.12 µg/L	12
Methylene chloride	FXR	1.5 µg/L	0.12 µg/L	13
Methylene chloride	FXR	1.6 µg/L	0.12 µg/L	13
Methylene chloride	FXR	1.8 µg/L	0.12 µg/L	15
Methylene chloride	FXR	1.8 µg/L	0.12 µg/L	15
Methylene chloride	FXR	1.9 µg/L	0.12 µg/L	16
Methylene chloride	FXR	2 µg/L	0.12 µg/L	17
Methylene chloride	FXR	2.2 µg/L	0.12 µg/L	18
Methylene chloride	FXR	4 µg/L	0.12 µg/L	33
Methylene chloride	FXR	4.2 µg/L	0.12 µg/L	35
Methylene chloride	FTB	1.1 µg/L	0.12 µg/L	9.2
Radiological Parameters				
Technetium-99	FTB	5880 pCi/L	11 pCi/L	535
Tritium	FTB	58.9 pCi/L	5.7 pCi/L	10
^a FTB = Full trip blank, FXR = Field transfer blank, EB = Equipment blank Shaded cells = Results that exceeded the QC limits by a factor of 5 or more.				

Laboratory QC Data

Blind Standards. Double-blind standards containing known amounts of selected anions, organic compounds, and radionuclides were prepared and submitted to STL ST. Louis in May 2005. Duplicates of the total organic carbon and gross beta standards were submitted concurrently to Lionville Laboratory and Eberline Services, respectively. A special set of standards containing technetium-99 was submitted to PNNL analysts in the 325 Building. 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 TOX-phenol standards; and TOX-VOA 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.6. Shaded values in the tables were outside the QC limits, as described in the following paragraphs.

The acceptance limits for blind standard recoveries are generally 75 to 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 total organic carbon, total organic halides, and carbon tetrachloride, while STL Richland had unacceptable results for gross alpha and technetium-99. Lionville Laboratory's results for total organic carbon were also outside the acceptance range. Eberline Services' results for gross beta were acceptable.

Table A.6. Blind Standard Results

Constituent	Spike Amount	Lab ^a	Result 1	Recovery	Result 2	Recovery	Result 3	Recovery	Mean	RSD
General Chemical Parameters										
Conductivity	445 uS/cm	SL	418	94%	420	94%	409	92%	416	1%
TOC ^(b)	1500 µg/L	LL	2100	140%	2000	133%	2100	140%	2050	3%
TOC ^(c)	1500 µg/L	SL	2000	133%	1900	127%	1900	127%	1950	3%
TOX (phenol)	13 µg/L	SL	73.6	566%	89.2	686%	105	808%	89.3	18%
TOX (VOA) ^(d)	14 µg/L	SL	20.7	148%	8.5	61%	18	129%	17.1	34%
Anions										
Cyanide	301 µg/L	SL	311	103%	312	104%	308	102%	310	1%
Fluoride	3000 µg/L	SL	2500	83%	2500	83%	2500	83%	2500	0%
Nitrate as N	45180 µg/L	SL	41400	92%	40800	90%	41400	92%	41200	1%
Volatile Organic Compounds										
Carbon tetrachloride	5.9 µg/L	SL	4.4	75%	4.3	73%	4.5	76%	4.40	2%
Chloroform	4.9 µg/L	SL	4.4	90%	4.5	92%	4.6	94%	4.50	2%
Trichloroethene	4.9 µg/L	SL	4.3	88%	4.4	90%	4.4	90%	4.37	1%
Radiological Parameters										
Cesium-137	212.8 pCi/L	RL	202	95%	205	96%	221	104%	209	5%
Cobalt-60	53.17 pCi/L	RL	52.1	98%	57.1	107%	51.2	96%	53.5	6%
Gross alpha	7.12 pCi/L	RL	11.7	164%	8.13	114%	4.76	67%	8.20	42%
Gross beta ^(e)	67.76 pCi/L	ES	73.4	108%	72.2	107%	73.5	108%	73.0	1%
Gross beta ^(e)	67.76 pCi/L	RL	60.5	89%	65.3	96%	64.7	95%	63.5	4%
Iodine-129	10.2 pCi/L	RL	9.69	95%	9.49	93%	10.1	99%	9.76	3%
Plutonium-239	7.13 pCi/L	RL	7	98%	7.18	101%	6.05	85%	6.74	9%
Technetium-99	1033.5 pCi/L	RL	1060	103%	598	58%	1060	103%	906	29%
Technetium-99	21003 pCi/L	325	22780	108%	23460	112%	22780	108%	23007	2%
Uranium-238	923.4 µg/L	RL	971	105%	1020	110%	972	105%	988	3%

^a Lab codes: SL = Severn Trent St. Louis, RL = Severn Trent Richland, LL = Lionville Laboratory, ES = Eberline Services, 325 = PNNL 325 Building

^b TOC standards were submitted to Lionville Laboratory in quadruplicate. The fourth result was 2000 µg/L, and the recovery was 133%.

^c TOC standards were submitted to Severn Trent St. Louis in quadruplicate. The fourth TOC result was 2000 µg/L, and the recovery was 133%.

^d TOX VOA standards were submitted to Severn Trent St. Louis in quadruplicate. The fourth result was 21.1 µg/L, and the recovery was 151%.

^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 third quarter of 2004.

Shaded cells = Values outside the QC limits.

All of the total organic carbon results from STL St. Louis and Lionville Laboratory were biased high. The laboratories re-analyzed the samples, but the re-analysis results were similar to the original values. In-house analyses of replicate samples by two independent methods (combustion and UV spectroscopy) appeared to confirm that the samples contained a higher concentration of organic carbon than was intended (1700 to 2200 µg/L). Therefore, we believe that the elevated results were caused by a sample-spiking error. The commercial laboratories' results are within the acceptance limits if the in-house concentrations are assumed to be the correct values.

STL St. Louis' results for total organic halides were biased high. The standards spiked with 2,4,5-trichlorophenol were reanalyzed, but the results were consistent with the original values. Due to the very

large discrepancies between the spiked and measured concentrations, we suspect that a dilution or calculation error occurred when the samples were prepared. The results for the samples spiked with the volatile mixture were variable, and most were biased high. Due to the low spiking level (i.e., <5 times the MDL), the results are not surprising. However, the elevated values are consistent with the recent trends observed at several wells, as discussed earlier. Two special sets of blind standards were submitted to STL St. Louis and WSCF during September to further investigate this problem. Those results will be discussed in next quarter's QC summary.

Two results for carbon tetrachloride were out-of-limits; reasons for the low-biased results are unknown. Sample instability or volatilization seems unlikely since the recoveries for chloroform and trichloroethene were acceptable. Instrument drift or a problem with the continuing calibration may have caused the low results.

STL Richland had two out-of-limit results for gross alpha. Because the samples were spiked at very low concentrations (i.e., approximately 3 times the minimum detectable activity), the results are not unreasonable.

One of STL Richland's results for technetium-99 had a recovery of 58%. A reanalysis of the sample was requested, but the laboratory did not have sufficient sample volume to perform another analysis. We suspect that the low result was caused by a procedural error at the laboratory.

A special set of blind standards was submitted to PNNL analysts in the 325 Building to evaluate the laboratory's ability to measure technetium-99 by ICP-MS. All of the results were acceptable.

ERA Water Supply/Water Pollution Programs. STL St. Louis and Lionville Laboratory participate in the EPA sanctioned Water Supply/Water Pollution (WS/WP) Performance Evaluation studies conducted by Environmental Resources Associates (ERA). 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 sample provider found acceptable, independently verify the level of laboratory performance.

A report from one Water Pollution study (Environmental Resource Associates 2005) was received from STL St. Louis this quarter. The percentage of acceptable results was 96.9%. Values were high for orthophosphate as phosphorus, total phenolics, Aroclor 1260, barium, iron, and manganese. Values were low for total organic carbon, benzo(g,h,i)perylene, and grease and oil (gravimetric). An investigative report discussing these results was also received this quarter. The high total phenolics result may have been due to a dilution error. The non-detect for benzo(g,h,i)perylene was caused by a spectral match that was not reliable; however, the HPLC method for this sample is not used for Hanford groundwater samples. The high Aroclor 1260 result may have been caused by the presence of a surrogate that elutes within the elution range of the Aroclor. Quick response proficiency studies were ordered for orthophosphate as P and for oil and grease to assist in the laboratory's evaluations. No cause was found for the unacceptable results for the other compounds; however, all were acceptable in two previous studies.

Mixed Analyte Performance Evaluation Program. The Mixed Analyte Performance Evaluation Program (MAPEP) is conducted by the U. S. Department of Energy (DOE) independent of the groundwater 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 MAPEP results were available this quarter.

InterLaB RadChem Proficiency Testing Program Studies. The InterLaB RadChem Proficiency Testing Program is conducted by Environmental Resource Associates (ERA). 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 Eberline Services this quarter (RAD-61). All results were acceptable. The following were analyzed with acceptable results: radium-226, radium-228, strontium-89, strontium-90, uranium (two results).

Multi-Media Radiochemistry Proficiency Testing Studies. The Multi-Media Radiochemistry Proficiency Testing Program is conducted by Environmental Resource Associates (ERA) 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 DOE report EML-564, *Analysis of EML QAP Data from 198201992: Determination of Operational Criteria and Control Limits for Performance Evaluation Purposes* (DOE 1995).

No new Mutli-Media Radchem PT results were available this quarter.

Laboratory QC Data from Severn Trent Laboratories. Laboratory QC data provide a means to assess laboratory performance and the suitability of a method for a particular sample matrix. These data are not currently used for inhouse 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 2 times the MDL for chemical constituents and 2 times the MDA for radiochemistry components. For common laboratory contaminants such as acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the QC limit is 5times 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 5 times greater than the MDL or MDA 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 to 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.7 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.8 lists the individual constituents that had out-of-limit method blanks, including the concentration range for method blanks above the detection limit. Table 9 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.8 and A.9. Finally, Table A.10 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 the Hanford Environmental Information System (HEIS). Thus, it is possible that some of the QC data described in this report may no longer be associated with current results in HEIS.

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 (2.5%) was about the same as that for last quarter (3.0%). This quarter showed an increase in the number of laboratory control samples for ammonia and anions, blanks for metals, and duplicates for volatile organic compounds that were out of limits. There was a decrease in the number of out-of-limit duplicates for ammonia and anions, laboratory control samples and matrix spikes for volatile organic compounds and semivolatile organic compounds, matrix spikes for radiological parameters, and surrogates.
- Two or more method blank results exceeded the QC limits for coliform, *chloride*, *fluoride*, aluminum, arsenic, barium, beryllium, calcium, iron, *zinc*, and *methylene chloride*. The percentage of method blank results that were out of limits was higher this quarter for metals. A number of polychlorinated dioxins and dibenzofurans were analyzed this quarter; a method detection limit was not available for these compounds. Polychlorodibenzofurans and polychlorodibenzo-p-dioxins ranging from tetrachloro through octachloro compounds were detected at pg/L levels.
- Out-of-limit blank results for chloride, barium, and calcium were, in general, not significant because results for most Hanford groundwater samples were significantly higher (at least 5 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, more ammonia and anions, but fewer metals, volatile organic compounds, semivolatile organic compounds, and radiological parameters, had laboratory control samples that were out of limits. Laboratory control samples were significantly out of limits for *cyanide*, *nitrogen*

in nitrite, acetone, vinyl chloride, 2-secbutyl-4,6-dinitrophenol, and gross alpha. Table A.10 indicates which wells have data associated with laboratory control sample results that were significantly out of limits.

- Compared to last quarter, fewer metals, volatile organic compounds, and semivolatile organic compounds had matrix spike results that were out of limits. Conductivity, total organic carbon, cyanide, fluoride, *nitrogen in nitrate*, *nitrogen in nitrite*, 1,1,2-trichloroethane, 1,4-dichlorobenzene, acetone, *carbon tetrachloride*, ethylbenzene, toluene, vinyl chloride, 2,4,5-T, 2-secbutyl-4,6-dinitrophenol, and hexachlorocyclopentadiene had matrix spike results that were significantly out of limits.
- Matrix duplicates had more volatile organic compounds, but fewer ammonia and anions with out-of-limit results compared to last quarter. Matrix duplicates were significantly out of limits for *total organic halides*, *chloride*, *fluoride*, *nitrogen in nitrate*, 11 chlorinated aliphatic hydrocarbons, 1,4-dichlorobenzene, *2-butanone*, *acetone*, benzene, carbon disulfide, ethylbenzene, toluene, 2,4,5-T, 17 *phenols*, 4-chloroaniline, hexachloroethane, *gross alpha*, iodine-129, and technecium-99.
- Fewer volatile and semivolatile organic surrogates were out of limits this quarter compared to last quarter. Surrogates were significantly out of limits for *4-bromofluorobenzene*, *dibromofluoromethane*, *o-terphenyl*, 2,4,6-tribromophenol, and 2-fluorophenol.

Laboratory QC Data from Eberline Services and Lionville Laboratory. Second quarter QC data from Lionville Laboratory are limited to anions. 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.

Table A.7. Percentage of Out-of-Limit QC Results by Category

	General Chemistry Parameters	Ammonia and Anions	Metals	VOC	SVOC	Radiological Parameters	Total
Method Blanks	2.4	5.4	7.5	0.9	0	0	2.4
Lab Control Samples	1.2	3.8	0.1	1.5	0.9	0.8	1.3
Matrix Spikes	2.1	12.3	0	2.6	1.0	3.0	2.2
Matrix Duplicates	2.2	1.4	0	3.8	13.4	1.1	3.7
Surrogates	—	—	—	3.2	0.7	—	2.6

Table A.8. Method Blanks with Out-of-Limit Results

Constituent	Number Out of Limits ^(a)	Number of Analyses	Concentration Range of Detections
General Chemistry Parameters			
Coliform	2	8	1 colony
Ammonia and Anions			
Chloride	14	58	0.051 – 0.11 mg/L
Fluoride	2(2)	58	0.021 – 0.022 mg/L
Phosphate	1(1)	1	0.29 mg/L
Metals			
Aluminum	14(3)	35	36.4 – 82.5 µg/L
Arsenic	3(1)	10	0.99 – 1.8 µg/L
Barium	2	33	0.74 – 0.92 µg/L
Beryllium	3(2)	33	0.59 – 0.91 µg/L
Calcium	12	33	22.4 – 38.3 µg/L
Iron	2(2)	34	106 – 154 µg/L
Sodium	1(1)	33	3590 µg/L
Zinc	13(2)	33	2.7 – 31.2 µg/L
Volatile Organic Compounds			
Methylene chloride	9(5)	37	0.76 – 2.2 µg/L
Trichloroethene	1(1)	37	0.92 µg/L

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

Table A.9. Laboratory Spikes and Duplicates with Out-of-Limit Results

Constituent	Number Out of Limits ^(a)	Number of Analyses
Laboratory Control Samples		
<i>General Chemistry Parameters</i>		
Total Organic Carbon	1	24
<i>Ammonia and Anions</i>		
Bromide	1	8
Chloride	1	58
Cyanide	1(1)	12
Nitrogen in nitrate	1	58
Nitrogen in nitrite	7(7)	58
Sulfate	1	58
<i>Metals</i>		
Aluminum	1	35
<i>Volatile Organic Compounds</i>		
1,1,2-Trichloroethane	1	37
1,2-Dibromo-3-chloropropane	2	6
4-Methyl-2-pentanone	2	37
Acetone	4(2)	37
Carbon disulfide	2	37
Dibromochloromethane	1	6
Ethyl methacrylate	1	6
Vinyl chloride	1(1)	37
<i>Semivolatile Organic Compounds</i>		
2-secButyl-4,6-dinitrophenol	2(1)	9
Oil and grease	1	4
<i>Radiological Parameters</i>		
Gross alpha	1(1)	29
Uranium	2	62
Matrix Spikes and Matrix Spike Duplicates		
<i>General Chemistry Parameters</i>		
Conductivity	1(1)	2
Total organic carbon	1(1)	30
<i>Ammonia and Anions</i>		
Chloride	1	61
Cyanide	4(3)	15
Fluoride	1(1)	62
Nitrogen in ammonia	1	7
Nitrogen in nitrate	4(3)	61
Nitrogen in nitrite	29(25)	61
Sulfate	1	61
<i>Volatile Organic Compounds</i>		
1,1,1-Trichloroethane	1	48
1,1,2-Trichloroethane	1(1)	48
1,1-Dichloroethane	1	48
1,4-Dichlorobenzene	5(2)	50
Acetone	3(3)	48
Benzene	1	48

Constituent	Number Out of Limits ^(a)	Number of Analyses
Carbon tetrachloride	12(8)	48
Ethylbenzene	1(1)	48
Toluene	1(1)	48
Vinyl chloride	4(4)	48
<i>Semivolatile Organic Compounds</i>		
2,4,5-T	1(1)	4
2-sec-Butyl-4,6-dinitrophenol	3(2)	18
Hexachlorocyclopentadiene	1(1)	4
Oil and grease	1	5
<i>Radiological Parameters</i>		
Technetium-99	2	35
Duplicates		
<i>General Chemistry Parameters</i>		
Total organic carbon	1	53
Total organic halides	2(2)	31
<i>Ammonia and Anions</i>		
Chloride	2(1)	116
Fluoride	5(5)	117
Nitrogen in nitrate	2(2)	116
<i>Volatile Organic Compounds</i>		
1,1,1-Trichloroethane	2(1)	32
1,1,2-Trichloroethane	1(1)	32
1,1-Dichloroethane	1(1)	32
1,1-Dichloroethene	1(1)	31
1,2-Dichloroethane	1(1)	32
1,4-Dichlorobenzene	2(2)	33
2-Butanone	2(1)	32
4-Methyl-2-pentanone	1	32
Acetone	5(2)	32
Benzene	1(1)	32
Carbon disulfide	1(1)	32
Chloroform	1	32
cis-1,2-Dichloroethylene	1(1)	32
Ethyl benzene	1(1)	32
Methylene chloride	2(1)	32
Tetrachloroethene	1(1)	32
Toluene	1(1)	32
trans-1,2-Dichloroethylene	1(1)	32
Trichloroethene	1(1)	32
Vinyl chloride	1(1)	32
<i>Semivolatile Organic Compounds</i>		
1,2-Dichlorobenzene	1	1
1,3-Dichlorobenzene	1	1
2,3,4,6-Tetrachlorophenol	3(1)	7
2,4,5-T	1(1)	2
2,4,5-Trichlorophenol	2(1)	9
2,4,6-Trichlorophenol	1(1)	9
2,4-Dichlorophenol	2(1)	11
2,4-Dimethylphenol	2(1)	9
2,4-Dinitrophenol	1(1)	9

Constituent	Number Out of Limits ^(a)	Number of Analyses
2,6-Dichlorophenol	1(1)	7
2-Chlorophenol	1(1)	9
2-Methylphenol	2(1)	11
2-Nitrophenol	1(1)	11
2-secButyl-4,6-dinitrophenol	2(1)	9
3,3'-Dichlorobenzidine	1	2
3+4 Methylphenol	2(1)	7
4,6-Dinitro-2-methylphenol	2(1)	9
4-Chloro-3-methylphenol	2(1)	9
4-Chloroaniline	1(1)	2
4-Nitrophenol	3(1)	9
Benzo(ghi)perylene	1	2
Benzo(k)fluoranthene	1	2
Dibenz[a,h]anthracene	1	2
di-n-Octylphthalate	1	2
Hexachlorobutadiene	1	2
Hexachlorocyclopentadiene	2	3
Hexachloroethane	1(1)	2
Indeno(1,2,3-cd)pyrene	1	2
Pentachlorophenol	2(1)	11
Phenol	4(2)	11
<i>Radiological Parameters</i>		
Gross alpha	1(1)	27
Iodine-129	1(1)	23
Plutonium-239/240	1	7
Strontium-90	1	19
Technetium-99	1(1)	35
Surrogates		
<i>Volatile Organic Compounds</i>		
4-Bromofluorobenzene	18(2)	297
Dibromofluoromethane	16(12)	297
o-Terphenyl	6(5)	28
<i>Semivolatile Organic Compounds</i>		
2,4,6-Tribromophenol	2(1)	91
2-Fluorophenol	1(1)	91
^a Numbers in parentheses are the number of results that were significantly out of limits as defined in the text.		

Table A.10. Wells Associated with Laboratory QC Parameters with Significantly Out-of-Limit Results

Constituent	Analysis Date	Wells with Associated Data
Method Blanks		
Fluoride	4/22/05	199-K-30, 199-K-34, 199-K-132
	4/26/05	199-N-16, 299-E33-13
Phosphate	4/8/05	299-E34-7
Aluminum	6/2/05	199-H4-7, 299-W14-6, 299-W14-11, 299-W17-1, 299-W18-30, 299-W19-12, 299-W19-47, 299-W19-48, 699-19-88, 699-30-66, 699-36-70B, 699-S6-E4A, 699-S6-E4L
	6/6/05	199-H4-7, 299-E27-12, 299-E27-13, 299-E27-21, 299-E27-23
Arsenic	7/12/05	299-E24-16
Beryllium	6/6/05	199-H4-7, 299-E27-12, 299-E27-13, 299-E27-21, 299-E27-23
Iron	4/18/05	199-K-27, 199-K-106A, 199-K-109A, 299-E17-14, 299-E17-16, 299-E17-18, 299-E24-16, 299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A
	6/3/05	299-E27-4, 299-E27-15
Sodium	5/23/05	299-E33-2, 299-E33-14, 299-E33-32, 299-E33-16, 299-E33-17, 299-E33-18, 299-E33-33, 299-E33-33A
Zinc	6/30/05	699-13-3A, 699-S6-E4L
	7/12/05	299-E24-16
Methylene chloride	4/18/05	299-W22-47, 399-1-10A, 399-1-10B
	5/18/05	299-W14-16, 299-W15-45, 299-W15-49, 299-W15-50, 299-W15-765
	5/19/05	699-22-35, 699-23-34A, 699-23-34B, 699-24-34A
	6/25/05	399-1-1, 399-1-8, 399-1-12, 399-1-21B, 399-3-2, 399-3-6, 399-3-11, 399-3-12, 399-5-4B, 699-25-34D
	6/27/05	399-8-5A, 699-13-1E, 699-S6-E4A, 699-S27-E9B
Trichloroethene	6/10/05	299-W23-21
Laboratory Control Samples		
Cyanide	4/14/05	699-55-60A
Nitrogen in Nitrite	5/18/05	699-22-35, 699-23-34A, 699-23-34B, 699-24-34A, 699-24-34B, 699-24-34C, 699-24-35, 699-26-35A, 699-40-65
	5/19/05	299-W17-1, 299-W19-47, 699-19-88, 699-24-33
	5/21/05	299-W14-11
	5/27/05	199-H4-7
	6/10/05	299-W22-50, 299-W22-80, 299-W22-81, 299-W22-82, 299-W22-83, 299-W22-84, 299-W23-15, 299-W26-13
6/11/05	199-N-103A, 199-N-105A, 199-N-119, 199-N-120, 199-N-121, 299-W22-85	
Acetone	4/18/05	299-W22-47, 399-1-10A, 399-1-10B
	5/19/05	299-W13-1, 299-W18-16, 699-36-70B, 699-38-70C
Vinyl chloride	6/2/05	699-30-66
2-secButyl-4,6-dinitrophenol(DNBP)	4/15/05	299-E34-7
Gross alpha	5/29/05	299-E13-5, 299-E17-1, 299-E27-11, 299-E27-19, 299-E33-37, 299-E34-5, 299-E34-8, 299-E34-10, 299-E34-12, 299-W22-47
Matrix Spikes or Matrix Spike Duplicates		

Constituent	Analysis Date	Wells with Associated Data
Conductivity	5/25/05	299-W10-4
Total organic carbon	5/31/05	699-22-35, 699-23-34A, 699-23-34B, 699-24-34A
Cyanide	5/4/05	299-E33-13, 699-49-55A
	5/12/05	299-E33-1A, 299-E33-3, 299-E33-31, 299-E33-338, 299-E33-339
	5/23/05	299-E33-4, 299-E33-20, 299-E33-26, 299-E33-38, 299-E33-41, 299-E33-43
Fluoride	5/13/05	299-E33-47, 299-E33-48, 299-W11-7, 299-W11-40, 299-W14-13, 299-W15-40, 299-W15-45, 299-W15-49, 299-W15-50, 299-W15-763, 299-W18-31
Nitrogen in Nitrate	5/10/05	299-E33-4, 299-E33-20, 299-E33-26, 299-E33-38, 299-E33-41, 299-E33-43, 299-W10-1, 299-W10-22, 299-W10-23, 299-W10-24, 299-W10-28
	5/11/05	299-W10-4, 299-W10-26, 299-W10-27, 299-W11-12, 299-W11-39, 299-W11-41, 299-W11-42, 299-W14-14, 299-W14-15, 299-W14-16
Nitrogen in Nitrite	4/8/05	299-E25-28, 299-E25-35, 299-E26-12, 299-E26-13, 299-E34-7, 699-43-45
	4/16/05	699-2-7, 699-8-17, 699-S38-E12A
	4/30/05	199-H4-9
	5/3/05	299-E33-2, 299-E33-14, 299-E33-16, 299-E33-17, 299-E33-18
	5/11/05	299-W10-4, 299-W10-26, 299-W10-27, 299-W11-12, 299-W11-39, 299-W11-41, 299-W11-42, 299-W14-14, 299-W14-15, 299-W14-16
	5/13/05	299-E33-47, 299-E33-48, 299-W11-7, 299-W11-40, 299-W14-13, 299-W15-40, 299-W15-45, 299-W15-49, 299-W15-50, 299-W15-763, 299-W18-31
	5/18/05	299-W14-6, 299-W18-16, 299-W18-30, 299-W21-2, 699-22-35, 699-23-34A, 699-23-34B, 699-24-34A, 699-24-34B, 699-24-34C, 699-24-35, 699-26-35A, 699-36-70B, 699-38-70C
	5/25/05	299-W19-12, 699-30-66, 699-S6-E4A, 699-S6-E4L
	5/26/05	699-38-70B
	5/27/05	199-H4-7
	6/2/05	299-E27-4, 299-E27-12, 299-E27-13, 299-E27-15, 299-E27-21, 299-E27-23
	6/3/05	299-E27-7, 299-E27-22, 299-E28-26, 299-E28-28, 299-E32-4, 299-E33-28, 299-E33-29
	6/8/05	299-E32-2, 299-E32-6, 299-E32-9, 299-E32-10
	6/9/05	299-E32-3, 299-E32-8, 299-E33-30, 299-E33-34, 299-W22-45, 299-W22-47, 299-W22-48, 299-W23-20, 299-W23-21
	6/10/05	299-W22-50, 299-W22-80, 299-W22-81, 299-W22-82, 299-W22-83, 299-W22-84, 299-W23-15
	6/15/05	199-N-46, 199-N-67, 199-N-75, 199-N-96A, 199-N-99A, 199-N-106A, 299-E28-5, 299-E28-6, 299-W10-8, 299-W23-19, 699-S36-E13A, NS-2A-168cm, NS-2A-23cm, NS-2A-87cm, NS-3A-10cm, NS-3A-176cm, NS-3A-87cm, NS-3B-40CM, NS-3B-52CM, NS-4A-138cm, NS-4A-17c, NS-4B-31CM
6/23/05	399-1-6, 699-25-34D	
6/24/05	399-4-1, 399-4-12, 699-12-2C, 699-13-0A, 699-13-1E, 699-13-2D	
1,4-Dichlorobenzene	5/2/05	299-E34-7
	5/5/05	699-S6-E4A, 699-S6-E4L

Constituent	Analysis Date	Wells with Associated Data
Acetone	5/19/05	299-W15-45, 299-W15-49, 299-W15-50, 299-W15-765
	6/10/05	299-W22-47
Carbon tetrachloride	5/5/05	299-W19-34A
	5/9/05	299-W19-35, 299-W19-36, 299-W19-37, 299-W19-39, 299-W19-40, 299-W19-43, 299-W19-46, 299-W19-48, 699-38-70B
	5/17/05	299-W10-22
	5/19/05	299-W15-45, 299-W15-49, 299-W15-50, 299-W15-765
	6/10/05	299-W22-47, 299-W23-21
Vinyl chloride	4/27/05	699-S28-E0, 699-S43-E12
2-secButyl-4,6-dinitrophenol(DNBP)	4/15/05	299-E34-7
	5/11/05	299-E17-14, 299-E17-16, 299-E17-18, 299-E17-19, 299-E24-16, 299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A
Hexachlorocyclopentadiene	5/2/05	299-E34-7
Duplicates		
Total organic halides	5/11/05	299-E27-8
	6/17/05	299-E32-2, 299-E32-6, 299-E32-10, 299-E33-28
Chloride	6/10/05	299-W22-50, 299-W22-80, 299-W22-81, 299-W22-82, 299-W22-83, 299-W22-84, 299-W23-15
Fluoride	4/16/05	699-2-7, 699-8-17, 699-S38-E12A
	4/29/05	199-N-2, 299-W19-34A, 299-W19-35, 299-W19-36, 299-W19-37, 299-W19-39, 299-W19-40, 299-W19-43, 299-W19-46, 299-W19-48, 699-38-70B
	6/22/05	299-E24-22, 399-1-10A, 399-1-2, 299-E24-20
Nitrogen in Nitrate	5/5/05	299-E33-1A, 299-E33-3, 299-E33-31, 299-E33-338, 299-E33-339
	5/19/05	299-W19-47, 699-19-88, 699-24-33
1,1,1-Trichloroethane	6/10/05	299-W23-21
1,1,2-Trichloroethane	6/10/05	299-W23-21
1,1-Dichloroethane	6/10/05	299-W23-21
1,1-Dichloroethene	6/10/05	299-W23-21
1,2-Dichloroethane	6/10/05	299-W23-21
1,4-Dichlorobenzene	5/2/05	299-E34-7
	6/10/05	299-W23-21
2-Butanone	6/10/05	299-W23-21
Acetone	6/21/05	399-1-10B
Benzene	6/10/05	299-W23-21
Carbon disulfide	6/10/05	299-W23-21
cis-1,2-Dichloroethylene	6/10/05	299-W23-21
Ethylbenzene	6/10/05	299-W23-21
Methylene chloride	6/10/05	299-W23-21
Tetrachloroethene	6/10/05	299-W23-21
Toluene	6/10/05	299-W23-21
trans-1,2-Dichloroethylene	6/10/05	299-W23-21
Trichloroethene	6/10/05	299-W23-21

Constituent	Analysis Date	Wells with Associated Data
Vinyl chloride	6/10/05	299-W23-21
2,3,4,6-Tetrachlorophenol	5/11/05	299-E17-14, 299-E17-16, 299-E17-18, 299-E17-19, 299-E24-16, 299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A
2,4,5-T	6/23/05	299-E24-33
2,4,5-Trichlorophenol	5/11/05	299-E17-14, 299-E17-16, 299-E17-18, 299-E17-19, 299-E24-16, 299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A
2,4,6-Trichlorophenol	5/11/05	299-E17-14, 299-E17-16, 299-E17-18, 299-E17-19, 299-E24-16, 299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A
2,4-Dichlorophenol	5/11/05	299-E17-14, 299-E17-16, 299-E17-18, 299-E17-19, 299-E24-16, 299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A
2,4-Dimethylphenol	5/11/05	299-E17-14, 299-E17-16, 299-E17-18, 299-E17-19, 299-E24-16, 299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A
2,4-Dinitrophenol	5/11/05	299-E17-14, 299-E17-16, 299-E17-18, 299-E17-19, 299-E24-16, 299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A
2,6-Dichlorophenol	5/11/05	299-E17-14, 299-E17-16, 299-E17-18, 299-E17-19, 299-E24-16, 299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A
2-Chlorophenol	5/11/05	299-E17-14, 299-E17-16, 299-E17-18, 299-E17-19, 299-E24-16, 299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A
2-Methylphenol (cresol, o-)	5/11/05	299-E17-14, 299-E17-16, 299-E17-18, 299-E17-19, 299-E24-16, 299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A
2-Nitrophenol	5/11/05	299-E17-14, 299-E17-16, 299-E17-18, 299-E17-19, 299-E24-16, 299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A
2-secButyl-4,6-dinitrophenol(DNBP)	5/11/05	299-E17-14, 299-E17-16, 299-E17-18, 299-E17-19, 299-E24-16, 299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A
3+4 methyl phenol	5/11/05	299-E17-14, 299-E17-16, 299-E17-18, 299-E17-19, 299-E24-16, 299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A
4,6-Dinitro-2methyl phenol	5/11/05	299-E17-14, 299-E17-16, 299-E17-18, 299-E17-19, 299-E24-16, 299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A
4-Chloro-3-methylphenol	5/11/05	299-E17-14, 299-E17-16, 299-E17-18, 299-E17-19, 299-E24-16, 299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A
4-Chloroaniline	5/2/05	299-E34-7
4-Nitrophenol	5/13/05	299-E17-1
Hexachloroethane	5/2/05	299-E34-7
Pentachlorophenol	5/11/05	299-E17-14, 299-E17-16, 299-E17-18, 299-E17-19, 299-E24-16, 299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A
Phenol	5/11/05	299-E17-14, 299-E17-16, 299-E17-18, 299-E17-19, 299-E24-16,

Constituent	Analysis Date	Wells with Associated Data
		299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A
	5/13/05	299-E17-1
Gross alpha	6/29/05	299-W14-11, 299-W19-47, 699-19-88, 699-49-100C, 699-S6-E4A, 699-S6-E4L
Iodine-129	5/24/05	299-E17-14, 299-E17-19, 299-E24-16, 299-E25-17, 299-E25-19, 299-E25-31, 299-E27-10, 299-E34-7, 699-37-47A, 699-55-60A
Technetium-99	5/25/05	299-E27-10, 299-E34-7, 699-55-60A
Surrogates		
4-Bromofluorobenzene	6/6/05	699-38-70B
	6/27/05	399-1-7, 399-1-18A, 399-1-18B, 399-1-21A, 399-2-1, 399-2-2, 399-3-10, 399-4-1, 399-4-12, 699-12-2C, 699-13-0A, 699-13-2D
Dibromofluoromethane	5/18/05	299-W14-16, 299-W15-45, 299-W15-49, 299-W15-50, 299-W15-765
	5/19/05	299-W13-1, 299-W15-45, 299-W15-49, 299-W15-50, 299-W15-765, 299-W18-16, 699-36-70B, 699-38-70C
	6/6/05	699-38-70B
o-terphenyl	4/14/05	299-E34-7
	5/4/05	199-N-16
2,4,6-Tribromophenol	5/19/05	299-E17-14, 299-E17-16, 299-E17-18, 299-E17-19, 299-E24-16, 299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A
2-Fluorophenol	5/19/05	299-E17-14, 299-E17-16, 299-E17-18, 299-E17-19, 299-E24-16, 299-E24-18, 299-E25-17, 299-E25-19, 299-E25-31, 299-E34-7, 699-37-47A

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 VOA sample bottles with Type II reagent water that has been transported to the field. FXRs are normally prepared at the same time VOA 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 lab.

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 lab. Typically, EBs are analyzed for the same constituents as the samples from the associated well.

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