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**Quarterly RCRA Groundwater
Monitoring Data for the
Period July through September 2005**

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

February 2006

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

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This letter report has been prepared to provide the U.S. Department of Energy, 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

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

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COMPARISON TO CONCENTRATION LIMITS

Contamination indicator parameter data (pH, specific conductance, total organic halides, and total organic carbon) from downgradient wells were compared to background values at sites monitored under interim-status, detection requirements, as described in 40 CFR 265.93. Results of the comparisons are listed in Table 1. Additional explanation, if needed, is provided below.

1301-N Liquid Waste Disposal Facility. Average specific conductance in downgradient well 199-N-3 (1,258 $\mu\text{S}/\text{cm}$) exceeded the critical mean value (1,118 $\mu\text{S}/\text{cm}$) in September. Prior assessment results (Hartman 1992) indicated the elevated specific conductance is related to sulfate and sodium from an upgradient facility. The site will remain in detection monitoring.

1325-N Liquid Waste Disposal Facility. Average specific conductance in downgradient wells 199-N-32 (413.5 $\mu\text{S}/\text{cm}$), 199-N-41 (536.75 $\mu\text{S}/\text{cm}$), and 199-N-81 (421.5 $\mu\text{S}/\text{cm}$) continued to exceed the critical mean value (407 $\mu\text{S}/\text{cm}$) in September. DOE notified Washington State Department of Ecology (Ecology) of an earlier exceedance and transmitted the results of the groundwater quality assessment (Thompson 2000). The high specific conductance is believed to have originated at an upgradient source, and passed the location of the upgradient well several years ago, so the site will remain in a detection monitoring program.

Nonradioactive Dangerous Waste Landfill. Average specific conductance concentrations from downgradient wells 699-25-34A (628.75 $\mu\text{S}/\text{cm}$), 699-25-34B (632.75 $\mu\text{S}/\text{cm}$), 699-25-34D (613.5 $\mu\text{S}/\text{cm}$), and 699-26-33 (599.75 $\mu\text{S}/\text{cm}$) exceeded the critical mean of 573 $\mu\text{S}/\text{cm}$ during the reporting period. Verification sampling is deemed not necessary because these specific conductance values are

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

consistent with the trends. Previous exceedances were attributed to non-hazardous constituents from the adjacent Solid Waste Landfill (Morse 2001).

Table 1. Status of RCRA Sites, July-September 2005

Site	Routine Sampling?	DG Statistical Exceedance?	Comments
Detection Sites [40 CFR 265.93(b)] (sampled semiannually)			
1301-N Liquid Waste Disposal Facility	Yes	Yes ^a	
1325-N Liquid Waste Disposal Facility	Yes	Yes ^a	
1324-N/NA Facilities	No	Not sampled	
216-B-3 Pond	Yes	No	
216-A-29 Ditch	No	Not sampled	
216-B-63 Trench	No	Not sampled	
216-S-10 Pond and Ditch	No	Not sampled	Current network 2 shallow and 1 deep DG wells ^(b)
LERF	No	Not applicable	Current network 1 UG and 1 DG well. No statistical evaluation per Ecology.
LLWMA 1	No	Not applicable	
LLWMA 2	No	Not applicable	Wells monitoring the north part of the LLWMA are dry ^(b) .
LLWMA 3	Yes	Not applicable	Statistical comparisons suspended until new background baseline established.
LLWMA 4	Yes	No	Only one shallow DG well ^(b) .
SST WMA C	Yes	No	
NRDWL	Yes	Yes	See text.
Groundwater Quality Assessment Sites [40 CFR 265.93(d)] (sampled quarterly)			
Eight 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	Not applicable	
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	

^a No 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 A-AX, B-BX-BY, S-SX, T, TX-TY, and U.

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

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
299-E24-33	WMA A-AX	9/2005	11/15/2005	Breaker tripped.
299-E33-4	WMA B-BX-BY	8/2005	--	Well has too little water for standard sampling methods.
299-E33-9	WMA B-BX-BY	8/2005	--	Restricted access; safety concerns.
299-W7-4	LLWMA 3	9/2005	10/5/2005	Sampling behind schedule.
299-W8-1	LLWMA 3	9/2005	10/3/2005	Broken compressor.
299-W10-21	LLWMA 3	9/2005	--	Well is dry.
299-W14-5	WMA TX-TY	8/2005	--	Well is dry.
299-W15-16	LLWMA 4	7/2005	--	Well is dry.
299-W15-30	LLWMA 4	8/2005	10/28/2005	Needed maintenance.
299-W15-41	WMA TX-TY	8/2005	10/5/2005	No water to surface.
299-W22-48	WMA S-SX	9/2005	10/27/2005	Pump needed lowering.
299-W22-82	WMA S-SX	9/2005	10/28/2005	Pump problem.
699-25-34D	NRDWL	8/2005	10/18/2005	Sampling behind schedule.
699-26-33	NRDWL	8/2005	10/14/2005	Sampling behind schedule.

LLWMA = Low-level waste management area.
NRDWL = Nonradioactive dangerous waste landfill.
RCRA = *Resource Conservation and Recover Act*.
WMA = Waste management area.

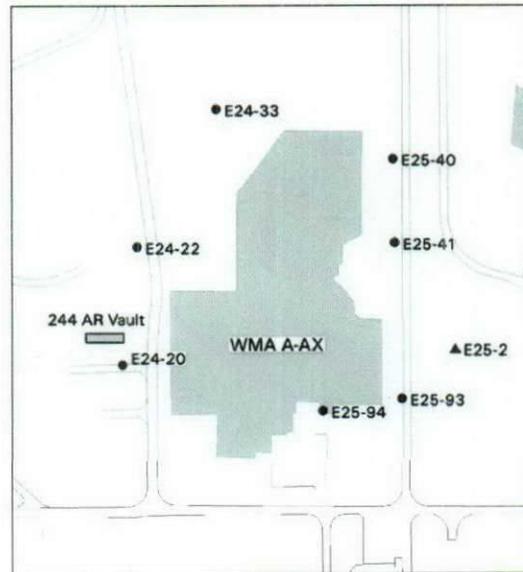
STATUS OF ASSESSMENT PROGRAMS

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

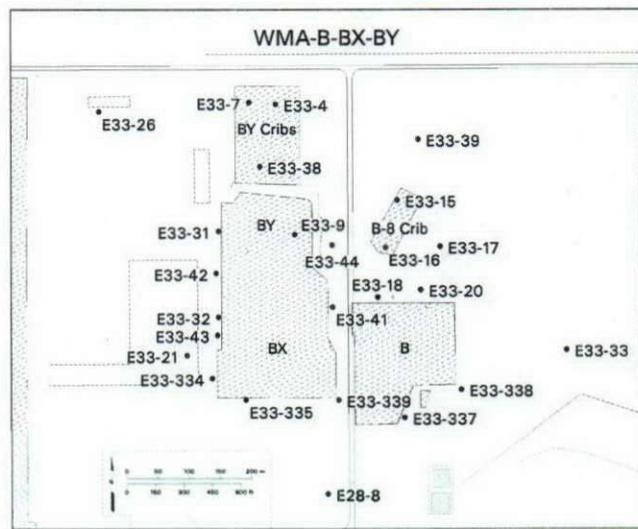
Single-Shell Tank Waste Management Area A-AX. Because of elevated specific conductance, this site was placed in a groundwater-quality assessment program in July 2005. Under this assessment program, quarterly sampling began December 2005. Comment resolution on the assessment monitoring plan has been completed. Distribution of the plan will take place in January 2006.

The groundwater flow direction, based on local hydrographs and in situ flow measurements, is east southeast to southeast (Hartman et al. 2004). The aquifer thickness is ~27 meters, and although the water-table has declined ~9 centimeters in the past year, there have been no changes in flow direction or rate at this site since the last annual groundwater report.

During the reporting quarter (prior to implementation of assessment monitoring), data from the newly installed downgradient well 299-E25-94, were the only values reported. The well shows elevated concentrations of nitrate (42.5 mg/L), sulfate (79.2 mg/L) and technetium-99 (474 pCi/L). The sulfate and technetium-99 concentrations were lower than those observed in nearby well 299-E25-93, where elevated specific conductance results recently sent the site into assessment. The values from June 2005 in well 299-E25-93 were 39.8 mg/L for nitrate (drinking water standard 45 mg/L), 93.8 mg/L for sulfate (secondary drinking water standard 250 mg/L) and 8,350 pCi/L for technetium-99 (drinking water standard 900 pCi/L). In recent years, there appears to be a regional increase in both sulfate and nitrate over most of the 200 East Area. Because these constituents are elevated in upgradient wells, the high concentrations of nitrate and sulfate found at this site may be associated with regional trends. However there are no upgradient values as high as the technetium-99 seen at well 299-E25-93.



Single-Shell Tank Waste Management Area B-BX-BY. Because the hydraulic gradient is nearly flat across the 200 East Area, small inaccuracies in water elevations are important when estimating flow direction and rate. These inaccuracies are caused by measurement errors, deviations from vertical of the borehole, small differences between elevation references from different surveys, and pressure effects associated with changing weather conditions. Consequently, considerable uncertainty remains in flow directions surrounding the waste management area.



The region of the aquifer near the basalt subcrop is slowly receding back to pre-Hanford water levels, which will leave most of the area under Waste Management Area B-BX-BY and the Low-Level Waste Management Area 2 devoid of an unconfined aquifer. These structural highs in the basalt, most likely, affect the local flow directions in the vicinity of Waste Management Area B-BX-BY, especially where the aquifer is thin.

Most of the wells in the assessment network were sampled in August 2005. Well 299-E33-9, located in the BY Tank Farm has not been sampled since March 2004 due to tank farm safety issues, which have restricted access to the well. Well 299-E33-4 was not sampled this quarter because insufficient water remains in the well. Alternative methods of sampling are being explored.

Groundwater beneath this site is contaminated with nitrate, technetium-99, and uranium attributed to two general source areas including the Waste Management Area B-BX-BY and the BY cribs. The nitrate plume lies beneath the north part of the waste management area and the BY cribs, and extends south, east, and west from the highly contaminated groundwater under the BY cribs. The source of this plume appears to be the BY cribs. Based on results from 10 years of groundwater sampling, there is a long term increasing trend in nitrate across the area. In wells 299-E33-32, 299-E33-42, 299-E33-44, 299-E33-38 and 299-E33-7, nitrate ranged from 122 to over 800 mg/L (Figure 1). Nitrate concentrations were even higher in well 299-E33-4 beneath the BY cribs, at 1,340 mg/L in February 2005, when it was last sampled. The area east of the BY Tank Farm also shows increasing nitrate over the years, with recent values at 219 and 664 mg/L, respectively, in wells 299-E33-20 and 299-E33-16. This contamination is part of a larger nitrate plume that extends south, east and west from the highly contaminated groundwater under the BY cribs.

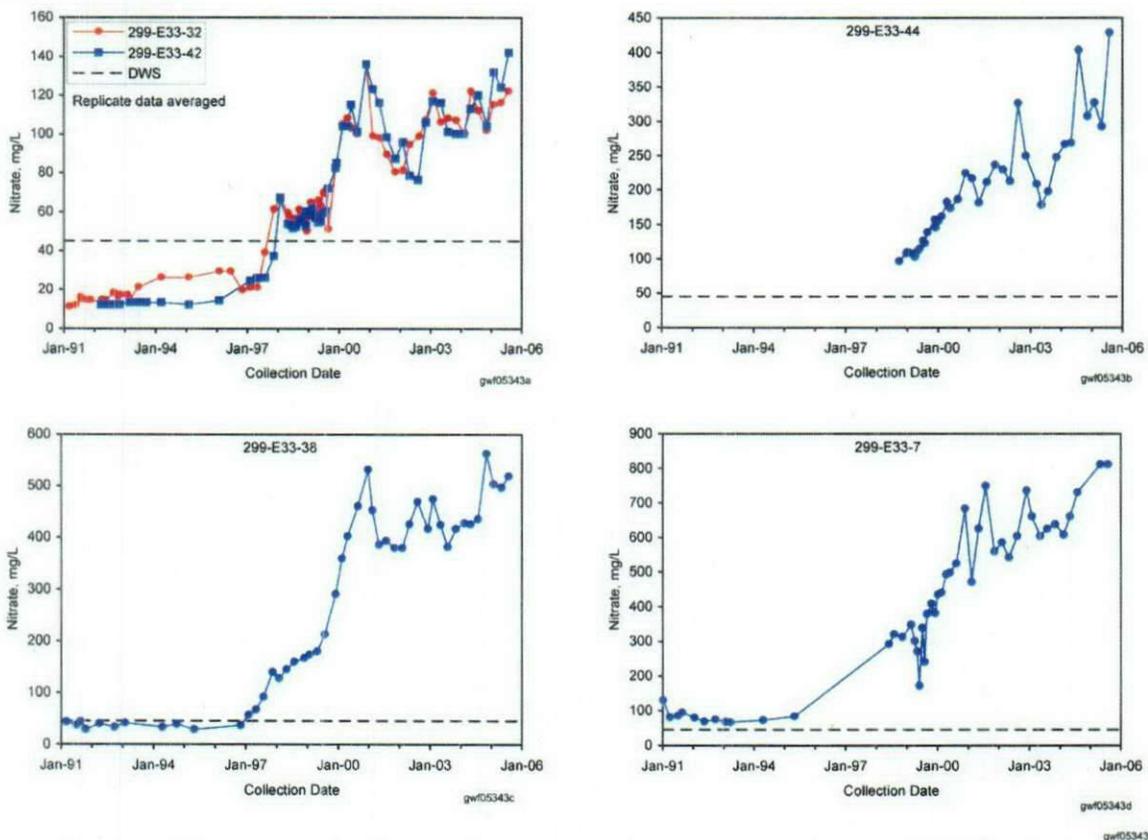


Figure 1. Nitrate Concentrations in Waste Management Area B-BX-BY and BY Cribs Wells

A technetium-99 plume with an apparent source in the BY cribs and Waste Management Area B-BX-BY is similar to the nitrate plume in lateral extent and temporal trends. Like nitrate, technetium-99

concentrations also are increasing across the waste management area. The highest level observed to date was 23,100 pCi/L in well 299-E33-4 in the BY cribs in November 2004, while a value of 13,700 pCi/L was observed in the south part of the BY cribs in well 299-E33-38 in August 2005. In the south part of Waste Management Area B-BX-BY, technetium-99 levels are much lower, but increasing. A long-term increasing trend is found in well 299-E33-21 (Figure 2), located southwest of the waste management area. Also of note is the increasing technetium-99 concentration along the south boundary of the waste management area in well 299-E33-339, where the concentration was over 200 pCi/L (see Figure 2).

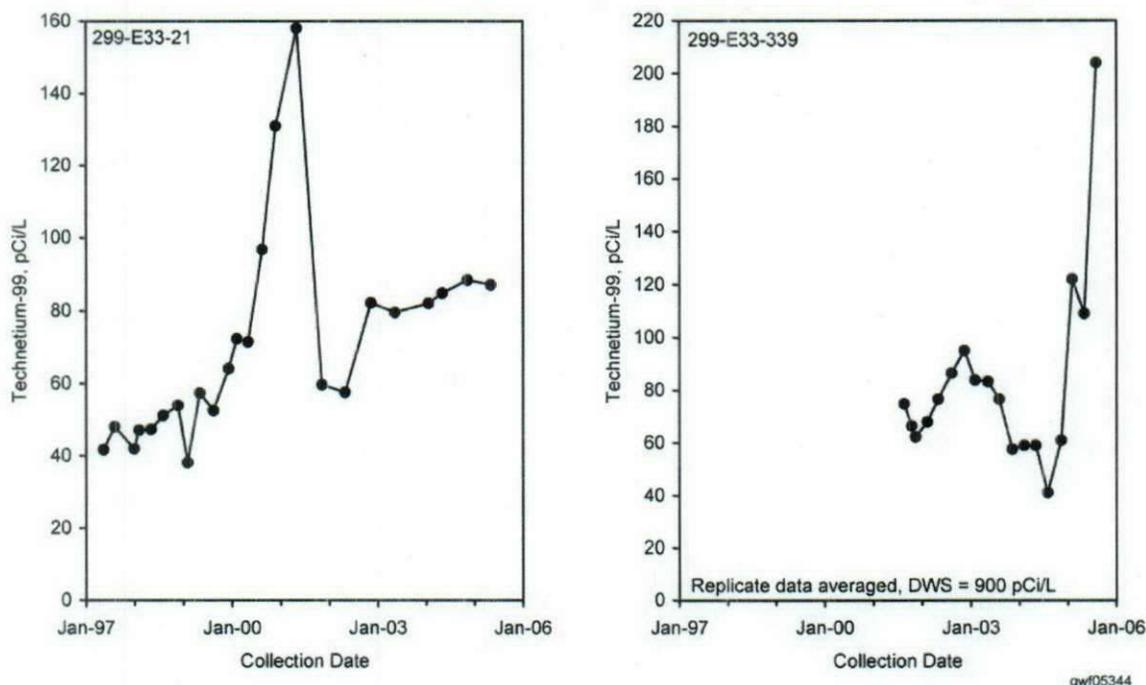


Figure 2. Technetium-99 Concentrations in Waste Management Area B-BX-BY Wells

The uranium plume in groundwater continues to be evaluated beneath the BY Tank Farm and BY cribs, and extends to the northwest for some undetermined distance. Without information from well 299-E33-9, located in the BY Tank Farm, we may not have a complete view of the current uranium concentrations and distribution in the groundwater. Uranium continued to increase slowly north of the BY Tank Farm during FY 2005 and increased markedly to the southeast. Figure 3 compares uranium trends between well 299-E33-9, the center of the uranium plume in 2000 under the BY Tank Farm, with the increasing trend observed in well 299-E33-18. Uranium concentrations have increased over the year from 227 to 454 $\mu\text{g/L}$ in well 299-E33-18 as the center of the plumes migrates south.

As shown in the January through March 2004 quarterly RCRA groundwater monitoring report, uranium co-varies with the mobile constituents technetium-99 and nitrate. This co-variation indicates that the source or sources of technetium-99 and nitrate in the soils also are sources of uranium. However, east of the BY Tank Farm in well 299-E33-44, uranium recently decreased from 350 $\mu\text{g/L}$ in 2004 to 207 $\mu\text{g/L}$ at the end of FY2005. This lack of co-variation between the mobile contaminants and uranium east of the BY Tank Farm may indicate movement of a new plume into the local area, which has lower levels of uranium but high nitrate and technetium-99.

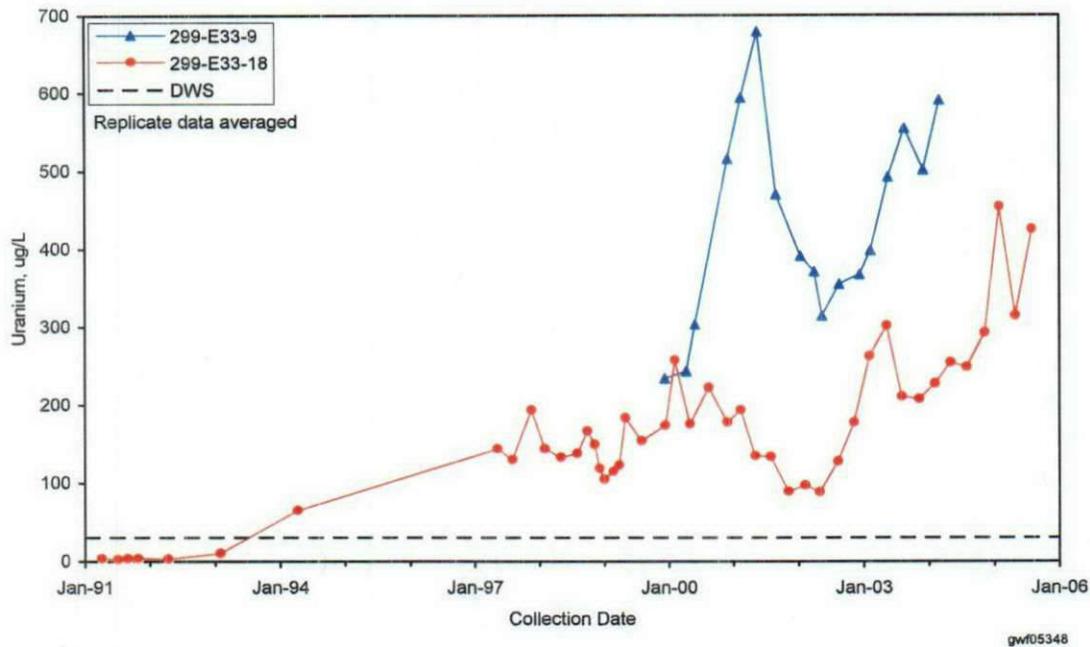
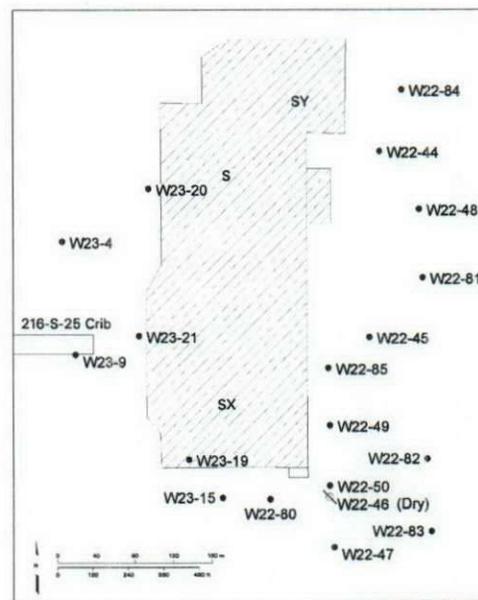


Figure 3. Uranium Concentrations in Waste Management Area B-BX-BY Wells

Single-Shell Tank Waste Management Area S-SX. Groundwater beneath this site is contaminated with hexavalent chromium, nitrate, and technetium-99 attributed to two general source areas within the waste management area. In addition, tritium and carbon tetrachloride are present in groundwater beneath the waste management area, but their sources are from adjacent facilities.

Water level measurements during the quarter indicated that the water table 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 waste management area, based on water level and contaminant migration data. All water levels measured during the quarter were consistent with the falling water table trend. All but two wells were sampled during the quarter, and those two wells, 299-W22-48 and 299-W22-82, were sampled in late October. The results from the two wells sampled late are included in this report.



Concentrations of the defining constituents in the north contaminant plume, with an apparent source in S Tank Farm, continued to decline or remain about the same. Chromium remained below the drinking water standard (100 $\mu\text{g/L}$) at $\sim 15 \mu\text{g/L}$, nitrate remained level above the drinking water standard (45 mg/L) at $\sim 48 \text{mg/L}$, and technetium-99 remained above the drinking water standard (900 pCi/L) at $\sim 1,300 \text{pCi/L}$.

The contaminant plume migrating from the SX Tank Farm in the south portion of the waste management area continued to spread downgradient, as indicated by increasing concentrations of chromium and technetium-99 in farthest downgradient well 299-W22-83 (see Figures 4 and 5). As seen in the figures, there is an indication that the concentrations may be leveling off. Chromium concentrations in the source area (represented by well 299-W23-19) increased again during the quarter by about 60% (Figure 6). The chromium concentration rose from 1,110 $\mu\text{g/L}$ in June to 1,710 $\mu\text{g/L}$ in September. Figure 6 shows the rapid rise in chromium concentrations over the past 18 months in the well. At the same time, technetium-99 and nitrate concentrations increased slightly.

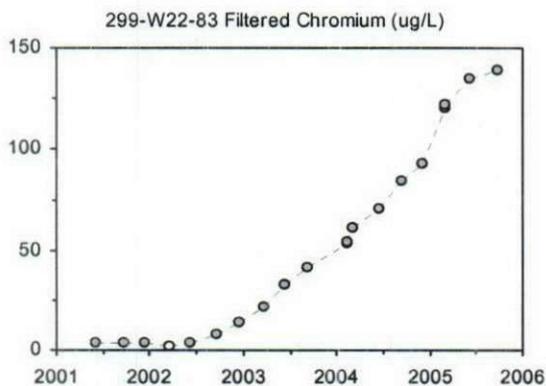


Figure 4. Chromium Trends in Well 299-W22-83

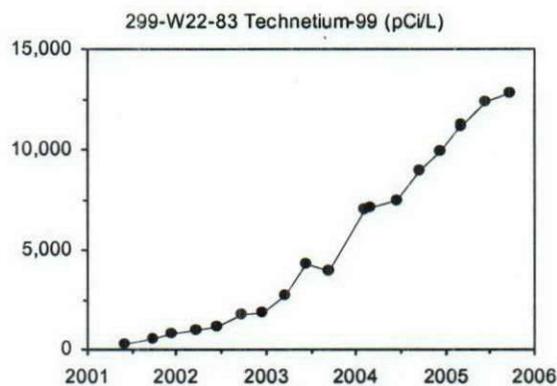


Figure 5. Technetium-99 Trends in Well 299-W22-83

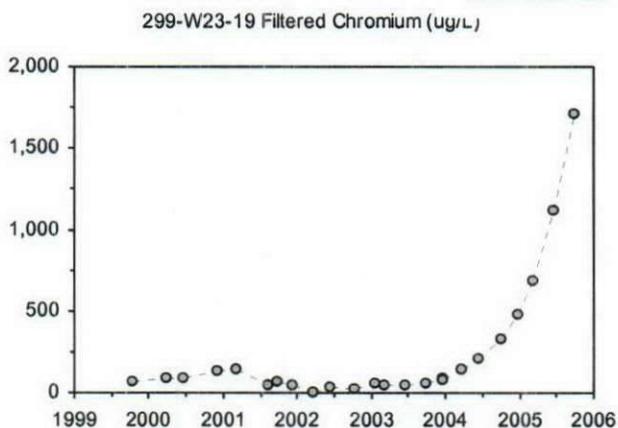


Figure 6. Chromium Trends in Well 299-W23-19

Specific conductance probe measurements continued to be collected during the quarter in well 299-W23-19 and are shown in Figure 7. It appears that contaminant concentrations in the south plume reached a maximum level during the quarter.

299-W23-19 Specific Conductance - Fiscal Year 2005

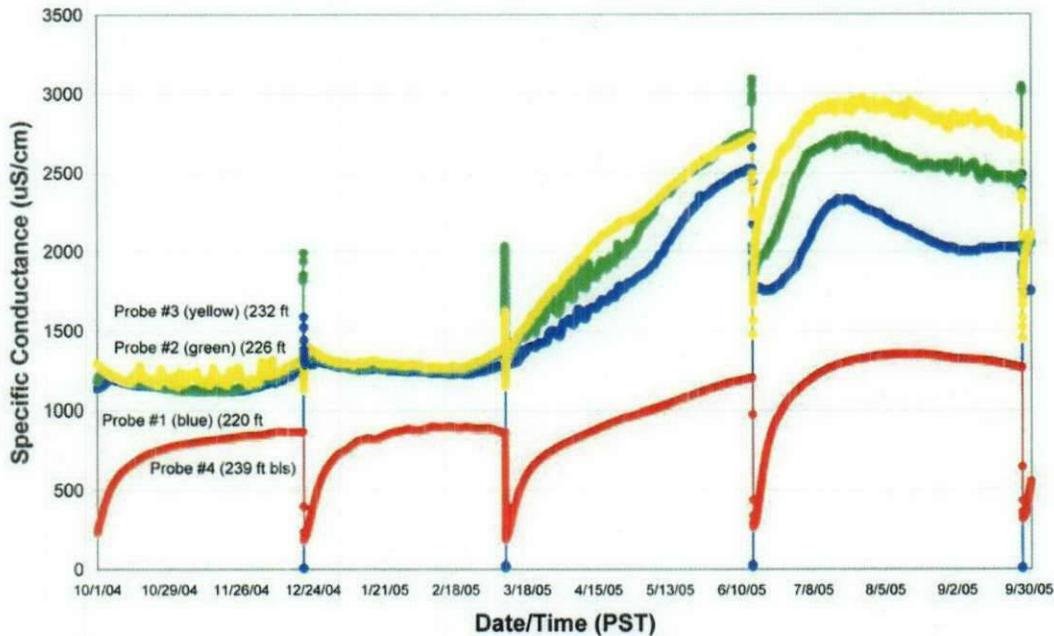
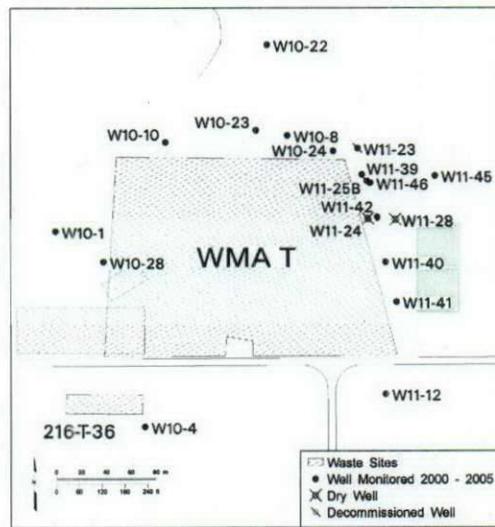


Figure 7. Probe-Measured Specific Conductance in Well 299-W23-10 During FY 2005

Single-Shell Tank Waste Management Area T.

Water levels in wells near Waste Management Area T continued to decline during the reporting period. The measured amount of decline during the past year was between 0.33 and 0.46 meter. Groundwater flow direction at Waste Management Area T is between east-northeast and east-southeast at a rate of ~0.003 to 0.024 meter per day. All wells in the monitoring networks at Waste Management Area T were successfully sampled during the reporting period.

A new well, 299-W11-46, was drilled and made sample ready during the reporting period. The new well is a replacement for well 299-W11-25B, which was damaged during construction. The new well is screened between 6 and 12 meters below the water table. This was the depth of the maximum technetium-99 and chromium concentrations found in well 299-W11-25B during drilling. No routine data were available from the new well for inclusion in this report.



A second new well, 299-W11-45, was begun during the reporting period. It is scheduled for sampling in 2006.

Chromium, carbon tetrachloride, and trichloroethene continued to be the dangerous waste constituents found in the groundwater beneath Waste Management Area T. The source of the carbon tetrachloride and trichloroethene was liquid disposal associated with processes at the Plutonium Finishing Plant and not Waste Management Area 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 waste management area.

Chromium concentrations exceeded the drinking water standard (100 µg/L) in four wells during routine sampling at Waste Management Area T in August. The plume exceeding the drinking water standard extends to wells both upgradient and downgradient of the waste management area. Although concentrations of chromium changed slightly in some wells from the previous quarter, the overall extent of the plume generally remained unchanged. The most significant concentration change was in well 299-W11-39, in which the chromium concentration decreased to less than the drinking water standard (57.1 and 57.8 µg/L for duplicate samples) from the previous quarter's concentration of 122 µg/L. This change moved the edge of the plume that exceeds the drinking water standard toward the south along the downgradient side of the waste management area. The lack of wells downgradient of the wells just east of the Waste Management Area T boundary precludes detailed evaluation of the extent of the plume to the east.

Chromium also exceeded the drinking water standard in the well development sample collected from new well 299-W11-46. The concentration was 248 µg/L. However, this concentration may not be representative of the groundwater at the location of the well screen because it was measured on an unfiltered sample collected from a newly constructed well.

The highest chromium concentrations were in wells 299-W10-4, located south of the southwest corner of the waste management area, and in 299-W10-28 located upgradient of the waste management area (Figure 8). The concentration of chromium in well 299-W10-4 was 584 µg/L. Chromium concentrations had been increasing in this well since 1997 until mid 2005. The concentration of chromium in well 299-W10-28 in May was 240 µg/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 (see Figure 8).

The chromium concentrations exceeding the drinking water standard in downgradient wells at Waste Management Area T were 155 µg/L (well 299-W11-41) and 185 µg/L (well 299-W11-42), similar to the previous quarter's concentrations.

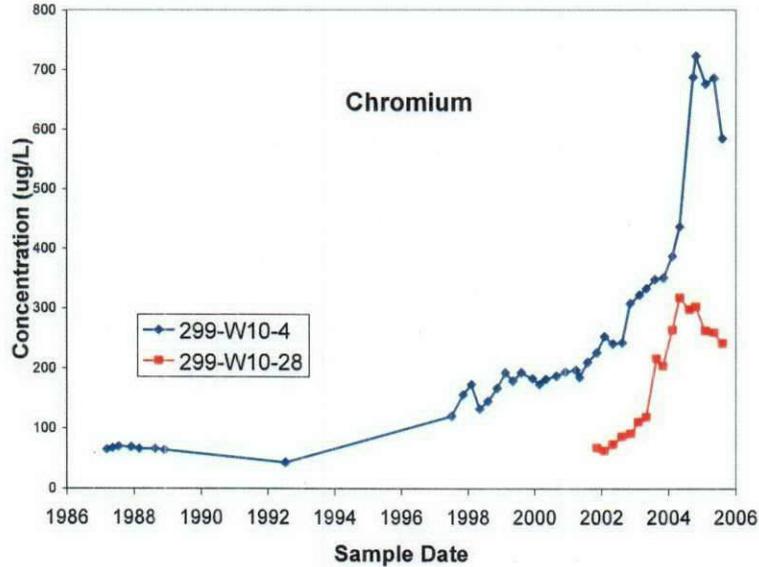


Figure 8. Chromium Concentrations in Wells 299-W10-4 and 299-W10-28 at Waste Management Area T

There is a local, high nitrate plume beneath Waste Management Area T and within the regional 200 West Area plume. Although the nitrate concentrations remained above the 45-mg/L drinking water standard in all wells in the Waste Management Area T network during the reporting period, the local high nitrate plume exceeds ten times the drinking water standard in both upgradient and downgradient wells. The highest concentration of nitrate was in well 299-W10-4, where it increased from 3,090 mg/L in August 2005 to 3,540 mg/L during the reporting period (Figure 9). This was a substantial increase over the previous quarter's concentration and was the highest concentration from the well since the late 1950s. 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.

Nitrate concentrations in downgradient monitoring wells during the reporting quarter remained fairly constant with the previous quarter (see Figure 9). Concentrations in downgradient wells were between 127 mg/L (well 299-W11-39) and 815 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 Waste Management Area T. However, the eastern extent of the plume is not well defined with the existing monitoring well network.

Fluoride concentrations did not exceed the drinking water standard of 4 mg/L in any well at Waste Management Area T during the reporting period. Fluoride concentrations exceeded the drinking water standard in two wells (wells 299-W10-23 and 299-W10-4) the previous quarter. Fluoride concentrations did exceed the 2-mg/L secondary standard in five wells at Waste Management Area T in August. Wells with fluoride between 2 and 4 mg/L are located north, southwest and east of the waste management area; the source of fluoride has not been identified.

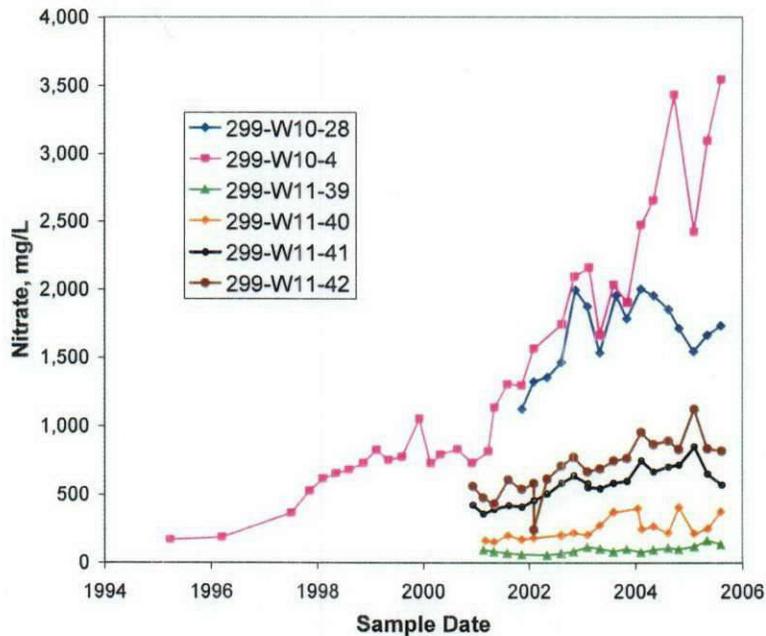


Figure 9. Nitrate Concentrations in Selected Wells at Waste Management Area T

There is a technetium-99 plume downgradient of Waste Management Area T. The lateral extent of the plume is not known because of the lack of wells east of the existing downgradient wells. Well 299-W11-45 is currently being constructed to help assess the eastern extent of the plume. The greatest technetium-99 concentration was 15,600 pCi/L (and 15,300 pCi/L in duplicate sample) in well 299-W11-39 during routine sampling in August. This was a decrease from 27,400 pCi/L during the previous quarter (Figure 10). It is possible that the previous quarter's concentration was not a valid data point ; however, there is currently insufficient data to determine this. The technetium-99 concentration will be watched closely during the next quarter to determine whether the extreme concentration increase in May was valid and representative of the groundwater in the well.

The technetium-99 concentration in the development sample from new well 299-W11-46 was 36,000 pCi/L. The measured concentration was lower than what was expected when compared to the concentrations measured in the adjacent (and now decommissioned) well 299-W11-25B (Figure 11). The sample was collected after extensive purging of the well during well development and it is possible that the sample was not representative of the ambient groundwater at the well. The first routine sampling for the well was scheduled in November and the technetium-99 concentration in that sample will be compared to the concentrations measured from the drilling samples from well 299-W11-25B.

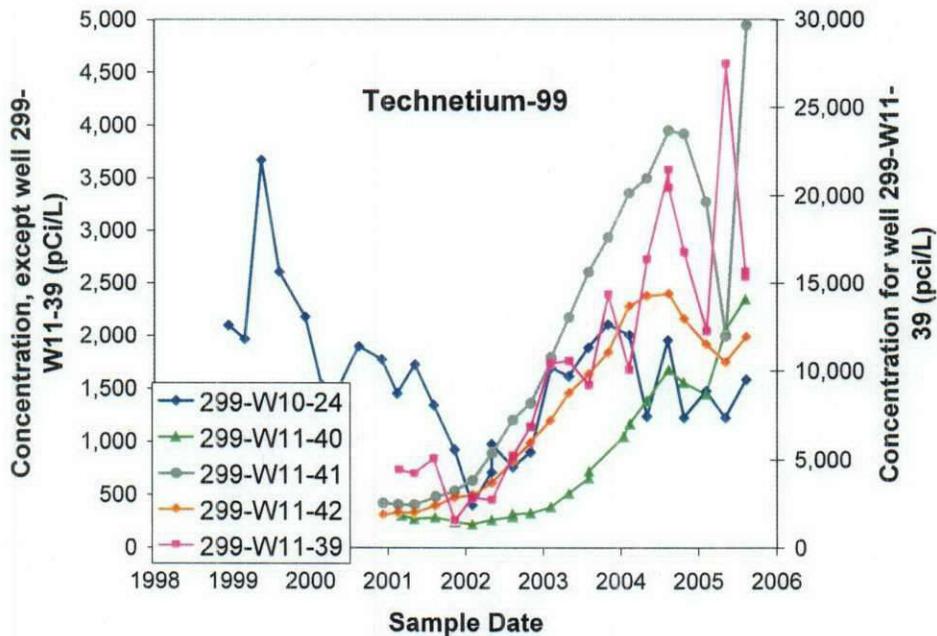


Figure 10. Technetium-99 Concentrations in Selected Wells at Waste Management Area T

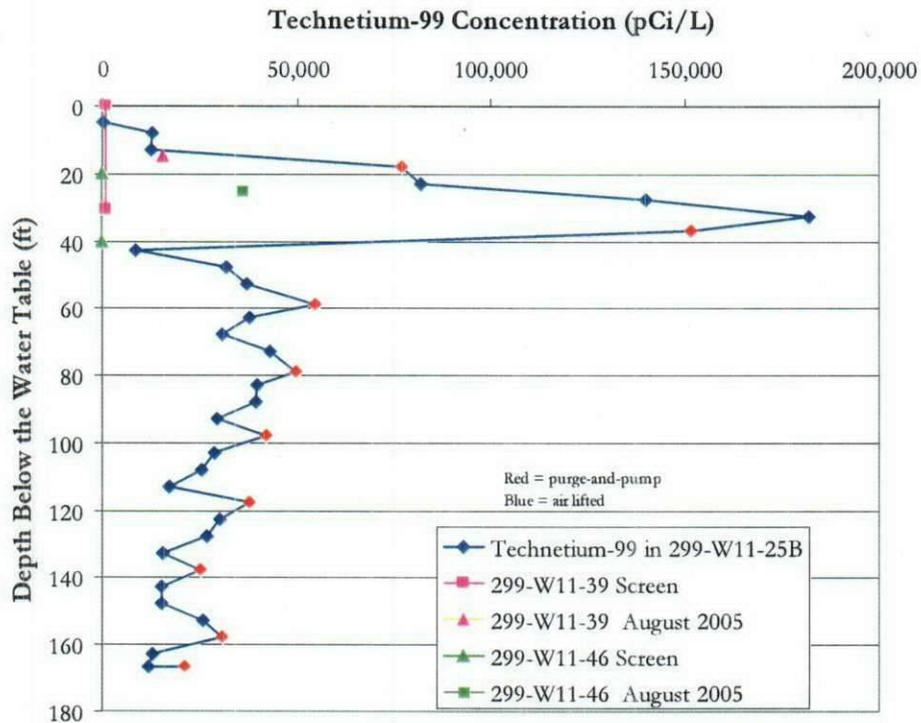
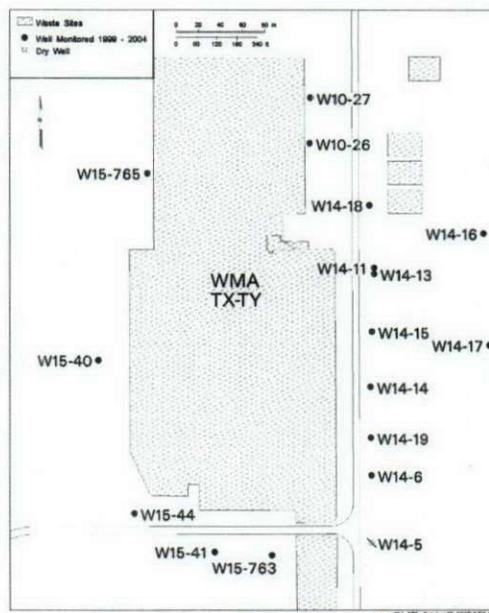


Figure 11. Technetium-99 concentrations in three clustered wells at Waste Management Area T

Tritium exceeded the drinking water standard of 20,000 pCi/L in one well (299-W11-12) at Waste Management Area T during the reporting period. The tritium concentration was 41,300 pCi/L in August, essentially unchanged from the previous quarter. The tritium concentration generally has been decreasing slightly since the well was first regularly sampled for tritium in late 1998.

Single-Shell Tank Waste Management Area TX-TY.

Water-level measurements in wells near Waste Management Area TX-TY showed between ~0.34 and 0.44 meter decline during the past year. However, the water levels in many wells at the waste management area are perturbed by the 200-ZP-1 pump-and-treat system. The groundwater flow direction at Waste Management Area TX-TY varies from the north to the south part of the waste management area. In the north, groundwater flow is east to southeast at a rate of ~0.001 to 0.2 meter per day. In the south, where groundwater flow has been greatly altered by the 200-ZP-1 pump-and-treat system, the flow direction is to the south or south-southwest at ~0.3 meter per day. Three wells in the Waste Management Area TX-TY monitoring network were modified and added to the 200-ZP-1 pump-and-treat system as extraction wells in July 2005: 299-W15-765, 299-W15-40, and 299-W15-44. This probably will result in a reversal of groundwater flow direction in the future.



All wells in the monitoring network at Waste Management Area TX-TY were successfully sampled during the reporting period.

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

Chromium equaled or exceeded the 100- $\mu\text{g/L}$ drinking water standard in well 299-W14-13 (769 $\mu\text{g/L}$) and well 299-W14-11 (100 $\mu\text{g/L}$) at Waste Management Area TX-TY. The wells are within ~5 meters of each other. The chromium plume is restricted to the vicinity of the two wells. The most likely source for the chromium is the waste management area itself and/or the nearby TY cribs.

Nitrate continued to exceed the drinking water standard (45 mg/L) in all wells in the Waste Management Area TX-TY monitoring network during the reporting quarter. The highest nitrate concentration was 553 mg/L in well 299-W14-13 in the central part of the east side of the waste management area. This was a significant increase over the previous quarter when the nitrate concentration was 349 mg/L. Nitrate concentrations have been between 349 mg/L and 580 mg/L for the past 3 years. The regional nitrate plume at Waste Management Area TX-TY is attributed to past disposal practices throughout the 200 West Area. The local high nitrate concentration at well 299-W14-13 may be due to one or a combination of nearby liquid disposal facilities and Waste Management Area TX-TY.

Manganese exceeded the secondary drinking water standard (50 µg/L) in well 299-W10-27 in August. This well has a history of high manganese concentrations since it was drilled in August 2001, at which time the manganese concentration was 862 µg/L.

Iodine-129 exceeded the 1-pCi/L drinking water standard in well 299-W14-13 at Waste Management Area TX-TY in August 2005. The concentration of iodine-129 in well 299-W14-13 was 22.1, up from 16.5 pCi/L during the previous quarter (Figure 12). The iodine-129 concentration has fluctuated between 9.7 and 50 pCi/L since the well was drilled in late 1998. The iodine-129 plume is restricted to the vicinity of the well.

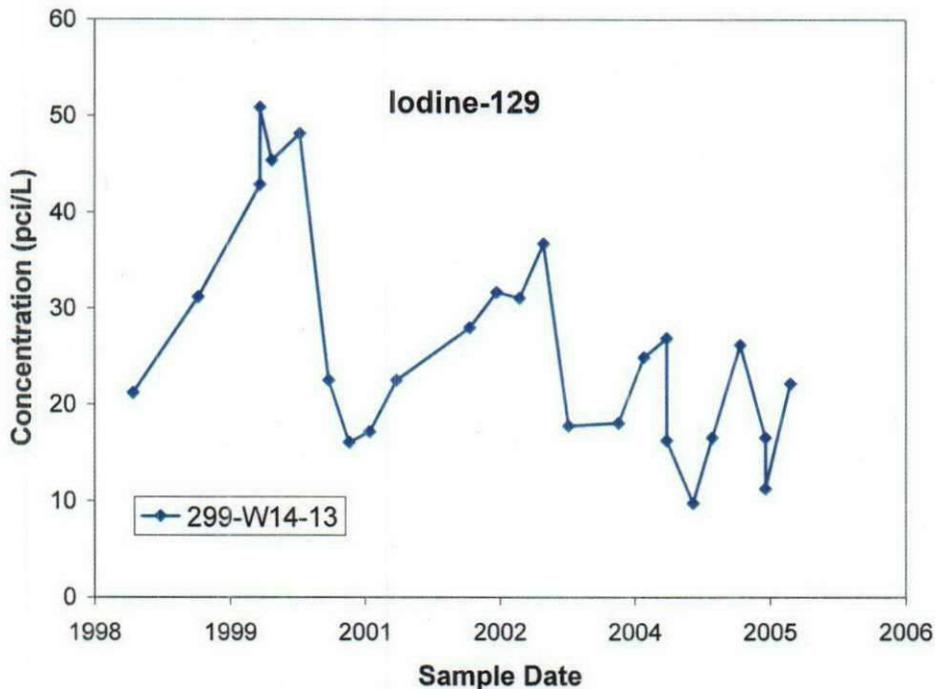
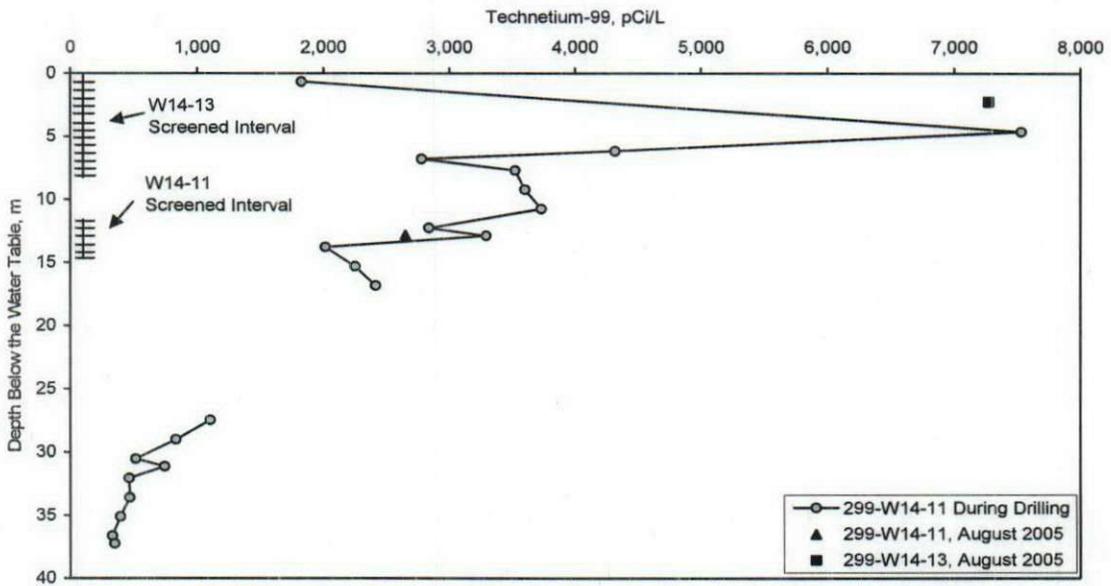


Figure 12. Iodine-129 concentration in well 299-W14-13 at Waste Management Area TX-TY

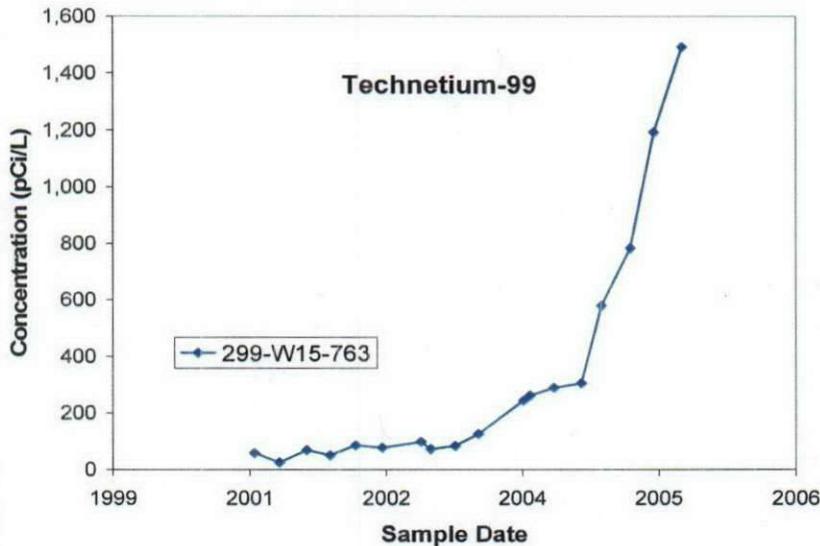
Concentrations of technetium-99 exceeded the drinking water standard of 900 pCi/L in three wells at Waste Management Area TX-TY during the reporting period. The highest concentration was 7,270 pCi/L in well 299-W14-13, located east of the waste management area. The technetium-99 concentration was 2,650 pCi/L in well 299-W14-11 located within ~4 meters of, and screened deeper than, well 299-W14-13. The technetium-99 concentrations in both wells were expected based on the concentration versus depth curve from samples obtained during drilling of well 299-W14-11 (Figure 13).

The technetium-99 concentration also exceeded the drinking water standard in well 299-W15-763, located south of the waste management area. Technetium-99 concentrations have been increasing significantly during the past year (Figure 14). The increase is probably due to the pump-and-treat system drawing technetium-99 toward the well from beneath the TX Tank Farm.



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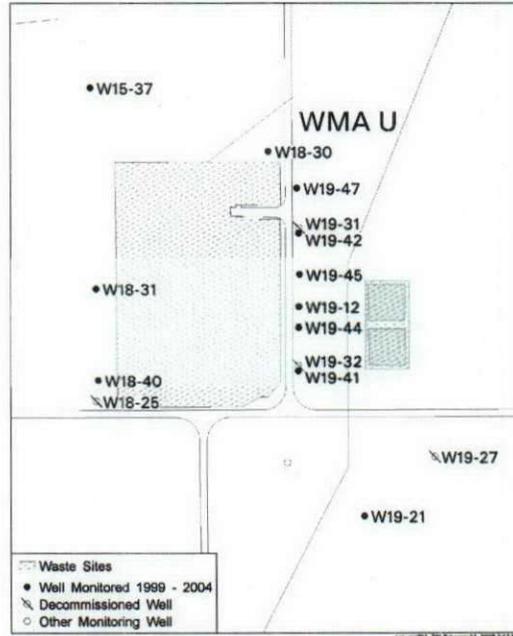
Figure 13. August Technetium-99 Concentrations In Wells 299-W14-11 and 299-W14-13 Compared to Concentrations from Samples Obtained During Drilling of Well 299-W14-11



concentration was 43,500 pCi/L in well 299-W14-15, located south of well 299-W14-13. The high tritium plume at Waste Management Area TX-TY is confined to the central part of the east (downgradient) side of the waste management area.

Single-Shell Tank Waste Management Area U.

This waste management area, which has been in assessment monitoring since 1999, has affected groundwater quality with elevated concentrations of chromium, nitrate, and technetium-99. In the past, contamination was limited to the south half of the downgradient (east) side of the waste management area, 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 waste management area. Carbon tetrachloride is also present beneath the waste management area 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 waste management area. All wells in the monitoring network were sampled as scheduled during the quarter.



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.

Technetium-99 and nitrate trends remained the same as reported previously. These constituents are present beneath the waste management area apparently from three sources. A source of nitrate is producing a nitrate plume on the south half of the east side of the waste management area, and an upgradient source of nitrate has reached the waste management area from the upgradient (west) side of the waste management area. The upgradient concentration of nitrate is ~30 mg/L and the downgradient concentration is ~70 mg/L, above the drinking water standard of 45 mg/L.

There is also a technetium-99 plume on the north half of the east side of the waste management area. The technetium-99 plume is at a maximum concentration of 1,200 pCi/L, but the concentrations have leveled off (Figure 15).

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,

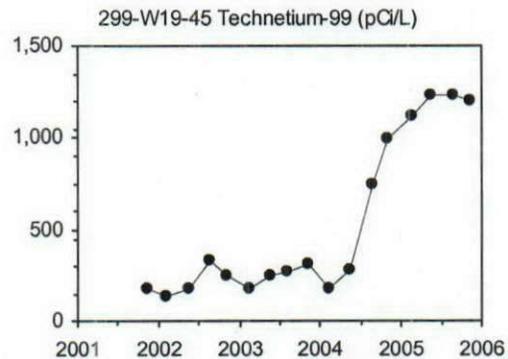
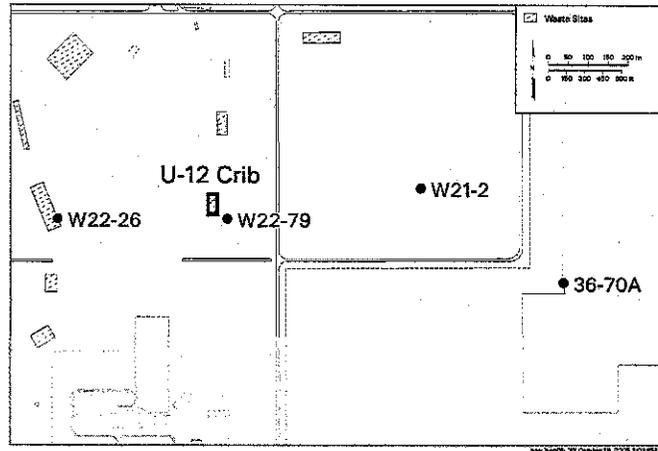


Figure 15. Changes in Maximum Technetium-99 Concentrations at Waste Management Area U

699-36-70A, and 299-W21-2). The site is in assessment for elevated specific conductance and is sampled quarterly. The constituent of primary interest in nitrate.

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



Based on data from a regional network of wells, the groundwater flow direction beneath the crib has remained relatively unchanged, toward the east-southeast for years. Water levels continued to decline around the 216-U-12 crib but the decline has slowed over the past 12 months. The rate of decline ranges from ~0.13 to 0.2 meter per year as the regional water table drops.

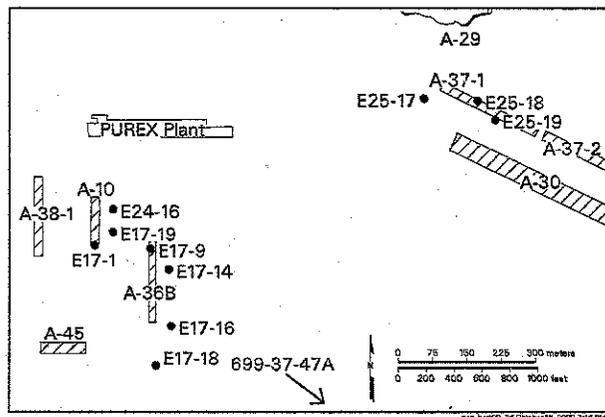
In downgradient well 299-W22-79, nitrate concentrations rebounded slightly in September 2005, but remained below the 45-mg/L drinking water standard at 24.3 mg/L.

In downgradient well 699-36-70A, the farthest well from the 216-U-12 crib, nitrate concentrations increased slightly to 68.8 mg/L. However, nitrate concentrations generally are decreasing overall in this well.

In newly added, downgradient well 299-W21-2, the nitrate concentration was down slightly to 67.3 mg/L. This new well is located between the 216-U-12 crib and well 699-36-70A and the regional plume maps suggest that the center of mass of the nitrate plume has passed through this area.

Constituent concentrations in recently added, upgradient well 299-W22-26 appear to be rising slowly, possibly due to contaminants detected downgradient of the S-SX Tank Farm. Nitrate was measured at 28.35 mg/L in well 299-W22-26 in August.

PUREX Cribs (216-A-10, 216-A-36B, and 216-A-37-1). Three of the 11 near-field network wells were sampled during the reporting quarter. PUREX Cribs network wells are sampled quarterly as required by 40 CFR 265.93 [d][7][i] to determine if there are any changing contaminant conditions near the three PUREX cribs. Water levels were measured at each well at the time of sampling. Nitrate was the only constituent in groundwater that



continued to exceed its drinking water standard in one or more of the wells sampled. Radioactive constituents (not regulated under RCRA) that continued to exceed drinking water standards included iodine-129, strontium-90, gross beta, and tritium.

Beneath the PUREX cribs, the differences in water-table elevations from well to well are very small indicating an extremely low water-table gradient. During July through September 2005, the greatest water-level difference between wells was 0.07 meter over the distance from well 299-E24-16 to 299-E25-19 (a distance of ~900 meters). The gradient between these two well is 0.00008. Therefore, the water-table gradient is too low to determine groundwater flow rate or flow direction reliably. However, groundwater flow directions determined from the movement of groundwater contamination plumes indicate that the regional flow is toward the southeast.

Nitrate was reported at levels greater than the drinking water standard (45 mg/L) at the wells monitoring the 216-A-36B and 216-A-10 cribs. The highest concentration during this quarter was 134 mg/L at well 299-E17-14, located near the 216-A-36B crib. At this well, the trend was generally upward between 2001 and early 2004. Thereafter, nitrate results in this well showed greater variability but neither an increasing nor decreasing trend (Figure 16). The trend for nitrate at well 299-E26-16 near the 216-A-10 crib has been generally increasing since 2002 (Figure 17).

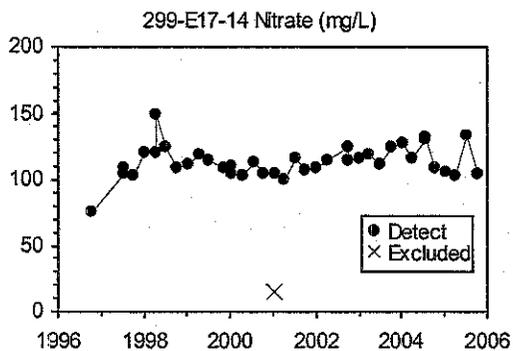


Figure 16. Nitrate at Well 299-E17-14 Near the 216-A-36B Crib

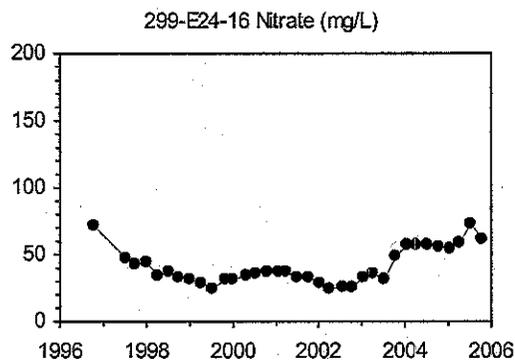


Figure 17. Nitrate at Well 299-E24-16 Near the 216-A-10 Crib

Iodine-129 also exceeded its drinking water standard (1 pCi/L) at the two wells near the 216-A-10 and 216-A-36B cribs. The highest level was 7.7 pCi/L at well 299-E17-14, which is located near the 216-A-36B crib. Iodine-129 concentrations in this well fluctuate in the 5 to 12 pCi/L range and have a gradually decreasing trend since 2002.

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 level for gross beta during the reporting quarter was 65.7 pCi/L while strontium-90 was 20.5 pCi/L. Although both showed slightly upward trends prior to 2000, more recent results indicate that the trend has stabilized.

Tritium exceeded its drinking water standard (20,000 pCi/L) at the three wells sampled during the reporting quarter. Two of the three wells exceeded the drinking water standard by more than a factor of 10. The highest reported level was 380,000 pCi/L at well 299-E17-14 near the 216-A-36B crib. The trend in this well has been decreasing since 2002. However, at well 299-E24-16 (near the 216-A-10 crib) the latest result was 369,000 pCi/L, and the trend has been increasing since 2002 (Figure 18).

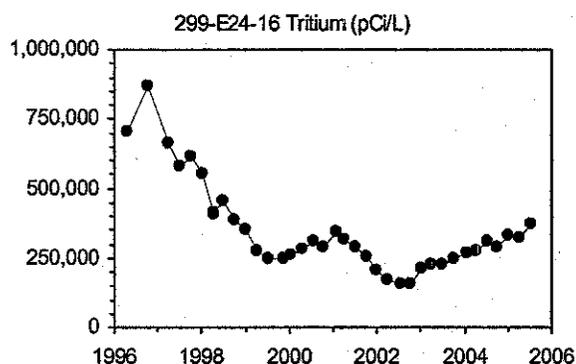


Figure 18. Tritium at Well 299-E24-16 Near the 216-A-10 Crib

QUALITY CONTROL

- Eighty-eight results were flagged with an H due to missed holding times. Nitrate, nitrite, and volatile organic compounds account for most of the flagged results.
- Total organic halides results were improved this quarter. The number of out-of-limit results for field blanks, quadruplicates, and blind standards was significantly reduced. Split samples analyzed in quadruplicate by STL St. Louis and Lionville Laboratory showed that slightly lower precision was obtained by STL, but the differences between the two laboratories were not significant.
- Most of the field duplicate results demonstrated good precision, although the relative percent differences for five pairs of results failed to meet the acceptance criteria. Coliform bacteria, nitrogen in nitrite, arsenic, total petroleum hydrocarbons (diesel), and gross alpha were the constituents with out-of-limit results.
- Laboratory performance on the analysis of blind standards was good overall. Severn Trent St. Louis had out-of-limit results for total organic halides, cyanide, and carbon tetrachloride. All of the results from Severn Trent Richland, Lionville Laboratory, and Eberline Services were acceptable.
- Approximately 4% of the field blank results exceeded the quality control (QC) limits. Methylene chloride, zinc, and calcium had the greatest number of out-of-limit results. Overall, the field blank results should have little impact on the interpretation of 3rd quarter groundwater data.
- Performance-evaluation study results were available from one MAPEP study, one InterLaB RadChem Proficiency Testing Program study, and one Multi-Media Radiochemistry Proficiency Testing study this quarter. The majority of the laboratories' results were within the acceptance limits, indicating good performance overall.
- Approximately 97% 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

Hanford Groundwater Performance Assessment Project
Quality Control Report
July 1 to September 30, 2005

Highlights

- Eighty-eight results were flagged with an H due to missed holding times. Nitrate, nitrite, and volatile organic compounds account for most of the flagged results.
- Total organic halides results were improved this quarter. The number of out-of-limit results for field blanks, quadruplicates, and blind standards was significantly reduced. Split samples analyzed in quadruplicate by Severn Trent Laboratories (STL) St. Louis and Lionville Laboratory showed that slightly lower precision was obtained by STL, but the differences between the two laboratories were not significant.
- Most of the field duplicate results demonstrated good precision, although the relative percent differences for five pairs of results failed to meet the acceptance criteria. Coliform bacteria, nitrogen in nitrite, arsenic, total petroleum hydrocarbons (diesel), and gross alpha were the constituents with out-of-limit results.
- Laboratory performance on the analysis of blind standards was good overall. Severn Trent St. Louis had out-of-limit results for total organic halides, cyanide, and carbon tetrachloride. All of the results from STL Richland, Lionville Laboratory, and Eberline Services were acceptable.
- Approximately 4% of the field blank results exceeded the quality control (QC) limits. Methylene chloride, zinc, and calcium had the greatest number of out-of-limit results. Overall, the field blank results should have little impact on the interpretation of third quarter groundwater data.
- Performance-evaluation study results were available from one Mixed Analyte Performance Evaluation Program (MAPEP) study, one InterLaB RadChem Proficiency Testing Program study, and one Multi-Media Radiochemistry Proficiency Testing study this quarter. The majority of the laboratories' results were within the acceptance limits, indicating good performance overall.
- Approximately 97% 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 quality control (QC) report presents information on laboratory performance and field QC sample results for the third quarter of calendar year (CY) 2005. Routine chemical and radiochemical analyses were performed by STL (St. Louis, MO and Richland, WA) for the U. S. Department of Energy's (DOE's) 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 under the direction of Duratek Federal Services Incorporated (Duratek). 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.

Tables 1 and 2 summarize 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-six percent of the third quarter's results were considered valid. This percentage is a little higher than that for the previous quarter (82%). Roughly 92% of the third 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 88 results were flagged with an H this quarter to indicate the recommended holding time had been exceeded. For STL St. Louis, 42 anion results, 11 alkalinity results, 27 results for volatile organic compounds (from one sample), one phenol, and three oil and grease results were flagged. For Lionville Laboratory, three anion results were flagged. For the mobile laboratory, one hexavalent chromium result was flagged. Most of the missed holding times were associated with sample reanalyses that were triggered by QC failures. Several were also caused by a power outage in the laboratory. A few were caused by the necessity for radiological screening (for analytes with very short holding times).

Table 1. Completeness Summarized by Project

Project	Total Results	Suspect Results	Rejected Results	Field QC Flags	Missed Holding Times	Method Blank Qualifiers	Results Flagged
AEA	6815	7	0	47	10	492	551
CERCLA	17524	6	0	68	6	2092	2150
QC	408	0	0	24	0	8	32
RCRA	46569	176	0	795	154	6090	6683

AEA = Atomic Energy Act.
 CERCLA = Comprehensive Environmental Resource Conservation and Liability Act.
 QC = Quality control.
 RCRA = Resource Conservation and Recovery Act.

Table 2. Completeness Summarized by Method

HEIS Method Name	Total Results	Suspect Results	Rejected Results	Field QC Flags	Missed Holding Times	Method Blank Qualifiers	Results Flagged
General Chemical Parameters							
120.1_CONDUCT	4	0	0	0	0	4	4
214A_TURBIDITY	374	1	0	0	0	0	1
310.1_ALKALINITY	161	1	0	0	8	0	9
360.1_OXYGEN_FLD	97	0	0	0	0	0	0
410.4_COD	10	0	0	0	0	2	2
413.1_OILGREASE	5	0	0	0	2	0	2
415.1_TOC	1	0	0	0	0	1	1
9020_TOX	227	14	0	0	0	33	46
9040_PH	420	0	0	0	0	0	0
9050_CONDUCT	429	0	0	0	0	0	0
9060_TOC	173	0	0	23	0	83	96
9223_COLIFORM	13	0	0	2	0	0	2
REDOX_PROBE_FLD	77	0	0	0	0	0	0
TEMP_FLD	429	0	0	0	0	0	0
Ammonia and Anions							
300.0_ANIONS_IC	1082	4	0	19	33	112	164
350.1_AMMONIA	18	0	0	0	0	0	0
9012_CYANIDE	58	1	0	0	0	0	1
9030_SULFIDE	7	0	0	0	0	0	0
Metals							
6010_METALS_ICP	3477	14	0	89	0	1170	1171
6020_METALS_ICPMS	68	0	0	2	0	37	37
7470_HG_CVAA	18	0	0	0	0	0	0
CR6_HACH_M	19	0	0	0	0	0	0
Volatile Organic Compounds							
8260_VOA_GCMS	2622	0	0	56	23	15	91
WTPH_GASOLINE	12	0	0	0	0	0	0
Semivolatile Organic Compounds							
8040_PHENOLIC_GC	221	0	0	0	0	0	0
8081_PEST_GC	168	0	0	0	0	0	0
8082_PCB_GC	49	0	0	0	0	0	0

HEIS Method Name	Total Results	Suspect Results	Rejected Results	Field QC Flags	Missed Holding Times	Method Blank Qualifiers	Results Flagged
8151_HERBICIDE_GC	70	0	0	0	0	0	0
8270_SVOA_GCMS	143	0	0	0	0	0	0
8290_DIOXINS_GCMS	175	0	0	0	0	8	8
WTPH_DIESEL	12	0	0	2	0	0	2
Radiological Parameters							
906.0_H3_LSC	126	0	0	0	0	0	0
9310_ALPHABETA_GPC	262	4	0	4	0	0	7
AMCMISO_EIE_PLT_AEA	2	0	0	0	0	0	0
BETA_GPC	3	0	0	0	0	0	0
C14_LSC	1	0	0	0	0	0	0
GAMMALL_GS	572	1	0	0	0	0	1
I129LL_ETVDSK_SEP_GS	2	0	0	0	0	0	0
I129LL_SEP_LEPS_GS	41	0	0	0	0	0	0
NP237_LLE_PLATE_AEA	2	0	0	0	0	0	0
PUISO_PLATE_AEA	14	0	0	0	0	0	0
SE79_SEP_IE_LSC	1	0	0	0	0	0	0
SRISO_SEP_PRECIP_GPC	29	0	0	0	0	0	0
TC99_ETVDSK_LSC	117	0	0	0	0	0	0
TC99_SEP_LSC	4	0	0	0	0	0	0
TRITIUM_ELECT_LSC	2	0	0	0	0	0	0
UTOT KPA	142	0	0	4	0	3	4

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 third quarter of 2005 included full trip blanks and field transfer blanks. In general, the desired collection frequency for field duplicates and full trip blanks is one sample per 20 well trips. The target collection frequency for field transfer blanks is one blank on each day in which routine well samples are collected for analysis of volatile organic compounds. Equipment blanks are normally collected once per 10 well trips for portable Grundfos pumps or as needed for special projects. Split samples are also collected on an as-needed basis. Table 3 lists the number of QC samples and their frequencies of collection for the third quarter. Results from each type of QC sample are summarized in the following paragraphs.

Table 3. Quality Control Samples for third Quarter 2005

QC Samples	Number of well trips	Number of QC samples ^(a)	Frequency
Field Duplicates	417	16	4%
Split Samples	7 ^(b)	7 ^(c)	100%
TOC Quadruplicates	73 ^(d)	30	41%
TOX Quadruplicates	70 ^(d)	32	46%
Full Trip Blanks	417	20	5%
Field Transfer Blanks	VOC samples collected on 24 days	22	92% ^(e)
Equipment Blanks	2 ^(f)	0	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 sets of quadruplicate samples collected for TOX analysis and split between two laboratories.
^d Number of well trips in which TOC and/or TOX samples were collected.
^e Number of days with field transfer blanks divided by the number of days that VOC samples were collected (i.e., 22/24).
^f Number of routine sampling events in which non-dedicated sampling equipment was used.
 QC = Quality control
 TOC = Total organic carbon.
 TOX = Total organic halides.
 VOC = Volatile organic carbon.

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.

Sixteen field duplicates were collected and analyzed during the third quarter of 2005 to produce 274 pairs of results. Overall, the results demonstrate good sampling and analysis precision. Six pairs of qualifying duplicate results had relative percent differences greater than 20%. Acceptable precision was obtained for one result pair after reanalyses were performed on a sample with out-of-trend results for gross alpha. Table 4 lists the remaining five pairs of results with poor precision. The high coliform bacteria results from well 699-23-34A and the high nitrogen in nitrite results from well 299-W11-39 are outliers based on historical data, but reanalyses would not be useful because of the instability of these constituents. Low concentrations probably account for the high RPD for arsenic because the concentrations were close to the method's quantitation limits.

Table 4. Field Duplicate Results that Exceeded Quality Control Limits

Constituent	Well	Method	Filtered	Result 1	Result 2	RPD
General Chemistry Parameters						
Coliform bacteria	699-23-34A	EPA 9223	N	48.7 Col/100mL	113 Col/100mL	80%
Ammonia and Anions						
Nitrogen in nitrite	299-W11-39	EPA 300.0	N	105 µg/L	N	49.3 µg/L BN 72%
Metals						
Arsenic	699-23-34A	EPA 6020	Y	2.8 µg/L	BC	2.2 µg/L BC 24%
Semivolatile Organic Compounds						
TPH Diesel	199-N-19	WTPH Ecolog	N	580 µg/L	N	60 µg/L U N 163%
Radiological Parameters						
Gross alpha	299-E33-31	EPA 9310	N	66.4 pCi/L	90.4 pCi/L	31%
N = No.						
RPD – Relative percent difference.						

Split Samples. Split samples are replicate samples that are sequentially collected from the same location and analyzed by different laboratories. The results from split samples are useful for confirming out-of-trend results and assessing one laboratory's performance relative to another laboratory. Like field duplicates, split samples should have RPDs less than 20% to be considered acceptable. However, because the two laboratories can have different detection limits, concentrations that are quantifiable at one laboratory may go undetected at the other laboratory. Therefore, the 20% RPD criterion applies only to those results that are quantifiable at both laboratories.

During the third quarter of FY 2005, seven sets of split samples were collected from seven wells and analyzed to investigate anomalous total organic halide results at several wells across the site. Each set was collected in quadruplicate (i.e., four samples were submitted to both STL St. Louis and Lionville Laboratory), as is typical for total organic halide samples, so that the precision of this indicator analysis may be determined. The results for the two laboratories were variable (Table 5). An analysis of variance indicated that the factor that contributed most to the variability in the data was the lack of analytical precision (i.e., the spread of results determined for each group of four samples) rather than the difference in the means determined by the two laboratories. In general, STL's level of precision was slightly lower than that of Lionville Laboratory. However, this quarter's reduced number of out-of-limit results for field blanks, quadruplicates, and blind standards demonstrate a significant improvement in the results for total organic halides.

Table 5. Split Results for Total Organic Halides

Well	STL St. Louis ^(a)		Lionville Laboratory ^(a)		Percent of Variability: Analytical Precision vs. Laboratory Differences ^(c)
	Average ^(b) (µg/L)	Standard Deviation (µg/L)	Average ^(b) (µg/L)	Standard Deviation (µg/L)	
299-E25-32P	13.3	9.9	5.1	3.5	73.3 vs. 26.7
299-E25-48	13.0	5.7	2.5	0.0	24.2 vs. 75.8
299-E27-9	8.3	11.2	6.4	3.7	100 vs. 0.0
299-E33-34	3.8	2.5	11.2	15.5	100 vs. 0.0
299-E34-7	19.2	9.6	21.3	7.9	100 vs. 0.0
299-E34-10	8.7	10.7	3.3	1.6	97.6 vs. 2.4
699-E25-34B	7.6	4.3	11.4	11.7	100 vs. 0.0

^a Method detection limit was 3.2 µg/L at STL St. Louis and 5 µg/L at Lionville Laboratory.
^b Average was calculated using ½ the method detection limit value for non-detects.
^c Analysis of variance estimate of the variability contributed by the analysis (precision) and the laboratory (mean).

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

For the third quarter, the precision for all qualifying total organic carbon quadruplicates was acceptable, but 4 out of 14 total organic halide quadruplicates failed to meet the evaluation criteria (Table 6). This number for total organic halides is significantly reduced from last quarter (43). Low sample concentrations probably account for the poor precision in the total organic halide quadruplicates from all four wells. One of the quadruplicates in the table contains one value marked as suspect (Y flag). Two of the quadruplicates in the table appeared to contain an outlier (shaded values in the table). In both cases, removing the outlier drops the RSDs below the QC limits.

Table 6. Total Organic Halide Quadruplicates with Low Precision

Well	MDL (µg/L)	Result 1 (µg/L)	Result 2 (µg/L)	Result 3 (µg/L)	Result 4 (µg/L)	RSD
199-N-41	3.2	5.7	88.4 Y	5.9	3.2 U	162%
199-N-57	3.2	12.3	9.2	16.2	19.6	32%
299-E33-34	5	5.31	5 U	37.3	5 U	118%
299-W18-21	3.2	14.2	17.4	13.2	9.6	24%

Cells shaded in grey = outliers.
MDL = Method detection limit.

Field Blanks. Full trip blanks, field transfer blanks, and equipment blanks are used to check for contamination resulting from field activities and/or bottle preparation. Definitions of full trip blanks, field transfer blanks, and equipment blanks are provided in the Field Blank Definitions 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 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.

A total of 864 results were produced from the third quarter field blank samples. Approximately 3.8% of the results (i.e., 33 results) exceeded the QC limits for field blanks. The percentage of out-of-limit results was about the same as the value from last quarter. Table 7 lists the third 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, zinc, and calcium; however, results were also flagged for total organic carbon, chloride, nitrogen in nitrate, aluminum, acetone, carbon tetrachloride, chloroform, and trichloroethene. The potential impacts on the data are minor in most cases. For example, although chloride, nitrogen in nitrate, 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 third quarter groundwater samples. As another example, the gray-highlighted flagged results for carbon tetrachloride, chloroform, and trichloroethene are all from one field transfer blank; however, no well samples were associated with this QC sample.

Many of the constituents (i.e., chloride, aluminum, calcium, zinc, acetone, chloroform, methylene chloride, and trichloroethene) that had out-of-limit field blank results also had out-of-limit method blank results. Consequently, some of the results in Table 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.

Table 7. Field Blank Results that Exceeded Quality Control Limits

Constituent Name	Blank Type ^(a)	Result	QC Limit	Result/QC Limit
General Chemistry Parameters				
Total organic carbon	FTB	870 µg/L	860 µg/L	1.01
Total organic carbon	FTB	1100 µg/L	860 µg/L	1.3
Ammonia and Anions				
Chloride	FTB	100 µg/L	50 µg/L	2.0
Chloride	FTB	130 µg/L	50 µg/L	2.6
Nitrogen in nitrate	FTB	186 µg/L	88.6 µg/L	2.1
Metals				
Aluminum	FTB	68.2 µg/L	33.2 µg/L	2.1
Calcium	FTB	22 µg/L	21.4 µg/L	1.03
Calcium	FTB	30.7 µg/L	21.4 µg/L	1.4
Calcium	FTB	38.6 µg/L	21.4 µg/L	1.8
Calcium	FTB	38.6 µg/L	21.4 µg/L	1.8
Calcium	FTB	40.3 µg/L	21.4 µg/L	1.9
Zinc	FTB	2.5 µg/L	2.4 µg/L	1.04
Zinc	FTB	2.6 µg/L	2.4 µg/L	1.1
Zinc	FTB	2.6 µg/L	2.4 µg/L	1.1
Zinc	FTB	3.7 µg/L	2.4 µg/L	1.5
Zinc	FTB	4 µg/L	2.4 µg/L	1.7
Zinc	FTB	4.7 µg/L	2.4 µg/L	2.0
Volatile Organic Compounds				
Acetone	FXR	1.8 µg/L	1.05 µg/L	1.7
Carbon tetrachloride	FXR	0.25 µg/L	0.18 µg/L	1.4
Carbon tetrachloride	FXR	0.48 µg/L	0.18 µg/L	2.7
Carbon tetrachloride	FXR	21 µg/L	0.18 µg/L	117
Chloroform	FXR	28 µg/L	0.14 µg/L	200
Methylene chloride	FXR	.84 µg/L	0.6 µg/L	1.4
Methylene chloride	FXR	0.87 µg/L	0.6 µg/L	1.5
Methylene chloride	FTB	1 µg/L	0.6 µg/L	1.7
Methylene chloride	FXR	1.1 µg/L	0.6 µg/L	1.8
Methylene chloride	FTB	1.1 µg/L	0.6 µg/L	1.8
Methylene chloride	FXR	1.3 µg/L	0.6 µg/L	2.2
Methylene chloride	FXR	1.4 µg/L	0.6 µg/L	2.3
Methylene chloride	FXR	1.5 µg/L	0.6 µg/L	2.5
Methylene chloride	FXR	1.7 µg/L	0.6 µg/L	2.8
Methylene chloride	FXR	5.1 µg/L	0.6 µg/L	8.5
Trichloroethene	FXR	12 µg/L	0.26 µg/L	46

^a FTB = Full trip blank, FXR = Field transfer blank, EB = Equipment blank.
 QC = quality control.
 Results that exceeded the QC limits by a factor of 5 or more are shaded in gray.

Laboratory QC Data

Blind Standards. Double-blind standards containing known amounts of selected anions, organic compounds, and radionuclides were prepared and submitted to STL in September. Duplicates of the total organic carbon and gross beta standards were submitted concurrently to Lionville Laboratory and Eberline Services, respectively. In most cases, the standards were prepared using groundwater from background wells. However, the conductivity standards were prepared commercially in deionized water. Standards for indicator analyses were spiked using the following constituents: potassium hydrogen phthalate was used to prepare total organic carbon standards, 2,4,5-trichlorophenol was used to prepare total organic halides (TOX)-phenol standards, and TOX and volatile organic analysis (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 8. 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 $\pm 30\%$ acceptance range. Most of the results were acceptable, indicating good performance overall. STL St. Louis had out-of-limit results for total organic halides, cyanide, and carbon tetrachloride. All of the results from STL Richland (radiological parameters), Lionville Laboratory (total organic carbon), and Eberline Services (gross beta) were acceptable.

STL St. Louis' results for total organic halides were improved compared to the results from last quarter. Four groups of standards were submitted to the laboratory to investigate the large number of elevated sample results obtained between April and June. The spiked concentrations of the phenolic standards were 15 and 44 $\mu\text{g/L}$, and the concentrations of the volatile standards were 16 and 45 $\mu\text{g/L}$. All of the results were acceptable except for one that was associated with a low-concentration volatile standard. Since the spiking level was within a factor of 5 of the MDL, the one out-of-limit result is not unreasonable. As noted earlier, the problems that occurred last quarter with this method appear to have been corrected.

One of STL St. Louis' results for cyanide was unacceptable (56% recovery). Loss of cyanide during the distillation step of the analysis is the likely cause of the low-biased result.

Two results for carbon tetrachloride were out-of-limits, and the results were biased low. These results are similar to those from last quarter. 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.

Table 8. Blind Standard Results

Constituent	Spike Amount	Lab ^a	Result 1	Recovery	Result 2	Recovery	Result 3	Recovery	Mean	RSD
General Chemical Parameters										
Conductivity	445 µS/cm	SL	457	103%	490	110%	484	109%	477	4%
TOC ^(b)	2005 µg/L	LL	2390	119%	2220	111%	2220	111%	2262	4%
TOC ^(c)	2005 µg/L	SL	2200	110%	2200	110%	2200	110%	2200	0%
TOX (phenol)	15 µg/L	SL	12.1	81%	18.7	125%	15.1	101%	15.3	22%
TOX (phenol) ^(d)	44 µg/L	SL	38.2	87%	47.1	107%	38.7	88%	41.1	10%
TOX (VOA)	16 µg/L	SL	21.1	132%	13.8	86%	13.2	83%	16.0	27%
TOX (VOA)	45 µg/L	SL	37.8	84%	35.3	78%	45.8	102%	40.0	14%
Anions										
Cyanide	52 µg/L	SL	29.2	56%	39.4	76%	46.6	90%	38.4	23%
Fluoride	5000 µg/L	SL	4100	82%	4200	84%	4000	80%	4100	2%
Nitrate as N	45180 µg/L	SL	46100	102%	46800	104%	46700	103%	46533	1%
Volatile Organic Compounds										
Carbon tetrachloride	19.8 µg/L	SL	4.3	22%	8.2	41%	17	86%	9.83	66%
Chloroform	20.3 µg/L	SL	22	108%	23	113%	23	113%	22.7	3%
Trichloroethene	10.7 µg/L	SL	8.9	83%	9.7	91%	9.5	89%	9.4	4%
Radiological Parameters										
Gross alpha	102.6 pCi/L	RL	81	79%	110	107%	81.3	79%	90.8	18%
Gross beta ^(e)	114.13 pCi/L	RL	115	101%	112	98%	107	94%	111	4%
Gross beta ^(e)	117.34 pCi/L	ES	115	98%	119	101%	114	97%	116	2%
Plutonium-239	2.01 pCi/L	RL	2.14	106%	2.03	101%	2.2	109%	2.12	4%
Strontium-90	101.44 pCi/L	RL	126	124%	119	117%	120	118%	122	3%
Technetium-99	101.9 pCi/L	RL	108	106%	98	96%	106	104%	104	5%
Uranium-238	326.1 µg/L	RL	257	79%	379	116%	343	105%	326	19%

^a Lab codes: SL = Severn Trent St. Louis, RL = Severn Trent Richland, LL = Lionville Laboratory, ES = Eberline Services
^b TOC standards were submitted to Lionville Laboratory in quadruplicate. The fourth result was 2,220 µg/L, and the recovery was 111%.
^c TOC standards were submitted to Severn Trent St. Louis in quadruplicate. The fourth TOC result was 2,200 µg/L, and the recovery was 110%.
^d Higher concentration TOX VOA standards were submitted to Severn Trent St. Louis in quadruplicate. The fourth result was 40.3 µg/L, and the recovery was 92%.
^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 fourth quarter of last year. Shaded values in the table were outside the quality control limits.
RSD = Relative standard deviation.
TOC = Total organic carbon.
TOX = Total organic halides.
VOA = Volatile organic analysis.

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).

No new WS/WP study results were received this quarter.

Mixed Analyte Performance Evaluation Program. The Mixed Analyte Performance Evaluation Program (MAPEP) is conducted by 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.

MAPEP results for aqueous samples were available from STL St. Louis, STL Richland, Eberline Services, and Lionville Laboratory this quarter (MAPEP-05-MAW14, GrW14, and OrW14). Two results (mercury and strontium-90) from STL St. Louis were unacceptable; one result (nickel-63) from STL Richland was unacceptable. All other results from the four laboratories were acceptable. Constituents analyzed by STL Richland, STL St. Louis, and Eberline Services included americium-241, cesium-134, cesium-137, cobalt-57, cobalt-60, gross alpha, gross beta, iron-55, manganese-54, nickel-63, plutonium-238, plutonium-239/240, strontium-90, technetium-99, tritium, uranium-234/233, uranium-238, and zinc-65. Constituents analyzed by STL St. Louis and Lionville Laboratory included antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, thallium, vanadium, zinc, 2-chlorophenol, 1,3-dichlorobenzene, hexachloroethane, nitrobenzene, 2,4-dimethylphenol, 1,2,4-trichlorobenzene, naphthalene, hexachlorobutadiene, 2-methylphenol, 2,6-dichlorophenol, 2,6-dinitrotoluene, 2,4-dinitrotoluene, diethylphthalate, hexachlorobenzene, anthracene, 1,3-dinitrobenzene, fluoranthene, pyrene, benzo(a)anthracene, heptachlor (STL St. Louis only), 4,4'-DDE (STL St. Louis only), and 4,4'-DDT (STL St. Louis only).

InterLaB RadChem Proficiency Testing Program Studies. The InterLaB RadChem Proficiency Testing Program is conducted by 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-62). All results were acceptable. The following were analyzed: 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 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 Environmental Measurements Laboratory (EML) Quality Assessment Program (QAP) Data Determination of Operational Criteria and Control Limits for Performance Evaluation Purposes*.

The results from one Mutli-Media Radchem Proficiency Testing study were received from Eberline Services this quarter (MRAD-003). Unacceptable results were reported for gross alpha, gross beta, plutonium-238, and plutonium-239. The following were analyzed with acceptable results: americium-241, cesium-134, cesium-137, cobalt-60, iron-55, strontium-90, uranium-234, uranium-238, uranium, and uranium mass.

Laboratory QC Data from STL. Laboratory QC data provide a means of assessing laboratory performance and the suitability of a method for a particular sample matrix. These data are not

currently used for in-house validation of individual sample results unless the laboratory is experiencing unusual performance problems with an analytical method. Laboratory QC data include the results from method blanks, laboratory control samples, matrix spikes, matrix spike duplicates, surrogates, and matrix or laboratory duplicates.

Different criteria are used to evaluate the various laboratory QC parameters. Results for method blanks are evaluated based on the frequency of detection above the blank QC limits. In general, these limits are two times the MDL for chemical constituents and two times the MDA for radiochemistry components. For common laboratory contaminants such as acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the QC limit is five times the MDL. Results for laboratory control samples, matrix spikes, and surrogates are evaluated by comparing the recovery percentages with minimum and maximum control limits. For matrix duplicates, only those samples with values five times greater than the MDL or 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 third quarter laboratory QC results were within acceptance limits, suggesting that the analyses were in control and reliable data were generated. Table 9 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 10 lists the individual constituents that had out-of-limit method blanks, including the concentration range for method blanks above the detection limit. Table 11 summarizes the out-of-limit results for the other QC parameters. The number of significantly out-of-limit results is also indicated in Tables 10 and 11. Finally, Table 12 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 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 in the following paragraphs. 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 (2.9%) was about the same as that for last quarter (2.5%). This quarter showed an increase in the number of matrix spikes for volatile organic compounds and semivolatile organic compounds that were out of limits. There was a decrease in the number of out-of-limit duplicates for semivolatile organic compounds and laboratory control samples for ammonia and anions.
- Two or more method blank results exceeded the QC limits for bromide, *chloride*, sulfate, *aluminum*, *arsenic*, *calcium*, *zinc*, acetone, bromomethane, chloroform, and *methylene chloride*. 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 heptachloro through octachloro compounds were detected at pg/L levels.
- Out-of-limit blank results for chloride, sulfate, barium, calcium, and sodium were, in general, not significant because results for most Hanford groundwater samples were significantly higher (at least five times) than the blank values. Many sample results for other constituents with out-of-limit blank results were comparable to the blank values.
- Relative to last quarter, more metals, but fewer ammonia and anions, had laboratory control samples that were out of limits. Laboratory control samples were significantly out of limits for *nitrogen in nitrite*, aluminum, *acetone*, carbon tetrachloride, ethyl methacrylate, and *2-secbutyl-4,6-dinitrophenol*. Table 11 indicates which wells have data associated with laboratory control sample results that were significantly out of limits.
- Compared to last quarter, more general chemistry parameters, metals, volatile organic compounds, semivolatile organic compounds, and radiological parameters had matrix spike results that were out of limits. Alkalinity, chloride, *cyanide*, *fluoride*, *nitrogen in nitrate*, *nitrogen in nitrite*, sulfate, sulfide, calcium, 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichloropropane, *1,4-dichlorobenzene*, 2-butanone, 4-methyl-2-pentanone, *acetone*, benzene, carbon disulfide, *carbon tetrachloride*, chloroform, chloromethane, cis-1,2-dichloroethylene, methylene chloride, tetrachloroethene, trans-1,2-dichloroethylene, trichloroethene, 2,4-dichlorophenol, 2-methylphenol, 2-nitrophenol, *2-secbutyl-4,6-dinitrophenol*, bis(2-ethylhexyl)phthalate, endosulfan II, heptachlor epoxide, naphthalene, pentachlorophenol, TPH diesel, technetium-99, and uranium had matrix spike results that were significantly out of limits.
- Matrix duplicates had fewer semivolatile organic compounds with out-of-limit results compared to last quarter. Matrix duplicates were significantly out of limits for *total organic halides*, bromide, *cyanide*, *fluoride*, nitrogen in nitrite, *2-butanone*, 4-methyl-2-pentanone, *acetone*, carbon tetrachloride, vinyl chloride, 2,2-dichloropropionic acid, *iodine-129*, and plutonium-239/240.
- Surrogates were significantly out of limits for *4-bromofluorobenzene*, *dibromofluoromethane*, *o-terphenyl*, and TPH diesel.

Laboratory QC Data from Eberline Services and Lionville Laboratory. Third quarter QC data from Lionville Laboratory are limited to total organic halides and total organic carbon. Third quarter QC data from Eberline Services are limited to gross beta. All of the QC data except two matrix spikes for total organic halides were within limits.

Project scientists requiring additional information about the laboratory QC data are encouraged to contact Debbie Sklarew or Chris Thompson.

Table 9. Percentage of Out-of-Limit QC Results by Category

	General Chemistry Parameters	Ammonia and Anions	Metals	VOC	SVOC	Radiological Parameters	Total
Method Blanks	1.3	7.0	4.3	1.5	0	0.3	2.6
Lab Control Samples	0	1.6	0.3	1.9	0.9	0.7	1.0
Matrix Spikes	4.5	14.7	0.1	10.0	4.4	6.5	5.0
Matrix Duplicates	1.6	2.0	0	2.4	2.6	1.2	1.4
Surrogates	—	—	—	4.0	1.5	—	3.3

SVOC = Semivolatile organic carbon.
VOC = Volatile organic carbon.

Table 10. Method Blanks with Out-of Limit Results

Constituent	Number Out of Limits ^(a)	Number of Analyses	Concentration Range of Detections
General Chemistry Parameters			
Total organic halides	1	32	11.7 µg/L
Ammonia and Anions			
Bromide	2	4	0.081 – 0.095 mg/L
Chloride	16(3)	58	0.053 – 0.19 mg/L
Fluoride	1	58	0.016 mg/L
Nitrogen in nitrite	1	58	0.013 mg/L
Sulfate	2	58	0.15 mg/L
Metals			
Aluminum	11	59	33.6 – 55.8 µg/L
Arsenic	4(3)	20	0.85 – 1.8 µg/L
Barium	1	59	0.74 µg/L
Calcium	16(1)	59	22.3 – 120 µg/L
Sodium	1	59	1060 µg/L
Zinc	18(3)	59	2.5 – 31.2 µg/L
Volatile Organic Compounds			
Acetone	5	43	1.3 – 1.9 µg/L
Bromomethane	2(1)	7	0.68 – 1.2 µg/L
Chloroform	2	36	0.2 – 0.23 µg/L
Methylene chloride	8(6)	36	0.86 – 4.8 µg/L
Trichloroethene	1	36	0.27 µg/L
Radiological Parameters			
Uranium	1(1)	31	0.381 µg/L

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

Table 11. Laboratory Spikes and Duplicates with Out-of-Limit Results

Constituent	Number Out of Limits ^(a)	Number of Analyses
Laboratory Control Samples		
<i>Ammonia and Anions</i>		
Nitrogen in nitrate	4	58
Nitrogen in nitrite	1(1)	58
<i>Metals</i>		
Aluminum	2(1)	59
Selenium	1	3
<i>Volatile Organic Compounds</i>		
1,1,1-Trichloroethane	1	36
1,1-Dichloroethane	1	36
1,1-Dichloroethene	5	35
1,2-Dichloroethane	1	36
1,4-Dichlorobenzene	1	33
4-Methyl-2-pentanone	1	36
Acetone	3(2)	36
Bromoform	1	7
Carbon tetrachloride	1(1)	42
cis-1,3-Dichloropropene	1	7
Ethyl methacrylate	1(1)	7
Vinyl chloride	1	36
<i>Semivolatile Organic Compounds</i>		
2,4-D	1	4
2-secButyl-4,6-dinitrophenol	2(1)	8
<i>Radiological Parameters</i>		
Cesium-137	1	15
Gross alpha	1	21
Matrix Spikes and Matrix Spike Duplicates		
<i>General Chemistry Parameters</i>		
Alkalinity	2(2)	23
Total organic halides	2	35
<i>Ammonia and Anions</i>		
Chloride	1(1)	60
Cyanide	3(2)	13
Fluoride	3(1)	60
Nitrogen in nitrate	7(2)	60
Nitrogen in nitrite	26(20)	60
Sulfate	7(4)	60
Sulfide	1(1)	4
<i>Metals</i>		
Calcium	1(1)	124
Mercury	1	18
<i>Volatile Organic Compounds</i>		
1,1,1-Trichloroethane	6	76
1,1-Dichloroethane	18(7)	76
1,1-Dichloroethene	12(7)	71
1,2-Dichloroethane	9	76
1,2-Dichloropropane	2(1)	12
1,4-Dichlorobenzene	1(1)	74
2-Butanone	2(1)	76

Constituent	Number Out of Limits ^(a)	Number of Analyses
4-Methyl-2-pentanone	5(1)	76
Acetone	12(12)	74
Benzene	21(8)	76
Carbon disulfide	14(7)	74
Carbon tetrachloride	17(14)	82
Chloroform	20(8)	76
Chloromethane	2(2)	12
cis-1,2-Dichloroethylene	7(2)	76
Dichlorodifluoromethane	1	12
Methylene chloride	10(7)	76
Tetrachloroethene	5(2)	74
Toluene	1	76
trans-1,2-Dichloroethylene	18(6)	74
Trichloroethene	2(2)	76
Vinyl chloride	3	76
<i>Semivolatile Organic Compounds</i>		
2,4-Dichlorophenol	1(1)	26
2-Methylphenol	1(1)	26
2-Nitrophenol	1(1)	26
2-sec-Butyl-4,6-dinitrophenol	4(4)	14
bis(2-Ethylhexyl)phthalate	1(1)	18
Endosulfan I	4	10
Endosulfan II	4(3)	10
Heptachlor epoxide	2(2)	10
Naphthalene	1(1)	18
Oil and grease	2	4
Pentachlorophenol	1(1)	26
Phenol	1	27
TPH Diesel	4(4)	17
<i>Radiological Parameters</i>		
Technetium-99	2(1)	32
Uranium	2(2)	30
Duplicates		
<i>General Chemistry Parameters</i>		
Total organic halides	2(1)	32
<i>Ammonia and Anions</i>		
Bromide	1(1)	7
Chloride	1	114
Cyanide	1(1)	13
Fluoride	6(2)	113
Nitrogen in nitrite	2(1)	113
Sulfate	1	112
<i>Volatile Organic Compounds</i>		
1,1-Dichloroethene	1	48
2-Butanone	4(3)	48
4-Methyl-2-pentanone	3(2)	49
Acetone	9(2)	47
Bromomethane	1	5
Carbon tetrachloride	3(1)	51
Chloroform	1	49
Chloromethane	1	5

Constituent	Number Out of Limits ^(a)	Number of Analyses
Vinyl chloride	4(1)	49
<i>Semivolatile Organic Compounds</i>		
2,2-Dichloropropionic acid	1(1)	4
2,3,4,6-Tetrachlorophenol	1	4
4,4'-DDT	1	6
Aldrin	1	6
Alpha-BHC	1	6
Aroclor-1016	1	4
Beta-BHC	1	6
Gamma-BHC	1	6
TPH Diesel	1	9
<i>Radiological Parameters</i>		
Carbon-14	1	2
Iodine-129	1(1)	19
Plutonium-239/240	1(1)	2
Technetium-99	1	31
Surrogates		
<i>Volatile Organic Compounds</i>		
1,2-Dichloroethane-d4	4	447
4-Bromofluorobenzene	25(3)	447
Dibromofluoromethane	34(28)	447
o-Terphenyl	10(8)	52
Toluene-d8	3	447
<i>Semivolatile Organic Compounds</i>		
2,4,6-Tribromophenol	3	78
2-Fluorobiphenyl	2	48
Terphenyl-d14	1	48
TPH Diesel	1(1)	5
^a Numbers in parentheses are the number of results that were significantly out of limits as defined in the text.		

Table 12. Wells Associated with Laboratory QC Parameters with Significantly Out-of-Limit Results

Constituent	Analysis Date	Wells with Associated Data
Method Blanks		
Chloride	9/28/05	299-W10-20, 299-W22-84, 299-W23-15, 299-W23-19, 299-E25-94
	10/1/05	299-W22-80, 699-S6-E4A, 699-S6-E4L, 699-S20-E10, 699-S41-E12, 82-M, 84-D, 86-D
	10/4/05	299-W8-1
Arsenic	7/12/05	299-E17-22, 299-E24-16
	8/15/05	299-E24-21, 299-W10-1, 299-W10-4
	8/24/05	699-22-35, 699-23-34A, 699-23-34B, 699-24-33, 699-24-34A, 699-24-34B, 699-24-34C, 699-24-35, 699-26-35A
Calcium	8/15/05	299-E24-21, 299-W10-8, 299-W10-28, 299-W11-39, 299-W11-40
Zinc	6/30/05	699-13-3A, 699-S6-E4L
	7/12/05	299-E17-22, 299-E24-16
	10/10/05	299-W11-45
Bromomethane	10/2/05	299-W19-48
Methylenechloride	8/31/05	299-W18-30
	9/7/05	299-W11-6, 299-W11-7, 299-W15-1, 299-W15-2, 299-W15-11, 699-36-70B, 699-38-68A, 699-38-70C, 699-40-65
	9/9/05	299-W19-34A, 299-W19-35, 299-W19-40, 299-W19-36, 299-W19-37, 299-W19-39, 299-W19-43, 299-W19-46, 299-W19-48, 699-36-70B, 699-38-70B
	9/29/05	299-W7-3, 299-W7-12, 299-W10-14, 299-W10-20, 299-W11-3, 299-W22-49, 299-W22-83, 299-W23-15, 299-W23-21
Uranium	10/17/05	299-E28-18, 699-36-70B, 699-38-68A, 699-38-70C, 699-40-65
Laboratory Control Samples		
Nitrogen in Nitrite	8/20/05	299-E13-16, 299-E13-17, 299-E13-19
Aluminum	9/6/05	299-W19-43
Acetone	9/7/05	299-W11-6, 299-W11-7, 299-W15-1, 299-W15-2, 299-W15-11, 699-36-70B, 699-38-68A, 699-38-70C, 699-40-65
Carbon tetrachloride	9/14/05	299-W21-2, 299-W23-10, 699-49-100C
Ethyl methacrylate	7/30/05	299-W19-34A, 299-W19-35, 299-W19-36, 299-W19-39, 299-W19-43, 299-W19-46, 299-W19-48, 699-38-70B
2-secButyl-4,6-dinitrophenol(DNBP)	7/15/05	299-E17-22
Matrix Spikes or Matrix Spike Duplicates		
Alkalinity	8/19/05	299-E24-21
	9/21/05	199-N-32, 299-E18-1, 299-E24-24
Chloride	8/15/05	299-W10-27, 299-W14-13, 299-W14-15, 299-W14-16, 299-W14-17, 299-W14-18
Cyanide	8/29/05	299-E13-16, 299-E13-17, 299-E13-19
	9/8/05	299-W19-43
Fluoride	8/15/05	299-W10-27, 299-W14-13, 299-W14-15, 299-W14-16, 299-W14-17, 299-W14-18
Nitrogen in Nitrate	8/15/05	299-W10-27, 299-W14-13, 299-W14-15, 299-W14-16, 299-W14-17, 299-W14-18

Constituent	Analysis Date	Wells with Associated Data
	9/16/05	199-N-32, 299-E24-24
Nitrogen in Nitrite	7/27/05	299-E17-22, 299-E17-26, 299-E24-21, 299-E24-24
	8/11/05	299-E24-21
	8/15/05	299-W10-27, 299-W14-13, 299-W14-15, 299-W14-16, 299-W14-17, 299-W14-18
	8/18/05	299-E13-11, 299-W10-26, 299-W14-6, 299-W14-14, 299-W14-19
	8/19/05	299-E13-8, 299-E13-12, 299-E13-18, 699-22-35, 699-23-34A, 699-23-34B, 699-24-33, 699-24-34A, 699-24-34B, 699-24-34C, 699-24-35, 699-26-35A
	8/20/05	299-E13-16, 299-E13-17, 299-E13-19
	8/26/05	299-W10-20, 299-W11-13, 299-W11-18, 299-W14-11, 299-W15-46, 299-W19-12, 299-W19-41, 299-W19-44, 299-W19-45
	8/27/05	299-W11-6, 299-W11-7, 299-W15-1, 299-W15-2, 299-W15-11
	9/2/05	299-W6-10, 299-W7-12, 299-W13-1, 299-W15-38, 299-W15-39, 299-W17-1, 299-W18-15
	9/7/05	299-W21-2, 299-W23-10
	9/8/05	299-W10-23, 299-W10-24, 299-W11-12, 299-W11-41, 299-W11-42
	9/10/05	199-N-2, 199-N-103A, 199-N-105A, 199-N-106A
	9/15/05	299-E18-1
	9/17/05	199-N-32, 299-E24-24
	10/1/05	299-W15-45, 299-W15-47, 299-W15-765, 299-W19-4, 299-W22-80, 699-S6-E4A, 699-S6-E4L, 699-S20-E10, 699-S27-E12A, 699-S28-E13A, 699-S29-E10A, 699-S29-E13A, 699-S30-E11A, 699-S31-E10A, 699-S31-E10D, 699-S31-E11, 699-S41-E12
	10/5/05	299-W8-1
10/6/05	299-W15-41, 299-W7-4	
Sulfate	8/15/05	299-W10-27, 299-W14-13, 299-W14-15, 299-W14-16, 299-W14-17, 299-W14-18
	9/16/05	199-N-32, 299-E18-1, 299-E24-24
	9/17/05	299-W10-20, 299-W11-13, 299-W11-18, 299-W14-11, 299-W15-46, 299-W19-12, 299-W19-41, 299-W19-44, 299-W19-45
Sulfide	7/13/05	299-E17-22
Calcium	9/6/05	299-W19-43
1,1-Dichloroethane	8/30/05	299-W10-20, 299-W11-13, 299-W15-40, 299-W15-44, 299-W15-46, 299-W15-49, 299-W15-50, 699-23-34B, 699-24-33, 699-24-34A, 699-24-34B, 699-24-34C, 699-24-35, 699-26-35A
	9/7/05	299-W11-6, 299-W11-7, 299-W15-1, 299-W15-2, 299-W15-11, 699-36-70B, 699-38-68A, 699-38-70C, 699-40-65
1,1-Dichloroethene	9/7/05	299-W11-6, 299-W11-7, 299-W15-1, 299-W15-2, 299-W15-11, 699-36-70B, 699-38-68A, 699-38-70C, 699-40-65
1,2-Dichloropropane	9/7/05	699-36-70B, 699-38-70C
1,4-Dichlorobenzene		299-E17-22
2-Butanone	7/30/05	299-W15-17, 299-W19-34A, 299-W19-35, 299-W19-36, 299-W19-39, 299-W19-43, 299-W19-46, 299-W19-48, 699-38-70B
4-Methyl-2-Pentanone	9/7/05	699-36-70B, 699-38-70C
Acetone	8/12/05	299-W10-1, 299-W10-4
	8/30/05	299-W10-20, 299-W11-13, 299-W15-40, 299-W15-44, 299-W15-46, 299-W15-49, 299-W15-50, 699-23-34B, 699-24-33, 699-24-

Constituent	Analysis Date	Wells with Associated Data
		34A, 699-24-34B, 699-24-34C, 699-24-35, 699-26-35A
	9/7/05	299-W11-6, 299-W11-7, 299-W15-1, 299-W15-2, 299-W15-11, 699-36-70B, 699-38-68A, 699-38-70C, 699-40-65
	9/9/05	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
Benzene	9/7/05	299-W11-6, 299-W11-7, 299-W15-1, 299-W15-2, 299-W15-11, 699-36-70B, 699-38-68A, 699-38-70C, 699-40-65
	9/9/05	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
Carbon disulfide	9/7/05	299-W11-6, 299-W11-7, 299-W15-1, 299-W15-2, 299-W15-11, 699-36-70B, 699-38-68A, 699-38-70C, 699-40-65
Carbon tetrachloride	8/12/05	299-W10-1, 299-W10-4
	8/30/05	299-W10-20, 299-W11-13, 299-W15-40, 299-W15-44, 299-W15-46, 299-W15-49, 299-W15-50, 699-23-34B, 699-24-33, 699-24-34A, 699-24-34B, 699-24-34C, 699-24-35, 699-26-35A
	9/7/05	299-W11-6, 299-W11-7, 299-W15-1, 299-W15-2, 299-W15-11, 699-36-70B, 699-38-68A, 699-38-70C, 699-40-65
	10/2/05	299-W15-45, 299-W15-47, 299-W19-4, 299-W19-48, 699-S27-E12A, 699-S28-E13A, 699-S29-E10A, 699-S29-E13A, 699-S30-E11A, 699-S31-E10A, 699-S31-E10D, 699-S31-E11
	10/14/05	299-W7-4
Chloroform	8/12/05	299-W10-1, 299-W10-4
	8/30/05	299-W10-20, 299-W11-13, 299-W15-40, 299-W15-44, 299-W15-46, 299-W15-49, 299-W15-50, 699-23-34B, 699-24-33, 699-24-34A, 699-24-34B, 699-24-34C, 699-24-35, 699-26-35A
	9/7/05	299-W11-6, 299-W11-7, 299-W15-1, 299-W15-2, 299-W15-11, 699-36-70B, 699-38-68A, 699-38-70C, 699-40-65
Chloromethane	9/7/05	699-36-70B, 699-38-70C
Methylenechloride	8/30/05	299-W10-20, 299-W11-13, 299-W15-40, 299-W15-44, 299-W15-46, 299-W15-49, 299-W15-50, 699-23-34B, 699-24-33, 699-24-34A, 699-24-34B, 699-24-34C, 699-24-35, 699-26-35A
	9/7/05	299-W11-6, 299-W11-7, 299-W15-1, 299-W15-2, 299-W15-11, 699-38-68A, 699-40-65
	9/9/05	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
Tetrachloroethene	9/7/05	299-W11-6, 299-W11-7, 299-W15-1, 299-W15-2, 299-W15-11, 699-38-68A, 699-40-65
Trichloroethene	8/30/05	299-W10-20, 299-W11-13, 299-W15-40, 299-W15-44, 299-W15-46, 299-W15-49, 299-W15-50, 699-23-34B, 699-24-33, 699-24-34A, 699-24-34B, 699-24-34C, 699-24-35, 699-26-35A
cis-1,2-Dichloroethylene	8/9/05	299-W19-37, 299-W26-14, 399-1-16A, 399-1-16B
	9/7/05	299-W11-6, 299-W11-7, 299-W15-1, 299-W15-2, 299-W15-11, 699-38-68A, 699-40-65
trans-1,2-Dichloroethylene	9/7/05	299-W11-6, 299-W11-7, 299-W15-1, 299-W15-2, 299-W15-11, 699-36-70B, 699-38-68A, 699-38-70C, 699-40-65
2,4-Dichlorophenol		299-E17-22
2-Methylphenol (cresol, o-)		299-E17-22

Constituent	Analysis Date	Wells with Associated Data
2-Nitrophenol		299-E17-22
2-secButyl-4,6-dinitrophenol(DNBP)	7/8/05	299-E17-25, 299-E18-1, 299-E24-24
	7/15/05	299-E17-22
Bis(2-ethylhexyl) phthalate		299-E17-22
Endosulfan II	7/13/05	299-E17-22
	10/6/05	699-S31-E10A
Heptachlor epoxide	10/6/05	699-S31-E10A
Naphthalene		299-E17-22
Pentachlorophenol		299-E17-22
TPHDIESEL	9/20/05	199-N-18, 199-N-19
	9/24/05	199-N-16
Technetium-99	9/13/05	299-W19-36, 299-W19-43
Uranium	8/23/05	299-W19-37
	10/12/05	299-W19-36, 299-W19-43
Duplicates		
Total organic halides	8/17/05	299-E34-7
Bromide	10/1/05	299-W22-80
Fluoride	8/3/05	699-25-33A, 699-25-34A, 699-25-34B
	10/5/05	299-W8-1
Nitrogen in Nitrite	10/1/05	299-W15-45, 299-W15-47, 299-W15-765, 299-W19-4, 699-S27-E12A, 699-S28-E13A, 699-S29-E10A, 699-S29-E13A, 699-S30-E11A, 699-S31-E10A, 699-S31-E10D, 699-S31-E11
2-Butanone	8/31/05	299-W18-30
	9/7/05	299-W11-6, 299-W11-7, 299-W15-1, 299-W15-2, 299-W15-11, 699-38-68A, 699-40-65
4-Methyl-2-Pentanone	7/15/05	399-1-10A, 399-1-10B, 399-1-16A, 399-1-16B, 399-1-17A, 399-1-17B, 399-1-18A, 399-1-18B
	9/7/05	299-W11-6, 299-W11-7, 299-W15-1, 299-W15-2, 299-W15-11, 699-38-68A, 699-40-65
Acetone	8/12/05	299-W10-1, 299-W10-4
	9/9/05	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
Carbon tetrachloride	9/7/05	699-36-70B, 699-38-70C
Vinyl chloride	9/13/05	299-W6-10, 299-W7-12, 299-W10-5, 299-W13-1, 299-W15-38, 299-W15-39, 299-W17-1, 299-W18-15, 299-W18-33, 299-W22-26, 299-W23-4, 299-W26-13
2,2-Dichloropropionic acid	7/15/05	299-E17-22
Iodine-129	9/28/05	299-W14-15, 299-W14-16
Plutonium-239/240	11/5/05	699-49-100C
Surrogates		
4-Bromofluorobenzene	9/13/05	299-W6-10, 299-W7-12, 299-W10-5, 299-W13-1, 299-W15-38, 299-W15-39, 299-W17-1, 299-W18-15, 299-W18-33, 299-W22-26, 299-W23-4, 299-W26-13
	9/14/05	299-W21-2, 299-W23-10
Dibromofluoromethane	8/12/05	299-W10-1, 299-W10-4

Constituent	Analysis Date	Wells with Associated Data
	8/26/05	299-W10-23, 299-W14-14
	8/30/05	299-W10-20, 299-W11-13, 299-W15-40, 299-W15-44, 299-W15-46, 299-W15-49, 299-W15-50, 699-23-34B, 699-24-33, 699-24-34A, 699-24-34B, 699-24-34C, 699-24-35, 699-26-35A
	9/7/05	299-W11-6, 299-W11-7, 299-W15-1, 299-W15-2, 299-W15-11, 699-38-68A, 699-40-65
	9/29/05	299-W7-3, 299-W7-12, 299-W10-14, 299-W11-3, 299-W22-49, 299-W22-83, 299-W23-15, 299-W23-21
	10/2/05	299-W15-45, 299-W15-47, 299-W19-4, 299-W19-48, 399-1-16B, 699-S27-E12A, 699-S28-E13A, 699-S29-E10A, 699-S29-E13A, 699-S30-E11A, 699-S31-E10A, 699-S31-E10D, 699-S31-E11
	10/12/05	299-W7-4, 299-W15-41
o-Terphenyl	7/18/05	299-E17-22
	9/14/05	199-N-96A
	9/20/05	199-N-18, 199-N-19
	9/24/05	199-N-16
	9/28/05	199-N-3
TPHDIESEL	8/22/05	299-E24-21

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.