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FEB 21 2001

01-GWVZ-012

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Addressees:

**QUARTERLY RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)
GROUNDWATER MONITORING DATA FOR THE PERIOD JULY 1, 2000, THROUGH
SEPTEMBER 30, 2000**

Please find enclosed the subject report. The RCRA groundwater chemistry and water level data for the subject period have been verified and evaluated. The data are publicly available in electronic form in the Hanford Environmental Information System database. The electronic availability of the data and the summary provided below fulfill the reporting requirements of WAC 173-303 (and by reference 40 CFR 265.94). Verification of data included a completion check (requested analyses were received), quality control checks (field blanks, field duplicates, and blind samples), and project scientist evaluation.

Sixteen RCRA sites were sampled during the reporting quarter (see enclosure, Table 1). Sampled sites include eight monitored under indicator evaluation programs, seven monitored under groundwater quality assessment programs, and one monitored under final-status corrective action. Detailed information on salient issues during this quarter is included in the enclosure.

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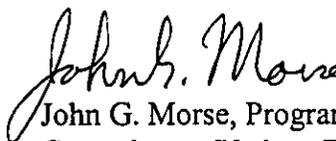
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If you have questions about this quarterly data transmittal, please contact Marvin J. Furman at (509) 373-9630.

Sincerely,



John G. Morse, Program Manager
Groundwater/Vadose Zone Project

GWVZ:MJF

Enclosure

cc w/encl:

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QUARTERLY RESOURCE CONSERVATION AND RECOVERY ACT GROUNDWATER MONITORING DATA FOR THE PERIOD JULY 1 THROUGH SEPTEMBER 30, 2000.

Sixteen RCRA sites were sampled during the reporting quarter, as listed in Table 1. Sampled sites include eight monitored under indicator evaluation programs, seven monitored under groundwater quality assessment programs, and one monitored under final-status corrective action.

Comparison to Concentration Limits

Contamination indicator parameter data (pH, specific conductance, total organic halides [TOX], and total organic carbon [TOC]) from downgradient wells were compared to background values at sites monitored under interim-status, indicator evaluation requirements, as described in 40 CFR 265.93. Six of the eight sites sampled under indicator evaluation programs this quarter had an exceedance of a critical mean value, as previously reported. None indicated hazardous contamination from the RCRA units, as explained below.

1301-N Liquid Waste Disposal Facility. Total organic carbon in downgradient well 199-N-3 exceeded the critical mean value in September. DOE notified Ecology in February 1999 of an earlier exceedance in this well, concluding that the exceedance was caused by petroleum contamination from a nearby waste site.

1324-N/NA Facilities. Specific conductance at downgradient wells continued to exceed the critical mean. Groundwater quality assessment monitoring in 1992 indicated that the high conductivity is caused by the nonhazardous constituents sulfate and sodium. Because an assessment has already been completed and the high conductivity is caused by nonhazardous constituents, verification sampling and additional assessment monitoring will not be conducted.

1325-N Liquid Waste Disposal Facility. Specific conductance in downgradient well 199-N-41 continued to exceed the critical mean value in September. DOE notified Ecology in January 2000 of a September 1999 exceedance in wells 199-N-41 and 199-N-81, and transmitted the results of the groundwater quality assessment in July 2000. The high specific conductance is believed to originate at an upgradient source, and passed the upgradient well several years ago.

216-A-29 Ditch. Sampling was delayed until October 2000. Specific conductance in downgradient well 299-E25-48 continued to exceed the critical mean value. DOE submitted a letter of notification and assessment plan/report to Ecology in April 2000, concluding that the increase in specific conductance is caused by nonhazardous constituents sulfate, calcium, and sodium.

Low-Level Waste Management Area 3. Specific conductance continued to exceed the critical mean value in an upgradient well (299-W10-13). The rise in specific conductance was reported previously and is caused by sulfate and nitrate. Wells 299-W9-1 and 299-W7-10 did not contain enough water to sample because of a declining water table.

Low-Level Waste Management Area 4. TOX continued to exceed the critical mean value in downgradient well 299-W15-16. This well used to be an upgradient well, and as reported earlier, the exceedance is believed to originate at an upgradient source.

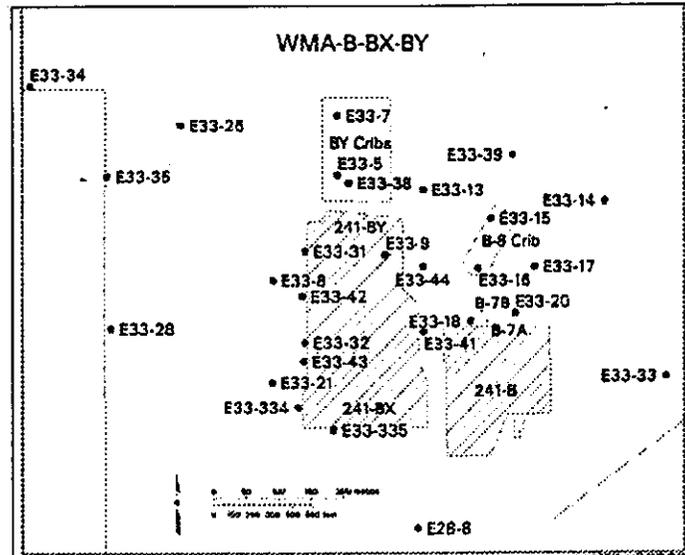
Status of Assessment Programs

Single-Shell Tanks WMA B-BX-BY:

Chemical ratios, chemical suites, contaminant locations, and trend analyses provide evidence of at least three distinct regions of contamination in proximity to the WMA.

Direct measurements of flow direction were collected in August 2000. The results were incorporated with other relevant data sets to form a more complete evaluation of flow direction. The data indicate that the flow direction along the southern border is to the southeast. These results are in agreement

with apparent contaminant migration and hydrographs. Although there was no perceptible change in flow rate this quarter, results from the colloidal borescope investigation indicate that flow rates are slower in the north than in the south half of the WMA. Three new wells will be drilled in FY 2001 to begin well coverage along the south side and southeast corner of the WMA.



Technetium-99. The first area of contamination represents impacts from the BY cribs, located north of WMA B-BX-BY. In the region of highest technetium-99 contamination, the concentration fell in well 299-E33-7 from 11,200 pCi/L in May to 8,980 pCi/L in August. Farther south the technetium-99 concentration rose to 13,300 pCi/L in well 299-E33-38. Technetium-99 continued to increase to the west, with the highest values in well 299-E33-26 and well 299-E33-34 (6,310 pCi/L and 5,320 pCi/L respectively). West and south of well 299-E33-34, technetium-99 levels have reached about 1,500 pCi/L in wells 299-E32-10 and 299-E33-35. Concentrations are lower to the south, although values are still increasing. Along the west side of the WMA, technetium-99 concentrations continue to increase although at lower levels than in the north.

The groundwater in wells 299-E33-7 and 299-E33-38, also impacted by the BY cribs, continues to show elevated cobalt-60 and cyanide. Cobalt-60 has remained approximately level at well 299-E33-7 (75.3 pCi/L in February to 71.2 pCi/L in August). Values for cyanide decreased from 349 µg/L in well 299-E33-38 in May to 306 µg/L in August. Concentrations also decreased in well 299-E33-7 from 386 µg/L in February to 276 µg/L in August. Farther west, the cyanide concentration remained level in well 299-E33-26 at 156 µg/L in August but rose to a new local maximum in well 299-E33-34 from 156 µg/L in May to 190 µg/L in August.

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Cobalt-60 contamination has risen in well 299-E33-44 to 28 pCi/L in August and in well 299-E33-9 to 54 pCi/L in May. Along with the cobalt-60 is 28 µg/L of cyanide in well 299-E33-9, and low levels of cyanide in well 299-E33-44. Cyanide concentrations also increased in well 299-E33-31, located on the west side of the WMA from about 10 µg/L in May to 21 µg/L in August. This cyanide and cobalt-60 are believed to be moving into these areas from farther north in the BY Cribs.

The second area of contamination is represented by well 299-E33-16 and is associated with the B-8 Crib and tile field. Technetium-99 concentrations remained level in this well at about 2,000 pCi/L for the last year. Overall, the contamination at this well appears to be rising slowly and is probably associated with a residual plume left from liquid effluent releases at the B-8 Crib. Other wells directly to the north, and east have much lower technetium-99 concentrations that continued to rise slowly this quarter.

The third apparent area of contamination is represented by wells 299-E33-44 and 299-E33-9, east of the BY tank farm. Technetium-99 concentrations remained constant in well 299-E33-44 at about 6,410 pCi/L in August. In well 299-E33-9, the technetium-99 level rose to 6,080 pCi/L in May. There are no August data for this well. These wells have a low nitrate: technetium-99 ratio and a unique chemical suite, consisting of high levels of uranium, technetium-99, nitrate and elevated nitrite (at 1,215 µg/L in well 299-E33-44). In February 2000, results from special sampling (not in HEIS) indicated about 5 pCi/L of cesium-137 in ionic form in the groundwater at well 299-E33-9. Low level (highest sensitivity) analyses of samples collected in December 1999 and April 2000 detected 6.26 ± 4.9 pCi/L and 8.47 ± 5.3 pCi/L of cesium-137, respectively. In May 2000 the lab reported cesium-137 at less than the 4.87 pCi/L minimum detectable activity, indicating that levels are too low to detect consistently in well 299-E33-9. Low-level gamma analyses are scheduled for this well quarterly. Because the results were so close to the minimum detectable activity, future samples will be filtered and pre-concentrated on a rad filter disk; this will allow us to obtain a lower detection level.

Nitrate. Nitrate concentrations are increasing in many wells in the vicinity of WMA B-BX-BY. Indicating impacts from the BY cribs, concentrations in well 299-E33-7 exceeded 500 mg/L in August and rose to 460 mg/L in well 299-E33-38. West of well 299-E33-7, nitrate also rose in wells 299-E33-26, 299-E33-34, 299-E33-35 and 299-E33-28. Farther south along the west side of the WMA, nitrate concentrations also rose to 224 mg/L in well 299-E33-31. Values remained level or dropped in wells 299-E33-32, and 299-E33-42 this quarter. In well 299-E33-43, nitrate concentrations had increased sharply in May to 91 mg/L but fell to 42 mg/L in August. Concentrations in wells 299-E33-334 and 299-E33-335, located at the southwest corner of the WMA, rose slightly to 14 mg/L and 17 mg/L, respectively, in August.

The highest nitrate concentrations are detected in well 299-E33-16 in the B-8 Crib. Nitrate values remained level at 558 mg/L in May. Nitrate concentrations in surrounding wells, 299-E33-17 and 299-E33-20, rose from 216 mg/L and 299 mg/L, respectively, in May to 254 mg/L and 322 mg/L, respectively, in August.

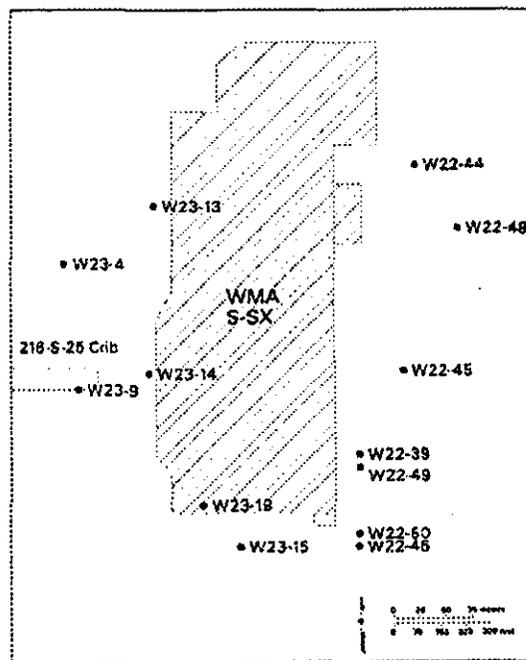
Nitrate levels continued to rise in well 299-E33-44 from 173 mg/L in May to 182 mg/L in August. Nearby well 299-E33-9, located inside the 241-BY Tank Farm, had nitrate values

increasing from 166 mg/L in December 1999 to 181 mg/L in May 2000. There were no August data for this well. Concentrations in well 299-E33-41, after increasing from 36 mg/L in February to 45 mg/L in May, dropped down to 35 mg/L in August. Nitrate, like technetium-99, is rising slowly in the well compared to the large increases observed farther north.

Uranium. This contaminant is found in the groundwater above the 20 µg/L maximum contaminant level in the southern part of the BY cribs (well 299-E33-38), beneath and southeast of the 241-BY Tank Farm (well 299-E33-9, 299-E33-44, 299-E33-18 and 299-E33-41), and on both sides of the BY Cribs (wells 299-E33-26, 299-E33-13 and 299-E33-34). Values range from 353 µg/L at well 299-E33-44 to 33 µg/L in well 299-E33-13. In general many of the wells that display elevated uranium concentrations do not show rapid increases in uranium levels even though technetium-99 and nitrate levels show sharp increases. For example, uranium has only risen from 113 µg/L in May 1999 to 125 µg/L in August 2000 in well 299-E33-38. Similarly the December 1998 value in well 299-E33-13 was 36 µg/L while the August 2000 value is 33 µg/L. In well 299-E33-34, the uranium concentration was 19 µg/L in December 1998. By August 2000 the value was 22 µg/L. Two wells that do display noticeable increases in the last two years are wells 299-E33-31 and 299-E33-26. Since late 1998, the former well has gone from background values below 3 µg/L to 51 µg/L in August 2000. In well 299-E33-26, uranium concentrations have risen from 28 µg/L in December 1998 to about 70 µg/L in August 2000.

Single-Shell Tanks WMA S-SX: Groundwater beneath this WMA is contaminated with technetium-99, nitrate, and hexavalent chromium, primarily from sources assumed to be within the WMA. High concentrations of tritium and carbon tetrachloride are also present from upgradient sources. The water table elevation has continued to decline but the gradient is relatively stable. The inferred flow direction has gradually shifted from southeastward to a more eastward direction with the decline in water table. The calculated groundwater flow rate remained unchanged for the quarter.

The technetium-99 drinking water standard of 900 pCi/L continued to be exceeded in new well 299-W23-19, which is located inside of the SX tank farm. This well has the highest concentration in the WMA and at the Hanford Site (63,700 pCi/L in June 2000). The well is located immediately adjacent to tank SX-115, where a leak occurred in the early 1960s. Concentrations have been gradually increasing since the well was first sampled in October 1999. The proximity of this well to a known source, and the occurrence of high technetium-99 in the vadose zone at this well location, indicates this area of the SX tank farm is the source of the observed groundwater contamination in well 299-W23-19. Technetium-99 concentrations also continued to exceed the standard in downgradient wells 299-W22-45, 299-W22-46, 299-W22-48 and 299-W22-50. The upward trend observed earlier in



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well 299-W22-45 appears to have reached a maximum concentration in January and declined or leveled out since March 2000 (see Figure 1).

Nitrate continued to exceed the 45-mg/L maximum contaminant level in upgradient wells 299-W23-9 and 299-W23-14 and in downgradient well 299-W23-19. Concentrations remain at or near the drinking water standard in downgradient well 299-W22-45 (see Figure 1). High nitrate concentrations in well 299-W23-19 (562 mg/L in June) are consistent with the high technetium-99 in this well. The technetium-99/nitrate ratio is similar to the expected ratio for the contents of the single shell tanks adjacent to the well.

The maximum contaminant level (100 µg/L) for chromium was not exceeded in any of the network wells. Concentrations, however, are approaching this level in well 299-W23-19. The presence of hexavalent chromium in this well is expected as a mobile co-contaminant with technetium-99 and nitrate. Chromium concentrations ranged from 7.5 to 31 µg/L in the other network wells.

The tritium drinking water standard of 20,000 pCi/L continued to be exceeded in both upgradient and downgradient wells. The highest concentrations for this quarter occurred in wells closest to and directly downgradient from the 216-S-25 crib (wells 299-W23-9, 299-W23-14 and 299-W23-19). Concentrations in downgradient wells 299-W22-45 and 299-W22-46 are declining, while increasing trends are observed in upgradient well 299-W23-9 and downgradient well 299-W22-39. The primary source of tritium in these wells is due to residual contamination from past-practice discharges to the 216-S-25 crib as well as from tank leakage sources.

Carbon tetrachloride exceeded the 5-µg/L maximum contaminant level in both upgradient and downgradient wells. During the quarter, the highest concentration, 150 µg/L, occurred in upgradient well 299-W23-4 and the next highest concentration, 72 µg/L, occurred in downgradient well 299-W23-15. The concentration in 299-W23-15 declined from a maximum of 120 µg/L in June. Carbon tetrachloride in groundwater beneath WMA S-SX is attributed to past-practice liquid waste disposal to various Plutonium Finishing Plant cribs, trenches and ponds. The specific location of the groundwater source area and pathway to WMA S-SX wells is unclear.

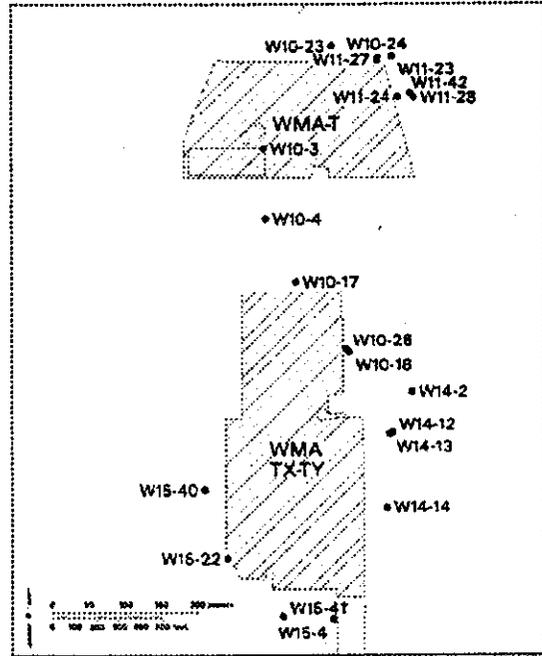
Uranium exceeded the proposed 20-µg/L maximum contaminant level in upgradient well 299-W23-4 (25 µg/L in October). The next highest uranium concentration reported for October was 17 µg/L in upgradient well 299-W23-9 (at the 216-S-25 crib). Uranium in the other downgradient wells for WMA S-SX ranged from 4 to 14 µg/L, as compared to a mean natural background uranium concentration of 2.5 µg/L. Most of the uranium in excess of the natural background level is attributed to upgradient, past-practice sources.

Strontium-90 and cesium-137 were undetected in the WMA network wells. The one apparent detection (1.5 pCi/L) of strontium-90 in well 299-W22-50 for last quarter was not substantiated by the October 2000 sample from this well.

Single-Shell Tanks WMA T and TX-TY:

Water levels near these waste management areas continued to decline this quarter. While the water table has continued to drop, the gradient has changed little; therefore the rate and direction of groundwater flow have not changed during the quarter. As reported previously, groundwater flow directions have been affected by the 200-ZP-1 groundwater remediation. Groundwater flow is to the east or slightly north of east beneath T tank farm, to the east or east-southeast beneath TY tank farm, and to the south or south-southeast beneath the TX tank farm.

WMA T. Technetium-99 concentrations in well 299-W10-24, the replacement well for 299-W11-27, increased from 1,460 pCi/L in May to 1,890 pCi/L in August. Technetium-99 in well 299-W11-23, a non-RCRA well located ~30 meters west of 299-W10-24, increased to 3,100 pCi/L in August. The highest recorded technetium-99 value in this well was 8,540 pCi/L in November 1998. This well is almost dry and is being sampled with a Kabis Sampler.



Groundwater samples were collected at discrete depths during the drilling of well 299-W11-42, located near the northeast corner of WMA T. Nitrate and specific conductance were much higher near the bottom of the borehole than near the top. Water from samples collected during well development was similar to that obtained near the bottom of the borehole during drilling. This suggests that most of the water is coming from the lower portion of the completed screened interval. These data indicate there may be a zone of low permeability near the top of the aquifer and a more permeable zone deeper in the aquifer. Groundwater high in nitrate and specific conductance is more similar to the upgradient background. These observations are consistent with ratio analysis (tritium, nitrate, technetium-99) for samples from well 299-W10-24. Groundwater sampled in this well appears to be a mixture of high technetium-99 water similar to that sampled in well 299-W11-27 and the regional high nitrate, low technetium-99 background groundwater composition sampled in surrounding wells.

The nitrate concentration in well 299-W10-4, a non-RCRA well located south of WMA T, increased to 828 mg/L in August. Nitrate had been increasing in this well over the past several years and reached 1,049 mg/L in December 1999. Specific conductance increased to 1,995 $\mu\text{S}/\text{cm}$ in August, after declining from a high of 2,250 $\mu\text{S}/\text{cm}$ in December 1999. Chromium increased slightly to 86 $\mu\text{g}/\text{L}$ and fluoride decreased. Carbon tetrachloride increased to 1,400 $\mu\text{g}/\text{L}$, slightly higher than 1,300 $\mu\text{g}/\text{L}$, reported in December 1999. The probable origin of these contaminants is waste disposal at facilities associated with the Plutonium Finishing Plant.

Nitrite concentrations in downgradient wells 299-W11-24 and 299-W11-28, on the east side of WMA T, continued to be high and variable. Nitrite is normally undetected in Hanford Site

groundwater, but in August nitrite was reported at 30.9 mg/L in well 299-W11-24 and 14.8 mg/L in well 299-W11-28, both exceeding the maximum contaminant level of 3.3 mg/L. In addition, well 299-W11-23, located approximately 60 meters to the north, had a nitrite concentration of 0.53 mg/L in May. These wells consistently have elevated concentrations of iron, manganese, and nickel. Chromium is relatively low.

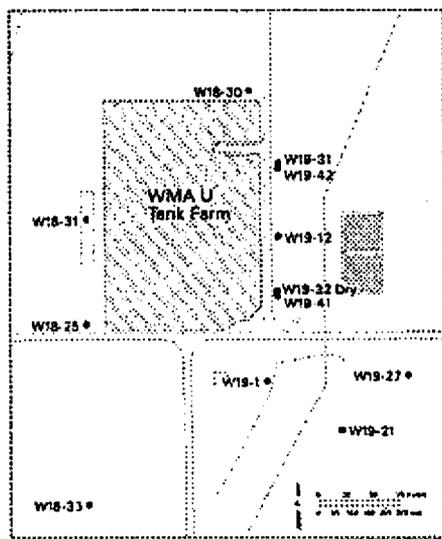
WMA TX-TY. Groundwater chemistry in well 299-W10-17 did not change significantly since the last sampling. Nitrate, which has been slowly increasing over the past several years, continued to exceed the maximum contaminant level, reaching 264 mg/L in August, while chromium and technetium-99 were below applicable standards. Reported fluoride was 2,200 µg/L. This was one of the wells that initially placed WMA TX-TY in assessment but it is no longer downgradient of the WMA. It is apparently intercepting part of the high nitrate plume in wells 299-W10-3 and 299-W10-4 to the north. Carbon tetrachloride was reported at 1,200 µg/L in August, similar to the concentration reported for 299-W10-4.

Technetium-99 concentrations were unchanged in well 299-W14-13 and increased slightly in well 299-W14-2 in May (Figure 2). Nitrate in well 299-W14-13 was 397 mg/L, exceeding the maximum contaminant level. Chromium was also elevated in well 299-W14-13 (476 µg/L), exceeding the maximum contaminant level. Technetium-99 and chromium are similar to the contaminant signature initially detected in well 299-W14-12; however, the chromium/technetium-99 ratio seems to have increased, indicating that there may be more than one source location within the tank farms. Previous high values of technetium-99 and chromium were detected when groundwater flowed toward the northeast. Presently groundwater flow in the area around well 299-W14-13 is toward the southeast.

The high tritium groundwater plume first noted in well 299-W14-2 now includes well 299-W14-13. This quarter, tritium levels decreased in well 299-W14-2 and increased in well 299-W14-13 (see Figure 2). Iodine-129 concentrations also continued to be elevated in these wells during the quarter, up to 31 pCi/L in well 299-W14-2 and 48 pCi/L in 299-W14-13. The source of the high tritium/iodine-129 component is unclear, but the most likely source is operational leaks from the nearby 242-T Evaporator, which was closed in the early 1970s. The lack of elevated technetium-99 in well 299-W14-2 indicates the possibility of at least two plumes in the area.

The first sampling of new well 299-W15-41, located along the southern margin of WMA TX-TY, in March 2000 indicated a technetium-99 concentration of 1,980 pCi/L. Sampling in August indicates that after a decrease in May, it increased to 1,140 pCi/L in August. Nearby dry well 299-W15-4 previously had concentrations up to 982 pCi/L.

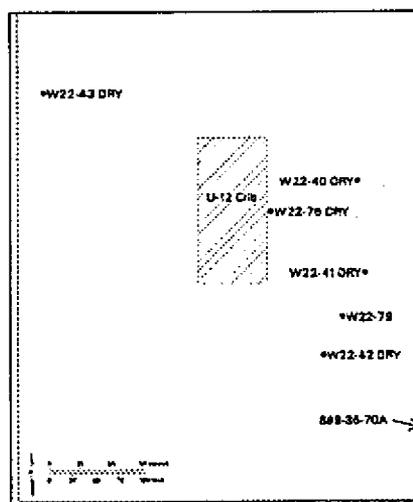
Single-Shell Tanks Waste Management Area U. This WMA was placed into assessment after specific conductance in downgradient well 299-W19-41 exceeded the critical mean. Specific conductance for September was reported at 366 µS/cm, well above the critical mean. Overall there was little change in groundwater chemistry from the previous quarter, although nitrate continued to increase, reaching 21.2 mg/L in September. Since the well was installed in 1998, nitrate has increased nearly four-fold.



There was insufficient water for sampling in upgradient well 299-W18-25 in September. The pump intake in this well was previously lowered to the bottom of the screen to extend the sampling life of the well. A replacement well for 299-W18-25 is scheduled to be installed in 2001.

200-ZP-1 pumping well 299-W15-37, located approximately 70 meters northwest of WMA U, was shut down on January 17. Weekly water level measurements in nearby wells, initiated last year, will allow a determination of groundwater flow direction changes resulting from the shutdown and estimates of aquifer hydraulic properties in the vicinity of WMA U.

216-U-12 Crib: The current groundwater-assessment monitoring network for the 216-U-12 Crib consists of only two downgradient wells (299-W22-79 and 699-36-70A). The July-September 2000 sampling was conducted at the end of September and in early October due to sampling delays. With the exception of technetium-99 concentrations in well 699-36-70A, concentrations for all contaminants measured in both wells have been declining and are expected to continue to decline. Water levels were measured in all the wells including 299-W22-40, 299-W22-41, 299-W22-42, and 299-W22-43, which no longer contain enough water to sample. The water level data indicate that the downgradient two-well network is still monitoring releases from the 216-U-12 Crib. Due to regional changes in the water table the groundwater flow direction beneath the Crib is slowly changing from an east-southeastward direction to a more eastward direction. The rate of flow has not changed.



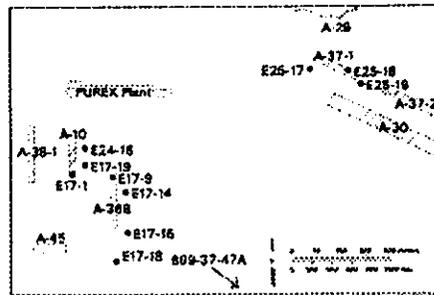
Specific conductance in both downgradient wells continued to decline. Nitrate values for the wells continued to exceed the 45-mg/L maximum contaminant level. Results were 47.8 mg/L in well 299-W22-79 and 102.5mg/L in well 699-36-70A.

Radiological chemistry results for technetium-99, tritium, and iodine-129 for well 299-W22-79 were not available. The concentrations of these constituents in well 699-36-70A are 81.05 pCi/L (average), 72,600 pCi/L and 13.5 pCi/L, respectively. Iodine-129 is only analyzed once a year. Tritium and iodine-129 are regional contaminants not associated with the crib, both these constituents are at concentrations above the drinking water standards.

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

One well near each of the three cribs was sampled July 19, 2000. The wells are 299-E17-14 near the 216-A-36B crib, 299-E24-16 near the 216-A-10 crib, and well 299-E25-19 near the 216-A-37-1 crib.

Contaminant concentrations continued to exceed the maximum contaminant level for nitrate and interim drinking water standards for iodine-129, strontium-90, and tritium.



In the vicinity of the PUREX cribs, the difference in water table elevations from well to well is very small. Therefore, the hydraulic gradient is too low to determine groundwater flow rate or flow direction reliably from water table maps. However, groundwater flow directions determined from the movement of contaminant plumes indicate that the average overall flow direction is to the southeast.

Nitrate concentrations remain above the 45-mg/L maximum contaminant level near the 216-A-36B crib. The concentration at well 299-E17-14 was reported to be 112.9 mg/L. The trend has been steady since at least 1998.

Iodine-129 remained above the 1 pCi/L interim drinking water standard at all three wells sampled. The groundwater sample collected at the 216-A-10 crib (299-E24-16) had a concentration of 7.14 pCi/L, which is part of a slowly declining trend since 1997. The well at the 216-A-36B crib (299-E17-14) had a reported value of 9.57 pCi/L, which is part of a relatively steady trend. The well at the 216-A-37-1 crib (299-E25-19) had a concentration of 1.42 pCi/L, which is also part of a relatively steady trend.

Strontium-90 remained above the interim 8 pCi/L drinking water standard at the 216-A-36B crib. The concentration was 17.1 pCi/L at well 299-E17-14. This reported value is part of a slightly rising trend since 1997. The elevated strontium-90 (a beta-emitter) result at the 216-A-36B crib (well 299-E17-14) was consistent with elevated gross beta (54.4 pCi/L; drinking water standard = 50 pCi/L).

Tritium concentrations remained above the 20,000-pCi/L drinking water standard at all three wells sampled. The highest concentration (573,000 pCi/L) was at well 299-E17-14 near the 216-A-36B crib. The trend at this well has been decreasing since 1991. Well 299-E24-16 near the 216-A-10 crib had a reported value of 308,000 pCi/L, which was part of a decreasing trend until mid-1999 but became steady thereafter. The well near the 216-A-37-1 crib (299-E25-19) had a reported value of 167,000 pCi/L, which is part of a steady trend since 1994. The reported values at the 216-A-10 and 216-A-36B cribs are greater than 10 times the drinking water standard.

Quality Control

Results of the RCRA quality control program for the July - September quarter are discussed in the Appendix. Quality control data that are not available in HEIS are available in electronic

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form upon request. The quality control program indicated that the data were acceptable for use in the statistical comparisons discussed above.

References:

(1) Hodges, F.N. and C.J. Chou, 2000. Groundwater Quality Assessment for Waste Management Area U: First Determination. PNNL-13282. Pacific Northwest National Laboratory, Richland, Washington.

Table 1. Status of RCRA Sites, July-September 2000.

Site	Routine sampling July-Sept 2000	Statistical exceedance
Indicator Evaluation Sites [40 CFR 265.93(b)] (sampled semiannually)		
1301-N Facility	Yes	Yes ¹
1325-N Facility	Yes	Yes ¹
1324-N/NA Site	Yes	Yes ¹
B-Pond	No	Not applicable
A-29 Ditch	Yes ²	Yes ¹
B-63 Trench	No	Not applicable
S-10 Pond and Crib	Yes	No
LERF	No	Not applicable
LLBG WMA 1	No	Not applicable
LLBG WMA 2	No	Not applicable
LLBG WMA 3	Yes	Yes ¹
LLBG WMA 4	Yes	Yes ¹
SST WMA A-AX	No	Not applicable
SST WMA C	No	Not applicable
NRDWL	Yes- <i>delayed</i>	No
Groundwater Quality Assessment Sites [40 CFR 265.93(d)] (sampled quarterly)		
Seven sites ³	Yes	Not required
Final Status Sites (WAC 173-303-645)		
300 Area Process Trenches	Yes	Yes ⁴
183-H Basins	No	Not applicable

LERF = Liquid Effluent Retention Facility

LLBG = Low-Level Burial Grounds

NRDWL = Nonradioactive Dangerous Waste Landfill

SST = Single-Shell Tanks

WMA = Waste Management Area

¹ No indication of hazardous waste contamination from facility; see text for explanation.² Quarterly sampling delayed until October 2000.³ U-12 Crib, PUREX Cribs, SST WMAs B-BX-BY, S-SX, T, TX-TY, and U.⁴ Site has entered corrective action because of previous exceedances.

Appendix: Quality Control Results, July through September 2000.

This quality control (QC) report presents information on laboratory performance and field QC sample results for the 3rd quarter of calendar year 2000.

Completeness. Completeness is determined 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 data that have not been flagged with an Y, R, Q, or H, or qualified to indicate laboratory blank contamination. Eighty-nine percent of the 3rd quarter's 8,228 results were considered valid, approximately the same as the percentages from the previous two quarters. Roughly 86% of the 3rd quarter flags resulted from detection of anions, metals, and total organic carbon 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.

One hundred thirty-one of the 3rd quarter results were flagged with an H to signify missed holding times. Last quarter, 20 results were flagged for exceeded holding times (the previous QC summary incorrectly stated that no holding times were exceeded for 2nd quarter). Most of the 3rd quarter H flags were associated with anions and alkalinity (65%), but some of the results for oil and grease, specific conductance, total dissolved solids, total organic halides, and volatile organic compounds were also potentially affected. Shipping problems caused many of the holding times to be missed for anions. All 28 of the quarter's alkalinity analyses were performed out of holding time, but the data impacts should be minimal because all of the samples were analyzed on the same day the holding time expired. Late analyses for total organic halides were caused by an analyst error. The lab has pledged to make improvements where possible to reduce the number of missed hold times in the future.

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 3rd quarter of 2000 included full trip blanks, field transfer blanks, and equipment 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. The collection frequencies for field duplicates and full trip blanks were 4% and #5, respectively, which is lower than the target of 5% due to sampling events that were postponed during the quarter. Results from each type of QC sample are summarized below.

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 or minimum detectable activity must have RPDs less than 20% to be considered acceptable. Duplicates with RPDs outside this range are flagged with a Q in the database.

Ten field duplicates were collected and analyzed during the 3rd quarter of 2000 to produce 295 pairs of results. Overall, the results demonstrate excellent sampling and analysis precision. Six pairs of qualifying duplicate results had relative percent differences greater than 20%. Sample reanalyses resulted in acceptable precision for 2 duplicate result pairs (nitrite and gross beta). Suspended solids in unfiltered samples and low sample concentrations probably explain the poor precision in the remaining samples.

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 3rd quarter of 2000, a single pair of split samples was collected from well 1199-39-16D. The samples were analyzed for low-level tritium by Severn Trent-Richland and the University of Miami. Results from the analyses indicated excellent agreement between the two laboratories—Severn Trent obtained 82.6 pCi/L, and the University of Miami obtained 78.8 pCi/L.

TOC and TOX 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 3rd quarter, 2 out of 34 total organic carbon quadruplicates failed to meet the evaluation criteria. Both quadruplicates contained an apparent outlier with an elevated concentration of approximately 1.7 mg/L. The samples with the suspect results were reanalyzed, and the resulting RSDs for both quadruplicates were within the acceptance limits. Precision for total organic halides was acceptable for all of the quadruplicates that included a quantifiable result.

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. In general, the QC limit for blank results is 2 times the method detection limit or instrument detection limit for chemistry methods and 2 times the total propagated error 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 method detection limit. 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 907 results were produced from the 3rd quarter field blank samples. Approximately 3% of the results (i.e., 28 results) exceeded the QC limits for field blanks. This is the same percentage that occurred last quarter and is relatively low compared to the frequency of out-of-limit results for the previous year. Most of the flagged results were for metals and volatile organic compounds; however, results were also flagged for chloride, nitrate, and tritium. The potential impacts on the data are minor in most cases. Chloride, nitrate, magnesium, and sodium had field blank results that were greater than the QC limits, but the values were much lower than the concentrations of these constituents in almost all 3rd quarter groundwater samples. Some additional observations about the field blanks are noted below.

Volatile organic compounds had the greatest number of out-of-limit field blank results (17). Nine results for methylene chloride and 3 results for 2-butanone exceeded the QC limits. Laboratory contamination is the suspected source of these compounds. Concentrations of the remaining volatiles that exceeded the QC limits were low (i.e., < 5 µg/L), but the levels were higher than the concentrations of these compounds in several groundwater samples. Therefore, trace-level results for carbon tetrachloride, *cis*-1,2-dichloroethene, and trichloroethene in groundwater samples should be considered suspect due to possible sample contamination or false detection of these compounds. Chloroform, which has had several out-of-limit field blank results in previous quarters, did not exceed the QC limits in any 3rd quarter blank samples.

Total organic carbon was not detected in any 3rd quarter field blank samples. Roughly one-third to one-half of the field blanks that were analyzed for total organic carbon during the previous 2 quarters were out-of-limits. Reasons for the improved results are unknown.

A relatively high tritium result of 138 pCi/L was obtained for a full-trip blank associated with well 1199-39-16D. None of the groundwater samples collected on the same date as this blank (8/3/00) had tritium levels over 102 pCi/L. Reanalysis of the blank sample confirmed the elevated result. Thus, tritium may have been present in the source water used to prepare the blank.

Laboratory QC Data

Blind Standards. Double-blind standards containing known amounts of selected anions, metals, organic compounds, and radionuclides were prepared and submitted to Severn Trent in July, August, and September.

Duplicates of the total organic carbon, total organic halides and gross beta standards were submitted to Recra and ThermoRetec. All of the standards except those for cyanide were prepared using groundwater from background wells. Cyanide standards were prepared in deionized water. Standards for indicator analyses were spiked using the following constituents: potassium hydrogen phthalate was used to prepare total organic carbon standards, 2,4,6-trichlorophenol was used to prepare TOX-phenol standards, and TOX-VOA standards were prepared using a mixture of carbon tetrachloride, chloroform, and trichloroethene. Gross alpha and gross beta standards were spiked with plutonium-239 and strontium-90, respectively.

The acceptance limits for blind standard recoveries are generally 75 – 125% except for chromium, which has limits of 80 – 120%, and specific radionuclides, which have a $\pm 30\%$ acceptance range. The majority of the 3rd quarter results were acceptable, indicating good analytical performance overall. However, Severn Trent had one or more low recoveries for carbon tetrachloride, cyanide, technetium-99, and total organic halides. Recra also had unacceptable results for total organic halides. Severn Trent's out-of-limit result for carbon tetrachloride appears to be an isolated incidence of poor performance. The other out-of-limit results are discussed in more detail below.

Two of Severn Trent's total organic halide recoveries were less than 75% for the standards spiked with volatile organic compounds. Since all of Severn Trent's results for the standards spiked with 2,4,6-trichlorophenol were acceptable, the reason for the low bias appears to be volatilization or weak retention of the volatile analytes on the charcoal cartridges used in the analysis. All of Recra's total organic halide results were approximately 5 times higher than the presumed spiking level. This is the second quarter in a row that Recra's total organic halide results showed a systematic, positive bias. Recra performed a data recheck on the results but did not find any mistakes. Nevertheless, a calculation error is suspected as the cause of the high values.

As noted in previous reports, Severn Trent's blind standard results for cyanide have typically been biased low by approximately 25 – 40% during the past year. To help troubleshoot this problem, 2 sets of blind standards were submitted to Severn Trent during the 3rd quarter. The first set of standards was prepared in the same manner as the standards from previous quarters (i.e., by diluting a commercially-prepared standard solution containing cyanide). The second set of standards was prepared gravimetrically using a cyanide salt. Recoveries for the gravimetric standards (88-90%) were significantly higher than the recoveries for the standards prepared from a commercial solution. Additional investigation of the commercially prepared cyanide solutions revealed that some of the certified solutions used in the past had not been preserved at a high pH level. Consequently, it is believed that the low bias was caused by instability of the commercially prepared cyanide solutions. Verification of proper preservation will be performed in the future to help ensure the cyanide standards are reliable. Additional gravimetric standards will also be utilized if necessary.

A standard containing several metals was submitted to Severn Trent St. Louis as a check on some corrective actions the lab took to eliminate a metals contamination problem that occurred earlier in the year. All of the results for this standard were within $\pm 20\%$ of the expected concentrations. These results, combined with improved method- and field-blank results for metals, appear to indicate that the laboratory effectively corrected the contamination problem.

During the investigation of high tritium levels at the 618-11 Burial Ground, PNNL and Severn Trent Richland discovered that tritium levels over 40,000 pCi/L introduce a positive bias in the technetium-99 results from the lab's new TEVA disk analysis method. Soon after the problem was identified, Severn Trent Richland added a sample evaporation step to the procedure to remove tritium from the sample matrix. In order to verify that the evaporation step removed the interference without introducing additional analytical problems, the groundwater project submitted a special set of four blind standards. All of the standards in the set were spiked with approximately 50 pCi/L of technetium-99. The first standard also contained approximately 5,000,000 pCi/L of tritium in a background well-water matrix. The remaining standards contained 100,000 pCi/L of tritium in either deionized water, background well water, or background well water and 200 mg/L nitrate. The purpose of the diverse sample matrices was to determine whether the technetium recovery might be affected by incomplete dissolution of salts and inorganic complexes in the sample matrix when the sample is reconstituted after evaporation. All of the standards' results were within control limits except for the standard prepared in deionized water. It is suspected that this latter result was compromised by a sample-preparation or laboratory error. Consequently, this study demonstrated that the tritium interference problem was eliminated, and the sample matrices investigated do not appear to have a significant impact on the technetium-99 results.

ERA Water Supply/Water Pollution Programs. Severn Trent-St. Louis and Recra participate in the EPA sanctioned Water Supply/Water Pollution (WS/WP) Performance Evaluation studies conducted by New York State (Environmental Laboratory Approval Program [ELAP]) and Environmental Resources Associates (ERA), respectively. Every month, standard water samples are distributed as blind standards to participating laboratories. These samples contain specific organic and inorganic analytes at concentrations unknown to the participating laboratories. After analysis, the laboratories submit their results to the study administrator which uses regression equations to determine acceptance and warning limits for the study participants. The results of these studies, expressed in this report as a percentage of the results that the PE provider found acceptable, independently verify the level of laboratory performance.

For the two WP studies received from Severn Trent-St. Louis this quarter, the percentage of acceptable results ranged from 91% to 96%. Of the 25 constituents with unacceptable results, none were out of limits more than once. Twelve unacceptable results were caused by reporting or calculation errors, namely, from seven chlorinated hydrocarbon pesticides, chlordane, 2,4-D, cyanide, potassium, and alkalinity. Four unacceptable results were not applicable to Hanford groundwater samples: PCB 1232 (soils), PCB 1260 (soils), total phosphorus (different method used) and total kjeldahl nitrogen (not performed on Hanford samples). Iron and zinc were high because of a laboratory contamination problem which has been corrected. Endrin was high because of a dilution error. The other six constituents (conductivity, total organic carbon, total suspended solids, benzene, 1,2-dichloroethane, and PCB-1260) were only slightly out of acceptance limits.

Results were received from Recra for the WS samples reported in April 2000. Eight of the 207 results were unacceptable (3.9%), namely, cyanide, total organic carbon, dichlorodifluoromethane, 2,4-D, dicamba, pentachlorophenol, 1,2-dichlorobenzene, and 1,2-dichloroethane. The cyanide result was high because of a dilution error. Analyst errors may have caused the low organic results. No explanation was given for the high total organic carbon results.

Mixed Analyte Performance Evaluation Program. The Mixed Analyte Performance Evaluation Program (MAPEP) is conducted by the Department of Energy. In this program, samples containing metals, volatile and semivolatile organic compounds, and radionuclides are sent to participating laboratories in January and July. New MAPEP results for aqueous samples were not available this quarter.

InterLaB RadCheM Proficiency Testing Program Studies. The InterLaB RadCheM Proficiency Testing Program, conducted by Environmental Resource Associates (ERA), is a replacement for the EPA's National Exposure Research Laboratory PE studies. 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 Severn Trent-Richland this quarter. Iodine-131 was analyzed and was within control limits. ThermoRetec does not participate in the RadCheM PE studies.

Department of Energy Quality Assessment Program. This program is conducted by the Environmental Measurements Laboratory 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 historic data distributions. Acceptable results should fall within the 15th and 85th percentile of the cumulative normalized distribution. Results are within warning limits if they fall between the 5th and 15th percentile or the 85th and 95th percentile. Results less than the 5th percentile or greater than the 95th percentile are "not acceptable". All of the results for Severn Trent-Richland were acceptable, although cobalt-60, cesium-137, strontium-90, uranium-234, and uranium-238 were within the warning limits. One result from ThermoRetec was not acceptable (uranium). The other results for ThermoRetec were acceptable, but uranium-234 and uranium-238 were within the warning limits.

Laboratory QC Data from Severn Trent. Laboratory QC data includes the results from method blanks, laboratory control samples, matrix spikes, matrix spike duplicates, surrogates, and matrix duplicates. This information provides a means of assessing laboratory performance and the suitability of a method for a particular sample matrix. Laboratory QC data are not currently used for in-house validation of individual sample results unless the lab is experiencing unusual performance problems with an analytical method. Most of the third quarter

laboratory QC results were within acceptance limits, suggesting that the analyses were in control and reliable data were generated. Nevertheless, several parameters had unacceptable results, and some were "significantly" out of limits. For method blanks, "significantly out-of-limits" means some results were greater than twice the QC limit. For laboratory control samples, matrix spikes, and duplicates, significantly out-of-limits means the results were outside the range of the QC limits plus or minus 10 percentage points (e.g., if the QC limits are 80-120%, significantly out-of-limits would mean less than 70% or greater than 130%). Most of the results that were significantly out-of-limits were matrix spikes for anions and radiological constituents.

Results for method blanks were evaluated based on the frequency of detection above the blank QC limits. In general, these limits are 2 times the method detection limit or instrument detection limit (IDL) for chemical constituents and 2 times the total propagated error for radiochemistry components. For common laboratory contaminants such as acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the QC limit is 5 times the method detection limit. The NH₃-anions category had the greatest percentage of method blank results exceeding the QC limits, with 4.8% exceeding twice the method detection limit. All of the out-of-limit results for NH₃-anions were for chloride (25.6%). For all other categories, the QC limits were exceeded by fewer than 4% of the method blanks. None of the constituents in the other categories with ten or more measurements had greater than 10% of method blanks outside the QC. Conductivity, total organic carbon, aluminum, 1,4-dichlorobenzene, carbon disulfide, methylene chloride and technetium-99 were the other parameters that had out-of-limit results. Of these, only chloride had a result that was significantly out-of-limits as defined in the preceding paragraph. However, none of the out-of-limit chloride blank levels was significant compared to concentrations measured in Hanford groundwater samples.

All laboratory control sample recoveries were acceptable this quarter.

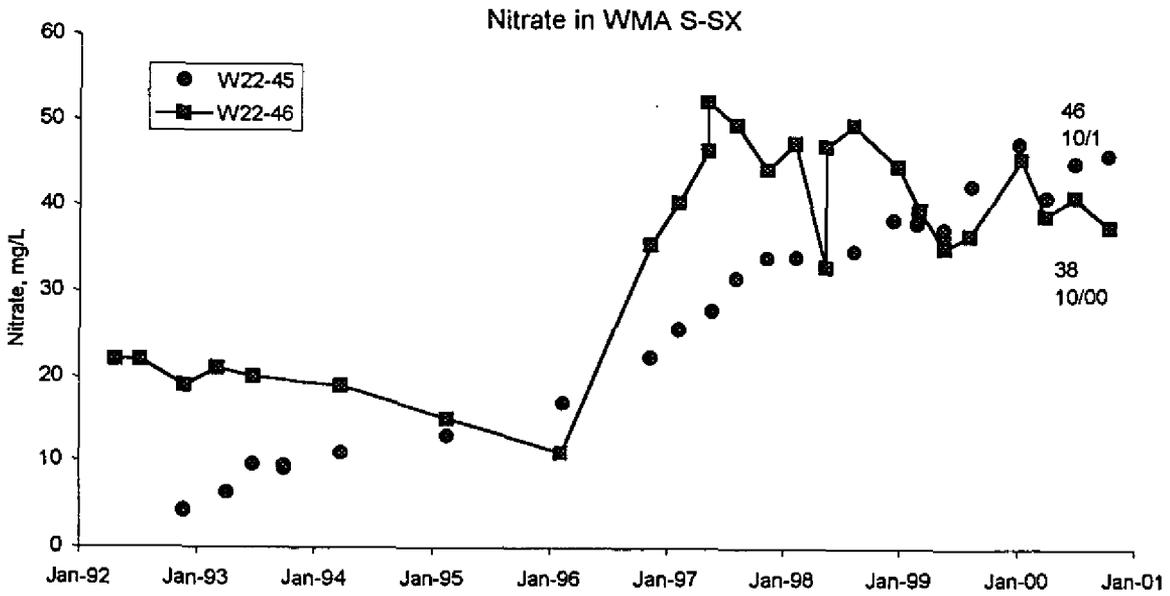
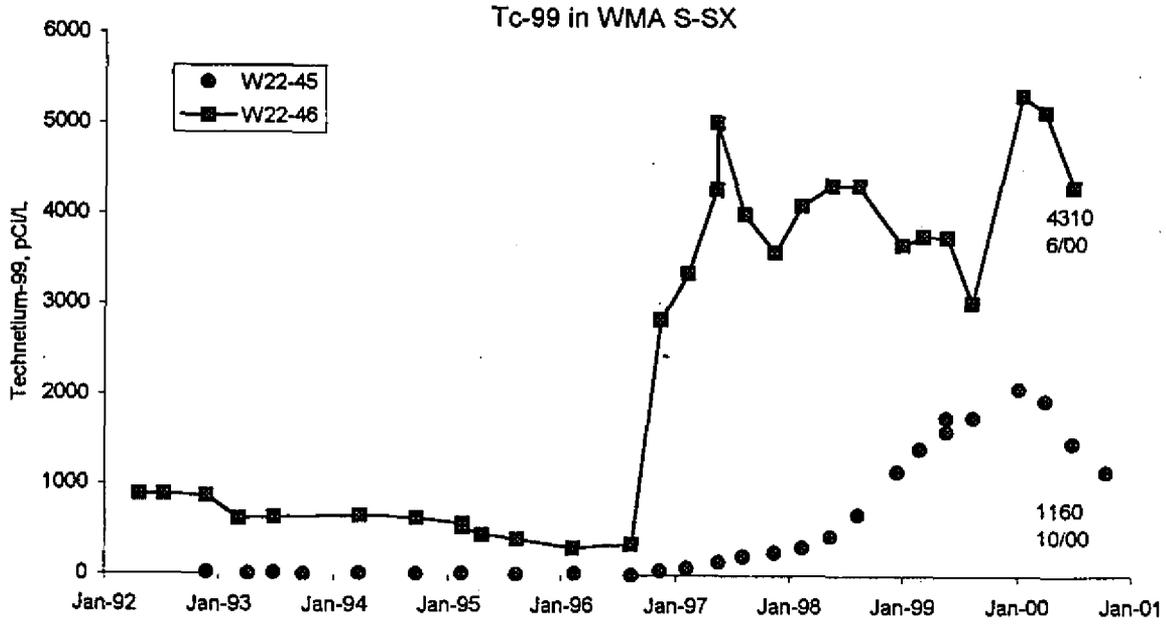
For matrix spikes and matrix spike duplicates, the percentages of out-of-limit results were as follows: 3.3% for general chemistry parameters, 32.4% for ammonia and anions, 0% for metals, 5.4% for volatile organic compounds, 46.2% for semivolatile organic compounds, and 37.5% for radiochemistry parameters. A very limited number of samples containing semivolatile organic compounds were analyzed this quarter; thus the high percentage of out-of-limit results can be attributed mainly to one sample. Constituents with 10 or more measurements that had greater than 10% of matrix spikes outside QC limits included nitrate, nitrite, sulfate, technetium-99, and uranium. Each of these constituents had one or more matrix spikes that were significantly outside the QC limits. Additional parameters that had out-of-limit results are as follows: total organic halides, chloride, cyanide, fluoride, 1,1-dichloroethene, tetrachloroethene, toluene, trichloroethene, oil/grease, TPH diesel, and many of the alkylated, chlorinated or nitro-containing phenols. Of these, total organic halides, cyanide, oil/grease, TPH diesel, and thirteen of the phenols had results that were significantly outside the QC limits.

For matrix duplicates with values five times greater than the method detection limit or minimum detectable activity, percentages of out-of-limit results were as follows: 0% for general chemistry parameters, 0% for ammonia and anions, 0% for metals, 3.6% for volatile organic compounds, 90.5% for semivolatile organic compounds, and 0.5% for radiochemistry parameters. A very limited number of samples containing semivolatile organic compounds were analyzed this quarter; thus the high percentage of out-of-limit results can be attributed mainly to one sample. The only constituent with at least 10 measurements that had greater than 10% of matrix duplicates outside QC limits was chlorobenzene. Other parameters that had out-of-limit results are as follows: TPH diesel, many of the alkylated, chlorinated, or nitro-containing phenols, and plutonium 239/240. Of these, chlorobenzene, TPH diesel, and fifteen of the phenols had results that were significantly outside QC limits.

Surrogate recoveries were also evaluated. The percentages of out-of-limit results were as follows: 1.9% for volatile organic compounds and 7.1% for semivolatile organic compounds. The only constituent with at least 10 measurements that had greater than 10% of matrix duplicates outside QC limits was o-terphenyl. Other constituents with out-of-limit results included 1,2-dichloroethane-d₄, 1-chloro-4-fluorobenzene, 4-bromofluorobenzene, dibromofluoromethane, toluene-d₈, and 2,4,6-tribromophenol. Of these, 1,2-dichloroethane-d₄ and 2,4,6-tribromophenol had at least one result that was significantly outside the QC limits.

Laboratory QC Data from ThermoRetec and Recra. Third quarter QC data from ThermoRetec are limited to gross beta. All the QC data were within limits. Third quarter QC data from Recra are limited to total organic carbon and total organic halides. All the associated laboratory QC data were within limits.

Attachment 2



Attachment 3

