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Addressees:

QUARTERLY RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) GROUNDWATER MONITORING DATA FOR THE PERIOD OCTOBER 1, 2000, THROUGH DECEMBER 31, 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.

Nineteen RCRA sites were sampled during the reporting quarter (see enclosure, Table 1). Sampled sites include 10 monitored under indicator evaluation programs, 7 monitored under groundwater quality assessment programs, and 2 monitored under final-status corrective action. Detailed information on salient issues during this quarter is included in the enclosure.

QUARTERLY RESOURCE CONSERVATION AND RECOVERY ACT GROUNDWATER MONITORING DATA FOR THE PERIOD OCTOBER 1 THROUGH DECEMBER 31, 2000.

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

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, indicator evaluation requirements, as described in 40 CFR 265.93. Three of the ten 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.

216-A-29 Ditch. Specific conductance in downgradient well 299-E25-48 continued to exceed the critical mean value in October 2000. 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.

Liquid Effluent Retention Facility. Only two wells had enough water to sample in December 2000. Ecology instructed DOE to cease statistical evaluations at the site (reference 1).

Low-Level Waste Management Area 1. Specific conductance in one downgradient well continued to exceed the critical mean value. DOE submitted an assessment report to Ecology in March 1999. The elevated specific conductance is caused by high nitrate concentrations from non-WMA sources.

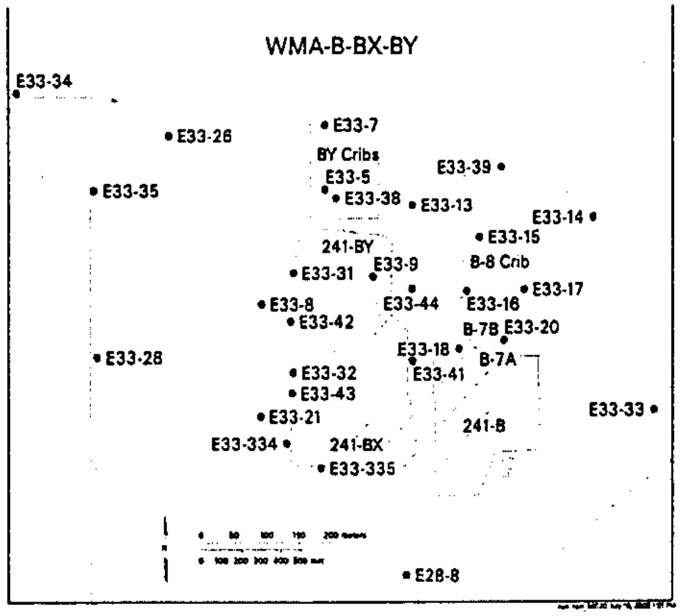
Low-Level Waste Management Area 2. Specific conductance, total organic carbon, and total organic halides in an upgradient well exceeded the critical mean values. The upward trends in specific conductance and total organic carbon were reported earlier. Sulfate increases caused the high conductance. An investigation of the organic constituents is continuing. Since the exceedances occurred in an upgradient well, assessment monitoring is not required.

Single-Shell Tanks Waste Management Area C. Due to a scheduling error, quadruplicate samples were not collected in November. Quadruplicates were taken in March 2001 and will be evaluated and reported in the next quarterly letter.

Sulfate, nitrate, calcium, chloride, and technetium-99 continued to rise in three of the five monitoring wells at WMA C, particularly the two upgradient wells. Upgradient well 299-E27-14 had a specific conductance value of 507 μS/cm during the reporting period, close to the critical mean of 553.5 µS/cm, and a technetium-99 concentration at 857 pCi/L, which is approaching the 900 pCi/L drinking water standard. Critical mean values may need to be reestablished based on recent upgradient concentrations. Elevated sulfate/calcium concentrations are observed in the groundwater to the north, east and southeast of this WMA. In addition to the anions and technetium-99, low levels of cyanide were observed in upgradient well 299-E27-7 in November.

Status of Assessment Programs

Single-Shell Tanks WMA B-BX-BY: The contaminant suite consisting of nitrate, technetium-99, cyanide, and some cobalt-60 continued to migrate south across the WMA. These contaminants are believed to be part of the original BY Crib plume mapped in the early 1990's north of the WMA along the basalt subcrop; this regional plume is moving south through the WMA. The appearance of cyanide in wells south of the BY Cribs along with large increases in nitrate and technetium-99 provide further support of southward migration of this regional plume.



Although the flow appears to be complicated, direct measurements of flow direction, collected in August 2000, provide evidence of primarily a southerly flow direction across the WMA. These results are in agreement with interpretations based on contaminant migration and hydrographs. Although there was no perceptible change in flow rate this quarter, results from the colloidal boroscope investigation indicate that flow rates are slower in the north half of the WMA than in the south. At least three new wells will be drilled in FY2001 to provide partial coverage along the south side and southeast corner of the WMA.

Upgradient (north) of the WMA, the BY Crib technetium-99 plume has migrated south. Concentrations in well 299-E33-7 may have leveled off recently (Figure 1). Contaminant levels are lower farther south, although values continue to increase. Further evidence of southern movement is displayed in the sharp increases in technetium-99 and nitrate in well 299-E33-44. Technetium-99 activities rose in well 299-E33-44 to over 8,000 pCi/L in November 2000 from 6,410 pCi/L in August 2000. Contamination at wells 299-E33-44 and 299-E33-9 did not previously appear to be increasing, but cyanide was detected in August 1999 at well 299-E33-44. Contamination at these wells is generally characterized by a low nitrate/technetium-99 ratio (indicative of tank wastes), moderate technetium-99 and nitrate levels, and high nitrite, not usually found in groundwater but present in tank waste at high levels. These characteristics and high uranium concentrations suggest this contamination may be residual metals waste from early WMA-related leaks, now settled into a structural low in the basalt surface. Well 299-E33-9 is located near such a structural low. The technetium-99 and nitrate increases may indicate the local contamination is being overwhelmed by the regional BY Crib plume migrating from the north.

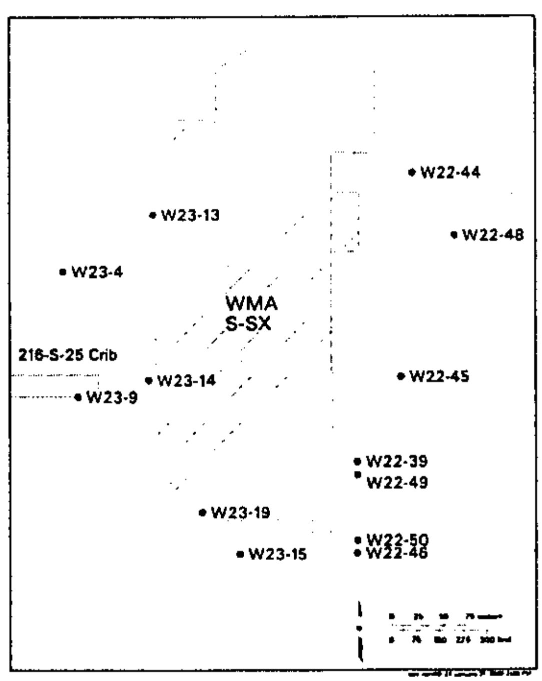
Wells south and east of 299-E33-44 have increased from below 2,000 pCi/L to over 3,000 pCi/L during the last year. Well 299-E33-16, that had previously displayed only minor increases in technetium-99, rose from 1940 pCi/L in May 2000 to over 3,080 pCi/L in November 2000 while well 299-E33-18 is currently at 3,800 pCi/L (3,080 pCi/L in August 2000). Cyanide was found farther south, in well 299-E33-41, at 24 µg/L for the first time this quarter. On the west side of the WMA, technetium-99 levels continued to increase, but was at lower levels than in the north.

Technetium-99, nitrate, cobalt-60 and cyanide, associated with the regional BY Crib plume, continued to increase west of the BY Cribs, with concentrations rising similarly in wells 299-E33-26 and 299-E33-34 (see Figure 1). For example, technetium-99 values rose from 6,310 pCi/L and 5,320 pCi/L respectively in August 2000 to 7,170 pCi/L and 6,140 pCi/L in December 2000. These wells show similar levels of cobalt-60 at about 39 pCi/L but well 299-E33-34 has the higher cyanide level of 240 µg/L. The current level at 299-E33-26 is 185 µg/L. To the south and west of well 299-E33-34, technetium-99 levels have also risen from about 1,500 pCi/L in August 2000 to 1,650 pCi/L in well 299-E33-35 and to 2,070 pCi/L in 299-E32-10. Although no detectable cobalt-60 is found in these wells, cyanide continues to rise in well 299-E33-35 from 38 µg/L in August 2000 to 69 µg/L in November 2000.

Uranium concentrations are elevated in wells in the southern part of the BY cribs (299-E33-38); beneath and southeast of the 241-BY Tank Farm (299-E33-9, 299-E33-44, 299-E33-18, 299-E33-41); and on both sides of the BY Cribs (299-E33-26, 299-E33-13, 299-E33-34). Values range from 515 µg/L at well 299-E33-9 to 25 µg/L in well 299-E33-13. Most of these wells have not shown distinct increases in uranium in the past. This further suggests that the uranium may be trapped in structural lows on the basalt surface. However, uranium levels in well 299-E33-9, an old well located inside the 241-BY Tank Farm that was only recently sampled for uranium, rose from 303 µg/L in May to 515 µg/L in November 2000. Uranium remained stable at 114 µg/L in well 299-E33-38 (113 µg/L reported in May 1999).

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 also are 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 technetium-99 drinking water standard of 900 pCi/L continued to be exceeded in well 299-W23-19 located inside the SX tank farm. This well has



the highest concentration in WMA S-SX network wells (72,300 pCi/L in December). The well is located immediately adjacent to tank SX-115, where a leak occurred in the early 1960s. Technetium-99 concentrations have gradually increased 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 location indicate this area of the SX tank farm is the source of the observed groundwater contamination in the well. Technetium-99 concentrations also continued to exceed the drinking water standard in downgradient wells 299-W22-45, 299-W22-46, 299-W22-48 and 299-W22-50. The upward trend observed earlier in well 299-W22-45 appeared to reach a maximum concentration in January 2000 and has declined slowly since then (Figure 2).

Nitrate continued to exceed the 45-mg/L maximum contaminant level in upgradient wells 299-W23-9 and 299-W23-14 and in well 299-W23-19 inside SX tank farm. Concentrations remained at or near the maximum contaminant level in downgradient well 299-W22-45 (see Figure 2). The high and increasing nitrate concentrations in well 299-W23-19 (677 mg/L in December) are consistent with the elevated 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.

Chromium concentration in well 299-W23-19 exceeded the 100 µg/L maximum contaminant level for the first time in December (131 µg/L). Chromium is one of the mobile tank waste contaminants. Chromium concentrations ranged from 4 to 31 µg/L in the other network wells.

The tritium drinking water standard of 20,000 pCi/L continued to be exceeded in upgradient and downgradient wells. The highest concentrations for this quarter occurred in wells directly downgradient from the 216-S-25 crib. Concentrations in wells 299-W23-9, 299-W23-14 and 299-W23-19 were 173,000, 100,000 and 115,000 pCi/L, respectively. Concentrations in the other network wells ranged from 273 to 28,700 pCi/L during the quarter. The primary source of tritium in these wells is residual contamination from past-practice discharges to the 216-S-25 crib as well as tank leakage.

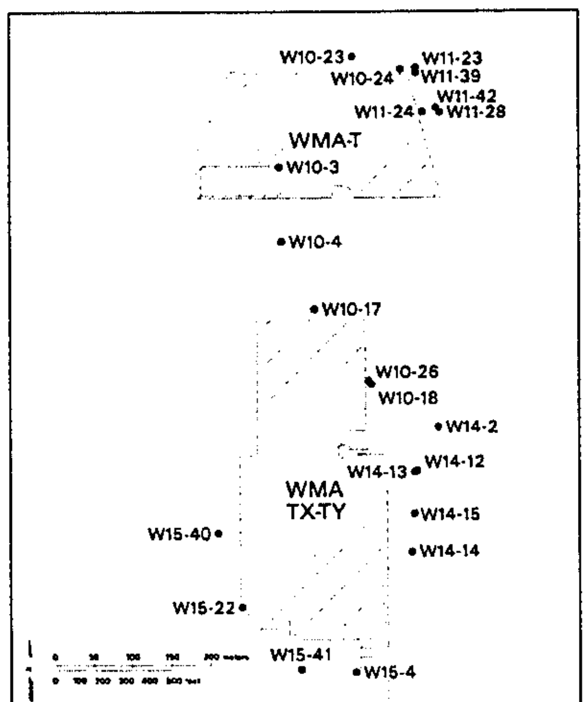
Carbon tetrachloride exceeded the 5-µg/L maximum contaminant level in upgradient and downgradient wells. During the quarter, the highest concentration, 150 µg/L, occurred in upgradient well 299-W23-4 and the next highest concentration, 72 µg/L, occurred in downgradient well 299-W23-15. The concentration in this well has declined from a maximum of 120 µg/L in June 2000. Concentrations in the other network wells ranged from 0.2 to 36 µg/L during the reporting period. 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 was detected at 23.4 µg/L in upgradient well 299-W23-4 and 20.1 µg/L in well 299-W23-19 in December. Uranium in the other downgradient wells for WMA S-SX ranged from 3 to 18 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.

Iodine-129 was detected for the first time in well 299-W23-19 (5.6 pCi/L; drinking water standard is 1 pCi/L). Iodine-129 is a mobile co-contaminant in tank waste, so its occurrence in the well with the highest technetium-99 is not surprising. Iodine-129 has not been detected at other downgradient S-SX network wells. Strontium-90 and cesium-137 continued to be undetected in WMA S-SX network wells.

Aluminum, iron and manganese concentrations exceeded their maximum contaminant levels (50, 300 and 50 μg/L, respectively) in upgradient well 299-W23-14 during the quarter. The reported concentrations were 1,100, 2,530 and 202 μg/L, respectively. This well is going dry and has been replaced. The anomalous metal concentrations occurred when the turbidity was unavoidably high (900 NTU). Thus excessive filter loading may have caused bypass of the filter. Beginning with the next quarterly sampling event, this well will no longer be in the network. Aside from the anomaly described above, aluminum was not detected in any other network wells during the quarter. Manganese, however, exceeded its maximum contaminant level in two other wells (299-W22-48 and 299-W23-19; 77 and 117 μg/L respectively), and ranged from 1 to 44 μg/L in the remaining network wells. Other than in well 299-W23-14, there were no other exceedances for iron.

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 presently 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 decreased from 1,890 pCi/L in August to 1,770 pCi/L in December. Technetium-99 in well 299-W11-23, a non-RCRA well located ~30 meters east of 299-W10-24, increased to 4,470 pCi/L in December. The highest recorded technetium-99 value in this well was 8,540 pCi/L in November 1998. This well was sampled with a bailer in December and had too little water to sample in February 2001. It has been replaced by new RCRA well, 299-W11-39, which was first sampled in February 2001.

The nitrate concentration in well 299-W10-4, a non-RCRA well located south of WMA T, decreased to 726 mg/L in December 2000, down from a high of 1,049 mg/L in December 1999.

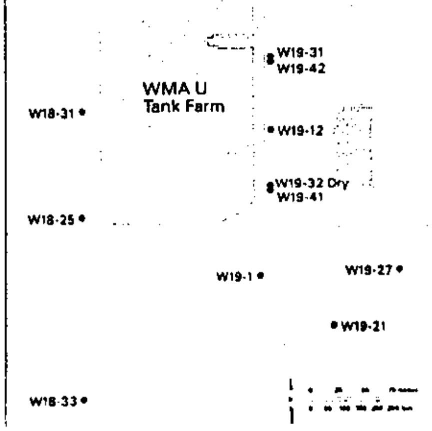
Chromium increased slightly to 193 µg/L and carbon tetrachloride decreased to 570 µg/L. The probable origin of these contaminants is waste disposal at facilities associated with the Plutonium Finishing Plant.

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 December nitrite was reported at 990 µg/L in well 299-W11-24 and 1,120 µg/L in well 299-W11-28, below the maximum contaminant level of 3,300 µg/L. These wells consistently have elevated concentrations of iron, manganese, and nickel. Chromium and technetium-99 concentrations are 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 and remained essentially unchanged at 263 mg/L in December, while chromium, fluoride, and technetium-99 were below applicable standards. This was one of the wells that initially placed WMA TX-TY in assessment but it is no longer downgradient of the WMA. It apparently is intercepting part of the high nitrate plume also seen in well 299-W10-4 to the north.

Technetium-99 concentrations decreased in well 299-W14-13 and increased slightly in well 299-W14-2 in December (Figure 3). Nitrate (309 mg/L) and chromium (246 µg/L) also exceeded maximum contaminant levels in well 299-W14-13. Previously high values of technetium-99 and chromium were detected when groundwater flowed toward the northeast. Present 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 continued their variable trend well 299-W14-2 and decreased in well 299-W14-13 (see Figure 3). Iodine-129 concentrations also continued to be elevated in these wells during the quarter, up to 64 pCi/L in well 299-W14-2 and down to 22 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 relatively low concentration of technetium-99 in well 299-W14-2 indicates the possibility of at least two contaminant plumes in the area. Concentrations of nitrate (99 mg/L), tritium (8,820 pCi/L), and technetium-99 (380 pCi/L) in new RCRA well 299-W14-15 are much lower than in well 299-W14-13, and constrain the southern boundary of the contaminant plumes.



In March 2000 the first sampling of new well 299-W15-41, located along the southern margin of WMA TX-TY, indicated a technetium-99 concentration of 1,980 pCi/L. The concentrations have fluctuated between May and December, reaching 1,210 pCi/L. 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 in August 1999. The assessment report concluded that the elevated specific conductance was from the WMA and due to elevated concentrations of non-hazardous constituents calcium, magnesium, chloride, and sulfate. Nitrate and technetium-99 also were present as co-contaminants and concentrations have increased over the past

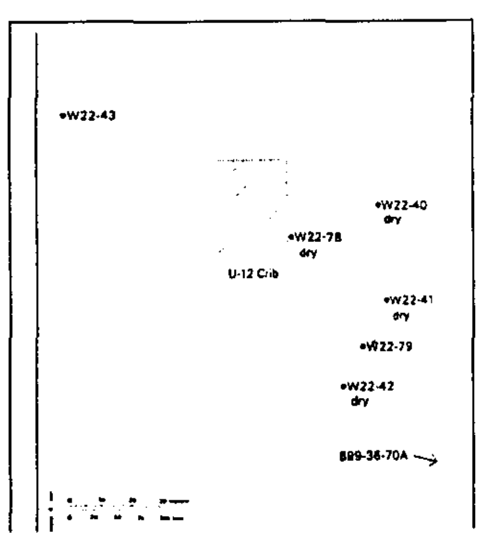
several years, though levels are well below drinking water standards. Chromium concentrations in downgradient wells have generally exceeded background levels, but similar levels also were observed in upgradient well 299-W18-25 in early 2000 before it went dry.

Overall there was little change in groundwater chemistry from previous quarters. During the quarter, specific conductance in downgradient wells 299-W18-30, 299-W19-12, and 299-W19-41 exceeded the critical mean value, indicating that the WMA is still affecting groundwater quality. Major non-hazardous constituents reported previously continue to be the cause of the elevated specific conductance levels. Nitrate and technetium-99 remain as co-contaminants in downgradient wells 299-W19-12 and 299-W19-41. Nitrate concentrations have continued to increase in the two wells to about 25 mg/L, below the maximum contaminant level. Nitrate concentrations also continued to rise in upgradient well 299-W18-31, but at only 20% of the level found in the downgradient wells. Therefore, the increasing nitrate concentrations downgradient of the WMA are attributed to sources within the WMA. Technetium-99 remained elevated in both downgradient wells but at levels below the drinking water standard.

Well 299-W15-37, an extraction well for the 200-ZP-1 Operable Unit and located approximately 70 meters northwest of WMA U, was shut down on January 17, 2001. Weekly water level measurements in nearby wells and data from pressure transducers in wells 299-W18-31 and 299-W19-42 were used to evaluate groundwater flow directions and effects of shutting off the pumping well. Water level responses were virtually identical in all of the wells in the immediate vicinity of the WMA. These data showed that groundwater flow varies between 5° to 12° north of east in the north and south halves of the WMA. Transducer data were used to show that the pumping well had an effect on groundwater beneath the WMA, but the effect was small and equal across the WMA. The rate of groundwater flow is estimated to be 0.075 meters per day.

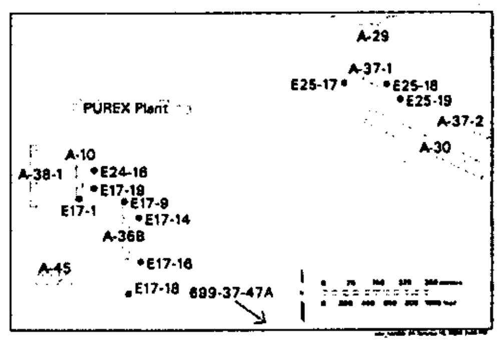
216-U-12 Crib: The current groundwater assessment monitoring network for the 216-U-12 Crib consists of only two downgradient wells (299-W22-79 and 699-36-70A). The wells were sampled in mid-December 2000. Concentrations for all contaminants declined or remained flat during the quarter and are expected to continue to decline. Water levels were measured in all the wells including unsampleable well 299-W22-42. The water level data indicate that the downgradient two-well network is still monitoring releases from the 216-U-12 Crib. The groundwater flow direction beneath the crib is toward the east-southeast. The rate of flow has not changed.

Specific conductance in both downgradient wells continued to decline. Specific conductance in downgradient well 299-W22-79 was 343 μS/cm, which is below the critical mean (457.8 μS/cm).



Specific conductance in downgradient well 699-36-70A is 563 µS/cm. The nitrate concentration in well 299-W22-79 declined to 43 mg/L, below the 45 mg/L maximum contaminant level for the first time since monitoring began in 1998. The nitrate concentration in 699-36-70A continued to exceed the maximum contaminant level; the December result was 97 mg/L, a slight decline from the previous quarter. Technetium-99 results were essentially unchanged and far below the drinking water standard in well 299-W22-79.

Concentrations of tritium and iodine-129, regional contaminants not associated with the 216-U-12 crib, declined slightly in both wells during the reporting period. In well 699-36-70A iodine-129 was 13.3 pCi/L and tritium was 67,400 pCi/L. In well 299-W22-79 iodine-129 was 1.9 pCi/L and tritium was 11,200 pCi/L.



PUREX Cribs (216-A-10, 216-A-36B, and 216-A-37-1): Drinking water standards for nitrate, gross beta, iodine-129, strontium-90, and tritium continued to be exceeded during the quarter at near-field wells of the PUREX Cribs monitoring well network. The near-field wells were sampled in October 2000. Far-field wells are sampled annually to once every three years for tritium, nitrate, and iodine-129, and the results are reported in the annual Hanford Site groundwater monitoring report.

Beneath the PUREX Cribs, the differences in water table elevations from well to well are very small. During the reporting period the elevation difference between the lowest and highest water levels was 0.2 meters. Therefore, the water table gradient is too small to reliably determine groundwater flow rate or flow direction. However, groundwater flow directions as determined from the movement of contaminant plumes indicate that the regional flow is toward the southeast.

Manganese concentrations in filtered samples from well 299-E17-9 have been increasing since January 2000 (Figure 4). A January 2000 sample had a concentration of 78 µg/L, and the October sample had a concentration of 191 (maximum contaminant level = 100 µg/L). It is not presently clear whether the elevated manganese is due to a release from the 216-A-36B Crib or whether it is from corrosion of the carbon steel casing (the well is not compliant with WAC 173-160). Samples from this well had high turbidity in January and October. The manganese trend will continue to be tracked.

Nitrate concentrations remained above the 45 mg/L maximum contaminant level in two wells at the PUREX Cribs. At the 216-A-10 Crib, the nitrate concentration was 82 mg/L in well 299-E17-1, where concentrations have been decreasing since 1991. At the 216-A-36B Crib, the nitrate concentration was 104 mg/L in well 299-E17-14, where nitrate concentrations have been steady since 1997.

Strontium-90 remained above the 8 pCi/L drinking water standard in only one well during the current reporting period (17.7 pCi/L at well 299-17-14 near the 216-A-36B Crib).

Concentrations have been slightly increasing since 1997. Because strontium-90 is a beta-emitter, the strontium-90 results are associated with elevated gross beta (drinking water standard = 50 pCi/L). The reported gross beta result for 299-E17-14 was 54.8 pCi/L for the quarter.

Iodine-129 remained elevated at all near-field network wells at the PUREX Cribs during the reporting period. Concentrations are stable in seven of the nine downgradient wells. The trend is decreasing in the other two downgradient wells (299-E17-1 and 299-E17-18 at the 216-A-10 and 216-A-36B cribs). The highest iodine-129 result for the reporting period was 9.8 pCi/L in well 299-E24-16. The lowest value was 1.33 pCi/L in well 299-E17-18. The drinking water standard is 1 pCi/L.

Tritium concentrations remained above the 20,000 pCi/L drinking water standard in all but upgradient well 299-E25-31 and downgradient well 299-E25-17, near the 299-A-37-1 Crib. The highest tritium concentration was 4,100,000 pCi/L at well 299-E17-9 (see Figure 4). This result is above the DOE derived concentration guide of 2,000,000 pCi/L. Levels have been fairly stable over the last 10 years in this well. The overall trend of tritium is decreasing in other PUREX Cribs wells.

Quality Control

Results of the RCRA quality control program for the October-December quarter are discussed in the Appendix. Quality control data that are not available in HEIS are available in electronic form upon request. The quality control program indicated that the data were acceptable for use in the statistical comparisons discussed above.

References:

(1) Dib Goswami and Fred Jamison, Washington State Department of Ecology, to Kevin Leary and Michael Thompson, DOE. "Liquid Effluent Retention Facility Unsaturated Zone Monitoring Alternative Evaluation, Suspension of Groundwater Monitoring Statistical Evaluation Requirements..." dated 24 January 2001.

Table 1. Status of RCRA Sites, October-December 2000.

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

LERF = Liquid Effluent Retention Facility
LLBG = Low-Level Burial Grounds
NRDWL = Nonradioactive Dangerous Waste Landfill
SST = Single-Shell Tanks
WMA = Waste Management Area

[a] Sampling scheduled for Oct-Dec 2000 but delayed until early 2001. However, data were available in time to be evaluated.
[b] Statistical evaluation was suspended. See text for explanation.
[c] No indication of hazardous waste contamination from facility; see text for explanation.
[d] Due to scheduling error, no quadruplicate samples were collected. March 2001 data will be statistically evaluated.
[e] Makeup sampling originally scheduled for August 2000.
[f] U-12 Crib, PUREX Cribs, SST WMAs B-BX-BY, S-SX, T, TX-TY, and U.
[g] Site has entered corrective action because of previous exceedances.

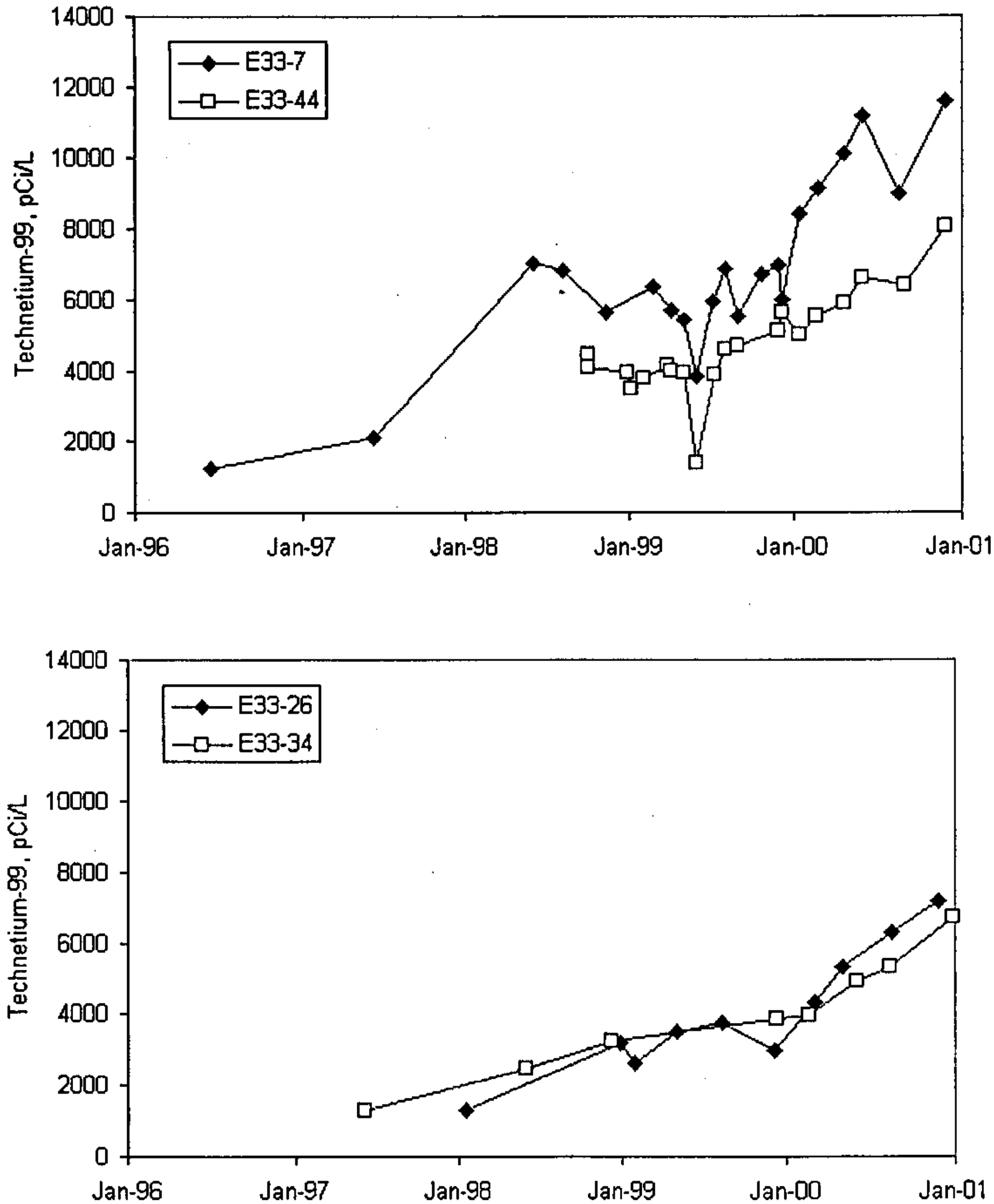
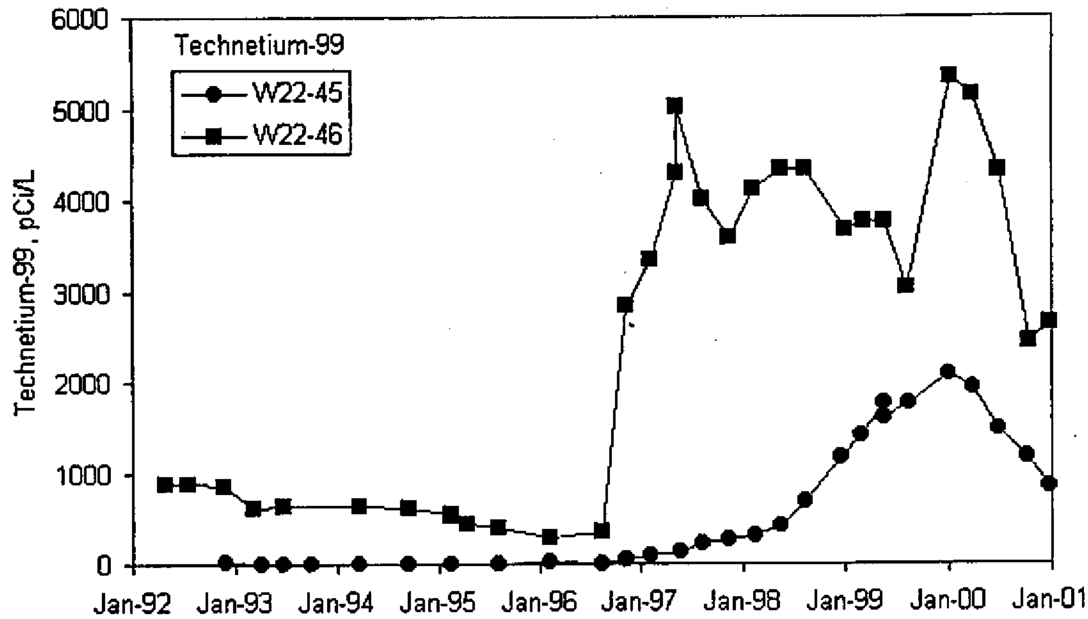


Figure 1. Technetium-99 in Wells Monitoring WMA B-BX-BY.



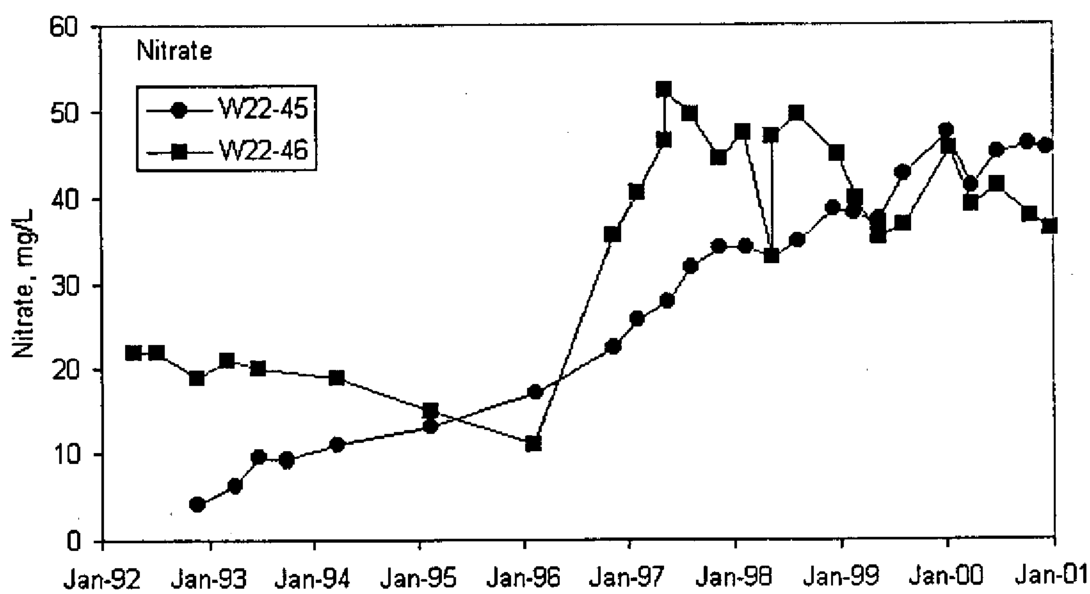
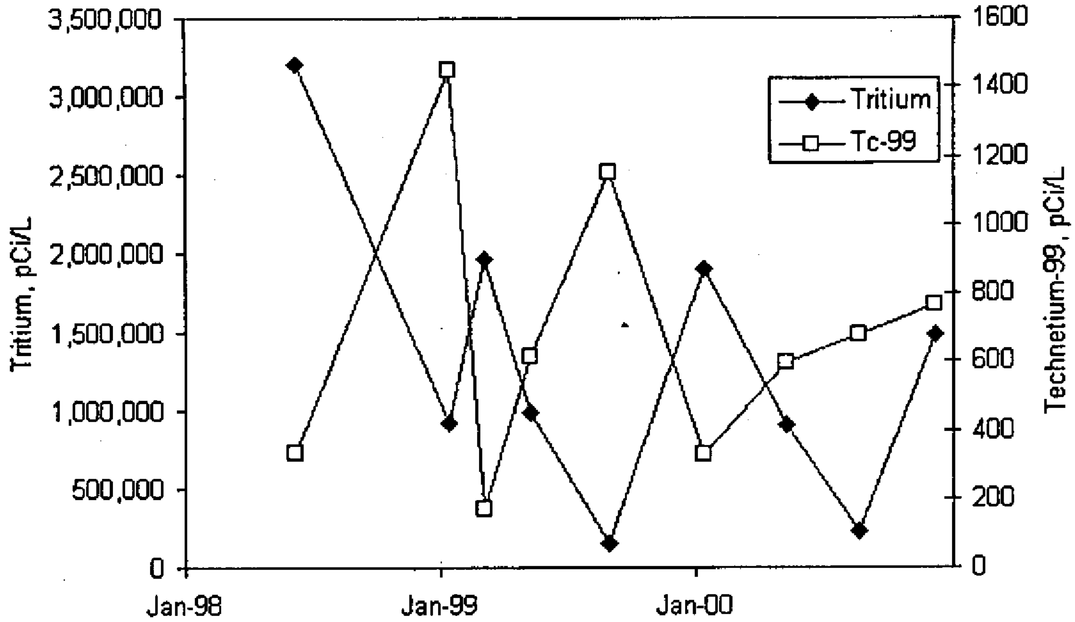


Figure 2. Technetium-99 and Nitrate in Wells Monitoring WMA S-SX.



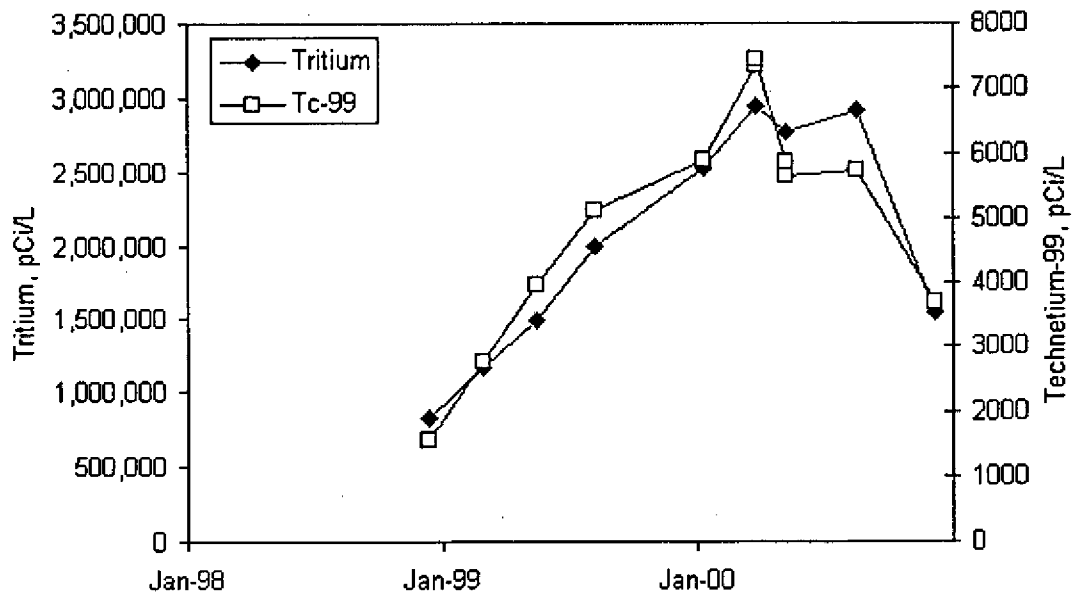


Figure 3. Technetium-99 and Tritium in Wells 299-W14-2 (top) and 299-W14-13 (bottom), WMA TX-TY.

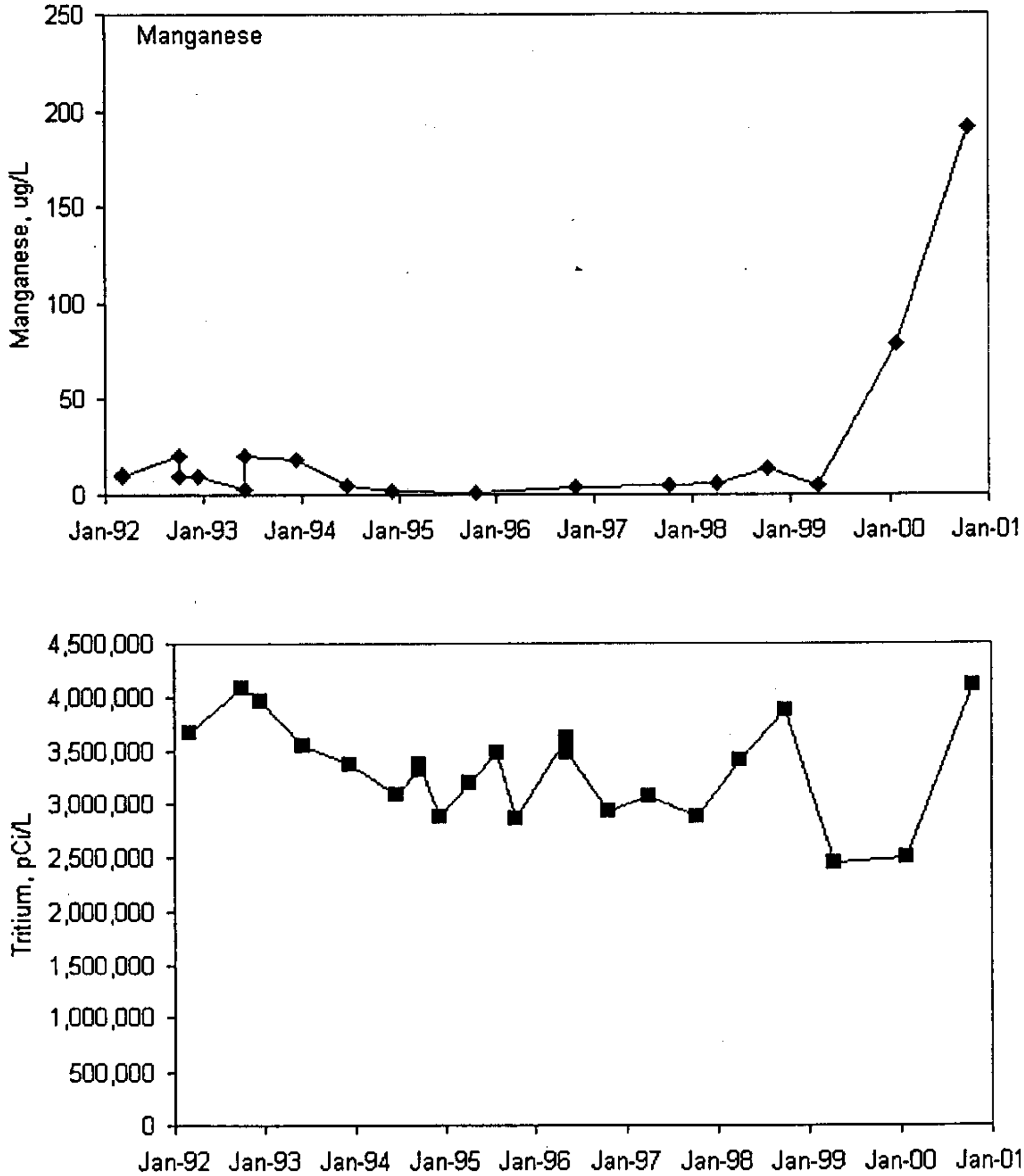


Figure 4. Manganese and Tritium in well 299-E17-9, near the 216-A-36B Crib.

Appendix: Quality Control Results, October through December 2000.

This quality control (QC) report presents information on laboratory performance and field QC sample results for the fourth 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. Ninety percent of the 4th quarter's 15,832 results were considered valid. This fraction is approximately the same as the percentages from the previous three quarters. Roughly two thirds of the 4th quarter flags resulted from detection of anions, metals, and total organic carbon in field and method blanks. Most 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.

Four hundred fifteen of the 4th quarter results were flagged with an H to signify missed holding times. Last quarter, 131 results were flagged for exceeded holding times. Most of the 4th quarter H flags were associated with anions (47%) and volatile organic compounds (34%), but some results for alkalinity, specific conductance, total dissolved solids, total organic carbon, total organic halides, and TPH-diesel were also flagged. Several problems contributed to the missed holding times: shipping delays, an instrument failure (anions), reanalyses triggered by high method blank results, and reanalyses requested after the holding times had already expired. Most of the late analyses for volatile organic compounds were performed within a few hours of the holding time. This resulted in part from the way the laboratory was accounting for holding-time expiration (i.e., to the nearest day rather than to the nearest minute), and samples were not prioritized for analysis correctly. Staff are working with the laboratory to correct these problems and reduce the number of missed holding 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 4th 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 full trip blanks were lower than the target of 5% due to a large number of 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 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 relative percent differences less than 20% to be considered acceptable. Duplicates with relative percent differences outside this range are flagged with a Q in the database.

Twenty-two field duplicates were collected and analyzed during the 4th quarter of 2000 to produce 672 pairs of results. Overall, the results demonstrate good sampling and analysis precision. Nineteen pairs of qualifying duplicate results had relative percent differences greater than 20%. None of the samples was reanalyzed, but 5 results appear to be outliers based on historical trends at the associated wells. These results have been flagged with a Y in the database to indicate that the data are suspect. Most of the metal results with poor precision were associated with unfiltered samples. Suspended solids in heterogeneous sample fractions may account for some of the discrepancies in these results. Low sample concentrations probably explains the poor precision in cobalt-60 and iodine-129 results for two wells. Swapped samples or procedural deviations at the laboratory may have caused other discrepancies.

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 relative percent differences 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% criterion applies only to those results that are quantifiable at both laboratories.

During the 4th quarter of 2000, thirteen pairs of split samples were collected from 100 K Area wells. Severn Trent-Richland and ThermoRetec analyzed the samples for tritium. Five of the samples contained concentrations that were quantifiable at both laboratories, and the relative percent differences for all of these pairs were less than 20%. Thus, the laboratories showed excellent agreement overall for tritium.

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 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 for each set of quadruplicate results. Each quadruplicate set having a relative standard deviation greater than 20% and at least one result greater than 5 times the method detection limit was considered to have poor precision. For the 4th quarter, 3 out of 79 total organic carbon quadruplicates and 2 out of 79 total organic halide quadruplicates failed to meet the evaluation criteria. In all cases, the out-of-limit quadruplicates contained one anomalously high result. Removing the outliers drops the relative standard deviations to less than 20% in all but one case. That single result was significantly higher than all other total organic carbon results for the quarter; it is believed the high values resulted from swapped samples at the laboratory. These results, along with a suspect total organic halide result, have been flagged with a Y in the database to indicate that the data may be invalid.

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 1,231 results were produced from the 4th quarter field blank samples. Only 2% of the results (i.e., 28 results) exceeded the QC limits for field blanks. This represents a slight improvement over 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, cyanide, nitrate, total dissolved solids, total organic carbon, and tritium. The potential impacts on the data are minor in most cases. Chloride, nitrate, sodium, and total dissolved solids had field blank results that were greater than the QC limits, but the values were significantly lower than the concentrations of these constituents in almost all 4th quarter groundwater samples. Some additional observations about the field blanks are noted below.

Approximately 40% of the out-of-limit field blank results were for volatile organic compounds. Relatively high concentrations of carbon tetrachloride (29 µg/L) and chloroform (5.1 µg/L) were measured in a single field blank collected on December 4th. One out of three groundwater samples associated with this blank had concentrations of carbon tetrachloride and chloroform that were less than or within a factor of 3 of the blank results. The sample meeting these criteria was from well 299-W23-2, and the sample's results for both compounds were less than 1 µg/L. Thus, the cause of the elevated blank results did not appear to adversely affect the results for the associated samples. Concentrations of trichloroethene and *cis*-1,2-dichloroethylene exceeded the QC limits in one field blank each by factors of approximately 2 and 5, respectively. Both compounds have been detected infrequently in field blank samples in the past. Methylene chloride was detected in 8 field blanks at concentrations ranging from 2.6 to 11 µg/L. Slightly lower concentrations of this compound were also detected in laboratory method blanks. Laboratory contamination is the suspected source of methylene chloride.

A relatively high tritium result of 156 pCi/L was obtained for a full-trip blank collected in November. Tritium may have been present in the source water used to prepare the blank. However, a similar tritium result of 152 µg/L was obtained for the groundwater sample associated with the blank. Consequently, the groundwater sample result for well 1199-39-16D has been flagged with Q in the database.

Two out of 17 field blank results for total organic carbon exceeded the QC limits. Because of the importance of total organic carbon as an indicator parameter for detection monitoring, the results are of concern. However, the relative number of out-of-limit results is lower than the first 2 quarters of 2000, in which approximately 1/3 to1/2 of the blanks analyzed for total organic carbon were out of limits. None of the 3rd quarter results was greater than 2 times the method detection limit. It is hoped that the use of a new deionized water system for blank preparation (see below) will reduce the number of out-of-limit field blank results for total organic carbon in the future.

A new deionized water system was installed for the samplers in December. Accordingly, an equipment blank was collected from the system before the system was used as a source of water for field-blank samples. The equipment blank was analyzed for anions, metals, specific conductance, total dissolved solids, and total organic carbon. The latter three constituents and iron were detected in the equipment blank, but total dissolved solids and total organic carbon were the only constituents that had results greater than 2 times the method detection limit. No additional field blanks with water from the new system were collected during the 4th quarter, but further data on system performance will be available during the first quarter of 2001.

Laboratory QC Data

Blind Standards. Double-blind standards containing known amounts of selected anions, organic compounds, and radionuclides were prepared and submitted to Severn Trent in November. Duplicates of the total organic carbon, total organic halides, gross alpha, and gross beta standards were submitted to Recra/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 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 specific radionuclides, which have a ± 30% acceptance range. The majority of the 4th quarter results were acceptable, indicating good analytical performance overall. However, Severn Trent had low, out-of-limit recoveries for cyanide and total organic halides. Recra also had unacceptable results for total organic halides. Finally, some of ThermoRetec's results for gross alpha were biased low. All of the out-of-limit results are briefly discussed below.

Both STL-St. Louis and Recra had problems with the total organic halides standards. All four of their recoveries were less than 75% for the standards spiked with volatile organic compounds. Since the lab'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. This is a recurring problem that appears to be somewhat inherent with the method when volatile organic halides are analyzed. In contrast to STL St. Louis, all of Recra's total organic halide results were approximately 2 times higher than the presumed spiking level. This is the third 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. Due to the Recra's repeated problems with this analysis, the Groundwater Monitoring Project is investigating alternative laboratories for use as a backup.

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. Last quarter, the low recovery problem was investigated by having two sets of standards analyzed and comparing the results. 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. The results from this study suggested a problem with the commercial solution, because the gravimetric standards had acceptable results, while the data from the "commercial" standards continued to exhibit a negative bias. For confirmatory purposes, this experiment was repeated during the 4th quarter. Similar results were obtained: acceptable recoveries were associated with the gravimetric standards, while the "commercial" standards produced results that were low by approximately 40%. Although the nature of the problem with the commercially prepared stock solution has not been determined, solution instability is suspected. Future cyanide standards will be prepared gravimetrically to help ensure the standards are reliable.

Two of ThermoRetec's gross alpha recoveries were less than 75%. The lab performed reanalyses on the samples with the out-of-limit results, but the reanalysis results were consistent with the original values. Since STL Richland's results on supposedly identical samples were acceptable, the problem does not appear to be with the standards. ThermoRetec did not analyze any 4th quarter groundwater samples for gross alpha, so the blind-standard results have no impact on the interpretation of groundwater monitoring data. Additional blind standards for gross alpha were sent to ThermoRetec in February; the results from these samples will be used to determine if any investigative or remedial actions are required.

EPA Water Supply/Water Pollution Programs. Severn Trent-St. Louis (STL-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) and Environmental Resources Associates, 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. Regression equations are used to determine acceptance and warning limits for the study participants. The results of these studies, expressed in this report as a percentage of the results that the performance evaluation provider found acceptable, independently verify the level of laboratory performance.

For the two WP studies received from Recra this quarter, the percentages of acceptable results were 86% and 94%. Of the 39 constituents with unacceptable results, benzene, 1,2-dichlorobenzene, methylene chloride, and 1,1,2,2-tetrachloroethane were out of limits more than once; in one case these were all biased high, in the other case, they were all biased low. The problem with these compounds and 25 others that were biased high appears to have been caused by using an ampoule that had previously been opened for another analysis. In the future, Recra will request separate ampoules when dual analyses are to be performed. Cyanide results have been unacceptable in this and previous WS studies; the error appears to be caused by lack of pH control which is now being corrected. Corrective action has also been taken for persistent unacceptable results for 2,4-D; hydrolysis and derivatization procedures have been modified. Total phosphate was incorrect probably because of poorly controlled pH adjustment. BOD results were corrected during reanalysis. No explanations were given for the other four volatiles and one pesticide with unacceptable results. The laboratory believes that there is an ongoing problem with the sample provided for total suspended solids analysis and does not believe that corrective action on their part is necessary; they propose using other sources for the samples.

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, is a replacement for the EPA's National Exposure Research Laboratory performance evaluation studies. Control limits are based on the National Standards for Water Proficiency Testing Studies Criteria Document, December 1998.

The results from five RadCheM PE studies were received from STL-Richland this quarter. Cesium-134 was analyzed twice and was unacceptable in both studies; gross beta was unacceptable in one of two studies in which it was analyzed. The following were analyzed with acceptable results: barium-133, cesium-137, cobalt-60, gross alpha, iodine-131, radium-226, radium-228, strontium-89, strontium-90, uranium (natural), and zinc-65. 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. New results were not available this quarter.

Laboratory QC Data from Severn Trent. 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 method detection limit or instrument detection limit for chemical constituents and two 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 five times the method detection limit. Results for laboratory control samples, matrix spikes, and surrogates are evaluated by comparing the actual percentages recovered with minimum and maximum control limits. For matrix duplicates, only those samples with values five times greater than the method detection limit or total propagated error are considered. Quantifiable matrix duplicates are evaluated by comparing the relative percent difference with an acceptable maximum for each constituent.

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

Most of the fourth quarter laboratory QC results were within acceptance limits, suggesting that the analyses were in control and reliable data were generated. Some of the more significant findings from the laboratory QC data include the following:

- Several method blank results exceeded the QC limits for conductivity, chloride, fluoride, sulfate, and methylene chloride.
- For most of the constituents with method blanks that were significantly out of limits, (i.e., fluoride, sulfate, magnesium, and sodium), a number of Hanford groundwater sample results were less than five times the blank values.
- Phenol and 4-nitrophenol had laboratory control sample results that were significantly out of limits.
- The percentages of matrix spikes and matrix spike duplicates that were out of limits were relatively high for ammonia and anions and for radiochemistry parameters; however, these numbers are similar to last quarter's results.
- Matrix spike duplicates were significantly out of limits for several anions, mainly nitrogen in nitrate and sulfate, and for several radiochemistry parameters, mainly technetium-99 and uranium. Again, this is similar to last quarter's results.

Laboratory QC Data from ThermoRetec and Recra. Fourth quarter QC data from ThermoRetec are limited to gross alpha and gross beta. All the QC data were within limits. Fourth quarter QC data from Recra are limited to total organic carbon and total organic halides. All the associated laboratory QC data except the matrix spike for total organic halides were within limits.

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

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