QUARTERLY RESOURCE CONSERVATION AND RECOVERY ACT GROUNDWATER MONITORING DATA FOR THE PERIOD APRIL THROUGH JUNE 2002.

Sixteen *Resource Conservation and Recovery Act of 1976* (RCRA) sites (a site is either a Treatment, Storage, and/or Disposal unit or a waste management area associated with a Treatment, Storage, and/or Disposal unit) were sampled during the reporting quarter, as listed in Table 1. Sampled sites include eight monitored under groundwater indicator evaluation programs [40 CFR 265.93(b)], seven monitored under groundwater quality assessment programs [40 CFR 265.93(d)], and one monitored under final-status groundwater corrective action programs [WAC 173-303-645(11)].

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 sites had an exceedance in a downgradient well during the quarter, but none of these appears to indicate dangerous waste contamination from the RCRA units, as explained below. Alternative statistical comparisons, as allowed by 40 CFR 265.90(f), were made for 216-B-3 Pond.

216-A-29 Ditch: Average specific conductance in downgradient wells 299-E25-35 and 299-E25-48 continued to exceed the critical mean of 270.8 μS/cm. The exceedance is caused by elevated levels of the nondangerous constituents sulfate, calcium, and sodium, and was reported earlier; this requires no additional action because the increase was not accompanied by dangerous waste constituents.

Low-Level Waste Management Area 1: Average specific conductance in downgradient wells 299-E33-34 and 299-E32-10 continued to exceed the critical mean value of 590.4 μS/cm. The exceedance is caused by elevated nitrate from upgradient sources and was reported previously; this requires no additional action.

Low-Level Waste Management Area 2: Indicator parameter values from downgradient wells did not exceed their critical mean values. However, TOC, TOX, and specific conductance continued to exceed the critical mean values in upgradient well 299-E34-7. This is a continuation of exceedances reported previously. Evaluation of the source of elevated TOC and TOX is ongoing.

Single-Shell Tanks Waste Management Area A-AX: In June, average pH from downgradient well 299-E25-46 was below the lower limit of the critical range (6.81, 9.67). The reported values did not match the historical trend in the well. Verification sampling conducted in July indicated that the June measurements were erroneous.

Single-Shell Tanks Waste Management Area C: The current direction of groundwater flow beneath this WMA is toward the southwest, as stated in a recent interim change notice. Well 299-E27-7 is now the only upgradient well, and specific conductance is rising sharply. A critical mean for specific conductance cannot be calculated using data from this well until four quarters of stable data are available. Consequently, no upgradient/downgradient comparisons will be made until these four quarters of data are obtained and specific conductance stabilizes in well 299-E27-7, or a new upgradient well is installed.

216-B-3 Pond: This quarter was the second sampling event after the implementation of alternative statistical methods. Statistical comparisons were performed for the three site-specific parameters that DOE and Ecology agreed upon: gross alpha, gross beta, and specific conductance. The comparisons used various control limits that range from the mean concentration plus 2 standard deviations, to the mean concentration plus 4.5 standard deviations. All measured values were below the lowest Shewhart control limit. The cumulative sum (CUSUM) for specific conductance and gross beta from downgradient well 699-43-45 were slightly above the mean + 2s control (see Figures 1 and 2). Exceedance of the lowest CUSUM control limit for specific conductance is due to gradual increases evident in Figure 1. Exceedance of the lowest gross beta CUSUM limit this quarter was due to a higher result of 8.61 pCi/L that was obtained in January 2002 and reported last quarter. The CUSUM excursion for gross beta this quarter simply reflects a time-lag due to the different nature of these two control charts. That is, the Shewhart control chart is designed to detect an abrupt change earlier than the CUSUM chart. This quarter the concentration of gross beta in well 699-43-45 dropped to 7.7 pCi/L (see Figure 2).

The last of the minimum-required 8 representative observations were obtained to establish baseline values for gross alpha and gross beta for well 699-43-44 this quarter. Baseline summary statistics and various control limits were calculated. The number of observations is insufficient to establish baseline values for specific conductance because the first two samples (collected on in September 1999) were obtained during well development and are not considered representative of groundwater conditions.

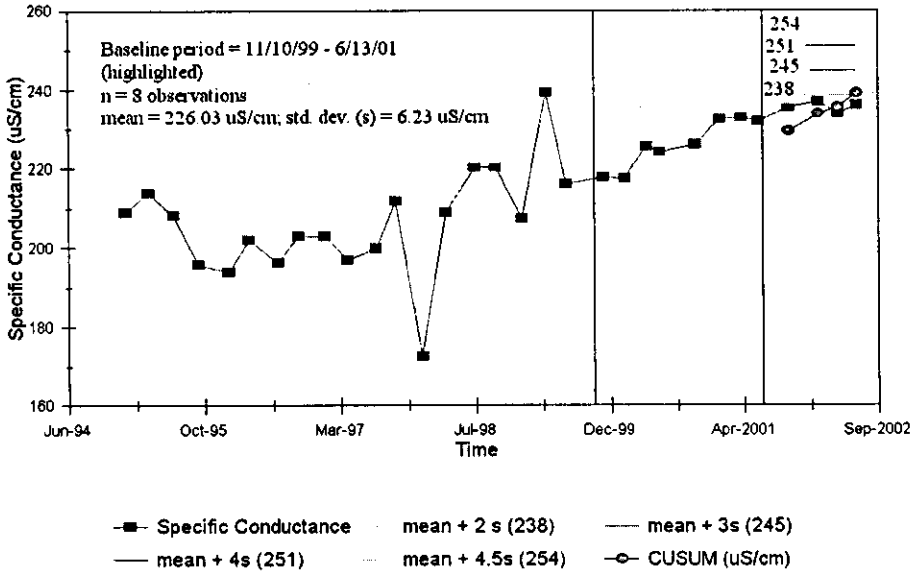


Figure 1. Shewhart-CUSUM Control Chart for Specific Conductance in Well 699-43-45

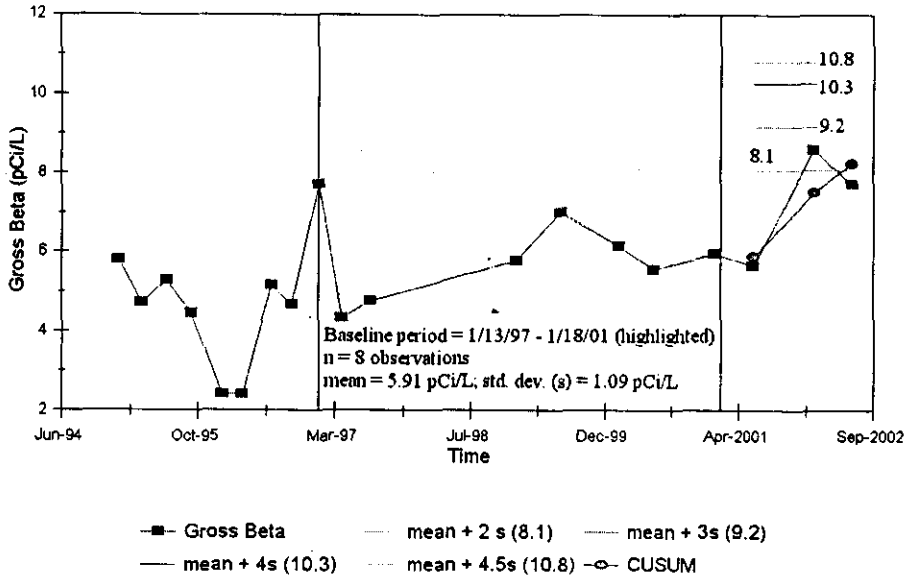


Figure 2. Shewhart-CUSUM Control Chart for Gross Beta in Well 699-43-45

Wells Not Sampled

A number of wells that were scheduled to be sampled for RCRA during the reporting period were not sampled. Some of these wells were collected the next quarter; other wells were dry. Table 2 lists the wells that were not sampled as scheduled, and the reason why.

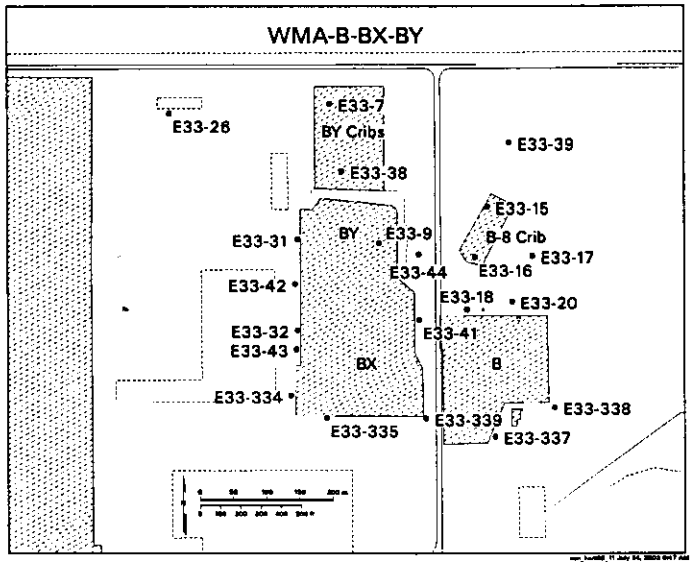
Table 2. Wells Not Sampled as Scheduled During April-June 2002.

Well	RCRA Site	Date Attempted	Date Sampled	Reason delayed or not sampled
299-E17-1	PUREX	4/3/02	7/12/02	Pump problem.
299-E17-9	PUREX	4/3/02	--	Pump intake above water level.
299-E25-17	PUREX	4/3/02	7/15/02	Broken pipe.
299-E28-8	WMA B-BX-BY	6/6/02	7/12/02	Circuit breaker tripped; unable to restart pump.
299-E34-11	LLBG WMA 2	4/8/02	--	Dry.
299-W10-17	WMA TX-TY	5/9/02	--	Dry.
299-W11-30	WMA T	5/7/02	--	Dry.
299-W19-44	WMA U	5/14/02	8/22/02	Pump problem. Not fixed in time to make up May sample. Collected August sample as scheduled.

Status of Assessment Programs

This section describes the seven RCRA sites currently monitored under groundwater quality assessment. Discussions of waste constituents not regulated under RCRA (e.g., radionuclides) are included where the information may provide further insight regarding the source and migration of dangerous waste constituents in groundwater.

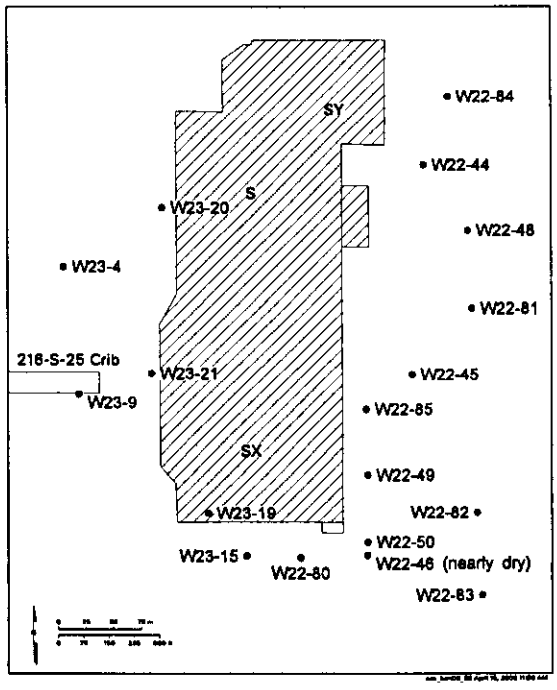
Single-Shell Tanks Waste Management Area B-BX-BY: There was no apparent change in the direction or rate of groundwater flow this quarter. Based on in situ measurements, the groundwater is flowing slowly to the southwest in the north half of the waste management area. In the southern half, it flows towards the south-southeast to southeast with a faster flow rate.



Cyanide levels, found with elevated nitrate under the BY Tank Farm and to the north under the BY cribs, have sharply decreased.

Nitrate concentrations have continued to decline across the waste management area except in the southwest corner and along the southern boundary. The highest values remain under the BY Cribs (540 mg/L) and the B-8 Crib (567 mg/L) while the lowest value is in the southeast corner of the waste management area (8.4 mg/L). While the contamination levels were increasing, it appeared that the source of this nitrate contamination was the original BY Cribs plume migrating into the area from the north. Since that time nitrate and other contaminants have been decreasing steadily with a few exceptions. The groundwater data across the waste management area is currently being reevaluated with respect to surface water drivers and waste sources in the vadose zone.

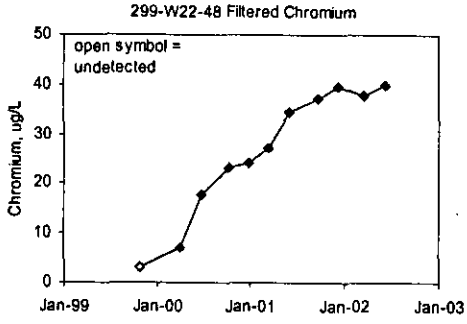
Nitrate concentrations continued to rise in the southwest corner of the site in wells 299-E33-32, 299-E33-43, 299-E33-21, 299-E33-334, and 299-E33-335, but values are still below 30 mg/L. These recent nitrate trends track with the increases in concentrations of the non-RCRA constituent tritium. The tritium plume is centered on wells 299-E33-334 and 299-E33-43, reported at 17,900 pCi/L and 17,100 pCi/L in May 2002. The exponential rise in tritium concentrations in these wells indicates that tritium and associated contaminants entered the groundwater relatively close to these wells. Tritium may be migrating into the groundwater from a zone of perched water, observed in a tank farm borehole 5 to 6 meters above the water table. Tritium concentrations were ~75,000 pCi/L in the perched water in this borehole.

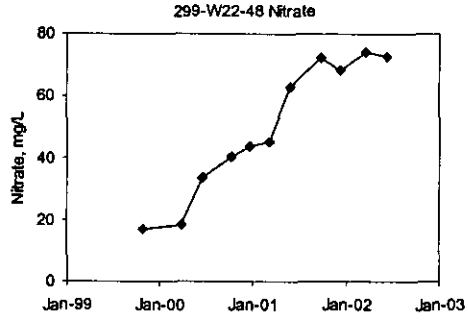


The concentration of nitrite rose slightly in well 299-E33-44 in the central part of the waste management area, from 690 μg/L in February to 887 μg/L in May 2002. Nitrite is not usually found in the groundwater, probably because it is oxidized to nitrate before it can be detected. The presence of nitrite might suggest a recent release from the waste management area.

Single-Shell Tanks Waste Management Area S-SX: Groundwater beneath this waste management area is contaminated with hexavalent chromium attributed to two general source areas within the waste management area. All analytical results from groundwater samples collected in June 2002 were on trend except those from well 299-W23-19, located in the southwest corner of the WMA. The water table has continued to decline but water levels in all of the monitoring wells in the network have dropped equally so the gradient is stable and the interpreted flow direction is still eastward.

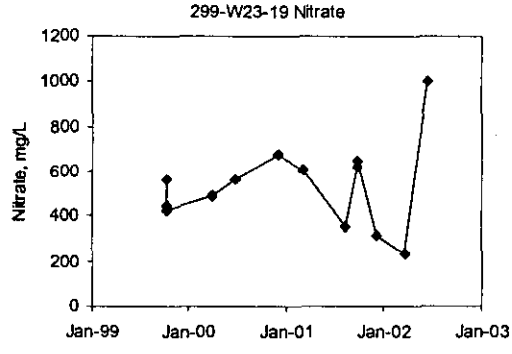
The northern plume with an apparent source in S Tank Farm has migrated eastward beyond well 299-W22-48, where chromium and nitrate concentrations have leveled off at about 40 μg/L and 73 mg/L, respectively.





The chromium contaminant plume is limited to between well 299-W22-44 on the north and 299-W22-81 on the south. Chromium concentrations have been below or near the detection limit in both of these bounding wells and nitrate concentrations in these have been lower than the levels in well 299-W22-48, although the trends are similar in wells 299-W22-44 and 299-W22-48. These observations indicate that the plume center line may be between wells 299-W22-48 and 299-W22-44.

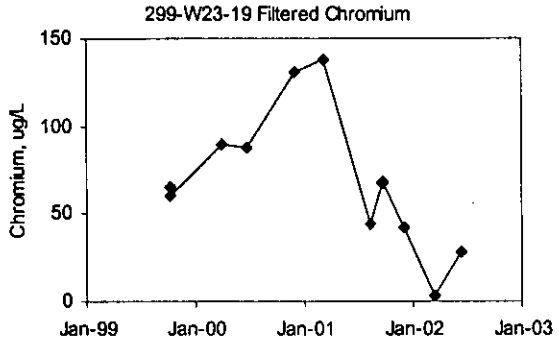
The contaminant plume located beneath the southern portion of the waste management area continues to spread slowly downgradient. This plume is comprised of chromium and the non-dangerous constituent nitrate, just as the S Tank Farm plume to the north. The shape and extent of the plume have changed little during the quarter, but nitrate concentrations rose sharply in well 299-W23-19. The nitrate concentration rose from its lowest in March 2002 to its highest in June 2002.

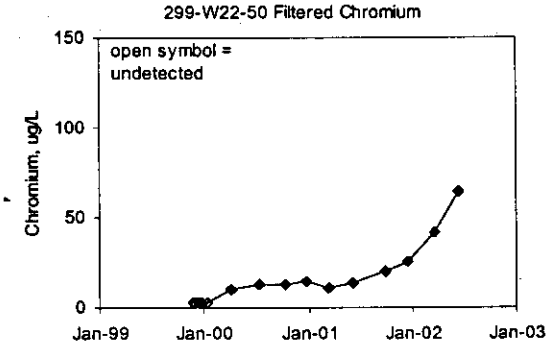


Almost identical trends have been observed for calcium, magnesium, chloride, and elemental strontium. There are no known changes in tank farm operations or water releases to account for these changes and the large fluctuations in concentrations. Multiple constituents with different analytical methods produced similar trends, so analytical causes can be eliminated. Possible causes are variations in the plume or in sampling technique. The well was constructed inside the tank farm and a portable submersible pump has been used to sample the well since routine sampling began in early 2000. The pump is lowered into the well for each sampling event, potentially allowing different sampling conditions each time the well is sampled. Plans are underway to reconfigure the wellhead and install a permanent sampling pump to reduce the sampling variables.

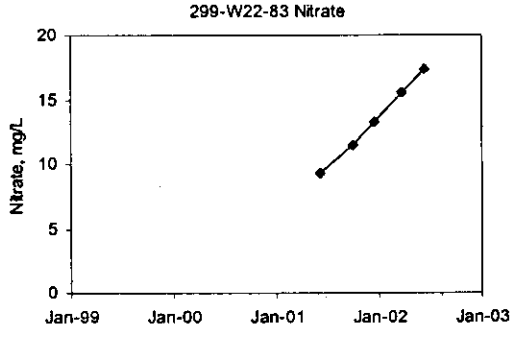
The southern contaminant plume contains chromium, but historical chromium concentrations in well 299-W23-19 do not follow the same trend as for nitrate or the other constituents discussed previously. It

appears that after March 2001, chromium concentration trends in well 299-W23-19 began to deviate from the trends for nitrate and the other constituents. These data indicate that the chromium may be from a different source than the nitrate. Chromium began to increase in the middle of the plume, as indicated by well 299-W22-50, located downgradient from well 299-W23-19.

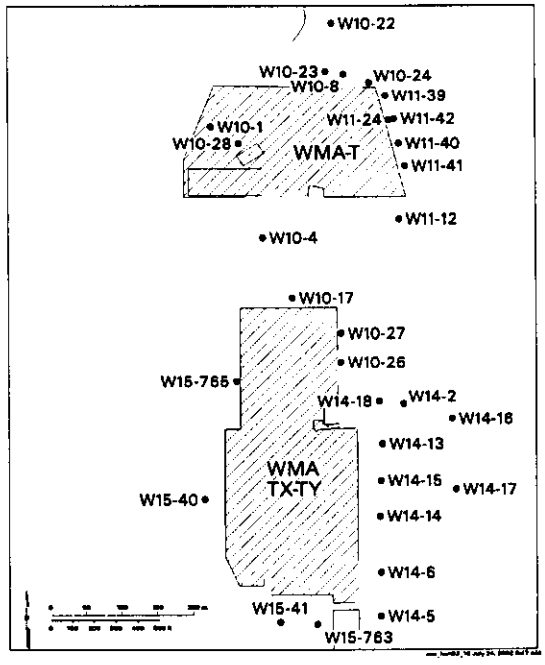




Well 299-W22-83 has been used to delineate the downgradient margin of the SX Tank Farm contaminant plume. Nitrate concentrations in this well continued to increase, and chromium remained at low levels (less than 5 ug/L). The northern margin of the plume continues to be bounded by well 299-W22-49 where nitrate concentrations have been increasing and are at slightly higher levels than in 299-W22-83.



Single-Shell Tanks Waste Management Areas T and TX-TY: Water levels near these waste management areas continued to decline during the reporting period. Well 299-W11-30, located approximately 300 m east of WMA T, and well 299-W10-17, located on the north side of WMA TX-TY, could not be sampled because the drop in water level caused them to become dry.

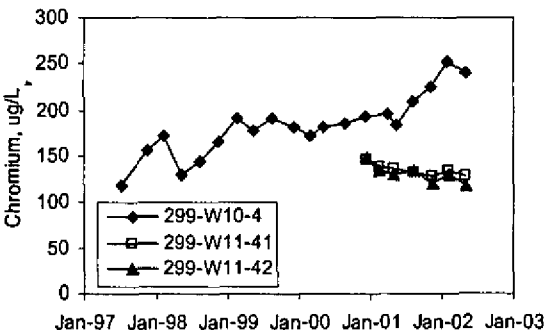


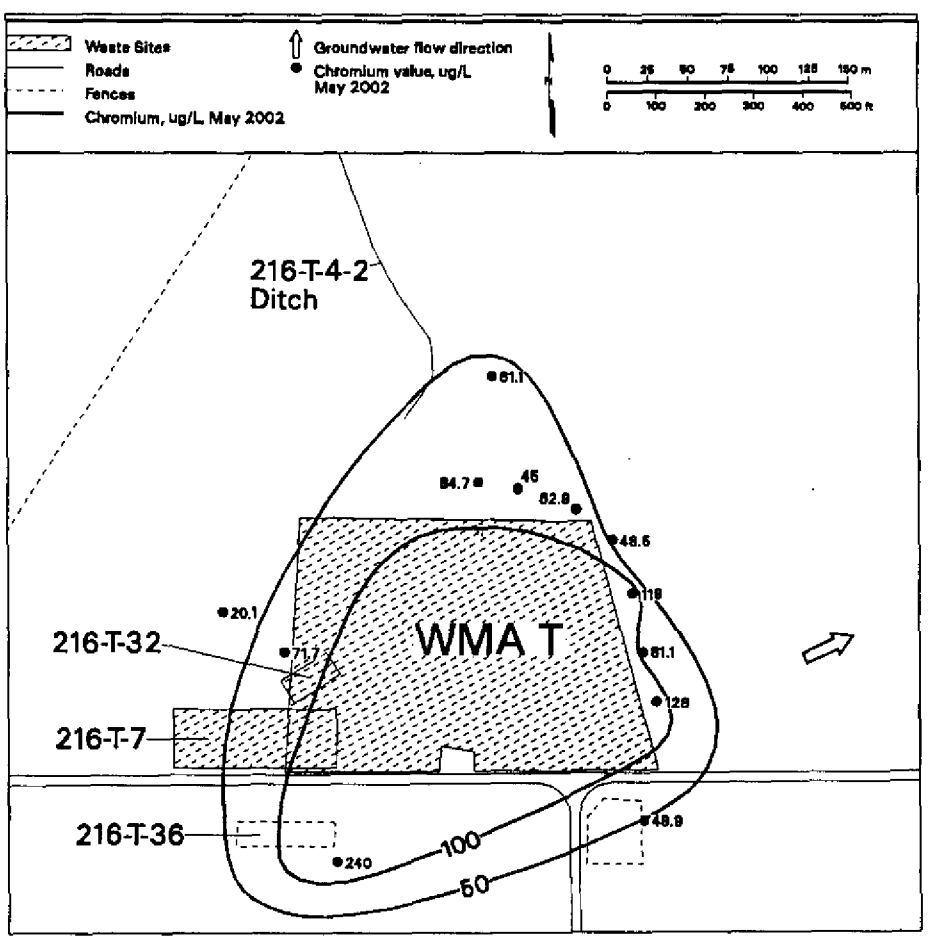
Although the water table has continued to drop, the gradient has changed little; therefore, the rate and direction of groundwater flow has not changed appreciably during the quarter. Groundwater flow at WMA T is approximately 5 to 10 degrees north of east at a rate of about 0.025 meters per day. Groundwater flow in the north part of WMA TX-TY is approximately 20 degrees south of east at a rate of about 0.01 to 0.025 meters per day. In the south part of the WMA where groundwater flow has been altered by the 200-ZP-1 pump-and-treat operations, groundwater flow is to the south or south southwest at about 0.3 meters per day. A groundwater assessment report for WMA T for the period January 1998 through December 2001 was issued during the quarter (Horton et al., 2002).

Waste Management Area T

Chromium is the only dangerous waste constituent found in the groundwater beneath WMA T. The chromium concentration exceeded the maximum contaminant level (100 µg/L) in three wells (see map below). The highest chromium concentration was in well 299-W10-4, located upgradient of the WMA. The concentration of chromium in this well was 240 µg/L, just slightly lower than the 252 µg/L in the previous quarter's sample. Well 299-W10-4 is located at the 216-T-36 crib, and the crib is the most likely source for the chromium.

Chromium concentrations above the maximum contaminant level also were found in downgradient wells 299-W11-41 and 299-W11-42. The chromium concentration was 128 µg/L in well 299-W11-41 and 119 µg/L in well 299-W11-42. Chromium concentrations have been decreasing gradually in both wells since they were drilled in 2000. Both wells are located downgradient of well 299-W10-4 and the 216-T-36 crib. The chromium found downgradient of WMA T is most likely from the 216-T-36 crib.





Chromium Distribution at WMA T, May 2002.

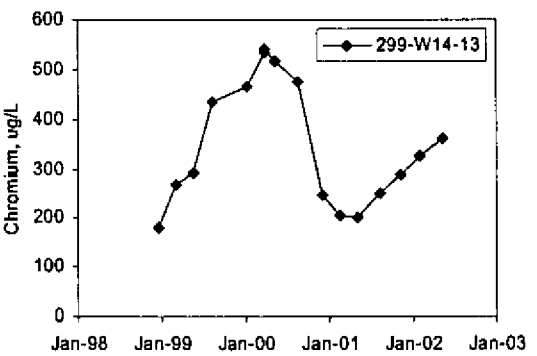
Nitrate is not a regulated, dangerous waste constituent. However, nitrate concentrations remained above the 45 mg/L maximum contaminant level in all wells in the WMA T network. The available information indicates that most nitrate in groundwater at WMA T is part of a regional plume and not from the WMA. The highest reported concentration was in downgradient well 299-W11-40 and was 1,560 mg/L. However, this value is far off trend for nitrate in this well; nitrate was 174 mg/L the previous quarter. A review of the quarter's data shows a large charge imbalance such that the nitrate value is suspect. The second highest nitrate concentration was in upgradient well 299-W10-28 and was 1,350 mg/L. This value is on trend and the analysis appears valid. During the previous quarter, nitrate concentration in upgradient well 299-W10-4 was over 1,500 m g/L. However, the concentration reported from the May sampling event is anomalously low and there is a poor charge balance for the sample.

Nitrate concentrations in all monitoring wells except 299-W11-40 on the downgradient (east) side of WMA T were between 50 mg/L (well 299-W11-39) and 611 mg/L (well 299-W11-42). Nitrate concentrations are increasing slightly in well 299-W11-41 and 299-W11-42 but remained fairly level in the other downgradient wells.

Waste Management Area TX-TY

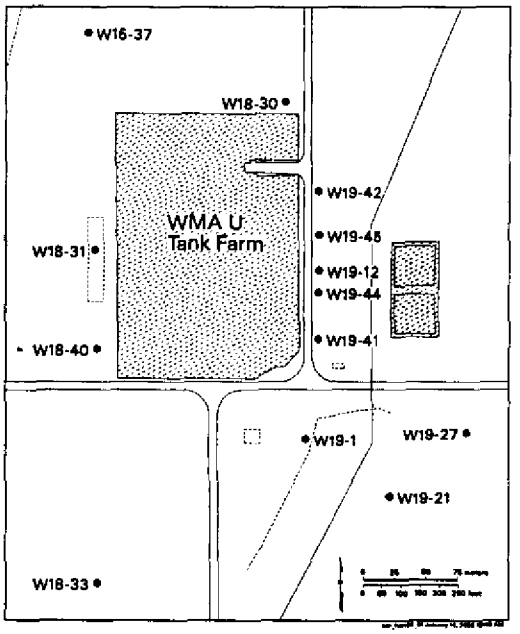
Chromium is the only dangerous-waste constituent that has been detected in groundwater beneath WMA TX-TY and may be from a source within the WMA. Chromium exceeded the maximum contaminant level of 100 µg/L in one well at WMA TX-TY, 299-W14-13. The chromium concentration in that well was 360 µg/L during the reporting quarter, up from 326 µg/L the previous quarter. The chromium concentration has been above the maximum contaminant level since the well was first sampled in December 1998 and the concentration has been increasing since May 2001.

Although not a RCRA-regulated constituent, the distribution of technetium-99 may have some bearing on the source for the dangerous-waste constituent chromium. Technetium-99 has been shown to have high concentrations near the top of the aquifer at well 299-W14-13 and the concentration decreases with depth. Chromium has been shown to have low concentrations at the top of the aquifer and the chromium concentration increases with depth. This suggests two sources for the two constituents. Depth discrete sampling is planned for well 299-W14-13 to learn more about the vertical distribution of chromium in the aquifer at that location.



Nitrate is not a regulated dangerous waste constituent. However, nitrate exceeded the 45 mg/L maximum contaminant level in all wells in the WMA TX-TY monitoring network except 299-W15-763, located south of the WMA. The nitrate plume at WMA TX-TY is attributed to past disposal practices at facilities associated with the Plutonium Finishing Plant and T Plant. The highest nitrate concentration was found in well 299-W14-13 in the central part of the east side of the WMA. The nitrate concentration in this well was 362 mg/L in May 2002, down slightly from 390 mg/L the previous quarter.

Single-Shell Tanks Waste Management Area U. This waste management area, which has been in assessment monitoring since 1999, has affected groundwater quality with elevated concentrations of chromium and the non-dangerous constituent nitrate. The impact has been limited to the southern half of the downgradient (east) side of the WMA.

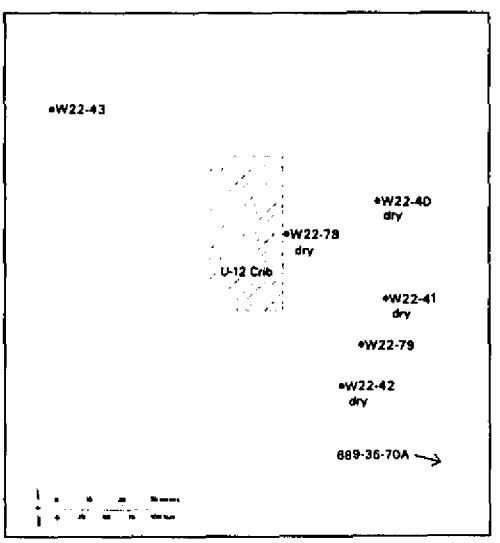


The water table elevation has continued to decline but the gradient is relatively stable and the interpreted flow direction is eastward. Water levels from well 299-W18-40, an upgradient well installed last year, are approximately the same elevation as the downgradient wells or about 10 inches lower than expected. In reviewing the survey data for the well, it was noted that the casing length above the brass marker is about 10 inches shorter than other typical new well completions. These measurements will be checked in October and the well will be re-surveyed and water levels will be corrected if errors are discovered.

All analytical results from groundwater samples collected in May 2002 were on trend. Chromium concentrations exceeded background levels during the quarter only in downgradient well 299-W19-41. The area where chromium has impacted the groundwater is represented by this single well where concentrations have decreased from a high of 38 μg/L in 1999 to the current low of 17 μg/L during the reporting quarter. The current chromium concentration is about twice the level of upgradient wells.

Nitrate concentrations have increased over the past several years, though concentrations are below the maximum contaminant level. Accompanying nitrate are elevated concentrations of calcium, magnesium, strontium, barium, chloride, and sulfate. The greatest increases of these constituents used to delineate the area affected by the WMA have shifted north from well 299-W19-41 to well 299-W19-12. Technetium-99, a non-dangerous waste tank constituent used to help track migration of the plume, has steadily increased in well 299-W19-12, but has fluctuated and even dropped in well 299-W19-41, indicating that the plume's migration pathway may have moved slightly north over that past year.

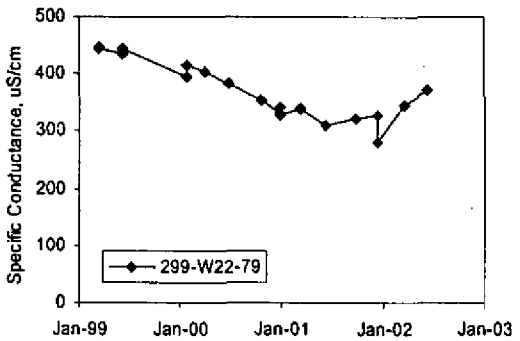
216-U-12 Crib: The current groundwater assessment monitoring network for the 216-U-12 Crib consists of only two downgradient wells (299-W22-79 and 699-36-70A). Both wells were sampled in June 2002. Concentrations for most site-specific contaminants increased slightly during the past quarter, but are expected to continue to decline overall.

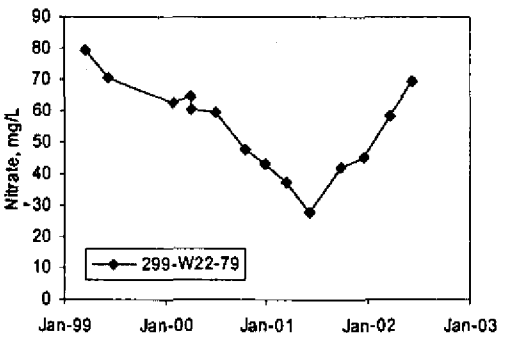


The groundwater flow direction beneath the crib is relatively unchanged, toward the east-southeast, and the two wells still effectively monitor releases from the 216-U-12 Crib.

Specific conductance in downgradient well 299-W22-79 has now increased four quarters in a row, including the June sampling event. The new value was 370 μS/cm. The nitrate concentration (sourced at the 216-U-12 Crib) in well 299-W22-79 increased to

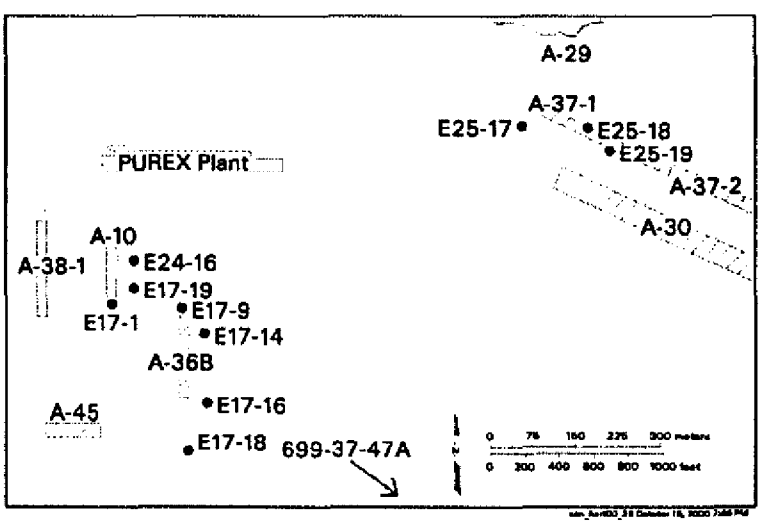
69.5 mg/L, a rise of 11.1 mg/L from last quarter, and remained above the 45 mg/L maximum contaminant level. These increases in specific conductance and nitrate signify a potential increase in vadose flux drainage beneath the 216-U-12 Crib. There is currently no upgradient well available to determine if an upgradient source may be responsible for the increasing nitrate.



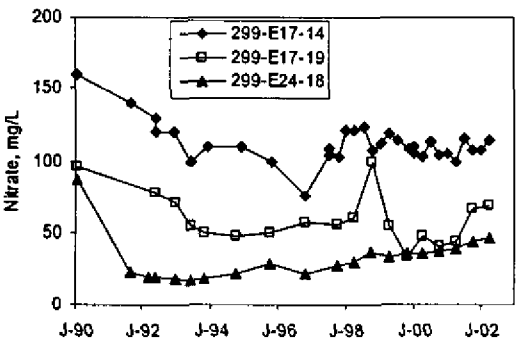


Specific conductance in downgradient well 699-36-70A increased very slightly to 537 µS/cm in June, but is expected to resume its overall decline. The nitrate concentration in that well also increased slightly from 76.7 to 83.3 mg/L and remained above the maximum contaminant level.

PUREX Cribs (216-A-10, 216-A-36B, and 216-A-37-1): Seven of the 11 near-field network wells were sampled in April 2002. The other three wells (299-E17-1, 299-E17-9, and 299-E25-17) could not be sampled because of declining water levels. Well 299-E17-1 may have enough water to sample in October 2002. The other two wells are nearly dry, and replacements wells have been selected. If they cannot be sampled in October, the replacement wells will be used. The replacement for well 299-E17-9 is 299-E17-16, and the replacement for 299-E25-17 is 299-E25-18.



Beneath the PUREX Cribs, the differences in water table elevations from well to well are very small (less than half a meter). Therefore, the water table gradient is too low to determine groundwater flow direction and flow rate reliably from water table maps. However, groundwater flow directions determined from the movement of groundwater contamination plumes indicate that the regional flow is toward the southeast.



Nitrate exceeded the maximum contaminant level at three of the near-field network wells sampled during the reporting period. At well 299-E17-14 the result was 114 mg/L, which is part of a relatively stable trend at this well since 1998. At

well 299-E17-19 the result was 67.7 mg/L, which is part of a general increasing trend. At well 299-E24-18 (upgradient) the result was 46 mg/L, which is also part of an increasing trend.

The drinking water standard for pH (8.5) was exceeded at well 299-E25-31 (an upgradient well to the northeast) during the reporting period. The result was 8.56 and is part of a slight increase since 1997.

Quality Control

Highlights of the Groundwater Monitoring Project's quality control program for April-June 2002 are listed in Table 3. Details and data that are not available in the Hanford Environmental Information System are available upon request. The quality control program indicated that the data were acceptable for use in the statistical comparisons discussed above.

Table 3. Quality Control Highlights, April-June 2002.

- Sixty-seven results were flagged H due to missed holding times. Anions account for most of the flagged results, and the data impacts should be minor.
- Most of the field duplicate results demonstrated good precision. Thirteen out of 661 pairs of results failed to meet the acceptance criteria. Acetone, chromium, copper, fluoride, gross beta, lead, nitrate, technetium-99, uranium-235, and zinc were the constituents with out-of-limit results.
- Most total organic carbon and total organic halide quadruplicates exhibited acceptable precision. One out of 61 TOC quadruplicates and 3 out of 61 TOX quadruplicates exhibited a high degree of variability, but other QC indicators (i.e., matrix duplicates and blind standards) demonstrated satisfactory precision for this method.
- Approximately 5% of the field-blank results exceeded the QC limits. Most of the out-of-limit results were for acetone, chloride, copper, methylene chloride, sulfate, total organic carbon, trichloroethene, and tritium. In general, the field blank results should have little impact on the interpretation of 2nd quarter groundwater data.
- Severn Trent, Lionville Laboratory, and Eberline Services performed well on the analysis of blind standards. All of the results were within the acceptance limits.
- Performance-evaluation study results were available from two InterLaB RadCheM studies, one Water Pollution study, and one Department of Energy Quality Assessment Program this quarter. The majority of the labs' results were within the acceptance limits, indicating good performance overall.
- Most of the laboratory QC results for this quarter were within acceptance limits, suggesting that the analyses were in control and reliable data were generated. Parameters with more than one result that was significantly out of limits include method blanks for chloride, sulfate, copper, acetone, and methylene chloride; laboratory control samples for acetone and vinyl chloride; matrix spikes for carbon tetrachloride, methylene chloride, vinyl chloride, 2,4,5-trichlorophenol, 2,4-dinitrophenol, 2-secbutyl-4,6-dinitrophenol, 4,6-dinitro-2-methylphenol, and pentachlorophenol; and two surrogates.

References

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