

2.3 100-KR-4 Operable Unit

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This section discusses groundwater beneath the 100-KR-4 Operable Unit, which includes the facilities and waste sites within the limited area defined by security fencing, and the adjacent past-practices facilities and waste sites that are associated with former reactor operations. A description of reactor operations and waste sites can be found in WHC-SD-EN-TI-239, which is the primary source for historical information presented below. The operable unit lies within a larger groundwater interest area, as defined by the Groundwater Performance Assessment Project (groundwater project) (Figure 2.1-1). Figure 2.3-1 is a location map showing 100-K Area facilities, waste sites, monitoring wells, and shoreline monitoring sites.

The principal groundwater issues in the operable unit involve (a) groundwater contamination associated with past discharges to the ground near the KE and KW reactor buildings, (b) groundwater contamination associated with past disposal to a large infiltration trench located near the river, and (c) groundwater conditions near fuel storage basins at each reactor building. Emerging issues include unexplained changes in tritium concentrations near the KW condensate crib, the KE Basin, and the 118-K-1 burial ground. Contaminants of concern, or potential concern, being monitored in groundwater include carbon-14, strontium-90, technetium-99, tritium, chromium, nitrate, and trichloroethene. The hexavalent form of chromium has been identified as a contaminant of concern that warrants interim remedial action. This form of chromium, which is fully soluble in water, is recognized as toxic to aquatic organisms in the Columbia River.

Chromium is the contaminant of concern currently being treated by interim remedial action.

Groundwater monitoring in the 100-KR-4 groundwater interest area includes CERCLA and AEA monitoring:

CERCLA Long-Term Monitoring

- *Twenty-seven wells are sampled annually for contaminants of concern and constituents of interest.*
- *Riverbank springs (two locations) and aquifer sampling tubes (eight locations) are sampled annually along the 100-K Area river shore.*
- *During fiscal year 2003, all wells were sampled as scheduled, though one of the two riverbank spring sites scheduled was not flowing.*

CERCLA Interim Remedial Action Performance Evaluation

- *Four compliance wells are sampled monthly for hexavalent chromium.*
- *Seven performance wells are sampled quarterly to track changes in chromium and co-contaminant concentrations.*
- *Treatment system influent and effluent chromium concentrations are sampled quarterly.*
- *During fiscal year 2003, all wells were sampled as scheduled except for a monthly event missed for three wells because of equipment problems.*

AEA Monitoring

- *Four wells are sampled quarterly to detect shielding water loss to the ground from the KW and KE Basins.*
- *Seven wells are sampled quarterly to monitor plumes created by past leakage from the KE Basin.*
- *Riverbank springs (one location) and aquifer tubes (four locations) are sampled annually.*
- *In fiscal year 2003, all wells were sampled as scheduled.*

Groundwater flow is generally to the northwest, toward the Columbia River.

Groundwater flow beneath the 100-K Area is generally to the northwest, with discharge to the Columbia River occurring through the riverbed sediment, and to a limited degree, as riverbank springs (see Figure 2.3-1 for water-table elevation contours; flow direction is generally perpendicular to contours). The average rate of flow toward the river is in the range 0.1 to 0.3 meter per day. The best-supported estimate for movement between the KE Reactor and the river is based on the migration of a plume created by a leak from the KE Basin in 1993 (0.12 meter per day), which suggests a 10- to 12-year travel time for contaminants that do not sorb to sediment, such as tritium, to travel from the vicinity of the KE Reactor to the river (PNNL-14031).

For most of the operable unit, the current movement of contaminant plumes is controlled by the flow of groundwater under natural conditions, i.e., there are no effluent disposal operations that alter gradients. The exception is the region to the northeast of the KE Reactor where the pump-and-treat system is operating. Here, treated effluent is injected back into the aquifer. A mound has formed on the water table, and a radial flow pattern has developed around the injection sites (DOE/RL-2003-09).

Near the Columbia River, groundwater is influenced by fluctuations in river discharge, which is controlled by releases from Priest Rapids Dam. The pattern of movement and the rate at which groundwater discharges to the river are affected by these fluctuations. Because river water infiltrates the banks during periods of high river discharge, contaminants carried by groundwater may become diluted prior to release to the river via riverbank springs and through riverbed sediment.

During 2003, remedial actions at the 100-K Area involved removal of contaminated facilities and soil associated with past operations; operation of a pump-and-treat system to reduce a chromium plume beneath the infiltration trench; and removal/re-packaging of irradiated fuel stored in basins at each reactor building.

Groundwater monitoring in the 100-K Area is conducted under two regulatory drivers: *Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)* (100-KR-4 Operable Unit) and *Atomic Energy Act of 1954 (AEA)* requirements (K Basins). CERCLA requirements are further subdivided into monitoring conducted to (a) characterize and track all contaminants of concern in the operable unit, and (b) evaluate the performance of the pump-and-treat system that removes the chromium from groundwater contaminated by effluents associated with the 116-K-2 trench.

During fiscal year 2003, all sampling and analysis activities were completed as described in published monitoring plans. Exceptions include the loss of one monitoring well (199-K-33) because of remedial action excavation activity; the addition of several wells to the pump-and-treat system; and minor changes to scheduling dates and analysis suites in response to new information that became available during the year.

2.3.1 Groundwater Contaminants

Of the various contaminants found in groundwater at the 100-KR-4 Operable Unit, only hexavalent chromium has been identified as a contaminant of concern that warrants interim remedial action (ROD 1996a). Additional contaminants of potential concern are present, but decisions on whether to pursue active remediation of these plumes, or to rely on natural attenuation processes, have yet to be made.

2.3.1.1 Chromium

Chromium was used in large quantities at each of the single-pass production reactor areas during the years of operation (1955 through 1971 for KE and KW Reactors). The hexavalent form of chromium is fully soluble in water and is toxic to aquatic organisms and humans. The relevant Washington State standards are: 10 µg/L for aquatic organisms (measured as hexavalent chromium) and 100 µg/L (measured as total chromium) for drinking water supplies.

The distribution of chromium in groundwater beneath the 100-K Area during 2003 is shown in Figure 2.3-2. The contour patterns reflect the various source locations and the direction of plume migration inferred from water-table elevations.

Chromium Beneath 116-K-2 Trench. The largest area of chromium contamination is associated with the 116-K-2 trench, which received significant volumes of reactor coolant. The interpretation shown in Figure 2.3-2 assumes that chromium detected in well 699-78-62, which is east of the 100-K Area (Figure 2.3-1), was pushed inland by radial flow around a mound beneath the 116-K-2 trench during the operating years. If this assumption is incorrect, the area of contamination is considerably less. The trench plume is the target of a pump-and-treat system intended to protect aquatic receptors in the Columbia River by extracting and treating groundwater (ROD 1996a), thus reducing the flux of chromium to the river ecosystem and the total amount of chromium in the environment. The system began operating in October 1997 (see Section 2.3.2).

Concentrations in the trench plume are typically $<200 \mu\text{g/L}$ and appear to be decreasing with time or remaining nearly constant, with exceptions at several locations. The decrease is a combined consequence of the pump-and-treat operation and natural attenuation by dispersion. Figure 2.3-3 illustrates typical concentration trends for performance monitoring wells within this plume area.

Exceptions to the decreasing trends occur at wells 199-K-111A and 199-K-18, both located near the southwest edge of the plume where concentrations are increasing (Figure 2.3-4). The cause for these trends is believed to be related to the altered flow pattern in the area as a result of the extraction and injection of groundwater. At the northeast end of the trench, recently installed wells reveal the presence of chromium that reflects past migration of trench effluents away from the trench footprint. Concentrations at new wells 199-K-126 and 199-K-130 show relatively constant or variable trends, though their monitoring record is brief. Older wells near the shoreline opposite the trench show gradually decreasing concentrations, as do aquifer sampling tubes along the shoreline downstream from the trench (PNNL-14444).

Chromium Near KE and KW Reactors. Two additional areas contain elevated concentrations of chromium, although the extent of each is poorly defined. Near KE Reactor, a plume extends from the southeast side of the water treatment plant basins, where contaminated soil in the vicinity of a former sodium dichromate storage tank and railcar transfer station is the likely source. Periodic events appear to remobilize chromium and create concentration changes in groundwater, as seen at well 199-K-36 (Figure 2.3-5). Leakage of clean water from the water treatment plant basins may provide a driving mechanism. Migration downgradient beyond the KE Reactor does not appear to have occurred.

Near KW Reactor, elevated chromium concentrations are present at several wells, with the suspected source being sodium dichromate in the vadose zone at unknown locations. Candidate locations include the storage tank and transfer station at the southeast side of the KW water treatment basins (same as at KE), and also the underground piping associated with the system used to add sodium dichromate to clean coolant makeup water. Figure 2.3-6 shows concentration trends for wells located within this plume. Monitoring near the Columbia River at well 199-K-31, aquifer tube site AT-17, and riverbank spring SK-063 does not show evidence that this plume has reached the river.

2.3.1.2 Tritium

Tritium was common in effluents discharged during reactor operations. However, some of the tritium currently observed in groundwater was introduced after the shutdown of the reactors in 1971. Current sources and potential sources for providing tritium to groundwater include shielding water contained in the KE and KW Basins; the reactor atmosphere condensate cribs and underlying soil column to the east of each reactor building; and possibly materials contained in the 118-K-1 burial ground. Tritium has a radioactive

The largest area of chromium contamination is associated with past disposal to the 116-K-2 trench. Concentrations are decreasing or constant in most wells.

decay half-life of 12.3 years. The drinking water standard for this radionuclide is 20,000 pCi/L, and it is not considered threatening to the river ecosystem.

The distribution of tritium in groundwater beneath the 100-K Area during 2003 is shown in Figure 2.3-7. The contour patterns reflect several past and present source locations, as well as the direction of plume migration inferred from water-table elevations. The highest tritium concentrations are associated with conditions downgradient of the 116-KE-1 and 116-KW-1 cribs at each reactor (both cribs are scheduled for removal during December 2003). Carbon-14, a less mobile constituent than tritium, is a co-contaminant at these waste sites. Because tritium is present in the shielding water of each fuel storage basin, concentrations in groundwater are closely monitored for evidence of shielding water loss to the ground (PNNL-14033). Technetium-99 is another mobile radionuclide contained in shielding water and is used to help differentiate shielding water from other contaminant sources.

Tritium Near KE Reactor. The plume shown in Figure 2.3-7 near KE Reactor has been formed by tritium from leaks to the ground from KE Basin (1976 to 1979 and again in 1993), continued release from the vadose zone beneath the 116-KE-1 crib, and possible releases from the vadose zone beneath the 116-KE-3 drain field. The tritium distribution reflects a coalescing of plumes from these sources and the timing of release from each source. The highest concentrations are immediately downgradient of the 116-KE-1 crib. Recent trends for tritium and carbon-14 at a well near this source are shown in Figure 2.3-8.

Tritium concentration trends in wells most likely to detect shielding water loss from KE Basin are shown in Figure 2.3-9. The recent increases at wells 199-K-27 and 199-K-109A are unexplained, although there is no evidence suggesting current loss of shielding water to the ground. Technetium-99, a second indicator of shielding water, has not been detected at these wells. The earlier increased concentrations at well 199-K-29 in 2001 to 2002 are believed to reflect the plume from the 116-KE-1 crib.

Tritium Near KW Reactor. The tritium plume mapped near the KW Reactor is associated with effluent disposed to the 116-KW-1 crib during the operating years. An unexplained increase in tritium concentrations at well 199-K-106A, located downgradient of the crib, began in 2001 and abruptly peaked in 2003 (Figure 2.3-10). Other constituents showing a similar trend include nitrate and groundwater temperature. Also, technetium-99 was detected at low concentrations (25 to 65 pCi/L) in samples collected during the peak tritium concentrations. The origin for technetium-99 at this location is unknown. The cause for the recent change in the tritium trend at well 199-K-106A is presumed to be remobilization of contaminants in the 116-KW-1 crib and underlying soil column, although a driving mechanism has not been positively identified.

There is no groundwater evidence suggesting water loss from the KW Basin in recent years. Tritium concentrations in wells most likely to detect shielding water are shown in Figure 2.3-11. The groundwater concentrations are well below concentrations in KW Basin shielding water and are currently in the range 600 to 850 pCi/L. (Note: The most recent result for well 199-K-34 is a suspected outlier and currently under review.)

Tritium Near the 118-K-1 Burial Ground. Tritium concentrations at well 199-K-111A, located at the northwest corner of the burial ground, began rising abruptly in mid-2000 to a peak value of 98,200 pCi/L in April 2002 (Figure 2.3-12). Since that time, concentrations have steadily declined. The source for the tritium was the subject of a detailed investigation during 2002 of groundwater movement and soil gas in the vicinity of the burial ground (PNNL-14031). The best explanation to date is that a tritium plume lies to the east of the well, i.e., beneath the burial ground. This plume has been displaced to the west under the influence of the mound that has formed beneath the pump-and-treat injection site. Supporting this idea is (a) the pattern of groundwater movement inferred

Recent increases in tritium concentration at wells near fuel storage basins are unexplained, but there is no evidence of new basin leaks.

Plume areas (square kilometers) above the drinking water standard at the 100-KR-4 Operable Unit:

Chromium — 0.23
Nitrate — 0.30
Strontium-90 — 0.17
Trichloroethene — 0.15
Tritium — 0.28

from water-table elevations, (b) gradually increasing chromium concentrations as the pump-and-treat plume shifts somewhat to the west, and (c) the absence of other constituents that would identify known tritium sources.

An additional soil-gas survey was conducted during 2003 along the perimeter of the burial ground on the side closest to the river. Soil gas was analyzed for helium isotopes (helium-3 is a decay product of tritium). An excess of helium-3, as compared to ambient air amounts, was measured at all sites, indicating the nearby presence of tritium (Figure 2.3-13). The pattern of isotope ratios suggests the likelihood of a tritium source in the burial ground, along with an underlying groundwater plume. The plume may be the same as that observed at downgradient wells 199-K-18 and 199-K-120A, the latter a pump-and-treat extraction well.

Tritium Near 116-K-2 Trench. Groundwater downgradient of the trench typically contains low concentrations of tritium, i.e., <2,000 pCi/L. The exception occurs at the southwest end of the trench, where concentrations range between 40,000 and 80,000 pCi/L at wells 199-K-18 and 199-K-120A (a pump-and-treat system extraction well). The source for this tritium is uncertain; it may represent past disposal to the 100-K crib (116-K-1 waste site) or possibly tritium from a source farther inland, such as a previously unidentified burial ground source.

Tritium is being re-introduced to the aquifer via injection of the effluent from the pump-and-treat system. The average tritium concentration in effluent was 12,600 pCi/L in 2000 (DOE/RL-2001-04), and most of the tritium comes from extraction well 199-K-120A. Injected effluent appears to have started arriving at downgradient well 199-K-119A in 2000, as shown by increasing tritium concentrations, which reached ~3,500 pCi/L during 2003.

2.3.1.3 Carbon-14

Condensate from atmosphere gas for the KE and KW Reactors contained carbon-14 (along with tritium) and was discharged to infiltration cribs. Release of carbon-14 from the cribs and/or underlying soil continues to re-supply groundwater plumes even though discharge to the cribs ended in 1971. The half-life of carbon-14 is 5,730 years. The radionuclide exchanges with carbon in carbonate minerals, and so its movement is more restricted and variable than a non-retarded constituent like tritium. The drinking water standard is 2,000 pCi/L, and that standard has been exceeded at several wells downgradient of the reactor complexes.

Current concentrations of carbon-14 at wells immediately downgradient from the 116-KE-1 and 116-KW-1 cribs are shown in Figures 2.3-8 and 2.3-10. Concentrations near the 116-KE-1 crib are between 5,000 and 7,000 pCi/L, and near the 116-KW-1 crib are between 15,000 and 22,000 pCi/L. The two plumes do not appear to have reached the Columbia River, as indicated by low concentrations in aquifer sampling tubes.

2.3.1.4 Strontium-90

Strontium-90 was released to the environment at 100-K Area primarily via used reactor coolant. It was also present in fuel storage basin shielding water, which was discharged to nearby drain fields/injection wells during the reactor operating period. It is moderately mobile in the environment and has a half-life of ~29 years. The drinking water standard is 8 pCi/L, which is based on a radiological dose rate, and the DOE derived concentration guide is 1,000 pCi/L.

Strontium-90 Near the KE and KW Reactors. The highest concentrations in 100-K Area groundwater have been observed near the northwest corner of the KE Reactor, at well 199-K-109A, and reached a peak of ~18,000 pCi/L in 1997. Since 2000, concentrations have been generally declining at that location and current concentrations are ~1,200 pCi/L (Figure 2.3-14), which still exceeds the DOE derived concentration guide. The gross beta observed in groundwater at this location appears to be caused primarily by strontium-90.

A soil-gas survey near the 118-K-1 burial ground indicated the presence of tritium in the vadose zone.

Strontium-90 was apparently remobilized during the 1990s by infiltrating water, affecting underlying groundwater.

Nitrate and trichloroethene concentrations exceed drinking water standards in some 100-K Area monitoring wells.

The highly elevated concentrations during 1997 have been attributed to remobilization of strontium-90 in the soil beneath the 116-KE-3 drain field by infiltration of water from leaking fire hydrant service lines, possibly exacerbated by an unusually high water table (PNNL-12023). Use of the drain field ended in 1971.

Strontium-90 concentrations are lower at equivalent locations near KW Reactor and range from 20 to 50 pCi/L, with essentially constant trends. Leakage from hydrant service lines has not been observed near the northwest corner of the KW Basin. There are indications of temporarily elevated levels during the high water-table conditions in 1996 and 1997 based on gross beta measurements and one strontium-90 result.

Strontium-90 Near the 116-K-2 Trench. The effluent disposed to the 116-K-2 trench contained strontium-90, which is still present in groundwater affected by trench operations. The highest concentrations are generally <40 pCi/L and limited in areal extent; most observed concentrations are near or below the 8 pCi/L drinking water standard. Also, most concentration trends indicate a gradual decline, with the exception being at wells near the southwest end of the trench (see discussion of chromium trends in Section 2.3.1.1).

2.3.1.5 Other Constituents

Nitrate is widely distributed beneath the 100-K Area, with potential sources that include currently active septic systems and past-practices waste sites. The distribution patterns do not clearly delineate specific source sites. Nitrate exceeds the 45 mg/L drinking water standard in some areas. Concentration trends vary depending on monitoring location; the cause for the variability is likely to be shifts in plume position.

Trichloroethene has been detected in wells 199-K-106A and 199-K-33, which are located downgradient of the 116-KE-1 crib, at concentrations above the 5 µg/L drinking water standard. Concentrations in fiscal year 2003 were ~10 µg/L (Note: well 199-K-33 was decommissioned in June 2003). Concentrations have steadily declined from 1994 levels of ~36 µg/L in well 199-K-106A and ~20 µg/L in well 199-K-33.

In the past, several metals have been measured in filtered samples at concentrations above the drinking water standard (e.g., aluminum, iron, manganese, and nickel). These occurrences have not been positively connected to waste sites or waste streams. They are not considered contaminants of concern because of (a) limited areal extent, (b) sporadic occurrence, and (c) possibility that they are influenced by well construction and do not represent groundwater conditions.

2.3.2 CERCLA Interim Remedial Action for Chromium

This interim remedial action involves a pump-and-treat system designed to remove hexavalent chromium from groundwater in the region between the 116-K-2 trench and the Columbia River (DOE/RL-96-84). Hexavalent chromium poses a threat to aquatic organisms that use the riverbed substrate for habitat. Fall chinook salmon, which spawn in riverbed gravels, are of particular concern in the Hanford Reach. As described in the record of decision (ROD 1996a), the protection standard for aquatic life is 11 µg/L as measured in riverbed substrate porewater. Because some dilution of contaminants by river water occurs along the pathway between the aquifer and riverbed substrate, the record of decision considers a value of 22 µg/L in near-river compliance wells as being protective of aquatic life.

The interim remedial action consists of a pump-and-treat system involving nine extraction wells, five injection wells, and an ion-exchange resin

The remedial action objectives for the 100-KR-4 Operable Unit (ROD 1996a) are:

- *Protect aquatic receptors in the river bottom from contaminants in groundwater entering the Columbia River.*
- *Protect human health by preventing exposure to contaminant in the groundwater.*
- *Provide information that will lead to the final remedy.*

The contaminant of concern is hexavalent chromium. The record of decision specifies the cleanup goal at compliance wells as 22 µg/L. EPA specified enhancements needed to the system in their 5-year review (EPA 2001).

treatment system that removes hexavalent chromium. The system began operating in October 1997. Performance monitoring of the pump-and-treat system is described in an interim remedial action monitoring plan (DOE/RL-96-90). Four wells, located between the extraction wells and the Columbia River, have been identified as compliance monitoring locations. Seven additional wells are used to help evaluate the performance of the system on aquifer conditions. Approximately five aquifer sampling tube sites along the rivershore are also monitored. Lists of sampling frequencies and analyses performed are included in Appendix A.

The results of the interim remedial action for chromium are described in an annual summary report for each calendar year, which is prepared by the remedial action contractor (e.g., DOE/RL-2003-09). Highlights from the summary report for calendar year 2002, with updates for volumes treated and mass removed through September 2003, are presented in the following sections.

2.3.2.1 Progress During Fiscal Year 2003

During the period October 1, 2002, through September 30, 2003, ~510.3 million liters of groundwater were extracted and treated, with 37.9 kilograms of chromium removed. Since the startup of operations in October 1997, the total volume extracted is 2,069 million liters and total mass of chromium removed is ~213 kilograms.

Several changes in the extraction/injection well network occurred during fiscal year 2003: newly installed wells include extraction wells 199-K-127 and 199-K-129; injection well 199-K-128; and monitoring well 199-K-130. Also, well 199-K-126 was converted to an extraction well.

2.3.2.2 Influence on Aquifer Conditions

Changes in chromium concentrations within the target plume area suggest that in general the level of contamination is decreasing with time. Chromium concentrations in compliance wells 199-K-20 and 199-K-112A are shown in Figure 2.3-3, and Section 2.3.1 provides additional discussion. This decrease is resulting from the pump-and-treat operation and the reduction in the level of contamination by natural processes, such as dispersion. No facility operations or discharges to waste sites are known to be current sources of recharge to the chromium plume, although some chromium may continue to be slowly released from the vadose zone beneath the 116-K-2 trench.

Chromium concentrations in aquifer sampling tubes along the shore segment affected by the plume appear to have decreased with time, although the results are limited in number and are not adjusted for mixing with river water (PNNL-14444). When results are available for tube samples from several depths at a particular site, the deeper site has the higher concentration, thus revealing the diluting effect of river water that infiltrates the riverbank during high river stage. Additional tubes sites along this shore segment are being installed during fall 2003 to provide increased monitoring capability (WMP-18051).

The injection of treated effluent at five wells has created a mound of uncertain magnitude on the water table. The injected treated effluent appears to have migrated downgradient as far as extraction wells 199-K-119A and 199-K-125A, as shown by the increasing tritium concentrations in those wells during recent years (Figure 2.3-15; Note: tritium concentrations are higher in the injected effluent than in groundwater near the extraction wells). The mounding may also have caused the boundary of the chromium plume, and perhaps an unmapped tritium plume, to shift to the west, where the boundary(ies) are now detected at well 199-K-111A (Figures 2.3-4 and 2.3-12).

Uncertainties regarding the pump-and-treat system's influence on aquifer conditions involve the (1) extent of plume inland of the trench, and whether or not chromium observed at well 699-78-62 is part of the plume; (2) source for chromium and tritium at wells 199-K-18 and 199-K-120A, where concentrations are increasing; and (3) height and extent of the mound created at the injection site.

Levels of chromium contamination appear to be generally decreasing in the area of the pump-and-treat system.

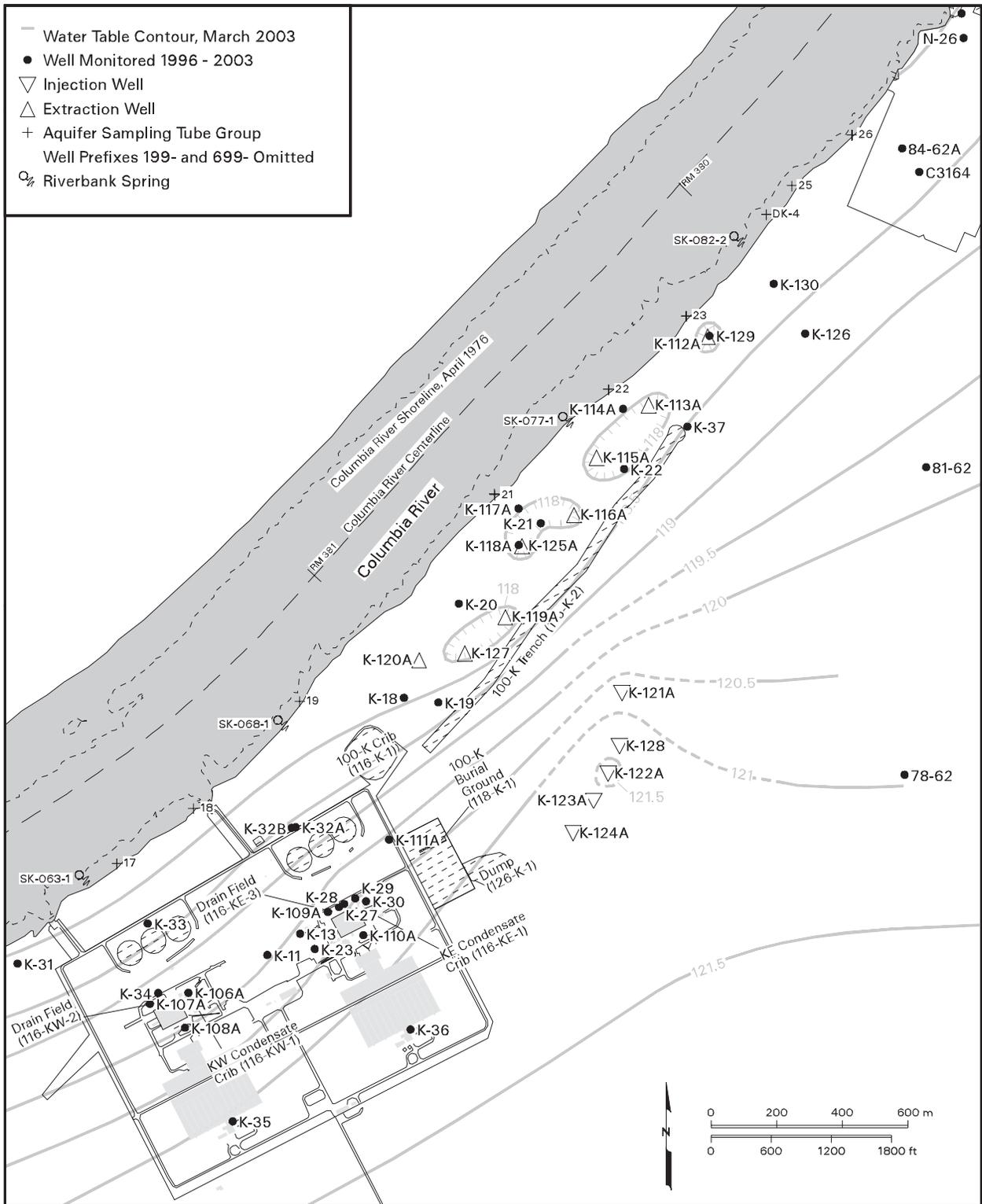
2.3.3 AEA Monitoring (K Basins)

Basins within the KE and KW Reactor buildings have been used to store irradiated fuel from the last run of the 100-N Reactor, along with other miscellaneous fuel recovered during remedial actions at other reactor areas. The fuel is being removed, re-packaged, and moved to a better storage facility in the Central Plateau as part of the Spent Nuclear Fuels Project. Tri-Party Agreement Milestone M-34-00 covers the fuel removal and basin cleanup project.

Groundwater monitoring and characterization near the K Basins are conducted under a subtask within the groundwater project. The sampling and analysis schedule complements schedules associated with the 100-KR-4 Operable Unit. The monitoring plan (PNNL-14033) describes the objectives for the subtask:

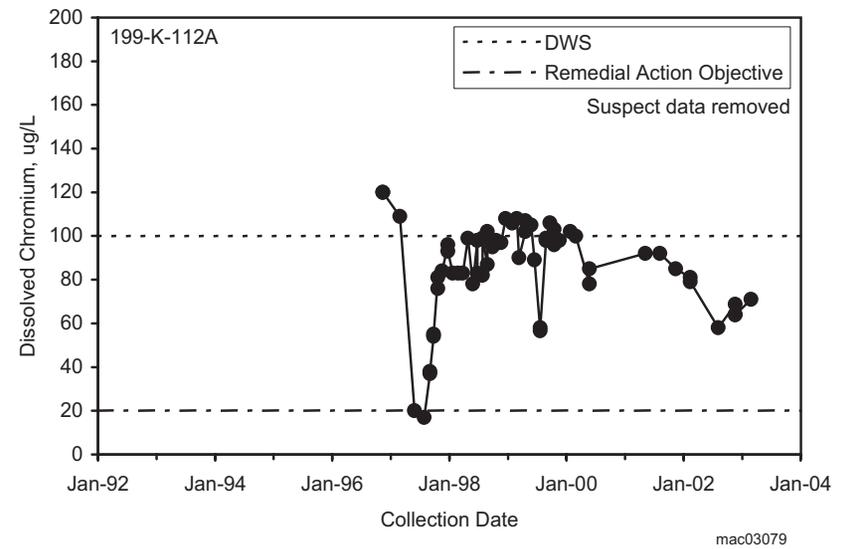
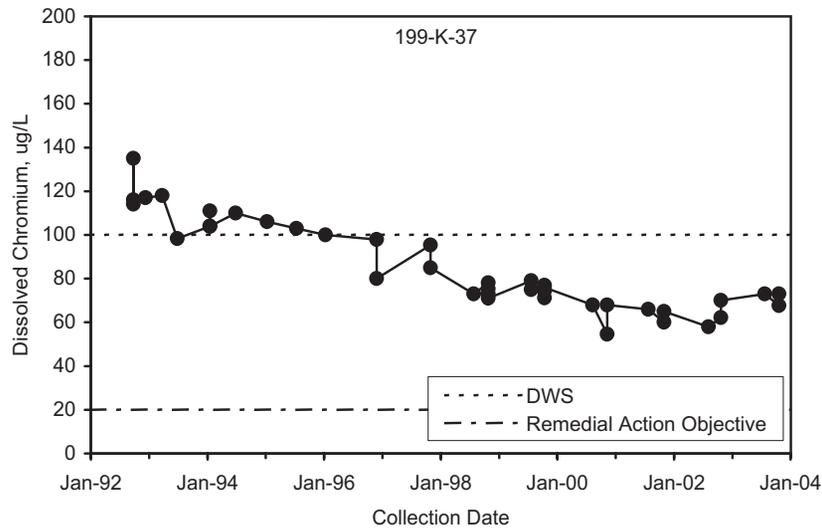
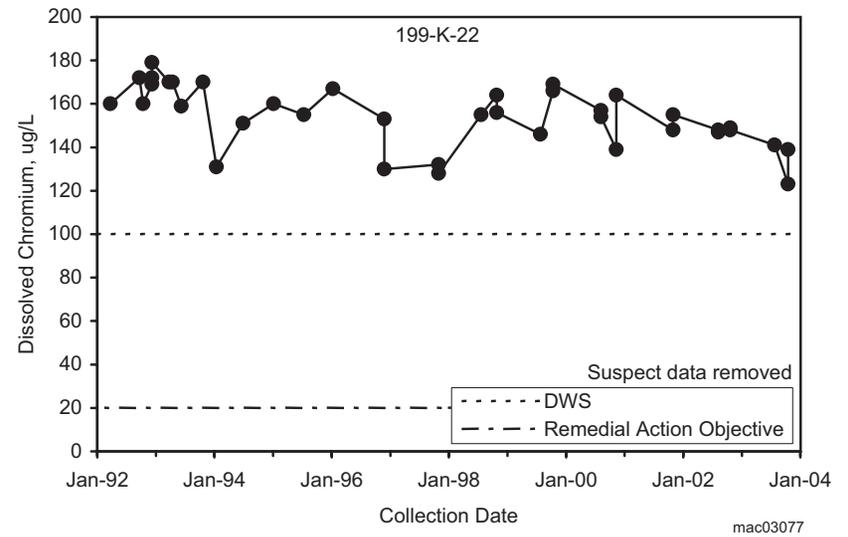
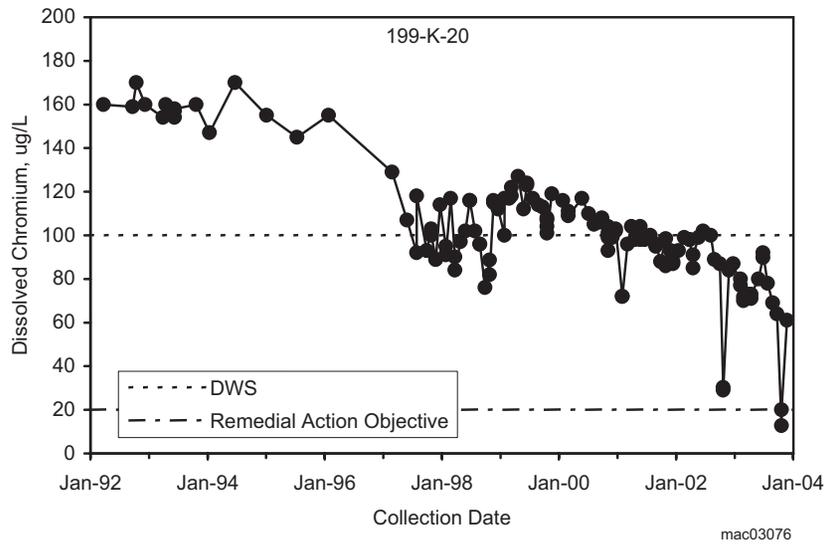
- Characterize groundwater conditions between the K Basins and the Columbia River to provide a periodic status of current conditions and the attenuation of plumes.
- Distinguish between groundwater contamination associated with K Basins and contamination from other past-practices sources to help guide operational and remedial action decisions.
- Maintain a strategy for the potential expansion of monitoring capabilities to respond to future basin-related issues.

Results of this subtask's activities are reported quarterly to the U.S. Department of Energy and the Spent Nuclear Fuels Project via email. Discussions of contaminants potentially associated with the basins (e.g., tritium, technetium-99, and strontium-90) are included in Section 2.3.1.



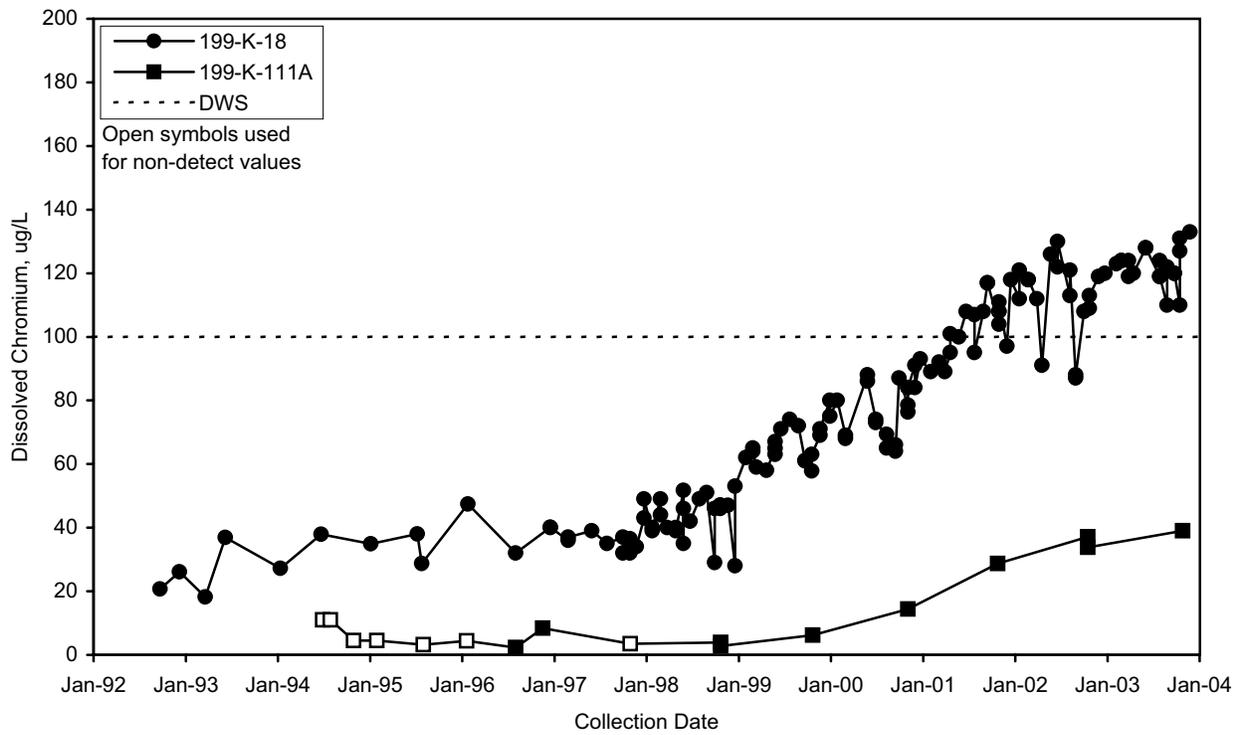
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Figure 2.3-1. Location Map for 100-K Area Facilities, Waste Sites, Monitoring Wells, and Shoreline Monitoring Sites



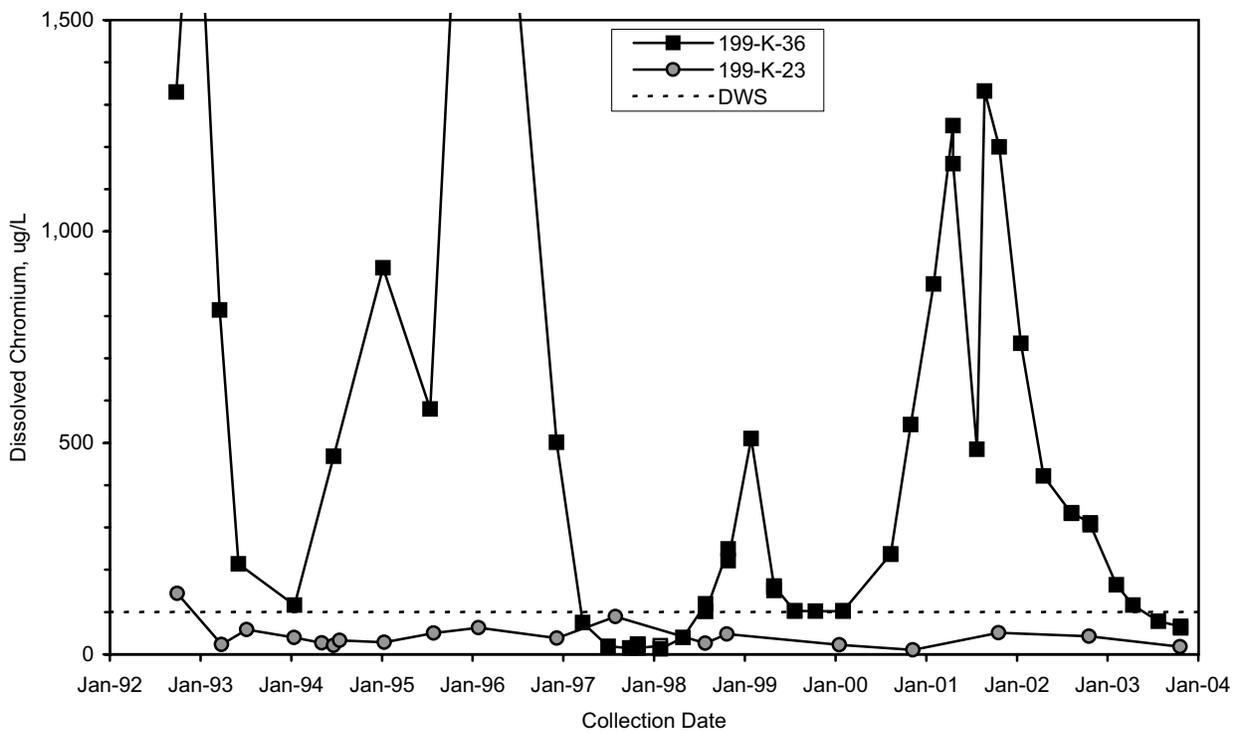
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Figure 2.3-3. Chromium Concentrations in Pump-and-Treat Performance Monitoring Wells



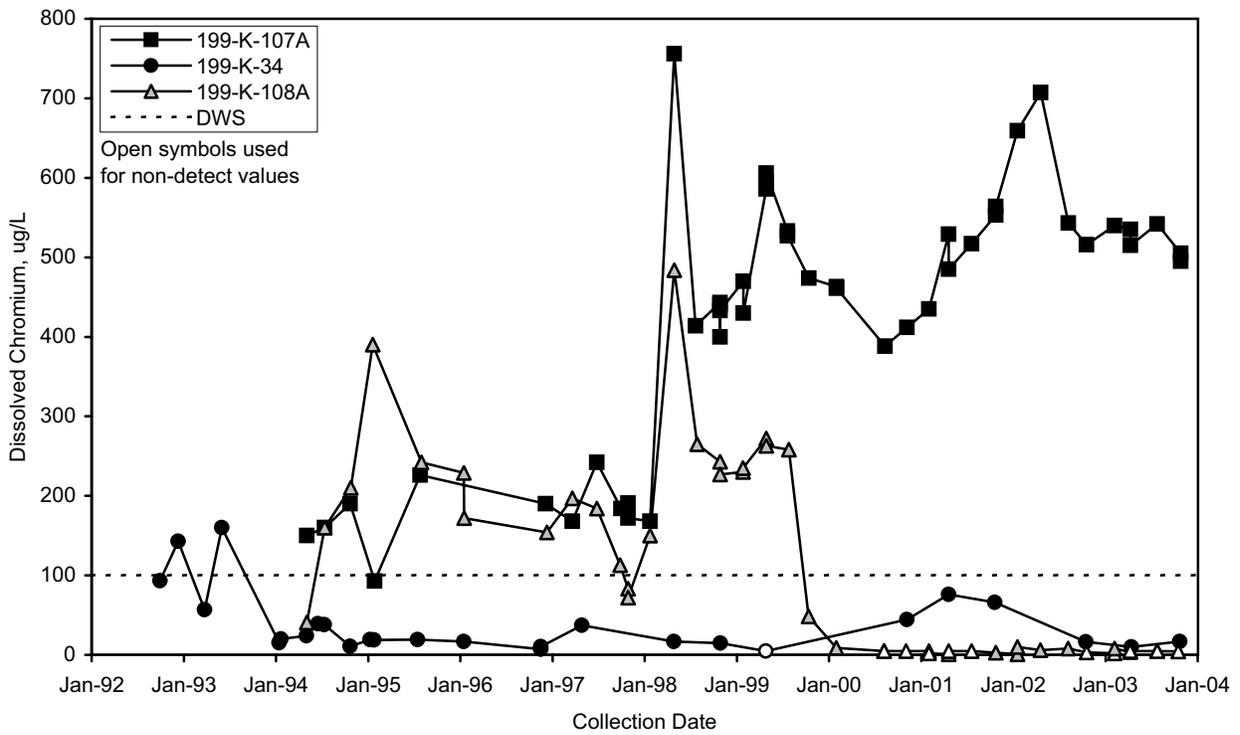
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Figure 2.3.4. Increasing Chromium Concentrations at the Southwest Edge of Plume Associated with the 116-K-2 Trench



mac03081

Figure 2.3.5. Chromium Concentrations Near KE Water Treatment Plant Basins



mac03082

Figure 2.3-6. Chromium Concentrations Near KW Reactor

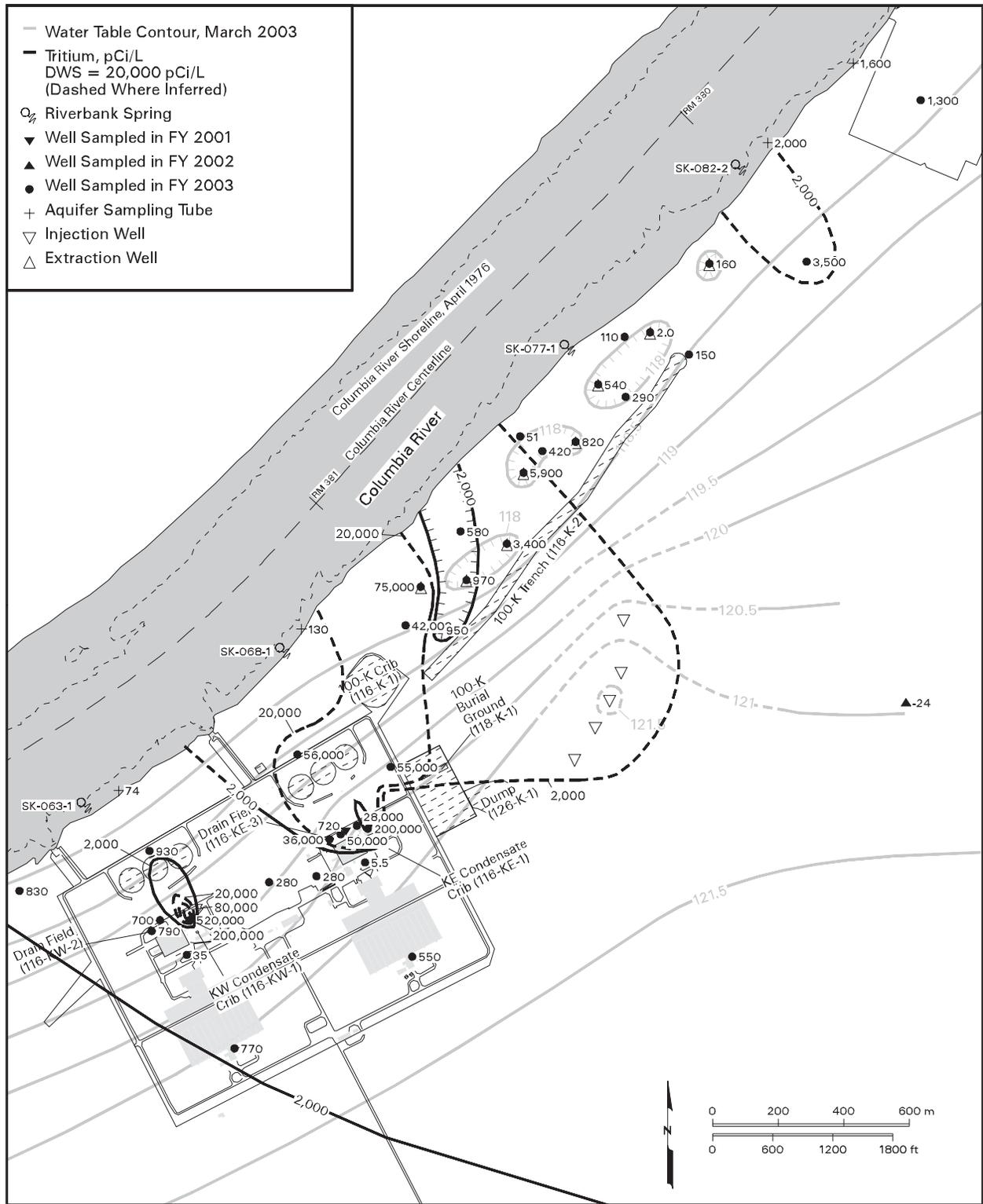


Figure 2.3-7. Tritium Distribution in 100-K Area Groundwater, Fiscal Year 2003

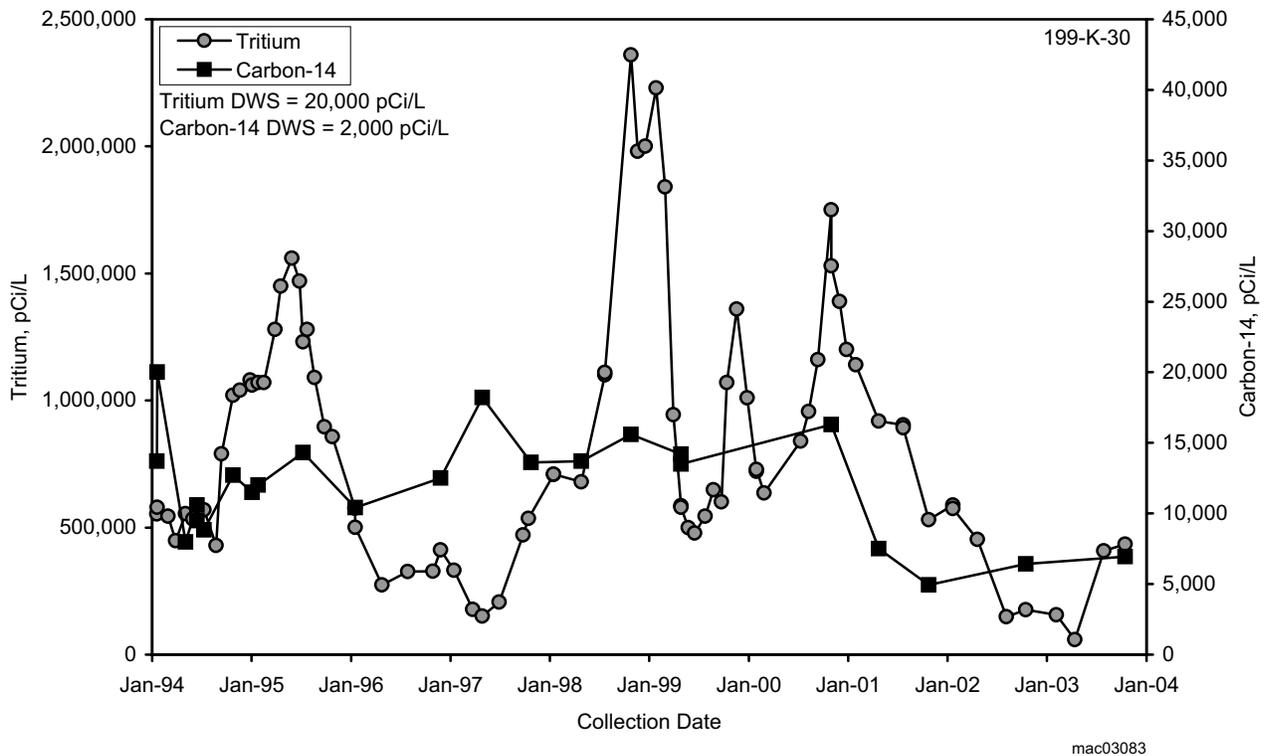


Figure 2.3-8. Tritium and Carbon-14 Concentrations Near the 116-KE-1 Crib

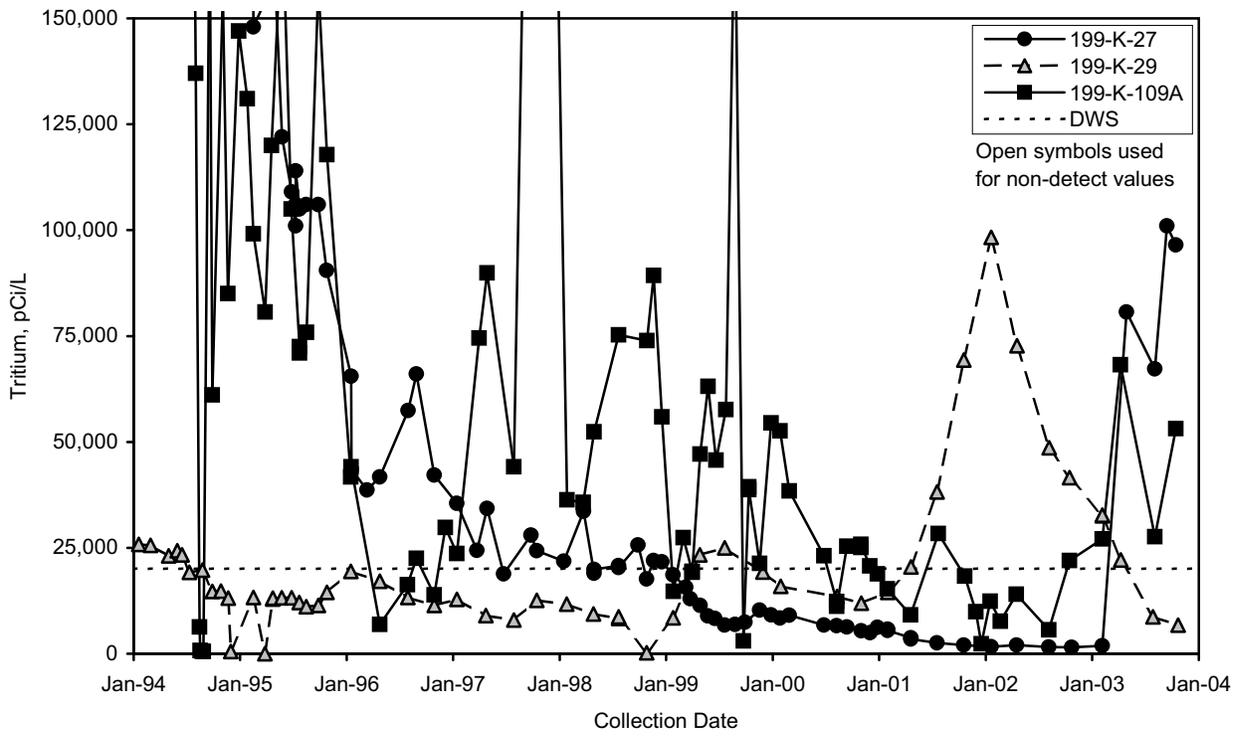


Figure 2.3-9. Tritium Concentrations Near KE Basin

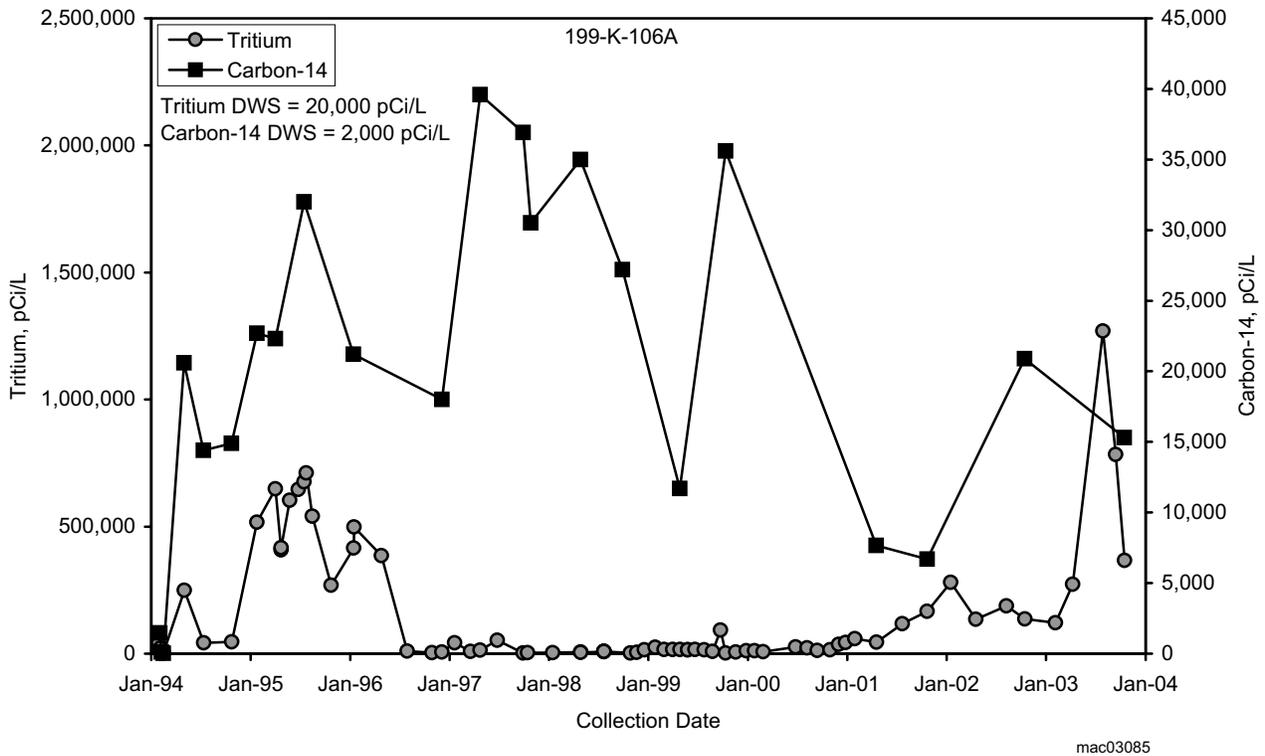


Figure 2.3-10. Tritium and Carbon-14 Concentrations Near the 116-KW-1 Crib

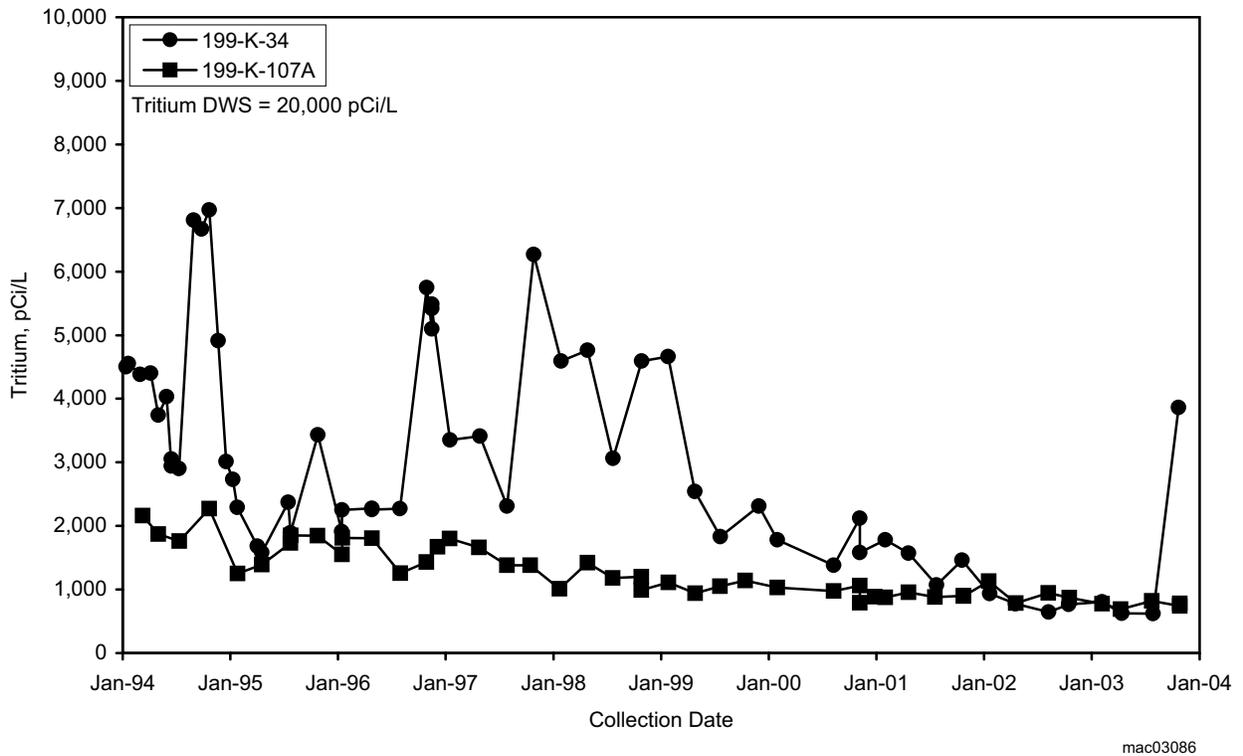
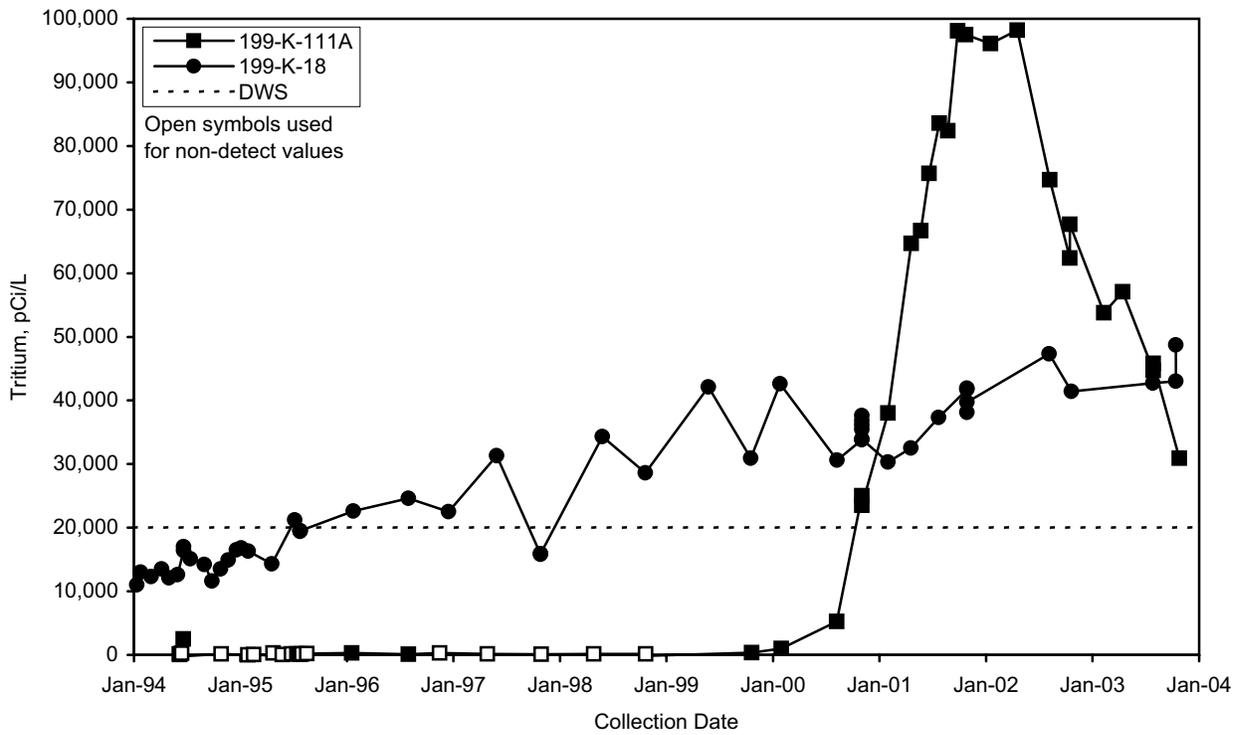
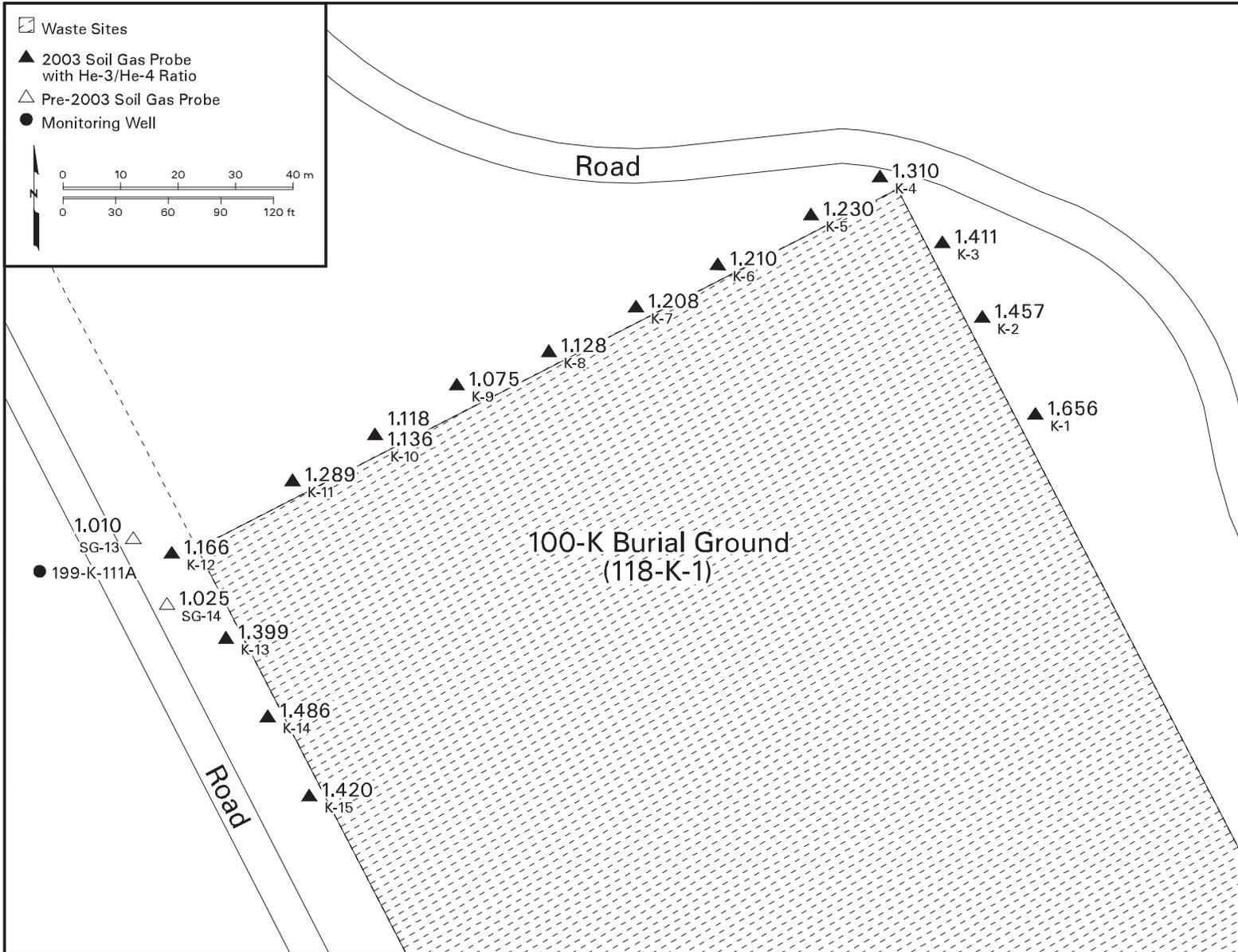


Figure 2.3-11. Tritium Concentrations Near KW Basin



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Figure 2.3-12. Tritium Concentrations Near 118-K-1 Burial Ground



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Figure 2.3-13. Helium Isotope Ratios in Soil Gas Near 118-K-1 Burial Ground

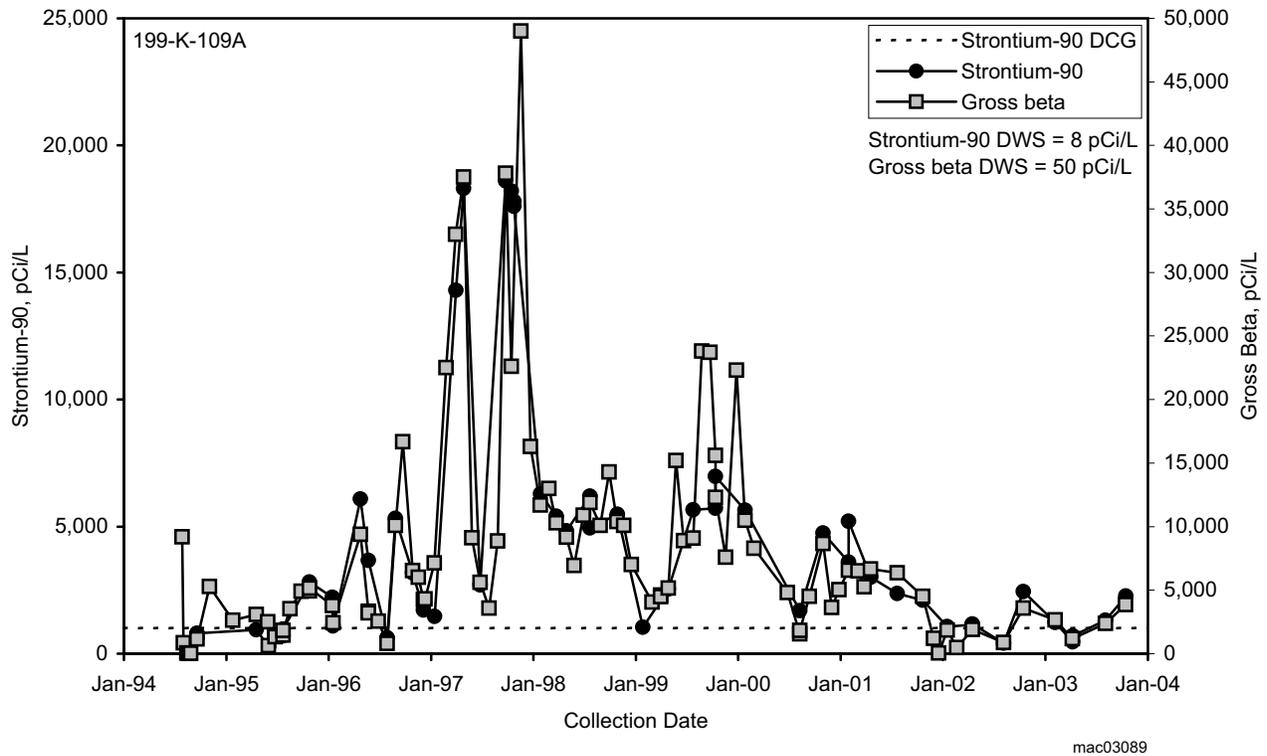


Figure 2.3-14. Strontium-90 and Gross Beta Concentrations Near KE Basin

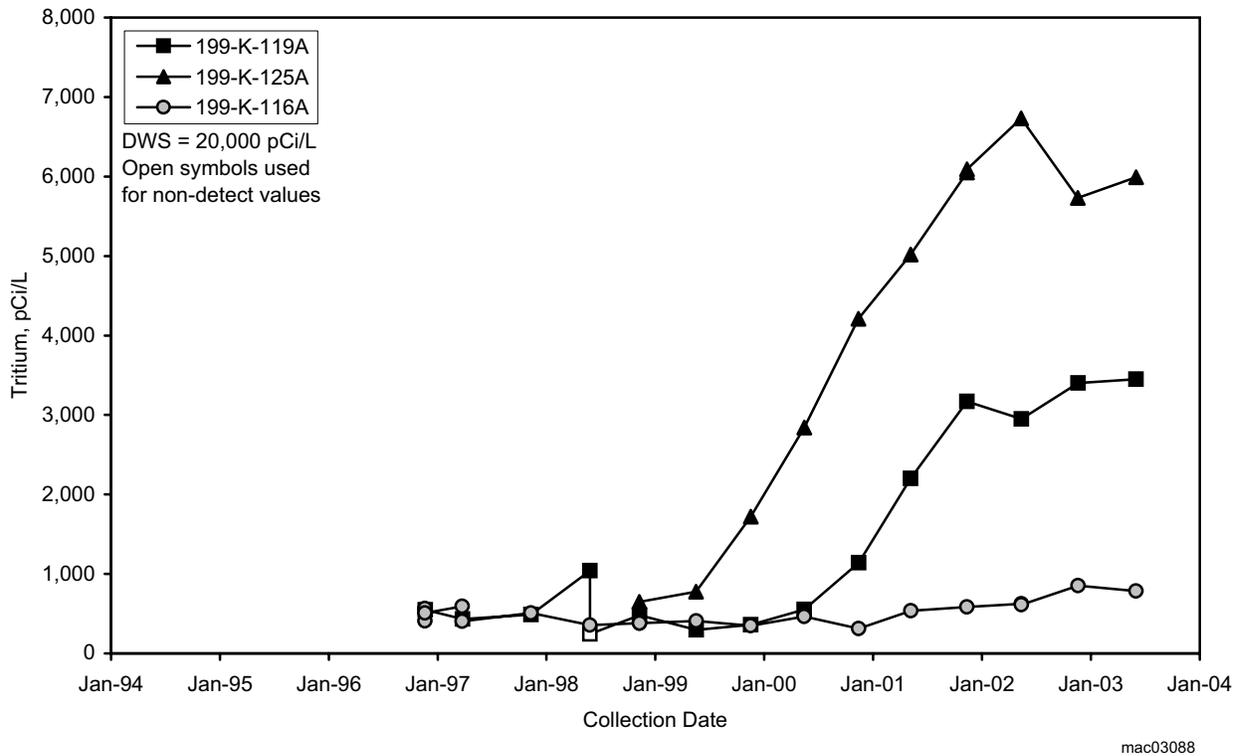


Figure 2.3-15. Tritium Concentrations in Wells Downgradient of the Pump-and-Treat Injection Site