Appendix B—Supporting Information for RCRA and Other Monitored Facilities

D.C. Weekes

This appendix provides supplemental information for Resource Conservation and Recovery Act of 1976 (RCRA) and other regulated units on the Hanford Site that require groundwater monitoring, excluding Comprehensive Environmental Response, Compensation, and Liability Act of 1980 units (discussed in Appendix A). Site-specific descriptions for each facility included in this appendix are provided in the main text of this document under the respective operable unit in which the facility is located.

Groundwater monitoring under RCRA continued during the reporting period at 26 waste management areas (Figure B-1). Estimates of groundwater velocity, hydrologic properties, and associated references are shown in Table B-1 for the RCRA sites. To determine if a waste site has adversely affected groundwater quality under RCRA interim status regulations (WAC 173-303-400, “Dangerous Waste Regulations,” “Interim Status Facility Standards;” 40 CFR 265.93, “Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities,” “Preparation, Evaluation, and Response”), concentrations of indicator parameters in downgradient wells are compared to statistically derived critical mean values. The indicator parameters under interim status are specific conductance, pH, total organic carbon, and total organic halides. The critical values to which the indicator parameters are compared represent 99 percent prediction limits, which are calculated for each facility based on samples from upgradient wells. The methodology used to calculate the critical value is the Student’s t-test in accordance with 40 CFR 265.93(b). The formula and individual parameters for the test are provided in Section 7.1 of PNNL-13080, Hanford Site Groundwater Monitoring: Setting, Sources, and Methods. The upper prediction limits (and lower limit in the case of pH) also are known as critical mean values.

Critical mean values are recalculated annually or if the number of analyses changes. Annual recalculation accounts for changing background conditions. Changes in the number of analyses are usually the result of changes in monitoring well networks (e.g., wells are added or deleted). If changes occur in a monitoring well network, critical mean values for that facility are recalculated for subsequent semiannual sampling events using the new well network.

To reliably indicate potential groundwater effects from a facility, the sample results must be reasonably precise or quantifiable. Specific conductance and pH are field-measured indicator parameters that are reasonably detectable and quantifiable. The parameters of total organic carbon and total organic halides, however, are much more variable and are often below detection levels. Significant imprecision and variability occur when measuring these parameters near detection limits. The variability in laboratory measurements of field blanks is used to estimate laboratory limits of quantitation during the sampling period. The limit of quantitation is defined as ten times the standard deviation of the field blank analyses (Appendix D). For detection monitoring, the statistical comparison values for total organic carbon and total organic halides are the larger of either the critical mean or the limit of quantitation. The direct substitution of the detection limit biases the mean values high and likely decreases the variance used in calculating the critical means. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance (EPA 530/R-09-007) recommends substitution methods for populations with proportion of non-detecteds less than 50 percent. For TOC and TOX, if the proportion of non-detects is
greater than this threshold, the measurements at a particular site cannot be estimated; therefore, a critical mean value cannot be calculated. In these cases, the critical mean is reported as NC (not calculable). In this analysis, values reported as being below the detection limit were substituted using robust regression on order statistics (Non-detects and Data Analysis for Environmental Data [Helsel, 2005]). Non-detects were imputed using the population of upgradient results to estimate values reported as non-detects. This implicitly assumes that values from all upgradient wells come from the same underlying population.

Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance (EPA 530/R-09-007) recommends using 8 to 10 independent samples for background limit calculations. If data from 2010 to 2011 did not provide a suitable sample size, earlier data were incorporated until a suitable sample size was reached. For each site, the analyte with the minimum number of samples was considered. Typically, this was either TOX or TOC. The effect of this is that for all analytes at a site, the critical means at each site used data from the same period - although varying number of data points might be used. The period of data to be used at each site was determined before the proportion of non-detects was calculated and substitution methods considered.

The following data were excluded from the analysis.

- Review qualifiers coded with either an F, R, or Y. Definitions for these qualifiers can be found in Appendix D.
- Review qualifiers of Q and QH indicate blanks or duplicates with enough differences to require further evaluation. They are currently excluded from this analysis and may be reviewed at a later date.

The Bonferroni adjustment used to control the overall false-positive error rate while making multiple comparisons is a function of the number of comparisons being made. This analysis assumes that upgradient, as well as downgradient wells, will be compared against the critical means. This is consistent with earlier analysis.

Table B-2 lists the comparison values (critical mean values and limits of quantitation) used during the reporting period. Additional tables list updated critical mean values for use in calendar year 2012 for each RCRA unit where these statistics apply. Tables B-3 through B-41 provide supporting information for the RCRA sites, and Figures B-2 through B-17 show the locations of monitoring wells at RCRA regulated units.

This appendix also provides constituent lists, well network configurations, and other ancillary information for regulated facilities that fall outside of the RCRA program. Some network wells in these facilities are shared with RCRA facilities, and Figure B-18 shows the general locations of these facilities. Locations of monitoring wells for these facilities are shown in Figures B-5, B-14, B-19, B-20, and B-21. Tables B-42 through B-48 list the constituents and/or the results summaries for these facilities.
References


Appendix B

Hanford Site Groundwater Monitoring for 2011


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Table B-1. Estimates of Groundwater Flow Rates at Hanford Site RCRA Facilities

<table>
<thead>
<tr>
<th>Site</th>
<th>Flow Direction</th>
<th>Flow Rate (m/day)</th>
<th>Method</th>
<th>Hydraulic Conductivity (m/day) (Source)</th>
<th>Effective Porosity&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Gradient&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>116-N-1 LWDF</td>
<td>Mar.: East-northeast</td>
<td>Mar.: 0.01 to 0.13</td>
<td>Darcy</td>
<td>6.1 to 37 (PNL-8335)</td>
<td>2.3 × 10&lt;sup&gt;-3&lt;/sup&gt;d</td>
<td>Mar: 3.5 × 10&lt;sup&gt;-4d&lt;/sup&gt;</td>
<td>Trend surface analysis, wells 199-N-2, 199-N-3, 199-N-34, 199-N-57, and 199-N-105A.</td>
</tr>
<tr>
<td></td>
<td>Sept.: North-northwest</td>
<td>Sept.: 0.05 to 0.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>120-N-1 and</td>
<td>Mar.: Northeast</td>
<td>Mar.: 0.01 to 0.19</td>
<td>Darcy</td>
<td>6.1 to 37 (PNL-8335)</td>
<td>2.3 × 10&lt;sup&gt;-3&lt;/sup&gt;d</td>
<td>Mar: 5.9 × 10&lt;sup&gt;-4d&lt;/sup&gt;</td>
<td>Trend surface analysis, wells 199-N-57, 199-N-71, 199-N-72, 199-N-73, and 199-N-165.</td>
</tr>
<tr>
<td>120-N-2</td>
<td>Sept.: East-northeast</td>
<td>Sept.: 0.02 to 0.34</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>116-N-3 LWDF</td>
<td>Mar.: North-northwest</td>
<td>Mar.: 0.01 to 0.19</td>
<td>Darcy</td>
<td>6.1 to 37 (PNL-8335)</td>
<td>2.3 × 10&lt;sup&gt;-3&lt;/sup&gt;d</td>
<td>Mar: 5.1 × 10&lt;sup&gt;-4d&lt;/sup&gt;</td>
<td>Trend surface analysis, wells 199-N-28, 199-N-32, 199-N-34, 199-N-41, 199-N-71, and 199-N-81 (removed 199-N-28 and 199-N-81 and added 199-N-27 in Sept.).</td>
</tr>
<tr>
<td></td>
<td>Sept.: East-northeast</td>
<td>Sept.: 0.02 to 0.30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>116-H-6</td>
<td>East</td>
<td>Not calculated</td>
<td>Darcy</td>
<td>15 to 140 (PNL-6728)</td>
<td>2.5 × 10&lt;sup&gt;-5&lt;/sup&gt;e</td>
<td>Not calculated</td>
<td>Flow toward extraction wells east of basins. Water level data not sufficient to calculate gradient.</td>
</tr>
<tr>
<td>Evaporation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basins</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>216-A-29 Ditch</td>
<td>Southeast&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.001 to 0.004</td>
<td>Darcy</td>
<td>18 (WHC-SD-EN-DP-047)</td>
<td>2.2 × 10&lt;sup&gt;-5&lt;/sup&gt;e</td>
<td></td>
<td>Uncertainty with gradient and rate of flow (see Section 3.1.2).</td>
</tr>
<tr>
<td>Site</td>
<td>Flow Direction</td>
<td>Flow Rate (m/day)</td>
<td>Method</td>
<td>Hydraulic Conductivity (m/day) (Source)</td>
<td>Effective Porosity$^a$</td>
<td>Gradient$^b$</td>
<td>Comments</td>
</tr>
<tr>
<td>----------------------</td>
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<td>-------------------</td>
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<td>----------------------------------------</td>
<td>------------------------</td>
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<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>216-A-37-1 Crib</td>
<td>Southeast</td>
<td>0.06 to 29.46</td>
<td>Darcy</td>
<td>18 to 3,000 (PNNL-11523)</td>
<td>--</td>
<td>9.8 × 10$^{-4}$</td>
<td>Uncertainty with gradient and rate of flow due to lack of corrected groundwater level measurements. Flow direction inferred from plume maps.</td>
</tr>
<tr>
<td>216-B-3 Pond</td>
<td>West</td>
<td>0.0048</td>
<td>Darcy</td>
<td>1.0 (WHC-SD-EN-EV-002; PNL-10195)</td>
<td>0.25</td>
<td>0.0014$^c$</td>
<td></td>
</tr>
<tr>
<td>216-B-63 Trench</td>
<td>Indeterminate</td>
<td>Indeterminate</td>
<td>Darcy</td>
<td>182 (WHC-MR-0207)</td>
<td>0.2</td>
<td>Indeterminate</td>
<td>Uncertainty with gradient and rate of flow due to proximity to flow divide.</td>
</tr>
<tr>
<td>216-S-10 Pond and Ditch</td>
<td>East-southeast</td>
<td>0.17</td>
<td>Darcy</td>
<td>10.4 (WHC-SD-EN-DP-052)</td>
<td>0.15</td>
<td>2.5 × 10$^{-3}$</td>
<td>Trend surface analysis, wells 299-W26-13, 299-W26-14, 699-32-76, 699-32-77, 699-33-75, and 699-33-76.</td>
</tr>
<tr>
<td>316-5 Process Trenches</td>
<td>South-southeast</td>
<td>20</td>
<td>Darcy</td>
<td>9,000 (PNNL-17708)</td>
<td>0.17</td>
<td>3.8 × 10$^{-4}$</td>
<td>Trend surface analysis, wells 399-1-6, 399-1-10A, 399-1-12, 399-1-15, 399-1-16A, 399-1-17A, and 399-1-18A.</td>
</tr>
<tr>
<td>IDF</td>
<td>East-northeast</td>
<td>0.005 to 0.02</td>
<td>Darcy</td>
<td>68 to 75 (PNNL-13652; PNNL-11957)</td>
<td>--</td>
<td>2.2 × 10$^{-5}$</td>
<td>Trend surface analysis, wells 299-E17-18, 299-E17-21, 299-E17-22, 299-E17-23, 299-E17-25, 299-E24-16, 299-E24-18, 299-E24-21, 299-E24-24, 299-E25-36, and 699-37-47A</td>
</tr>
<tr>
<td>LERF</td>
<td>Southwest</td>
<td>0.02</td>
<td>Darcy</td>
<td>39.8 (PNNL-14804)</td>
<td>0.373</td>
<td>2.6 × 10$^{-4}$</td>
<td>Trend surface analysis, wells 299-E26-10, 299-E26-77, and 299-E26-79 (Section 3.4.113)</td>
</tr>
</tbody>
</table>
### Table B-1. Estimates of Groundwater Flow Rates at Hanford Site RCRA Facilities

<table>
<thead>
<tr>
<th>Site</th>
<th>Flow Direction</th>
<th>Flow Rate (m/day)</th>
<th>Method</th>
<th>Hydraulic Conductivity (m/day) (Source)</th>
<th>Effective Porosity&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Gradient&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>LLWMA-1</td>
<td>Variable</td>
<td>Variable</td>
<td>Darcy</td>
<td>2,500 to 7,500 (PNNL-14753)</td>
<td>0.2</td>
<td>Variable&lt;sup&gt;e&lt;/sup&gt;</td>
<td>Variable gradient and rate of flow due to mid-year flow change.</td>
</tr>
<tr>
<td>LLWMA-2</td>
<td>Indeterminate</td>
<td>Indeterminate</td>
<td>--</td>
<td>2,500 to 7,500 (PNNL-14753)</td>
<td>0.2</td>
<td>Indeterminate&lt;sup&gt;e&lt;/sup&gt;</td>
<td>Uncertainty with gradient and rate of flow due to proximity to flow divide.</td>
</tr>
<tr>
<td>LLWMA-3</td>
<td>East-northeast</td>
<td>0.04 to 0.15</td>
<td>Darcy</td>
<td>2.5 to 10 (PNNL-14753)</td>
<td>0.1</td>
<td>1.5 × 10&lt;sup&gt;-3d&lt;/sup&gt;</td>
<td>Trend surface analysis, wells 299-W7-3, 299-W7-4, 299-W10-29, and 299-W10-31.</td>
</tr>
<tr>
<td>LLWMA-4</td>
<td>East</td>
<td>0.08 to 0.32</td>
<td>Darcy</td>
<td>2.5 to 10 (PNNL-14753)</td>
<td>0.1</td>
<td>3.2 × 10&lt;sup&gt;-3d&lt;/sup&gt;</td>
<td>Trend surface analysis, wells 299-W15-42, 299-W15-94, 299-W15-152, 299-W15-224, 299-W18-16, 299-W18-21, and 299-W18-40.</td>
</tr>
<tr>
<td>WMA A-AX</td>
<td>Southeast</td>
<td>Indeterminate</td>
<td>Darcy</td>
<td>1,981 (PNL-8337; WHC-SD-EN-TI-019)</td>
<td>--</td>
<td>Indeterminate</td>
<td>Uncertainty with gradient and rate of flow due to lack of corrected groundwater level measurements. Flow direction inferred from plume maps.</td>
</tr>
<tr>
<td>WMA B-BX-BY</td>
<td>Variable</td>
<td>Variable</td>
<td>Darcy</td>
<td>73 to 2,520 (PNL-6820)</td>
<td>0.3</td>
<td>Variable</td>
<td>Variable with gradient and rate of flow due to mid-year flow change.</td>
</tr>
</tbody>
</table>
Table B-1. Estimates of Groundwater Flow Rates at Hanford Site RCRA Facilities

<table>
<thead>
<tr>
<th>Site</th>
<th>Flow Direction</th>
<th>Flow Rate (m/day)</th>
<th>Method</th>
<th>Hydraulic Conductivity (m/day) (Source)</th>
<th>Effective Porosity</th>
<th>Gradient</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>WMA C</td>
<td>South</td>
<td>Indeterminate</td>
<td>Darcy</td>
<td>1890 to 6,888 (PNNL-14656)</td>
<td>0.3</td>
<td>Indeterminate</td>
<td>Uncertainty with gradient and rate of flow due to lack of corrected groundwater level measurements.</td>
</tr>
<tr>
<td>WMA S-SX</td>
<td>East to east-southeast</td>
<td>0.07 to 0.14</td>
<td>Contaminant travel time (PNNL-13441)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Based on inferred contaminant travel time between 216-S-25 Crib and downgradient wells 299-W23-15 and 299-W22-46, and between wells 299-W22-46 and 299-W22-83.</td>
</tr>
<tr>
<td>WMA T</td>
<td>East-northeast</td>
<td>0.12 to 0.19</td>
<td>Darcy</td>
<td>6.11 to 9.69 (PNNL-17732)</td>
<td>0.1</td>
<td>$2.0 \times 10^{-3}$</td>
<td>Trend surface analysis, wells 299-W10-1, 299-W10-4, 299-W10-8, 299-W10-23, 299-W10-28, 299-W11-12, 299-W11-40, 299-W11-41, and 299-W11-42. Flow direction and gradient influenced by groundwater extraction south and west of the WMA.</td>
</tr>
<tr>
<td>WMA TX-TY</td>
<td>Variable</td>
<td>NA</td>
<td>NA</td>
<td>0.07 to 19.9 (PNNL-18279)</td>
<td>0.18</td>
<td>NA</td>
<td>Flow direction and rate influenced by 200-ZP-1 pump-and-treat system (Section 3.2.10).</td>
</tr>
</tbody>
</table>
Table B-1. Estimates of Groundwater Flow Rates at Hanford Site RCRA Facilities

<table>
<thead>
<tr>
<th>Site</th>
<th>Flow Direction</th>
<th>Flow Rate (m/day)</th>
<th>Method</th>
<th>Hydraulic Conductivity (m/day) (Source)</th>
<th>Effective Porosity&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Gradient&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Comments</th>
</tr>
</thead>
</table>

Note: Complete citations are provided in the References Section of the main text for the appendix.

a. Effective porosity assumed to be between 0.1 and 0.3, a representative range for the unconfined aquifer system, unless otherwise noted.
b. March 2011, unless noted otherwise.
c. Flow direction is based on those determined on a regional basis.
d. ECF-HANFORD-12-0048, *Hydraulic Gradients and Velocity Calculations for RCRA Sites in 2011*.
e. ECF-HANFORD-12-0061, *Groundwater Hydraulic Gradient and Velocity Calculations for 200 East Area RCRA Sites in 2011*.

NA = not applicable
### Table B-2. Upgradient/Downgradient Comparison Values Used for Statistical Comparisons at RCRA Sites, 2011

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Facility</th>
<th>Specific Conductance Critical Mean (µS/cm)</th>
<th>pH Critical Range</th>
<th>TOC Critical Mean(^{a,b})/LOQ (µg/L)</th>
<th>TOX Critical Mean(^{a})/LOQ (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr. to June 2011</td>
<td></td>
<td>1,950</td>
<td>5.39 – 10.15</td>
<td>2,350/240</td>
<td>33.4/15.0</td>
</tr>
<tr>
<td>July to Sept. 2011</td>
<td></td>
<td>1,950</td>
<td>5.39 – 10.15</td>
<td>2,350/670</td>
<td>33.4/25.5</td>
</tr>
<tr>
<td>July to Sept. 2011</td>
<td></td>
<td>785</td>
<td>7.34 – 8.59</td>
<td>860/670</td>
<td>15.9/25.5</td>
</tr>
<tr>
<td>Jan. to Mar. 2011</td>
<td>116-N-3 (1325-N) Facility</td>
<td>520</td>
<td>7.12 – 8.91</td>
<td>1,040/210</td>
<td>21.5/11.8</td>
</tr>
<tr>
<td>July to Sept. 2011</td>
<td></td>
<td>520</td>
<td>7.12 – 8.91</td>
<td>1,040/670</td>
<td>21.5/25.5</td>
</tr>
<tr>
<td>Apr. to June 2011</td>
<td>216-A-29 Ditch</td>
<td>336</td>
<td>7.46 – 8.79</td>
<td>1,970/240</td>
<td>10.4/15.0</td>
</tr>
<tr>
<td>July to Sept. 2011</td>
<td></td>
<td>336</td>
<td>7.46 – 8.79</td>
<td>1,970/670</td>
<td>10.4/25.5</td>
</tr>
<tr>
<td>Oct. to Dec. 2011</td>
<td></td>
<td>336</td>
<td>7.46 – 8.79</td>
<td>1,970/1620</td>
<td>10.4/28.1</td>
</tr>
</tbody>
</table>
### Table B-2. Upgradient/Downgradient Comparison Values Used for Statistical Comparisons at RCRA Sites, 2011

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Specific Conductance Critical Mean (µS/cm)</th>
<th>pH Critical Range</th>
<th>TOC Critical Mean(^a/b)/LOQ (µg/L)</th>
<th>TOX Critical Mean(^a/)LOQ (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>216-B-63 Trench</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Jan. to Mar. 2011</td>
<td>1,030</td>
<td>7.42 – 8.67</td>
<td>1,000/210</td>
<td>10.9/11.8</td>
</tr>
<tr>
<td>Apr. to June 2011</td>
<td>1,030</td>
<td>7.42 – 8.67</td>
<td>1,000/240</td>
<td>10.9/15.0</td>
</tr>
<tr>
<td>Oct. to Dec. 2011</td>
<td>1,030</td>
<td>7.42 – 8.67</td>
<td>1,000/1620</td>
<td>10.9/28.1</td>
</tr>
<tr>
<td><strong>216-S-10 Pond and Ditch</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Jan. to Mar. 2011</td>
<td>350</td>
<td>6.72 – 8.85</td>
<td>1,510/210</td>
<td>17.6/11.8</td>
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<tr>
<td>Apr. to June 2011</td>
<td>350</td>
<td>6.72 – 8.85</td>
<td>1,510/240</td>
<td>17.6/15.0</td>
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<tr>
<td><strong>LLWMA-1</strong></td>
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<tr>
<td>Jan. to Mar. 2011</td>
<td>1,110</td>
<td>7.43 – 8.57</td>
<td>1,330/210</td>
<td>11.1/11.8</td>
</tr>
<tr>
<td>Apr. to June 2011</td>
<td>1,110</td>
<td>7.43 – 8.57</td>
<td>1,330/240</td>
<td>11.1/15.0</td>
</tr>
<tr>
<td><strong>LLWMA-2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apr. to June 2011</td>
<td>1,460</td>
<td>6.72 – 8.89</td>
<td>2,200/240</td>
<td>37.1/15.0</td>
</tr>
<tr>
<td><strong>LLWMA-3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No statistical comparisons until new baseline is established.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LLWMA-4</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jan. to Mar. 2011</td>
<td>750</td>
<td>7.00 – 8.84</td>
<td>870/210</td>
<td>24.3/11.8</td>
</tr>
<tr>
<td>July to Sept. 2011</td>
<td>750</td>
<td>7.00 – 8.84</td>
<td>870/670</td>
<td>24.3/25.5</td>
</tr>
<tr>
<td>Oct. to Dec. 2011</td>
<td>750</td>
<td>7.00 – 8.84</td>
<td>870/1620</td>
<td>24.3/NA</td>
</tr>
</tbody>
</table>
### Table B-2. Upgradient/Downgradient Comparison Values Used for Statistical Comparisons at RCRA Sites, 2011

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Specific Conductance Critical Mean (µS/cm)</th>
<th>pH Critical Range</th>
<th>TOC Critical Mean$^{a,b}$/LOQ (µg/L)</th>
<th>TOX Critical Mean$^{a}$/LOQ (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan. to Mar. 2011</td>
<td>570</td>
<td>6.95 – 7.66</td>
<td>1,010/210</td>
<td>13.9/11.8</td>
</tr>
<tr>
<td>July to Sept. 2011</td>
<td>570</td>
<td>6.95 – 7.66</td>
<td>1,010/670</td>
<td>13.9/25.5</td>
</tr>
</tbody>
</table>

a. Upgradient/downgradient comparison values (in **bold**) for TOC and TOX are the larger of calculated critical mean value and limit of quantitation for the respective quarter.

b. Reported values rounded to the nearest 10 µg/L.

LOQ = limit of quantitation; based on field blanks collected and analyzed in the previous four quarters

NC = not calculated

NA = no blanks data available

TOC = total organic carbon

TOX = total organic halides
### Table B-3. Monitoring Wells and Constituents for 100-N Area Units

<table>
<thead>
<tr>
<th>Well Number&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Comment</th>
<th>WAC-Compliant</th>
<th>Contamination Indicator Parameters</th>
<th>Other Parameters</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Specific Conductance (Field)</td>
<td>pH (Field)</td>
<td>TOC</td>
</tr>
<tr>
<td>116-N-1 (1301-N) Liquid Waste Disposal Facility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>199-N-105A</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>199-N-2</td>
<td>--</td>
<td>P</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>199-N-3</td>
<td>--</td>
<td>P</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>199-N-34</td>
<td>--</td>
<td>P</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>199-N-57</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>120-N-1 and 120-N-2 (1324-N/NA) Facilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>199-N-71</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>199-N-72</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>199-N-73</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>199-N-77</td>
<td>Bottom of aquifer; no statistics</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>199-N-165</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>116-N-3 (1325-N) Liquid Waste Disposal Facility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>199-N-28</td>
<td>Information only; no statistics</td>
<td>P</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>199-N-32</td>
<td>--</td>
<td>P</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>199-N-41</td>
<td>--</td>
<td>P</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>199-N-74</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>199-N-81</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
</tbody>
</table>

Note: Requirements are from *Groundwater Monitoring Plan for the 1301-N, 1324-N/NA, and 1325-N RCRA Facilities* (PNNL-13914).

Wells completed at the top of the unconfined aquifer unless specified otherwise.

a. **Bold italic** indicates upgradient well.

b. Monitored for the *Atomic Energy Act of 1954*.

- **A** = to be sampled annually
- **C** = well is constructed as a resource protection well in accordance with WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”
- **P** = constructed prior to WAC requirements
- **S** = to be sampled semiannually
- **TOC** = total organic carbon
- **TOX** = total organic halides
### Table B-4. Critical Means for 1301-N (116-N-1) Liquid Waste Disposal Facility for 2012 Comparisons

<table>
<thead>
<tr>
<th>Constituent (units)</th>
<th>n</th>
<th>df</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>CV (%)</th>
<th>t&lt;sub&gt;c&lt;/sub&gt;</th>
<th>Critical Mean</th>
<th>Proportion ND Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>8</td>
<td>7</td>
<td>7.74</td>
<td>0.42</td>
<td>5%</td>
<td>5.41</td>
<td>5.31 - 10.17</td>
<td>0%</td>
</tr>
<tr>
<td>Specific conductance (µS/cm)</td>
<td>8</td>
<td>7</td>
<td>718.34</td>
<td>260.89</td>
<td>36%</td>
<td>5.41</td>
<td>2214.81</td>
<td>0%</td>
</tr>
<tr>
<td>TOC* (µg/L)</td>
<td>8</td>
<td>7</td>
<td>570.19</td>
<td>322.15</td>
<td>56%</td>
<td>5.41</td>
<td>2397.92</td>
<td>13%</td>
</tr>
<tr>
<td>TOX* (µg/L)</td>
<td>8</td>
<td>7</td>
<td>7.29</td>
<td>45.75</td>
<td>45%</td>
<td>5.41</td>
<td>26.12</td>
<td>47%</td>
</tr>
</tbody>
</table>

Note: Based on semiannual sampling events from March 2010 through September 2011.

* Non-detects were imputed using the population of upgradient results to estimate values reported as non-detects. This implicitly assumes that values from all upgradient wells come from the same underlying population.

CV = coefficient of variation  
df = degrees of freedom (n-1)  
n = number of background replicate averages  
t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 20 comparisons  
TOC = total organic carbon  
TOX = total organic halides  
ND = non-detects

### Table B-5. Critical Means for 1324-NA (120-N-1) Percolation Pond and 1324-N (120-N-2) Surface Impoundment for 2012 Comparisons

<table>
<thead>
<tr>
<th>Constituent (unit)</th>
<th>n</th>
<th>df</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>CV (%)</th>
<th>t&lt;sub&gt;c&lt;/sub&gt;</th>
<th>Critical Mean</th>
<th>Proportion ND Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>17</td>
<td>16</td>
<td>8.02</td>
<td>0.10</td>
<td>1%</td>
<td>3.91</td>
<td>7.6 - 8.43</td>
<td>0%</td>
</tr>
<tr>
<td>Specific conductance (µS/cm)</td>
<td>17</td>
<td>16</td>
<td>471.21</td>
<td>28</td>
<td>6%</td>
<td>3.91</td>
<td>584.64</td>
<td>0%</td>
</tr>
<tr>
<td>TOC* (µg/L)</td>
<td>8</td>
<td>7</td>
<td>354.34</td>
<td>58.90</td>
<td>17%</td>
<td>5.20</td>
<td>679.37</td>
<td>0%</td>
</tr>
<tr>
<td>TOX* (µg/L)</td>
<td>8</td>
<td>7</td>
<td>5.20</td>
<td>1.40</td>
<td>27%</td>
<td>5.20</td>
<td>12.93</td>
<td>43%</td>
</tr>
</tbody>
</table>

Note: Based on semiannual sampling events from December 2007 through November 2011.

* Non-detects were imputed using the population of upgradient results to estimate values reported as non-detects. This implicitly assumes that values from all upgradient wells come from the same underlying population.

CV = coefficient of variation  
df = degrees of freedom (n-1)  
n = number of background replicate averages  
t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 16 comparisons  
TOC = total organic carbon  
TOX = total organic halides  
ND = non-detects
Table B-6. Critical Means for 1325-N (116-N-3) Liquid Waste Disposal Facility for 2012 Comparisons

<table>
<thead>
<tr>
<th>Constituent (unit)</th>
<th>n</th>
<th>df</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>CV (%)</th>
<th>t&lt;sub&gt;c&lt;/sub&gt;</th>
<th>Critical Mean</th>
<th>Proportion ND Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>10</td>
<td>9</td>
<td>8.05</td>
<td>0.12</td>
<td>1%</td>
<td>4.62</td>
<td>7.48 - 8.63</td>
<td>0%</td>
</tr>
<tr>
<td>Specific conductance (µS/cm)</td>
<td>10</td>
<td>9</td>
<td>405.20</td>
<td>12.02</td>
<td>3%</td>
<td>4.62</td>
<td>463.45</td>
<td>0%</td>
</tr>
<tr>
<td>TOC* (µg/L)</td>
<td>10</td>
<td>9</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>59%</td>
</tr>
<tr>
<td>TOX* (µg/L)</td>
<td>8</td>
<td>7</td>
<td>5.87</td>
<td>2.33</td>
<td>40%</td>
<td>5.20</td>
<td>18.73</td>
<td>36%</td>
</tr>
</tbody>
</table>

Note: Based on semiannual sampling events from March 2008 through September 2011.

* Non-detects were imputed using the population of upgradient results to estimate values reported as non-detects. This implicitly assumes that values from all upgradient wells come from the same underlying population.

CV  = coefficient of variation  
df  = degrees of freedom (n-1)  
n  = number of background replicate averages  
t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 16 comparisons  
TOC = total organic carbon  
TOX = total organic halides  
ND = non-detects  
NC = not calculated because proportion of non-detects is greater than 50%
Table B-7. Monitoring Wells and Constituents for 183-H (116-H-6) Evaporation Basins

<table>
<thead>
<tr>
<th>Well Number</th>
<th>Comment</th>
<th>WAC-Compliant</th>
<th>Permit-Specified</th>
<th>Other Parameters</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chromium (Filtered)</td>
<td>Nitrate</td>
<td>Te-99*</td>
</tr>
<tr>
<td>199-H4-12A</td>
<td>Extraction well</td>
<td>C</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>199-H4-12C</td>
<td>Extraction well; RUM</td>
<td>C</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>199-H4-3</td>
<td>Extraction well</td>
<td>P</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>199-H4-8</td>
<td>--</td>
<td>C</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
</tbody>
</table>

Notes:
Wells completed at the top of the unconfined aquifer unless specified otherwise.
* Radionuclides not typically subject to RCRA monitoring but included in the current Hanford Facility RCRA Permit (WA7890008967) for this facility.
A = to be sampled annually
C = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”
P = constructed before WAC requirements
### Table B-8. Monitoring Wells and Constituents for 216-A-29 Ditch

<table>
<thead>
<tr>
<th>Well Number</th>
<th>Comment</th>
<th>WAC-Compliant</th>
<th>Contamination Indicator Parameters</th>
<th>Other Parameters</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>299-E25-26</td>
<td>Upper unconfined</td>
<td>C</td>
<td>S S S S</td>
<td>S S A A</td>
<td>No^b</td>
</tr>
<tr>
<td>299-E25-28</td>
<td>Deep unconfined; no statistics</td>
<td>C</td>
<td>A A A A</td>
<td>A A A A</td>
<td>Yes</td>
</tr>
<tr>
<td>299-E25-32P</td>
<td>--</td>
<td>C</td>
<td>S S S S</td>
<td>S S A A</td>
<td>Yes</td>
</tr>
<tr>
<td>299-E25-35</td>
<td>--</td>
<td>C</td>
<td>S S S S</td>
<td>S S A A</td>
<td>Yes</td>
</tr>
<tr>
<td>299-E25-48</td>
<td>--</td>
<td>C</td>
<td>S S S S</td>
<td>S S A A</td>
<td>Yes</td>
</tr>
<tr>
<td>299-E26-12</td>
<td>--</td>
<td>C</td>
<td>A A A A</td>
<td>A A A A</td>
<td>Yes</td>
</tr>
<tr>
<td>299-E26-13</td>
<td>--</td>
<td>C</td>
<td>S S S S</td>
<td>S S A A</td>
<td>Yes</td>
</tr>
<tr>
<td>699-43-45</td>
<td>--</td>
<td>C</td>
<td>S S S S</td>
<td>S S A A</td>
<td>Yes</td>
</tr>
</tbody>
</table>


Wells completed at the top of the unconfined aquifer unless specified otherwise.

- **a.** Upgradient well(s) are noted in *bold italic*.
- **b.** Well was not sampled for the year due to maintenance and pump issues (2 sample events missed).

- **A** = to be sampled annually
- **C** = well is constructed as a resource protection well in accordance with WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”
- **S** = to be sampled semiannually
- **TOC** = total organic carbon
- **TOX** = total organic halides
### Table B-9. Critical Means for 216-A-29 Ditch for 2012 Comparisons

<table>
<thead>
<tr>
<th>Constituent (unit)</th>
<th>n</th>
<th>df</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>CV (%)</th>
<th>tc</th>
<th>Critical Mean</th>
<th>Proportion ND Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>12</td>
<td>11</td>
<td>8.20</td>
<td>0.13</td>
<td>2%</td>
<td>4.72</td>
<td>7.58 - 8.82</td>
<td>0%</td>
</tr>
<tr>
<td>Specific conductance (µS/cm)</td>
<td>12</td>
<td>11</td>
<td>270.23</td>
<td>23.67</td>
<td>9%</td>
<td>4.72</td>
<td>386.63</td>
<td>0%</td>
</tr>
<tr>
<td>TOC* (µg/L)</td>
<td>12</td>
<td>11</td>
<td>301.61</td>
<td>73.65</td>
<td>24%</td>
<td>4.72</td>
<td>663.75</td>
<td>49%</td>
</tr>
<tr>
<td>TOX* (µg/L)</td>
<td>12</td>
<td>11</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>63%</td>
</tr>
</tbody>
</table>

Note: Based on semiannual sampling events from January 2010 through November 2011.

* Non-detects were imputed using the population of upgradient results to estimate values reported as non-detects. This implicitly assumes that values from all upgradient wells come from the same underlying population.

CV = coefficient of variation

df = degrees of freedom (n-1)

n = number of background replicate averages

$t_c$ = Bonferroni critical t-value for appropriate df and 32 comparisons

TOC = total organic carbon

TOX = total organic halides

ND = non-detects

NC = not calculated because proportion non-detects is greater than 50%
# Table B-10. Monitoring Wells and Constituents for 216-A-36B Crib

<table>
<thead>
<tr>
<th>Well Number&lt;sup&gt;a&lt;/sup&gt;</th>
<th>WAC-Compliant</th>
<th>Other Field Parameters</th>
<th>Indicator Parameters</th>
<th>Supporting Constituents</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Temperature, Turbidity, Water Levels</td>
<td>Specific Conductance, pH, TOC, TOX</td>
<td>Anions&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Metals&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>299-E17-14</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>299-E17-16</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>299-E17-18</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>299-E17-19</td>
<td>C</td>
<td>Q</td>
<td>Q&lt;sup&gt;e&lt;/sup&gt;</td>
<td>A</td>
<td>A</td>
</tr>
</tbody>
</table>

Note:
2. Wells completed at the top of the unconfined aquifer unless specified otherwise.
   a. *Bold italic* indicates upgradient well.
   b. Anions analysis includes, at a minimum, nitrate and the groundwater quality parameters chloride and sulfate.
   c. Metals analysis includes, at a minimum, calcium, magnesium, potassium, and sodium, as well as the groundwater quality parameters iron and manganese.
   d. Samples analyzed for VOCs for one year (two sampling events).
   e. Quadruplicate replicates collected during each sampling event.

A = to be sampled annually  
C = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”  
Q = to be sampled quarterly  
S = to be sampled semianually  
TOC = total organic carbon  
TOX = total organic halides
### Table B-11. Critical Means for 216-A-36B Crib for CY 2012 Comparisons

<table>
<thead>
<tr>
<th>Constituent (unit)</th>
<th>n</th>
<th>df</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>CV (%)</th>
<th>tc</th>
<th>Critical Mean</th>
<th>Proportion ND Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>12</td>
<td>11</td>
<td>7.92</td>
<td>0.06</td>
<td>1%</td>
<td>4.30</td>
<td>7.64 - 8.19</td>
<td>0%</td>
</tr>
<tr>
<td>Specific conductance (µS/cm)</td>
<td>12</td>
<td>11</td>
<td>574.90</td>
<td>49.07</td>
<td>9%</td>
<td>4.30</td>
<td>794.64</td>
<td>0%</td>
</tr>
<tr>
<td>TOC* (µg/L)</td>
<td>4</td>
<td>3</td>
<td>182.49</td>
<td>96.78</td>
<td>53%</td>
<td>11.98</td>
<td>1479.15</td>
<td>25%</td>
</tr>
<tr>
<td>TOX* (µg/L)</td>
<td>3</td>
<td>2</td>
<td>5.06</td>
<td>1.98</td>
<td>39%</td>
<td>28.26</td>
<td>69.82</td>
<td>50%</td>
</tr>
</tbody>
</table>

Note: Based on quarterly sampling events from April 2007 through October 2011.

* Non-detects were imputed using the population of upgradient results to estimate values reported as non-detects. This implicitly assumes that values from all upgradient wells come from the same underlying population.

CV = coefficient of variation
df = degrees of freedom (n-1)
n = number of background replicate averages
tc = Bonferroni critical t-value for appropriate df and 16 comparisons
TOC = total organic carbon
TOX = total organic halides
ND = non-detects
## Table B-12. Monitoring Wells and Constituents for 216-A-37-1 Crib

<table>
<thead>
<tr>
<th>Well Number</th>
<th>WAC-Compliant</th>
<th>Other Field Parameters</th>
<th>Indicator Parameters</th>
<th>Supporting Constituents</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Temperature, Turbidity, Water Levels</td>
<td>Specific Conductance, pH, TOC, TOX</td>
<td>Anions</td>
<td>Metals</td>
</tr>
<tr>
<td>299-E25-17</td>
<td>P</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>299-E25-19</td>
<td>P</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>299-E25-20</td>
<td>P</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>299-E25-47</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
</tr>
</tbody>
</table>

Notes:
- Wells completed at the top of the unconfined aquifer unless specified otherwise.
- **Bold italic** indicates upgradient well.
- Anions analysis includes, at a minimum, nitrate and the groundwater quality parameters chloride and sulfate.
- Metals analysis includes, at a minimum, calcium, magnesium, potassium, and sodium, as well as the groundwater quality parameters iron and manganese.
- Samples analyzed for VOCs for one year (two sampling events).
- Quadruplicate replicates collected during each sampling event.
- A = to be sampled annually
- C = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”
- P = constructed before WAC requirements
- Q = to be sampled quarterly
- S = to be sampled semiannually
- VOC = volatile organic compounds
- TOC = total organic carbon
- TOX = total organic halides
### Table B-13. Critical Means for 216-A-37-1 Crib for 2012 Comparisons

<table>
<thead>
<tr>
<th>Constituent (unit)</th>
<th>n</th>
<th>df</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>CV (%)</th>
<th>tc</th>
<th>Critical Mean</th>
<th>Proportion ND Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>4</td>
<td>3</td>
<td>8.39</td>
<td>0.06</td>
<td>1%</td>
<td></td>
<td>11.98</td>
<td>7.63 - 9.16</td>
</tr>
<tr>
<td>Specific conductance (µS/cm)</td>
<td>4</td>
<td>3</td>
<td>419.44</td>
<td>15.95</td>
<td>4%</td>
<td></td>
<td>11.98</td>
<td>633.15</td>
</tr>
<tr>
<td>TOC* (µg/L)</td>
<td>3</td>
<td>2</td>
<td>321.11</td>
<td>94.43</td>
<td>29%</td>
<td></td>
<td>28.26</td>
<td>3402.39</td>
</tr>
<tr>
<td>TOX* (µg/L)</td>
<td>4</td>
<td>3</td>
<td>5.31</td>
<td>2.06</td>
<td>39%</td>
<td></td>
<td>11.98</td>
<td>32.92</td>
</tr>
</tbody>
</table>

Note: Based on quarterly sampling events from March through October 2011.

* Non-detects were imputed using the population of upgradient results to estimate values reported as non-detects. This implicitly assumes that values from all upgradient wells come from the same underlying population.

CV = coefficient of variation

df = degrees of freedom (n-1)

n = number of background replicate averages

tc = Bonferroni critical t-value for appropriate df and 16 comparisons

TOC = total organic carbon

TOX = total organic halides

ND = non-detects

### Table B-14. Monitoring Wells and Constituents for 216-B-3 Pond

<table>
<thead>
<tr>
<th>Well Number</th>
<th>Comment</th>
<th>WAC-Compliant</th>
<th>Contamination Indicator Parameters</th>
<th>Other Parameters</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>699-42-42B</td>
<td>Bottom of aquifer</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>699-43-44</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>699-43-45</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>699-44-39B</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
</tbody>
</table>

Note: Requirements are from Interim Status Groundwater Monitoring Plan for the 216-B-3 Pond (DOE/RL-2008-59).

Wells completed at the top of the unconfined aquifer, unless specified otherwise.

a. Upgradient well noted by bold italic.


A = to be sampled annually

C = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”

S = to be sampled semiannually

TOC = total organic carbon

TOX = total organic halides
### Table B-15. Critical Means for 216-B-3 Pond for 2012 Comparisons

<table>
<thead>
<tr>
<th>Constituent (unit)</th>
<th>n</th>
<th>df</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>CV (%)</th>
<th>t_c</th>
<th>Critical Mean</th>
<th>Proportion ND Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>8</td>
<td>7</td>
<td>8.05</td>
<td>0.12</td>
<td>2%</td>
<td>5.20</td>
<td>7.38 - 8.72</td>
<td>0%</td>
</tr>
<tr>
<td>Specific conductance (µS/cm)</td>
<td>8</td>
<td>7</td>
<td>269.97</td>
<td>0.12</td>
<td>0%</td>
<td>5.20</td>
<td>344.18</td>
<td>0%</td>
</tr>
<tr>
<td>TOC* (µg/L)</td>
<td>8</td>
<td>7</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>63%</td>
</tr>
<tr>
<td>TOX* (µg/L)</td>
<td>8</td>
<td>7</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>78%</td>
</tr>
</tbody>
</table>

Note: Based on semiannual sampling events from January 2008 through November 2011.

* Non-detects were imputed using the population of upgradient results to estimate values reported as non-detects. This implicitly assumes that values from all upgradient wells come from the same underlying population.

\[ CV = \text{coefficient of variation} \]
\[ df = \text{degrees of freedom (n-1)} \]
\[ n = \text{number of background replicate averages} \]
\[ t_c = \text{Bonferroni critical t-value for appropriate df and 16 comparisons} \]
\[ TOC = \text{total organic carbon} \]
\[ TOX = \text{total organic halides} \]
\[ ND = \text{non-detects} \]
\[ NC = \text{not calculated because proportion non-detects is greater than 50%} \]
Table B-16. Monitoring Wells and Constituents for 216-B-63 Trench

<table>
<thead>
<tr>
<th>Well Number</th>
<th>WAC-Compliant</th>
<th>Contamination Indicator Parameters</th>
<th>Other Parameters</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Specific Conductance (Field)</td>
<td>pH (Field)</td>
<td>TOC</td>
</tr>
<tr>
<td>299-E27-11</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-E27-16</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-E27-17</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-E27-18</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-E27-19</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-E33-37</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-E34-10</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
</tbody>
</table>

Notes: Requirements are from *Interim Status Groundwater Monitoring Plan for the 216-B-63 Trench* (DOE/RL-2008-60).

Wells completed at the top of the unconfined aquifer, unless specified otherwise.

* Monitored for the *Atomic Energy Act of 1954*.

- **A** = to be sampled annually
- **C** = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”
- **S** = to be sampled semiannually
- **TOC** = total organic carbon
- **TOX** = total organic halides
Table B-17. Critical Means for 216-B-63 Trench for 2012 Comparisons

<table>
<thead>
<tr>
<th>Constituent</th>
<th>N</th>
<th>df</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>CV (%)</th>
<th>t_c</th>
<th>Critical Mean</th>
<th>Proportion ND Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>21</td>
<td>20</td>
<td>8.06</td>
<td>0.10</td>
<td>1%</td>
<td>4.22</td>
<td>7.61 - 8.51</td>
<td>0%</td>
</tr>
<tr>
<td>Specific conductance (µS/cm)</td>
<td>20</td>
<td>19</td>
<td>526.06</td>
<td>142.94</td>
<td>27%</td>
<td>4.27</td>
<td>1151.04</td>
<td>0%</td>
</tr>
<tr>
<td>TOC* (µg/L)</td>
<td>20</td>
<td>19</td>
<td>359.03</td>
<td>145.58</td>
<td>41%</td>
<td>4.27</td>
<td>995.56</td>
<td>23%</td>
</tr>
<tr>
<td>TOX* (µg/L)</td>
<td>20</td>
<td>19</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>57%</td>
</tr>
</tbody>
</table>

Note: Based on semiannual sampling events from April 2010 through November 2011.

* Non-detects were imputed using the population of upgradient results to estimate values reported as non-detects. This implicitly assumes that values from all upgradient wells come from the same underlying population.

CV = coefficient of variation

df = degrees of freedom (n-1)

n = number of background replicate averages

t_c = Bonferroni critical t-value for appropriate df and 48 comparisons

TOC = total organic carbon

TOX = total organic halides

ND = non-detects

NC = not calculated because proportion non-detects is greater than 50%
<table>
<thead>
<tr>
<th>Well Number</th>
<th>Comment</th>
<th>WAC-Compliant</th>
<th>Specific Conductance (Field)</th>
<th>pH (Field)</th>
<th>TOC</th>
<th>TOX</th>
<th>Alkalinity</th>
<th>Anions</th>
<th>Carbon Tetrachloride</th>
<th>Chloroform</th>
<th>Hexavalent Chromium</th>
<th>Metals</th>
<th>Phenols</th>
<th>Mercury</th>
<th>Sampled as Scheduled During 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>299-W26-13</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>299-W26-14</td>
<td>--</td>
<td>C</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>299-W27-2</td>
<td>Bottom of aquifer; no statistics</td>
<td>C</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>699-32-76</td>
<td></td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>699-33-75</td>
<td></td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>699-33-76</strong></td>
<td>Quarterly samples – TOC, TOX^b</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Requirements are from Interim Status Groundwater Monitoring Plan for the 216-S-10 Pond and Ditch (DOE/RL-2008-61).

Wells completed at the top of the unconfined aquifer, unless specified otherwise.

a. Upgradient well noted by **bold italic**.

b. Quarterly samples collected for TOC and TOX for obtaining baseline conditions.

Routine monitoring frequency will be semiannual as shown.

A = to be sampled annually
C = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”
S = to be sampled semiannually
TOC = total organic carbon
TOX = total organic halides
### Table B-19. Critical Means for 216-S-10 Pond and Ditch for 2012 Comparisons

<table>
<thead>
<tr>
<th>Constituent (unit)</th>
<th>n</th>
<th>df</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>CV (%)</th>
<th>t_c</th>
<th>Critical Mean</th>
<th>Proportion ND Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>8</td>
<td>7</td>
<td>7.76</td>
<td>0.07</td>
<td>1%</td>
<td>5.41</td>
<td>7.36 - 8.16</td>
<td>0%</td>
</tr>
<tr>
<td>Specific conductance (µS/cm)</td>
<td>8</td>
<td>7</td>
<td>291.75</td>
<td>3.97</td>
<td>1%</td>
<td>5.41</td>
<td>314.54</td>
<td>0%</td>
</tr>
<tr>
<td>TOC* (µg/L)</td>
<td>8</td>
<td>7</td>
<td>240.59</td>
<td>130.08</td>
<td>54%</td>
<td>5.41</td>
<td>986.72</td>
<td>50%</td>
</tr>
<tr>
<td>TOX* (µg/L)</td>
<td>8</td>
<td>7</td>
<td>6.02</td>
<td>2.76</td>
<td>46%</td>
<td>5.41</td>
<td>21.85</td>
<td>41%</td>
</tr>
</tbody>
</table>

Note: Based on sampling events from March 2010 through December 2011.

* Non-detects were imputed using the population of upgradient results to estimate values reported as non-detects. This implicitly assumes that values from all upgradient wells come from the same underlying population.

CV = coefficient of variation  
df = degrees of freedom (n-1)  
n = number of background replicate averages  
t_c = Bonferroni critical t-value for appropriate df and 20 comparisons  
TOC = total organic carbon  
TOX = total organic halides  
ND = non-detects
## Table B-20. Monitoring Wells and Constituents for 316-5 Process Trenches

<table>
<thead>
<tr>
<th>Well Number</th>
<th>Comment</th>
<th>WAC-Compliant</th>
<th>cis-1,2-Dichloroethene</th>
<th>Tetrachloroethene</th>
<th>Trichloroethene</th>
<th>Uraniuma</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>399-1-10A</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>Yes</td>
</tr>
<tr>
<td>399-1-10B</td>
<td>Lower unconfined</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>Yes</td>
</tr>
<tr>
<td>399-1-16A</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>Yes</td>
</tr>
<tr>
<td>399-1-16B</td>
<td>Lower unconfined</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>Missed 1 month</td>
</tr>
<tr>
<td>399-1-17A</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>Yes</td>
</tr>
<tr>
<td>399-1-17B</td>
<td>Lower unconfined</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>Missed 2 months</td>
</tr>
<tr>
<td>399-1-18A</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>Yes</td>
</tr>
<tr>
<td>399-1-18B</td>
<td>Lower unconfined</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>Missed 2 months</td>
</tr>
</tbody>
</table>

Notes:

Requirements are from *Groundwater Monitoring Plan for the 300 Area Process Trenches* (WHC-SD-EN-AP-185).

2. Wells completed at the top of the unconfined aquifer unless specified otherwise.

a. Radionuclides are not typically subject to RCRA monitoring, but included in the current Hanford Facility RCRA Permit (WA7890008967, *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste*) for this facility.

C = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”

S = to be sampled four times semiannually (8 months)
<table>
<thead>
<tr>
<th>Well Number</th>
<th>WAC-Compliant</th>
<th>Indicator Parameters</th>
<th>Other Parameters</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>299-E17-22</td>
<td>C</td>
<td>A A A A A A A A A</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>299-E17-23</td>
<td>C</td>
<td>A A A A A A A A A</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>299-E17-25</td>
<td>C</td>
<td>A A A A A A A A A</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>299-E17-26</td>
<td>C</td>
<td>A A A A A A A A A</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>299-E18-1</td>
<td>C</td>
<td>A A A A A A A A A</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>299-E24-21</td>
<td>C</td>
<td>A A A A A A A A A</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>299-E24-24</td>
<td>C</td>
<td>A A A A A A A A A</td>
<td>A</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Notes:
Wells completed at the top of the unconfined aquifer unless specified otherwise.

a. **Bold italic** indicates upgradient well.
b. Operational parameters are monitored for DOE O 435.1, Radioactive Waste Management.
c. The sample frequency on all samples was changed to annually with the approval of Ecology starting in 2011.

C = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”
TOC = total organic carbon
TOX = total organic halides
### Table B-22. Monitoring Wells and Constituents for Liquid Effluent Retention Facility

<table>
<thead>
<tr>
<th>Well Number</th>
<th>WAC-Compliant</th>
<th>Alkalinity</th>
<th>A Phosphate</th>
<th>Anions</th>
<th>A Nitrate</th>
<th>Anions</th>
<th>A Chrome</th>
<th>A Copper</th>
<th>A Iron</th>
<th>Phenols</th>
<th>VOA</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>299-E26-10</td>
<td>C</td>
<td>A</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>S</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>299-E26-11</strong></td>
<td>C</td>
<td>A</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>S</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>299-E26-14c</td>
<td>C</td>
<td>A</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>S</td>
<td></td>
<td>New well not sampled in 2011</td>
<td></td>
<td></td>
</tr>
<tr>
<td>299-E26-77</td>
<td>C</td>
<td>A</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>S</td>
<td>Yes</td>
<td></td>
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</tr>
<tr>
<td>299-E26-79</td>
<td>C</td>
<td>A</td>
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<td>S</td>
<td>Yes</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: Requirements are from *Interim Status Groundwater Monitoring Plan for the 200 East Area Liquid Effluent Retention Facility* (WHC-SD-EN-AP-024).

Wells completed at the top of the unconfined aquifer unless specified otherwise.

a. **Bold italic** indicates upgradient well.

b. Monitored for the *Atomic Energy Act of 1954*.

c. Well 299-E26-14 was constructed in September 2011 and will be sampled in 2012 for the same analytes as the other wells and will be evaluated for inclusion in the monitoring well network.

- A = to be sampled annually
- C = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”
- S = to be sampled semiannually
- VOA = volatile organic analysis
<table>
<thead>
<tr>
<th>Well Name&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Purpose</th>
<th>WAC Compliant</th>
<th>Water Level&lt;sup&gt;b&lt;/sup&gt;</th>
<th>pH&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Specific Conductance&lt;sup&gt;d&lt;/sup&gt;</th>
<th>TOC</th>
<th>TOX</th>
<th>Chloride</th>
<th>Sulfate</th>
<th>Phenols</th>
<th>Metals, Unfiltered, Filtered&lt;sup&gt;e&lt;/sup&gt;</th>
<th>Supporting Constituents&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>299-E28-26</td>
<td>Upgradient</td>
<td>Y</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
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<tr>
<td>299-E28-27</td>
<td>Upgradient</td>
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<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
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<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-E28-28</td>
<td>Upgradient</td>
<td>Y</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-E32-2</td>
<td>Downgradient</td>
<td>Y</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>S</td>
<td>S</td>
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</tr>
<tr>
<td>299-E32-3</td>
<td>Downgradient</td>
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<td>S</td>
<td>S</td>
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<td>A</td>
<td>S</td>
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</tr>
<tr>
<td>299-E32-4</td>
<td>Cross-gradient</td>
<td>Y</td>
<td>S</td>
<td>S</td>
<td>S</td>
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<td>A</td>
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<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-E32-5</td>
<td>Downgradient</td>
<td>Y</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>S</td>
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<td>299-E32-6</td>
<td>Downgradient</td>
<td>Y</td>
<td>S</td>
<td>S</td>
<td>S</td>
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<td>S</td>
<td>S</td>
<td>A</td>
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<td>S</td>
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<td>299-E32-7</td>
<td>Downgradient</td>
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<td>S</td>
<td>A</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-E32-8</td>
<td>Downgradient</td>
<td>Y</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-E32-9</td>
<td>Downgradient</td>
<td>Y</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-E32-10</td>
<td>Downgradient</td>
<td>Y</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-E33-28</td>
<td>Upgradient</td>
<td>Y</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
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<tr>
<td>299-E33-29</td>
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<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Well Namea</td>
<td>Purpose</td>
<td>WAC Compliant</td>
<td>Water Levelb</td>
<td>pHd</td>
<td>Specific Conductanceb</td>
<td>TOC</td>
<td>TOX</td>
<td>Chloride</td>
<td>Sulfate</td>
<td>Phenols</td>
<td>Iron</td>
<td>Manganese</td>
<td>Sodium</td>
</tr>
<tr>
<td>------------</td>
<td>---------</td>
<td>--------------</td>
<td>--------------</td>
<td>-----</td>
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<td>---------</td>
<td>------</td>
<td>------------</td>
<td>--------</td>
</tr>
<tr>
<td>299-E33-34</td>
<td>Downgradient</td>
<td>Y</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>S</td>
<td>S</td>
<td>S</td>
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<tr>
<td>299-E33-35</td>
<td>Upgradient</td>
<td>Y</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
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</tr>
<tr>
<td>299-E33-265</td>
<td>Downgradient</td>
<td>Y</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>S</td>
<td>S</td>
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</tr>
<tr>
<td>299-E33-266</td>
<td>Downgradient</td>
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<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
</tbody>
</table>

**Table B-23. Monitoring Wells and Constituents for Low-Level Waste Management Area 1**

Note: Requirements are from *Interim Status Groundwater Monitoring Plan for LLBG WMA-1* (DOE/RL-2009-75).

a. Upgradient wells are noted in *bold italic*.

b. Constituents and parameters are required by 40 CFR 265.92, “Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities,” “Sampling and Analysis.”

c. Constituents not required by RCRA but used for geochemical support.

d. Field measurement.

e. For anions, analytes include chloride, fluoride, nitrate, nitrite, and sulfate. For metals, analytes include (but are not limited to) calcium, chromium, iron, manganese, potassium, and sodium.

A = to be sampled annually

RCRA = *Resource Conservation and Recovery Act of 1976*

S = to be sampled semiannually

TOC = total organic carbon

TOX = total organic halides

Y = well is constructed in accordance with WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells,” requirements
### Table B-24. Critical Means for Low-Level Waste Management Area 1 for 2012 Comparisons

<table>
<thead>
<tr>
<th>Constituent (unit)</th>
<th>n</th>
<th>df</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>CV (%)</th>
<th>tc</th>
<th>Critical Mean</th>
<th>Proportion ND Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>26</td>
<td>25</td>
<td>8.03</td>
<td>0.14</td>
<td>2%</td>
<td>4.20</td>
<td>7.42 - 8.64</td>
<td>0%</td>
</tr>
<tr>
<td>Specific conductance (µS/cm)</td>
<td>26</td>
<td>25</td>
<td>595.99</td>
<td>165.76</td>
<td>28%</td>
<td>4.20</td>
<td>1305.87</td>
<td>0%</td>
</tr>
<tr>
<td>TOC* (µg/L)</td>
<td>26</td>
<td>25</td>
<td>234.55</td>
<td>82.25</td>
<td>35%</td>
<td>4.20</td>
<td>586.79</td>
<td>41%</td>
</tr>
<tr>
<td>TOX* (µg/L)</td>
<td>26</td>
<td>25</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>73%</td>
</tr>
</tbody>
</table>

Note: Based on semiannual sampling events from January 2010 through December 2011.

* Non-detects were imputed using the population of upgradient results to estimate values reported as non-detects. This implicitly assumes that values from all upgradient wells come from the same underlying population.

CV = coefficient of variation

df = degrees of freedom (n-1)

n = number of background replicate averages

\( t_c \) = Bonferroni critical t-value for appropriate df and 68 comparisons

TOC = total organic carbon

TOX = total organic halides

ND = non-detects

NC = not calculated because proportion non-detects is greater than 50%
Table B-25. Monitoring Wells and Constituents for Low-Level Waste Management Area 2

<table>
<thead>
<tr>
<th>Well Name</th>
<th>Purpose</th>
<th>WAC Compliant</th>
<th>Water Level</th>
<th>pH</th>
<th>Specific Conductance</th>
<th>TOC</th>
<th>TOX</th>
<th>Chloride</th>
<th>Sulfate</th>
<th>Phenols</th>
<th>Iron</th>
<th>Manganese</th>
<th>Sodium</th>
<th>Alkalinity</th>
<th>Dissolved Oxygen</th>
<th>Temperature</th>
<th>Turbidity</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>299-E27-8</td>
<td>Downgradient</td>
<td>Y</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
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<td>S</td>
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<td>S</td>
<td>S</td>
<td>S</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>299-E27-9</td>
<td>Downgradient</td>
<td>Y</td>
<td>S</td>
<td>S</td>
<td>S</td>
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<td>A</td>
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<td>S</td>
<td>S</td>
<td>Yes</td>
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</tr>
<tr>
<td>299-E27-10</td>
<td>Cross-gradient</td>
<td>Y</td>
<td>S</td>
<td>S</td>
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<td>S</td>
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<td>A</td>
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<td>S</td>
<td>S</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>299-E27-11</td>
<td>Downgradient</td>
<td>Y</td>
<td>S</td>
<td>S</td>
<td>S</td>
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<td>S</td>
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<td>Yes</td>
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<tr>
<td>299-E27-17</td>
<td>Downgradient</td>
<td>Y</td>
<td>S</td>
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<td>299-E34-2</td>
<td>Downgradient</td>
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<td>S</td>
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<tr>
<td>299-E34-9</td>
<td>Downgradient</td>
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<td>S</td>
<td>S</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>299-E34-10</td>
<td>Downgradient</td>
<td>Y</td>
<td>S</td>
<td>S</td>
<td>S</td>
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<tr>
<td>299-E34-12</td>
<td>Downgradient</td>
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<td>S</td>
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</tbody>
</table>
Table B-25. Monitoring Wells and Constituents for Low-Level Waste Management Area 2

<table>
<thead>
<tr>
<th>Well Name</th>
<th>Purpose</th>
<th>WAC Compliant</th>
<th>Water Level</th>
<th>pH</th>
<th>Specific Conductance</th>
<th>TOC</th>
<th>TOX</th>
<th>Chloride</th>
<th>Sulfate</th>
<th>Phenols</th>
<th>Iron</th>
<th>Manganese</th>
<th>Sodium</th>
<th>Alkalinity</th>
<th>Dissolved Oxygen</th>
<th>Temperature</th>
<th>Turbidity</th>
<th>Sampled as Scheduled in 2011</th>
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</table>

**RCRA Required Constituents**

<table>
<thead>
<tr>
<th>Contaminant Indicator Parameters</th>
<th>Groundwater Quality Parameters</th>
<th>Metals, Unfiltered, Filtered</th>
<th>Supporting Constituents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anions<strong>d</strong></td>
<td></td>
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</tr>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Note:** Requirements are from *Interim Status Groundwater Monitoring Plan for LLBG WMA-2* (DOE/RL-2009-76).

a. Constituents and parameters are required by 40 CFR 265.92, “Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities,” “Sampling and Analysis.”

b. Constituents not required by RCRA but needed to support interpretation.

c. Field measurement.

d. For anions, analytes include chloride, fluoride, nitrate, nitrite, and sulfate. For metals, analytes include (but are not limited to) calcium, chromium, iron, manganese, potassium, and sodium.

A = to be sampled annually

RCRA = *Resource Conservation and Recovery Act of 1976*

S = to be sampled semiannually

TOC = total organic carbon

TOX = total organic halides

Y = well is constructed in accordance with requirements of WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells.”
### Table B-26. Critical Means for Low-Level Waste Management Area 2 for 2012 Comparisons

<table>
<thead>
<tr>
<th>Constituent (unit)</th>
<th>n</th>
<th>df</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>CV (%)</th>
<th>tc</th>
<th>Critical Mean</th>
<th>Proportion ND Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>9</td>
<td>8</td>
<td>7.78</td>
<td>0.17</td>
<td>2%</td>
<td>5.53</td>
<td>6.82 - 8.75</td>
<td>0%</td>
</tr>
<tr>
<td>Specific conductance (µS/cm)</td>
<td>9</td>
<td>8</td>
<td>1069.86</td>
<td>55.92</td>
<td>5%</td>
<td>5.53</td>
<td>1395.68</td>
<td>0%</td>
</tr>
<tr>
<td>TOC* (µg/L)</td>
<td>8</td>
<td>7</td>
<td>728.34</td>
<td>185.71</td>
<td>25%</td>
<td>5.98</td>
<td>1905.43</td>
<td>0%</td>
</tr>
<tr>
<td>TOX* (µg/L)</td>
<td>7</td>
<td>6</td>
<td>5.66</td>
<td>0.64</td>
<td>11%</td>
<td>6.66</td>
<td>10.19</td>
<td>28%</td>
</tr>
</tbody>
</table>

Note: Based on semiannual sampling events from January 2010 through November 2011.

* Non-detects were imputed using the population of upgradient results to estimate values reported as non-detects. This implicitly assumes that values from all upgradient wells come from the same underlying population.

CV  = coefficient of variation

df  = degrees of freedom (n-1)

n  = number of background replicate averages

tc  = Bonferroni critical t-value for appropriate df and 36 comparisons

TOC = total organic carbon

TOX = total organic halides

ND  = non-detects

### Table B-27. Monitoring Wells and Constituents for Low-Level Waste Management Area 3

<table>
<thead>
<tr>
<th>Well Number</th>
<th>WAC-Compliant</th>
<th>pH (Field)</th>
<th>Specific Conductance (Field)</th>
<th>TOC</th>
<th>TOX</th>
<th>Alkalinity</th>
<th>Anions</th>
<th>Metals</th>
<th>Phenols</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>299-W7-4</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>No*</td>
</tr>
<tr>
<td>299-W10-29</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>299-W10-30</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>299-W10-31</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Notes:

Requirements are from *Interim Status Groundwater Monitoring Plan for the LLBG WMA-3* (DOE/RL-2009-68).

Wells completed at the top of the unconfined aquifer unless specified otherwise.

* Well 299-W7-4 went dry in 2011.

A  = to be sampled annually

C  = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”

S  = to be sampled semiannually

TOC = total organic carbon

TOX = total organic halides
Table B-28. Indicator Parameter Averages for 2010 and 2011 at LLWMA-3 Downgradient Wells

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>299-W10-29</td>
<td>7.91</td>
<td>7.91</td>
<td>386</td>
<td>384</td>
<td>436</td>
<td>1,766</td>
<td>19.1</td>
<td>22.7</td>
</tr>
<tr>
<td>299-W10-30</td>
<td>7.76</td>
<td>7.84</td>
<td>419</td>
<td>419</td>
<td>1,696</td>
<td>2,059</td>
<td>10.7</td>
<td>9.2</td>
</tr>
<tr>
<td>299-W10-31</td>
<td>7.84</td>
<td>8.01</td>
<td>596</td>
<td>504</td>
<td>615</td>
<td>463</td>
<td>36.0</td>
<td>50.0</td>
</tr>
</tbody>
</table>


Table B-29. Monitoring Wells and Constituents for Low-Level Waste Management Area 4

<table>
<thead>
<tr>
<th>Well Number</th>
<th>Comment</th>
<th>WAC Compliant</th>
<th>Contamination Indicator Parameters</th>
<th>Other Chemical Parameters</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>pH (Field)</td>
<td>Specific Conductance (Field) TOC TOX Alkalinity Anions Metals Phenols</td>
<td></td>
<td></td>
</tr>
<tr>
<td>299-W15-17</td>
<td>Deep unconfined; no statistics</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-W15-30</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-W15-83</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-W15-94</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-W15-152</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-W15-224</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-W18-21</td>
<td>Went dry in mid-2010</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-W18-22</td>
<td>Deep unconfined; no statistics</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
</tbody>
</table>

Notes:
Requirements are from *Interim Status Groundwater Monitoring Plan for the LLBG WMA-4* (DOE/RL-2009-69).

Wells completed at the top of the unconfined aquifer unless specified otherwise.

a. *Bold italic* indicates upgradient well.
b. Well 299-W15-224 was not sampled in July as scheduled due to electrical problems with the well pump.
c. Well 299-W18-21 was not sampled in 2011 as it went dry in July 2010.

A = to be sampled annually
C = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”
S = to be sampled semiannually
TOC = total organic carbon
TOX = total organic halides
### Table B-30. Critical Means for Low-Level Waste Management Area 4 for 2012 Comparisons

<table>
<thead>
<tr>
<th>Constituent (unit)</th>
<th>n</th>
<th>df</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>CV (%)</th>
<th>( t_c )</th>
<th>Critical Mean</th>
<th>Proportion ND Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>11</td>
<td>10</td>
<td>7.86</td>
<td>0.09</td>
<td>1%</td>
<td>4.98</td>
<td>7.38 - 8.34</td>
<td>0%</td>
</tr>
<tr>
<td>Specific conductance (( \mu \text{S/cm} ))</td>
<td>11</td>
<td>10</td>
<td>430.09</td>
<td>73.12</td>
<td>17%</td>
<td>4.98</td>
<td>810.24</td>
<td>0%</td>
</tr>
<tr>
<td>TOC* (( \mu \text{g/L} ))</td>
<td>9</td>
<td>8</td>
<td>259.48</td>
<td>75.07</td>
<td>29%</td>
<td>5.53</td>
<td>696.88</td>
<td>28%</td>
</tr>
<tr>
<td>TOX* (( \mu \text{g/L} ))</td>
<td>9</td>
<td>8</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>64%</td>
</tr>
</tbody>
</table>

Note: Based on semiannual sampling events from February 2009 through November 2011.

* Non-detects were imputed using the population of upgradient results to estimate values reported as non-detects. This implicitly assumes that values from all upgradient wells come from the same underlying population.

\( CV \) = coefficient of variation
\( df \) = degrees of freedom (n-1)
\( n \) = number of background replicate averages
\( t_c \) = Bonferroni critical t-value for appropriate \( df \) and 36 comparisons

TOC = total organic carbon
TOX = total organic halides
ND = non-detects
NC = not calculated because proportion non-detects is greater than 50%

---

### Table B-31. Indicator Parameter Averages for 2010 and 2011 at LLWMA-4 Wells

<table>
<thead>
<tr>
<th>Well</th>
<th>pH</th>
<th>Specific Conductance</th>
<th>Total Organic Carbon</th>
<th>Total Organic Halides</th>
</tr>
</thead>
<tbody>
<tr>
<td>299-W15-17( ^a )</td>
<td>8.04</td>
<td>7.86</td>
<td>374</td>
<td>381</td>
</tr>
<tr>
<td>299-W15-30( ^a )</td>
<td>8.17</td>
<td>8.45</td>
<td>522</td>
<td>503</td>
</tr>
<tr>
<td>299-W15-83( ^a )</td>
<td>7.88</td>
<td>7.77</td>
<td>533</td>
<td>548</td>
</tr>
<tr>
<td>299-W15-94( ^a )</td>
<td>7.85</td>
<td>7.89</td>
<td>536</td>
<td>532</td>
</tr>
<tr>
<td>299-W15-152( ^a )</td>
<td>7.72</td>
<td>7.82</td>
<td>562</td>
<td>536</td>
</tr>
<tr>
<td>299-W15-224( ^a )</td>
<td>7.83</td>
<td>7.80</td>
<td>510</td>
<td>523</td>
</tr>
<tr>
<td>299-W18-21( ^b )</td>
<td>7.90</td>
<td>7.87</td>
<td>530</td>
<td>483</td>
</tr>
<tr>
<td>299-W18-22( ^b )</td>
<td>7.82</td>
<td>7.95</td>
<td>384</td>
<td>372</td>
</tr>
</tbody>
</table>


a. downgradient well
b. upgradient well
### Table B-32. Monitoring Wells and Constituents for the Nonradioactive Dangerous Waste Landfill

<table>
<thead>
<tr>
<th>Well Numbera</th>
<th>Comment</th>
<th>WAC-Compliant</th>
<th>pH (Field)</th>
<th>Specific Conductance (Field)</th>
<th>TOC</th>
<th>TOX</th>
<th>Anions</th>
<th>Metals</th>
<th>Phenols</th>
<th>VOA</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>699-25-33A</td>
<td>Top of LPU; no statistics</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>S</td>
<td>Yes</td>
</tr>
<tr>
<td>699-25-34A</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>S</td>
<td>Yes</td>
</tr>
<tr>
<td>699-25-34B</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>S</td>
<td>Yes</td>
</tr>
<tr>
<td>699-25-34D</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>699-26-33</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>S</td>
<td>Yes</td>
</tr>
<tr>
<td>699-26-34A</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>699-26-34B</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>699-26-35A</td>
<td>--</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>699-26-35C</td>
<td>Top of LPU; no statistics</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Requirements are from *Groundwater Monitoring Plan for the Nonradioactive Dangerous Waste Landfill* and corresponding Interim Change Notice 1 (PNNL-12227 and PNNL-12227-ICN-1).

Wells completed at the top of the unconfined aquifer unless otherwise specified.

a. **Bold italic** indicates upgradient well.

b. The second semiannual sample was not collected for well 699-26-34A because of limited maintenance resources to remove the sampling pump.

c. The second semiannual sample was not collected for well 699-25-34D because of limited maintenance resources to lower the sampling pump.

A = to be sampled annually

C = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”

LPU = low-permeability unit in upper portion of Ringold Formation (within member of Taylor Flat)

S = to be sampled semiannually

TOC = total organic carbon

TOX = total organic halides

VOA = volatile organic analysis
### Table B-33. Critical Means for Nonradioactive Dangerous Waste Landfill for 2012 Comparisons

<table>
<thead>
<tr>
<th>Constituent (unit)</th>
<th>n</th>
<th>df</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>CV (%)</th>
<th>tc</th>
<th>Critical Mean</th>
<th>Proportion ND Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>18</td>
<td>17</td>
<td>7.48</td>
<td>0.27</td>
<td>4%</td>
<td>4.12</td>
<td>6.36 - 8.61</td>
<td>0%</td>
</tr>
<tr>
<td>Specific conductance (µS/cm)</td>
<td>18</td>
<td>17</td>
<td>502.49</td>
<td>49.79</td>
<td>10%</td>
<td>4.12</td>
<td>713.26</td>
<td>0%</td>
</tr>
<tr>
<td>TOC* (µg/L)</td>
<td>18</td>
<td>17</td>
<td>369.56</td>
<td>269.32</td>
<td>73%</td>
<td>4.12</td>
<td>1509.73</td>
<td>46%</td>
</tr>
<tr>
<td>TOX* (µg/L)</td>
<td>18</td>
<td>17</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>81%</td>
</tr>
</tbody>
</table>

Note: Based on semiannual sampling events from January 2010 through December 2011.

* Non-detects were imputed using the population of upgradient results to estimate values reported as non-detects. This implicitly assumes that values from all upgradient wells come from the same underlying population.

CV  = coefficient of variation
df  = degrees of freedom (n-1)
n  = number of background replicate averages
tc  = Bonferroni critical t-value for appropriate df and 28 comparisons
TOC = total organic carbon
TOX = total organic halides
ND  = non-detects
NC  = not calculated because proportion non-detects is greater than 50%
### Table B-34. Monitoring Wells and Constituents for Waste Management Area A-AX

<table>
<thead>
<tr>
<th>Well Number&lt;sup&gt;a&lt;/sup&gt;</th>
<th>WAC-Compliant</th>
<th>Site-Specific Constituents</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Nitrate</td>
<td>Sodium</td>
</tr>
<tr>
<td>299-E24-20</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>299-E24-22</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>299-E24-33</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>299-E25-2</td>
<td>P</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>299-E25-40</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>299-E25-41</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>299-E25-93</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>299-E25-94</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>299-E25-236</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
</tr>
</tbody>
</table>

Notes:
- Requirements are from *RCRA Assessment Plan for Single-Shell Tank Waste Management Area A-AX at the Hanford Site* (PNNL-15315).
- Wells completed at the top of the unconfined aquifer unless specified otherwise.
- **Bold italic** indicates upgradient well.
- **Atomic Energy Act of 1954** parameter.
- Sample not collected in first quarter due to pump problem.
- **C** = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells
- **P** = constructed before WAC requirements
- **Q** = to be sampled quarterly
- **TOC** = total organic carbon
### Table B-35. Monitoring Wells and Constituents for Waste Management Area B-BX-BY

<table>
<thead>
<tr>
<th>Well Number*</th>
<th>WAC-Compliant</th>
<th>RCRA Parameters</th>
<th>AEA Parameters</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Alkalinity</td>
<td>Anions</td>
<td>Cyanide</td>
</tr>
<tr>
<td>299-E28-8</td>
<td>P</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>299-E33-7</td>
<td>P</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>299-E33-9</td>
<td>P</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>299-E33-15</td>
<td>P</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-E33-16</td>
<td>P</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>299-E33-17</td>
<td>P</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-E33-18</td>
<td>P</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>299-E33-20</td>
<td>P</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>299-E33-21</td>
<td>P</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>299-E33-26</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>299-E33-31</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>299-E33-32</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>299-E33-38</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>299-E33-39</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>299-E33-41</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>299-E33-42</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
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<td>299-E33-43</td>
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Table B-35. Monitoring Wells and Constituents for Waste Management Area B-BX-BY

<table>
<thead>
<tr>
<th>Well Number*</th>
<th>WAC-Compliant</th>
<th>RCRA Parameters</th>
<th>AEA Parameters</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
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<td>WAC-Compliant</td>
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<td>299-E33-338 C</td>
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</table>

Note: Requirements from *Groundwater Quality Assessment Plan for Single-Shell Tank Waste Management Area B-BX-BY at the Hanford Site* (PNNL-13022-ICN-3).

Wells completed at the top of the unconfined aquifer.

* Indeterminate flow direction due to flow direction change; no upgradient wells defined.

A = to be sampled annually
C = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”
P = constructed before WAC requirements
Q = to be sampled quarterly
S = to be sampled semiannually
Table B-36. Monitoring Wells and Constituents for Waste Management Area C

<table>
<thead>
<tr>
<th>Well Name(^{a})</th>
<th>Purpose</th>
<th>Well Construction Standard</th>
<th>pH</th>
<th>Specific Conductance</th>
<th>Alkalinity</th>
<th>Anions</th>
<th>Cyanide</th>
<th>Metals(^{b}), Unfiltered, Filtered</th>
<th>Water Level</th>
<th>Sampled as Scheduled in 2011</th>
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<td>299-E27-4</td>
<td>Downgradient</td>
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<td>Q</td>
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<td>Upgradient</td>
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<td>Q</td>
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<td>299-E27-25</td>
<td>Cross-gradient</td>
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Note: Requirements are from *Groundwater Quality Assessment Plan for the Single-Shell Waste Management Area C* (DOE/RL-2009-77).

a. **Bold italic** indicates change from cross gradient to upgradient determination.

b. Metals for groundwater quality include iron, manganese, and sodium.

C = well constructed as a WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells,” resource protection well

N = well constructed before requirements of WAC 173-160 were applicable at the Hanford Site

Q = quarterly

SA = semiannually
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<tr>
<th>Dangerous Waste Constituent Name</th>
<th>CAS #</th>
<th>Wells</th>
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<tbody>
<tr>
<td>1,1-Dichloroethane</td>
<td>75-34-3</td>
<td>X X X X X X X X X X X</td>
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<tr>
<td>1,1-Dichloroethylene</td>
<td>75-35-4</td>
<td>X X X X X X X X X X X</td>
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<tr>
<td>1,1,1-Trichloroethane</td>
<td>71-55-6</td>
<td>X X X X X X X X X X X</td>
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<td>1,1,2,2-Tetrachloroethane</td>
<td>79034-5</td>
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<td>1,1,2-Trichloroethane</td>
<td>79-00-5</td>
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<tr>
<td>1,2-Dibromoethane</td>
<td>106-93-4</td>
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<tr>
<td>1,2-Dichloroethane</td>
<td>107-06-2</td>
<td>X X X X X X X X X X X</td>
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<td>1,2-Dichloropropane</td>
<td>78-87-5</td>
<td>X X X X X X X X X X X</td>
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<td>1,2,4-Trichlorobenzene</td>
<td>120-82-1</td>
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<td>1,4-Dioxane</td>
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<tr>
<td>2-Butanone (MEK)</td>
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<td>2-Propanone (Acetone)</td>
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<td>3-Chloropropene</td>
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<td>4-Methyl-2-petanone</td>
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<td>Bromomethane</td>
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<td>Carbon disulfide</td>
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<td>Carbon tetrachloride</td>
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<td>Chloroethene</td>
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<td>Chloroform&lt;sup&gt;a&lt;/sup&gt;</td>
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### Table B-37. Groundwater Assessment Volatile Organic Compound Monitoring at Waste Management Area C

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<th>Dangerous Waste Constituent Name</th>
<th>CAS #</th>
<th>Wells</th>
<th>Wells</th>
<th>Wells</th>
<th>Wells</th>
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<tr>
<td>Chloromethane</td>
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<td>cis-1,3-dichloropropene</td>
<td>10061-01-5</td>
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<td>Dichloromethane</td>
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<td>Ethyl cyanide</td>
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<td>Tetrachloroethene</td>
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<td>Toluene</td>
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a. Constituents collected and analyzed during 2011 for continued assessment.

X = Constituent collected and analyzed for in 2011.

CAS = Chemical Abstract Services
### Table B-38. Monitoring Wells and Constituents for Waste Management Area S-SX

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<th>Well Number</th>
<th>WAC-Compliant</th>
<th>Chromium</th>
<th>Nitrate</th>
<th>Alkalinity</th>
<th>Anions</th>
<th>Metals</th>
<th>Selenium-79</th>
<th>Technetium-99</th>
<th>Tritium</th>
<th>Uranium</th>
<th>Gamma</th>
<th>Sampled as Scheduled in 2011</th>
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<td>Q</td>
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<td>Well Number&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>Technetium-99</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Gamma</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>


Wells completed at the top of the unconfined aquifer.

a. **Bold italic** indicates upgradient well.

A = to be sampled annually

C = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”

P = constructed before WAC requirements

S = to be sampled semiannually

Q = to be sampled quarterly
### Table B-39. Monitoring Wells and Constituents for Waste Management Area T

<table>
<thead>
<tr>
<th>Well Number*</th>
<th>Comment</th>
<th>WAC-Compliant</th>
<th>RCRA Dangerous Constituent</th>
<th>Supporting Parameters</th>
<th>Field-Measured Parameters</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>299-W10-1</td>
<td>--</td>
<td>P</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
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<tr>
<td>299-W10-4</td>
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<td>P</td>
<td>SA</td>
<td>A</td>
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<tr>
<td>299-W10-8</td>
<td>--</td>
<td>P</td>
<td>A</td>
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<td>299-W10-23</td>
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<td>299-W10-24</td>
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<td>C</td>
<td>SA</td>
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<tr>
<td>299-W10-28</td>
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<td>C</td>
<td>A</td>
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<td>A</td>
</tr>
<tr>
<td>299-W11-12</td>
<td>Well is dry</td>
<td>P</td>
<td>A</td>
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<td>A</td>
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<td>299-W11-39</td>
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<td>C</td>
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<td>299-W11-40</td>
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<td>C</td>
<td>Q</td>
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<td>Q</td>
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<tr>
<td>299-W11-41</td>
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<td>C</td>
<td>Q</td>
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<tr>
<td>299-W11-42</td>
<td>--</td>
<td>C</td>
<td>Q</td>
<td>SA</td>
<td>SA</td>
<td>Q</td>
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<tr>
<td>299-W11-45</td>
<td>Extraction well; screened 8.5 to 13 meters below water table</td>
<td>C</td>
<td>Q</td>
<td>SA</td>
<td>SA</td>
<td>Q</td>
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<tr>
<td>299-W11-46</td>
<td>Extraction well; screened 6 to 12 meters below water table</td>
<td>C</td>
<td>Q</td>
<td>SA</td>
<td>SA</td>
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<tr>
<td>299-W11-47</td>
<td>Screened 9 to 18 meters below water table</td>
<td>C</td>
<td>Q</td>
<td>SA</td>
<td>SA</td>
<td>Q</td>
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</tbody>
</table>

**Notes:**
- Wells completed at the top of the unconfined aquifer unless specified otherwise.
- *Bold italic* indicates upgradient well.
- A = to be sampled annually
- C = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”
- P = constructed prior to WAC requirements
- Q = to be sampled quarterly
- RCRA = *Resource Conservation and Recovery Act of 1976*
- SA = to be sampled semiannually
### Table B-40. Monitoring Wells and Constituents for Waste Management Area TX-TY

<table>
<thead>
<tr>
<th>Well Number&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Comment</th>
<th>WAC-Compliant</th>
<th>RCRA Dangerous Parameter</th>
<th>Supporting Parameters</th>
<th>Field-Measured Parameters</th>
<th>Sampled as Scheduled in 2011</th>
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<tr>
<td>299-W10-26</td>
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<td>299-W10-27</td>
<td>--</td>
<td>C</td>
<td>Q</td>
<td>SA SA SA</td>
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<tr>
<td>299-W14-11</td>
<td>Screened 11 to 14.6 m below water table</td>
<td>C</td>
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<td>SA SA SA</td>
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<tr>
<td>299-W14-13</td>
<td>Pump required lowering; not sampled in first and second quarters</td>
<td>C</td>
<td>Q</td>
<td>SA SA SA</td>
<td>Q Q Q Q Q</td>
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<td>299-W14-14</td>
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<td>SA SA SA SA</td>
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<td>SA SA SA SA</td>
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<td>299-W14-15</td>
<td>--</td>
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<td>SA SA SA</td>
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<td>Q</td>
<td>SA SA SA SA</td>
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<td>299-W14-19</td>
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<td>SA SA SA SA</td>
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<td>SA SA SA SA</td>
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<tr>
<td><strong>299-W15-40</strong></td>
<td>Extraction well; well offline due to low water</td>
<td>C</td>
<td>Q</td>
<td>SA SA SA</td>
<td>Q Q Q Q Q</td>
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<tr>
<td>299-W15-41</td>
<td>Well is dry</td>
<td>C</td>
<td>SA SA SA SA</td>
<td>SA SA SA SA</td>
<td>SA SA SA SA</td>
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<td>299-W15-44&lt;sup&gt;b&lt;/sup&gt;</td>
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<td>C</td>
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<td>299-W15-763</td>
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<td>Extraction well; offline Mar 2011 due to low water</td>
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</table>

Note: Requirements are from *Interim Status Groundwater Quality Assessment Plan for Single-Shell Tank Waste Management Area TX-TY* (DOE/RL-2009-67).

Wells completed at the top of the unconfined aquifer, unless specified otherwise.

a. Bold italic indicates upgradient well.
b. Well 299-W15-44 was taken out of service as an extraction well and converted to a monitoring well by third quarter CY 2010.

A = to be sampled annually

C = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”

P = constructed before WAC requirements

Q = to be sampled quarterly

SA = to be sampled semiannually

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### Table B-41. Monitoring Wells and Constituents for Waste Management Area U

<table>
<thead>
<tr>
<th>Well Number</th>
<th>WAC-Compliant</th>
<th>Chromium</th>
<th>Nitrates</th>
<th>Alkalinity</th>
<th>Anions</th>
<th>Metals</th>
<th>Technetium-99</th>
<th>Gross Alpha/Beta</th>
<th>Gamma</th>
<th>Sampled as Scheduled in 2011</th>
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<tbody>
<tr>
<td>299-W18-30</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
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<tr>
<td>299-W18-40</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
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<td>S</td>
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<td>A</td>
<td>No; 2nd and 3rd quarter samples missed due to electric sample pump safety issue</td>
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<tr>
<td>299-W19-12</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
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<tr>
<td>299-W19-41</td>
<td>C</td>
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</table>

Note: Requirement is from *Interim Status Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area U* (DOE/RL-2009-74).

Wells completed at the top of the unconfined aquifer.

- Bold italic indicates upgradient well.
- A = to be sampled annually
- C = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”
- S = to be sampled semi-annually
- Q = to be sampled quarterly
Table B-42. Monitoring Wells, Constituents, and Enforcement Limits for 200 Area Treated Effluent Disposal Facility

<table>
<thead>
<tr>
<th>Well Number*</th>
<th>WAC-Compliant</th>
<th>pH (6.5 to 8.5)</th>
<th>Cadmium (5 µg/L)</th>
<th>Lead (10 µg/L)</th>
<th>Specific Conductance</th>
<th>Alpha</th>
<th>Anions</th>
<th>Beta</th>
<th>Metals</th>
<th>Total Dissolved Solids</th>
<th>Trace Metals</th>
<th>Tritium</th>
<th>Sampled as Scheduled in 2011</th>
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<tbody>
<tr>
<td>699-40-36</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
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<td>Q</td>
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<td>Yes</td>
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<td>699-41-35</td>
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<td>Q</td>
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<tr>
<td>699-42-37</td>
<td>C</td>
<td>Q</td>
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<td>Q</td>
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<td>A</td>
<td>Yes</td>
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</tbody>
</table>

Notes:
Requirements are from *Groundwater Monitoring Plan for the Hanford Site 200 Area Treated Effluent Disposal Facility* (PNNL-13032).
All wells completed at the top of the Ringold Formation confined aquifer.
* Bold italic indicates upgradient well.
A = to be sampled annually
C = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”
Q = to be sampled quarterly

Table B-43. Monitoring Wells and Constituents for Environmental Restoration Disposal Facility

<table>
<thead>
<tr>
<th>Well Numbera</th>
<th>WAC-Compliant</th>
<th>Alkalinity</th>
<th>Alpha</th>
<th>Anions</th>
<th>Beta</th>
<th>Carbons-14</th>
<th>Iodine-129</th>
<th>Metals</th>
<th>Radiumb</th>
<th>Total Dissolved Solids</th>
<th>Technetium-99</th>
<th>TOX</th>
<th>Uranium</th>
<th>VOA</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>699-35-66A</td>
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<td>S</td>
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<td>S</td>
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</tr>
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<td>699-36-66B</td>
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</table>

Notes:
Requirements are from *Groundwater Protection Plan for the Environmental Restoration Disposal Facility* (WCH-198).
Wells completed at the top of the unconfined aquifer.
a. Bold italic indicates upgradient well.
b. Total alpha energy emitted from radium.
C = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”
P = constructed before WAC requirements
S = to be sampled semiannually
TOX = total organic halides
VOA = volatile organic analyte
### Table B-44. Monitoring Wells and Constituents for the KE and KW Basins

<table>
<thead>
<tr>
<th>Well</th>
<th>WAC Compliant</th>
<th>Gross Alpha</th>
<th>Anions</th>
<th>Gross Beta</th>
<th>Carbon-14</th>
<th>Metals</th>
<th>Strontium-90</th>
<th>Technetium-90</th>
<th>Tritium</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE Basins</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>199-K-32A</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
<td>A</td>
<td>--</td>
<td>--</td>
<td>A</td>
<td>Q</td>
<td>Yes</td>
</tr>
<tr>
<td>199-K-110A</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>--</td>
<td>A</td>
<td>--</td>
<td>--</td>
<td>S</td>
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<tr>
<td>199-K-111A</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
<td>A</td>
<td>A</td>
<td>--</td>
<td>A</td>
<td>Q</td>
<td>Yes</td>
</tr>
<tr>
<td>199-K-141*</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
<td>A</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>Q</td>
<td>Yes</td>
</tr>
<tr>
<td>199-K-142*</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
<td>A</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>Q</td>
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<tr>
<td>KW Basins</td>
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<td></td>
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</tr>
<tr>
<td>199-K-31*</td>
<td>P</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>--</td>
<td>A</td>
<td>A</td>
<td>S</td>
<td>Yes</td>
</tr>
<tr>
<td>199-K-34</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
<td>A</td>
<td>S</td>
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<td>A</td>
<td>Q</td>
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</tr>
<tr>
<td>199-K-106A</td>
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<td>Q</td>
<td>Q</td>
<td>Q</td>
<td>A</td>
<td>S</td>
<td>--</td>
<td>--</td>
<td>Q</td>
<td>No metals</td>
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<tr>
<td>199-K-107A</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
<td>A</td>
<td>S</td>
<td>A</td>
<td>A</td>
<td>Q</td>
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</tr>
<tr>
<td>199-K-108A</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>--</td>
<td>S</td>
<td>--</td>
<td>--</td>
<td>S</td>
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</tr>
<tr>
<td>199-K-132*</td>
<td>C</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>A</td>
<td>S</td>
<td>--</td>
<td>--</td>
<td>S</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Notes: Requirements are modified from *Groundwater Monitoring and Assessment Plan for the 100-K Area Fuel Storage Basins* (PNNL-14033).

The following were listed in PNNL-14033 but were decommissioned before 2011: 199-K-27, 199-K-29, 199-K-30, and 199-K-109A (KE Basins) and 199-K-33 (KW Basins).

* Wells not listed in PNNL-14033.

Sampling abbreviations used in this table are as follows:

- **A** = to be sampled annually
- **C** = well is constructed as a resource protection well under WAC 173-160, “Minimum Standard for Construction and Maintenance of Wells”
- **P** = constructed before WAC requirements
- **Q** = to be sampled quarterly
- **S** = to be sampled semiannually
<table>
<thead>
<tr>
<th>Well</th>
<th>Comment</th>
<th>Constituents with Enforcement Limits</th>
<th>Other Constituents</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>WAC Compliant</td>
<td>pH</td>
<td>Acetone</td>
</tr>
<tr>
<td>299-W6-6</td>
<td>Bottom of unconfined</td>
<td>C</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>299-W6-11</td>
<td>--</td>
<td>C</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>299-W6-12</td>
<td>--</td>
<td>C</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>299-W7-3</td>
<td>Bottom of unconfined</td>
<td>C</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>299-W8-1</td>
<td>--</td>
<td>C</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>699-48-71</td>
<td>Unconfined</td>
<td>P</td>
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<td>--</td>
</tr>
<tr>
<td>699-48-77A</td>
<td>Ringold Formation unit E, upper</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>699-48-77C</td>
<td>Ringold Formation unit E, middle to lower</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
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<td>Ringold Formation unit E, upper</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
</tr>
<tr>
<td>699-49-79</td>
<td>--</td>
<td>P</td>
<td>--</td>
<td>--</td>
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<td>--</td>
<td>P</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>699-51-75P</td>
<td>Lower unconfined</td>
<td>P</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Well</td>
<td>Comment</td>
<td>Constituents with Enforcement Limits</td>
<td>Other Constituents</td>
<td>Sampled as Scheduled in 2011</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
<td>-------------------------------------</td>
<td>--------------------</td>
<td>-----------------------------</td>
</tr>
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<td></td>
<td></td>
<td>WAC Compliant</td>
<td>pH</td>
<td>Acetone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pH</td>
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<td>Acetone</td>
<td>Benzene</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pH</td>
<td>Acetone</td>
<td>Benzene</td>
</tr>
</tbody>
</table>

Notes: Requirements are from *Groundwater Monitoring and Tritium-Tracking Plan for the 200 Area State-Approved Land Disposal Site* (PNNL-13121).

Wells are completed at the top of the aquifer unless specified otherwise.

* Filtered and unfiltered samples.
A = to be sampled annually
C = well is constructed as a resource protection well under WAC-173-160, “Minimum Standards for Construction and Maintenance of Wells”
P = constructed before WAC requirements
Q = to be sampled quarterly
S = to be sampled semiannually
### Table B-46. Monitoring Wells and Constituents for Solid Waste Landfill

<table>
<thead>
<tr>
<th>Well Number</th>
<th>Comment</th>
<th>WAC-Compliant</th>
<th>Ammonia/Ammonium ion</th>
<th>Chemical Oxygen Demand</th>
<th>Chloride</th>
<th>Iron (Filtered)</th>
<th>Manganese (Filtered)</th>
<th>Zinc (Filtered)</th>
<th>Nitrate</th>
<th>Nitrite</th>
<th>pH (Field)</th>
<th>Specific Conductance (Field)</th>
<th>Sulfate</th>
<th>Temperature (Field)</th>
<th>Coliform Bacteria</th>
<th>TOC</th>
<th>Anions</th>
<th>Metals (Filtered)</th>
<th>Arsenic (Filtered)</th>
<th>VOA</th>
<th>Sampled as Scheduled in 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>699-22-35</td>
<td>--</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
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<td>Q</td>
<td>Q</td>
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<td>No</td>
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<td></td>
<td>No</td>
</tr>
<tr>
<td>699-23-34A</td>
<td>--</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
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<td>Q</td>
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<td>Q</td>
<td>Q</td>
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<td>Q</td>
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</tr>
<tr>
<td>699-23-34B</td>
<td>--</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
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<td></td>
<td>Yes</td>
</tr>
<tr>
<td>699-24-33</td>
<td>Information only; no statistics</td>
<td>P</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
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<td></td>
<td>Yes</td>
</tr>
<tr>
<td>699-24-34A</td>
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<td>C</td>
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<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>699-24-34C</td>
<td>--</td>
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<td>Q</td>
<td>Q</td>
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<td>Q</td>
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<td>No</td>
</tr>
<tr>
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<td>--</td>
<td>C</td>
<td>Q</td>
<td>Q</td>
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<td>Q</td>
<td>Q</td>
<td>Q</td>
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<td>Q</td>
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<td>699-26-35A</td>
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<td>No</td>
<td></td>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>

**Notes:**

- Wells completed at the top of the unconfined aquifer.
- **a.** Bold italic indicates upgradient well.
- **b.** Well not sampled as scheduled due to sampling priorities. One sampling event was missed in each well.
- **c.** Sampling attempted in April 2011; well appears to be dry.
- **C** = well is constructed as a resource protection well under WAC 173-160, “Minimum Standards for Construction and Maintenance of Wells”
- **P** = constructed before WAC requirements
- **Q** = to be sampled quarterly
- **TOC** = total organic carbon
- **VOA** = volatile organic analysis
Table B-47. Analytical Results for Required Constituents at the Solid Waste Landfill

<table>
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<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>Ammonium ion (µg/L) BTV = 90 µg/L b</td>
<td>1/12/11</td>
<td>SNC</td>
<td>9.92</td>
<td>&lt;3.09</td>
<td>13.3</td>
<td>&lt;3.09</td>
<td>SNC</td>
<td>10.6</td>
<td>12</td>
<td>&lt;3.09</td>
</tr>
<tr>
<td></td>
<td>4/13 to 4/14/11</td>
<td>&lt;1.8</td>
<td>&lt;1.8</td>
<td>31.4</td>
<td>19.2</td>
<td>47.3</td>
<td>71</td>
<td>SNC</td>
<td>30.7</td>
<td>SNC</td>
</tr>
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<td></td>
<td>7/13/11</td>
<td>&lt;1.8</td>
<td>&lt;1.8</td>
<td>&lt;1.8</td>
<td>22.2</td>
<td>&lt;1.8</td>
<td>&lt;1.8</td>
<td>SNC</td>
<td>15.8</td>
<td>31.4 c</td>
</tr>
<tr>
<td></td>
<td>11/3 to 11/7</td>
<td>SNC</td>
<td>SNC</td>
<td>SNC</td>
<td>SNC</td>
<td>SNC</td>
<td>SNC</td>
<td>SNC</td>
<td>SNC</td>
<td></td>
</tr>
<tr>
<td>Chemical oxygen demand (mg/L) BTV = 10 mg/L</td>
<td>1/12/11</td>
<td>SNC</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>SNC</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
</tr>
<tr>
<td></td>
<td>4/13 to 4/14/11</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
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<td>&lt;10</td>
<td>&lt;10</td>
<td>SNC</td>
<td>&lt;10</td>
<td>SNC</td>
</tr>
<tr>
<td></td>
<td>7/13/11</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
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<td>&lt;10</td>
<td>SNC</td>
<td>&lt;10</td>
<td>10 c</td>
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<td></td>
<td>11/3 to 11/7</td>
<td>&lt;10</td>
<td>&lt;6.5</td>
<td>&lt;6.5</td>
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<td>&lt;6.5</td>
<td>&lt;6.5</td>
<td>&lt;6.5</td>
<td>SNC</td>
<td>&lt;6.5</td>
</tr>
<tr>
<td>Chloride (mg/L) BTV = 7.82 mg/L</td>
<td>1/12/11</td>
<td>SNC</td>
<td>6.92</td>
<td>6.52</td>
<td>7.29</td>
<td>7.28</td>
<td>SNC</td>
<td>7.16</td>
<td>6.34</td>
<td>7.35</td>
</tr>
<tr>
<td></td>
<td>4/13 to 4/14/11</td>
<td>6.85</td>
<td>6.85</td>
<td>6.31</td>
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<td>7.23</td>
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<td>6.17</td>
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<td>7/13/11</td>
<td>7.12</td>
<td>6.79</td>
<td>5.71</td>
<td>6.86</td>
<td>6.67</td>
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<td>SNC</td>
<td>5.80</td>
<td>7.70 c</td>
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<tr>
<td></td>
<td>11/3 to 11/7</td>
<td>8.30</td>
<td>7.30</td>
<td>6.50</td>
<td>7.10</td>
<td>8.30</td>
<td>7.00</td>
<td>SNC</td>
<td>6.30</td>
<td>7.10</td>
</tr>
<tr>
<td>Coliform bacteria (colonies/100mL) BTV = 1 col./100 mL</td>
<td>1/12/11</td>
<td>SNC</td>
<td>≤1</td>
<td>≤1</td>
<td>≤1</td>
<td>2</td>
<td>SNC</td>
<td>111 d</td>
<td>≤1</td>
<td>≤1</td>
</tr>
<tr>
<td></td>
<td>4/13 to 4/14/11</td>
<td>≤1</td>
<td>≤1</td>
<td>≤1</td>
<td>≤1</td>
<td>≤1</td>
<td>≤1</td>
<td>SNC</td>
<td>≤1</td>
<td>SNC</td>
</tr>
<tr>
<td></td>
<td>7/13/11</td>
<td>≤1</td>
<td>3.1</td>
<td>≤1</td>
<td>≤1</td>
<td>≤1</td>
<td>≤1</td>
<td>SNC</td>
<td>62.7 d</td>
<td>≤1 c</td>
</tr>
<tr>
<td></td>
<td>11/3 to 11/7</td>
<td>≤1</td>
<td>≤1</td>
<td>≤1</td>
<td>≤1</td>
<td>≤1</td>
<td>≤1</td>
<td>SNC</td>
<td>2</td>
<td>≤1</td>
</tr>
<tr>
<td>Iron (filtered) (µg/L) BTV = 160 µg/L</td>
<td>1/12/11</td>
<td>SNC</td>
<td>&lt;38</td>
<td>&lt;38</td>
<td>&lt;38</td>
<td>&lt;38</td>
<td>SNC</td>
<td>66</td>
<td>&lt;38</td>
<td>&lt;38</td>
</tr>
<tr>
<td></td>
<td>4/13 to 4/14/11</td>
<td>32</td>
<td>&lt;20</td>
<td>22</td>
<td>&lt;20</td>
<td>27</td>
<td>87</td>
<td>SNC</td>
<td>&lt;20</td>
<td>SNC</td>
</tr>
<tr>
<td></td>
<td>7/13/11</td>
<td>259 d</td>
<td>22</td>
<td>&lt;20</td>
<td>&lt;20</td>
<td>28</td>
<td>79</td>
<td>SNC</td>
<td>32</td>
<td>&lt;19 c</td>
</tr>
<tr>
<td></td>
<td>11/3 to 11/7</td>
<td>68.5</td>
<td>&lt;28.2</td>
<td>56.6</td>
<td>&lt;28.2</td>
<td>&lt;28.2</td>
<td>67.9</td>
<td>SNC</td>
<td>&lt;28.2</td>
<td>&lt;28.2</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------------</td>
<td>-----------</td>
<td>------------</td>
<td>------------</td>
<td>------------</td>
<td>------------</td>
<td>------------</td>
<td>------------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>Manganese (filtered)</td>
<td>1/12/11</td>
<td>SNC</td>
<td>&lt;6</td>
<td>&lt;6</td>
<td>&lt;6</td>
<td>SNC</td>
<td>&lt;6</td>
<td>&lt;6</td>
<td>&lt;6</td>
<td>&lt;6</td>
</tr>
<tr>
<td>(µg/L)</td>
<td>4/13 to 4/14/11</td>
<td>&lt;4</td>
<td>&lt;4</td>
<td>&lt;4</td>
<td>&lt;4</td>
<td>&lt;4</td>
<td>SNC</td>
<td>&lt;4</td>
<td>SNC</td>
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</tr>
<tr>
<td>BTV = 18 µg/L</td>
<td>7/13/11</td>
<td>&lt;4.1</td>
<td>&lt;4.1</td>
<td>&lt;4.1</td>
<td>&lt;4.1</td>
<td>&lt;4.1</td>
<td>SNC</td>
<td>&lt;4.1</td>
<td>&lt;4&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11/3 to 11/7</td>
<td>&lt;3.3</td>
<td>&lt;3.3</td>
<td>&lt;3.3</td>
<td>&lt;3.3</td>
<td>&lt;3.3</td>
<td>SNC</td>
<td>&lt;3.3</td>
<td>&lt;3.3</td>
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</tr>
<tr>
<td>Nitrate (mg/L)</td>
<td>1/12/11</td>
<td>SNC</td>
<td>19.4</td>
<td>17.1</td>
<td>14.8</td>
<td>13.7</td>
<td>SNC</td>
<td>14.5</td>
<td>12.4</td>
<td>17.8</td>
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<tr>
<td>BTV = 29 mg/L</td>
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<td>17.6</td>
<td>18.5</td>
<td>17.2</td>
<td>14.4</td>
<td>13.5</td>
<td>14.7</td>
<td>SNC</td>
<td>12.8</td>
<td>SNC</td>
</tr>
<tr>
<td></td>
<td>7/13/11</td>
<td>17.9</td>
<td>19.0</td>
<td>17.4</td>
<td>14.2</td>
<td>14.0</td>
<td>15.4</td>
<td>SNC</td>
<td>12.7</td>
<td>19.5&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>11/3 to 11/7</td>
<td>18.6</td>
<td>20.4</td>
<td>18.1</td>
<td>14.2</td>
<td>15.5</td>
<td>16.4</td>
<td>SNC</td>
<td>13.7</td>
<td>18.6</td>
</tr>
<tr>
<td>Nitrite (µg/L)</td>
<td>1/12/11</td>
<td>SNC</td>
<td>&lt;118</td>
<td>&lt;118</td>
<td>&lt;118</td>
<td>&lt;118</td>
<td>SNC</td>
<td>&lt;118</td>
<td>&lt;118</td>
<td>&lt;118</td>
</tr>
<tr>
<td>BTV = 266 µg/L</td>
<td>4/13 to 4/14/11</td>
<td>&lt;131</td>
<td>&lt;131</td>
<td>&lt;131</td>
<td>&lt;131</td>
<td>&lt;131</td>
<td>SNC</td>
<td>&lt;131</td>
<td>SNC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7/13/11</td>
<td>&lt;131</td>
<td>&lt;131</td>
<td>897&lt;sup&gt;d&lt;/sup&gt;</td>
<td>&lt;131</td>
<td>716&lt;sup&gt;d&lt;/sup&gt;</td>
<td>657&lt;sup&gt;d&lt;/sup&gt;</td>
<td>SNC</td>
<td>519&lt;sup&gt;d&lt;/sup&gt;</td>
<td>&lt;9.85&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>pH measurement</td>
<td>1/12/11</td>
<td>SNC</td>
<td>6.80</td>
<td>6.86</td>
<td>6.98</td>
<td>6.80</td>
<td>SNC</td>
<td>6.90</td>
<td>6.94</td>
<td>7.33</td>
</tr>
<tr>
<td>BTR = 6.68-7.84</td>
<td>4/13 to 4/14/11</td>
<td>7.23</td>
<td>6.95</td>
<td>6.74</td>
<td>6.92</td>
<td>6.80</td>
<td>6.78</td>
<td>SNC</td>
<td>6.87</td>
<td>SNC</td>
</tr>
<tr>
<td></td>
<td>7/13/11</td>
<td>6.9</td>
<td>6.63</td>
<td>6.79</td>
<td>6.85</td>
<td>6.80</td>
<td>6.78</td>
<td>SNC</td>
<td>6.86</td>
<td>7.30&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td>Specific conductance</td>
<td>1/12/11</td>
<td>SNC</td>
<td>762</td>
<td>748</td>
<td>749</td>
<td>658</td>
<td>SNC</td>
<td>729</td>
<td>579</td>
<td>533</td>
</tr>
<tr>
<td>(µS/cm)</td>
<td>4/13 to 4/14/11</td>
<td>821</td>
<td>769</td>
<td>760</td>
<td>756</td>
<td>663</td>
<td>682</td>
<td>SNC</td>
<td>582</td>
<td>SNC</td>
</tr>
<tr>
<td>BTV = 583 µS/cm</td>
<td>7/13/11</td>
<td>815</td>
<td>764</td>
<td>760</td>
<td>750</td>
<td>660</td>
<td>662</td>
<td>SNC</td>
<td>558</td>
<td>556&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>11/3 to 11/7</td>
<td>818</td>
<td>769</td>
<td>752</td>
<td>758</td>
<td>675</td>
<td>668</td>
<td>SNC</td>
<td>564</td>
<td>532</td>
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### Table B-47. Analytical Results for Required Constituents at the Solid Waste Landfill

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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<tbody>
<tr>
<td>Sulfate (mg/L)</td>
<td>1/12/11</td>
<td>SNC</td>
<td>47.5</td>
<td>44.8</td>
<td>43.7</td>
<td>46.0</td>
<td>SNC</td>
<td>43.9</td>
<td>43.8</td>
<td>39.9</td>
</tr>
<tr>
<td>BTV = 47.2 mg/L</td>
<td>4/13 to 4/14/11</td>
<td>41.9</td>
<td>45.9</td>
<td>44.4</td>
<td>43.9</td>
<td>45.2</td>
<td>45.4</td>
<td>SNC</td>
<td>43.8</td>
<td>SNC</td>
</tr>
<tr>
<td></td>
<td>7/13/11</td>
<td>42.8</td>
<td>46.4</td>
<td>44.0</td>
<td>43.3</td>
<td>45.4</td>
<td>46.4</td>
<td>SNC</td>
<td>44.7</td>
<td>38.6c</td>
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<tr>
<td></td>
<td>11/3 to 11/7</td>
<td>42.7</td>
<td>50.7</td>
<td>44.7</td>
<td>46.0</td>
<td>46.3</td>
<td>46.0</td>
<td>SNC</td>
<td>47.1</td>
<td>42.0</td>
</tr>
<tr>
<td>Temperature (°C)</td>
<td>1/12/11</td>
<td>SNC</td>
<td>16.1</td>
<td>17.3</td>
<td>19.2</td>
<td>18.0</td>
<td>SNC</td>
<td>16.6</td>
<td>16.2</td>
<td>19.0</td>
</tr>
<tr>
<td>BTV = 20.7 °C</td>
<td>4/13 to 4/14/11</td>
<td>16.9</td>
<td>18.1</td>
<td>17.5</td>
<td>19.2</td>
<td>15.9</td>
<td>17.8</td>
<td>SNC</td>
<td>17.1</td>
<td>SNC</td>
</tr>
<tr>
<td></td>
<td>7/13/11</td>
<td>19.7</td>
<td>19.5</td>
<td>19.4</td>
<td>19.9</td>
<td>19.5</td>
<td>20.3</td>
<td>SNC</td>
<td>19.1</td>
<td>19.2c</td>
</tr>
<tr>
<td></td>
<td>11/3 to 11/7</td>
<td>17.9</td>
<td>17.8</td>
<td>18.1</td>
<td>19.4</td>
<td>18.2</td>
<td>18.7</td>
<td>SNC</td>
<td>17.3</td>
<td>18.9</td>
</tr>
<tr>
<td>TOC (µg/L)</td>
<td>1/12/11</td>
<td>SNC</td>
<td>287</td>
<td>335</td>
<td>296</td>
<td>307</td>
<td>SNC</td>
<td>292</td>
<td>215</td>
<td>159</td>
</tr>
<tr>
<td>BTV = 1,200 µg/L</td>
<td>4/13 to 4/14/11</td>
<td>453</td>
<td>482</td>
<td>321</td>
<td>273</td>
<td>267</td>
<td>246</td>
<td>SNC</td>
<td>200</td>
<td>SNC</td>
</tr>
<tr>
<td></td>
<td>7/13/11</td>
<td>1,890d</td>
<td>1,870d</td>
<td>512</td>
<td>1,160</td>
<td>460</td>
<td>330</td>
<td>SNC</td>
<td>352</td>
<td>353c</td>
</tr>
<tr>
<td></td>
<td>11/3 to 11/7</td>
<td>2,400d</td>
<td>2,800d</td>
<td>3,100d</td>
<td>2,800d</td>
<td>2,000d</td>
<td>1000</td>
<td>SNC</td>
<td>2,200d</td>
<td>1,000</td>
</tr>
<tr>
<td>Zinc (filtered)</td>
<td>1/12/11</td>
<td>SNC</td>
<td>&lt;4</td>
<td>&lt;4</td>
<td>10</td>
<td>&lt;4</td>
<td>SNC</td>
<td>9</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>(µg/L)</td>
<td>4/13 to 4/14/11</td>
<td>&lt;4</td>
<td>&lt;4</td>
<td>&lt;4</td>
<td>11</td>
<td>&lt;4</td>
<td>&lt;4</td>
<td>SNC</td>
<td>13</td>
<td>SNC</td>
</tr>
<tr>
<td>BTV = 42.3 µg/L</td>
<td>7/13/11</td>
<td>&lt;4.1</td>
<td>&lt;4.1</td>
<td>&lt;4.1</td>
<td>7</td>
<td>&lt;4.1</td>
<td>&lt;4.1</td>
<td>SNC</td>
<td>15</td>
<td>&lt;5c</td>
</tr>
<tr>
<td></td>
<td>11/3 to 11/7</td>
<td>&lt;7</td>
<td>&lt;7</td>
<td>&lt;7</td>
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<td>&lt;7</td>
<td>&lt;7</td>
<td>SNC</td>
<td>11.8</td>
<td>&lt;7</td>
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</table>

**Note:** Results in **bold** exceed background threshold values.

b. 2010 Background threshold values were obtained from Table C-41 of Hanford Site Groundwater Monitoring and Performance Report for 2009: Volumes 1 & 2 (DOE/RL-2010-11).
c. Sample collected on December 5, 2011 to the July constituent list.
d. Analysis flagged because it is out of trend and higher than BTV.

- **BTV** = background threshold value
- **SNC** = sample not collected
- **TOC** = total organic carbon
Table B-48. Results of Shapiro and Francia Test for Normality and Background Threshold Values for the Solid Waste Landfill

<table>
<thead>
<tr>
<th>Constituent* (unit)</th>
<th>W-test Statisticb (Log Value)</th>
<th>W-test Statisticb (Raw Data)</th>
<th>W-testb Critical Value, Wαc</th>
<th>Upper Tolerance Limit</th>
<th>Background Threshold Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonium (as NH₃) (µg/L)</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>90d</td>
<td>90</td>
</tr>
<tr>
<td>Chemical oxygen demand (µg/L)</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>10,000f</td>
<td>10,000</td>
</tr>
<tr>
<td>Chloride (µg/L)</td>
<td>0.954 s</td>
<td>0.962 s</td>
<td>0.963</td>
<td>7,820d</td>
<td>7,820</td>
</tr>
<tr>
<td>Coliform bacteria (colonies/100 mL)</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>1f</td>
<td>1</td>
</tr>
<tr>
<td>Field pH</td>
<td>0.988 ns</td>
<td>NA</td>
<td>0.963</td>
<td>[6.68, 7.84]g</td>
<td>[6.68, 7.84]</td>
</tr>
<tr>
<td>Iron, dissolved (µg/L)</td>
<td>0.960 s</td>
<td>0.802 s</td>
<td>0.962</td>
<td>160d</td>
<td>174</td>
</tr>
<tr>
<td>Manganese, dissolved (µg/L)</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>10d</td>
<td>27.5</td>
</tr>
<tr>
<td>Nitrate (as NO₃) (µg/L)</td>
<td>0.833 s</td>
<td>0.844 s</td>
<td>0.963</td>
<td>29,000d</td>
<td>29,000</td>
</tr>
<tr>
<td>Nitrite (as NO₂) (µg/L)</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>165e</td>
<td>165</td>
</tr>
<tr>
<td>Specific conductance (µS/cm)</td>
<td>0.978 ns</td>
<td>NA</td>
<td>0.960</td>
<td>583#</td>
<td>583</td>
</tr>
<tr>
<td>Sulfate (µg/L)</td>
<td>0.983 ns</td>
<td>NA</td>
<td>0.963</td>
<td>47,200d</td>
<td>47,200</td>
</tr>
<tr>
<td>Temperature (degrees C)</td>
<td>0.953 s</td>
<td>0.961 s</td>
<td>0.963</td>
<td>20.7d</td>
<td>20.7</td>
</tr>
<tr>
<td>Total organic carbon (µg/L)</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>842d</td>
<td>842</td>
</tr>
<tr>
<td>Zinc, dissolved (µg/L)</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>42.3d</td>
<td>42.3</td>
</tr>
</tbody>
</table>


** b. From “An Approximate Analysis of Variance Test for Normality” (Shapiro and Francia, 1972).

** c. Obtained from Table A-9 in “How to Test Normality and Other Distributional Assumptions,” The ASQC Basic References in Quality Control: Statistical Techniques (Shapiro, 1990) for α = 5%.

** d. Maximum value reported.

** e. Based on limit of quantitation determined from field blanks (for total organic carbon) or laboratory blanks.

** f. Based on laboratory lowest detected result.

** g. Based on log-normal distribution.

NA = not applicable
NC = not calculated; insufficient measured values
ns = not significant at 0.05 level of significance
s = significant at 0.05 level of significance
STL = Severn Trent Laboratories (St. Louis)
WSCF = Waste Sampling and Characterization Facility
Figure B-1. RCRA Units on the Hanford Site Requiring Groundwater Monitoring

Not to Scale
Figure B-2. Groundwater Monitoring Wells for 100-N Area RCRA Sites
Figure B-3. Groundwater Monitoring Wells at 116-H-6 Evaporation Basins
Figure B-4. Groundwater Monitoring Wells at 216-A-29 Ditch, PUREX Cribs, and Waste Management Areas A-AX and C
Figure B-5. Groundwater Monitoring Wells at 216-B-3 Pond and 200 Areas Treated Effluent Disposal Facility
Figure B-6. Groundwater Monitoring Wells at 216-S-10 Pond and Ditch
Figure B-7. Groundwater Monitoring Wells at 316-5 Process Trenches
Figure B-9. Groundwater Monitoring Wells at Liquid Effluent Retention Facility
Figure B-10. Groundwater Monitoring Wells at Low-Level Waste Management Area 1
Figure B-11. Groundwater Monitoring Wells at 216-B-63 Trench and Low-Level Waste Management Area 2
Figure B-12. Groundwater Monitoring Wells at Low-Level Waste Management Area 3
Figure B-13. Groundwater Monitoring Wells at Low-Level Waste Management Area 4
Figure B-14. Groundwater Monitoring Wells at Nonradioactive Dangerous Waste Landfill and Solid Waste Landfill

- Monitoring Well Completed at Top of Unconfined
- Monitoring Well Completed in Upper Ringold Unit
- Waste Site
Figure B-15. Groundwater Monitoring Wells at Waste Management Area B-BX-BY
Figure B-16. Groundwater Monitoring Wells at Waste Management Areas S-SX-U
Figure B-17. Groundwater Monitoring Wells at Waste Management Areas T and TX-TY
Figure B-18. Non-RCRA Regulated Units on the Hanford Site Requiring Groundwater Monitoring
Figure B-19. Groundwater Monitoring Wells at 100-K Basins
Figure B-20. Groundwater Monitoring Wells at State-Approved Land Disposal Site

- Tritium Tracking Well
  (Sampled for Tritium Only)
- SALDS Network Monitoring Well
- Other Monitoring Well
- Dry Monitoring Well
- Decommissioned Well

Legend:
- Well prefix '299-' or '699-' omitted
- Waste Site
- Former Operational Area

Scale:
0  200  400  600 m
Figure B-21. Groundwater Monitoring Wells at the Environmental Restoration Disposal Facility
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