
Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

P.O. Box 550
Richland, Washington 99352

Approved for Public Release; Further Dissemination Unlimited

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Title

DOE/RL-2013-36-ADD3, Rev. 0, 100-KR-4 Groundwater Operable Unit
Well Installation Sampling and Analysis Plan, Addendum 3:

Michael W. Cline
U.S. Department of Energy, Richland Operations Office

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2/10/2016

Date

Chris Guzzetti
U.S. Environmental Protection Agency

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2/10/16

Date
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### Terms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bgs</td>
<td>below ground surface</td>
</tr>
<tr>
<td>Cr(VI)</td>
<td>hexavalent chromium</td>
</tr>
<tr>
<td>RUM</td>
<td>Ringold Formation Upper Mud</td>
</tr>
</tbody>
</table>
1 Introduction

This sampling and analysis plan addendum is being prepared to support ongoing groundwater remediation efforts in support of the interim remedial design/remedial action work plan for 100-KR-4 and 100-HR-3 Operable Units as described in DOE/RL-96-84, Remedial Design Report and Remedial Action Work Plan for the 100-HR-3 and 100-KR-4 Groundwater Operable Units’ Interim Action. DOE/RL-2013-36, 100-KR-4 Groundwater Operable Unit Well Installation Sampling and Analysis Plan, Addendum 3, contains site-specific field sampling plans for wells identified in Table 1. The wells identified are planned for installation, as noted, but work is dependent upon actual funding and U.S. Department of Energy priorities.

Table 1. Proposed Wells

<table>
<thead>
<tr>
<th>Borehole Identification</th>
<th>Well Name</th>
<th>Well Type</th>
<th>Well Diameter</th>
<th>Easting</th>
<th>Northing</th>
<th>Fiscal Year 2016 Funded</th>
</tr>
</thead>
<tbody>
<tr>
<td>C9595</td>
<td>199-K-223</td>
<td>Extraction Well</td>
<td>6</td>
<td>568781.31</td>
<td>146145.49</td>
<td>Yes</td>
</tr>
<tr>
<td>C9596</td>
<td>199-K-224</td>
<td>Extraction Well</td>
<td>6</td>
<td>568734.73</td>
<td>146205.99</td>
<td>Yes</td>
</tr>
<tr>
<td>C9597</td>
<td>199-K-225</td>
<td>Extraction Well</td>
<td>6</td>
<td>569280.56</td>
<td>146457.63</td>
<td>Yes</td>
</tr>
<tr>
<td>C9598</td>
<td>199-K-226</td>
<td>Extraction Well</td>
<td>6</td>
<td>569187.44</td>
<td>147038.89</td>
<td>TBD*</td>
</tr>
</tbody>
</table>

*Well 199-K-226 (C9598) is not currently funded in fiscal year 2016. When funding becomes available, this well will be drilled.

The objectives and requirements of these wells are defined in SGW-58986, FY2016 Plume Containment and Remediation Utilization Plan, and are described, in general, in this chapter. Figure 1 shows the locations of proposed wells identified in Table 1. Detailed information regarding well construction, quality assurance, and sampling procedures is provided in DOE/RL-2013-36, 100-KR-4 Groundwater Operable Unit Well Installation Sampling and Analysis Plan. Figure 2 presents the general well construction diagram for a 6 in. diameter well.

The remaining figures are associated with specific wells, as shown in Table 2. Table 3 presents the summary of technical justification for each well, and Tables 4 through 6 present the geologic information, sample collection depths, and analytes.

Table 2. List of Figures for Well Stratigraphy and Split Spoon Intervals

<table>
<thead>
<tr>
<th>Well Name</th>
<th>Figure of Stratigraphy and Split Spoon Collection Intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>199-K-223</td>
<td>Figure 3</td>
</tr>
<tr>
<td>199-K-224</td>
<td>Figure 4</td>
</tr>
<tr>
<td>199-K-225</td>
<td>Figure 5</td>
</tr>
<tr>
<td>199-K-226</td>
<td>Figure 6</td>
</tr>
</tbody>
</table>
Following completion, wells will be transitioned to the 100-KR-4 groundwater monitoring schedule for triannual (three times per year) sampling to establish baseline conditions. Samples will be collected for the same list of parameters as described for post-development unless the contaminant is below the detection limit. Post-development samples will be analyzed on an expedited turnaround time to ensure that contaminant concentrations are as expected prior to connection to the applicable 100-KR-4 pump and treat system. The wells will also be added to DOE/RL-96-90, *Interim Action Monitoring Plan for the 100-HR-3 and 100-KR-4 Operable Units*, and DOE/RL-2013-29, *Sampling and Analysis Plan for 100-KR-4 Groundwater Operable Unit Monitoring*, following approval.
2 Technical Justification Summary

Technical justification for each well identified in this sampling and analysis addendum is listed in Table 3.

Table 3. Technical Justification Summary

<table>
<thead>
<tr>
<th>Proposed Well</th>
<th>Technical Justification</th>
<th>Well Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>199-K-223</td>
<td>This well targets Cr(VI) mass removal downgradient of the 183.1 K West Head House.</td>
<td>Extraction</td>
</tr>
<tr>
<td>199-K-224</td>
<td>This well targets Cr(VI) mass removal downgradient of the 183.1 K West Head House.</td>
<td>Extraction</td>
</tr>
<tr>
<td>199-K-225</td>
<td>This well targets Cr(VI) mass removal downgradient of the 183.1 K East Head House.</td>
<td>Extraction</td>
</tr>
<tr>
<td>199-K-226</td>
<td>This well targets Cr(VI) mass removal downgradient of the 118-K-1 Burial Ground.</td>
<td>Extraction</td>
</tr>
</tbody>
</table>

Cr(VI) = hexavalent chromium

Table 4. Summary of Geologic Information

<table>
<thead>
<tr>
<th>Well Identification</th>
<th>Well Name</th>
<th>Expected Depth to Water (bgs)</th>
<th>Expected Depth to RUM (bgs)</th>
<th>Expected Total Depth (bgs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Feet</td>
<td>Meters</td>
<td>Feet</td>
</tr>
<tr>
<td>C9595</td>
<td>199-K-223</td>
<td>85</td>
<td>26</td>
<td>180</td>
</tr>
<tr>
<td>C9596</td>
<td>199-K-224</td>
<td>81</td>
<td>25</td>
<td>180</td>
</tr>
<tr>
<td>C9597</td>
<td>199-K-225</td>
<td>81</td>
<td>25</td>
<td>165</td>
</tr>
<tr>
<td>C9598</td>
<td>199-K-226</td>
<td>45</td>
<td>14</td>
<td>130</td>
</tr>
</tbody>
</table>

bgs = below ground surface
RUM = Ringold Formation Upper Mud
Figure 1. Locations for New Wells
Figure 2. Generalized Well Construction Diagram for 6-Inch Diameter Well
Figure 3. 199-K-223 General Stratigraphy and Split Spoon Intervals
Figure 4. 199-K-224 General Stratigraphy and Split Spoon Intervals
Figure 5. 199-K-225 General Stratigraphy and Split Spoon Intervals
Figure 6. 199-K-226 General Stratigraphy and Split Spoon Intervals
### Table 5. Soil Sampling

<table>
<thead>
<tr>
<th>Media</th>
<th>Sample Type</th>
<th>Comments</th>
<th>Location</th>
<th>Estimated Depth (ft bgs)</th>
<th>Analytes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Soil/Geologic</strong></td>
<td>Grab</td>
<td>Archival Purposes</td>
<td>All Wells</td>
<td>Every 5 ft and at lithology changes</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Screen Selection</td>
<td>All Wells</td>
<td>Every 5 ft of screened interval within unconfined aquifer</td>
<td>Grain Size (Field Measurement)</td>
</tr>
<tr>
<td><strong>Soil/Geologic</strong></td>
<td>Split Spoon</td>
<td>Vadose Zone</td>
<td>Well Name: 199-K-223, C9595</td>
<td>80 to 82.5 (periodically rewetted zone)</td>
<td>Cr(VI) and Total Chromium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>77 to 79.5 (periodically rewetted zone)</td>
<td>Cr(VI) and Total Chromium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>199-K-224, C9596</td>
<td>77 to 79.5 (periodically rewetted zone)</td>
<td>Cr(VI) and Total Chromium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>42.5 to 45 (sand in periodically rewetted zone)</td>
<td>Cr(VI), Total Chromium, and Tritium</td>
</tr>
<tr>
<td><strong>Soil/Geologic</strong></td>
<td>Split Spoon</td>
<td>Unconfined Aquifer</td>
<td>199-K-223, C9595</td>
<td>87.5 to 90 (upper aquifer)</td>
<td>Hydraulic Conductivity, Calcium Carbonate, Cr(VI), and Total Chromium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>130 to 132.5 (mid to upper aquifer)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>177.5 to 180 (bottom aquifer)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>199-K-224, C9596</td>
<td>83.5 to 86 (upper aquifer)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>128 to 130.5 (mid to upper aquifer)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>177.5 to 180 (bottom aquifer)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>199-K-225, C9597</td>
<td>83.5 to 86 (upper aquifer)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>122 to 124.5 (mid to upper aquifer)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>162.5 to 165 (bottom aquifer)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>199-K-226, C9598</td>
<td>47.5 to 50 (upper aquifer)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>86 to 88.5 (mid to upper aquifer)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>127.5 to 130 (bottom aquifer)</td>
<td></td>
</tr>
</tbody>
</table>
Table 6. Groundwater Sampling

<table>
<thead>
<tr>
<th>Media</th>
<th>Sample Type</th>
<th>Comments</th>
<th>Well Name</th>
<th>Well Identification</th>
<th>Estimated Depths (ft bgs)</th>
<th>Analytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>During Drilling</td>
<td>Top, Mid-depth, and Bottom of Unconfined Aquifer</td>
<td>199-K-223</td>
<td>C9595</td>
<td>87.5 130 177.5</td>
<td>Cr(VI) (Field Measurement)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>199-K-224</td>
<td>C9596</td>
<td>83.5 128 177.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>199-K-225</td>
<td>C9597</td>
<td>83.5 122 162.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>199-K-226</td>
<td>C9598</td>
<td>47.5 86 127.5</td>
<td>Cr(VI) (field measurement), Nitrate, and Tritium</td>
</tr>
<tr>
<td>Water</td>
<td>Pumped: Common Analyte List</td>
<td>Depth of sample will be determined based on the maximum concentration of Cr(VI) observed during drilling.</td>
<td>All Wells</td>
<td>--</td>
<td>Screened Interval</td>
<td>Total and Cr(VI) (filtered Sample)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Metals (Calcium, Magnesium, Potassium, and Sodium) on Filtered Sample</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Anions (Bicarbonate, Carbonate, Chloride, Fluoride, Phosphate, and Sulfate) on Filtered Sample</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Radioisotopes (Carbon-14, Tritium, and Strontium-90) on Unfiltered Sample</td>
</tr>
</tbody>
</table>

bgs = below ground surface
Cr(VI) = hexavalent chromium
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3 Documentation and Reporting

Field sampling and laboratory analytical documentation requirements are documented in Section 2.1.4 of DOE/RL-2013-36. The analytical results collected under this sampling and analysis addendum will be summarized and included in the Hanford Site annual groundwater report (i.e., DOE/RL-2015-07) as appropriate.
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4 References


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### Distribution

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<td>Hanson, James P.</td>
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<td>Hulstrom, Jason A.</td>
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<td>Miller, Charles W.</td>
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| Administrative Record                                | H6-08 | 1        |

| Document Clearance                                   | H6-08 | 1        |