**DOCUMENT RELEASE AND CHANGE FORM**

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

By Washington River Protection Solutions, LLC., PO Box 850, Richland, WA 99352

Contractor For U.S. Department of Energy, Office of River Protection, under Contract DE-AC27-08RV14800

TRADEMARK DISCLAIMER: Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States government or any agency thereof or its contractors or subcontractors.  Printed in the United States of America.

1. **Doc No:** OSD-T-151-00007  **Rev.** 22

2. **Title:** OPERATING SPECIFICATIONS FOR THE DOUBLE-SHELL STORAGE TANKS

3. **Project Number:** N/A  
4. **Design Verification Required:** ☐ Yes ☒ No

5. **USQ Number:** TF-18-1022-D Rev. 0  
6. **PHA Number Rev.** N/A

7. **Approvals**

<table>
<thead>
<tr>
<th>Title</th>
<th>Name</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearance Review</td>
<td>Aardal, Janis D</td>
<td>Aardal, Janis D</td>
<td>06/27/2018</td>
</tr>
<tr>
<td>Design Authority</td>
<td>Laney, Terance (Terry)</td>
<td>Laney, Terance (Terry)</td>
<td>05/30/2018</td>
</tr>
<tr>
<td>Checker</td>
<td>Girardot, Crystal L</td>
<td>Girardot, Crystal L</td>
<td>05/31/2018</td>
</tr>
<tr>
<td>Document Control Approval</td>
<td>Hood, Evan</td>
<td>Hood, Evan</td>
<td>06/27/2018</td>
</tr>
<tr>
<td>Environmental Protection</td>
<td>Voogd, Jeffrey A</td>
<td>Voogd, Jeffrey A</td>
<td>05/31/2018</td>
</tr>
<tr>
<td>Originator</td>
<td>Rice, Joseph P</td>
<td>Rice, Joseph P</td>
<td>05/30/2018</td>
</tr>
<tr>
<td>Other Approver</td>
<td>Haass, Matt J</td>
<td>Haass, Matt J</td>
<td>06/13/2018</td>
</tr>
<tr>
<td>Other Approver</td>
<td>Cuttlers, Matt S</td>
<td>Cuttlers, Matt S</td>
<td>06/27/2018</td>
</tr>
<tr>
<td>Other Approver</td>
<td>Kirch, Nick</td>
<td>Kirch, Nick</td>
<td>06/20/2018</td>
</tr>
<tr>
<td>Responsible Engineering Manager</td>
<td>Mendoza, Ruben E</td>
<td>Mendoza, Ruben E</td>
<td>06/27/2018</td>
</tr>
<tr>
<td>USQ Evaluator</td>
<td>Higuera, Maurice</td>
<td>Higuera, Maurice</td>
<td>06/27/2018</td>
</tr>
</tbody>
</table>

8. **Description of Change and Justification**

OSD-T-151-00007 is revised from Revision 21 to Revision 22. Water and condensate addition limits, detection/control and recovery actions have been added for tanks AY-101 and AZ-102. The technical basis section has also been revised accordingly. Annulus ventilation recovery action has been revised to clarify that the time limit to submit a RAP is 30 days from date ventilation goes out of service.

9. **TBDs or Holds**  ☒ N/A

10. **Related Structures, Systems, and Components**

<table>
<thead>
<tr>
<th>a. Related Building/Facilities</th>
<th>☐ N/A</th>
<th>b. Related Systems</th>
<th>☒ N/A</th>
<th>c. Related Equipment ID Nos. (EIN)</th>
<th>☐ N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>241-AN</td>
<td></td>
<td>241-AW-101</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241-AP</td>
<td></td>
<td>241-AW-102</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241-AW</td>
<td></td>
<td>241-AW-103</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241-AW</td>
<td></td>
<td>241-AW-104</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241-AW</td>
<td></td>
<td>241-AW-105</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241-AW</td>
<td></td>
<td>241-AW-106</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241-AW</td>
<td></td>
<td>241-AW-107</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241-AW</td>
<td></td>
<td>241-AW-108</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241-AW</td>
<td></td>
<td>241-AW-109</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241-AW</td>
<td></td>
<td>241-AW-110</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241-AY</td>
<td></td>
<td>241-AZ-101</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241-AY</td>
<td></td>
<td>241-AZ-102</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241-AY</td>
<td></td>
<td>241-AZ-103</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241-AY</td>
<td></td>
<td>241-AZ-104</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241-AY</td>
<td></td>
<td>241-AZ-105</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241-AY</td>
<td></td>
<td>241-AZ-106</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241-AY</td>
<td></td>
<td>241-AZ-107</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241-AY</td>
<td></td>
<td>241-AZ-108</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241-AW</td>
<td></td>
<td>241-AZ-109</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241-AW</td>
<td></td>
<td>241-AZ-110</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11. **Impacted Documents – Engineering**  ☒ N/A

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Rev.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-101-C1</td>
<td>00</td>
<td>SPECIFICATION FOR PRIMARY AND SECONDARY STEEL TANKS PROJECT B-101 241SY TANK FARM</td>
</tr>
<tr>
<td>B-340-D1</td>
<td>01</td>
<td>PRIMARY AND SECONDARY STEEL TANKS 241-AP TANK FARM</td>
</tr>
<tr>
<td>ECN-723442-R2</td>
<td>00</td>
<td>DST ISOLATION PROJECT WEATHERSEAL OF 241-AZ-ELDP-101/102 AND 241-AZ-LDP-101 &amp; 102</td>
</tr>
<tr>
<td>H-14-020807 SH 001</td>
<td>20</td>
<td>WASTE TRANSFER SYSTEM (WT) O &amp; M SYSTEM P &amp; ID</td>
</tr>
<tr>
<td>H-14-020807 SH 002</td>
<td>17</td>
<td>WASTE TRANSFER SYSTEM (WT) O &amp; M SYSTEM P &amp; ID</td>
</tr>
<tr>
<td>H-14-020807 SH 003</td>
<td>06</td>
<td>WASTE TRANSFER SYSTEM (WT) O &amp; M SYSTEM P &amp; ID</td>
</tr>
<tr>
<td>H-14-020807 SH 004</td>
<td>15</td>
<td>WASTE TRANSFER SYSTEM (WT) O &amp; M SYSTEM P &amp; ID</td>
</tr>
<tr>
<td>H-14-020807 SH 005</td>
<td>06</td>
<td>WASTE TRANSFER SYSTEM (WT) O&amp;M SYSTEM P&amp;ID</td>
</tr>
<tr>
<td>H-14-020807 SH 006</td>
<td>11</td>
<td>WASTE TRANSFER SYSTEM (WT) O&amp;M SYSTEM P&amp;ID</td>
</tr>
<tr>
<td>H-14-020807 SH 007</td>
<td>03</td>
<td>WASTE TRANSFER SYSTEM (WT) O&amp;M SYSTEM P&amp;ID</td>
</tr>
<tr>
<td>H-14-020807 SH 008</td>
<td>01</td>
<td>WASTE TRANSFER SYSTEM (WT) O&amp;M SYSTEM P&amp;ID</td>
</tr>
<tr>
<td>H-14-020807 SH 009</td>
<td>14</td>
<td>WASTE TRANSFER SYSTEM (WT) O &amp; M SYSTEM P &amp; ID</td>
</tr>
<tr>
<td>H-14-020807 SH 010</td>
<td>00</td>
<td>WASTE TRANSFER SYSTEM (WT) O &amp; M SYSTEM P &amp; ID</td>
</tr>
</tbody>
</table>

12. **Impacted Documents (Outside SPF):**  N/A

13. **Related Documents**  ☐ N/A

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Rev.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-101-C1</td>
<td>00</td>
<td>SPECIFICATION FOR PRIMARY AND SECONDARY STEEL TANKS PROJECT B-101 241SY TANK FARM</td>
</tr>
<tr>
<td>B-340-D1</td>
<td>01</td>
<td>PRIMARY AND SECONDARY STEEL TANKS 241-AP TANK FARM</td>
</tr>
<tr>
<td>ECN-723442-R2</td>
<td>00</td>
<td>DST ISOLATION PROJECT WEATHERSEAL OF 241-AZ-ELDP-101/102 AND 241-AZ-LDP-101 &amp; 102</td>
</tr>
<tr>
<td>H-14-020807 SH 001</td>
<td>20</td>
<td>WASTE TRANSFER SYSTEM (WT) O &amp; M SYSTEM P &amp; ID</td>
</tr>
<tr>
<td>H-14-020807 SH 002</td>
<td>17</td>
<td>WASTE TRANSFER SYSTEM (WT) O &amp; M SYSTEM P &amp; ID</td>
</tr>
<tr>
<td>H-14-020807 SH 003</td>
<td>06</td>
<td>WASTE TRANSFER SYSTEM (WT) O &amp; M SYSTEM P &amp; ID</td>
</tr>
<tr>
<td>H-14-020807 SH 004</td>
<td>15</td>
<td>WASTE TRANSFER SYSTEM (WT) O &amp; M SYSTEM P &amp; ID</td>
</tr>
<tr>
<td>H-14-020807 SH 005</td>
<td>06</td>
<td>WASTE TRANSFER SYSTEM (WT) O&amp;M SYSTEM P&amp;ID</td>
</tr>
<tr>
<td>H-14-020807 SH 006</td>
<td>11</td>
<td>WASTE TRANSFER SYSTEM (WT) O&amp;M SYSTEM P&amp;ID</td>
</tr>
<tr>
<td>H-14-020807 SH 007</td>
<td>03</td>
<td>WASTE TRANSFER SYSTEM (WT) O&amp;M SYSTEM P&amp;ID</td>
</tr>
<tr>
<td>H-14-020807 SH 008</td>
<td>01</td>
<td>WASTE TRANSFER SYSTEM (WT) O&amp;M SYSTEM P&amp;ID</td>
</tr>
<tr>
<td>H-14-020807 SH 009</td>
<td>14</td>
<td>WASTE TRANSFER SYSTEM (WT) O &amp; M SYSTEM P &amp; ID</td>
</tr>
<tr>
<td>H-14-020807 SH 010</td>
<td>00</td>
<td>WASTE TRANSFER SYSTEM (WT) O &amp; M SYSTEM P &amp; ID</td>
</tr>
</tbody>
</table>
13. Related Documents

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Rev.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-2-37703 SH 001</td>
<td>02</td>
<td>TK BASE ODRAIN LEAK DETECTION SUMP PLNS+DETS TKS 241SY101,10</td>
</tr>
<tr>
<td>H-2-37772 SH 001</td>
<td>02</td>
<td>TANK CROSS SECTION 241SY TANK FARM</td>
</tr>
<tr>
<td>H-2-37787 SH 001</td>
<td>04</td>
<td>PIPING PLAN &amp; DETAILS LEAK DETECTION PIT 241-SY-01C, 02C &amp; 03C</td>
</tr>
<tr>
<td>H-2-64306 SH 001</td>
<td>04</td>
<td>TANK FOUNDATION PLAN</td>
</tr>
<tr>
<td>H-2-64317 SH 001</td>
<td>04</td>
<td>LEAK DETECTION PIT + SLAB DRAIN PIPING</td>
</tr>
<tr>
<td>H-2-64419 SH 001</td>
<td>10</td>
<td>TANK RISER DETAILS</td>
</tr>
<tr>
<td>H-2-64419 SH 003</td>
<td>01</td>
<td>TANK RISER DETAILS</td>
</tr>
<tr>
<td>H-2-64428 SH 001</td>
<td>01</td>
<td>DUAL LEAK DETECTION PIT PIPING SECTION AND DETAILS TK - 101 AND ENCASEMENT</td>
</tr>
<tr>
<td>H-2-64430 SH 001</td>
<td>01</td>
<td>241-AY TANK FARM LEAK DETECTION PIT PIPING SECTIONS AND DETAILS (TK-102)</td>
</tr>
<tr>
<td>H-2-64448 SH 001</td>
<td>04</td>
<td>TANK PENETRATION DETAILS</td>
</tr>
<tr>
<td>H-2-64449 SH 001</td>
<td>07</td>
<td>TANK ELEVATION AND DETAILS</td>
</tr>
<tr>
<td>H-2-64449 SH 002</td>
<td>01</td>
<td>TANK ELEVATION &amp; DETAILS</td>
</tr>
<tr>
<td>H-2-67248 SH 001</td>
<td>01</td>
<td>TK BASE DRAIN LEAK DETECTION SUMP PLANS+DETAILS TK241AZ-101+</td>
</tr>
<tr>
<td>H-2-67316 SH 001</td>
<td>01</td>
<td>PENETRATION DETS TK 101+102 241-AZ TANK FARM</td>
</tr>
<tr>
<td>H-2-67317 SH 001</td>
<td>02</td>
<td>TANKS 101 &amp; 102 SECTION &amp; DETAILS 241-AZ TANK FARM</td>
</tr>
<tr>
<td>H-2-67317 SH 002</td>
<td>00</td>
<td>TANKS 101 &amp; 102 SECTION &amp; DETAILS 241-AZ TANK FARM</td>
</tr>
<tr>
<td>H-2-67349 SH 001</td>
<td>01</td>
<td>AIR LIFT CIRCULATOR+RISER EXTENSION DETAILS</td>
</tr>
<tr>
<td>H-2-68366 SH 001</td>
<td>01</td>
<td>DUAL LEAK DETECTION PIT PIPING SECTION+DETAILS TK-102+ENCASE</td>
</tr>
<tr>
<td>H-2-68385 SH 001</td>
<td>02</td>
<td>LEAK DETECTION PIT PIPING SECTIONS+DETAILS TANK 101</td>
</tr>
<tr>
<td>H-2-70306 SH 001</td>
<td>02</td>
<td>CIVIL LEAK DETECTION DRAIN AND SUMP PLANS AND DETAILS</td>
</tr>
<tr>
<td>H-2-70394 SH 001</td>
<td>02</td>
<td>TANK CROSS SECTION</td>
</tr>
<tr>
<td>H-2-70413 SH 001</td>
<td>01</td>
<td>PIPING PLAN &amp; DETAILS LEAK DETECTION PIT 241-AW-01C THRU 06C</td>
</tr>
<tr>
<td>H-2-70413 SH 002</td>
<td>00</td>
<td>PIPING PLAN &amp; DETAILS LEAK DETECTION PIT 01C THRU 06C</td>
</tr>
<tr>
<td>H-2-71160 SH 001</td>
<td>02</td>
<td>TANK CROSS SECTION 241-AN-107 TANK</td>
</tr>
<tr>
<td>H-2-71160 SH 002</td>
<td>00</td>
<td>TANK CROSS SECTION 241-AN-107 TANK</td>
</tr>
<tr>
<td>H-2-71905 SH 001</td>
<td>02</td>
<td>CIVIL LEAK DETECTION DRAIN AND SUMP PLANS AND DETAILS</td>
</tr>
<tr>
<td>H-2-71975 SH 001</td>
<td>03</td>
<td>TANK CROSS SECTION 241-AN TANKS</td>
</tr>
<tr>
<td>H-2-71975 SH 002</td>
<td>00</td>
<td>TANK CROSS SECTION 241-AN TANKS</td>
</tr>
<tr>
<td>H-2-71997 SH 001</td>
<td>06</td>
<td>PIPING PLAN &amp; DETAILS LEAK DETECTION PIT 241-AN-01C THRU 07C</td>
</tr>
<tr>
<td>H-2-71997 SH 002</td>
<td>02</td>
<td>PIPING PLAN &amp; DETAILS LEAK DETECTION PIT 241-AN-01C THRU 07C</td>
</tr>
<tr>
<td>H-2-90444 SH 001</td>
<td>01</td>
<td>241-AP TANK WASTE VOLUME AND LEVEL CALCULATIONS IN DOME SPACE FOR 241-AP TANK FARM UP TO 460 INCHES</td>
</tr>
<tr>
<td>HNF-2317</td>
<td>00</td>
<td>PROJECT W-320 HIGH VACUUM 241-AZ-102 ANNULUS VENTILATION SYSTEM OPERABILITY TEST REPORT</td>
</tr>
<tr>
<td>HNF-SD-WM-OCD-015</td>
<td>43</td>
<td>Tank Farms Waste Transfer Compatibility Program</td>
</tr>
<tr>
<td>RPP-13033</td>
<td>07B</td>
<td>TANK FARM DOCUMENTED SAFETY ANALYSIS</td>
</tr>
<tr>
<td>RPP-13438</td>
<td>02</td>
<td>TECHNICAL BASIS FOR THE TANK BUMP ACCIDENT AND ASSOCIATED REPRESENTATIVE HAZARDOUS CONDITIONS</td>
</tr>
<tr>
<td>RPP-16922</td>
<td>32</td>
<td>Update to: ENVIRONMENTAL SPECIFICATION REQUIREMENTS</td>
</tr>
<tr>
<td>RPP-46868</td>
<td>00</td>
<td>TECHNICAL BASIS FOR TEMPERATURE CONTROL TO PREVENT TANK BUMPS IN 241-AN-106</td>
</tr>
<tr>
<td>RPP-6213</td>
<td>04</td>
<td>HANFORD WASTE TANK BUMP ACCIDENT AND CONSEQUENCE ANALYSIS</td>
</tr>
<tr>
<td>RPP-7695</td>
<td>00A</td>
<td>DOUBLE-SHELL TANK ANNULUS VENTILATION ENGINEERING STUDY</td>
</tr>
<tr>
<td>RPP-7795</td>
<td>14</td>
<td>TECHNICAL BASIS FOR CHEMISTRY CONTROL PROGRAM</td>
</tr>
<tr>
<td>RPP-ASMT-35619</td>
<td>00</td>
<td>EXPERT PANEL OVERSIGHT COMMITTEE ASSESSMENT OF FY 2007 CORROSION &amp; STRESS CORROSION CRACKING SIMULATING TEST PROGRAM &amp; THE IMPACT ON DDT 241-AY-102</td>
</tr>
<tr>
<td>RPP-ASMT-37653</td>
<td>00</td>
<td>EXPERT PANEL OVERSIGHT COMMITTEE ASSESSMENT OF RPP-RPT-35923, HANFORD TANK AY101: EFFECT OF CHEMISTRY AND OTHER VARIABLES ON CORROSION AND STRESS CORR</td>
</tr>
<tr>
<td>RPP-ASMT-46121</td>
<td>00</td>
<td>CORROSION PROPENSITY ASSESSMENT OF TANK 241-AN-106 WASTE</td>
</tr>
<tr>
<td>RPP-CALC-33163</td>
<td>00</td>
<td>TANK WASTE VOLUME AND LEVEL CALCULATIONS IN DOME SPACE FOR 241-AP TANK FARM UP TO 460 INCHES</td>
</tr>
<tr>
<td>RPP-PLAN-32124</td>
<td>00A</td>
<td>PROCESS CONTROL PLAN FOR 241-AP-108 TANK WASTE LEVEL INCREASE</td>
</tr>
<tr>
<td>RPP-PLAN-40592</td>
<td>00</td>
<td>PROCESS CONTROL PLAN FOR TANK 241-AP-103 TANK WASTE LEVEL INCREASE</td>
</tr>
<tr>
<td>RPP-PLAN-52170</td>
<td>00</td>
<td>Process Control Plan for Tank 241-AP-101 Tank Waste Level Increase</td>
</tr>
<tr>
<td>RPP-RPT-28967</td>
<td>02</td>
<td>HANFORD DOUBLE-SHELL TANK THERMAL AND SEISMIC PROJECT-BUCKLING EVALUATION METHODS AND RESULTS FOR THE PRIMARY TANKS</td>
</tr>
<tr>
<td>RPP-RPT-28968</td>
<td>01</td>
<td>HANFORD DOUBLE-SHELL TANK THERMAL AND SEISMIC PROJECT-SUMMARY OF COMBINED THERMAL AND OPERATING LOADS</td>
</tr>
<tr>
<td>RPP-RPT-31680</td>
<td>00</td>
<td>HANFORD TANKS 241-AN-107 AND 241-AN-102: EFFECT OF CHEMISTRY AND OTHER VARIABLES ON CORROSION AND STRESS CORROSION CRACKING</td>
</tr>
<tr>
<td>RPP-RPT-32237</td>
<td>01</td>
<td>HANFORD DOUBLE-SHELL TANK THERMAL AND SEISMIC PROJECT - INCREASED LIQUID LEVEL ANALYSIS FOR 241-AP TANK FARMS</td>
</tr>
<tr>
<td>RPP-RPT-33284</td>
<td>00</td>
<td>HANFORD TANKS AY102 AND AP101 EFFECT OF CHEMISTRY AND OTHER VARIABLES ON CORROSION AND STRESS CORROSION CRACKING</td>
</tr>
</tbody>
</table>
### 13. Related Documents

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Rev.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPP-RPT-35923</td>
<td>00</td>
<td>HANFORD TANK AY101 EFFECT OF CHEMISTRY AND OTHER VARIABLES ON CORROSION AND STRESS CORROSION CRACKING</td>
</tr>
<tr>
<td>SD-WM-TI-150</td>
<td>00</td>
<td>TECHNICAL BASIS FOR WASTE TANK CORROSION SPECIFICATIONS</td>
</tr>
</tbody>
</table>

### 14. Distribution

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anderson, Rick A</td>
<td>AN TEAM AREA DAY SHIFT</td>
</tr>
<tr>
<td>Baide, Dan</td>
<td>PROCESS ENGINEERING ANALYSIS</td>
</tr>
<tr>
<td>Bergman, Scott M</td>
<td>SHIFT OPERATIONS</td>
</tr>
<tr>
<td>Bingham, James D</td>
<td>COGNIZANT SYSTEM ENGINEERING</td>
</tr>
<tr>
<td>Brown, Rodney J</td>
<td>T/TX/TY/SX/SY/SU FARM TEAM</td>
</tr>
<tr>
<td>Cato, Diane M</td>
<td>PROD OPERATIONS ENGINEERING</td>
</tr>
<tr>
<td>Curt, Scotty C</td>
<td>ELECTRICAL ENGINEERING</td>
</tr>
<tr>
<td>Dale, Rob</td>
<td>ELECTRICAL ENGINEERING</td>
</tr>
<tr>
<td>Davis, Neil R</td>
<td>ENGINEERING</td>
</tr>
<tr>
<td>Everett, Brian K</td>
<td>WASTE TRANSFER PLANNING MGMT</td>
</tr>
<tr>
<td>Follett, Jordan R</td>
<td>RETRIEVAL PROCESS ENGINEERING</td>
</tr>
<tr>
<td>Gauck, Gregory J</td>
<td>COGNIZANT SYSTEM ENGINEERING</td>
</tr>
<tr>
<td>Hanson, Carl E</td>
<td>AY/AX FARM RETRIEVAL ENGRNG</td>
</tr>
<tr>
<td>Hull, Kevin J</td>
<td>ELECTRICAL ENGINEERING</td>
</tr>
<tr>
<td>Huntington, Matthew R</td>
<td>TANK FARM PROJECTS ENGINEERING</td>
</tr>
<tr>
<td>Johnson, Brian A</td>
<td>242-A/AW OPERATIONS</td>
</tr>
<tr>
<td>Kirch, Nick</td>
<td>PROD OPERATIONS PROCESS ENGRNG</td>
</tr>
<tr>
<td>Laney, Terance (Terry)</td>
<td>WASTE STORAGE &amp; TECH SUPPORT</td>
</tr>
<tr>
<td>Lutz, Mark T</td>
<td>SHIFT OPERATIONS</td>
</tr>
<tr>
<td>MCFERRAN, BRANDON E</td>
<td>SHIFT OPERATIONS</td>
</tr>
<tr>
<td>Mendoza, Ruben E</td>
<td>TANK &amp; PIPELINE INTEGRITY</td>
</tr>
<tr>
<td>Nicholson, Robert S (Bob)</td>
<td>WASTE STORAGE &amp; TECH SUPPORT</td>
</tr>
<tr>
<td>Peters, Raymond P</td>
<td>COGNIZANT SYSTEM ENGINEERING</td>
</tr>
<tr>
<td>Reeploeg, Gretchen E</td>
<td>TANK &amp; PIPELINE INTEGRITY</td>
</tr>
<tr>
<td>Scott, Andrew F</td>
<td>ELECTRICAL ENGINEERING</td>
</tr>
<tr>
<td>Sheridan, Michael J</td>
<td>COGNIZANT SYSTEM ENGINEERING</td>
</tr>
<tr>
<td>Smith, Gregory E</td>
<td>TANK FARM PROJECTS ENGINEERING</td>
</tr>
<tr>
<td>Smith, Kelly M</td>
<td>ST TEAM AREA DAY SHIFT</td>
</tr>
<tr>
<td>Strasser, David W</td>
<td>A/AX/A/AY/AZ FARM TEAM</td>
</tr>
<tr>
<td>Tavelli, Mark F</td>
<td>ENGINEERING</td>
</tr>
<tr>
<td>Tucker, Ron</td>
<td>AN/AP/B/BX/BY/C FARM TEAM</td>
</tr>
<tr>
<td>Uytioco, Elise M</td>
<td>PROD OPERATIONS PROCESS ENGRNG</td>
</tr>
<tr>
<td>Von Bargen, Brian H</td>
<td>SITE SERV &amp; INT MNGT</td>
</tr>
<tr>
<td>Wells, Michele N</td>
<td>STRATEGIC AND OPS PLANNING</td>
</tr>
</tbody>
</table>
Operating Specifications for the Double-Shell Storage Tanks

Author Name:
J.P. Rice
Washington River Protection Solutions
Richland, WA 99352
U.S. Department of Energy Contract DE-AC27-08RV14800

EDT/ECN: N/A
Cost Center: Charge
Code:
B&R Code: Total Pages:

Key Words: Operating Specification Document, OSD, Double-Shell Tank, DST, Primary Tank, Secondary Liner, Liquid Level, Leak Detection Pit, Hydrostatic Load, Pressure, Vacuum, Temperature, Corrosion Mitigation, Dome Load, Tank Bump

Abstract: This document provides the operating specifications for the Double-Shell Storage Tanks.
OPERATING SPECIFICATIONS
FOR THE DOUBLE-SHELL
STORAGE TANKS

J.P. Rice
Washington River Protection Solutions

Date Published
July 2018
Effective Date: On Issue

Prepared for the U.S. Department of Energy
Office of River Protection

Contract # DE-AC27-08RV14800

Approved for Public Release; Further Dissemination Unlimited
# TABLE OF CONTENTS

1.0 INTRODUCTION ......................................................................................................................................... 1

1.1 Liquid Levels .............................................................................................................................................. 1

1.2 Hydrostatic Load....................................................................................................................................... 10

1.3 Primary Tank and Annulus Vapor Space ................................................................................................. 11

1.4 Tank and Waste Temperatures .................................................................................................................. 13

1.5 Corrosion Mitigation................................................................................................................................. 19

1.6 Dome Loading .......................................................................................................................................... 27

1.7 Tank Bump ................................................................................................................................................ 29

1.8 Separable Organic Layer ........................................................................................................................... 31

2.0 REFERENCES ........................................................................................................................................... 33
TABLE OF TABLES

Table 1.1.1 Primary Tank Maximum Waste Liquid Level ................................................................. 1
Table 1.1.2 Primary Tank Minimum Waste Liquid Level ................................................................. 4
Table 1.1.3 Tertiary Leak Detection Pit Liquid Level ..................................................................... 5
Table 1.2.1 Maximum Bulk Specific Gravity ................................................................................. 10
Table 1.3.1 Primary Tank Vapor Space Vacuum ........................................................................... 11
Table 1.3.2 Secondary Tank Annulus Vacuum ............................................................................. 12
Table 1.4.1 Maximum Temperature for Waste, Steel, and Concrete .......................................... 13
Table 1.4.2 Bulk Temperature Change ........................................................................................ 15
Table 1.4.3-1 Minimum Number of Operational Thermocouples for Tanks 241-AY and AZ .... 16
Table 1.4.3-2 AY and AZ Farm Thermocouple Groups (Arranged by Thermocouple Number)1............ 17
Table 1.5.1 Waste Chemistry Limits ............................................................................................ 19
Table 1.5.2 Annulus Tank Ventilation System and Annulus Inspection ...................................... 21
Table 1.5.3 Enhanced Annulus Video Inspection Requirements .................................................. 22
Table 1.5.4 Comprehensive Annulus Video Inspection Requirements ....................................... 23
Table 1.5.5 Water and Condensate Additions to DSTs ............................................................... 25
Table 1.6.1 Dome Loading Requirements .................................................................................... 27
Table 1.7.1 End-State Analysis for Tank Bump ............................................................................. 29
Table 1.8.1 Hydraulic Fluid Leak Limit ....................................................................................... 31
### LIST OF TERMS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>DST</td>
<td>Double-Shell Tank</td>
</tr>
<tr>
<td>Ecology</td>
<td>State of Washington Department of Ecology</td>
</tr>
<tr>
<td>Enraf</td>
<td>Enraf Corporation surface level measurement device</td>
</tr>
<tr>
<td>NA</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>OSD</td>
<td>Operating Specifications Document</td>
</tr>
<tr>
<td>PER</td>
<td>Problem Evaluation Request</td>
</tr>
<tr>
<td>SACS</td>
<td>Surveillance Analysis Computer System</td>
</tr>
<tr>
<td>SST</td>
<td>Single-Shell Tank</td>
</tr>
<tr>
<td>TMACS</td>
<td>Tank Monitor and Control System</td>
</tr>
<tr>
<td>TPA</td>
<td>Tri-Party Agreement</td>
</tr>
</tbody>
</table>
DEFINITIONS

Out of Service:
A device being unavailable due to electrical or mechanical failure of the device itself or lack of a required support system (e.g., electrical power or instrument air), or equipment being inaccessible due to nearby activities. This can be due to planned and/or scheduled outages, unplanned failures, or natural disasters.

Retrieval Status:
A tank is considered to be officially in "retrieval status" if one of two conditions are met:

1. Waste has been physically removed from the tank by retrieval operations
2. Preparations for retrieval operations are directly responsible for rendering the instrument "out of service" per the definition above.
1.0 INTRODUCTION

The operating specifications in this document cover storage operations for the Double-Shell Tank (DST) Farms (241-AN, AP, AW, AY, AZ, and SY Tank Farms).

The purpose and scope of the Operating Specification Documents (OSDs) as well as detailed requirements and authority for preparing, reviewing, releasing, and revising them are covered in TFC-ENG-CHEM-P-14, Operating Specification Documents.

Specification limits are given at the start of each section. The Detection/Control section describes the methods used to comply with the specification limits. The Recovery Action section describes the steps to be taken when a DST does not comply with an operating specification. The Technical Bases for the specification limits are located in Appendix A.

1.1 Liquid Levels

Tank liquid levels may be recorded by either an automatic liquid level measuring device (Enraf) or by manual liquid level tape/zip cord readings. When a tank has an operable Enraf and there is a discrepancy between the Enraf and manual tape readings, the Enraf readings shall be assumed to be accurate. Enrafs are calibrated in accordance with Maintenance Procedure 5-LCD-300, Enraf Calibration. Manual tapes are not calibrated.

<table>
<thead>
<tr>
<th>Tanks</th>
<th>Normal Operating Limit (inch)</th>
<th>Maximum Authorized Limit (inch)</th>
<th>Structural Limit (inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>241-AN</td>
<td>416</td>
<td>422</td>
<td>422</td>
</tr>
<tr>
<td>241-AP-102</td>
<td>416</td>
<td>422</td>
<td>460</td>
</tr>
<tr>
<td>241-AP-101, 103, 104, 105, 106, 107, 108</td>
<td>454</td>
<td>458</td>
<td>460</td>
</tr>
<tr>
<td>241-AW-101, 103-106</td>
<td>416</td>
<td>422</td>
<td>422</td>
</tr>
<tr>
<td>241-AW-102</td>
<td>409</td>
<td>422</td>
<td>422</td>
</tr>
<tr>
<td>241-AY</td>
<td>364</td>
<td>370</td>
<td>370</td>
</tr>
<tr>
<td>241-AZ</td>
<td>364</td>
<td>370</td>
<td>370</td>
</tr>
<tr>
<td>241-SY</td>
<td>416</td>
<td>422</td>
<td>422</td>
</tr>
</tbody>
</table>
Technical Basis: see Appendix A

Detection/Control:

Double-Shell Tanks are operated under the Normal Operating Limit; however, the Normal Operating Limit may be raised to the Maximum Authorized Limit by a Process Memo, which includes adjustments to surveillance requirements. The Normal Operating Limit and Maximum Authorized Limit can also be exceeded when performing level rise activities controlled by a Process Control Plan.

*An approved Process Memo or a Process Control Plan represents planned or approved activities that do not require Recovery Action for exceeding the Normal Operating Limit.

The primary tank waste level monitoring system in each tank is composed of several subsystems:

- Each tank is provided with an automatic liquid level measuring device (Enraf), which transmits data to the tank monitoring and control system (TMACS) in most cases.

- Tank levels are recorded on data sheets and checked against maximum and minimum liquid levels. A manual liquid level tape/zip cord reading may be taken at each tank as a backup to the automatic liquid level gauge.

- A 241-AP DST waste level above 422 inches must comply with in-service leak check requirements of RPP-19438, Report of Expert Panel Workshop for Hanford Site Double-Shell Tank Waste Level Increase. In-service leak check must be performed according to a process control plan. Results of an in-service leak check must be documented in an interoffice memo.

- In addition, some tanks are provided with a high-level alarm conductivity probe.

Readings are taken daily as specified by OSD-T-151-00031, Operating Specifications for Tank Farm Leak Detection and Single-Shell Tank Intrusion Detection, or during transfers as specified per transfer procedure.

Recovery Action:

Liquid Level Limit specification non-compliance shall be reported according to the dispositions described under this section.

If the Normal Operating Limit is exceeded as a result of unplanned, or unapproved activity:

- Notify the Shift Manager. Shift Manager shall treat OSD non-compliance as a significant operational issue and make appropriate notifications per TFC-OPS-OPER-C-57, Event Notification.
- Stop all transfers or additions into the tank.
- Verify that the level is less than the Maximum Authorized Limit level as listed in Table 1.1.1 for the applicable DST.
- Adjust surveillance requirements (alarms and/or rounds) to detect any more change, as required.
- Evaluate for reportability in accordance with TFC-OPS-OPER-C-24, Occurrence Reporting and Processing of Operations Information.
- Ensure a Problem Evaluation Request (PER) has been submitted.

**If the Maximum Authorized Limit is exceeded:**

- Notify the Shift Manager. Shift Manager shall treat OSD non-compliance as a significant operational issue and make appropriate notifications per TFC-OPS-OPER-C-57.
- Stop all transfers or additions into the tank.
- Evaluate for reportability in accordance with TFC-OPS-OPER-C-24.
- Ensure a Problem Evaluation Request (PER) has been submitted.

**If the Structural Limit is exceeded:**

- Notify the Shift Manager. Shift Manager shall treat OSD non-compliance as a significant operational issue and make appropriate notifications per TFC-OPS-OPER-C-57.
- Stop all transfers or additions into the tank.
- Evaluate for reportability in accordance with TFC-OPS-OPER-C-24.
- Ensure a Problem Evaluation Request (PER) has been submitted.
Table 1.1.2  Primary Tank Minimum Waste Liquid Level

<table>
<thead>
<tr>
<th>Tanks</th>
<th>When Annulus Ventilation in Operation (inch)</th>
<th>When Primary Tank Ventilation in Operation (inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>241-AY-101, AZ</td>
<td>64</td>
<td>6</td>
</tr>
<tr>
<td>241-AY-102</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>241-AN, SY, AW</td>
<td>N/A</td>
<td>6</td>
</tr>
<tr>
<td>241-AP</td>
<td>N/A</td>
<td>12</td>
</tr>
</tbody>
</table>

**Technical Basis: see Appendix A**

**Detection/Control:**

The primary tank waste level monitoring system in each tank is composed of several subsystems:

- Each tank is provided with an automatic liquid level measuring device (Enraf), which transmits data to the tank monitoring and control system (TMACS) in most cases.
- Tank levels are recorded on data sheets and checked against maximum and minimum liquid levels. A manual liquid level tape/zip cord reading may be taken at each tank as a backup to the automatic liquid level gauge.

Readings are taken daily as specified by OSD-T-151-00031, or during transfers as specified per transfer procedure.

**Recovery Action:**

If the DST does not comply with the Minimum Primary Tank Waste Liquid Level Limit while the Annulus Ventilation is in Operation:

- Notify the Shift Manager. Shift Manager shall treat OSD non-compliance as a significant operational issue and make appropriate notifications per TFC-OPS-OPER-C-57.
- Immediately shutdown the annulus ventilation system.
- Tank liquid level shall then be increased above the 64 inch limit by addition of water or waste and the annulus ventilation shall be restarted as soon as practical.
- Evaluate for reportability in accordance with TFC-OPS-OPER-C-24.
Ensure a Problem Evaluation Request (PER) has been submitted.

If the DST does not comply with the Minimum Primary Tank Waste Liquid Level Limit while the Primary Tank Ventilation is in Operation:

- Notify the Shift Manager. Shift Manager shall treat OSD non-compliance as a significant operational issue and make appropriate notifications per TFC-OPS-OPER-C-57.
- Immediately shutdown the primary tank ventilation system until new conditions of operations are determined.\(^{(1)}\)
- Evaluate for reportability in accordance with TFC-OPS-OPER-C-24.
- Ensure a Problem Evaluation Request (PER) has been submitted.

NOTE:
\(^{(1)}\) Operating below the minimum liquid level of 6 inches (12 inches for 241-AP) would require adjustment of the primary tank ventilation system. This condition of operation is not described, as pumping to this level is not planned in the foreseeable future.

### Table 1.1.3 Tertiary Leak Detection Pit Liquid Level

<table>
<thead>
<tr>
<th>Leak Detection Pit</th>
<th>Maximum Authorized Limit Dip Tube Reading (inch)</th>
<th>Structural Limit Dip Tube Reading (inch)</th>
<th>Level Reading Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>241-AN-01C - 06C</td>
<td>63</td>
<td>78</td>
<td>Monthly</td>
</tr>
<tr>
<td>241-AN-07C</td>
<td>63</td>
<td>74</td>
<td>Monthly</td>
</tr>
<tr>
<td>241-AP-03C, 05C</td>
<td>46</td>
<td>123</td>
<td>Monthly</td>
</tr>
<tr>
<td>241-AW-01C - 06C</td>
<td>63</td>
<td>74</td>
<td>Monthly</td>
</tr>
<tr>
<td>241-AY-101A - 102A</td>
<td>16</td>
<td>66</td>
<td>Weekly</td>
</tr>
<tr>
<td>241-AZ-101 - 102</td>
<td>23</td>
<td>73</td>
<td>Weekly</td>
</tr>
<tr>
<td>241-SY-01C - 03C</td>
<td>23</td>
<td>73</td>
<td>Weekly</td>
</tr>
</tbody>
</table>

Notes:
The values in Table 1.1.3 include a 2-inch “time to pump” margin. See technical basis section for details.

**Technical Basis: see Appendix A**
Detection/Control:

The Tertiary Leak Detection Pit Monitoring System is such that:

- Dip tubes are used to monitor the liquid level in the leak detection pit; a manual tape/zip cord reading may be taken at each tank as a backup to the dip tube instrumentation.

- Normal Operating Ranges (and if available, Alarm Set Points) verify equipment operation and provide indication that the liquid level is within the Maximum Authorized Limit. In all farms, dip tubes are read manually using pressure M&TE. The levels are checked and recorded on a regular frequency (located in Table 1.1.3) by operator rounds.

- The data is then reviewed per TFC-ENG-CHEM-D-21, *Process Engineering Waste Surveillance Data Review*.

Recovery Action:

Failure to Obtain a Required Level Reading:

- Notify the Shift Manager. Shift Manager shall treat OSD non-compliance as a significant operational issue and make appropriate notifications per TFC-OPS-OPER-C-57.

- Evaluate for reportability in accordance with TFC-OPS-OPER-C-24.

- Ensure a Problem Evaluation Request (PER) has been submitted.

If the Maximum Authorized Limit Dip Tube Reading is exceeded for a Leak Detection Pit that is Monitored Weekly:

- Notify the Shift Manager. Shift Manager shall treat OSD non-compliance as a significant operational issue and make appropriate notifications per TFC-OPS-OPER-C-57.

- Evaluate for reportability in accordance with TFC-OPS-OPER-C-24.

- Ensure a Problem Evaluation Request (PER) has been submitted.

- Pump the leak detection pit to below the Maximum Authorized Dip Tube limit within 30 calendar days.

- If the leak detection pit cannot or will not be pumped within 30 calendar days, system Engineering shall complete an OSD Recovery Action Plan Form (A-6005-240), submit the Recovery Action Plan to the WRPS Chief Engineer (with notification to the ORP Director of Tank Farm Operations Division when it is approved) within the
original 30 calendar days, and restore the leak detection pit level to within the established limit in accordance with the approved Recovery Action Plan.

- The recovery action plan shall include a technical basis for extending the time to pump. The actual rate of ingress of liquid shall be evaluated to ensure pumping is complete before the level reaches the Structural Limit Dip Tube Reading.

**If the Maximum Authorized Limit Dip Tube Reading is exceeded for a Leak Detection Pit that is Monitored Monthly:**

- Notify the Shift Manager. Shift Manager shall treat OSD non-compliance as a significant operational issue and make appropriate notifications per TFC-OPS-OPER-C-57.

- Evaluate for reportability in accordance with TFC-OPS-OPER-C-24.

- Ensure a Problem Evaluation Request (PER) has been submitted.

- Pump the leak detection pit to below the Maximum Authorized Dip Tube limit within 7 calendar days.

- If the leak detection pit cannot or will not be pumped within 7 calendar days, system Engineering shall complete an OSD Recovery Action Plan Form (A-6005-240), submit the Recovery Action Plan to the WRPS Chief Engineer (with notification to the ORP Director of Tank Farm Operations Division when it is approved) within the original 7 calendar days, and restore the leak detection pit level to within the established limit in accordance with the approved Recovery Action Plan.

  - The recovery action plan shall include a technical basis for extending the time to pump. The actual rate of ingress of liquid shall be evaluated to ensure pumping is complete before the level reaches the Structural Limit Dip Tube Reading.

- If the Leak Detection Pit continues to exceed the Maximum Authorized Dip Tube limit (after being pumped to below the limit) over 3 consecutive monthly level readings, then the leak detection pit monitoring frequency shall be increased to weekly inspections.

**If the Structural Limit Dip Tube Reading is exceeded:**

- Notify the Shift Manager. Shift Manager shall treat OSD non-compliance as a significant operational issue and make appropriate notifications per TFC-OPS-OPER-C-57.

- Evaluate for reportability in accordance with TFC-OPS-OPER-C-24.
- Prohibit waste transfers into or out of the DST while the Structural Limit Dip Tube Reading is exceeded.

- Ensure a Problem Evaluation Request (PER) has been submitted.

- Pump the leak detection pit to below the Maximum Authorized Dip Tube limit within 24 hours.

**Protocol for Pumping the Leak Detection Pit:**

- Prior to pumping the 241-AY-102A leak detection pit, **Task A** shall be completed to ensure the proper controls are established for the pumping process.

- Prior to pumping all other leak detection pits, **either perform Task A OR Task B** to ensure the proper controls are established for the pumping process.

**Task A** - Verify no waste is present in the leak detection pit by sampling and analysis of the liquid.

**Task B** - Perform a Technical Evaluation to document that there is low probability of tank waste being in the leak detection pit. The following data must be considered in the evaluation:

1. Verification using the required leak detection system for double-shell tanks as defined in OSD-T-151-00031;
   - Verification of no unexplained decrease in liquid level in the primary tank during the accumulation period (i.e. the period of time that liquid has accumulated in the leak detection pit),
   -AND-
   - Verification of no level alarms of the Enraf gauges in the annulus during the accumulation period.

2. If available, verification that the annulus Continuous Air Monitor has not detected any high airborne radiation during the accumulation period.

3. Verification of one of the following parameters;
   - Verification of no waste in the annulus by visual inspection during the accumulation period,
   -OR-
   - Verification that there is no indication of a deviation (large increase in rate) from historical leak detection pit liquid accumulation trends. Any deviations shall be investigated prior to pumping of the leak detection pit.
The Technical Evaluation shall be prepared in accordance with TFC-ENG-FACSUP-C-03, *Technical Evaluations* and must discuss each of the applicable parameters.

In addition to **Task A** or **Task B**, the following control shall be followed prior to pumping operations:

- Verification of a liquid pH in the range that is not consistent with tank waste (i.e., the pH of the leak detection pit liquid is in the range of 7-9). Concurrent verification shall be provided for the pH testing.
  
  o The pH measurement is performed as part of the Tank Farms Operations Administrative Controls (HNF-IP-1266 Section 5.8.11, *DST Leak Detection Pit Pumping Control*) which is implemented by TO-020-595, *Leak Detection Pit/Radiation Detection Drywell Transfers*.

  o The pH measurement shall be performed using a calibrated hand-held pH probe. The probe shall be lowered into the leak detection pit and a camera shall be used to ensure the probe is in contact with the liquid when taking the pH reading.

    o If the pH level is greater than 9, work shall be placed in a safe configuration and engineering should be contacted for further guidance.

    o If the pH level is less than 7, contact engineering for further guidance and a Criticality Safety Representative. A Criticality Safety Representative approval must be obtained prior to transferring waste with a pH of less than 7.
1.2 Hydrostatic Load

Table 1.2.1 Maximum Bulk Specific Gravity

<table>
<thead>
<tr>
<th>Tanks</th>
<th>Maximum Hydrostatic Load (in. w.g.)</th>
<th>Maximum Bulk Specific Gravity</th>
</tr>
</thead>
<tbody>
<tr>
<td>241 - AN, AW, SY</td>
<td>717</td>
<td>1.7</td>
</tr>
<tr>
<td>241 - AP</td>
<td>841</td>
<td>1.83</td>
</tr>
<tr>
<td>241 - AY, AZ</td>
<td>655</td>
<td>1.77</td>
</tr>
</tbody>
</table>

**Technical Basis: see Appendix A**

**Detection/Control:**


Specific gravity is measured by:

- Densitometer readings
- Laboratory analysis of DST tank waste sample
- Evaluation and approval of transfers into DST’s by Process Modeling per HNF-SD-WM-OCD-015 to prevent exceeding the maximum bulk specific gravity values specified.

**Recovery Action:**

If the Maximum Bulk Specific Gravity Limit is Exceeded:

- Notify the Shift Manager. Shift Manager shall treat OSD non-compliance as a significant operational issue and make appropriate notifications per TFC-OPS-OPER-C-57.
- Notify the Manager of Process Modeling regarding the need to evaluate the waste level in the tank with respect to hydrostatic load and the need for restrictions on waste level in the tank. The restrictions shall be documented in a process memo.
- Evaluate for reportability in accordance with TFC-OPS-OPER-C-24.
- Ensure a Problem Evaluation Request (PER) has been submitted.
1.3 Primary Tank and Annulus Vapor Space

Table 1.3.1 Primary Tank Vapor Space Vacuum

<table>
<thead>
<tr>
<th>Tanks</th>
<th>Primary Tank Vacuum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum Vacuum</td>
</tr>
<tr>
<td></td>
<td>Minimum Vacuum</td>
</tr>
<tr>
<td>241-AY-102</td>
<td>- 2 in. w.g</td>
</tr>
<tr>
<td></td>
<td>(+2 in. w.g. vacuum)</td>
</tr>
<tr>
<td>241-AN, AW, AY-101, AZ, SY</td>
<td>- 6 in. w.g</td>
</tr>
<tr>
<td></td>
<td>(+6 in. w.g. vacuum)</td>
</tr>
<tr>
<td>241-AP</td>
<td>- 8.7 in. w.g</td>
</tr>
<tr>
<td></td>
<td>(+8.7 in. w.g. vacuum)</td>
</tr>
</tbody>
</table>

Technical Basis: see Appendix A

Detection/Control:

- Normal Operating Ranges (Alarm Set Points) provide indication that the primary tank vacuum is within Maximum and Minimum limits.

- Pressure indicators and recorders measure primary tank vacuum. Readings are recorded on daily round sheets. Recorded pressure readings are entered into the Surveillance Analysis Computer System (SACS) database.

Recovery Action:

Primary tank vapor space vacuum shall be maintained within the Normal Operating Limits, except if the primary ventilation system was intentionally shut down or for planned activities described in the appropriate Alarm Response Procedure (ARP). In case of the ventilation being inoperable, respond per the appropriate ARP. If the pressure alarm becomes inoperable, it should be repaired or replaced on a priority basis.

If the Maximum Vacuum Limit -OR- Minimum Vacuum Limit is Exceeded:

- Notify the Shift Manager. Shift Manager shall treat OSD non-compliance as a significant operational issue and make appropriate notifications per TFC-OPS-OPER-C-57.

- Take immediate action to return the vacuum to within Normal Operating Limits.

- In case of a pressurization alarm, take corrective action as described in the appropriate Alarm Response Procedure.
- Evaluate for reportability in accordance with TFC-OPS-OPER-C-24.
- Ensure a Problem Evaluation Request (PER) has been submitted.

**Table 1.3.2 Secondary Tank Annulus Vacuum**

<table>
<thead>
<tr>
<th>Tanks</th>
<th>Annulus Vacuum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum Vacuum</td>
</tr>
<tr>
<td>241-AW, AZ, SY</td>
<td>- 6 in. w.g. (+6 in. w.g. vacuum)</td>
</tr>
<tr>
<td>241-AN, AP, AY</td>
<td>- 20 in. w.g. (+20 in. w.g. vacuum)</td>
</tr>
</tbody>
</table>

**Technical Basis: see Appendix A**

**Detection/Control:**
- Each DST has a pressure control system that includes a high and a low alarm set point for the annulus vacuum.
- Pressure indicators and recorders measure annulus vacuum. Readings are recorded on daily round sheets. Recorded pressure readings are entered into SACS database.

**Recovery Action:**
See Recovery Action for Primary Tank Vapor Space Vacuum
1.4  Tank and Waste Temperatures

Table 1.4.1  Maximum Temperature for Waste, Steel, and Concrete

<table>
<thead>
<tr>
<th>Tanks</th>
<th>Max Temperature for Waste and Steel (°F)</th>
<th>Max Temperature for Concrete (°F)</th>
</tr>
</thead>
</table>
| 241-AN, AW | 350                                      | Dome: 160  
|           |                                          | Wall: 236                  |
| 241-AP    | 210                                      | Dome: 135  
|           |                                          | Wall: 236                  |
| 241-AY, AZ| 260                                      | Dome: 160  
|           |                                          | Wall: 350                  |
| 241-SY    | 250                                      | Dome: 160  
|           |                                          | Wall: 250                  |

Technical Basis: see Appendix A

Detection/Control:

- For 241-AN, AP, AW, and SY tank farms, thermocouple trees are located in the primary tanks. Thermocouples are also located as pairs in the concrete dome and walls, and spaced in series in the concrete foundation and the insulating concrete. Temperatures can be read using a potentiometer the Tank Farm Instrument Buildings and are recorded continuously on the Tank Monitoring and Control System (TMACS).

- For 241-AY and AZ tank farms, see Table 1.4.3. Temperatures are continuously recorded on the Master Pump Shutdown System (MPSS).

- TMACS and MPSS display on the Surveillance Data Display System (SDDS) website, and the data is written to the Surveillance Analysis Computer System (SACS) database.

- All 241-DST temperatures can be taken manually, if the automated systems are not available.

- When planning a transfer, the flow rates shall be adjusted if the difference in temperature between the originating tank and the receiving tank is such that the specification limit can be exceeded. During the transfers, tank temperatures are monitored to avoid violating the specifications.
Recovery Action:

NOTE:
Table 1.4.1 temperatures are limits on DST bulk, or average temperature. The term “bulk” temperature is used such that the entire tank is assumed to be operating at this single temperature. Individual thermocouple readings in excess of Table 1.4.1 limits do not necessarily indicate DST “bulk” temperatures to be in excess of Table 1.4.1 limits. Process Engineering will make the determination for what readings constitute “bulk” tank temperature.

If a Table 1.4.1 temperature limit is exceeded, contact Process Engineering for determination if temperature represents bulk temperature.

If Process Modeling determines bulk temperature specification limit is exceeded:

- Notify the Shift Manager. Shift Manager shall treat OSD non-compliance as a significant operational issue and make appropriate notifications per TFC-OPS-OPER-C-57.
- Stop all additions to and transfers from affected tank.
- Adjust surveillance requirements (alarms and/or rounds) to detect any more change
- Appropriately adjust the ventilation
- Evaluate for reportability in accordance with TFC-OPS-OPER-C-24.
- Ensure a Problem Evaluation Request (PER) has been submitted.
Table 1.4.2 Bulk Temperature Change

Table 1.4.2-1 Bulk Temperature Change with Respect to Time

<table>
<thead>
<tr>
<th>Tanks</th>
<th>For temp. &lt; 125°F</th>
<th>For temp. ≥ 125°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>241-AN, AP, AW, SY</td>
<td>≤10°F/hr</td>
<td>≤20°F/day</td>
</tr>
<tr>
<td>241-AY, AZ</td>
<td></td>
<td>≤3°F/day or ≤24°F/day provided the tank temperature is kept constant ±3°F for 8 calendar days thereafter.</td>
</tr>
</tbody>
</table>

Notes: Table 1.4.2-1 does not apply when filling an empty tank.

Table 1.4.2-2 Temperature Change Gradients

<table>
<thead>
<tr>
<th>Tanks</th>
<th>Solution in Tank Including Solution/Vapor Interface</th>
<th>Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>241-AN, AP, AW, SY</td>
<td>≤55°F/ft</td>
<td>≤ 35°F/ft</td>
</tr>
<tr>
<td>241-AY, AZ</td>
<td></td>
<td>≤ 18°F/ft</td>
</tr>
</tbody>
</table>

Technical Basis: see Appendix A

Detection/Control:

See Detection/Control for Maximum Bulk Temperature for Steel, Concrete, and Waste.

Recovery Action:

See Recovery Action for Maximum Bulk Temperature for Steel, Concrete, and Waste.
Table 1.4.3-1 Minimum Number of Operational Thermocouples for Tanks 241-AY and AZ

<table>
<thead>
<tr>
<th>Type</th>
<th>Minimum Number of Operational Thermocouples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solution&lt;sup&gt;1&lt;/sup&gt;</td>
<td>2</td>
</tr>
<tr>
<td>Sludge&lt;sup&gt;1,2&lt;/sup&gt;</td>
<td>3 (any combination of sludge thermocouples and Air lift circulator [ALC] thermocouples) or 2 (any combination of inner sludge thermocouples and central and inner radius ALC thermocouples)</td>
</tr>
<tr>
<td>Concrete</td>
<td></td>
</tr>
<tr>
<td>Dome: at 36-ft Radius</td>
<td>2 Inside, 2 Outside</td>
</tr>
<tr>
<td>Dome: at 41-ft Radius</td>
<td>2 Inside, 2 Outside</td>
</tr>
<tr>
<td>Middle Wall&lt;sup&gt;3&lt;/sup&gt;</td>
<td>2 Inside, 2 Outside</td>
</tr>
<tr>
<td>Bottom Wall&lt;sup&gt;3&lt;/sup&gt;</td>
<td>2 Inside, 2 Outside</td>
</tr>
</tbody>
</table>

1. During active retrieval operations for Tank 241-AY-102, in-tank thermocouples will be uncovered as waste is retrieved from the tank. As a result, these thermocouples will no longer measure waste temperatures and are not required to be operable.
2. Sludge thermocouple heights must be investigated to ensure that the thermocouples chosen reside in the sludge layer of the applicable tank
3. Only applies to tanks in 241-AZ Farm
### Table 1.4.3-2 AY and AZ Farm Thermocouple Groups (Arranged by Thermocouple Number)\(^1\)

<table>
<thead>
<tr>
<th>Section</th>
<th>AY-101(^2)</th>
<th>AY-102(^3)</th>
<th>AZ-101(^2)</th>
<th>AZ-102(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outer Sludge</td>
<td>-62, 65, 68, 71</td>
<td>-62, 65, 68, 71</td>
<td>-61, 64, 67, 70, 98(^4) to 101(^4), 104(^4)</td>
<td>-61, 64, 67, 70</td>
</tr>
<tr>
<td>Outer Radius ALC</td>
<td>-46 to 59</td>
<td>-46 to 59</td>
<td>-45 to 58</td>
<td>-45 to 58</td>
</tr>
<tr>
<td>Inner Sludge</td>
<td>-72 to 74</td>
<td>-72 to 74</td>
<td>-71 and 72</td>
<td>-71 to 73</td>
</tr>
<tr>
<td>Inner Radius ALC</td>
<td>-38 to 45</td>
<td>-38 to 45</td>
<td>-37 to 44</td>
<td>-37 to 44</td>
</tr>
<tr>
<td>Solution</td>
<td>-60, 61, 63, 64, 66, 67, 69, 70</td>
<td>-60, 61, 63, 64, 66, 67, 69, 70</td>
<td>-59, 60, 62, 63, 65, 66, 68, 69, 102(^4), 103(^4)</td>
<td>-59, 60, 62, 63, 65, 66, 68, 69</td>
</tr>
<tr>
<td>Primary Tank Bottom</td>
<td>-1 to 25</td>
<td>-1 to 25</td>
<td>-1 to 24</td>
<td>-1 to 24</td>
</tr>
<tr>
<td>Primary Tank Wall-Lower</td>
<td>-26 and 27</td>
<td>-26 and 27</td>
<td>-25 and 28</td>
<td>-25 and 26</td>
</tr>
<tr>
<td>Concrete Foundation</td>
<td>-34 and 37</td>
<td>-30 to 37</td>
<td>-26, 27, 29 to 36</td>
<td>-28 to 36</td>
</tr>
<tr>
<td>Below Concrete Foundation</td>
<td>-106 to 132</td>
<td>-106 to 132</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Inner Concrete Dome</td>
<td>-91, 92, 93, 97, 98, 99, 103, 104, 105</td>
<td>-91 to 93</td>
<td>-83 to 85</td>
<td>-83 to 85</td>
</tr>
<tr>
<td>Inner Concrete Haunch</td>
<td>-88 to 90</td>
<td>-88 to 90</td>
<td>-80 to 82</td>
<td>-80 to 82</td>
</tr>
<tr>
<td>Inner Concrete Wall-Middle</td>
<td>N/A</td>
<td>N/A</td>
<td>-89 to 91</td>
<td>-89 to 91</td>
</tr>
<tr>
<td>Inner Concrete Wall-Lower</td>
<td>N/A</td>
<td>N/A</td>
<td>-95 to 97</td>
<td>-95 to 97</td>
</tr>
<tr>
<td>Outer Concrete Dome</td>
<td>-85, 86, 87, 94, 95, 96, 100, 101, 102</td>
<td>-85 to 87</td>
<td>-77 to 79</td>
<td>-77 to 79</td>
</tr>
<tr>
<td>Outer Concrete Haunch</td>
<td>-82 to 84</td>
<td>-82 to 84</td>
<td>-74 to 76</td>
<td>-74 to 76</td>
</tr>
<tr>
<td>Outer Concrete Wall-Middle</td>
<td>N/A</td>
<td>N/A</td>
<td>-86 to 88</td>
<td>-86 to 88</td>
</tr>
<tr>
<td>Outer Concrete Wall-Lower</td>
<td>N/A</td>
<td>N/A</td>
<td>-92 to 94</td>
<td>-92 to 94</td>
</tr>
<tr>
<td>Tank Bottom-Inside 24 ft.</td>
<td>-1 to 11</td>
<td>-1 to 11</td>
<td>-1 to 12</td>
<td>-1 to 12</td>
</tr>
</tbody>
</table>

**Notes:**

1. Reference: Table 2 of Internal Memo 13314-89-040, Aging Waste Tank Thermocouple Needs
2. Thermocouple number with prefix TE-101-[AY or AZ]
3. Thermocouple number with prefix TE-102-[AY or AZ]
4. Thermocouples that need to be recorded manually
**Technical Basis: see Appendix A**

**Detection/Control:**

Each time a thermocouple failure occurs, the number of operable thermocouples is checked against the table to verify the requirement is met.

**Recovery Action:**

Concrete thermocouples are not replaceable.

If the DST does not comply with specification for the minimum number of thermocouples:

- Notify the Shift Manager. Shift Manager shall treat OSD non-compliance as a significant operational issue and make appropriate notifications per TFC-OPS-OPER-C-57.

- Additional in tank thermocouples could be added to make-up for the failed concrete thermocouples or tank operation could be restricted to maintain temperatures below this limit.

- Evaluate for reportability in accordance with TFC-OPS-OPER-C-24.

- Ensure a Problem Evaluation Request (PER) has been submitted.
## 1.5 Corrosion Mitigation

### Table 1.5.1 Waste Chemistry Limits

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\text{Waste Temperature (T) Range}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$T &gt; 212^\circ F$</td>
</tr>
<tr>
<td></td>
<td>$167^\circ F &lt; T \leq 212^\circ F$</td>
</tr>
<tr>
<td></td>
<td>$T &lt; 167^\circ F$</td>
</tr>
<tr>
<td>$[\text{OH}^-]$</td>
<td>$0.010M \leq [\text{OH}^-] &lt; 4.0M$</td>
</tr>
<tr>
<td>$[\text{NO}_2^-]$</td>
<td>$0.011M \leq [\text{NO}_2^-] \leq 5.5M$</td>
</tr>
<tr>
<td>$[\text{NO}_3^-] / ([\text{OH}^-] + [\text{NO}_2^-])$</td>
<td>$&lt; 2.5$</td>
</tr>
<tr>
<td>$[\text{OH}^-]$</td>
<td>$0.1 ([\text{NO}_3^-]) \geq [\text{OH}^-] &lt; 10M$</td>
</tr>
<tr>
<td>$[\text{NO}_2^-]$</td>
<td>$0.3M \leq [\text{OH}^-] &lt; 10M$</td>
</tr>
<tr>
<td>$[\text{NO}_3^-]$</td>
<td>$\geq 0.4 ([\text{NO}_3^-])$</td>
</tr>
</tbody>
</table>

### For $[\text{NO}_3^-]$ Range

<table>
<thead>
<tr>
<th>$[\text{NO}_3^-]$</th>
<th>$\leq 1.0M$</th>
<th>$&gt; 1.0M$</th>
<th>$&gt; 3.0M$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$[\text{OH}^-]$</td>
<td>$1.0M \leq [\text{OH}^-] \leq 3.0M$</td>
<td>$[\text{OH}^-]$</td>
<td>$[\text{OH}^-]+$</td>
</tr>
</tbody>
</table>
Table 1.5.1-2 Waste Chemistry Limits for the Interstitial Liquid of Tanks 241-AN-102, AN-106, AN-107, AY-101, and AY-102

<table>
<thead>
<tr>
<th>TEMPERATURE</th>
<th>VARIABLE</th>
<th>LIMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 122 °F</td>
<td>$[\text{NO}_2^-]/[\text{NO}_3^-]$</td>
<td>≥ 0.32¹</td>
</tr>
<tr>
<td></td>
<td>pH</td>
<td>≥ 10</td>
</tr>
<tr>
<td>&gt; 122 °F</td>
<td>Limits in Table 1.5.1-1 above apply²</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. The $[\text{NO}_2^-]/[\text{NO}_3^-]$ limit ≥ 0.32 does not apply to 241-AY-102
2. 241-AY-102 chemistry limits apply for temperatures not in excess of 170°F

**Technical Basis:** see Appendix A

**Detection/Control:**

- Conduct periodic sampling of the waste in DST’s to determine the nitrite, nitrate, and hydroxide concentrations and to verify that measured concentrations are within the limits established in Tables 1.5.1-1 and 1.5.1-2. The technical basis for establishing sampling frequencies is provided in RPP-7795, *Technical Basis for Chemistry Control Program.*

- Establish and maintain a database to track the nitrite, nitrate, and hydroxide concentrations in each DST. This database is used to monitor compliance with the waste chemistry limits and to identify patterns of caustic consumption that are important in determining tank sampling frequencies. The database also is used for trending to help predict when chemical adjustments are required to ensure DST waste chemistry is within the established limits. The database is published annually as part of RPP-13639, *Caustic Limits Report.*

- Prior to waste transfers, the final states of the sending and receiving DST’s shall be evaluated for compliance with the waste chemistry limits. Compliance may be demonstrated by sample analysis or calculations of final waste chemistry conditions. The evaluation of compliance with the waste chemistry limits will be documented in a Waste Compatibility Assessment performed in accordance with HNF-SD-WM-OCD-015.

**Recovery Action:**

Waste samples are analyzed per the requirements of a Tank Sampling and Analysis Plan (TSAP) and when results are not in compliance with the TSAP, the 222-S Laboratory and Tank Farm Inventory personnel invoke TFC-ENG-CHEM-P-18, *Response To Anomalous Sample Results.*
When a DST is identified to be outside the established limits for the nitrite, nitrate, or hydroxide concentrations:

- Notify the Shift Manager. Shift Manager shall treat OSD non-compliance as a significant operational issue and make appropriate notifications per TFC-OPS-OPER-C-57.

- Evaluate for reportability in accordance with TFC-OPS-OPER-C-24.

- Ensure a Problem Evaluation Request (PER) has been submitted.

- Restore the nitrite, nitrate, or hydroxide concentrations within the established limits within 30 calendar days and verify by sample analysis that the waste chemistry is within the established limits within 90 calendar days.

-OR-

Process Engineering shall complete an OSD Recovery Action Plan Form (A-6005-240), submit the Recovery Action Plan to the WRPS Chief Engineer (with notification to the ORP Director of Tank Farm Operations Division when it is approved) within 30 calendar days, and restore the nitrite, nitrate, or hydroxide concentrations within the established limits in accordance with the approved Recovery Action Plan.

Table 1.5.2  Annulus Tank Ventilation System and Annulus Inspection

<table>
<thead>
<tr>
<th>Applicable System</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annulus Ventilation¹</td>
<td>Annulus tank ventilation systems shall be operating except for outages not to exceed 30 calendar days.</td>
</tr>
<tr>
<td>DST Annulus</td>
<td>Enhanced Annulus Video Inspections, covering ≥ 95% of annulus floor area and the portion of the primary tank (i.e., dome, sidewall, lower knuckle, and insulating refractory) that is visible from the annulus inspection risers, shall be conducted. Each DST annulus shall be video inspected on a 33 month frequency not to exceed 45 months. Comprehensive Annulus Video Inspections, covering ≥ 95% of annulus floor, shall be conducted on tank AY-101. These inspections shall be conducted on a 12 month frequency.</td>
</tr>
</tbody>
</table>

Notes:
1. Does not apply to Tank 241-AY-102 during active retrieval operations.
### Table 1.5.3 Enhanced Annulus Video Inspection Requirements

<table>
<thead>
<tr>
<th>Applicable System</th>
<th>Enhanced Annulus Video Inspection Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>DST Annulus</td>
<td>1. The starting date for establishing frequencies for the video inspection of each DST (33 month frequency not to exceed 45 months) is the date of the previously performed ≥ 95% inspection.</td>
</tr>
<tr>
<td></td>
<td>2. Video inspections shall be conducted to cover ≥ 95% of the annulus floor and the portion of the primary tank that is visible from the annulus inspection risers.</td>
</tr>
<tr>
<td></td>
<td>3. Video inspections shall focus on visible portions of the primary tank (i.e., dome, sidewall, lower knuckle, and insulating refractory), as well as the annulus floor. During these inspections the visible area shall be monitored for evidence of water ingress, which is most likely to appear on the primary tank dome.</td>
</tr>
<tr>
<td></td>
<td>4. Evaluation of the data obtained for each DST annulus in the video inspection will lead to one of the following conclusions:</td>
</tr>
<tr>
<td></td>
<td>a. There is no direct observation of water ingress and the outer walls and secondary tank steel liner show no indications of patches of notable corrosion or efflorescence stains/streaks and conditions are essentially unchanged since the last video inspection. The next video inspection shall be performed consistent with the 33 month not to exceed 45 months frequency described above.</td>
</tr>
<tr>
<td></td>
<td>b. There is direct observation of water ingress and/or the outer walls and/or secondary steel liner show that new patches of heavy corrosion and/or efflorescence stains/streaks have appeared since the last inspection.</td>
</tr>
<tr>
<td></td>
<td>5. If the criteria of 4b are met, the video inspection frequency shall be increased to annually (i.e., not to exceed 365 calendar days since completion of the last inspection) in the affected DST until the condition is stabilized/mitigated. Other actions, described in the Recovery Actions section shall also be implemented.</td>
</tr>
<tr>
<td></td>
<td>6. The criteria presented in 4a and 4b above (e.g., “no indications of patches of notable corrosion or efflorescence stains/streaks and conditions are essentially unchanged”, “new patches of heavy corrosion and/or efflorescence stains/streaks have appeared since the last inspection”) are qualitative. In situations where there is ambiguity on whether the observed conditions meet the criteria of 4a or 4b above, the Chief Engineer shall make the determination.</td>
</tr>
<tr>
<td></td>
<td>7. The results of the video inspection shall be documented in an engineering document.</td>
</tr>
</tbody>
</table>
Table 1.5.4 Comprehensive Annulus Video Inspection Requirements

<table>
<thead>
<tr>
<th>Applicable System</th>
<th>Comprehensive Annulus Video Inspection Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>DST Annulus</td>
<td>1. The starting date for establishing frequencies for the video inspection of tank AY-101 (12 months) is the date of the previously performed ≥ 95% inspection.</td>
</tr>
<tr>
<td></td>
<td>2. Video inspections shall be conducted to cover ≥ 95% of the annulus floor.</td>
</tr>
<tr>
<td></td>
<td>3. Video inspections shall focus on the annulus floor. During these inspections the visible area shall be monitored for a primary tank leak, which is most likely to appear on the annulus floor.</td>
</tr>
<tr>
<td></td>
<td>4. Evaluation of the data obtained in the video inspection will lead to one of the following conclusions:</td>
</tr>
<tr>
<td></td>
<td>a. There is no direct observation of a primary tank leak. The next video inspection shall be performed consistent with the 12 month frequency described above.</td>
</tr>
<tr>
<td></td>
<td>b. There is direct observation of an anomaly that could represent a primary tank leak site, but there is not enough video evidence to be certain. A more thorough video inspection shall be conducted as soon as possible to determine if the anomaly meets the criteria of 4a or 4c.</td>
</tr>
<tr>
<td></td>
<td>c. There is direct observation of a primary tank leak. A formal leak assessment shall be conducted and video inspection of the leak site(s) shall be conducted on a weekly frequency.</td>
</tr>
<tr>
<td></td>
<td>5. The results of the video inspection shall be documented in an engineering document.</td>
</tr>
</tbody>
</table>

**Technical Basis:** see Appendix A

**Detection/Control:**

Annulus ventilation system operation is verified as follows:

- Verify that at least one fan is operating

- Verify that inlet annulus ventilation dampers/valves are not closed (except 241-SY farm emergency pump out isolation station valves SY101-VTA-V-202, SY102-VTA-V-212, and SY103-VTA-V-222) by either:

  **Visual Inspection**

  -OR-

  Indication of differential pressure across the annulus inlet high-efficiency particulate air filter
Conditions that indicate the ingress of water are direct observation of water ingress into the annulus or the presence of heavy patches of rusting corrosion and/or the presence of mineral deposit stains. This phenomenon is known as efflorescence and involves the growth of mineral deposits (e.g., salt crystals) from the evaporation of mineral laden water.

Annulus video inspection schedules are located and tracked in the Tank Farm Projects Baseline.

**Recovery Action:**

If the annulus tank ventilation system is out of service for longer than 30 calendar days:

- Notify the Shift Manager. Shift Manager shall treat OSD non-compliance as a significant operational issue and make appropriate notifications per TFC-OPS-OPER-C-57.
- Evaluate for reportability in accordance with TFC-OPS-OPER-C-24.
- System Engineering shall complete an OSD Recovery Action Plan Form (A-6005-240) in accordance with TFC-ENG-CHEM-P-14, submit the Recovery Action Plan to the WRPS Chief Engineer (with notification to the ORP Director of Tank Farm Operations Division when it is approved) within 30 calendar days of the ventilation going out of service, and restore the annulus ventilation to operation in accordance with the approved Recovery Action Plan.

If video inspection indicates ingress of water into the annulus:

- Notify the Shift Manager. Shift Manager shall treat OSD non-compliance as a significant operational issue and make appropriate notifications per TFC-OPS-OPER-C-57.
- Evaluate for reportability in accordance with TFC-OPS-OPER-C-24.
- Ensure a Problem Evaluation Request (PER) has been submitted.
- Stop the ingress of water into the annulus within 30 calendar days.
  -OR-

  Process Engineering shall complete an OSD Recovery Action Plan Form (A-6005-240) in accordance with TFC-ENG-CHEM-P-14, submit the Recovery Action Plan to the WRPS Chief Engineer (with notification to the ORP Director of Tank Farm Operations Division when it is approved) within 30 calendar days, and stop the ingress of water into the annulus in accordance with the approved Recovery Action Plan.
If video inspection indicates a primary tank leak:

- Upon discovery of a potential tank leak, the process outlined in TFC-ENG-CHEM-D-42 shall be followed.
- Video inspection of the leak site(s) shall be conducted on a weekly frequency.

**Table 1.5.5 Water and Condensate Additions to AY-101 or AZ-102**

<table>
<thead>
<tr>
<th>Applicable System</th>
<th>Maximum Water and Condensate Addition to AY-101 or AZ-102</th>
</tr>
</thead>
</table>
| DST               | 1. Cumulative Allowed Water and Condensate Addition to AY-101 or AZ-102 is 2750 gallons. Water and condensate additions greater than or equal to 2750 gallons will require:  
  a. Recirculation of the tank contents within 30 days OR  
  b. Transfer of waste, chemical addition, or other liquid compliant with Table 1.5.1-1 into the tank within 30 days OR  
  c. Sampling and analysis within 30 days to demonstrate that the waste surface complies with Table 1.5.1-1 OR  
  d. Documented technical evaluation showing waste is predicted to be compliant with Table 1.5.1-1 after the addition. |

**Technical Basis: see Appendix A**

**Detection/Control:**

Many water additions to DSTs are tracked by TADD. Large additions of condensate from the AZ-301 tank and water pumped from Leak Detection Pits are included in Waste Compatibility Assessments. AZ-301 condensate when transferred to AY-101 or AZ-102 will exceed 2750 gallons and the requirements above are needed to prevent a dilute layer from persisting on the waste surface. For planned activities that are anticipated to exceed the cumulative allowed water addition (e.g. pump replacement) a technical evaluation and recovery plan may be prepared in advance of the work. Normally, water additions to support operational activities and pumping of leak detection pit water do not exceed 2750 gallons, however if the volume does, the requirements above are applied.

**Recovery Action:**

If more than 2750 gallons of water or condensate have been added cumulatively to AY-101 or AZ-102 without meeting one of the required actions above within 30 calendar days:

- Process and Integrity Engineering shall complete an OSD Recovery Action Plan (RAP) Form (A-6005-240) in accordance with TFC-ENG-CHEM-P-14. Approval of the OSD RAP via SPF must be completed within 30 calendar days of exceeding the water and condensate addition limit.

- An OSD non-compliance only occurs if the RAP is either not approved in time, or the RAP is not followed.
• Notify the Shift Manager. Shift Manager shall treat OSD non-compliance as a significant operational issue and make appropriate notifications per TFC-OPS-OPER-C-57.

• Evaluate for reportability in accordance with TFC-OPS-OPER-C-24.
1.6 Dome Loading

### Table 1.6.1 Dome Loading Requirements

<table>
<thead>
<tr>
<th>Applicable System</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>DST</td>
<td>Establish tank safe operating limits for concentrated loads as described in an Analysis of Record.</td>
</tr>
<tr>
<td></td>
<td>Determine in-place load conditions on the specific tank.</td>
</tr>
<tr>
<td></td>
<td>Track and control load additions to ensure that the total applied load does not exceed the documented load limits.</td>
</tr>
<tr>
<td></td>
<td>Restrict load additions to the tank until assessment of in-place loading. (This restriction does not apply to personnel or equipment carried by personnel.)</td>
</tr>
<tr>
<td></td>
<td>Changes to load limits shall be determined by structural evaluations in accordance with national codes and standards and DOE orders, and approved by qualified personnel in accordance with Tank Operations Contractor engineering procedures.</td>
</tr>
<tr>
<td></td>
<td>Tank dome surveys shall be performed on a 2 years ±4 month frequency.</td>
</tr>
</tbody>
</table>

**Technical Basis:** see Appendix A

**Detection/Control:**

Analysis of Record documents for DSTs shall be developed and maintained in accordance with TFC-ENG-FACSUP-C-10, Control of Dome Loading. The Analysis of Record documents establish tank safe operating load limits, including limits for concentrated loads and vehicular access controls.

The change process for Analysis of Record load limits shall meet the Table 1.6.1 requirement stating that: “Changes to load limits shall be determined by structural evaluations in accordance with national codes and standards and DOE orders, and approved by qualified personnel in accordance with Tank Operations Contractor engineering procedures.”

A Dome Load Record shall be developed and maintained for each DST in accordance with TFC-ENG-FACSUP-C-10.

Until the load summary provided in the Dome Load Record is completed for a specific DST, an interim load limit obtained from the Analysis of Record shall apply for that DST.
The addition and removal of temporary concentrated loads applied over tank domes and within Exclusion Zones shall be tracked and controlled in accordance with TFC-OPS-OPER-C-10, *Vehicle and Dome Load Control in Tank Farm Facilities*.

Vehicle access to tank farms and movement within tank farms shall be controlled in accordance with TFC-OPS-OPER-C-10.

Before a temporary concentrated load is added to a tank dome or Exclusion Zone (including vehicle loads; excluding personnel and equipment carried by personnel), the resulting sum of the temporary concentrated loads shall be evaluated against the Allowable Load Margin for that facility in accordance with TFC-OPS-OPER-C-10. TFC-ENG-FACSUP-C-10 includes provisions for waiving and revising the Allowable Load Margin.

Changes to permanent load conditions shall be included in the Dome Load Record and evaluated to ensure the Analysis of Record limits are not exceeded, in accordance with TFC-ENG-FACSUP-C-10.

Dome elevation surveys shall be scheduled in the computerized maintenance management system, results shall be reviewed and any necessary response taken in accordance with TFC-ENG-FACSUP-C-10.

**Recovery Action:**

If the Allowable Load Margin is exceeded:

- Notify the Shift Manager. Shift Manager shall treat OSD non-compliance as a significant operational issue and make appropriate notifications per TFC-OPS-OPER-C-57.

- Notify the Engineering Discipline Lead - Civil/Structural to determine if any restrictions or immediate actions are warranted.

- Evaluate for reportability in accordance with TFC-OPS-OPER-C-24.

- Ensure a Problem Evaluation Request (PER) has been submitted.

If a Dome Elevation Survey is missed:

The Cognizant System Engineer or Design Authority shall complete an OSD Recovery Action Plan Form (A-6005-240) in accordance with TFC-ENG-CHEM-P-14 and submit the Recovery Action Plan to the WRPS Chief Engineer (with notification to the ORP Director of Tank Farm Operations Division when it is approved) within 30 calendar days.
## 1.7 Tank Bump

**Table 1.7.1  End-State Analysis for Tank Bump**

<table>
<thead>
<tr>
<th>Applicable System</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DST</strong></td>
<td>Prior to waste transfers into DSTs, the Tank Operations Contractor shall evaluate the end state of the receiving tank to verify that at least one of the following criteria is met.</td>
</tr>
<tr>
<td></td>
<td>a. Total tank heat load is &lt; 58,000 Btu/h.</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td>b. Non-convective layer height is &lt; 12 in.</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td>c. Supernatant depth is &lt; 39 in.</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td>d. The non-condensable gas generation rate at saturation in the non-convective layer is sufficiently low, such that the ratio of vertical void fraction profile to the neutral buoyant void fraction is &lt; 1.0.</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td>e. For AN-106 only, the supernatant temperature is &lt; 177°F.</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td>f. For AZ-102 only, the supernatant temperature is &lt; 177°F.</td>
</tr>
</tbody>
</table>

The Tank Operations Contractor shall review all DSTs every two years to confirm that at least one of the criteria in Table 1.7.1 is met for all DSTs (i.e., that a tank bump is not a credible accident).

**Technical Basis: see Appendix A**
**Detection/Control:**

The evaluation of the tank bump criteria prior to waste transfers shall be performed and documented in accordance with HNF-SD-WM-OCD-015.

Temperature readings for AN-106 and AZ-102 are taken weekly to comply with AC 5.9.1 (HNF-IP-1266, *Tank Farms Operations Administrative Controls*). The temperature limit listed in Table 5.9.1-1 of HNF-IP-1266 is more restrictive than what is listed in Table 1.7.1.

**Recovery Action:**

If none of the criteria in Table 1.7.1 are met:

- The waste transfer/addition into the receiving tank is prohibited until controls (non-safety SSC or non-TSR) to address tank bump hazards are established.

- Ensure a Problem Evaluation Request (PER) has been submitted.

- If 241-AN-106 supernatant temperature $\geq 177^\circ F$, ensure that active ventilation is restored within 15 calendar days.
  
  o If active ventilation in 241-AN-106 cannot be restored within 15 calendar days, a recovery action plan is necessary.

- If 241-AZ-102 supernatant temperature $\geq 177^\circ F$, ensure that active ventilation is restored within 15 calendar days.
  
  o If active ventilation in 241-AZ-102 cannot be restored within 15 calendar days, a recovery action plan is necessary.

If the two-year review indicates that none of the six criteria for excluding a tank bump in Table 1.7.1 are met, the reviewing organization shall notify the Shift Manager, and shall prepare a Problem Evaluation Request (PER).
1.8 Separable Organic Layer

Table 1.8.1 Hydraulic Fluid Leak Limit

<table>
<thead>
<tr>
<th>Applicable Material</th>
<th>Maximum Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quintolubric® 888-46 or Shell Tellus® Plus Oil 46</td>
<td>275 gallons total per DST¹</td>
</tr>
</tbody>
</table>

Notes:
1. Limits apply to each DST individually and is a combined total for each material
2. Quintolubric® is a registered trademark of Quaker Chemical Corporation, Conshohocken, PA.
3. Shell Tellus® Plus Oil 46 is a registered trademark of SOPUS Products, Houston, TX.

**Technical Basis: see Appendix A**

**Detection/Control:**

24590-WTP-ICD-MG-01-019, *ICD 19 – Interface Control Document for Waste Feed*, requires no ‘visible immiscible layer’ as a requirement for waste receipt. To protect this requirement, controls are placed on DST contents. Additions to DSTs are subject to controls detailed in HNF-SD-WM-OCD-015. Compatibility evaluations are conducted in accordance with TFC-ENG-CHEM-P-13, *Tank Waste Compatibility Assessments* for planned waste transfers and chemical additions. In addition, introduction of small volumes of specific chemical products are permitted up to the listed volume in RPP-11192, *Tank Farm Chemical Compatibility Evaluation*. These supporting programmatic documents detail the controls placed on chemical additions, but are not subject to OSD requirements outside of the specific materials in Table 1.8.1.

The volume of hydraulic fluid introduced into a given DST shall be tracked by the process engineer supporting the project responsible for equipment operation with the potential to leak into a DST or other tank planned to be transferred to a DST (e.g., waste retrieval equipment that could leak into waste to be transferred to a DST receiver).

The hydraulic fluid volume tracking may be reset to zero gallons only on the basis of a tank sample collected at the supernatant surface showing no indication of a separable organic layer.

**Recovery Action:**

If a DST has been identified as potentially having received greater than the Maximum Volume of hydraulic fluid:

- The process engineer supporting the project responsible for the equipment shall submit a Problem Evaluation Request (PER) identifying that the volume of hydraulic fluid added to a DST has met or exceeded the limit and notify the Shift Office.
Process Engineering shall complete an OSD Recovery Action Plan form (A-6005-240) and submit the Recovery Action Plan to the WRPS Chief Engineer (with notification to the ORP Director of Tank Farm Operations Division when it is approved) within 30 calendar days. The Recovery Action Plan should include actions to sample the DST.

If tank sample results at the supernatant surface show no indication of a separable organic layer present, the hydraulic fluid volume tracking may be reset to zero gallons on the date corresponding to the grab sample.
2.0 REFERENCES

Analyses, Calculations, and Evaluations

2.1 HNF-2317, Project W-320 High Vacuum 241-AY-102 Annulus Ventilation System Operability Test Report

2.2 RPP-7475, Criticality Safety Evaluation for Hanford Tank Farms Facility

2.3 RPP-11192, Tank Farms Chemical Compatibility Evaluation

2.4 RPP-19524, Hydraulic Fluid Compatibility with TraceTek Leak Detection System and Mini-Probe

2.5 RPP-CALC-33163, Tank Waste Volume and Level Calculations in Dome Space for 241-AP Tank Farm Up to 460 inches

2.6 RPP-RPT-28967, Hanford Double-Shell Tank Thermal and Seismic Project – Buckling Evaluation Methods and Results for the Primary Tanks

2.7 RPP-RPT-28968, Hanford Double-Shell Tank Thermal and Seismic Project – Summary of Combined Thermal and Operating Loads with Seismic Analysis

2.8 RPP-RPT-32237, Hanford Double-Shell Tank Thermal and Seismic Project – Increased Liquid Level Analysis for 241-AP Tank Farms

2.9 RPP-RPT-56920, Criticality Analysis of Potential Separable Phase Organics in Tank Farm Wastes

2.10 RPP-TE-58298, Evaluation of Minimum Waste Level Limit Established by OSD-T-151-00007, Operating Specifications for Double-Shell Storage Tanks

2.11 TE-05-038, Technical Evaluation of High Annulus Vacuum on 241-AN Tanks

Drawings

2.12 E CN-712499, Removal of Floor Drain Plug (FDP-306) in Annulus Pump Pit (241-AY-02F)

2.13 H-2-37703, Tank Base Drain Leak Detection Sump Plans & Details Tanks 241-SY101, 102, & 103

2.14 H-2-37772, Tank Cross Section 241-SY Tank Farm

2.15 H-2-37787, Piping Plan & Details Leak Detection Pit 241-SY-01C, 02C, & 03C
<table>
<thead>
<tr>
<th>Section No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.16</td>
<td>H-2-64306, Tank Foundation Plan</td>
</tr>
<tr>
<td>2.17</td>
<td>H-2-64317, Leak Detection Pit &amp; Slab Drain Piping</td>
</tr>
<tr>
<td>2.18</td>
<td>H-2-64428, Dual Leak Detection Pit Piping Section &amp; Details TK-101 &amp; Encasement</td>
</tr>
<tr>
<td>2.19</td>
<td>H-2-64430, 241-AY Tank Farm Leak Detection Pit Piping Sections &amp; Details (TK-102)</td>
</tr>
<tr>
<td>2.20</td>
<td>H-2-64419, Tank Riser Details</td>
</tr>
<tr>
<td>2.21</td>
<td>H-2-64448, Purex Tank Farm Expansion – Tank Penetration Details</td>
</tr>
<tr>
<td>2.22</td>
<td>H-2-64449, Purex Tank Farm Expansion – Tank Elevation &amp; Details</td>
</tr>
<tr>
<td>2.23</td>
<td>H-2-67248, Tank Base Drain Leak Detection Sump Plans &amp; Details Tank 241-AZ-101 &amp; 102</td>
</tr>
<tr>
<td>2.24</td>
<td>H-2-67316, Penetration Details Tank 101 &amp; 102 241-AZ Tank Farm</td>
</tr>
<tr>
<td>2.25</td>
<td>H-2-67317, Tanks 101 &amp; 102 Section &amp; Details 241-AZ Tank Farm</td>
</tr>
<tr>
<td>2.26</td>
<td>H-2-67349, Air Lift Circulator and Riser Extension Details</td>
</tr>
<tr>
<td>2.27</td>
<td>H-2-68366, Dual Leak Detection Pit Piping Section &amp; Details Tank-102 &amp; Encasement</td>
</tr>
<tr>
<td>2.28</td>
<td>H-2-68385, Leak Detection Pit Piping Sections &amp; Details Tank 101</td>
</tr>
<tr>
<td>2.29</td>
<td>H-2-70306, Civil Leak Detection Drain and Sump Plans and Details</td>
</tr>
<tr>
<td>2.30</td>
<td>H-2-70394, Tank Cross Section 241-AW Tanks</td>
</tr>
<tr>
<td>2.31</td>
<td>H-2-70413, Piping Plan &amp; Details Leak Detection Pit 241-AW-01C thru 06C</td>
</tr>
<tr>
<td>2.32</td>
<td>H-2-71160, Tank Cross Section 241-AN-107 Tank</td>
</tr>
<tr>
<td>2.33</td>
<td>H-2-71905, Civil Leak Detection Drain and Sump Plans and Details</td>
</tr>
<tr>
<td>2.34</td>
<td>H-2-71975, Tank Cross Section 241-AN Tanks</td>
</tr>
<tr>
<td>2.35</td>
<td>H-2-71997, Piping Plan &amp; Details Leak Detection Pit 241-AN-01C thru 07C</td>
</tr>
<tr>
<td>2.36</td>
<td>H-2-90444, Piping Leak Detection Drain Plan and Sections</td>
</tr>
<tr>
<td>2.37</td>
<td>H-2-90534, Tank Cross Section 241-AP Tanks</td>
</tr>
<tr>
<td>2.38</td>
<td>H-2-90851, Piping Sections &amp; Details Leak Detection Well, 241-AP-03C &amp; -05C</td>
</tr>
</tbody>
</table>
Corrosion Mitigation


2.40 Internal Memo WRPS-1302595, Contract Number DE-AC27-08RV14800-Washington River Protection Solution LLC Submittal of Recommended Modifications to Double-Shell Tank Visual Inspections


2.44 RPP-7695, *Double-Shell Tank Annulus Ventilation Engineering Study*

2.45 RPP-7795, *Technical Basis for Chemistry Control Program*

2.46 RPP-13639, *Caustic Limits Report*


2.48 RPP-ASMT-37653, *Expert Panel Oversight Committee Assessment of RPP-RPT-35923, Hanford Tank AY101: Effect of Chemistry and Other Variables on Corrosion and Stress Corrosion Cracking*

2.49 RPP-ASMT-46121, *Corrosion Propensity Assessment of Tank 241-AN-106 Waste*

2.50 RPP-ASMT-53793, *Tank 241-AY-102 Leak Assessment Report*

2.51 RPP-RPT-28538, *Volume 1: IQRPE Double-Shell Tank Integrity Assessment Report HFFACO M-48-14*
2.52 RPP-RPT-31680, *Hanford Tanks 241-AN-107 and 241-AN-102: Effect of Chemistry and Other Variables on Corrosion and Stress Corrosion Cracking*

2.53 RPP-RPT-33284, *Hanford Tanks AY102 and AP101: Effect of Chemistry and Other Variables on Corrosion and Stress Corrosion Cracking*

2.54 RPP-RPT-35923, *Hanford Tank AY101: Effect of Chemistry and Other Variables on Corrosion and Stress Corrosion Cracking*

2.55 SD-WM-TI-150, *Technical Basis for Waste Tank Corrosion Specification*

2.56 TWRS PP-94-025, *Sludge Washing Materials Study: The Behavior of Carbon Steel in a Dilute Waste Environment*

**Design Specifications**

2.57 B-101-C1, *Specifications for Primary and Secondary Steel Tanks. Project B-101. 241-SY Tank Farm*

2.58 B-120-D1, *Design Specification for Primary and Secondary Steel Tanks. Project B-120. 241-AW Tank Farm*

2.59 B-130-D1, *Design Specification for Primary and Secondary Steel Tanks. Project B-130. 241-AN Tank Farm*

2.60 B-340-D1, *Design Specification for Primary and Secondary Steel Tanks. 241-AP Tank Farm. Work Order X34001*

2.61 HWS-7789, *Specification for Primary and Secondary Steel Tanks Purex Tank Farm Expansion. Project IAP-614*

2.62 HWS-8982, *Specification for Primary and Secondary Steel Tanks (241-AZ)*

**Supporting Documents**

2.63 24590-WTP-ICD-MG-01-019, *ICD 19 – Interface Control Document for Waste Feed*

2.64 24590-WTP-RPT-MGT-11-014, *Initial Data Quality Objectives for WTP Feed Acceptance*

2.65 24590-WTP-RPT-PE-12-004, *Proposed Deminimus Organic Concentration in Received Tank Waste*

2.66 5-LCD-300, *Enraf Calibration*

2.68 HNF-IP-1266, *Tank Farms Operations Administrative Controls*

2.69 HNF-SD-WM-OCD-015, *Tank Farms Waste Transfer Compatibility Program*

2.70 HNF-SD-WM-TSR-006, *Tank Farms Technical Safety Requirements*


2.72 Internal Memo WRPS-1203624, T. J. Venetz to D. J. Washenfelder, *Analysis of DST Leak Detection Pit Levels and Determination of Time to Pump Element,* August 30, 2012, Washington River Protection Solutions


2.74 OSD-T-151-00031, *Operating Specifications for Tank Farm Leak Detection and Single-Shell Tank Intrusion Detection*

2.75 RHO-C-59, *Additional Analysis of Underground Waste Storage Tanks 241-SY*

2.76 RHO-C-60, *A Comprehensive Summary of the Analyses of the 241-AW Underground Waste Storage Tanks*

2.77 RPP-6213, *Hanford Waste Tank Bump Accident, and Consequence Analysis*

2.78 RPP-13033, *Tank Farms Documented Safety Analysis*

2.79 RPP-13438, *Technical Basis for the Tank Bump Accident and Associated Representative Hazardous Conditions*

2.80 RPP-16922, *Environmental Specifications Requirements*


2.82 RPP-25782, *DST Dome Survey Program,* CH2M Hill Hanford Group Inc.

2.83 RPP-46868, *Technical Basis for Temperature Control to Prevent Tank Bumps in 241-AN-106*

2.84 RPP-PLAN-32124, *Process Control Plan for 241-AP-108 Tank Waste Level Increase*

2.85 RPP-PLAN-40592, *Process Control Plan for Tank 241-AP-103 Tank Waste Level Increase*
2.86 RPP-PLAN-52169, Process Control Plan for Tank 241-AP-105 Tank Waste Level Increase

2.87 RPP-PLAN-52170, Process Control Plan for Tank 241-AP-101 Tank Waste Level Increase

2.88 RPP-PLAN-60074, Tank 241-AY-102 Monitoring Plan

2.89 RPP-PLAN-60166, Process Control Plan for Tank 241-AP-107 Tank Waste Level Increase

2.90 RPP-PLAN-60390, Process Control Plan for Tank 241-AP-104 Tank Waste Level Increase

2.91 RPP-PLAN-60610, Tank 241-AY-102 Contingency Plan – Operations Phase

2.92 RPP-RPT-59014, Technical Basis for Temperature Control to Prevent Tank Bumps in 241-AZ-102

2.93 SD-RE-TI-008, Compilation of Basis Letters Referenced in 241-AN, AW, AY, AZ, and SY Process Specifications

2.94 SD-RE-TI-041, Thermal Creep and Ultimate Load Analyses of the 241-AY/AZ Reinforced Concrete Underground Waste Storage Tanks

2.95 SD-RE-TI-064, Compilation of Basis Letters Referenced in OSD-T-151-00017

2.96 TFC-ENG-CHEM-D-21, Process Engineering Waste Surveillance Data Review

2.97 TFC-ENG-CHEM-P-13, Tank Waste Compatibility Assessments

2.98 TFC-ENG-CHEM-P-14, Operating Specification Documents

2.99 TFC-ENG-CHEM-P-18, Response to Anomalous Sample Results

2.100 TFC-ENG-FACSUP-C-03, Technical Evaluations

2.101 TFC-ENG-FACSUP-C-10, Control of Dome Loading

2.102 TFC-ESHQ-ENV_FS-C-01, Environmental Notification

2.103 TFC-OPS-OPER-C-10, Vehicle and Dome Load Control in Tank Farm Facilities

2.104 TFC-OPS-OPER-C-24, Occurrence Reporting And Processing of Operations Information

2.105 TFC-OPS-OPER-C-34, Independent Verification

2.106 TFC-OPS-OPER-C-57, Event Notification
2.107 TFC-PLN-02, Quality Assurance Program Description

2.108 TO-020-595, Leak Detection Pit/Radiation Detection Drywell Transfers

2.109 WRPS-0900762, 241-AP-108 In-Service Leak Check Completion

2.110 WRPS-0901127, 241-AP-103 In-Service Leak Check Completion

2.111 WRPS-1202787, 241-AP-101 In-Service Leak Check Completion

2.112 WRPS-1202788, 241-AP-105 In-Service Leak Check Completion

2.113 WRPS-1503748, 241-AP-107 In-Service Leak Check Completion

2.114 WRPS-1503749, 241-AP-104 In-Service Leak Check Completion

2.115 WRPS-1705499, 241-AP-106 In-Service Leak Check Completion
Appendix A – OSD Technical Basis

Table 1.1.1 Primary Tank Maximum Operating Limit

Normal Operating Limit:
The Normal Operating Limit is set below the Maximum Authorized Limit to allow time for actions to be taken before the Maximum Authorized Limit is reached. (For levels less than or equal to 422 inch, 1 inch of tank liquid ≈ 2750 gallons)

- For 241-AN, AP-102, AW-101, AW-103-106, AY, AZ, and SY\(^1\), the 6 inch difference between the Normal Operating Limit and the Maximum Authorized Limit is equivalent to 16,500 gallons.

- For 241-AP-101, 103, 104, 105, 106, 107, and 108, the 4 inch difference between the Normal Operating Limit and the Maximum Authorized Limit is equivalent to 10,300 gallons as calculated per Table 1 of RPP-CALC-33163, Tank Waste Volume and Level Calculations in Dome Space for 241-AP Tank Farm Up to 460 Inches. A 4.2 inch space is required for a maximum pump run-out volume of 10,800 gallons based on a maximum flow rate of 360 gpm and an initial liquid level monitoring frequency of 30 minutes after transfer initiation. However, the 4 inch space provided is adequate since the actual flow rates during waste transfers will not approach the maximum pump run-out flow rate.

- For 241-AW-102, the 13 inch difference between the Normal Operating Limit and the Maximum Authorized Limit provides space for an approximately 36,000 gallon 242-A Evaporator dump and flush (25,000 gallon Evaporator dump with max 4 days pump seal water accumulation at a rate of approximately 1 in/day).

NOTE:
1. For 241-SY tanks, the Normal Operating Limit provides adequate space for two line flushes that could result from an aborted cross site transfer due to leakage, line blockage, or equipment malfunction.
**Maximum Authorized Limit:**

The Maximum Authorized Limit is the maximum allowable waste solution height in the tank.

- For 241-AN, AW, and SY, the Maximum Authorized Limit and the Structural Limit are identical (see Structural Limit below).

- For 241-AP-101, 103, 104, 105, 106, 107, and 108, the Maximum Authorized Limit is the waste height that has passed an in-service leak check.
  
  
  
  
  
  

- For 241-AP-102, the Maximum Authorized Limit is set at 422 inch because an in service leak check has NOT been performed. Once successfully performed, the Maximum Authorized Limit shall be 458 inch and the Normal Operating Limit shall be 454 inch.

**Maximum Authorized Limit (continued):**

- For 241- AY, the Maximum Authorized Limit is set by the height of sidewall process lines as shown in drawings, therefore preventing potential leakage of waste into the annulus:

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item</th>
<th>Drawing</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Inside Tank Bottom EL (ft)</td>
<td>623.07</td>
<td>H-2-64449</td>
</tr>
<tr>
<td>B</td>
<td>Maximum Plate Thickness (ft)</td>
<td>0.083</td>
<td>H-2-64449</td>
</tr>
<tr>
<td>C</td>
<td>Second Tangent Line EL (ft)</td>
<td>654.86</td>
<td>H-2-64449</td>
</tr>
<tr>
<td>D</td>
<td>Distance from Second Tangent Line to</td>
<td>0.15</td>
<td>H-2-64448</td>
</tr>
</tbody>
</table>
<pre><code>|       | Centerline of Higher Process Line (ft)    |          | 18              |
</code></pre>
<p>| E      | Distance from Centerline of Lower Process | 0.75     | H-2-64448       |
|       | Line to Centerline of Bottom Process Line (ft) |          | 18              |
| F      | Centerline of Lower Process Line EL (ft)  | 654.26   | calculated      |
| G      | Process Line Hole Diameter (ft)           | 0.42     | H-2-64448       |
| H      | Bottom of Lower Process Line Hole EL (ft) | 654.05   | calculated      |</p>

  \[ F = C + D - E = 654.26 \text{ ft} \]
  \[ H = F - G/2 = 654.05 \text{ ft} \]
  
  Maximum Authorized Limit = \((H - A - B) \times 12 \text{ in/ft} = 370.75 \text{ in} \). USE 370 inches

- For 241- AZ, the Maximum Authorized Limit is set by the height of sidewall process lines as shown in drawings, therefore preventing potential leakage of waste into the annulus:

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item</th>
<th>Drawing</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Inside Tank Bottom EL (ft)</td>
<td>616.50</td>
<td>H-2-67317</td>
</tr>
<tr>
<td>B</td>
<td>Maximum Plate Thickness (ft)</td>
<td>0.083</td>
<td>H-2-67317</td>
</tr>
<tr>
<td>C</td>
<td>Second Tangent Line EL (ft)</td>
<td>648.29</td>
<td>H-2-67317</td>
</tr>
<tr>
<td>D</td>
<td>Distance from Second Tangent Line to</td>
<td>0.15</td>
<td>H-2-67316</td>
</tr>
</tbody>
</table>
<pre><code>|       | Centerline of Higher Process Line (ft)    |          | 19              |
</code></pre>
<p>| E      | Distance from Centerline of Lower Process | 0.75     | H-2-67316       |
|       | Line to Centerline of Bottom Process Line (ft) |          | 19              |
| F      | Centerline of Lower Process Line EL (ft)  | 647.69   | calculated      |
| G      | Process Line Hole Diameter (ft)           | 0.42     | H-2-67316       |
| H      | Bottom of Lower Process Line Hole EL (ft) | 647.48   | calculated      |</p>
F = C + D - E = 647.69 ft
H = F - G/2 = 647.48 ft
Maximum Authorized Limit = (H - A - B)*12 in/ft = 370.75 in. USE 370 inches
Structural Limit:

The Structural Limit is the limit to which the tank structural analysis has been performed.

- For 241-AN, AW, and SY, the Structural Limits are based on the values presented in Table 1-1 of RPP-RPT-28968, *Hanford Double-Shell Tank Thermal and Seismic Project-Summary of Combined Thermal and Operating Loads with Seismic Analysis*, and conclusions presented in Section 7 of RPP-RPT-28968.

- For 241-AP, the Structural Limit is based on conclusions presented in Section 7 of RPP-RPT-32237, *Hanford Double-Shell Tank Thermal and Seismic Project-Increased Liquid Level Analysis for 241-AP Tank Farms*. In the 241-AP tanks, the Structural Limit is also the maximum waste liquid level that maintains double-confinement.

- For 241-AY and AZ, the structures are analyzed and deemed adequate for a 422 inch waste solution height in RPP-RPT-28968. However, the Structural Limit is equal to the Maximum Authorized Limit to prevent potential leakage of waste into the annulus by way of sidewall process lines.

### Table 1.1.2 Primary Tank Minimum Operating Limit:

When Annulus Ventilation in Operation:

- For 241-AY-101 and AZ, the Primary Tank Minimum Waste Liquid Level is set at 64 inch to prevent annulus contamination by vapor. A distance of 5.0 ft between the inside tank bottom and the bottom of pit drains is shown in drawings H-2-64419, *Tank Riser Details (241-AY)* and H-2-67349, *Air Lift Circulator and Riser Extension Details (241-AZ)*. The 64 inch limit prevents these drains from being uncovered.

- For 241-AY-102, the Primary Tank Minimum Waste Liquid Level does not apply because the drain line that connects the primary and the annulus has been grouted closed. This change is discussed in ECN-712499, *Removal of Floor Drain Plug (FDP-306) in Annulus Pump Pit (241-AY-02F)*.

- For 241-AN, SY, AW, and AP, the Primary Tank Minimum Waste Liquid Level does not apply because these pit drains do not exist in these tank farms.

When Primary Tank Ventilation in Operation:

- For 241-AY-101, AZ, AN, SY, and AW, the Primary Tank Minimum Waste Liquid Level is set at 6 inches to provide protection against bottom uplift and buckling of the primary tank as discussed in Section 8.0 of RPP-RPT-28967, *Hanford Double-Shell Tank Thermal and Seismic Project-Buckling Evaluation Methods and Results for the Primary Tanks*.

- For 241-AY-102, the Primary Tank Minimum Waste Liquid Level does not apply because the primary tank vapor space vacuum is reduced in accordance with Table 1.3.1. This
reduction in vacuum will protect against bottom uplift and buckling of the primary tank. This is discussed in RPP-TE-58298, *Evaluation of Minimum Waste Level Limit Established by OSD-T-151-00007, Operating Specifications for Double-Shell Storage Tanks*.

- For 241-AP, the Primary Tank Waste Minimum Liquid Level is set at 12 inch to provide protection against bottom uplift and buckling of the primary tank as discussed in Section 8.0 of RPP-RPT-28967.

**Table 1.1.3 Tertiary Leak Detection Pit Liquid Levels:**

Leak detection pits (LDP) serve no purpose in leak detection from the primary tank. LDP’s are used to detect a leak from the secondary tank should a primary tank leak into the annulus. All liquid levels presented in Table 1.1.3 are dip tube readings. These values reflect the use of an offset. The offset is the difference in elevation between the bottom of the dip tube and the inside bottom of the leak detection pit.

**Maximum Authorized Limit Dip Tube Reading:**

The Maximum Authorized Limit Dip Tube Reading (MALDTR) corresponds to the elevation difference between the bottom of the drain line and the bottom of the leak detection pit, incorporating the offset. This limit prevents liquid flow from the leak detection pit (LDP) into the drain line.

**NOTE:** A 2-inch action allowance is included in both the maximum authorized limit and the structural limit that are displayed in Table 1.1.3. Based on rates of normal ingress, this allows for a maximum of 37 days for pumping the LDP before the design limit will be reached, (see WRPS-1203624, *Analysis of DST Leak Detection Pit Level and Determination of Time to Pump Element*).

In order to prevent the weekly monitored LDPs from exceeding the design limit, they will be given a 30 day pumping allowance from time of detection. In order to prevent the monthly monitored LDPs from exceeding the design limit, they will be given a 7 day pumping allowance from time of detection.

- For 241-AN-01C – 06C, refer to drawings for the following information:

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item Description</th>
<th>Value</th>
<th>Drawing</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Top of DST Tank Foundation EL (ft)</td>
<td>612.33</td>
<td>H-2-71975</td>
<td>TYP Tank Section</td>
</tr>
<tr>
<td>B</td>
<td>Bottom LDP Baseplate EL (ft)</td>
<td>605.52</td>
<td>H-2-71905</td>
<td>7</td>
</tr>
<tr>
<td>C</td>
<td>LDP Baseplate Thickness (ft)</td>
<td>0.04</td>
<td>H-2-71905</td>
<td>7</td>
</tr>
<tr>
<td>D</td>
<td>Drain Pipe OD (in)</td>
<td>6.625</td>
<td>H-2-71905</td>
<td>4</td>
</tr>
<tr>
<td>E</td>
<td>Centerline Drainpipe EL (ft)</td>
<td>611.35</td>
<td>H-2-71905</td>
<td>1</td>
</tr>
<tr>
<td>F</td>
<td>LDP Bottom Inside EL (ft)</td>
<td>605.56</td>
<td>calculated</td>
<td>calculated</td>
</tr>
<tr>
<td>G</td>
<td>Offset (in)</td>
<td>1</td>
<td>H-2-71997 sht 2 of 2</td>
<td>3</td>
</tr>
<tr>
<td>H</td>
<td>Time to pump allowance (in)</td>
<td>2</td>
<td>See Note above</td>
<td></td>
</tr>
</tbody>
</table>

F = B + C = 605.56 ft
MALDTR = (E –F)*12 in/ft – D/2 - G = 65.15 in. –H=63.15 USE 63 inches
For 241-AN-07C, refer to drawings for the following information:

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item</th>
<th>Drawing</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Top of DST Tank Foundation EL (ft)</td>
<td>H-2-71160</td>
<td>TYP Tank Section</td>
</tr>
<tr>
<td>B</td>
<td>Bottom LDP Baseplate EL (ft)</td>
<td>H-2-71905</td>
<td>7</td>
</tr>
<tr>
<td>C</td>
<td>LDP Baseplate Thickness (ft)</td>
<td>H-2-71905</td>
<td>7</td>
</tr>
<tr>
<td>D</td>
<td>Drain Pipe OD (in)</td>
<td>H-2-71905</td>
<td>4</td>
</tr>
<tr>
<td>E</td>
<td>Centerline Drainpipe EL (ft)</td>
<td>H-2-71905</td>
<td>1</td>
</tr>
<tr>
<td>F</td>
<td>LDP Bottom Inside EL (ft)</td>
<td>H-2-71997 sht 2 of 2</td>
<td>calculated</td>
</tr>
<tr>
<td>G</td>
<td>Offset (in)</td>
<td>H-2-71905</td>
<td>calculated</td>
</tr>
<tr>
<td>H</td>
<td>Time to pump allowance (in)</td>
<td>H-2-71997 sht 2 of 2</td>
<td>3</td>
</tr>
</tbody>
</table>

F = B + C = 605.56 ft
MALDTR = (E – F)*12 in/ft – D/2 – G = 65.15 in.-H=63.15 USE 63 inches

For 241-AP-03C & 05C, refer to drawings for the following information:

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item</th>
<th>Drawing</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Top of DST Tank Foundation EL (ft)</td>
<td>H-2-90534</td>
<td>TYP Tank Section</td>
</tr>
<tr>
<td>B</td>
<td>Drain Pipe OD (in)</td>
<td>H-2-90444</td>
<td>A</td>
</tr>
<tr>
<td>C</td>
<td>Centerline Drainpipe EL (ft)</td>
<td>H-2-90444</td>
<td>A</td>
</tr>
<tr>
<td>D</td>
<td>LDP Bottom Inside EL (ft)</td>
<td>H-2-90851</td>
<td>ELEVATION A - 1a</td>
</tr>
<tr>
<td>E</td>
<td>Offset (in)</td>
<td>H-2-90851</td>
<td>ELEVATION A - 1a</td>
</tr>
<tr>
<td>F</td>
<td>Time to pump allowance (in)</td>
<td>H-2-90851</td>
<td>See Note Above</td>
</tr>
</tbody>
</table>

MALDTR = (C – D)*12 in/ft – B/2 – E = 48.63 in.-F=46.63  USE 46 inches

For 241-AW-01C - 06C, refer to drawings for the following information:

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item</th>
<th>Drawing</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Top of DST Tank Foundation EL (ft)</td>
<td>H-2-70394</td>
<td>TYP Tank Section</td>
</tr>
<tr>
<td>B</td>
<td>Bottom LDP Baseplate EL (ft)</td>
<td>H-2-70306</td>
<td>7</td>
</tr>
<tr>
<td>C</td>
<td>LDP Baseplate Thickness (ft)</td>
<td>H-2-70306</td>
<td>7</td>
</tr>
<tr>
<td>D</td>
<td>Drain Pipe diameter (ft)</td>
<td>H-2-70306</td>
<td>7</td>
</tr>
<tr>
<td>E</td>
<td>Centerline Drainpipe EL (ft)</td>
<td>H-2-70306</td>
<td>1</td>
</tr>
<tr>
<td>F</td>
<td>LDP Bottom Inside EL (ft)</td>
<td>H-2-70413 sht 1 of 2</td>
<td>calculated</td>
</tr>
<tr>
<td>G</td>
<td>Offset (in)</td>
<td>H-2-70413 sht 1 of 2</td>
<td>3</td>
</tr>
<tr>
<td>H</td>
<td>Time to pump allowance (in)</td>
<td>H-2-70413 sht 1 of 2</td>
<td>See Note Above</td>
</tr>
</tbody>
</table>

F = B + C = 625.06 ft
MALDTR = (E – D/2 – F)*12 in/ft – G =65.46 in.- H=63.46 USE 63.5 inches
• For 241-AY-101A – 102A, refer to drawings for the following information:

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item</th>
<th>Drawing</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Top of DST Tank Foundation EL (ft)</td>
<td>H-2-64306</td>
<td>2</td>
</tr>
<tr>
<td>B</td>
<td>Bottom LDP Baseplate EL (ft)</td>
<td>H-2-64317</td>
<td>5</td>
</tr>
<tr>
<td>C</td>
<td>LDP Baseplate Thickness (ft)</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>D</td>
<td>Drain Pipe OD (in)</td>
<td>H-2-64317</td>
<td>3</td>
</tr>
<tr>
<td>E</td>
<td>Centerline Drainpipe EL (ft)</td>
<td>H-2-64317</td>
<td>2</td>
</tr>
<tr>
<td>F</td>
<td>LDP Bottom Inside EL (ft)</td>
<td>H-2-64317</td>
<td>calculated</td>
</tr>
<tr>
<td>G</td>
<td>AY-101A Offset (in)</td>
<td>H-2-64428</td>
<td>Section B-B</td>
</tr>
<tr>
<td>H</td>
<td>AY-102A Offset (in)</td>
<td>H-2-64430</td>
<td>Section A-A</td>
</tr>
<tr>
<td>I</td>
<td>Time to pump allowance (in)</td>
<td></td>
<td>See Note Above</td>
</tr>
</tbody>
</table>

\[ F = B + C = 616.54 \text{ ft} \]

MALDTR (AY-101A) = \((E - F) \times 12 \text{ in/ft} - D/2 - G = 18.67 \text{ in.} - I = 16.67 \text{ USE 16 inches}\)

MALDTR (AY-102A) = \((E - F) \times 12 \text{ in/ft} - D/2 - H = 18.67 \text{ in.} - I = 16.67 \text{ USE 16 inches}\)

• For 241-AZ-101 – 102, refer to drawings for the following information:

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item</th>
<th>Drawing</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Top of DST Tank Foundation EL (ft)</td>
<td>H-2-67317</td>
<td>TYP Tank Section</td>
</tr>
<tr>
<td>B</td>
<td>Bottom LDP Baseplate EL (ft)</td>
<td>H-2-67248</td>
<td>7</td>
</tr>
<tr>
<td>C</td>
<td>LDP Baseplate Thickness (ft)</td>
<td>H-2-67248</td>
<td>7</td>
</tr>
<tr>
<td>D</td>
<td>Drain Pipe OD (in)</td>
<td>H-2-67248</td>
<td>5</td>
</tr>
<tr>
<td>E</td>
<td>Centerline Drainpipe EL (ft)</td>
<td>H-2-67248</td>
<td>1</td>
</tr>
<tr>
<td>F</td>
<td>LDP Bottom Inside EL (ft)</td>
<td>H-2-67248</td>
<td>calculated</td>
</tr>
<tr>
<td>G</td>
<td>AZ-101 Offset (in)</td>
<td>H-2-68385</td>
<td>Section A-A</td>
</tr>
<tr>
<td>H</td>
<td>AZ-102 Offset (in)</td>
<td>H-2-68366</td>
<td>Section B-B</td>
</tr>
<tr>
<td>I</td>
<td>Time to pump allowance (in)</td>
<td></td>
<td>See Note Above</td>
</tr>
</tbody>
</table>

\[ F = B + C = 609.37 \text{ ft} \]

MALDTR (AZ-101) = \((E - F) \times 12 \text{ in/ft} - D/2 - G = 25.75 \text{ in.} - I = 23.75 \text{ USE 23 inches}\)

MALDTR (AZ-102) = \((E - F) \times 12 \text{ in/ft} - D/2 - H = 25.75 \text{ in.} - I = 23.75 \text{ USE 23 inches}\)
For 241-SY-01C – 02C, refer to drawings for the following information:

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item</th>
<th>Drawing</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Top of DST Tank Foundation EL (ft)</td>
<td>H-2-37772</td>
<td>TYP Tank Section</td>
</tr>
<tr>
<td>B</td>
<td>Bottom LDP Baseplate EL (ft)</td>
<td>H-2-37703</td>
<td>7</td>
</tr>
<tr>
<td>C</td>
<td>LDP Baseplate Thickness (ft)</td>
<td>H-2-37703</td>
<td>7</td>
</tr>
<tr>
<td>D</td>
<td>Drain Pipe OD (in)</td>
<td>H-2-37703</td>
<td>6</td>
</tr>
<tr>
<td>E</td>
<td>Centerline Drainpipe EL (ft)</td>
<td>H-2-37703</td>
<td>1</td>
</tr>
<tr>
<td>F</td>
<td>LDP Bottom Inside EL (ft)</td>
<td>calculated</td>
<td>calculated</td>
</tr>
<tr>
<td>G</td>
<td>Offset (in)</td>
<td>H-2-37787 sht 2 of 2</td>
<td>II</td>
</tr>
<tr>
<td>H</td>
<td>Time to pump allowance (in)</td>
<td>See Note Above</td>
<td></td>
</tr>
</tbody>
</table>

F = B + C = 610.06 ft
MALDTR = (E – F)*12 in/ft – D/2 – G = 25.75 in.-H=23.75 USE 23 inches

Structural Limit Dip Tube Reading:

The Structural Limit Dip Tube Reading (SLDTR) corresponds to the elevation difference between the inside bottom of the pit and the top of the concrete DST tank foundation. A level exceeding the Structural Limit Dip Tube Reading will create a hydrostatic uplift pressure on the primary and secondary steel tank bottoms.

- For 241-AN-01C – 06C, refer to information provided for Maximum Authorized Dip Tube Reading. The Structural Limit Dip Tube Reading is calculated as:
  SLDTR = (A – F)*12 in/ft - G = 80.22 in.-H=78.22 USE 78 inches

- For 241-AN-07C, refer to information provided for Maximum Authorized Dip Tube Reading. The Structural Limit Dip Tube Reading is calculated as:
  SLDTR = (A – F) *12 in/ft - G = 76.26 in.-H=74.26 USE 74 inches

- For 241-AP-03C, 05C, refer to information provided for Maximum Authorized Dip Tube Reading. The Structural Limit Dip Tube Reading is calculated as:
  SLDTR = (A – D)*12 in/ft - E = 125.75 in.-F=123.75 USE 123 inches

- For 241-AW-01C – 06C, refer to information provided for Maximum Authorized Dip Tube Reading. The Structural Limit Dip Tube Reading is calculated as:
  SLDTR = (A – F)*12 in/ft - G = 76.26 in.-H=74.26 USE 74 inches

- For 241-AY-101A – 102A, refer to information provided for Maximum Authorized Dip Tube Reading. The Structural Limit Dip Tube Reading is calculated as:
  SLDTR (AY-101A) = (A – F)*12 in/ft - G = 68.18 in.-I=66.18 USE 66 inches
  SLDTR (AY-102A) = (A – F)*12 in/ft - H = 68.18 in.-I=66.18 USE 66 inches
For 241-AZ-101 – 102, refer to information provided for Maximum Authorized Dip Tube Reading. The Structural Limit Dip Tube Reading is calculated as:
\[
\text{SLDTR (AZ-101)} = (A - F) \times 12 \text{ in/ft} - G = 75.14 \text{ in.} - I = 73.14 \quad \text{USE 73 inches}
\]
\[
\text{SLDTR (AZ-102)} = (A - F) \times 12 \text{ in/ft} - H = 75.14 \text{ in.} - I = 73.14 \quad \text{USE 73 inches}
\]

For 241-SY-01C – 03C, refer to information provided for Maximum Authorized Dip Tube Reading. The Structural Limit Dip Tube Reading is calculated as:
\[
\text{SLDTR} = (A - F) \times 12 \text{ in/ft} - G = 75.26 \text{ in.} - H = 73.26 \quad \text{USE 73 inches}
\]

NOTE:
The protocol for pumping a leak detection pit to a DST was established to ensure the proper controls are established for the pumping process. The basis for the protocol was developed to provide an alternative to sampling the LDP in order to provide a high confidence that tank waste has not leaked into the LDP. Details and further technical basis is provided in the Internal Memo WRPS-1301766, *Leak Detection Pit Pumping Protocol* and Section 5.8.11 of HNF-IP-1266.

**Table 1.2.1 Maximum Bulk Specific Gravity:**

The maximum hydrostatic head is one of the parameters used in structural analyses. The maximum allowable load is governed by the application of seismic accelerations, the liquid level in the tank, and the average specific gravity. In an earthquake, a larger hydrostatic head could damage the tank due to the hydrodynamic loading of the waste sloshing in the tank.

The maximum hydrostatic load is equal to the product of the structural liquid level limit and the maximum bulk specific gravity.

- For 241-AP, Section 7.0 of RPP-RPT-32237 concludes that a waste height of 460 in at Maximum Specific Gravity of 1.83 does not reveal structural deficiencies of the DST.

- For 241-AN, AW, and SY the waste Maximum Specific Gravity of 1.7 is based on the values presented in Table 7-4 of RPP-RPT-28967 and conclusions presented in Section 8 of RPP-RPT-28967.

- For 241-AY and AZ, the waste Maximum Specific Gravity of 1.77 is based on the values presented in Table 7-7 of RPP-RPT-28967 and conclusions presented in Section 8 of RPP-RPT-28967.

**Table 1.3.1 Primary Tank Vapor Space Vacuum:**

Primary Tank Vapor Space Vacuum is measured with respect to atmosphere. The primary tank vacuum limits are set to prevent development of high stresses and possible uplifting of the tank bottom or buckling of the primary tank wall. Minimum Primary Tank Vacuum is set to avoid a pressurization event and to maintain confinement.
Maximum Vacuum:

- For 241-AP, the primary tank vacuum limit of -8.71 in w.g. is recognized as the governing allowable vacuum in Table 6-2 of RPP-RPT-32237.

- For 241-AN, the primary tank vacuum limit is specified in Section II.C.2.d(1) of original design specification, B-130-D1, *Design Specification for Primary and Secondary Steel Tanks*.

- For 241-AW, the primary tank vacuum limit is specified in Section II.C.2.d.(1) of original design specification, B-120-D1, *Design Specification for Primary and Secondary Steel Tanks*.

- For 241-AY-101, the primary tank vacuum limit is specified in Section 4.0.c.(2) of original design specification, HWS-7789, *Specification for Primary and Secondary Steel Tanks Purex Tank farm Expansion*.

- For 241-AY-102, the primary tank vacuum limit is specified in RPP-TE-58298, *Evaluation of Minimum Waste Level Limit Established by OSD-T-151-00007, Operating Specifications for Double-Shell Storage Tanks*.

- For 241-AZ, the primary tank vacuum limit is specified in Section 5.0.a.(1) of original design specification, HWS-8982, *Specification for Primary and Secondary Steel Tanks*.

- For 241-SY, the primary tank vacuum limit is specified in Section 5.a(1) of original design specification, B-101-C1, *Specifications for Primary and Secondary Steel Tanks*.

Table 1.3.2 Secondary Tank Annulus Vacuum

Secondary Tank Annulus Vacuum is with respect to atmosphere. Minimum Annulus Vacuum is set to avoid a pressurization event and to maintain confinement.

**Maximum Vacuum:**

- For 241-AY, Appendix A of HNF-2317, *Project W-320 High Vacuum 241-AY-102 Annulus Ventilation System Operability Test Report*, indicates that tank AY-102 is capable of withstanding a vacuum of -20 in. w.g. 241-AY-101, being the same design, is qualitatively capable of the same vacuum.

- For 241-AN, the Technical Evaluation, TE-05-038, *Technical Evaluation of High Annulus Vacuum on 241-AN Tanks*, indicates that through similarity to 241-AY tanks, 241-AN tanks are also capable of withstanding a vacuum of -20 in w.g.

- For 241-AP, annulus vacuum limits are specified in Section 3.2.3.2 of original design specification, B-340-D1, *Design Specification for Primary and Secondary Steel Tanks*. 
• For 241-AW, AZ, and SY tanks, the maximum vacuum remains at -6 in w.g., based on original design specifications. A Technical Evaluation is required to change the maximum vacuum to -20 in w.g.

**Table 1.4.1 Maximum Temperature for Waste, Steel, and Concrete**

Waste temperatures are limited to prevent excessive stress to the primary tank and structural degradation of the concrete shell. High temperatures, rapid temperature cycling and extreme temperature gradients can cause concrete deterioration and cracking.

**Maximum Operating Temperatures for Waste and Steel:**
A maximum temperature limit of 350°F was used in the buckling evaluation in RPP-RPT-28967. Primary tank and secondary liner steel has adequate capacity for structural demands at 350°F for all DST’s. However, past analyses have concluded lower operating temperatures are applicable.

- For 241-AN and AW, the 350°F limit agrees with conclusions presented in RPP-RPT-28967
- For 241-AP the 210°F limit is based on technical letters presented in SD-RE-TI-008, *Compilation of Basis Letters Referenced in 241-AN, AW, AY, AZ, and SY Process Specifications.*
- For 241-AY and AZ, the 260°F limit is based on analyses performed in SD-RE-TI-041, *Thermal Creep and Ultimate Load Analyses of the 241-AY/AZ Reinforced Concrete Underground Waste Storage Tanks.*
- For 241-SY, the 250°F limit is based on analyses performed in RHO-C-59, *Additional Analysis of Underground Waste Storage Tanks 241-SY.*

**Maximum Operating Temperature for Concrete Wall:**

- For 241-AN and AW, the 236°F limit is based on technical letters presented in SD-RE-TI-008 and analyses performed in RHO-C-60, *A Comprehensive Summary of the Analyses of the 241-AW Underground Waste Storage Tanks.*
- For 241-AP the 236°F limit is based on technical letters presented in SD-RE-TI-008
- For 241-AY and AZ, the 350°F limit is based on analyses performed in SD-RE-TI-041
- For 241-SY, the 250°F limit is based on analyses performed in RHO-C-59
**Maximum Operating Temperature for Concrete Dome:**

Dome temperature limits are based on the capacities of the anchorage between the steel tank and concrete structure in the dome region. Thermal structural analyses performed using steady state temperatures revealed lower temperature limits for the dome regions of the DST’s.

- For 241-AP, the maximum dome temperature of 135°F is based on conclusions presented in Section 7.6 of RPP-RPT-32237.
- For 241-AN, AW, AY, AZ, and SY, the maximum dome temperatures of 160°F are based on conclusions presented in Section 8.0 of RPP-RPT-28967.

**Table 1.4.2 Temperature Change**

Waste and concrete temperature change over time are limited to prevent structural degradation of the concrete. High temperatures, rapid temperature cycling, and extreme temperature gradients can cause concrete deterioration and cracking.

- Specification limits are somewhat based on recommendations from SD-RE-TI-008, a collection of basis letters of DST process specifications.
- The customary basis for the table limits is reproduced here from the previous revision of this document. The actual technical basis for the temperature change specifications is not well defined.

**Table 1.4.3 Minimum Number of Operational Thermocouples for Tanks AY and AZ**

The number of operable thermocouples is enough to ensure compliance with the more restrictive temperature limits in aging waste tanks, 241-AY and AZ. The original thermocouple requirements are located in Table 2 of Internal Memo 13314-89-040, Aging Waste Tank Thermocouple Needs.

**Table 1.5.1 Waste Chemistry Limits**

The concentration limits in Table 1.5.1-1 for all DST waste except 241-AN-102, 241-AN-106, 241-AN-107, 241-AY-101, and 241-AY-102 interstitial liquid are based on past corrosion studies (i.e., SD-WM-TI-150, Technical Basis for Waste Tank Corrosion Specification, and TWRS PP-94-025, Sludge Washing Materials Study: The Behavior of Carbon Steel in a Dilute Waste Environment) and are intended to limit the rate of uniform corrosion to less than or equal to the design basis of the tanks of 1 mil per year (0.001 inches per year) and to minimize the potential for pitting and stress corrosion cracking.

The concentration limits in Table 1.5.1-2 for 241-AN-102, 241-AN-106, 241-AN-107, 241-AY-101, and 241-AY-102 interstitial liquid are based on Expert Panel Oversight Committee for Chemistry Optimization recommendations which are supported by test data. The recommendations for 241-AN-102 and 241-AN-107 are contained in letter 0602740, Expert Panel Oversight Committee Assessment of the 241-AN-107 and 241-AN-102 Waste Chemistry
Corrosion Testing for Double-Shell Tank Waste Chemistry Optimization. These recommendations are supported by test data in RPP-RPT-31680, Hanford Tanks 241-AN-107 and 241-AN-102: Effect of Chemistry and Other Variables on Corrosion and Stress Corrosion Cracking. Recommendations for 241-AY-101 are documented in RPP-ASMT-37653, Expert Panel Oversight Committee Assessment of RPP-RPT-35923, Hanford Tank AY101: Effect of Chemistry and Other Variables on Corrosion and Stress Corrosion Cracking. These recommendations are supported by test data in RPP-RPT-35923, Hanford Tank AY101: Effect of Chemistry and Other Variables on Corrosion and Stress Corrosion Cracking. Recommendations for 241-AY-102 are documented in RPP-ASMT-35619, Expert Panel Oversight Committee Assessment of Fiscal Year 2007 Corrosion and Stress Corrosion Cracking Simulant Testing Program and the Impact on Double-Shell Tank 241-AY102. These recommendations are supported by test data in RPP-RPT-33284, Hanford Tanks AY102 and AP101: Effect of Chemistry and Other Variables on Corrosion and Stress Corrosion Cracking. The [NO2–]/[NO3–] limit of ≥ 0.32 does not apply to 241-AY-102, because the interstitial liquid has low concentrations of nitrite and nitrate and the ratio does not satisfy the limit. These tests were also conducted at 77°C (170°F) and showed a low propensity for Stress Corrosion Cracking. There is an offsetting factor in that this interstitial liquid has a high carbonate concentration. In RPP-ASMT-35619, the Expert Panel states that this carbonate based waste does not promote pitting corrosion and the potential range for stress corrosion cracking is so negative that it is not a credible threat in the interstitial liquid of 241-AY-102. An assessment of 241-AN-106 interstitial liquid is made by the Expert Panel in RPP-ASMT-46121, Corrosion Propensity Assessment for 241-AN-106 Waste. In RPP-ASMT-46121, the Panel concludes that the 241-AN-106 waste interstitial liquid has a low propensity for corrosion.

Table 1.5.2 Annulus Tank Ventilation System and Annulus Inspection

The basis for requiring operation of the annulus ventilation is that corrosion is a cumulative phenomenon that is minimized by operating the annulus ventilation system as much as possible to remove moisture and prevent condensation from collecting on the tank walls.

During active retrieval operations for Tank 241-AY-102, planned shut downs of the annulus ventilation system may be required to support waste retrieval operations. These intentional shut downs may require the annulus ventilation system to be shut down for longer than 30 days, and the annulus ventilation system will be controlled and monitored in accordance with both RPP-PLAN-60610, Tank 241-AY-102 Contingency Plan – Operations Phase, and RPP-PLAN-60074, Tank 241-AY-102 Monitoring Plan.

The effectiveness of the annulus ventilation systems was evaluated in RPP-7695, Double-Shell Tank Annulus Ventilation Engineering Study. RPP-7695 concluded that operation of the annulus ventilation systems may significantly reduce the amount of moisture in the annulus and thereby reduce the potential for corrosion.

The video inspection assesses the condition of the outer wall of the primary tank and the secondary tank steel liner and is focused on detecting corrosion caused by condensation or water intrusion into the annulus. Water intrusion into the annulus of a DST (especially if combined with inadequate ventilation) can cause increased corrosion of the outer wall of the primary tank and increased corrosion of the secondary tank steel liner.
This requirement originally consisted of a 5 year target frequency to provide adequate time to schedule the visual inspections before a 7 year deadline. This 7 year deadline requirement resulted from DOE failure to comply with the M-32 TPA Milestone relating to DST Integrity Assessment (JUN 13, 2000 letter from Ecology to DOE). In response, DOE submitted a plan (M-48-05) to visually inspect the DSTs, “Visual examinations will be completed approximately every five years (not to exceed seven years)...” (APR 30, 2002 letter from DOE to Ecology). This plan was evaluated and commented as acceptable and recommended for continuation in the IQRPE report (RPP-RPT-28538, *Volume 1L IQRPE Double-Shell Tank Integrity Assessment Report HFFACO M-48-14*). RPP-16922, *Environmental Specification Requirements*, recognizes the IQRPE recommendation in Section 5.5.2 as satisfying TPA Milestone M48-14 and WAC 173-303-640 requirements for an integrity assessment that are necessary to ensure the DST system throughout the RPP mission.

As a result of the discovery of the first leaking DST in August 2012, 241-AY-102 (RPP-ASMT-53793, *Tank 241-AY-102 Leak Assessment Report*), the DST visual inspection program is being modified to perform enhanced annulus inspections. These inspections typically utilize eight to twelve risers and allow ≥ 95% of the annulus floor to be viewed, as well as the portion of the primary tank (i.e., dome, sidewall, lower knuckle, and insulating refractory). Prior to the discovery of the first leaking DST, inspections were performed utilizing four annulus risers (allowing approximately 50% of the annulus floor to be visually inspected) (WRPS-1302595, *Contract Number DE-AC27-08RV14800-Washington River Protection Solutions LLC Submittal of Recommended Modifications to Double-Shell Tank Visual Inspections*).

An initial evaluation of inspection frequencies (WRPS-1204931, *Double-Shell Tank 241-AY-102 Primary Tank Leak Extent of Condition Evaluation and Recommended Annulus Visual Inspection Intervals*) recommended variable frequencies of one, two, or three years depending on the condition of the tank; however WRPS-1302595 proposed that inspections should occur on a three year frequency. Although no formal response or direction on annulus visual inspection frequencies has been received after WRPS-1302595 recommended a three year frequency, visual inspections have been performed according to the ≥ 95% visual inspection protocol and plan to be repeated on a three year frequency.

**Table 1.5.5 Water and Condensate Additions to DSTs**

Small volumes of water and aqueous solutions are occasionally added to the waste tanks. Sources of these additions include AZ-301 condensate transfer, operational activities, and pumping leak detection pit water. These additions generally do not significantly alter the bulk chemistry of the waste already present in the tank. However, these additions increase the risk of corrosion near the liquid air interface. The difference between the densities of water and concentrated waste solutions in the tank can cause inadequate mixing when an addition is made. Water additions to the tank have been shown to form a thin layer on top of the more dense bulk waste. The potential for higher corrosion rates exists for a period of time as the concentration of inhibitors, such as hydroxide and nitrite, increase by diffusion from the bulk waste to reach protective values in this added layer. The inhibitor requirements for supernatant were established as shown in Table 1.5.1-1. These levels of inhibitor have been shown to minimize corrosion in tanks holding wastes.
This specification allows the cumulative addition of up to 2,750 gallons of water (e.g., flush water, AZ-301 condensate return, etc.) to AY-101 or AZ-102 without any corrective action. This is based on the fact that in the waste tanks, an addition of 2,750 gallons or less of water does not significantly change the inhibitor concentration of that tank’s supernatant, and the inhibitor concentration from the supernatant in the tank will diffuse into the water that has been added within a reasonable amount of time. In order for water to be considered inhibited, it must be verified to comply with Table 1.5.1-1. All other water additions are considered uninhibited.

Uninhibited water can lead to corrosion of steel surfaces. The exact time duration that uninhibited water is allowed to contact the tank wall before unacceptable corrosion occurs is a matter of risk management. It is assumed that the corrosion rate is slow enough that short time periods (less than a week) of water contact would not noticeably corrode the metal surface. This is discussed in WSRC-TR-93-441, “Technical Basis for Acceptable Waster Additions to Waste Tanks (U)” . Unlike the WSRC-TR-93-441 report, the limit described here does not reset after a given time interval. In this OSD the cumulative water addition limit is reset when an activity is performed that mixes the surface layer into the bulk waste as defined in the sub-bullets in Table 1.5.5-1. The 2,750 gallon limit is the total water volume that may be added, regardless of if the limit is reached with a one-time addition or multiple small additions over time. This is because of the high carbon dioxide absorption rate in some of the tanks and the corresponding challenges with reaching target inhibitor chemistry if a non-convective layer forms. TADD is the primary tool used to track water additions, however the 2,750 gallon limit may also be measured by the change in tank level over time. This allows for crediting the impact evaporation has on removing surface water. Condensate returns to many of the DSTs, but only the AZ-301 condensate return results in a net increase in tank volume.

Past inspections have shown some wall thinning in the liquid air interface region going back to RPP-8519 from 2001. Recent inspections of AY-101 have shown accelerated corrosion near the liquid air interface that is attributed to condensate additions to the tank. The 2,750 gallon addition limit is designed to drive regular recirculation of the supernatant when condensate additions are occurring and minimize other sources of water. The limit was chosen based on engineering judgement guided by an evaluation of representative cases showing a short time to diffuse inhibitors into the thin water layer.

The recirculated volume, or transfer volume in the case of a waste transfer, must be sufficient to ensure the dilute surface layer is dissipated. Recirculating one supernatant volume is generally accepted as a sufficient volume to achieve good mixing. The document RPP-RPT-60162, “Hanford Double-Shell Tank Supernatant Mixing: Activities, Observations, and Modeling” describes tank recirculation in more detail. In certain circumstances smaller volumes may be used, but these must be evaluated on a case by case basis. The minimum required waste transfer volume for good mixing is more difficult to generalize, and must be evaluated. The document RPP-39013, “Double-Shell Tank Waste Mixing Evaluation” provides some information on evaluating waste transfer mixing.

Water is less dense than the waste it is added to. When water is added from above the momentum gained falling through the headspace will allow it to penetrate some distance into the waste. When the momentum is dissipated, density differences are expected to cause the stream entering the waste to reverse and rise to the surface. Once on the surface the low density water
added will spread out over the waste surface. This phenomena is described in fluid dynamic text such as Blevins, R.D., 2003, Applied Fluid Dynamics Handbook, Krieger Publishing Company, Malabar, FL. Or Wiegel, R. L., 1992, Oceanographical Engineering, Prentice-Hall, Englewood Cliffs, N.J. A number of empirical correlations exist to determine the depth a jet will penetrate, however quantifying the mixing that occurs in this process is more difficult. CFD programs can be used to estimate the mixing, however RPP-PLAN-60616, “Software Management Plan for Grade D Acquired Software COMSOL” describes some of the challenges with validating such a model in test case TC-H-3. Further work in this area may lead to a better understanding of the surface layer that forms. Past reports studying condensate addition in the DST exist, such as RPP-42644, “Tank 241-AY-101 Hydroxide Depletion Evaluation Following Tank 241-AN-101 Waste Transfer and Supernatant Mixing”. It describes how the mixing of condensate can create a concentration and density gradient at the surface of the waste. This gradient is thought to be stagnant, and an impediment to mass transfer.

To evaluate how a 2750 gallon addition to a DST might impact the surface hydroxide concentrations, two representative cases were run with the Supernate Chemistry Evaluation Model (HISI 3862, Software Management Plan RPP-PLAN-60697). These runs are intended to represent typical conditions for a DST that might receive condensate, and do not represent a bounding analysis. A scenario could be conceived (tank inhibitor concentrations at the minimum OSD limit and high ventilation flow rate) that would prohibit water addition. The assumption is made that a tank starts out well mixed after the last recirculation event.

The first case looked at a 1 inch layer (2750 gallons) added to a tank with a bulk supernatant depth of 50 inches. The layer assumed no mixing on entry, which is a conservative assumption. The bulk of the tank had a hydroxide concentration of 0.9 molar. The following parameters were used: 0.2 day time step, 200 SCFM ventilation flow rate, 2 F temperature difference between the supernatant and headspace, 76 F supernatant temperature, 0.85 Evaporation Ratio, and 1/1/2018 start date. This analysis shows the bulk concentration for the layer reaching 0.01 molar hydroxide in just a few hours, and the 0.3 M limit at 5.6 days. This shows that with the conservative assumption of no mixing on entry, a 1 inch layer is able to reach inhibitor concentrations in less than a week, and possibly less than a day depending on what the nitrite and nitrate values are. The SCEM estimates a surface concentration, however there is some debate if this represents a surface layer concentration that can be measured or a mathematical construct, and will not be included in the results.
The second case uses the above inputs, however instead of the layer being added all at once, it is dribbled in over the course of a month (From 1/1/2018 to 2/1/2018, an arbitrary one month time period). A 1 inch convective surface layer was setup in the model at the bulk concentration to provide a layer to receive material without mixing with the bulk of the tank. This results in the surface layer staying within even the highest hydroxide OSD specification the entire month, with the lowest hydroxide surface concentration anticipated to be 0.49 molar. Figure 1.5.5.-2 shows the expected change in the surface layer hydroxide concentration, it is apparent that if the water addition were to continue the hydroxide concentration would continue to decline until it no longer meet the OSD limit.

Figure 1.5.5-2. Surface Layer Hydroxide Concentration for Continuously Formed Layer Case
The minimum hydroxide concentration required from Table 1.5.1-1 for the surface layer could be different than the bulk supernatant based on nitrate concentrations. The OSD limit for a dilute layer would be 0.01 M hydroxide concentration initially even if the bulk supernatant limit was higher (0.3 M for instance). Hydroxide diffuses faster than Nitrate, so the water layer is expected to come into specification as the 0.01 M hydroxide limit is reached but before the Nitrate concentration increases. If the bulk supernatant is low in hydroxide and high in nitrate, the surface layer could go out of specification before evaporation removed the dilute layer. In other cases, such as high supernatant hydroxide concentration and low ventilation flow rate, the water layer may remain within the specification.

The previous two cases are not at the worst conditions currently seen in the DSTs from a chemistry control standpoint. The instantaneous layer addition case was modified and run with parameters from each of the DSTs as a screening to see which tanks would be the most problematic from a chemistry standpoint. The draft data from the caustic limit report, RPP-13639, Rev. 14 (3/30/2018 date) for the ventilation flow rate and hydroxide concentration was used with the other parameters described in the first case.

The screening analysis showed that all of the tanks except two are expected be within the OSD specification within one week after a water addition. The two tanks that may take longer are AN-102 and SY-102 because of their low hydroxide concentration and relatively high OSD limit due to the higher Nitrate concentration. The surface layers in these tanks are not expected to reach bulk supernatant OSD hydroxide specification until after evaporation removes the surface water. It would take about 0.61 years in AN-102 and 1.2 years in SY-102 to evaporate a one inch layer. The analysis is conservative as it does not account for mixing when the layer is formed, and the actual time that inhibitors would be below the amount needed to slow corrosion is likely much shorter. The layer, being low Nitrate initially, would have a lower hydroxide requirement. Indeed, the 0.01 M hydroxide concentrations are expected to be reached in the layer within the first day in both tanks, and the lower concentration of the two tanks expected at 0.094 M hydroxide after the first week.

Table 1.6.1 Dome Loading Requirements

One of the parameters requiring a control in the field to assure the DSTs are operated within the associated design limits is the load at the surface (i.e., dome loading). The programmatic requirements established in Table 1.6.1 are designed to prevent excessive concentrated loads from being placed on DSTs.

Dome Elevation Survey frequency requirements are established as part of the DST Dome Survey Program in RPP-25782, DST Dome Survey Program. Other elements of the Dome Survey Program including review of elevation data, response to exceeding deflection limits, and protection of survey monuments are managed under TFC-ENG-FACSUP-C-10. Exceeding the required survey frequency warrants a recovery action plan to be developed as the four month grace period provides ample operational flexibility.

Table 1.7.1 End-State Analysis for Tank Bump
Tank bumps are energetic events that could cause an overpressure in the primary tank headspace. This evaluation protects analysis assumptions leading to the conclusion that a tank bump is not a credible accident. Analysis of tank bump accidents including the criteria presented in Table 1.7.1 are documented in RPP-6213, Hanford Waste Tank Bump Accident and Consequence Analysis, and RPP-13438, Technical Basis for the Tank Bump Accident and Associated Representative Hazardous Conditions. The requirements in this operating specification document implement the Defense-In-Depth feature 19, End-State Analysis for Tank Bump in DSTs. The requirement of the Defense-In-Depth feature is to verify, prior to waste transfer, that the receiving DST meets one of the criteria. An additional measure of protection is included in the operating specification to review all DSTs against the criteria every two years. This review will address the low likelihood that new characterization information or new assumptions in the gas generation rate evaluation have changed the status of a DST.

The tank bump analysis for DST AN-106 receiving waste from SST C-107 is documented in RPP-46868, Technical Basis for Temperature Control to Prevent Tank Bumps in 241-AN-106. Conservative analysis indicates a supernatant temperature of 194 °F (18 °F below saturation) will prevent tank bumps in AN-106 after it receives C-107 waste. Calculations using conservative assumptions show that the time to reach temperature saturation is a minimum of 15 days. The only credible mechanism for reaching a supernatant temperature of 212 °F is an extended ventilation outage, so active ventilation needs to be restored within 15 days after the supernatant temperature reaches 194 °F. Supernatant temperatures are examined weekly, which means at most a 14 day period between temperature measurements (i.e., weekly is defined as at least once in the period from 00:00 hours on Monday through 23:59 hours on the following Sunday). At a heat up rate of 1.2 °F/day, the hypothetical temperature rise over this 14 day period would be about 17 °F. Therefore, the supernatant temperature limit is set at 177 °F. A recovery plan is necessary if the 241-AN-106 supernatant temperature reaches 177 °F and active ventilation cannot be restored within 15 days.

The tank bump analysis for DST AZ-102 receiving waste from DST AP-102 is documented in RPP-RPT-59014, Technical Basis for Temperature Control to Prevent Tank Bumps in 241-AZ-102. Conservative analysis indicates a supernatant temperature of 194 °F (18 °F below saturation) will prevent tank bumps in AZ-102 after it receives AP-102 waste. Calculations using conservative assumptions show that the time to reach temperature saturation is a minimum of 18 days. The only credible mechanism for reaching a supernatant temperature of 212 °F is an extended ventilation outage, so active ventilation needs to be restored within 18 days after the supernatant temperature reaches 194 °F. Supernatant temperatures are examined weekly, which means at most a 14 day period between temperature measurements (i.e., weekly is defined as at least once in the period from 00:00 hours on Monday through 23:59 hours on the following Sunday). At a heat up rate of 1.0 °F/day, the hypothetical temperature rise of this 14 day period would be about 14 °F. Therefore the supernatant temperature limit could be set at 180 °F, but for consistency it is set to the same temperature limit as 241-AN-106 (177 °F). Along with altering the temperature limit to be consistent with 241-AN-106, the time required to restore active ventilation was also changed to be consistent. Therefore, a recovery plan is necessary if the 241-AZ-102 supernatant temperature reaches 177 °F and active ventilation cannot be restored within 15 days.
Table 1.8.1 Separable Organic Layer

Previously, the Criticality Safety Evaluation Report (CSER) maintained a leak limit of 300 gallons of hydraulic fluid (RPP-7475, *Criticality Safety Evaluation for Hanford Tank Farms Facility*). The hydraulic fluid leak condition was investigated further and it was determined that leakage of hydraulic fluid did not introduce any criticality safety concern. As a result, the leak limit was removed from the CSER (RPP-RPT-56920, *Criticality Analysis of Potential Separable Phase Organics in Tank Farm Wastes*).

However, excessive addition of organic material into DSTs is not desired due to future waste retrieval and treatment constraints. The Waste Treatment Plant (WTP) Waste Acceptance Criteria (WAC) specifies a qualitative bound that “no separable organic layer” be present and also specifies a quantitative upper bound of 10 weight percent total organic carbon (TOC) (24590-WTP-RPT-MGT-11-014, *Initial Data Quality Objectives for WTP Feed Acceptance*, and 24590-WTP-ICD-MG-01-019). Evaluations by the WTP have considered separable organics as only the floating separable organic layer. The deminimus concentration level for separable organics has been defined by the WTP as “no visible immiscible layer” (24590-WTP-RPT-PE-12-004, *Proposed Deminimus Organic Concentration in Received Tank Waste*).

QUINTOLUBRIC 888-46 and Shell Tellus Plus Oil 46 were identified in RPP-56920 as possessing the capability of forming a visible immiscible layer. Currently, QUINTOLUBRIC 888-46 is the only hydraulic fluid used in tank-intruding waste retrieval equipment. Laboratory studies have shown QUINTOLUBRIC 888-46 readily breaks down in the highly alkaline environment of DST supernatant waste (RPP-RPT-56920). The QUINTOLUBRIC 888-46 fluid is believed to ultimately hydrolyze in an alkaline environment to form sodium oleate and sodium propanoate, which are substances already found in tank waste. The basis for the discontinued use of Shell Tellus Plus Oil 46 is documented in RPP-19524, *Hydraulic Fluid Compatibility with TraceTek Leak Detection System and Conductivity Probes*. However, it remains as an approved material in RPP-11192 and is therefore included in the OSD control.

In order to protect against the potential formation of a separable organic layer and to limit the total organic carbon in DST waste, a hydraulic fluid leak limit of 275 gallons of QUINTOLUBRIC 888-46 or Shell Tellus Plus Oil 46 was selected. This limit was qualitatively determined, as it represents a volume large enough to visibly identify given that 275 gallons is roughly one tenth of an inch of waste in DSTs, since one inch depth equates to 2,750 gallons.

Tracking of hydraulic fluid additions will be the responsibility of the process engineer supporting the project operating hydraulic equipment with the potential to leak into a DST (or into a SST that is to be subsequently retrieved to a DST), which is consistent with practices previously utilized in addressing the CSER limitation. The tracking can be reset to zero based on a surface sample indicating no separable organic layer is present. The tracking can be reset as of the date corresponding the sampling event. Sampling is the most pragmatic method currently available for identifying a visible organic layer. Given that QUINTOLUBRIC 888-46 has been shown to break down in the highly alkaline environment of DST supernatant waste, it is anticipated that if sampling shows no separable organic layer, the leaked hydraulic fluid has broken down into its...
reaction products and no longer poses a separable phase concern, thus justifying a reset of the tracked leakage volume.