1. **Doc No:** CHPRC-01900  **Rev.** 05

2. **Title:**
   200 Area Effluent Treatment Facility Resource Conservation and Recovery Act Permit Capacity Calculations

3. **Project Number:** ☒ N/A

4. **Design Verification Required:**
   ☐ Yes  ☒ No

5. **USQ Number:** ☒ N/A
   RPP-27195  

6. **PrHA Number**  

7. **Approval**
   **Title**  
   Clearance Review  
   Checker  
   Document Control Approval  
   Environmental Protection  
   Originator  
   Responsible Engineering Manager

   **Name**  
   Aardal, Janis D  
   McNamar, Edward A  
   Scales, Anthony  
   Allen, Clyde P  
   Halgren, Dale L  
   Rutherford, Wally

   **Signature**  
   Aardal, Janis D  
   McNamar, Edward A  
   Scales, Anthony  
   Allen, Clyde P  
   Halgren, Dale L  
   Rutherford, Wally

   **Date**  
   08/29/2019  
   08/29/2019  
   08/29/2019  
   08/29/2019  
   08/29/2019  
   08/29/2019

8. **Description of Change and Justification**
   This document is being revised to support the Class 2 RCRA permit submitted to address the ETF Brine Loadout Project and the ETF Load-In Filter Drain System Project. For the Brine Loadout Project the 2025E Secondary Containment Calculation was revised to add document a comparison of the original 50% floor space factor with actual data based on the new shield walls, 20 totes stored on the floor (20 more in the rack), and 3 loading station containments on the floor. The calculation showed the previous 50% floor space assumption was bounding so the calculation maintained use of that factor so no resulting values were changed.

   At the direction of Ecology the small filter sump tank, 59A-TK-3, to be installed by the Load-In Filter Drain System Project will be added as a tank. In addition, the similar small sump tank, 59A-TK-2, is being added as well. The volume calculation sheets for those two tanks are added in Attachment 1 and the Load-In secondary containment calculation was revised to account for the volume of those two tanks.

   These modifications did not result in any changes to conclusions or the overall capacity numbers. None of the text in the document was changed.

9. **TBDs or Holds** ☒ N/A

10. **Related Structures, Systems, and Components**
    a. **Related Building/Facilities** ☐ N/A
    b. **Related Systems** ☐ N/A
    c. **Related Equipment ID Nos. (EIN)** ☒ N/A

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<th>ETF-59A</th>
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11. **Impacted Documents – Engineering** ☒ N/A

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

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14. **Distribution**

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# DOCUMENT RELEASE AND CHANGE FORM

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### 14. Distribution
200 Area Effluent Treatment Facility
Resource Conservation and Recovery Act
Permit Capacity Calculations

D.L. Halgren

Date Published
September 2019

P.O. Box 850
Richland, Washington

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

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Approved for Public Release;
Further Dissemination Unlimited
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1.0 OBJECTIVE/PURPOSE

The 200 Area Effluent Treatment Facility (ETF) and Liquid Effluent Retention Facility (LERF) surface impoundments, containers, and tank systems are described in the Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit (Ecology, 2011) permit. Those descriptions include different volumes, capacities, and quantities in the Part A and Process Information sections of the permit. The purpose of this calculation is to document the ETF process quantities, tank volumes, and secondary containment capacities for use in the RCRA permit. A documented and approved set of calculations will provide an easily verified basis for the quantities and capacities in the permit. With documented calculations performed on a consistent basis any future additions or changes can be made according to the same criteria maintaining the integrity of the permit information.

2.0 INPUT DATA

The inputs for each calculation are provided on the individual calculation sheet as applicable.

3.0 ASSUMPTIONS

Any assumptions made are provided on individual calculation sheet as applicable.

4.0 METHOD OF ANALYSIS

There are three types of results needed to support the permit information. The calculations for each of these areas are non-complex in nature with straightforward methodology.

4.1. Tank Structural Design Capacity Calculations

The tank structural design capacities of the facility’s permitted tanks are presented in a table in the Process Information section of the permit. The calculation spreadsheets for each of the tanks are in Attachment 1. For tanks that have a designed overflow the structural design capacity is the tank volume at the overflow. If the tank does not have an overflow then the volume equivalent to the top of the side sheet (straight vertical side) height is calculated as the structural design capacity. Volume calculations were performed using the geometric equations shown in the calculation sheets in Attachment 1.

4.2. Secondary Containment Calculations

The tank system secondary containment system calculations use dimensions from the cited drawings and the geometric equations shown in the calculation sheet to determine the system capacity. That containment capacity is compared to the appropriate tank structural design capacity to verify adequate containment capacity. The calculations are presented in Attachment 2.

4.3. Part A Calculations

The RCRA Part A permit information includes process design capacities and estimated annual quantities of waste. Those values are documented in these two calculation sheets primarily based on referenced data and computations. The calculation sheets are included in Attachment 3.
5.0 USE OF COMPUTER SOFTWARE

Microsoft® Excel® 2013 was used for this calculation. The single-use spreadsheet file name is Permit Volume Calcs Rev 4.xlsx.

6.0 RESULTS

Tank structural design capacity calculation results are summarized in Table 1.

Table 1 - Tank Structural Design Capacity

<table>
<thead>
<tr>
<th>Tank</th>
<th>Volume (gal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load-in tank 59A-TK-109</td>
<td>9,100</td>
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<tr>
<td>Load-in tank 59A-TK-117</td>
<td>9,100</td>
</tr>
<tr>
<td>Load-in tank 59A-TK-1</td>
<td>6,900</td>
</tr>
<tr>
<td>Load-in filter drain sump tank 59A-TK-2</td>
<td>34</td>
</tr>
<tr>
<td>Load-in filter drain sump tank 59A-TK-3</td>
<td>48</td>
</tr>
<tr>
<td>Surge tank</td>
<td>122,000</td>
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<tr>
<td>pH adjustment tank</td>
<td>4,400</td>
</tr>
<tr>
<td>First RO feed tank</td>
<td>5,400</td>
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<tr>
<td>Second RO feed tank</td>
<td>2,300</td>
</tr>
<tr>
<td>Effluent pH adjustment tank</td>
<td>3,800</td>
</tr>
<tr>
<td>Verification tanks (3)</td>
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<td></td>
<td>799,000</td>
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<tr>
<td>Secondary waste receiving tanks (2)</td>
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<td></td>
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<tr>
<td>Concentrate tanks (2)</td>
<td>6,600</td>
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<tr>
<td></td>
<td>6,600</td>
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<tr>
<td>ETF evaporator (Vapor Body)</td>
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<td>Distillate flash tank</td>
<td>250</td>
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<tr>
<td>Sump tank 1</td>
<td>1,800</td>
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<tr>
<td>Sump tank 2</td>
<td>1,800</td>
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</table>

The results of the secondary containment evaluation are summarized in Table 2.

Table 2 – Secondary Containment Capacity

<table>
<thead>
<tr>
<th>Secondary Containment</th>
<th>2nd Containment Capacity (gal)</th>
<th>Tank Capacity + Rain Vol (gal)</th>
<th>2nd Contain &gt; Max Vol</th>
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<tr>
<td>2025-E Building</td>
<td>24,600</td>
<td>19,500</td>
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<tr>
<td>Surge Tank</td>
<td>226,000</td>
<td>126,500</td>
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1 Microsoft and Excel are registered trademarks of the Microsoft Corporation, Redmond, Washington.
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<th>826,000</th>
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<tr>
<td>2025-ED Load-In</td>
<td>20,100</td>
<td>8,100</td>
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The results of the Part A process design capacity calculations are summarized in Table 3.
The results of the Part A estimated annual quantity of waste calculations are summarized in Table 4.

Table 3 – Part A Process Design Capacity

<table>
<thead>
<tr>
<th>Process</th>
<th>Capacity (gal)</th>
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</thead>
<tbody>
<tr>
<td>LERF S04 T02</td>
<td>23,400,000</td>
</tr>
<tr>
<td>ETF S02</td>
<td>2,630,000</td>
</tr>
<tr>
<td>ETF T01</td>
<td>216,000</td>
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<td>ETF S01</td>
<td>39,000</td>
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<td>ETF T04</td>
<td>5,000</td>
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Table 4 – Part A Estimated Annual Quantity of Waste

<table>
<thead>
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<th>Process</th>
<th>Annual Quantity (lb/yr)</th>
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<tbody>
<tr>
<td>LERF S04 T02</td>
<td>337,000,000</td>
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<tr>
<td>ETF S02 T01</td>
<td>257,300,000</td>
</tr>
<tr>
<td>ETF S01</td>
<td>340,000</td>
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<tr>
<td>ETF T04</td>
<td>179,000</td>
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7.0 CONCLUSIONS

Based on the tank structural design capacity and secondary containment capacity calculations the ETF secondary containments are sized to hold the volume of the largest tank in the containment as required.

8.0 REFERENCES

Attachment 1

Structural Design Capacity Calculations
Surge Tank 60A-TK-1

**Inputs:**
Straight cylinder ID = 26.0 ft
Straight cylinder height = 30.1 ft
Tank sloped floor height (wedge) = 1.33 ft

**References:**
Vendor Information V-1354-001-C-017

**Structural Design Capacity Calculation**

Volume of cylinder = PI x (13^2) x 30.1 x 7.48 gal/ft³
Volume of cylinder = 119,458 gal

Volume of wedge heel = 2,641 gal

Structural Design Capacity = 119458 gal + 2641 gal
Structural Design Capacity = 122,099 gal

Tank Structural Design Capacity = 122,000 gal
**pH Adjust Tank 60C-TK-1**

**Inputs:**
- Straight cylinder ID = 10.0 ft
- Straight cylinder height @ overflow = 6.25 ft
- Tank dish bottom = 741 gal

**References:**
- Vendor Information V-1354-001-A-311

**Structural Design Capacity Calculation**

Volume of cylinder = \( \pi \times (5^2) \times 6.25 \times 7.48 \text{ gal/ft}^3 \)
Volume of cylinder = 3,672 gal

Structural Design Capacity @ overflow = 3672 + 741 gal
Structural Design Capacity @ overflow = 4,413 gal

Tank Structural Design Capacity = 4,400 gal
1st RO Feed Tank 60F-TK-1

Inputs:
Straight cylinder ID = 10.0 ft
Straight cylinder height@overflow = 8.0 ft
Tank dish bottom = 741 gal

References:
Vendor Information V-1354-001-A-317

Structural Design Capacity Calculation

Volume of cylinder = \( \pi \times (5^2) \times 8 \times 7.48 \text{ gal/ft}^3 \)
Volume of cylinder = 4,700 gal

Structural Design Capacity @ overflow = cyl vol + dish bottom vol
Structural Design Capacity @ overflow = 4700 + 741 gal
Structural Design Capacity @ overflow = 5,441 gal

Tank Structural Design Capacity = 5,400 gal
2nd RO Feed Tank 60F-TK-2

Inputs:
- Length (rectangular tank) 10.0 ft
- Width 6.0 ft
- Tank height to overflow = 4.67 ft
- Tank bottom heel = 171 gal

References:
- Vendor Information V-135A-003-323

Structural Design Capacity Calculation

Assumption:

Volume of cuboid = 10 x 6 x 4.67 x 7.48 gal/ft3
Volume of cuboid = 2,096 gal

Structural Design Capacity = volume of cuboid + volume of heel
Structural Design Capacity = 2096 gal + 171 gal
Structural Design Capacity = 2,267 gal

Tank Structural Design Capacity = 2,300 gal
Effluent pH Adjust Tank 60C-TK-2

Inputs:
Straight cylinder ID = 8.0 ft
Straight cylinder height @ overflow = 9.1 ft
Tank dish bottom = 379 gal

References:
Vendor Information V-1354-001-A-311

Structural Design Capacity Calculation

Volume of cylinder = \( \pi \times (4^2) \times 9.1 \times 7.48 \) gal/ft³
Volume of cylinder = 3,414 gal

Structural Design Capacity @ overflow = cyl vol + dish bottom vol
Structural Design Capacity @ overflow = 3414 + 379 gal
Structural Design Capacity @ overflow = 3,793 gal

Tank Structural Design Capacity = 3,800 gal
Verification Tank 60H-TK-1A, B, C

**Inputs:**
Straight cylinder ID = 60.0 ft
Straight cylinder height = 37.5 ft
Tank sloped floor height (wedge) = 0.583 ft

**References:**
Vendor Information V-1354-001-C-003

**Structural Design Capacity Calculation**

**Assumption:**
Volume of cylinder = \( \pi \times (30^2) \times 37.5 \times 7.48 \text{ gal/ft}^3 \)
Volume of cylinder = 793,095 gal

Volume of wedge heel = 6,165 gal

Structural Design Capacity = 793,095 gal + 6,165 gal
Structural Design Capacity = 799,260 gal

Tank Structural Design Capacity = 799,000 gal
Secondary Waste Receiving Tank 60I-TK-1A, B

Inputs:
- Straight cylinder ID = 14.0 ft
- Straight cylinder height @ overflow = 15.2 ft
- Tank dish bottom = 2,033 gal

References:
Vendor Information V-1354-001-A-305

Structural Design Capacity Calculation

Volume of cylinder = \( \pi \times (7^2) \times 15.2 \times 7.48 \text{ gal/ft}^3 \)

Volume of cylinder = 17,468 gal

Structural Design Capacity @ overflow = cyl vol + dish bottom vol

Structural Design Capacity @ overflow = 17468 + 2033 gal

Structural Design Capacity @ overflow = 19,501 gal

Tank Structural Design Capacity = 19,500 gal
Evaporator Vapor Body Vessel 60I-EV-1

Inputs:
- Straight cylinder ID = 8.0 ft
- Straight Cylinder height above 36% = 5.75 ft
- Vessel bottom (<36%) volume = 2813 gal

References:
- Vendor Information V-135A-004-314,-315,-318

Structural Design Capacity Calculation

Assumption:
A vessel bottom volume at 36% from VI is used as baseline due to non-linearity below that.
The VI volume included appurtenance volumes that were subtracted out to get the vessel volume only.

Volume of cylinder = \( \pi \times (4^2) \times 5.75 \times 7.48 \text{ gal/ft}^3 \)
Volume of cylinder = 2,162 gal

Structural Design Capacity = volume of cylinder + volume of heel
Structural Design Capacity = 2162 gal + 2813 gal
Structural Design Capacity = 4,975 gal

Tank Structural Design Capacity = 5,000 gal
Distillate Flash Tank 60I-TK-2

Inputs:
Straight cylinder ID = 2.5 ft
Straight cylinder length = 6.0 ft

References:
Vendor Information V-135A-004-319

Structural Design Capacity Calculation

Assumption:
For this horizontal tank the domed ends of the tank are semi-elliptical tank heads. Use the ASME formula \( V = 0.000586 \times D^3 \), \( D \) in Inches, \( V \) in gal) for volume calculation of the heads. For maximum calculation the tank is full so the length is the height.

Volume of cylinder = \( \pi \times (1.25)^2 \times 6 \times 7.48 \) gal/ft³
Volume of cylinder = 220 gal

Volume of head ends = 0.000586 \times (30 \text{ in }^3) \times 2
Volume of head ends = 32 gal

Structural Design Capacity = volume of cylinder + volume of heel
Structural Design Capacity = 220 gal + 32 gal
Structural Design Capacity = 252 gal

Tank Structural Design Capacity = 250 gal
Concentrate Tank 60J-TK-1A, B

Inputs:
- Straight cylinder ID = 10.0 ft
- Straight cylinder height @ overflow = 9.9 ft
- Tank dish bottom = 741 gal

References:
- Vendor Information V-1354-001-A-325

Structural Design Capacity Calculation

Volume of cylinder = $\pi \times (5^2) \times 9.9 \times 7.48 \text{ gal/ft}^3$
Volume of cylinder = 5,828 gal

Structural Design Capacity @ overflow = cyl vol + dish bottom vol
Structural Design Capacity @ overflow = 5,828 + 741 gal
Structural Design Capacity @ overflow = 6,569 gal

Tank Structural Design Capacity = 6,600 gal
Sump 1 Tank 20B-TK-1

Inputs:
Reference - VI V-1354-001-301
Length (rectangular tank) 5.0 ft
Width 5.0 ft
Tank height to overflow = 9.8 ft

References:
Vendor Information V-1354-001-301

Structural Design Capacity Calculation

Volume of cuboid = 5 x 5 x 9.8 x 7.48 gal/ft3
Volume of cuboid = 1,833 gal

Tank Structural Design Capacity = 1,800 gal
Sump 2 Tank 20B-TK-2

Inputs:
Length (rectangular tank)  5.0  ft
Width  5.0  ft
Tank height to overflow =  9.8  ft

References:
Vendor Information V-1354-001-303

Structural Design Capacity Calculation

Volume of cuboid = 5 x 5 x 9.8 x 7.48 gal/ft³
Volume of cuboid =  1,833  gal

Tank Structural Design Capacity =  1,800  gal
Load-in Tank 59A-TK-1

Inputs:
- Straight cylinder ID = 10.0 ft
- Straight cylinder height = 11.0 ft
- Dome ID at overflow = 6.8 ft

References:
- Vendor Information VI 50422

Structural Design Capacity Calculation

Assumption:
Use the standard ASME F&D head calculation for volume above cylinder to overflow V = 0.000346 x (ID ^ 3)

Volume of cylinder = PI x (5^2) x 11 x 7.48 gal/ft3
Volume of cylinder = 6,462 gal

Volume of dome = 0.000346 x (120 in ^ 3)
Volume of dome = 598 gal
Vol of dome above overflow = 0.000346 x (81.6 in ^ 3)
Vol of dome above overflow = 188 gal
Volume of dome to overflow = 598 – 188
Volume of dome to overflow = 410 gal

Structural Design Capacity = volume of dome (to overflow) + volume of cylinder
Structural Design Capacity = 6462 gal + 410 gal
Structural Design Capacity = 6,872 gal

Tank Structural Design Capacity = 6,900 gal
Load-In Filter Drain Sump Tank 59A-TK-2

Inputs:
Straight cylinder ID = 1.6 ft
Straight cylinder height @ overflow = 2.3 ft

References:
Field measurement.

Structural Design Capacity Calculation

Volume of cylinder = $\pi \times (0.8^2) \times 2.3 \times 7.48$ gal/ft$^3$
Volume of cylinder = 34 gal

Structural Design Capacity @ overflow = cyl vol
Structural Design Capacity @ overflow = 34 gal

Tank Structural Design Capacity = 34 gal

Metric Conversion

130 L
Load-In Filter Drain Sump Tank 59A-TK-3

Inputs:
Reference - H-9-6113
Length (rectangular tank) 2.0 ft
Width 2.0 ft
Tank height to overflow = 1.6 ft

References: H-9-6113

Structural Design Capacity Calculation

Volume = 2 x 2 x 1.6 x 7.48 gal/ft³
Volume = 48 gal

Tank Structural Design Capacity = 48 gal

Metric Conversions
200 L
Load-In Tanks 59A-TK-109/117

Inputs:
Straight cylinder ID = 12.0 ft
Straight cylinder height @ overflow = 9.5 ft

References:
Vendor Information VI 22657, Sheet 21

Structural Design Capacity Calculation

Assumption:
Use the standard ASME F&D head calculation for volume above cylinder to overflow $V = 0.000346 \times (ID ^ 3)$

Volume of cylinder = $\pi \times (6^2) \times 9.5 \times 7.48 \text{ gal/ft}^3$
Volume of cylinder = 8,037 gal

Volume of dish = $0.000346 \times (144 \text{ in} ^ 3)$
Volume of dish = 1,033 gal

Structural Design Capacity = volume of dish + volume of cylinder to overflow
Structural Design Capacity = 8037 gal + 1033 gal
Structural Design Capacity = 9,070 gal

Tank Structural Design Capacity = 9,100 gal
Attachment 2

Secondary Containment Calculations
2025-E Building Secondary Containment Calculation

2025-E Process Area
Dimensions from H-2-89047
L  198  ft  100 ft section + 49' + 49'
W  120  ft  4 each 30' sections, includes room space on west to berm
H  0.5  ft  6" berm H

Total Volume = 198 ft x 120 ft x 0.5 ft
Total Volume 11880  ft³
Used Floor Space Factor 20%

Available Volume in gal = 11880 ft³ x 0.2 x 7.48 gal/ft³
Available Volume in gal 17,800 gal 2025E Process Area

2025-E Container Storage Area
Dimensions from H-2-89047
L  77.3  ft  100 ft section-5'-13'-4.67' in from section ends to walls
W  28  ft  30' section-2' from wall
H  0.5  ft  6" berm H

Total Volume = 77.3 ft x 28 ft x 0.5 ft
Total Volume 1082  ft³

Approach: Determine if the 50% container space factor from the Mausshardt report used in previous revisions is still conservative with the brine loadout modification. Brine loadout has 3 things taking floor space. 1) Shield walls. 2) Tote storage. 3) Fill station containment. For the available containment calculation use the 50% floor space factor or space used by the 3 structures, whichever is larger.
Reference: H-2-838177 and RPP-SPEC-63202

Subtractions
1) Shield Walls
L  30  ft  one 22' and one 8' wall
W  0.5  ft  CMU width
H  0.5  ft  6" berm H
Total Volume = 30 ft x 0.5 ft x 0.5 ft
Total Volume 7.5  ft³
2) Tote Storage

<table>
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<th>Value</th>
<th>Unit</th>
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<tr>
<td>L</td>
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<td>ft</td>
</tr>
<tr>
<td>W</td>
<td>4</td>
<td>ft</td>
</tr>
<tr>
<td>H</td>
<td>0.5</td>
<td>ft</td>
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Total Tote Volume = 3.3 ft x 4 ft x 0.5 ft

Tote Volume = 6.6 ft³/ea

Totes on floor = 20.0 ea

Total Tote Volume = 6.6 ft³/ea x 20 ea

Total Tote Volume = 132.0 ft³

3) Fill station containment

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<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
<th>Unit</th>
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<tr>
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<td>5</td>
<td>ft</td>
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<tr>
<td>H</td>
<td>0.5</td>
<td>ft</td>
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</table>

Total Station Volume = 5 ft x 5 ft x 0.5 ft

Total Station Volume = 12.5 ft³/ea

Containments on floor = 3.0 ea

Total Station Volume = 12.5 ft³/ea x 3 ea

Total Station Volume = 37.5 ft³

Total Subtraction Volume = 37.5 + 132 + 7.5 ft³

Total Subtraction Volume = 177.0 ft³

Comparison with the 50% space factor

Reference: Final RCRA Information

Container Space Factor = 50%

Space Factor Volume = 1082 ft³ x 0.5

Space Factor Volume = 540 ft³

The space factor is more conservative than brine loadout floor space subtraction 540 > 177 ft³

Available Volume in gal = 1082 ft³ x 0.5 x 7.48 gal/ft³

Available Volume in gal = 4,000 gal

Available Volume in gal = 4,000 gal Container Storage Area

Secondary containment volume requirement is 10% of the total container volume from the Part A.

10% of container volume = .1 x 39,000 gal

10% of container volume = 3,900 gal

4,000 gal is greater than 3,900 gal so requirement is met.

2025-E Truck Bay

Dimensions from H-2-89047

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>53</td>
<td>ft</td>
</tr>
<tr>
<td>W</td>
<td>28</td>
<td>ft</td>
</tr>
</tbody>
</table>

49' + 4' 

4 each 30' sections, includes room space on west to berm
H 0.5 ft 6" berm H

Total Volume $= 53 \text{ ft x 28 ft x 0.5 ft}$
Total Volume $742 \text{ ft}^3$
Container Space Factor 50%
Available Volume in gal $= 742 \text{ ft}^3 \times 0.5 \times 7.48 \text{ gal/ft}^3$
Available Volume in gal 2,800 gal 2025E Truck Bay

Total 2025-E Building Secondary Containment
Total Process Area Containment $= $ Container Storage Area + Truck Bay + Process Area
Total Process Area Containment $= 4000 \text{ gal} + 2800 \text{ gal} + 17800 \text{ gal}$
Metric Conversion
Total Process Area Containment $= 24,600 \text{ gal}$ 93,100 L

Secondary containment volume requires the volume must be greater than the largest tank.
The largest tank is the SWRT @ 19500 gal
24600 gal is greater than 19500 gal so the requirement is met.
Surge Tank Secondary Containment Calculation

Inputs:
Dimensions from H-2-89063 & H-2-89070
L 62 ft 5 ea. 10' sect+6.67'+5.33'
W 55 ft 5 ea. 10' sect+5'
H 9.5 ft El 600.5 - 591'

Berm Area Volume = 62 ft x 55 ft x 9.5 ft
Berm Area Volume 32395 ft³

Subtract Tank Ring Wall Inputs:
Ring wall Dia = 28.0 ft
Ring wall height = 3.5 ft

Volume of ring wall to be subtracted
Volume of cylinder = PI x (14²) x 3.5 ft³
Volume of cylinder = 2,155 ft³

Secondary Containment Available Volume
Secondary Containment Available Volume = (32395 ft³ - 2155) ft³ x 7.48 gal/ft³
Secondary Containment Available Volume = 226,000 gal

Outside containment must account for 25 year, 24 hour storm 2.1 inch precipitation per permit.
Max Rain Volume (gal)= 62 ft x 55 ft x 2.1 / 12 ft * 7.48 gal/ft³
Max Rain Vol = 4,500 gal

Secondary containment volume requires the volume must be greater than the tank plus rainfall.
Total liquid volume = Surge Tank @ 122000 + Rainfall @ 4500 gal
Total liquid volume = 126,500 gal

226000 gal is greater than 126500 gal so the requirement is met.
Verification Tank Area Secondary Containment Calculation

Dimensions from H-2-89068 & H-2-89070

L 236 ft 23 ea. 10' sect + 6'
W 87.3 ft 8 ea. 10' sect+ 8' - .67'
H 8 ft El 597.67' - 589.67'
Tank Dia 60 ft

Berm Area Volume = 236 ft x 87.3 ft x 8 ft
Berm Area Volume 164822 ft³

Volume of 2 tanks to berm height= ((60/2)^2*8*π())*2
2 Tank Volumes 45239 ft³
Subtract the two tank volumes from the berm space = (164822-45239) x 7.48 gal/ft³
Available Volume in gal 894,000 gal

Outside containment must account for 25 year, 24 hour storm 2.1 inch precipitation per permit.
Max Rain Volume (gal)= 236 ft x 87.3 ft x 2.1 / 12 ft * 7.48 gal/ft³
Max Rain Vol = 27,000 gal

Secondary containment volume requires the volume must be greater than the tank plus rainfall.
Total liquid volume = Verification Tank @ 799000 + Rainfall @ 27000 gal
Total liquid volume = 826,000 gal

894000 gal is greater than 826000 gal so the requirement is met.
2025-ED Load-In Tank Area Secondary Containment Calculation

59A-Tk-109/117 Tank Containment
Dimensions from H-2-817970-1

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>42 ft</td>
</tr>
<tr>
<td>W</td>
<td>22 ft</td>
</tr>
<tr>
<td>H</td>
<td>3.5 ft</td>
</tr>
<tr>
<td>Tank Dia</td>
<td>12 ft</td>
</tr>
</tbody>
</table>

Sump

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>5 ft</td>
</tr>
<tr>
<td>W</td>
<td>5 ft</td>
</tr>
<tr>
<td>H</td>
<td>6 ft</td>
</tr>
</tbody>
</table>

Pad

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>30 ft</td>
</tr>
<tr>
<td>W</td>
<td>14 ft</td>
</tr>
<tr>
<td>H</td>
<td>1.5 ft</td>
</tr>
<tr>
<td>Corners</td>
<td>4.1 ft</td>
</tr>
</tbody>
</table>

Berm Area Volume = 42 ft x 22 ft x 3.5 ft + 5 ft x 5 ft x 6 ft
Berm Area Volume = 3384 ft³

Subtractions
LI Tank Base Volume = 30 x 14 x 1.5 ft³ - (4.1 x 4.1 x 2 x 1.5 ) ft³
Base Volume 580 ft³

The volume of the non-leaking LI tank above the pad up to the wall height is subtracted.
One Tank Vol = ((12/2)^2*(3.5-1.5)*π()) ft³
One Tank Vol 226 ft³

Filter Sump Tank 3
Filter Sump Tank 3 Vol = 2 x 2 x 1.5 ft³
Filter Sump Tank 3 Vol= 6 ft³

Available Containment Volume =(3384- 580 - 226- 6) ft³*7.48 gal/ft³
Load-In Containment Volume = 19,200 gal

59A-Tk-1 Basin
Dimensions from H-2-817970-3

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>30.7 ft</td>
</tr>
</tbody>
</table>

30
W 11.7 ft 8.34' + 3.33'
H 0.33 ft berm varies from 3'' to 6'' (except trench), use 4''

TK-1 Berm Area Volume = 30.7 ft x 11.7 ft x 0.33 ft³
TK-1 Berm Volume = 120 ft³

Subtractions
Filter Sump Tank 2 D 1.6 ft
Volume of cylinder = PI x (1.6/2)² x 0.3 x 7.48 gal/ft³
Filter Sump Tank 3
Vol= 1 ft³

Available Containment Volume = (120- 1) ft³ x 7.48 gal/ft³

59A-TK-1 Containment Volume = 890 gal

Total 2025-ED Tank Containment = 19200 + 890 gal

Total 2025-ED Tank Containment = 20,100 gal 76,000 L

Outside containment must account for 25 year, 24 hour storm 2.1 inch precipitation per permit.
Max Rain Volume (L)= 42 ft x 22 ft x (2.1/12) ft x 7.48 gal/ft³
Max Rain Vol = 1,200 gal

Secondary containment volume requires the volume must be greater than the tank plus rainfall.
Total liquid volume = 59A-Tk-1 Tank @ 6900 + Rainfall @ 1200 gal
Total liquid volume = 8,100 gal

20100 gal is greater than 8100 gal so the requirement is met.
Attachment 3

Part A Calculations
Part A Permit Process Design Capacity

LERF Basin Capacity - S04, T02

References:
WHC-SD-W105-OTR-001, Appendix D, "Basin Volume And Wetted Surface Area Calculations."

Assumption:
Maximum volume from reference at 22.2 ft (LERF berm top w/2 ft required freeboard).

Maximum volume per reference  7,800,000  gal/basin

Total LERF Capacity = 7800000 gal/basin x 3 basins
Total LERF Capacity = 23,400,000  gal

ETF Treatment Capacity - T01

Assumption:
ETF design flow is 150 gpm per H-2-88971

ETF Treatment Capacity = 150 gpm x 1440 min/day
ETF Treatment Capacity = 216,000  gal/day

ETF Tank Capacity - S02
The Part A process code S02 entry is the sum of the tank volumes calculated in Attachment 1.

<table>
<thead>
<tr>
<th>Tank</th>
<th>Max Vol (gal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load-in tank 59A-TK-109</td>
<td>9,100</td>
</tr>
<tr>
<td>Load-in tank 59A-TK-117</td>
<td>9,100</td>
</tr>
<tr>
<td>Load-in tank 59A-TK-1</td>
<td>6,900</td>
</tr>
<tr>
<td>Load-in sump tank 59A-TK-2</td>
<td>34</td>
</tr>
<tr>
<td>Load-in sump tank 59A-TK-3</td>
<td>48</td>
</tr>
<tr>
<td>Surge tank</td>
<td>122,000</td>
</tr>
<tr>
<td>pH adjustment tank</td>
<td>4,400</td>
</tr>
<tr>
<td>First RO feed tank</td>
<td>5,400</td>
</tr>
<tr>
<td>Second RO feed tank</td>
<td>2,300</td>
</tr>
<tr>
<td>Effluent pH adjustment tank</td>
<td>3,800</td>
</tr>
<tr>
<td>Verification tanks (3)</td>
<td>799,000</td>
</tr>
<tr>
<td></td>
<td>799,000</td>
</tr>
<tr>
<td></td>
<td>799,000</td>
</tr>
<tr>
<td>Secondary waste receiving tanks (2)</td>
<td>19,500</td>
</tr>
<tr>
<td></td>
<td>19,500</td>
</tr>
<tr>
<td>Component</td>
<td>Capacity (gal)</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Concentrate tanks (2)</td>
<td>6,600</td>
</tr>
<tr>
<td>ETF evaporator (Vapor Body)</td>
<td>5,000</td>
</tr>
<tr>
<td>Distillate flash tank</td>
<td>250</td>
</tr>
<tr>
<td>Sump tank 1</td>
<td>1,800</td>
</tr>
<tr>
<td>Sump tank 2</td>
<td>1,800</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,630,000</strong></td>
</tr>
</tbody>
</table>

ETF Container Storage Capacity - S01  
**Assumption:**  
The 39,000 gallon Part A process code S01 entry is an empirical number based on the equivalent of 709 drums of waste. No additional calculation is used.

ETF Treatment in Container Capacity - T04  
**Assumption:**  
The treatment in container code T04 is available for transfer of waste to containers during tank heel cleanout for decanting and use of absorbents and other material. The 5,000 gallons is an empirical number based on maximum anticipated use. No calculation is used.
Part A Permit Estimated Annual Quantity of Waste

References:

LERF Storage and Treatment Estimate Part A Process Codes SO4 T02

Methodology:
Plant data was reviewed to determine the highest discharge years in the last 15 years.

Assumption:
The largest annual volume will be used as the Part A estimated annual quantity of waste.

Inputs:
The following data was collected.

<table>
<thead>
<tr>
<th>Year</th>
<th>Discharged (gal)</th>
<th>LERF Begin Vol (gal)</th>
<th>LERF End Vol (gal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>25,880,000</td>
<td>11,200,000</td>
<td>12,200,000</td>
</tr>
<tr>
<td>2004</td>
<td>28,254,000</td>
<td>12,200,000</td>
<td>12,200,000</td>
</tr>
<tr>
<td>2009</td>
<td>21,834,000</td>
<td>13,800,000</td>
<td>17,000,000</td>
</tr>
</tbody>
</table>

Assumption:
The process additions such as chemicals are roughly equivalent to the feed water losses so the feed to ETF from LERF equals the discharge from ETF over time.

LERF Annual Volume = LERF max vol + LERF feed to ETF (gal/yr)

<table>
<thead>
<tr>
<th>Year</th>
<th>LERF End Vol (gal)</th>
<th>LERF Begin Vol (gal)</th>
<th>ETF Feed</th>
<th>Annual Volume (gal/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>12,200,000</td>
<td>11,200,000</td>
<td>25,880,000</td>
<td>38,080,000</td>
</tr>
<tr>
<td>2004</td>
<td>12,200,000</td>
<td>12,200,000</td>
<td>28,254,000</td>
<td>40,454,000</td>
</tr>
<tr>
<td>2009</td>
<td>17,000,000</td>
<td>13,800,000</td>
<td>21,834,000</td>
<td>38,834,000</td>
</tr>
</tbody>
</table>

2004 has the highest annual volume.
LERF S04 and T02 Estimated Annual Quantity of Waste = 40,454,000 gal/yr
= 40,454,000 gal/yr x 8.33 lb/gal
= 337,000,000 lb/yr

ETF Treatment and Storage Process Codes T01 and S02

Methodology:
The max result from the ETF feed column plus the design capacity volume of the tanks.

Inputs:
The 2004 result is the max ETF process volume at 28,254,000 gallons and the tank storage capacity is 2,630,000 gallons.
ETF T01 and S02 Estimated Annual Quantity of Waste = 30,884,000 gal/yr
= 30,884,000 gal/yr x 8.33 lb/gal
= 257,300,000 lb/yr

ETF Container Storage Process Code S01
Inputs:
Based on review of '08-'12 drum records powder drum average rate is 430 drums/yr by count.
Based on the same period the average drum weight was reported at 240 Kg.
Additional waste (bulk containers, drums to offsite, etc.) estimated at 44 m³ based on experience.

ETF Part A S01 Estimated Annual Quantity of Waste = 430 drums/yr x 530 lb/drum + 1555 ft³/yr x 72 lb/ft³
ETF Part A S01 Estimated Annual Quantity of Waste = 340,000 lb/yr

ETF Container Treatment Process Code T04
Assumption:
The treatment in container code T04 is available for transfer of waste to containers during tank heel cleanout for decanting and use of absorbents and other material. The 179,000 lb/yr is an empirical number based on anticipated use. No calculation is used.