Waiver #264 exists against this procedure. Due to the installation of the Interim Surface Barrier at SX Farm, it is not effective to update the dome load log as described per TFC-ENG-FACSUP-C-10 (Specifically Section 4.2-4.5). The final dome loading will be determined once gravel and asphalt additions are complete. RPP-CALC-48447 provides the calculated change in the depth of the soil and the change in the Allowable Concentrated Load (ACL); this calculation provides Operations with the assurance that the dome loading will not be exceeded during ISB installation. Full text of the waiver can be seen at: http://idmsweb/idms/livelink.exe/Open/223698753

<table>
<thead>
<tr>
<th>Control of Dome Loading and SSC Load Control</th>
<th>Manual Document</th>
<th>Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownership matrix</td>
<td>TFC-ENG-FACSUP-C-10, REV C-26</td>
<td>USQ # 18-0497-D</td>
</tr>
<tr>
<td></td>
<td>Page 1 of 27</td>
<td>March 29, 2018</td>
</tr>
</tbody>
</table>

TABLE OF CONTENTS

1.0 PURPOSE AND SCOPE ........................................................................................................... 2
1.1 Tank Dome Load Controls ................................................................................................. 2
1.2 Safety Significant Below Grade Waste Transfer Lines ..................................................... 3
1.3 Safety Significant Below Grade Primary Tank Ventilation ............................................. 3
1.4 Below Grade Anulus Tank Ventilation ............................................................................... 3
1.5 Below Grade Encasements ................................................................................................. 3
1.6 Below Grade Annulus Tank Ventilation ............................................................................ 3
1.7 In-Tank or On-Tank Operating Equipment ...................................................................... 4
2.0 IMPLEMENTATION .................................................................................................................. 4
3.0 RESPONSIBILITIES .............................................................................................................. 4
4.0 PROCEDURE .......................................................................................................................... 4
4.1 Generation and Control of Analysis of Record Document ............................................... 4
4.2 Generation of the Dome Load Record and Dome Load Record Summary Sheet ............ 5
4.3 DLRSS Revision ................................................................................................................ 6
4.4 Generation and Maintenance of Dome Load Log ............................................................. 6
4.5 Revision of Dome Load Logs ........................................................................................... 8
4.6 Walkdowns ........................................................................................................................ 9
4.7 Dome Elevation Survey .................................................................................................... 9
4.8 Route Maps and Route Drawings ..................................................................................... 11
5.0 DEFINITIONS ....................................................................................................................... 14
6.0 RECORDS ............................................................................................................................ 16
7.0 SOURCES ............................................................................................................................ 16
7.1 Requirements .................................................................................................................... 16
7.2 References ....................................................................................................................... 16

TABLE OF FIGURES

Figure 1. Documents List ............................................................................................................. 18
Figure 2. Control of Dome Loading Process ............................................................................. 20
Figure 3. Dome Elevation Survey Process ................................................................................. 21

TABLE OF ATTACHMENTS

ATTACHMENT A - LOAD TRACKING ........................................................................................ 22
ATTACHMENT B - DOME LOAD LOG TRACKING MATRIX .................................................. 25
ATTACHMENT C – DOME DEFLECTION CALCULATION EXAMPLE ................................. 26
1.0 PURPOSE AND SCOPE
(7.1.3, 7.1.4, 7.1.5)

Dome loading requirements for double-shell tanks (DSTs), single-shell tanks (SSTs), miscellaneous tanks (i.e., double-contained receiver tanks (DCRTs), catch tanks, miscellaneous underground storage tanks (IMUSTs), 244-AR Vault, 244-CR Vault are selected as a defense-in-depth feature for protection of the tanks against excessive concentrated loads in accordance with RPP-13033 (7.1.3).

Load control is also required for the following structures, systems, and components (SSCs):

- Waste transfer primary piping systems (safety significant per RPP-13033)
- Ductwork on DST primary tank ventilation systems (safety significant per RPP-13033)
- DST annulus ventilation ductwork (required to be operating to minimize corrosion per OSD-T-151-00007)
- Waste transfer line encasements (defense-in-depth feature per RPP-13033)
- Below grade pits, vaults and miscellaneous SSCs (associated with waste transfer primary piping systems [and encasements] listed above).

1.1 Tank Dome Load Controls

Analysis of Record documents and dome load records have been generated and maintained for the double-shell tanks and single-shell tanks per this procedure. Load additions are controlled by Operations using dome load logs in accordance with TFC-OPS-OPER-C-10. This procedure implements operations requirements necessary for compliance with the dome load control program specified in Letter No. CH2M-0303687 R1. (7.1.3)

Dome loading requirements provide defense-in-depth against dome collapse of DSTs and SSTs (100 and 200-series tanks). Per the dome loading requirements, concentrated loads are managed (with discrete limits and requirements on concentrated load limits and vehicular access controls) to maintain the structural integrity of the domes of the DSTs and SSTs. Dome loading requirements for DSTs and SSTs are based on RPP-11801, “Analysis of Record Summary for Double-Shell Tanks;” RPP-11802, “Analysis of Record Summary for Single-Shell Tanks;” RPP-11803, “Analysis of Record Summary for DCRTs, Catch Tanks, and IMUSTs;” and RPP-20473, “Design and Dome Load Criteria for Hanford Waste Storage Tanks.” These load limits and other operating limits are documented in OSD-T-151-00007, Operating Specifications for the Double-Shell Storage Tanks (7.1.4), and OSD-T-151-00013, Operating Specifications for Single-Shell Storage Tanks (7.1.5). Operations Procedure TFC-OPS-OPER-C-10 provides the field operating processes to comply with this procedure.

Dome loading requirements for miscellaneous tanks are documented in this procedure. The defense-in-depth feature for miscellaneous tanks will be met by continuing to apply the vehicle access and exclusion zone requirements of TFC-OPS-OPER-C-10 to the miscellaneous tanks, and by controlling facility changes through the Engineering Change Notice (ECN) process in accordance with TFC-ENG-DESIGN-C-06.
1.2 Safety Significant Below Grade Waste Transfer Lines

SSC load control requirements protect the safety significant below grade waste transfer lines. Waste transfer lines have been designed for vehicle and equipment loads as shown in Figure 1, Table 3. Protection of the safety-significant waste transfer lines will be met by continuing to apply the vehicle access and exclusion zone requirements of TFC-OPS-OPER-C-10, using route maps (Figure 1, Table 2), and by controlling facility changes through the ECN process in accordance with TFC-ENG-DESIGN-C-06.

1.3 Safety Significant Below Grade Primary Tank Ventilation

SSC load control requirements protect the safety significant below grade primary tank ventilation system ductwork in the DST Tank Farms. Below grade ductwork calculations are shown in Figure 1, Table 4. The DSA amendment, approved by DOE in letter DOE-06-12-NSD-0071, requires the upgrade of the below grade primary tank ventilation system ductwork to safety significant. Because the integrity of the existing ductwork is in question, an evaluation of the integrity of the below grade primary tank ventilation system ductwork is required. In the interim, the below grade primary tank ventilation system ductwork shall be shown on the Tank Farm Route Drawings. Vehicle and heavy equipment loading will only be allowed if 1” thick 4’ X 4’ minimum steel plate is placed over the below grade ductwork at the crossing route. Protection of the safety-significant below grade primary tank ventilation system ductwork will be met by continuing to apply the vehicle access and exclusion zone requirements of TFC-OPS-OPER-C-10, using route drawings/maps (Figure 1, Table 2), and by controlling facility changes through the ECN process in accordance with TFC-ENG-DESIGN-C-06. The 1” steel plate is not required when engineering validates, by analysis, that they are not required, i.e., deep buried duct.

1.4 Below Grade Annulus Tank Ventilation

SSC load control requirements protect the below grade annulus ventilation ductwork in the DST Tank Farms. Below grade annulus ventilation ductwork calculations are shown in Figure 1, Table 5. Protection of the below grade annulus ventilation ductwork will be met by continuing to apply the vehicle access and exclusion zone requirements of TFC-OPS-OPER-C-10, using route maps (Figure 1, Table 2), and by controlling facility changes through the Engineering Change Notice (ECN) process in accordance with TFC-ENG-DESIGN-C-06.

1.5 Below Grade Encasements

SSC load control requirements protect the below grade encasements. Encasement evaluations are shown in Figure 1, Table 6. Protection of the defense-in-depth feature for below grade encasements will be met by continuing to apply the vehicle access and exclusion zone requirements of TFC-OPS-OPER-C-10, using route maps (Figure 1, Table 2), and by controlling facility changes through the Engineering Change Notice (ECN) process in accordance with TFC-ENG-DESIGN-C-06.

1.6 Below Grade Pits, Vaults and Miscellaneous SSCs

SSC load control requirements protect the below grade pits, vaults and miscellaneous SSCs. Protection of the below grade pits, vaults and miscellaneous SSCs will be met by continuing to apply the vehicle access and exclusion zone requirements of TFC-OPS-OPER-C-10, using route
maps (Figure 1, Table 2), and by controlling facility changes through the ECN process in accordance with TFC-ENG-DESIGN-C-06.

1.7 In-Tank or On-Tank Operating Equipment

Operating on-tank or in-tank large heavy equipment (such as a 300hp motor) must be designed to avoid resonance between the tank and the operating equipment. Resonance was found at the DST AZ-101 during the testing of a 300 HP mixer pump (RPP-6548 page 5-1) when operated between 1,000 rpm and 1,150 rpm. Vibration was recorded at >0.9 in/s peak. The resulting frequency of approximately 16 to 19 Hz would indicate that the resonance was between the pump and the pump foundation. The DST and SST tanks are anticipated to have a natural frequency of 6 to 9 Hz but a tank with radial cracking is anticipated to have a natural frequency as low as 2 to 3 Hz. Large motor-driven vibratory rollers (road compactors) are not allowed inside tank farms or over buried tanks.

2.0 IMPLEMENTATION

This procedure is effective on the date shown in the header. Work packages at or beyond Work Release status on or before the effective date shall be reviewed for compliance with this procedure prior to authorizing the field work activity. All historic dome load records are preserved and issued via retrievable documents, i.e., via RPPs. Each tank shall have a Dome Load Record Summary Sheet (DLRSS) with specific information to be included in its corresponding dome load log. The dome load log shall be used to track permanent, temporary, and transient loads.

3.0 RESPONSIBILITIES

The Waste Storage Cognizant System Engineer (CSE) is responsible for dome load control. The responsibilities for the Waste Storage CSE, except approvals, may be delegated to a qualified Waste Storage Design Authority or Area Engineer.

Responsibilities are contained within Section 4.0.

4.0 PROCEDURE

See Figure 2 for process flowchart.

4.1 Generation and Control of Analysis of Record Document

Waste Storage Design Authority

1. Prepare or revise an Analysis of Record calculation in accordance with TFC-ENG-DESIGN-C-10.

2. Ensure large excavations, new openings, offset loading, or other activities that may affect the defined limits of the tank are controlled by performing an Analysis of Record calculation.

NOTE 1: The Analysis of Record summary documents (RPP-11801 for double-shell tanks and RPP-11802 for single-shell tanks) present a summary of, and a reference to, the Analysis of Record calculations that were performed to define the limits for the tanks. The Analysis of Record summary documents
also present a summary of the results of the Analysis of Record calculations for the various load limits that must be protected.

NOTE 2: The Analysis of Record summary document is generated using input from the Analysis of Record calculations as a supporting document in accordance with TFC-ENG-DESIGN-C-25.

3. Prepare or update the Analysis of Record summary documents when new or revised Analysis of Records are generated that affect the Analysis of Record summary documents limits.

4. Distribute the Analysis of Record summary document for review and approval in accordance with TFC-ENG-DESIGN-C-25.

5. Review and approve the Analysis of Record summary document in accordance with TFC-ENG-DESIGN-C-25.

6. Release the Analysis of Record summary document in accordance with TFC-ENG-DESIGN-C-25.

4.2 Generation of the Dome Load Record and Dome Load Record Summary Sheet

Historically, dome load records were generated based on data documented in the appropriate Analysis of Record summary document (i.e., RPP-11801 for double-shell tanks and RPP-11802 for single-shell tanks). The streamlined process requires releasing all dome load records as retrievable documents in accordance with TFC-ENG-DESIGN-C-25. (See Figure 1, Table 1, for a list of these documents.)

1. Generate Dome Load Record Summary Sheets (DLRSS) by using a calculation in accordance with TFC-ENG-DESIGN-C-10. Each tank shall have a Dome Load Record Summary Sheet (DLRSS) (A-6003-834).
   a. Estimate equipment weight through the use of drawings, VI data, manufacturer's data or other technical information. Do not use visual methods of estimating.

2. Distribute the DLRSS document for review and approval in accordance with TFC-ENG-DESIGN-C-25, including Production Operations Shift Manager.
   a. Ensure the DLRSS document references the PM Data Sheet for walkdown of the tank.

3. Review and approve the DLRSS document in accordance with TFC-ENG-DESIGN-C-25, including approval by Production Operations Shift Manager.
4. Release the DLRSS document in accordance with TFC-ENG-DESIGN-C-25.

   - The DLRSS shall be released via the associated RPP. (See Figure 1, Table 1, for a list of these documents.)

5. Based on the Analysis of Record summary document (RPP-11801 for double-shell tanks and RPP-11802 for single-shell tanks), provide the allowable concentrated load to Operations via an interoffice memo. This allowable concentrated load value is to be used in updating the dome load log in accordance with TFC-OPS-OPER-C-10.

6. Based on the DLRSS RPP document (see RPP list in Figure 1, Table 1), provide the total existing permanent load to Operations via an interoffice memo. This total existing permanent load value is to be used in updating the dome load log in accordance with TFC-OPS-OPER-C-10.

4.3 DLRSS Revision

Revision to the DLRSS is only necessary to incorporate permanent loads from the dome load log when the list of permanent loads in the dome load log becomes extensive (greater than approximately ten permanent items), difficult to manage, or when there is significant change in the permanent load only, e.g., addition of soil and tank vacuum pressure.

Waste Storage Cognizant System Engineer

1. If a revision to the DLRSS is necessary, revise and release via the revised associated RPP in accordance with Section 4.2.

4.4 Generation and Maintenance of Dome Load Log

Shift Manager

1. Obtain approval for entry into the exclusion zone and onto all miscellaneous facilities and over below grade DST ventilation ductwork from the Waste Storage Design Authority.

   - All loads on miscellaneous facilities shall be approved by the Waste Storage Design Authority.

   - Route maps that have been marked up to show crane routes and other features shall be used for all tank farm entries.

2. For borehole or direct push penetration locations to be closer than 5 feet to known subsurface structures (e.g., tanks, footings, pipelines, primary ductwork), ensure approval from the Chief Engineer or designee has been obtained for this activity.

Chief Engineer or delegate

3. Review tank farm boring or probe hole locations identified to be closer than five feet to known subsurface structures (e.g., tanks, footings, pipelines, and primary ductwork).
Shift Manager

4. Use the dome load log to track transient, permanent, and live loads.

   a. Refer to Attachment A for a list of dome load tracking requirements. Operations shall maintain active dome load logs for each tank (see Figure 2).

   • In addition to other pertinent information, each dome load log shall show the following:

     – The allowable concentrated load (ACL) limit from Section 4.2, step 5.

     – The total existing permanent load (TEPL) from Section 4.2, step 6.

     – The allowable load margin (ALM). The allowable load margin value is computed by subtracting the TEPL value from ACL value, i.e., $ALM = ACL - TEPL$.

     – The weight and location of all soil added to the tank farms (the soil weight can be found by subtracting the empty weight of the truck used from the weight of the loaded truck).

     – Any new activity load (NAL) from the new work package as documented on the New Activity Load Assessment Form (Site Form A-6006-570).

     – Total dome load (TDL) which includes the summation of all listed loads on the dome load log sheet including the planned NAL as documented on the New Activity Load Assessment Form (Form A-6006-570) and any transient load to be brought on the tank.

     – Margin to dome load (MDL) is the current available load margin for the tank, i.e., $MDL = ALM - TDL$.

     – The amount of ALM used by the MDL shall not exceed 100%, i.e., $1-(MDL/ALM) \times 100$, ensuring that the ALM value is not exceeded.

5. Access and control of the dome load log shall be in accordance with TFC-OPS-OPER-C-10.

6. If the allowable load margin (ALM) is believed to have been exceeded, notify the Waste Storage Cognizant System Engineer via an interoffice memo, initiate a Problem Evaluation Request (PER) to evaluate further action, and do not allow planned dome load activity on the tank. Dome
load log inconsistencies of less than the buffer load (see Attachment A) shall be corrected but do not require PERs.

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

Engineering Discipline Lead – Civil/Structural

8. Determine if any restrictions or immediate actions are warranted. Restrictions or actions may include limiting tank access or suspension of any planned dome loads.

9. Notify the Central Shift Manager via an interoffice memo to take the actions necessary to ensure the implementation of restrictions or actions identified.


### 4.5 Revision of Dome Load Logs

**Support Engineer**

1. Evaluate the new planned activity around the tank from Section 4.4, Step 4 and generate the New Activity Load Assessment Form (A-6006-570), showing the new activity load value to be included in the work package (see Figure 2).

**Waste Storage Design Authority**

2. Complete the New Activity Load Assessment Form for any additional dome loads to be entered into the Dome Load Log.

   a. See Attachment A for load tracking requirements and Attachment B for a summary matrix for dome load tracking.

**Area Engineer**

3. Review and verify by signing the work record in those work packages that affect dome loading.

   a. Permanent concentrated loads less than or equal to 1,000 lbs. are not required to be accounted for, but ensure that there is no accumulation of 10,000 lbs. in a ten foot radius area that is not accounted for.

4. Review and verify by signing the work record in those work packages that affect dome loading.

   a. Ensure the summation of all temporary concentrated loads each weighing up to 10,000 lbs. do not exceed 80,000 lbs.

   b. See Attachment B.

**Shift Manager**

5. Initiate update to the dome load log (DLL) in accordance with TFC-OPS-OPER-C-10, and enter the new activity load obtained from the associated work package into the dome load log. This step will provide the new allowable load margin for the tank.
6. Attach the New Activity Load Assessment Form to DLL until the DLL is updated after a walkdown.

### 4.6 Walkdowns

**Area Engineer**

1. Ensure a detailed inspection/evaluation of the dome loads for each tank farm is scheduled in the Work Management System (WMS), per TFC-OPS-MAINT-C-12, according to the reporting frequency required for reporting in TFC-ENG-FACSUP-D-01.1.

   - The walkdown shall include Operations.

   - The System Engineer Program (SEP) levels from TFC-ENG-STD-43 are:
     - SEP Level 2 - Semi-annual, + 1 month for active SST Farms and DST Farms.
     - SEP Level 3 – Annually, + 2 months for inactive SST Farms.

2. Perform walkdowns with Operations as scheduled, and ensure the results are recorded in the work package.

3. Review the results of the walkdowns with the Waste Storage Cognizant System Engineer.

**Waste Storage Cognizant System Engineer**

4. Prepare revision to DLRSS, as required, based on the results of the walkdown, and provide the Shift Manager with the changes.

**Shift Manager**

5. Initiate an update to the dome load log in accordance with TFC-OPS-OPER-C-10, and enter the new activity load obtained from the associated work package into the dome load log. This step will provide the new allowable load margin for the tank.

**Waste Storage Cognizant System Engineer**

6. Independently calculate the dome load and ensure that it matches the dome load log (DLL).

7. Complete revision of the DLRSS, including an image of the latest DLL, according to Section 4.2, if required.

8. Prepare status reports including the dome loads per TFC-ENG-FACSUP-P-01 and TFC-ENG-FACSUP-D-01.1 requirements.

### 4.7 Dome Elevation Survey

The dome surveys program, the execution of dome surveys, and the protection of dome survey benchmarks and monuments shall be in accordance with RPP-26516 for SSTs and RPP-25782 for DSTs. All the DSTs and active SST tank farms shall be surveyed at the nominal 2 year cycle (+4
months). The non-active, tank farms with limited activities, may be surveyed at the nominal 3 year cycle (+4 months). The Design Authority determines the required survey cycle for the SST Tank Farms based on the activity in the SST farm.

NOTE: The Waste Storage DA must consult with the Structural EDL about changing the frequency of the SST dome elevation survey when there is a change in the activity level.

<table>
<thead>
<tr>
<th>Waste Storage Design Authority or designee</th>
<th>Ensure dome surveys for each tank farm are scheduled in the computerized maintenance management system according to the frequency required in RPP-26516 for single-shell tanks and RPP-25782 for double-shell tanks.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surveyor</td>
<td>Request a dome survey when required using “Surveying, Subsurface Scan and Geotechnical Work Request Form,” Site Form A-6006-536.</td>
</tr>
<tr>
<td>Waste Storage Design Authority</td>
<td>Perform a dome elevation survey as requested by Engineering.</td>
</tr>
<tr>
<td></td>
<td>Transmit the results of the survey to the applicable Waste Storage Design Authority (see Figure 3).</td>
</tr>
<tr>
<td></td>
<td>Identify and notify the Area Engineer of any unprotected survey monuments.</td>
</tr>
<tr>
<td></td>
<td>If unprotected survey monuments are identified, initiate ECNs and have physical protection installed.</td>
</tr>
<tr>
<td></td>
<td>Ensure all tanks have at least one interior and one exterior benchmark.</td>
</tr>
<tr>
<td></td>
<td>Newly installed benchmarks must be surveyed during the next scheduled survey.</td>
</tr>
<tr>
<td></td>
<td>Review the dome elevation survey against deflection limits specified in RPP-26516 for single-shell tanks and RPP-25782 for double-shell tanks.</td>
</tr>
<tr>
<td></td>
<td>At least one interior benchmark and one exterior benchmark survey are required in order to determine dome deflection.</td>
</tr>
<tr>
<td></td>
<td>All historic benchmarks should be surveyed.</td>
</tr>
<tr>
<td></td>
<td>If deflection limits (+/-0.25&quot;) are exceeded, either negative or positive deflection, initiate a PER and notify the Production Operations shift manager.</td>
</tr>
<tr>
<td></td>
<td>Request a re-survey for tanks that exceeded the deflection limits.</td>
</tr>
<tr>
<td></td>
<td>Forward noncompliant tank data to the Engineering Discipline Lead - Civil/Structural, along with the schedule, for any additional surveys.</td>
</tr>
</tbody>
</table>
12. Forward data from the re-survey to the Engineering Discipline Lead - Civil/ Structural when it is obtained.

13. If the survey is acceptable, and deflection limits are not exceeded, issue a timely update to the dome load record RPP document (Figure 1, Table 1) with the survey data.

14. Impose any appropriate restrictions or limits pending resolution of discrepancies. Restrictions or limits may include limiting tank access, the invocation of an interim concentrated load limit, or suspension of any planned dome loads.

15. Resolve the PER and revise the Analysis of Record and dome load records RPP, as required.

### 4.8 Route Maps and Route Drawings

#### 4.8.1 Route Drawings (H-14 Drawings)

Route drawings are essential H-14 drawings and shall maintain configuration control showing all permanent installations. Temporary items at route crossings shall be hand written on the route map for work package planning. Known exclusion zones are shown on the route drawings. If an analysis has not been performed for the SSC exclusion zone, such as for a pit, then the exclusion zone is equal to the depth of the below grade SSC (inside wall depth). All vehicles must remain two feet clear of all structures (pits, electrical utility boxes, risers, etc.) unless noted otherwise on route maps or authorized by engineering. Route drawings identify exclusion zones that have been analyzed for 10,000 lbs., 28,000 lbs., 44,000, lbs., and 102,000 lbs. See Figure 1, Table 6, for analysis of horizontal clearance. For below grade risers surrounded by concrete collars with metal cover, vehicles may drive on the concrete portion, but NOT the metal cover.

Crane outriggers shall not be placed over any below grade SSC, or in the exclusion zone, unless there is a released calculation showing structural integrity or a technical justification by a Structural Engineer to carry the outrigger loading. If necessary, verify the location of buried SSCs using GPR scan. Calculations for outrigger placement over specific SSCs are identified in Figure 1, Table 8.

### Waste Storage Design Authority

1. Prepare and release an approved route drawing (H-14 drawing) for each Tank Farm per TFC-ENG-DESIGN-C-09 with enough detail to clearly identify hazards to avoid and areas safe for vehicle movement.

   a. Include the location of all below grade DST primary ventilation ductwork, concrete encasements, buried ductwork and other buried SSCs that could cause a detrimental effect to ground bearing stability.

   b. If underground hazards are identified, initiate an ECN and have physical protection installed.

2. Review the structural integrity of underground structures due to vehicle and crane loadings for all routes and crane setups.
3. Ensure ground stability at crane outrigger locations.
   a. Perform GPR and soil stability study if location of SSCs is not known.
   b. Use Site Form A-6006-536 to request a GPR or soil stability study.

4. Identify any areas of subsidence/sink-holes on the route drawings.
   a. Track these areas by showing the PER associated with the subsidence/sink-hole on the route drawing and ensuring that the PER contains any relevant information about the subsidence/sink-hole.

5. Identify pre-approved vehicle and crane routes, and crane set-up locations for crane access to all tank farms on the route drawings.

6. Design any vehicle bridge plates and temporary covers in accordance with TFC-ENG-STD-06.
   a. Identify temporary covers as required in TFC-ESHQ-S-STD-05.

7. Show all permanently installed plates on route drawing. The permanent plates shall be identified as required in TFC-ESHQ-S-STD-05.

8. Prepare an ECN to install or move permanent plates.

9. Review and approve Route Drawing, H-14 drawing, prior to initial release or release of a direct drawing revision.
   • This includes approval of any ECN, DCN, or drawing route change not previously approved by the EDL.
   • This may also include project generated drawings that will affect the crane routes.

4.8.2 Crane Routes and Crane Setup

NOTE 1: Review and approval of route maps is not required for pre-approved crane routes and pre-approved crane set-up locations shown on released route drawings.

NOTE 2: Field changes may be made to the route maps with the approval of the original approvers or equivalent.

1. Conduct a field walkdown and establish a vehicle route according to TFC-OPS-OPER-C-10, Section 4.3.
2. Visually verify and document the installation of cable guards on the route map.

3. Provide a proposed crane route and crane set-up location to the applicable Waste Storage Design Authority or Area Engineer.

4. Draft a route map showing the crane route and crane set-up that meets established criteria identified on the associated released “Tank Farm Route Map” and in this document.

5. Resolve approver comments and requested changes.
   a. Approve the route map as “Prepared by.”

6. Review and approve the route maps for the crane route and the crane set-up locations as “Engineering” or “Prepared by.”
   a. Ensure ground conditions are adequate to carry the crane outrigger loading as required by 29CFR1926.1402.
      1) See RPP-CALC-56716, “Soil Bearing Capacity for Crane Loads.”
   b. Contact a qualified Rigging Engineer for any questions regarding crane outrigger loading.

7. Review and approve route maps for crane route and crane set-up locations.

8. Review and approve route maps for crane route and crane set-up locations.

### 4.8.3 Vehicle Routes

**NOTE 1:** Review and approval of route maps is not required for pre-approved vehicle routes shown on released route drawings.

**NOTE 2:** Field changes may be made to the route maps with the approval of the original approvers or equivalent.

**NOTE 3:** For vehicle travel within the tank farms involving vehicles less than 10,000 lbs., an approved route drawing for the traveled areas is required, but a specific route map is not required.

**NOTE 4:** Crane route maps must include the approved crane’s counterweight configuration and shall be included in the description of the crane route approval.

1. Conduct a field walkdown, and establish a vehicle route according to TFC-OPS-OPER-C-10, Section 4.3.
2. Visually verify and document the installation of cable guards on the route map.

3. Provide a proposed vehicle route to the Applicable Waste Storage Design Authority or Area Engineer.

4. Draft a route map showing vehicle route that meets established criteria identified on the associated released “Tank Farm Route Drawing” and in this document.

5. Resolve approver comments and requested changes.
   a. Approve route map as “Prepared by.”

6. Review and approve the route map for the vehicle route.

7. Review and approve the route map for the vehicle route as “Engineering” or “Prepared by.”

8. Review and approve the route map for the vehicle route.

5.0 DEFINITIONS

Allowable concentrated load. The total allowed concentrated load included in the qualifying structural analysis for the tank.

Allowable load margin. The allowable dome load to be used by Operations.

Analysis of record. An engineering analysis for a tank/facility that defines the safe operating load limits.

Benchmark. An established survey point located on DST or SST tanks.

Benchmark – exterior. The exterior or perimeter benchmark is at the perimeter of the tank above the tank wall or above the annulus.

Benchmark – interior. The interior benchmark is located within the six-foot radius of the tank dome centerline.

Concentrated load. A load that is applied to a small area relative to the diameter of the tank and is located above the tank and within the exclusion zone for the tank.

Deflection. The numerical difference determined by subtracting a most recent surveyed exterior benchmark “Total Delta Orig. Elev.” from an interior tank benchmark “Total Delta Orig. Elev.” converted to units of inches. (See Attachment C for an example.)

Distributed load. A uniformly distributed load (such as soil) or a series of individual loads that are scattered, not grouped in one location, over the tank.
Dome load log. Binder(s) and/or electronic files located with and maintained by the Shift Manager that are used for tracking the accumulation of loads at the tank. It shows the allowable concentrated load, the total existing permanent load, the new activity load, and the allowable load margin values for each tank. It tracks permanent, temporary, and transient dome loads.

Dome load record. Documented computation of historic tank load records are summarized as listed in Figure 1, Table 1.

Dome load record summary sheet. This sheet lists the summary of permanent load at the time of latest dome load evaluation.

Exclusion zone. An area established around each tank, pit, electrical box, sink hole, or vault that defines the jurisdiction limit for the administrative control. Loads applied within this area will be controlled by the requirements of this program.

Margin to dome load. This load value is the current available load margin that can be placed on the dome for future applications and is equal to the allowable load margin minus the current total dome load.

MISF. Miscellaneous inactive storage facility.

New activity load. Summation of new activity loads from the new work package.

Natural load. A uniform load reserved for natural phenomena loads, which includes snow and volcanic ash fall.

Permanent load. Permanent loads that will remain on the tank and is not planned or anticipated to be removed.

Primary ductwork. The primary ductwork is part of the DST primary tank ventilation systems designed to provide air flow through the tank headspace.

Route drawing. The H-14 essential drawing of a Tank Farm identifying the exclusion zones around tanks, DCRTs, IMUSTs, vaults, underground SSCs, sink holes, etc. These drawings also include pre-approved vehicle routes and pre-approved crane routes and crane set-up locations.

Route map. The route, marked by hand, on an H-14 drawing that equipment is to take in a Tank Farm, including crane setup positions, for a specific work package. The Route map is approved by the Field Work Supervisor, Area Engineer and Shift manager.

Temporary loads. Loads not expected to remain permanently on the tank, not including transient loads.

Total existing permanent load. Summation of all existing permanent loads above the tank dome.

Total dome load. Grand total of all loads listed on the dome load log (including the new activity load) plus the summation of unlisted transient load(s).

Transient loads. Mobile equipment weighing more than 10,000 lbs.
6.0 RECORDS

The following records are generated during the performance of this procedure:

- Dome load records/dome load record summary sheets (DLRSS) (A-6003-834)
- ECN work packages
- Approved H-14 Route Drawings.

The record custodian identified in the Company Level Records Inventory and Disposition Schedule (RIDS) is responsible for record retention in accordance with TFC-BSM-IRM_DC-C-02.

7.0 SOURCES

7.1 Requirements

1. 29 CFR 1926.1400, “Cranes & Derricks in Construction.”
5. RPP-13033, “Tank Farms Documented Safety Analysis,” Table 3.3.2.3.2.

7.2 References

1. IB-09-018, Lessons Learned, “Subsidence, Sink Hole and Cave-In.”
2. 29 CFR 1926.1402, “Ground conditions.”
5. RPP-11801, “Analysis of Record Summary for Double-Shell Tanks.”
7. RPP-11803, “Analysis of Record Summary for DCRTs, Catch Tanks, and IMUSTs.”
10. RPP-25074, “Vehicle and Equipment Access over Buried Ducts/Pipes.”
<table>
<thead>
<tr>
<th>Control of Dome Loading and SSC Load Control</th>
<th>Manual Document Page</th>
<th>Engineering TFC-ENG-FACSUP-C-10, REV C-26</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. RPP-25782, “DST Dome Survey Program.”</td>
<td>March 29, 2018</td>
<td></td>
</tr>
<tr>
<td>13. RPP-38422, “Comparative Study of Wall Capacities.”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. RPP-CALC-38197, “Structural Analysis of 241 C-Farm Reinforced Concrete Slabs.”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. RPP-CALC-46715, “Structural Analysis of 241 TY-Farm Reinforced Concrete Slabs.”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. TFC-BSM-IRM_DC-C-02, “Records Management.”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. TFC-ENG-DESIGN-C-06, “Engineering Change Control.”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. TFC-ENG-FACSUP-C-25, “Hoisting and Rigging.”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. TFC-ENG-FACSUP-P-01, “TOC System Engineer Program.”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29. TFC-OPS-OPER-C-10, “Vehicle and Dome Load Control in Tank Farm Facilities.”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 1. Documents List.

<table>
<thead>
<tr>
<th>Table 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPP No.</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>RPP-20257</td>
</tr>
<tr>
<td>RPP-20258</td>
</tr>
<tr>
<td>RPP-20259</td>
</tr>
<tr>
<td>RPP-20260</td>
</tr>
<tr>
<td>RPP-20261</td>
</tr>
<tr>
<td>RPP-20262</td>
</tr>
<tr>
<td>RPP-20444</td>
</tr>
<tr>
<td>RPP-20445</td>
</tr>
<tr>
<td>RPP-20446</td>
</tr>
<tr>
<td>RPP-20447</td>
</tr>
<tr>
<td>RPP-20448</td>
</tr>
<tr>
<td>RPP-20449</td>
</tr>
<tr>
<td>RPP-20450</td>
</tr>
<tr>
<td>RPP-20451</td>
</tr>
<tr>
<td>RPP-20452</td>
</tr>
<tr>
<td>RPP-20453</td>
</tr>
<tr>
<td>RPP-20454</td>
</tr>
<tr>
<td>RPP-20455</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route Map Number</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>H-14-107608</td>
</tr>
<tr>
<td>H-14-107609</td>
</tr>
<tr>
<td>H-14-107610</td>
</tr>
<tr>
<td>H-14-107611</td>
</tr>
<tr>
<td>H-14-107612</td>
</tr>
<tr>
<td>H-14-107613</td>
</tr>
<tr>
<td>H-14-107614</td>
</tr>
<tr>
<td>H-14-107615</td>
</tr>
<tr>
<td>H-14-107616</td>
</tr>
<tr>
<td>H-14-107617</td>
</tr>
<tr>
<td>H-14-107618</td>
</tr>
<tr>
<td>H-14-107619</td>
</tr>
<tr>
<td>H-14-107620</td>
</tr>
<tr>
<td>H-14-107621</td>
</tr>
<tr>
<td>H-14-107622</td>
</tr>
<tr>
<td>H-14-107623</td>
</tr>
<tr>
<td>H-14-107624</td>
</tr>
<tr>
<td>H-14-107625</td>
</tr>
</tbody>
</table>
Table 3

<table>
<thead>
<tr>
<th>RPP No.</th>
<th>BELOW GRADE WASTE TRANSFER LINE CALCULATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPP-21726</td>
<td>Vehicle and Equipment Access over Buried Utilities in and Around Tank Farms</td>
</tr>
<tr>
<td>RPP-25074</td>
<td>Vehicle and Equipment Access over Buried Ducts/Pipes</td>
</tr>
</tbody>
</table>

Table 4

<table>
<thead>
<tr>
<th>RPP No.</th>
<th>BELOW GRADE SS PRIMARY TANK VENTILATION CALCULATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPP-25074</td>
<td>Vehicle and Equipment Access over Buried Ducts/Pipes</td>
</tr>
</tbody>
</table>

Table 5

<table>
<thead>
<tr>
<th>RPP No.</th>
<th>BELOW GRADE ANNULUS VENTILATION DUCTWORK</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPP-25074</td>
<td>Vehicle and Equipment Access over Buried Ducts/Pipes</td>
</tr>
</tbody>
</table>

Table 6

<table>
<thead>
<tr>
<th>RPP No.</th>
<th>BELOW GRADE PITS, VAULTS, BOXES &amp; SSCs CALCULATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPP-11803</td>
<td>Analysis of Record Summary for DCRTs, Catch Tanks, and IMUSTs</td>
</tr>
<tr>
<td>RPP-21726</td>
<td>Vehicle and Equipment Access over Buried Utilities in and Around Tank Farms</td>
</tr>
<tr>
<td>RPP-38422</td>
<td>Comparative Studies of Wall Capacities</td>
</tr>
</tbody>
</table>

Table 7

<table>
<thead>
<tr>
<th>RPP No.</th>
<th>BELOW GRADE SS ENCASEMENTS CALCULATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPP-CALC-38197</td>
<td>Structural Analysis of 241 C-Farm Reinforced Concrete Slabs</td>
</tr>
<tr>
<td>RPP-CALC-46715</td>
<td>Structural Analysis of 241 TY-Farm Reinforced Concrete Slabs</td>
</tr>
<tr>
<td>RPP-CALC-60162</td>
<td>Structural Analysis of 241 A Farm Reinforced Concrete Slabs</td>
</tr>
</tbody>
</table>

Table 8

<table>
<thead>
<tr>
<th>RPP No.</th>
<th>CRANE OUTRIGGER CALCULATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPP-CALC-25074</td>
<td>Crane Outtigger Pad Loads over Waste Transfer Lines</td>
</tr>
<tr>
<td>RPP-CALC-29489</td>
<td>Minimum Burial Depths for Ducts for Crane Outtigger Load Pads in Tank Farms</td>
</tr>
</tbody>
</table>
Figure 2. Control of Dome Loading Process.

**Key:**
- ACL: Allowable Concentrated Load
- ALM: Allowable Load Margin
- AOR: Analysis of Record
- CSE: Cognizant System Engineer
- DA: Design Authority – Waste Storage
- DLL: Dome Load Log
- DLRSS: Dome Load Record Summary Sheet
- EDL: Engineering Discipline Lead – Civil Structural
- MDL: Margin to Dome Load
- NAL: New Activity Load
- SE: Support Engineer
- TDL: Total Dome Load (Exist DLL listing + NAL + Transient Load)
- TEPL: Total Existing Permanent Load

**ENGINEERING PROGRAMS**
- Prepare or Revise AOR
  - Issue AOR Summary Documents with ACL Values
    - Evaluate and Document Results via AOR Revision (as required)
    - Determine Restrictions, Notify Operations
  - Prepare NAL Dome Load Assessment Form for the NAL Value to be Included in the Work Package
  - Notify EDL
  - Inspect and Evaluate Dome Loads with Operations
  - Revise DLRSS

**PRODUCTION OPERATIONS ENGINEERING**
- Prepare DLRSSs; Issue RPP with TEPL Values
  - Issue Interoffice Memo to Operations for ACL and TEPL Load Values
  - Evaluate the New Activity and Determines the NAL Value
  - Prepare NAL Dome Load Assessment Form for the NAL Value to be Included in the Work Package
  - Notify EDL
  - Inspect and Evaluate Dome Loads with Operations
  - Revise DLRSS

**PRODUCTION OPERATIONS**
- Update DLL
  - ALM = ACL - TEPL
- New Work Package is Being Planned
- Operations Notify the CSE that a Change in Dome Load is Planned per the New Work Package
- Work Package is Finalized
- Update Existing DLL
  - Showing the following: MDL = ALM - TDL
  - Ratio MDL/ALM ≤ 1.0
    - Dome Load is Acceptable
    - No Planned Activity Per the Work Package shall be Allowed on the Tank. Notify CSE for Evaluation and further Action. Initiate PER.
    - Walk Down Dome Loads with Engineering
    - Update Dome Load Log
Figure 3. Dome Elevation Survey Process.

SURVEYOR

Perform dome elevation survey or re-survey and submit report results to applicable structures, mixing and monitoring engineer

PRODUCTION OPERATIONS ENGINEERING

Review survey or re-survey report results

Is there any discrepancy in the dome elevation based on RPP-25782 and RPP-26516?

NO

Engineering Discipline Lead – Civil/Structural imposes limited tank access, if necessary, until PER is resolved

YES

Issue PER, request re-survey, and notify Engineering Discipline Lead – Civil/Structural

UPDATE

Update dome load record RPP document with survey data

Key:

PER: Problem Evaluation Request
A. GENERAL CONCENTRATED LOAD

1. A reference document for all entries shall be noted in the comment section of the dome load log.

2. The permanent concentrated loads and temporary (live) loads may be developed from a survey of the concentrated loads on the tank or an upper bound value estimated by the Waste Storage Design Authority to envelop the current concentrated load for a specific tank or for a group of tanks, such as entire tank farm. If an estimate is used for the load permanent concentrated load, then the basis for the estimate shall be included in the Dome Load Record Summary Sheet (DLRSS) or the dome load log.

3. RPP-20473 provides guidance for determining permanent concentrated loads, temporary, and transient live loads.

4. A group of concentrated loads (used to derive the permanent concentrated load only) that act in a manner similar to a uniform load may be removed from the permanent concentrated load of the Dome Load Record Summary Sheet (DLRSS) if the following requirements are met:
   
   a. An engineering evaluation has been performed to qualify an equivalent uniform load that has the same effect on the critical location within the tank structure as the group of individual loads. This evaluation requires approval by a qualified individual such as an engineering/analyses subject matter expert.

5. The following shall apply to recording concentrated loads in the dome load log.

   a. The Waste Storage Design Authority is to apply appropriate rigor and precision when performing the evaluation of the permanent concentrated load and temporary live loads to conservatively bound the summary of baseline loads. For guidance, see RPP-20473.

B. BUFFER LOAD

A buffer load of 31,000 lbs. is provided (for 100 series SST and DST) and 5000 lbs. of 200 SST; therefore, the entire allowable concentrated load limit on the dome load log may be used. The additional 31,000 lbs. and 5000 lbs. is allowed as an additional buffer load for the dome load log tracking purposes. Upon approaching total utilization of the allowable concentrated load limits, the actual field conditions should be evaluated. The buffer is to provide a workable range to allow for dome load log variations and for exceeding the dome load log allowable concentrated load. This buffer, however, is not to be intentionally used. It is a buffer only.
ATTACHMENT A - LOAD TRACKING (cont.)

C. PERMANENT LOADS

1. Facility modifications, for 100 series SST and DST that result in permanent concentrated load changes of 1,000 lbs. or less may be excluded from the requirement to identify the permanent concentrated load change in the dome load log. However, accumulation of such permanent loads should be reconciled in the dome load log when the accumulation approaches 10,000 lbs. in a 10 foot radius (e.g., after performance of a comprehensive walkdown or a special focus evaluation in accordance with TFC-ENG-FACSUP-P-01 and TFC-ENG-FACSUP-D-01.1). Tracking all 200 series SST loads is recommended. For guidance, see RPP-20473.

2. The following items are examples of permanent concentrated loads that could exceed 1,000 lbs. These loads shall be evaluated in the dome load log if they are permanently located over the tank and/or within the exclusion zone if they are judged to be significant:

- Installed equipment
- Piping (above grade and net weight below grade)
- Structures (including net weight of footings)
- Soil berms placed above grade
- Cover blocks
- Net weight of buried piping
- Permanent shielding.

NOTE: For additional permanent loads, see Temporary Loads, Section D (1), Note 2.

D. TEMPORARY LOADS

1. The temporary live loads, above 100 series SST and DST that result in concentrated load changes of 10,000 lbs. or less may be excluded from the requirement to identify the DLL change. However, accumulation of such temporary live loads should be reconciled in the DLL when the accumulation approaches 80,000 lbs. over the surface of the SSTs and 108,000 lbs. over the surface of the DSTs (e.g., after performance of a comprehensive walkdown or a special focus evaluation in accordance with TFC-ENG-FACSUP-P-01 and TFC-ENG-FACSUP-D-01.1). Exclusion zone temporary live loads less than 150,000 lbs. are exempt. Tracking all 200 series SST temporary loads is recommended. For guidance, see RPP-20473, “Exclusion Zone.”

NOTE 1: These temporary loads are based on 20 psf. live load and are separate from (in addition to) the ACL.

NOTE 2: Out of the maximum accumulation of 108,000 lbs. loads for the DSTs, the sub-total of 28,000 lbs. loads can be of the temporary and/or permanent uniformly distributed loads.
ATTACHMENT A - LOAD TRACKING (cont.)

2. The following items are examples of temporary live loads. These loads shall be evaluated in the dome load log if they are permanently located over the tank and/or within the exclusion zone if they are judged to be significant:
   - Temporary equipment
   - UT support trailer
   - 4 concrete tie down bocks
   - Soil berms placed above grade
   - Staging cover blocks
   - Temporary shielding.
   - Tents
   - Tool cribs.

E. TRANSIENT LOAD

1. Transient loads or a numeric value to account for transient loads shall be recorded in the dome load log. A description of the transient load or reason for the numeric entry shall be included in the dome load log.

2. Transient loads may be estimated, determined by actual weighing, determined from manufacturer’s data, or some other means of closely determining the weight. RPP-20473 provides guidance for determining transient loads and provides various verified equipment weights.

3. The Waste Storage Design Authority is expected to use appropriate judgment as to what is exempt from the controls of this procedure. When a significant accumulation of such loads occurs, the load should be reported to the shift manager for entry onto the dome load log. For guidance, see RPP-20473.

4. If the load is located over the tank, the full value of the load shall be recorded, unless otherwise justified. (See RPP-11356 as an acceptable method for estimating the load transferred to the dome.) For guidance, see RPP-20473.

5. Transient loads applied within the exclusion zones of 100 and 200 series SST and DST (around the tank but not over the tank) tanks that are less than or equal to the weight (approximately 150,000 lbs.) of the 110-ton crane (Grove AT1100) are exempt from the requirements for tracking on the DLL due to being a transient load. Once the equipment is positioned it becomes a temporary load which is tracked on the DLL.
### ATTACHMENT B - DOME LOAD LOG TRACKING MATRIX

<table>
<thead>
<tr>
<th>DST</th>
<th>SST 100 Series</th>
<th>SST 200 Series</th>
<th>Misc. Tanks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Load Type</strong></td>
<td><strong>Location</strong></td>
<td><strong>Exclusion Zone (20 ft)</strong></td>
<td><strong>Exclusion Zone (20 ft)</strong></td>
</tr>
<tr>
<td><strong>Permanent Loads</strong></td>
<td><strong>Above Tank</strong></td>
<td><strong>Exclusion Zone (20 ft)</strong></td>
<td><strong>Above Tank</strong></td>
</tr>
<tr>
<td>Load &lt; 1,000 lbs &amp; Load &lt; 10,000 lbs within a 10 ft radius then NT</td>
<td>Load &lt; 1,000 lbs &amp; Load &lt; 10,000 lbs within a 10 ft radius then NT</td>
<td>Load &lt; 1,000 lbs &amp; Load &lt; 10,000 lbs within a 10 ft radius then NT</td>
<td>Track All Loads</td>
</tr>
</tbody>
</table>

| **Temporary Loads** | **Above Tank** | **Exclusion Zone (20 ft)** | **Above Tank** | **Exclusion Zone (20 ft)** | **Track All Loads** | **Track All Loads** |
| Load < 10,000 lbs & Load < 80,000 lbs then NT | Load < 150,000 lbs then NT | Load < 10,000 lbs & Load < 80,000 lbs then NT | Load < 150,000 lbs then NT | Track All Loads | Load < 150,000 lbs then NT | Defense in Depth (Conduct of Ops.) | Defense in Depth (Conduct of Ops.) |

| **Transient Loads** | **Above Tank** | **Exclusion Zone (20 ft)** | **Above Tank** | **Exclusion Zone (20 ft)** | **Track All Loads** | **Track All Loads** |
| Load < Allowable Transient Load then NT | Load < 150,000 lbs then NT | Load < Allowable Transient Load then NT | Load < 150,000 lbs then NT | Track All Loads | Load < 150,000 lbs then NT | Track All Loads | Track All Loads |

---

*Exclusion Zone or depth to the bottom of the Facility Whichever is less.

**DSTs have an additional 28,000 lbs. temporary or Permanent Uniform Distributed Load

** NT - No Dome Load Tracking Requirements

**NOTE:** Only hand-held vibratory compaction tools are allowed in tank farms.
ATTACHMENT C – DOME DEFLECTION CALCULATION EXAMPLE

Monitoring of the tank dome by survey is required to physically verify the structural integrity of the tanks as deflection is a key indicator of structural integrity. Per RPP-26516 SST Dome Survey Study and RPP-25782 DST Dome Survey Study, in order to determine the actual deflection of the tank dome, the elevation change near the middle of the tank must be compared with the settlement of the tank as measured by the elevation change at the perimeter of the tank.

For Example: Tank AP 105 has a benchmark located on Riser 053 on the perimeter of the tank. On the 1/10/2006, it was surveyed and the initial elevation recorded at 679.680’. On 10/19/2012, the same riser was surveyed again, this time measuring 679.681’. The difference of 0.001’ is the Total Delta from Original Elevation, and indicates the amount the tank has settled over that timeframe.

A second benchmark, located near the middle of the tank on Pump Pit 05A, was surveyed on the 1/10/2006 at an elevation of 679.477’ and again on 10/19/2012 at the elevation 679.475’ a Total Delta from Original Elevation of -0.002’

Subtracting the elevation change at the perimeter benchmark (Riser 053) from the elevation change at the center benchmark (Pump Pit 05A), yields a dome deflection of -0.003’ (downward deflection is negative and upward deflection is positive).

\[-.002’ - .001’ = -.003’\]

According to RPP-26516, “…deflection in excess of ¼ inch should be reviewed by the Civil/Structural Discipline Lead Engineer”. In the case above the deflection is not in excess of ¼ inch, no action is needed.
## Tank AP-105 Benchmark Locations

### Control Monument Data

<table>
<thead>
<tr>
<th>Monument</th>
<th>N</th>
<th>W</th>
<th>EL</th>
<th>Location of Benchmarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP-1</td>
<td>40763.00</td>
<td>47100.03</td>
<td>679.282</td>
<td>(682.842 NAVD88-ft)</td>
</tr>
<tr>
<td>AP-4</td>
<td>40762.99</td>
<td>46968.03</td>
<td>679.408</td>
<td>(682.968 NAVD88-ft)</td>
</tr>
</tbody>
</table>

### Table of Data

<table>
<thead>
<tr>
<th>DATE</th>
<th>CENTRAL PUMP PIT 05A - NE COR</th>
<th>RISER - 025</th>
<th>RISER - 053</th>
<th>RISER - 069</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/10/2006</td>
<td>679.477</td>
<td>0</td>
<td>0</td>
<td>679.680</td>
</tr>
<tr>
<td>4/28/2008</td>
<td>679.477</td>
<td>0</td>
<td>0</td>
<td>679.687</td>
</tr>
<tr>
<td>8/10/2010</td>
<td>679.476</td>
<td>-0.001</td>
<td>-0.001</td>
<td>679.687</td>
</tr>
<tr>
<td>10/19/2012</td>
<td>679.475</td>
<td>-0.001</td>
<td>-0.002</td>
<td>679.685</td>
</tr>
</tbody>
</table>

Blocked by Enraf Equipment