Spill Prevention Control and Countermeasure (SPCC) Plan

Construct New Secondary Containment

WORKSHEET

This worksheet can be used to determine the possible dimensions for a rectangular or square dike or berm to meet the secondary containment requirement for aboveground bulk storage containers.

Information needed to use this worksheet:

- Tank shell capacity, diameter, length, and height
- Secondary containment length, width, and/or height limitations
- If rain can collect in secondary containment; the amount of rain, inches or feet, for the location

Steps:

A. Determining required dike or berm dimensions for largest single tank

1. Calculate the volume of the tank
2. Specify the containment wall height and one containment lateral dimension D1 to calculate lateral dimension D2
3. Calculate the volume of rain, V_{Rain}, to be collected in the secondary containment with area A_{SC} for the specified rain event
4. Calculate the required secondary containment volume, V_{SCReq}, to account for the additional volume of rain, V_{Rain}

B. Accounting for the displacements from other vertical cylindrical tanks to be located in dike or berm with the largest tank

1. For SC_{Height} (ft), calculate the displacement from additional vertical cylindrical tanks, Tank 2, 3, 4, etc., to be located with the largest tank in the dike or berm
2. Calculate the total displacement volume from the additional vertical cylindrical tanks in the dike or berm

C. Accounting for the displacements from other horizontal cylindrical tanks to be located In dike or berm with the largest tank

1. For SC_{Height} (ft), calculate the displacement from additional horizontal cylindrical tanks, Tank 2, 3, 4, etc., to be located with the largest tank in the dike or berm
2. Calculate the total displacement volume from the additional horizontal cylindrical tanks in the dike or berm

D. Accounting for the displacements from other rectangular tanks to be located in dike or berm with the largest tank

1. For SC_{Height} (ft), calculate the displacement from additional rectangular tanks, Tank 2, 3, 4, etc., to be located with the largest tank in the dike or berm
2. Calculate the total displacement volume from the additional rectangular tanks in the dike or berm

Disclaimer: Please note that these are simplified calculations for qualified facilities that assume: 1) the secondary containment is designed with a flat floor; 2) the wall height is equal for all four walls; and 3) the corners of the secondary containment system are 90 degrees. Additionally, the calculations do not include displacement for support structures or foundations. For Professional Engineer (PE) certified Plans, the PE may need to account for site-specific conditions associated with the secondary containment structure which may require modifications to these sample calculations to ensure good engineering practice.

A. Determining required dike or berm dimensions for largest single tank

1. Calculate the volume of the tank

Largest Tank Shell Capacity (gal) = [ ]
a

Largest Tank Volume (ft^3) = [ ] ÷ 7.48
a (gal) gal/ft^3

= [0] ft^3
b

Note that state and local fire and safety codes may prescribe limits on the height of containment walls, minimum separation distances between tanks, and setback distances. For instance, Occupational Safety and Health Administration (OSHA) flammable and combustible liquids standards in 29 CFR 1910.106 prescribe separation distances between adjacent tanks. Such requirements may present constraints on the location, dimensions, and configuration of the secondary containment structure. The footprint of the tank or tanks and arrangement of the tanks when there is to be more than a single tank within secondary containment may also present constraints on the containment dimensions.

2. Specify the containment wall height and one containment lateral dimension D1 to calculate lateral dimension D2

Note: NaN = Not A Number. Once values **b**, **c, and e** are inputted, NaN will be replaced with the correct value for **f**.

Height of Containment Wall, SC_{Height} (ft) = [ ] ft
c

Height of Containment Wall, SC_{Height} (in) = [ ] x 12
c (ft) in/ft

= [0] in
d

D1 (ft) = [ ] ft
e

D2 (ft) = [ ] ÷ [ ] ÷ [ ] = [NaN] ft
b (ft^3) c (ft) e (ft) **f**

***b** is the volume of the largest tank calculated in Step 1.*

3. Calculate the volume of rain, V_{Rain} to be collected in the secondary containment with area A_{SC} for the specified rain event

Selected Rainfall Event:

Rainfall (in) = [ ] in
g

f *is lateral dimension D2 calculated in Step 2.*

A_{SC} (ft^2) = [ ] e (ft) x [ ] f (ft) = [0] **h** ft^2

V_{Rain} (ft^3) = [ ] g (in) ÷ 12 in/ft x [ ] h (ft^2)

= [0] **i** ft^3

4. Calculate the required secondary containment volume, V_{SCReq} to account for the additional volume of rain, V_{Rain}

b *is the volume of the largest tank calculated in Step 1.*

i *is the volume of rain calculated in Step 3.*

V_{SCReq} (ft^3) = [ ] b (ft^3) + [ ] i (ft^3) = [0] **j** ft^3

Vary the secondary containment height and lateral dimensions, or footprint, in Step 2 to meet any space or dimension constraints or requirements and the required containment volume, V_{SCReq}, by using V_{SCReq} in place of the volume of the largest shell capacity tank, **b** in Step 2.

IF APPLICABLE: When other tanks or containers are also to be located within the secondary containment along with the largest tank, calculate the displacement volumes from these other tanks or containers using Parts B, C and D as applicable. Add the total displacement volume from the other tanks or containers to the volume of rain, V_{Rain}, and the largest tank volume, **b**, in Step 1, to obtain a net secondary containment volume, V_{NetSC}:

V_{NetSC} (ft^3) = [ ] j (ft^3) + [ ] Total Displacement Volume (ft^3) = [0] **k** ft^3

Vary the secondary containment height and lateral dimensions, or footprint, in Step 2 to meet any space or dimension constraints or requirements and the net required containment volume, V_{NetSC}, by using V_{NetSC} in place of the volume of the largest shell capacity tank, **b**.

B. <u>Accounting for the displacements from other vertical cylindrical tanks to be located in dike or berm with the largest tank</u>

1. For SC_{Height} (ft), calculate the displacement from additional vertical cylindrical tanks, Tank 2, 3, 4, etc., to be located with the largest tank in the dike or berm

Diameter of Tank 2 (ft) = [ ]
l

Radius of Tank 2 (ft) = [ ] ÷ 2 = [0] ft
l (ft) ... **m**

Displacement Area, $DA_{Tank\ 2}$ (ft^2) = 3.14 x [( )^2]
π ... m (ft)

= [0] ft^2
n

Displacement Volume, $DV_{Tank\ 2}$ (ft^3) = [ ] x [ ]
n (ft^2) ... c (ft)

__c__ is the containment wall height used in Step 2 of A.

= [0] ft^3
o

Repeat to calculate the displacement of each additional horizontal cylindrical tank located with the largest tank in the dike or berm.

2. Calculate the total displacement volume from the additional vertical cylindrical tanks in the dike or berm

Total Displacement Volume (ft^3) = [ ] + [ ] + [ ] + ...
o (ft^3) ... o1 (ft^3) ... o2 (ft^3)

__o__ is the displacement volume of Tank 2 calculated in Step 1 of B.

= [0] ft^3
p

C. Accounting for the displacements from other horizontal cylindrical tanks to be located in dike or berm with the largest tank

1. For SC_{Height} (ft), calculate the displacement from additional horizontal cylindrical tanks, Tank 2, 3, 4, etc., to be located with the largest tank in the dike or berm

The easiest way to determine the displacement volume for a horizontal cylindrical tank is to use the tank manufacturer's liquid height to gallons conversion chart for the tank in Method 1 calculation. If this information is not available, use Method 2 calculation to obtain the displacement volumes.

METHOD 1

Height of Tank 2 Below Containment Wall (in) = [ ] in

$V_{Tank\ 2}$ Displacement (gal) From Tank Conversion Chart = [ ] gal
q

$V_{Tank\ 2}$ Displacement (ft^3) = [ ] q (gal) x 0.1337 ft^3/gal = [0] ft^3 **r**

Repeat to calculate the displacement of each additional horizontal cylindrical tank located with the largest tank in the dike or berm.

Total Displacement Volume (ft^3) = [ ] r (ft^3) + [ ] r1 (ft^3) + [ ] r2 (ft^3) + …

= [0] ft^3
s

METHOD 2

Height of Tank 2 Below Containment Wall (in) = [ ] in
t

Tank 2 Diameter (in) = [ ] Diameter (ft) x 12 in/ft = [0] in **u**

Height to Diameter Ratio for Tank 2 = [ ] t (in) ÷ [ ] u (in) = [NaN] **v**

Tank 2 Volume Fraction for Height to Diameter Ratio (Table) = [ ]
w

<u>If the tank shell capacity in gallons is known:</u>

Tank Volume $V_{Tank\ 2}$ (ft^3) = [ ] Shell Capacity (gal) x 0.1337 ft^3/gal = [0] ft^3 **x**

METHOD 2 (CONT)

Or, if the tank shell capacity in gallons is not known:

Tank 2 radius (ft) = [ ] ÷ 2 = [0] ft
Diameter (ft)

$V_{Tank\ 2}$ (ft^3) = 3.14 x [( )^2] x [ ] = [0] ft^3
Radius (ft) — Tank Length (ft) — **y**

Displacement, $V_{Tank\ 2}$ (ft^3) = [ ] x [ ] = [0] ft^3
x or y (ft^3) — w — **z**

Repeat to calculate the displacement volume of each additional horizontal cylindrical tank to be located with the largest tank in the dike or berm.

2. Calculate the total displacement volume from the additional horizontal cylindrical tanks in the dike or berm

Total Displacement Volume (ft^3) = [ ] + [ ] + [ ] + ...
z (ft^3) — z1 (ft^3) — z2 (ft^3)

***z** is the displacement volume calculated in Step 1, Method 2 of C.*

= [0] ft^3
aa

D. <u>Accounting for the displacements from other rectangular tanks to be located in dike or berm with the largest tank</u>

1. For SC_{Height} (ft), calculate the displacement from additional rectangular tanks, Tank 2, 3, 4, etc., to be located with the largest tank in the dike or berm

Height of Tank 2 Below Containment Wall (ft) = [ ] ft
ab

Length of Tank 2 (ft) = [ ]
ac

Width of Tank 2 (ft) = [ ]
ad

Displacement Area, $DA_{Tank\ 2}$ (ft^2) = [ ] ac (ft) x [ ] ad (ft) = [0] **ae** ft^2

Displacement Volume, $DV_{Tank\ 2}$ (ft^3) = [ ] ae (ft^2) x [ ] ab (ft)

= [0] **af** ft^3

Repeat to calculate the displacement area and volume of each additional rectangular tank to be located with the largest tank in the dike or berm.

2. Calculate the total displacement volume from the additional rectangular tanks in the dike or berm

Total Displacement Volume (ft^3) = [ ] af (ft^3) + [ ] af1 (ft^3) + [ ] af2 (ft^3) + ...

__af__ is the displacement volume calculated in Step 1 of D.

= [0] **ag** ft^3

Please use the space below to sketch tanks and wall dimensions to assist with calculations.