Spill Prevention Control and Countermeasure (SPCC) Plan

Rectangular or Square Remote Impoundment Structure

EXAMPLE

This worksheet calculates the containment volume of a rectangular or square remote impoundment[1] structure providing secondary containment for an aboveground tank storage facility.

Steps:

1. Determine the volume of the secondary containment impoundment, V_{SC}

2a. Determine the volume of the largest tank when shell capacity is unknown, V_{Tank}

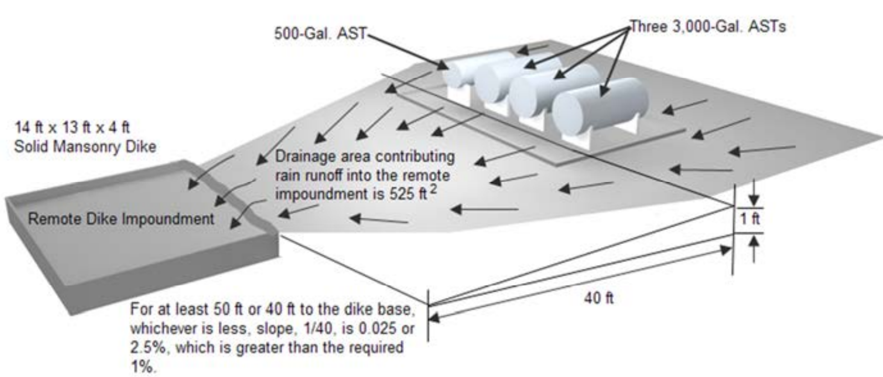
2b. Determine the volume of the largest tank when shell capacity is known, V_{Tank}

3. Determine the percentage of the secondary containment volume, V_{SC} to the largest tank volume, V_{Tank}

4. Determine whether the secondary containment impoundment can contain the entire tank shell capacity of the largest tank with additional capacity to contain rain.

Information needed to use this worksheet:

- **Tank shell capacity**
  See diagram for capacities.
- **Remote impoundment length, width, and height**
  See diagram for dimensions.
- **Rainfall amount**
  Rain can fall into the impoundment and the area draining into the impoundment. The selected rain event for the location is 7 inches. See the diagram to obtain the surface drainage area in square feet.



Largest Tank Shell Capacity (gal) = 3,000
a

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.

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[1] Remote impounding is an acceptable secondary containment method under NFPA 30 because the code primarily focuses on fire safety and emphasizes the importance of moving leaked or spilled flammable liquids away from the tank by adequate draining. A remote impoundment must be able to contain the contents of the largest tank. However, when this is not possible, partial impounding can be used in combination with diking to meet the largest-tank criterion.

For tank fields contained by diking, NFPA 30 requires that a slope of not less than one percent away from the tank shall be provided for at least 50 feet or to the dike base, whichever is less. This ensures that small spills will not accumulate against the wall of the tank. Also, if remote impounding is used, the drainage path to the impoundment should be designed so that if the drainage path is ignited, the flames will not pose serious risk to tanks or adjoining property.

1. Determine the volume of the secondary containment impoundment, V_{SC}

Impoundment Containment Area, A_{SC} = 14 Length (ft) x 13 Width (ft)

= 182 ft^2 **b**

V_{SC} (ft^3) = 182 b (ft^2) x 4 Height (ft) = 728 ft^3 **c**

2a. Determine the volume of the largest tank when the shell capacity is unknown, V_{Tank}

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

V_{Tank} (ft^3) = 3.14 x ( )^2 Radius^2 (ft)^2 x [ ] Tank Height (ft) = [ ] ft^3 **d**

2b. Determine the volume of the largest tank when shell capacity is known, V_{Tank}

a *is the tank shell capacity from page 1.*

V_{Tank} (ft^3) = 3,000 a (gal) x 0.1337 ft^3/gal = 401 ft^3 **e**

3. Determine the percentage of the secondary containment volume, V_{SC} to the largest tank volume, V_{Tank}[2] (to determine whether the volume of the containment is sufficient to contain the largest tank's entire shell capacity).

***c** is the secondary contianment volume.*
***d / e** is the tank volume calculated in Step 2 of this worksheet.*

V_{SC}/V_{Tank} = 728 (c, ft³) ÷ 401 (d or e, ft³) = 1.82 (**f**)

% = 1.82 (f) x 100 = 182 (**g**)

Percentage, **g**, is 182%, which is greater than 100%.The capacity of the impoundment containment is sufficient to contain the shell capacity of the largest tank. However, we must also account for rain that can collect in the impoundment. See Step 4.

4. Determine whether the secondary containment impoundment can contain the entire tank shell capacity with additional capacity to contain rain.

If rain can collect in a remote impoundment structure, the SPCC rule requires that secondary containment for bulk storage containers have additional capacity to contain rainfall or freeboard. The rule does not specify a method to determine the additional capacity required to contain rain or the size of the rain event for designing secondary containment. However, industry practice often considers a rule of thumb of 110% of the tank capacity to account for rainfall. Secondary containment with a 110% capacity of the tank may be acceptable depending on, the shell size of the tank, local precipitation patterns and frequency of containment inspections. In a different geographic area, secondary containment designed to hold 110% for the same size tank may not have enough additional containment capacity to account for a typical rain event in that area. The 110% standard may also not suffice for larger storm events. If you want to determine a conservative capacity for a rain event, you may want to consider a 24-hour 25-year storm event. It is the responsibility of the owner or operator[3] to determine the additional containment capacity necessary to contain rain. A typical rain event may exceed the amount determined by using a 110% "rule of thumb" so it is important to consider the amount of a typical rain event when designing or assessing your secondary containment capacity.

Rainfall data may be available from various sources such as local water authorities, local airports, and the National Oceanic and Atmospheric Administration (NOAA).

[2] Steps 3 and 4 in the worksheet determines whether the volume of the impoundment containment is sufficient to contain the largest tank's entire shell capacity and rainfall (freeboard for precipitation) as required by the SPCC rule. Step 3 primarily determines whether the volume of the impoundment containment is sufficient to contain the entire shell capacity of the largest tank. Step 4 is necessary to determine whether the impoundment containment can also contain the expected volume of rainfall (both the volume of rain that falls into the impoundment plus the rain from the drainage area contributing runoff into the impoundment).

[3] The SPCC rule does not require you to show the secondary containment calculations in your Plan. However, you should maintain documentation of secondary containment calculations to demonstrate compliance to an EPA inspector.

Selected Rainfall Event:

Rainfall (in) = 7 in
h

Rainfall (ft) = 7 ÷ 12
h (in) in/ft

= 0.6 ft
i

Volume of rain, $V_{RainImpound}$, that can fall directly into the impoundment:

$V_{RainImpound}$ (ft^3) = 0.6 x 182 = 109 ft^3
i (ft) b (ft^2) **j**

***b** is the area of secondary containment calculated in Step 1 of this worksheet*

Volume of rain contributed from the Impoundment Drainage Area, $V_{DrainageArea}$, to the remote impoundment: (The drainage surface area, $A_{DrainageArea}$, contributing rain runoff into the remote dike impoundment in ft^2 is required to determine $V_{DrainageArea}$. This information can be obtained from the as-built plans for the design and construction of the impoundment).

Area of Drainage, $A_{DrainageArea}$ (ft^2) = 525 ft^2
k

$V_{DrainageArea}$ (ft^3) = 0.6 x 525 = 315 ft^3
i (ft) k (ft^2) **l**

Total Volume of Rain Collected in Impoundment, $V_{TotalRainImpound}$:

$V_{TotalRainImpound}$ (ft^3) = 109 + 315 = 424 ft^3
j (ft^3) l (ft^3) **m**

Total Containment Capacity Required (ft^3) = 424 + 401
m (ft^3) e (ft^3)

***e** is the tank volume calculated in Step 2 of this worksheet*

= 825 ft^3
n

The volume of the impoundment containment in **c** is 728 ft^3, which is less than the required containment capacity in **n** (825 ft^3). Therefore, the impoundment containment is not sufficient to contain the shell capacity of the largest tank and the typical rainfall amount.

The percentage of the impoundment containment volume to the largest tank shell capacity volume is 182% (**g** in Step 3). This percentage, which is greater than 100%, indicates that additional impoundment containment capacity is available to contain rain as the containment is exposed to rain. Subtracting the largest tank shell capacity volume V_{Tank} of 401 ft^3 (**d** or **e** in Step 3) from the impoundment containment volume V_{SC} of 728 ft^3 (**c** in Step 3) yields 327 ft^3 of additional containment capacity for rain. $V_{TotalRainImpound}$, the total volume of rain collected in the impoundment containment in a 24-hour 25-year rainfall event that produces 7 inches of rain, is 424 ft^3 (**m** in Step 4). $V_{TotalRainImpound}$ is more than the 327 ft^3 of additional containment capacity by 97 ft^3; consequently, the additional impoundment containment capacity is **not sufficient** to also contain the rain from the selected rainfall event.

As concluded at the end of Step 4 in this example, the impoundment containment is **not sufficient** to contain the shell capacity of the largest tank and the selected typical rainfall amount.