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Design of Bund Wall for a 20,000 Gallon Capacity Diesel Tank (Gbaran-Ubie Early Production Facility)

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ABSTRACT: Bunds are embankments or wall of bricks which surrounds the perimeter of a tank and provides a barrier to retain liquid (diesel). The bund wall is designed to contain 110% of the contents of the diesel tank. The design bund wall capacity is 2943 ft^3 and a bund wall height of 3.27ft. This will adequately contain any spill from the diesel tank with capacity 0f 2674 ft^3 in case of any accidental discharges. The aim of building a bund wall around the diesel tank is to protect and preserve the environment.

KEYWORDS: Bunding, Bund wall, Secondary Containment, Embankment, Accidental Discharges, Impermeable.

I. INTRODUCTION

Bunding, also called bund wall, is a constructed retaining wall designed to prevent inundation or breaches from a known source. It is a secondary containment system commonly used to protect the environment from spills where chemicals and oils are stored. If there are failures or accidental discharges, the bund wall should be able to contain the contents of the entire tank.
Bunding is a legal requirement in oil field installations around tanks, storage vessels that contain liquids which may be dangerous to the environment.
Bunds have impermeable walls and base within which the tank is raised above the floor. Most oil storage facilities use concrete blocks to construct the bund walls.
This work involves the design of a bund wall to contain 20,000 gallons of diesel in case of accidental discharges in the early production facility of the Shell Gbaran-Ubie gas facility.

II. DEFINITION OF PROBLEM

It is SPDC requirement that all oil and chemical storage tanks must be provided with bund walls to contain leaks or accidental discharges from tanks, so it will not have adverse effect on the environment. So this work looks into the design of a bund wall to serve as a secondary containment for the plant black start-up diesel tank.

III. AIM OF THE DESIGN

To protect the environment by providing a secondary containment system for diesel liquid which if spilled is likely to cause pollution or pose an environmental hazard in the process plant and its environment

IV. DESIGN METHODOLOGY

A. BUND WALL SPECIFICATION

Situate the diesel tank and its ancillary equipment within a liquid tight secondary containment system i.e. within a bund wall. The risk of diesel escaping the bund and contaminating the environment will be minimized when the following are adhered to:

- Keep the primary container as low as possible.

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- Ensure that the walls of the bund are of sufficient height and integrity to avoid leakages.
- Ensure that all diesel dispensing mechanisms, valves, filters or other ancillary equipment are kept inside the bunded area to avoid spills outside the secondary containment.
- The bunding must be impermeable to liquids.
- There must be no direct outlet from the bunded area. No pipework may pass through the wall of the bund.
- The bunded area may not be discharged to any drain, sewer or water course or be discharged into the yard or unprotected soil.
- The bunded area must be roofed to ensure that rain water does not collect inside the bunded area. Rainwater will reduce the volume inside the bund, making the bunding ineffective.
- Do not use bunds to store materials or wastes, as this will reduce the capacity.
- The bund capacity should be sufficient to contain 110% of diesel tanks maximum capacity.
- The wall height should not exceed 1.5m.

B. CAPACITY OF DIESEL TANK

Capacity of horizontal diesel tank = 20,000 gallon
Length of the diesel tank = 35 ft
Diameter of the tank = 10 ft

The secondary containment area (bund wall) provides a 10ft buffer on all sides of the diesel tank in the design.

C. NET CAPACITY OF THE BUND WALL

Since the secondary containment provides a buffer of 10ft on all sides from the diesel tanks dimensions.
Then

Length of bund $= 45ft$
Width of bund $= 20ft$
Bund wall area $= Length \times Width$ (2.1)
Bund wall area $= 45ft \times 20ft = 900ft^2$
Volume based on 100% of tank capacity $= 20{,}000gallon = 2674ft^3$
Wall height that would contain tanks volume $= \frac{VolumeofTank}{BundWallArea}$ (2.2)
Wall height that would contain tanks volume $= \frac{2674ft^3}{900ft^2} = 2.97ft$

Since the bund capacity should be sufficient to contain 110% of the tanks maximum capacity.
Therefore

110% of tank capacity $= 110\%\ ofTankCapacity$ (2.3)
110% of tank capacity $= \frac{110}{100} \times 20000$
$= 22{,}000gallons = 2941ft^3$
Wall height equivalent to 110% of bund capacity $= \frac{2941ft^3}{900ft^2} = 3.27ft$

Therefore, a bund wall design based on a criterion of 110% of diesel tank capacity provides a bund wall height of $3.27ft$.

Bund wall net capacity $= Volume \times width \times height$ (2.4)
Bund wall net capacity $= 45ft \times 20ft \times 3.27ft = 2943ft^3$

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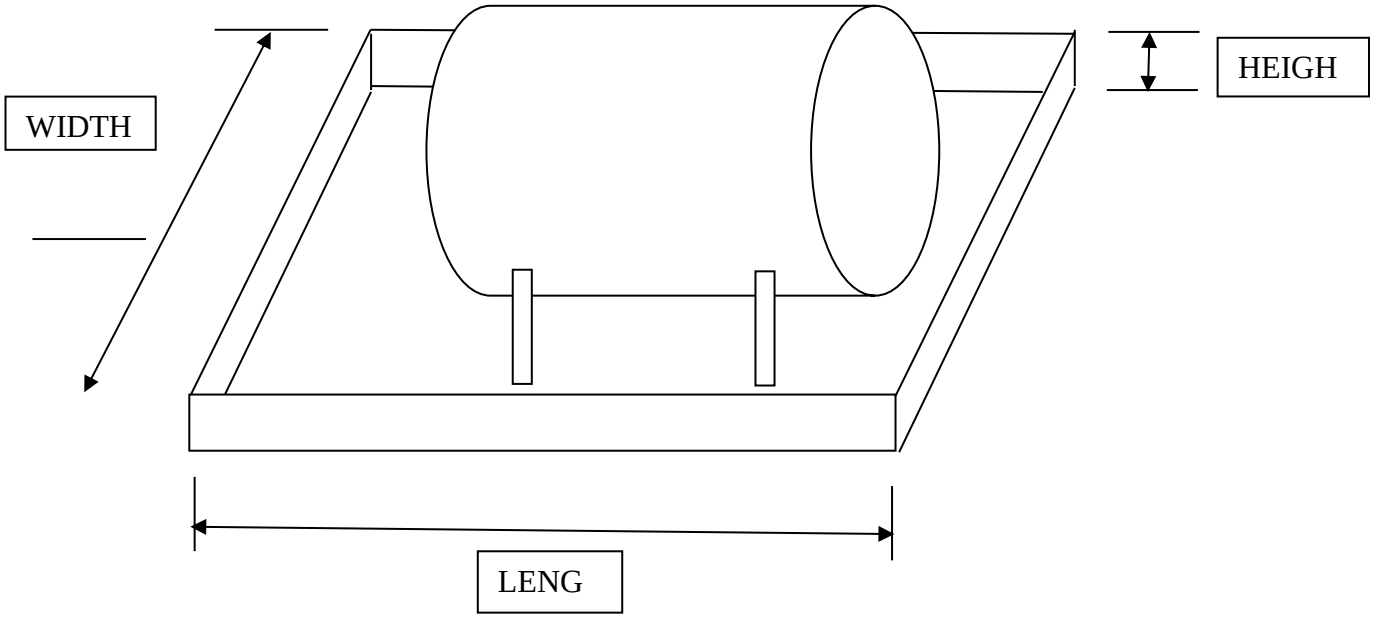
D. DESIGNED BUND WALL SCHEMATICS



E. DIMENSIONS OF DIESEL TANK

CAPACITY OF TANK = 20,000 gallons
LENGTH OF TANK = 35ft
DIAMETER = 10ft

F. DIMENSION OF BUND WALL

LENGTH OF BUND WALL = 45ft
WIDTH OF BUND WALL = 20ft
HEIGHT OF BUND WALL = 3.27ft
CAPACITY OF BUND WALL = 2943ft^3

V. RESULTS AND DISCUSSIONS

The designed bund wall net capacity is $2943\ ft^3$ and it will contain 100% of the diesel tank capacity of $2674\ ft^3$ and a tolerance of $269\ ft^3$. The height of the bund wall is $3.27\ ft$. So in case of any operational error or accidental discharge, the content of the diesel tank will not spill over the bund wall to contaminate the environment.

VI. CONCLUSION

The bund wall designed has a capacity of $2943\ ft^3$ and it is adequate for containing any emergency spill, leaks or accidental discharges from the diesel tank. With this bund wall in place, the diesel can be recovered if there is any spill and the environment is preserved.

REFERENCES

[1] Exterran Nigeria Ltd. (2008). Gbaran-Ubie Early Production Plant Start-up and Operating Manual.
[2] Glen, P. (2003). Bund design to prevent overtopping, *IChem symposium series N0. 149*, PP. 329 339.
[3] EPA Australia (1992). *Bunding guidelines*, Publication 347.
[4] Dangerous Goods Regulation. (2000), *Storage and Handling*, Statutory Rule No. 127.

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