



# Storage Tanks

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# Overview

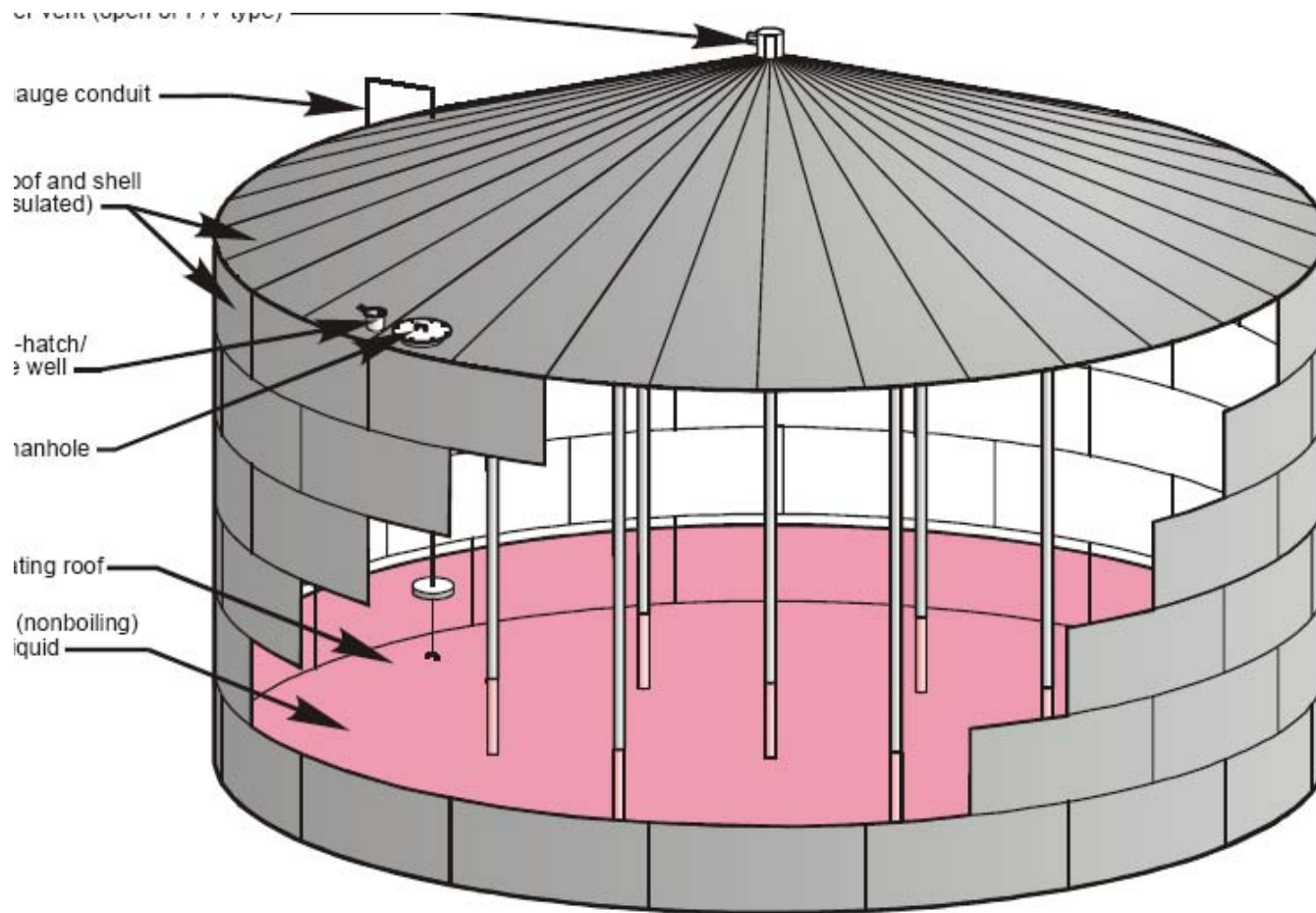
(27 slides)

- Tank Types
- Emission Mechanisms
  - Normal Operations
  - Roof Landings
  - Tank Cleanings
- Controls
  - Physical Controls
  - Operational Controls

# Tank Types



# Fixed Roof Tanks

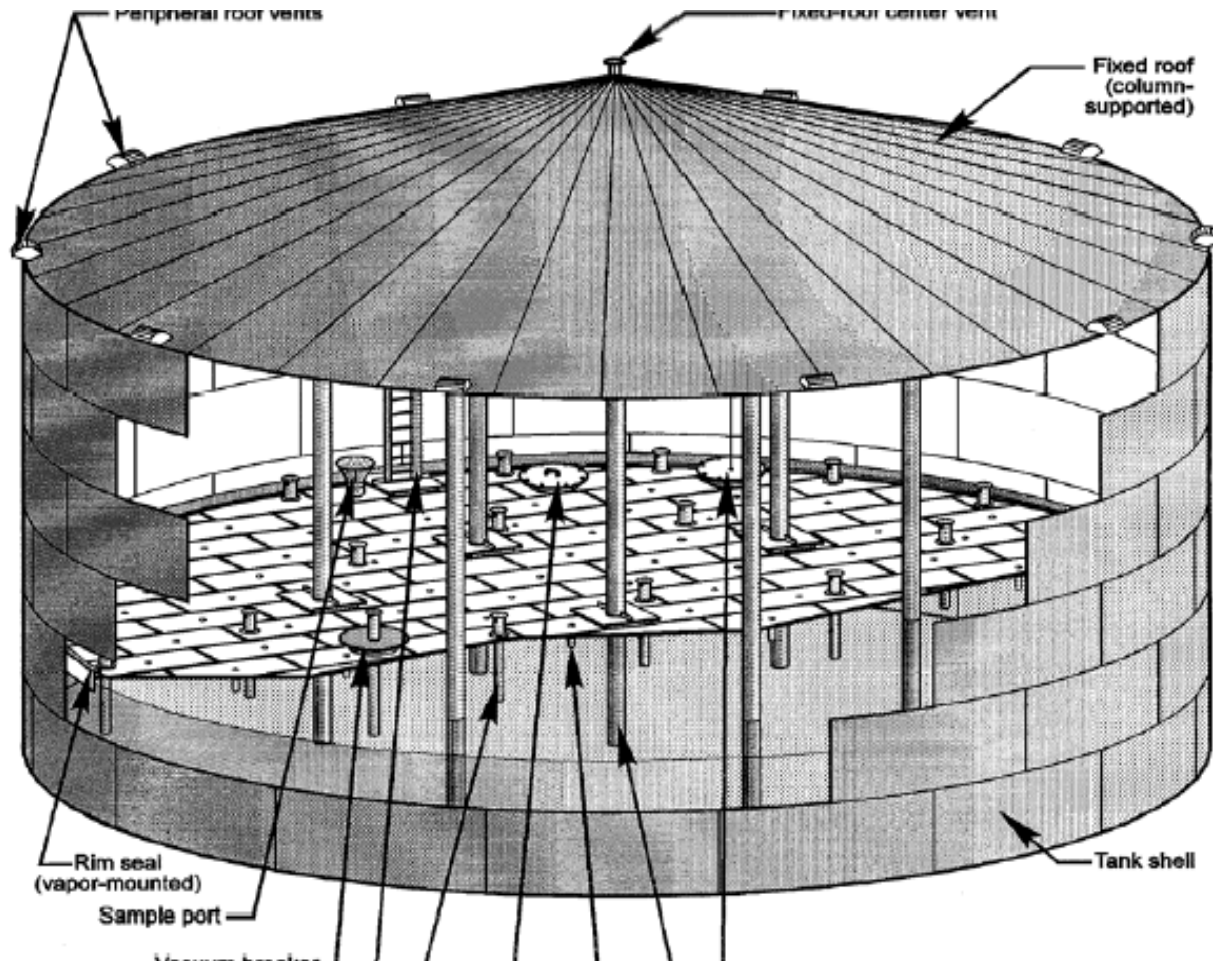


# Fixed Roof Tanks



- Horizontal Fixed Roof Tanks
- Vertical Fixed Roof Tanks

# Floating Roof Tanks



# Floating Roof Tanks



- External Floating Roof Tanks
- Internal Floating Roof Tanks
- Domed External Floating Roof Tanks

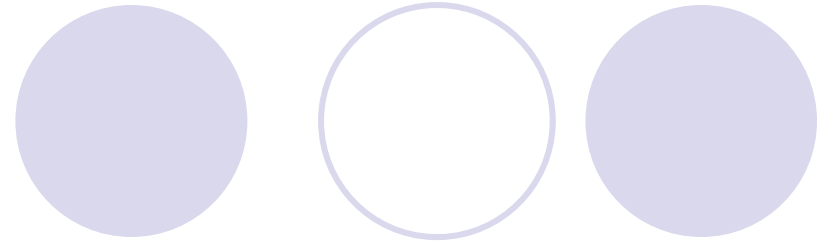


# Emissions Mechanisms

- Normal Operations
- Floating Roof Landings
- Tank Cleaning Activities



# Normal Operations



- When product is stored inside the tank
- Is not when a tank is landed (floaters only)
- Is not when the tank is clean and empty

# Normal Operations



- Emissions during normal operations result from:
  - Working losses
  - Breathing losses:
    - Deck seam losses
    - Rim seal losses
    - Fitting losses
  - Can be modeled using the EPA's TANKS program version 4.09d

# Normal Operations – Data Needs

- Type of Tank
- Dimensions, Capacity, Other Physical Attributes of the Tank
- Contents
- Throughput

# Normal Operations: Data Needs for VFRT

**Vertical Fixed Roof Tank**

Identification | **Physical Characteristics** | Site Selection | Tank Contents | Monthly Calculations

**Dimensions:**

Shell Height (ft):

Shell Diameter (ft):

Maximum Liquid Height (ft):

Average Liquid Height (ft):

Working Volume (gal):

Turnovers per Year:

Net Throughput (gal/yr):

Is Tank Heated?

**Roof Characteristics:**

Color/Shade:

Condition:

Type:

Height (ft):

**Shell Characteristics:**

Shell Color/Shade:

Shell Condition:

**Breather Vent Settings:**

Vacuum Setting (psig):

Pressure Setting (psig):

# Normal Operations: Data Needs for IFRT

The screenshot displays the 'Internal Floating Roof Tank' software interface. The title bar is green with the text 'Internal Floating Roof Tank'. Below the title bar are five tabs: 'Identification', 'Physical Characteristics' (which is selected and highlighted with a dotted border), 'Site Selection', 'Tank Contents', and 'Monthly Calculations'. The main content area is titled 'Physical Characteristics' and is divided into two columns. The left column is labeled 'Tank Characteristics:' and contains the following fields: 'Diameter (ft):' with a text box containing '0'; 'Tank Volume (gal):' with a text box containing '0.00'; 'Turnovers per year:' with a text box containing '0.00'; 'Net Throughput (gal/yr):' with a text box containing '0.00'; 'Self Supporting Roof?' with a dropdown menu; 'Number of Columns:' with a text box containing '0'; 'Effective Column Diameter:' with a dropdown menu containing '0'; 'Internal Shell Condition:', 'External Shell Color/Shade:', 'External Shell Condition:', 'Roof Color/Shade:', and 'Roof Paint Condition:' each with a dropdown menu. The right column is labeled 'Rim Seal System:' and contains 'Primary Seal:' and 'Secondary Seal:' with dropdown menus. Below these is the 'Deck Characteristics:' section with 'Deck Type:' and 'Deck Fitting Category:' dropdown menus. At the bottom right of the main content area is a button labeled 'View/Add Fittings'. At the very bottom of the window are five buttons: 'Copy', 'Run Report', 'Save', 'Close', and 'Help'.

# Tank Landings



- Occur when the liquid level becomes low enough that the floating roof lands on its legs at which point breather vents are activated to equalize pressure
- Calculated using methodologies in API 2567 (Evaporative Losses from Storage Tank Floating Roof Landings, April 2005) and EPA's AP-42, 7.1 (Organic Liquid Storage Tanks, November 2006)
- Sum of standing idle losses and filling losses

# Tank Landings – Data Needs

- Emission calculations are based on tank type and whether a heel is present upon landing

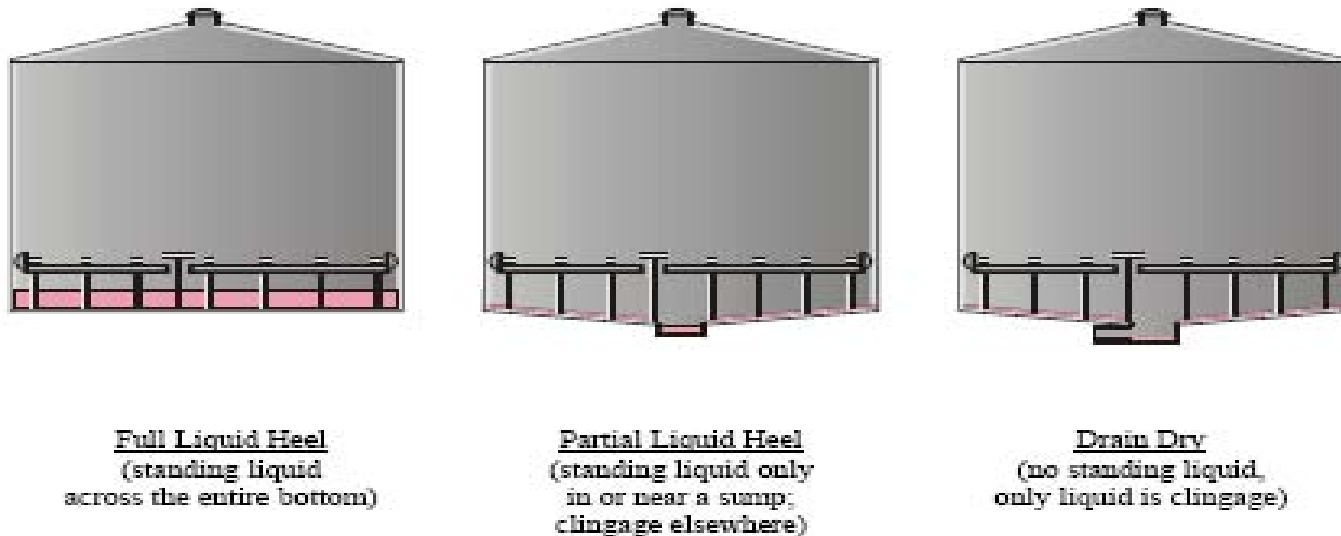


Figure 7.1-20. Bottom conditions for landing loss.<sup>20</sup>

# Tank Landings – Data Needs

- Physical conditions during landings:
  - Height of liquid in tank
  - Volume of vapor space below landed roof
- Contents being removed, contents being introduced
- Number of days standing idle



# Tank Cleanings



- Tank Cleanings occur when a tank is landed, degassed (vapor space purge), sludge is removed, and the tank is refilled
- Emission calculations calculated based on methodologies in API 2568 (Evaporative Loss from Cleaning of Storage Tanks, Nov 2007)

# Tank Cleanings



- Also applies to fixed roof tanks
- Emissions vary by tank type and heel type (drain dry, partial heel, or full heel)
- Emissions are affected by the process that a company uses

# Tank Cleanings – Data Needs

- Tank type
- Heel type
- Process used (timing of events)
- Height/Volume of vapor space
- Slope of tank bottom
- Ventilation rates
- LEL readings



# Controls to Reduce Emissions

- Physical Controls
- Operational Controls

# Physical Controls



- Install floating roof (deck) on fixed roof tanks
- Dome external floating roof tanks
- Weld decks
- Socks on legs
- Wipers, floats, and/or sleeves on guide/gauge poles

# Physical Controls



- Reduce leg heights or replace legs with cable suspended roofs
- Equip with new or better primary and secondary seals
- Combustion and recovery devices

# Physical Controls

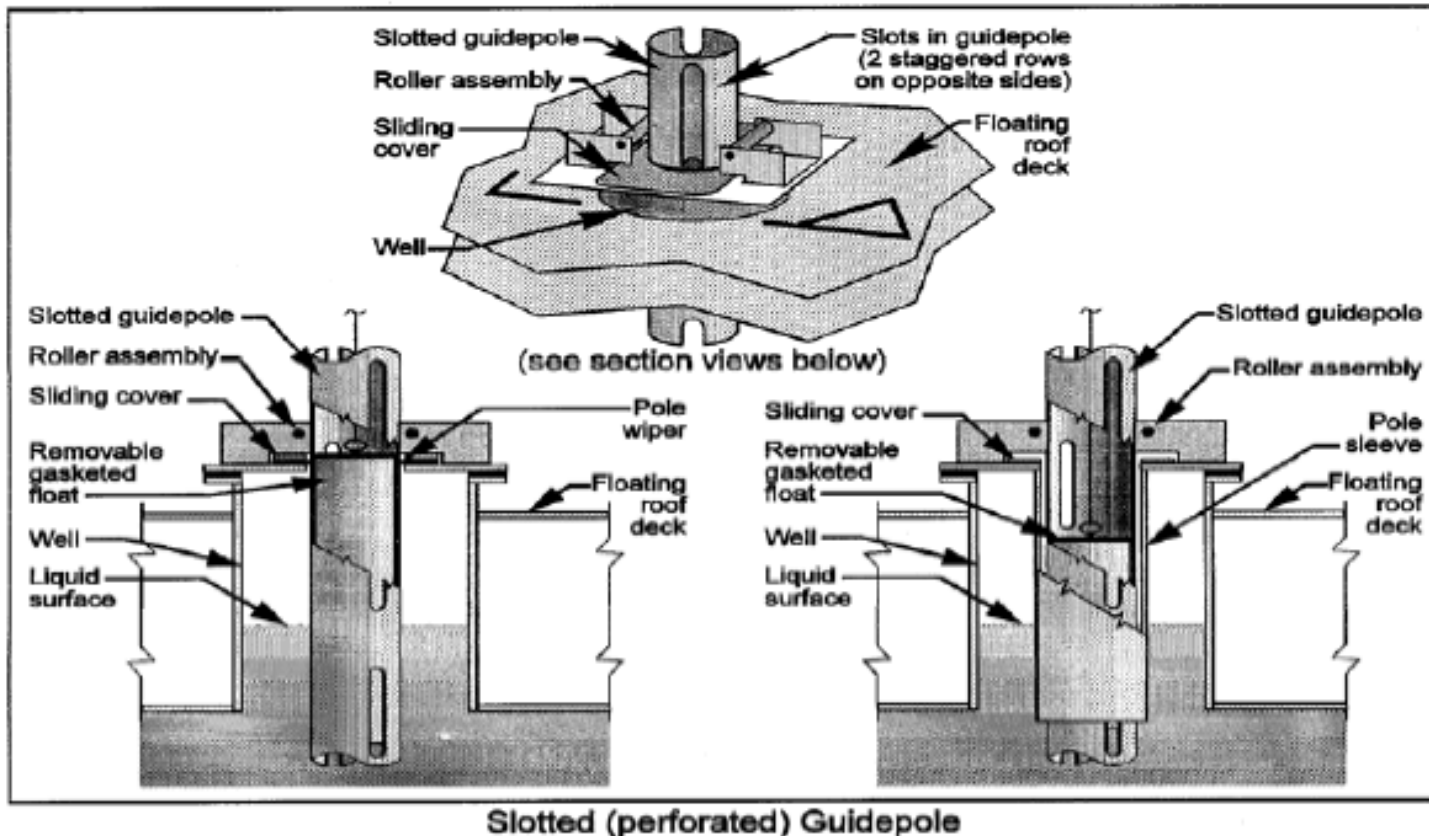


Figure 7.1-11. Slotted and unslotted guidepoles.<sup>20</sup>

# Physical Controls

Table 7.1-12. DECK-FITTING LOSS FACTORS,  $K_{Fa}$ ,  $K_{Fb}$ , AND  $m$ , AND TYPICAL NUMBER OF DECK FITTINGS,  $N_F^a$

Fitting Type And Construction Details	Loss Factors		
	$K_{Fa}$ (lb-mole/yr)	$K_{Fb}$ (lb-mole/(mph) <sup>3</sup> -yr)	$m$ (dimensionless)
Access hatch (24-inch diameter well)			
Bolted cover, gasketed <sup>b</sup>	1.6	0	0
Unbolted cover, ungasketed	36 <sup>c</sup>	3.9	1.2
Unbolted cover, gasketed	31	3.2	1.3
Fixed roof support column well <sup>d</sup>			
Round pipe, ungasketed sliding cover	31		
Round pipe, gasketed sliding cover	25		
Round pipe, flexible fabric sleeve seal	10		
Built-up column, ungasketed sliding cover <sup>e</sup>	51		
Built-up column, gasketed sliding cover	33		
Unslotted guide-pole and well (8-inch diameter unslotted pole, 21-inch diameter well)			
Ungasketed sliding cover <sup>b</sup>	31	130	1.4
Ungasketed sliding cover w/pole sleeve	25	2.2	2.1
Gasketed sliding cover	25	13	2.2
Gasketed sliding cover w/pole wiper	14	3.7	0.78
Gasketed sliding cover w/pole sleeve	8.6	12	0.61
Slotted guide-pole/sample well (8-inch diameter slotted pole, 21-inch diameter well) <sup>f</sup>			
Ungasketed or gasketed sliding cover	43	270	1.4
Ungasketed or gasketed sliding cover, with float <sup>g</sup>	31	36	2.0
Gasketed sliding cover, with pole wiper	41	48	1.4
Gasketed sliding cover, with pole sleeve	11	46	1.4
Gasketed sliding cover, with pole sleeve and pole wiper	8.3	4.4	1.6
Gasketed sliding cover, with float and pole wiper <sup>h</sup>	21	7.9	1.8
Gasketed sliding cover, with float, pole sleeve, and pole wiper <sup>b</sup>	11	9.9	0.89



# Operational Controls



- Avoid or reduce the number of landings per year
- Reduce the number of cleanings per year
- Minimize the time that the tank stands idle (time between landing and degassing or landing and refilling)
- Always drain product completely when landing (if drain dry conditions are possible)

# Operational Controls



- During tank cleanings, run ventilation fans continuously to avoid vapor build-up and subsequent vapor space purges

A decorative horizontal line of five circles. From left to right: a solid light purple circle, an empty light purple circle outline, a solid light purple circle, an empty light purple circle outline, and a solid light purple circle.

# Thanks For Staying Awake!

- Questions?