

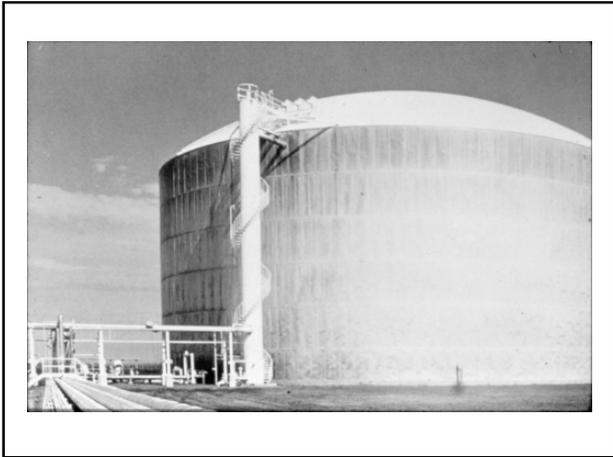
Chapter 9: Petroleum Product Storage and Distribution

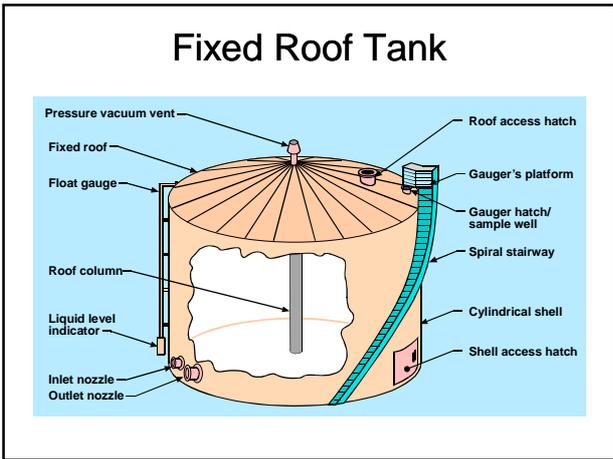
	Chapter 9
	Petroleum Product Storage and Distribution

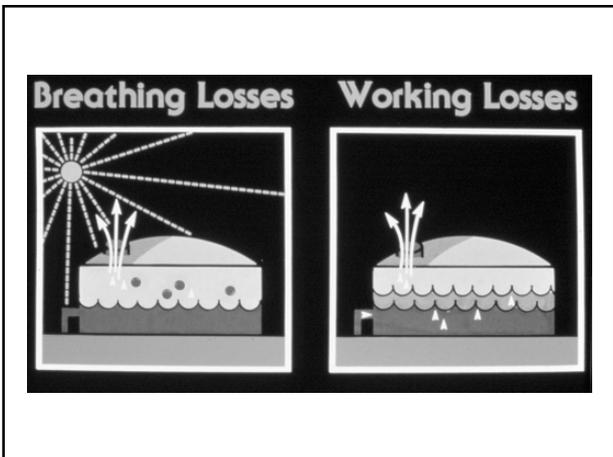
<h3>Petroleum Product Storage</h3> <ul style="list-style-type: none">• Fixed roof tanks• Internal floating roof tanks• External floating roof tanks

Product	Volatility	VP Range	Tank Type
Crude, lube oils	Low	<1.5 psia	Fixed
Kerosene, gasoline, fuel oils	Moderate	1.5-11.1 psia	Float
Butane, propane	High	>11.1 psia	Pressure

Chapter 9: Petroleum Product Storage and Distribution

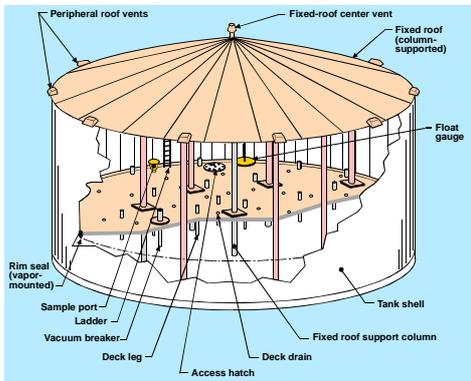






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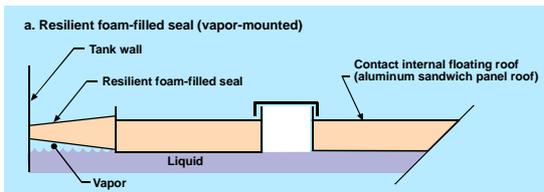
Internal Floating Roof Tank



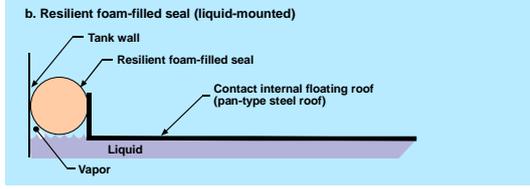
Floating Roof Construction

- Aluminum panel with honeycombed core
- Aluminum deck on aluminum framework
- FRP panel
- Steel pan

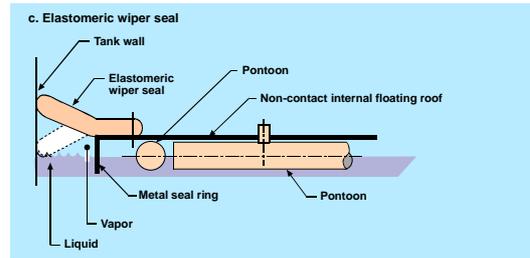
Vapor Mounted Foam Seal



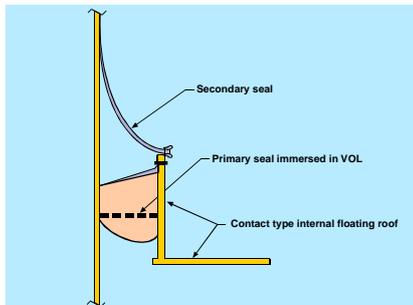
Liquid Mounted Foam Seal



Elastomeric Wiper Seal



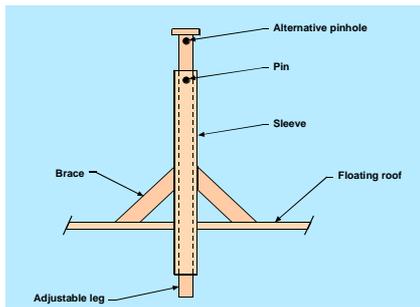
Rim Mounted Secondary Seal



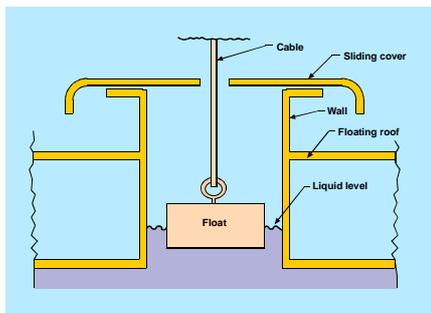
Roof Penetrations

- Column wells
- Roof legs
- Vacuum breakers
- Gauge-float wells
- Sample wells
- Access hatches
- Ladder wells

Roof Leg



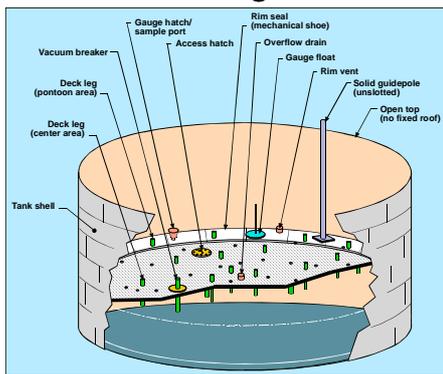
Gauge-Float Well



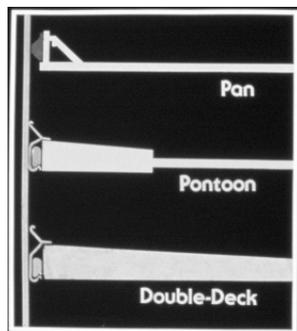
Sources of VOC Losses

- Rim seal
- Roof fittings
- Non-welded deck seams
- Wet tank wall

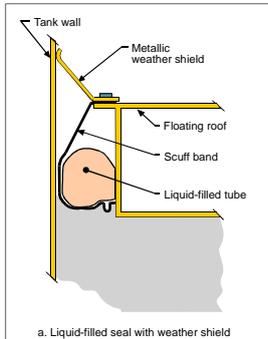
External Floating Roof Tank



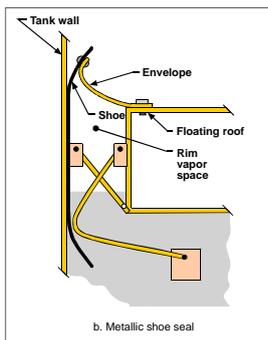
Types of External Floating Roofs



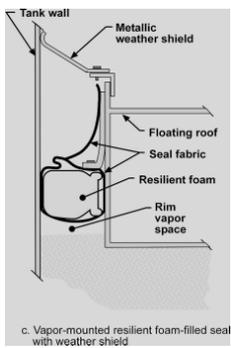
Liquid Filled Seal



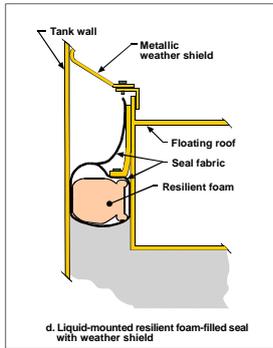
Mechanical Shoe Seal



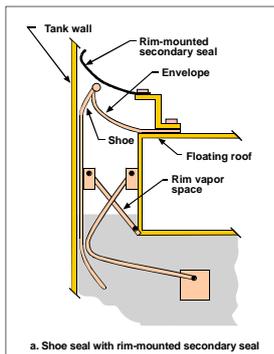
Vapor Mounted Foam Seal



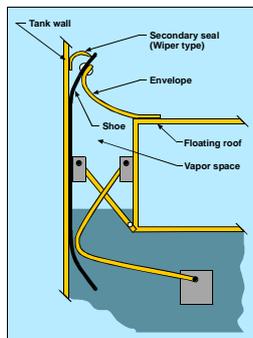
Liquid Mounted Foam Seal



Mechanical Shoe Seal with Secondary Seal

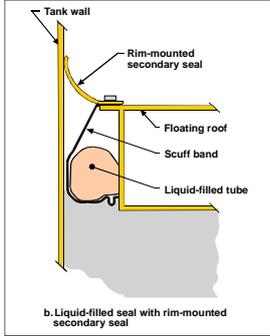


Shoe Mounted Secondary Seal

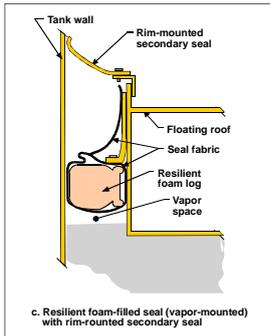


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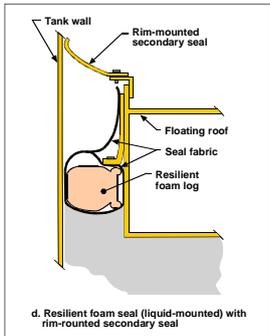
Liquid Filled Seal with Secondary Seal



Vapor Mounted Foam Seal with Secondary Seal



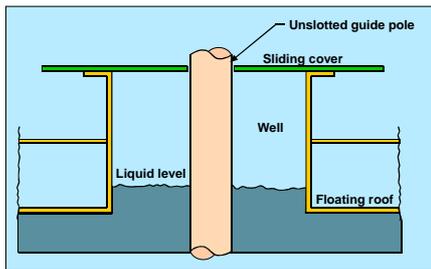
Liquid Mounted Foam Seal with Secondary Seal



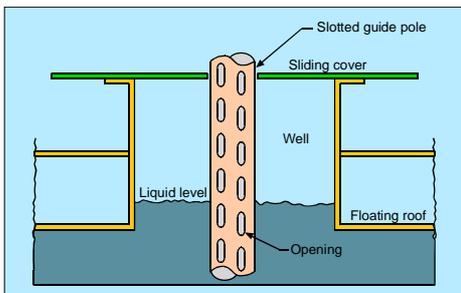
Roof Penetrations

- Guide-pole wells
- Sample wells
- Roof drains
- Rim vents

Unslotted Guide Pole Well

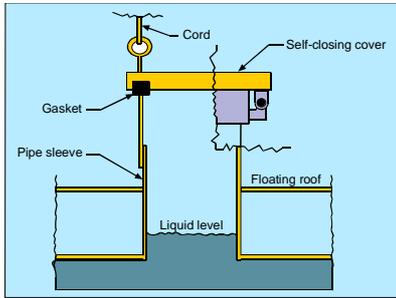


Slotted Guide Pole Well

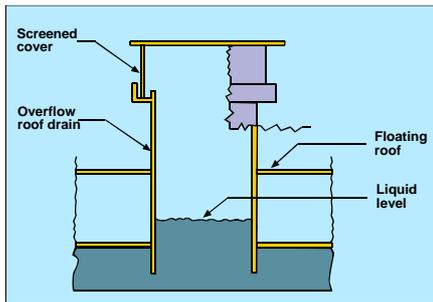


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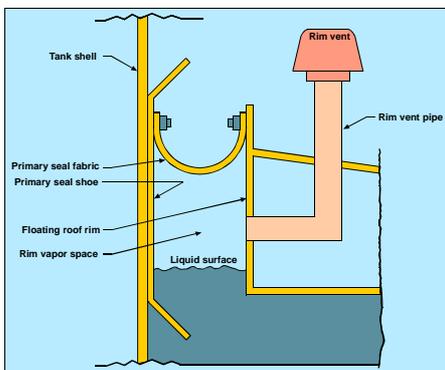
Sample Well



Overflow Drain



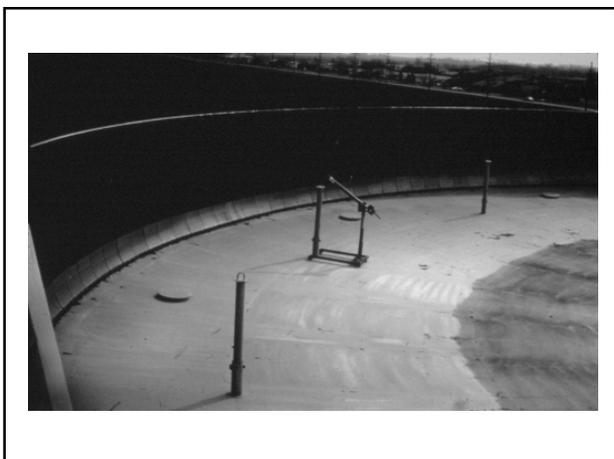
Rim Vent



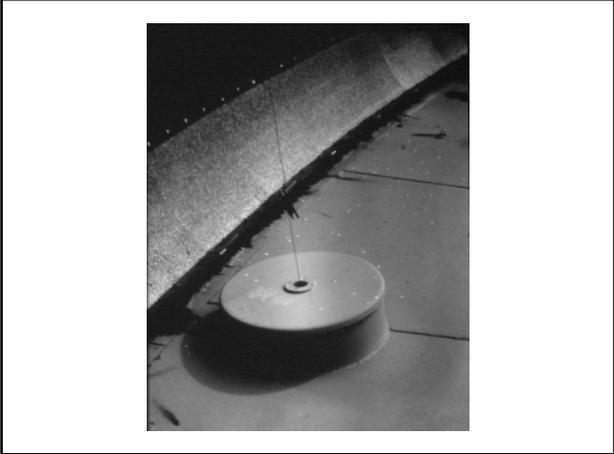
Sources of VOC Losses

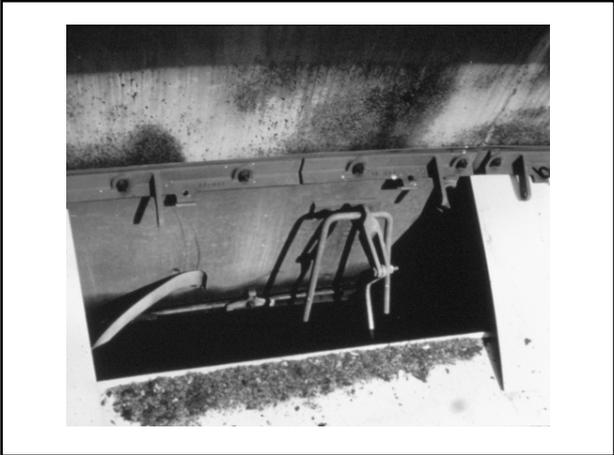
- Rim seal
- Roof fittings
- Wet tank wall

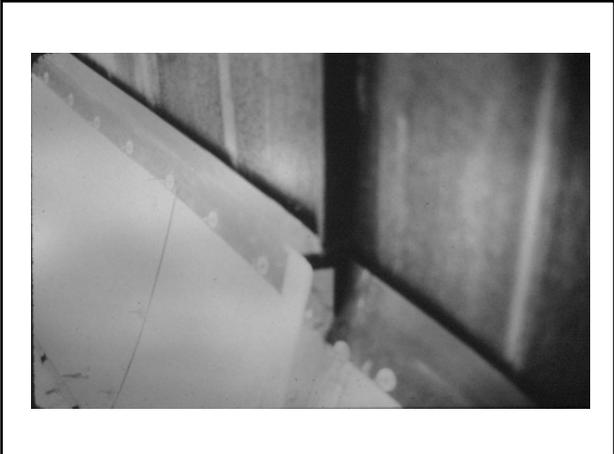




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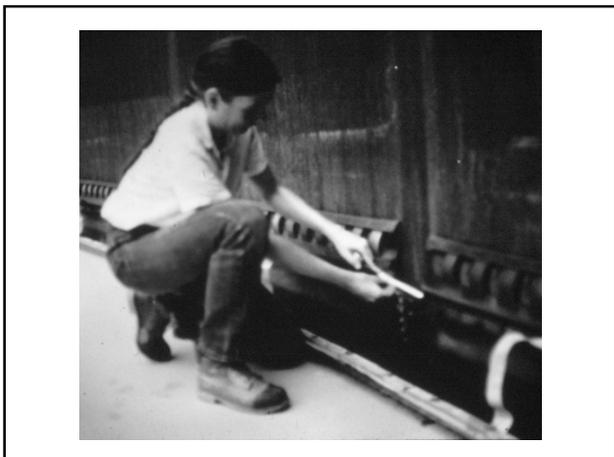


Chapter 9: Petroleum Product Storage and Distribution









Emission Control Techniques

Fixed Roof Tanks

- Internal floating roof
- Vapor recovery system

Basic Internal Floating Roof Design

- Non-contact bolted roof
- Primary vapor mounted wiper seal
- Uncontrolled fittings

Distribution of VOC Losses for Internal Floating Roof Tanks

Rim seal losses	35%
Fitting losses	35%
Deck seam losses	18%
Withdrawal losses	12%

Controlled and Uncontrolled Internal Floating Roof Deck Fittings

Deck Fitting Type	Equipment Description	
	Uncontrolled	Controlled
Access hatch	Unbolted, ungasketed cover; or unbolted gasketed cover	Bolted, gasketed cover
Gauge-float well	Unbolted, ungasketed cover; or unbolted, gasketed cover	Bolted, gasketed cover
Column well	Built-up column with sliding cover, ungasketed	Built-up column with sliding cover, gasketed; or pipe column with flexible fabric sleeve seal

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Controlled and Uncontrolled Internal Floating Roof Deck Fittings (continued)

Deck Fitting Type	Equipment Description	
	Uncontrolled	Controlled
Ladder well	Ungasketed sliding cover	Gasketed sliding cover
Sample well	Slotted pipe with sliding cover, ungasketed; or slotted pipe with sliding cover, gasketed	Sample thief well with slit fabric seal and 10% open area
Vacuum breaker	Weighted mechanical actuation, ungasketed	Weighted mechanical actuation, gasketed

Internal Floating Roof Rim Seal System Control Efficiency

Seal System Description	Efficiency Relative to Baseline
Vapor mounted primary seal only	Baseline
Mechanical shoe or liquid mounted primary seal only	55%
Vapor mounted primary seal with secondary seal	63%
Mechanical shoe or liquid mounted primary seal with secondary seal	76%

Basic External Floating Roof Design

- Welded steel roof
- Mechanical shoe primary seal
- Uncontrolled fittings

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Distribution of VOC Losses for External Floating Roof Tanks

Rim seal losses	68%
Fitting losses	28%
Withdrawal losses	4%

Controlled and Uncontrolled External Floating Roof Deck Fittings

Deck Fitting Type	Equipment Description	
	Uncontrolled	Controlled
Access hatch	Unbolted, ungasketed cover; or unbolted gasketed cover	Bolted, gasketed cover
Gauge-float well	Unbolted, ungasketed cover; or unbolted, gasketed cover	Bolted, gasketed cover
Guide-pole well	Unslotted pipe with sliding cover, ungasketed	Unslotted pipe with sliding cover, gasketed

Controlled and Uncontrolled External Floating Roof Deck Fittings (continued)

Deck Fitting Type	Equipment Description	
	Uncontrolled	Controlled
Sample well	Weighted mechanical actuation, ungasketed	Weighted mechanical actuation, gasketed
Vacuum breaker	Weighted mechanical actuation, ungasketed	Weighted mechanical actuation, gasketed
Roof drain	Open	90% closed
Rim vent	Weighted mechanical actuation, ungasketed	Weighted mechanical actuation, gasketed

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External Floating Roof Rim Seal System Control Efficiency

Seal System Description	Efficiency Relative to Baseline
Vapor mounted primary seal only	Baseline
Vapor mounted primary seal with secondary seal	66%
Mechanical shoe primary seal only	84%
Mechanical shoe primary seal with shoe mounted secondary seal	95%
Liquid mounted primary seal only	95%
Mechanical shoe primary seal with rim mounted secondary seal	99%
Liquid mounted primary seal with rim mounted secondary seal	99%

Emission Regulation

Process Inspection

- Review records maintained by source
- Observe condition of tank
- Observe floating roof
- Measure rim seal gap areas

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Review Records Maintained by Source

- Design information
 - Type of floating roof
 - Type of rim space seals
 - Type of penetration seals
- Operational information
 - Liquid stored
 - Period of storage
 - Maximum true VP
- Maintenance information

Observe Condition of Tank

- Evidence of corrosion
- Liquid or vapor leaks
- Condition of relief valves

Observe Floating Roof

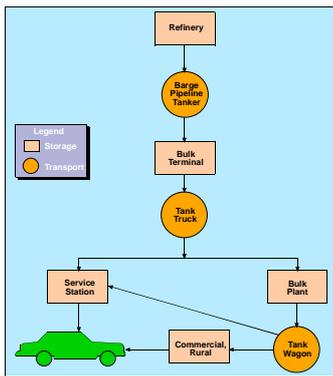
- SAFETY
- General condition
- Roof floating on liquid
- Liquid accumulation on roof
- Condition of rim space seals
- Roof penetrations

Chapter 9: Petroleum Product Storage and Distribution

Process Inspection

- Review records maintained by source
- Observe condition of tank
- Observe floating roof
- Measure rim seal gap areas

Gasoline Marketing System



Emission Control Techniques

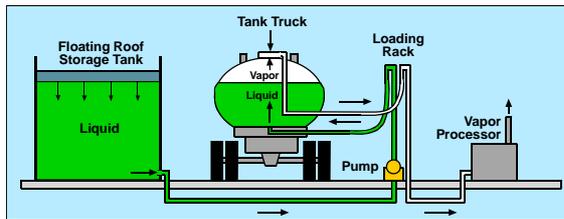
Collect vapors emitted at end of chain and transport to beginning of chain for recovery or destruction

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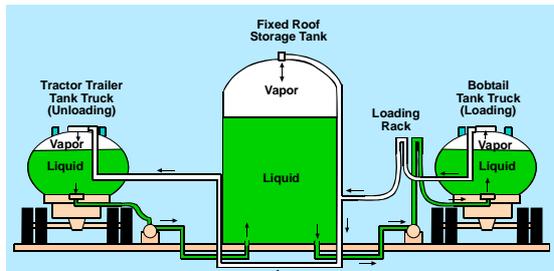
Tank Trucks

- Must be equipped with vapor return piping
- System must be free of significant leaks

Bulk Terminals



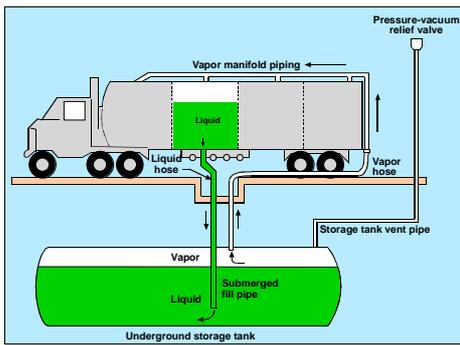
Bulk Plants



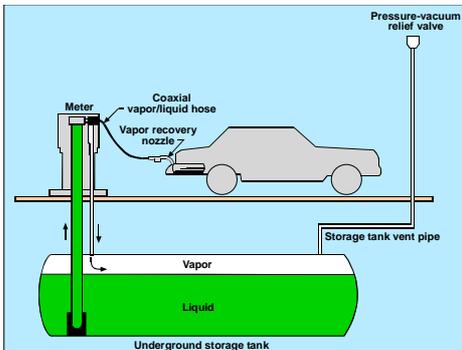
Service Stations

- Stage I controls
- Stage II controls

Stage I Control



Stage II Control



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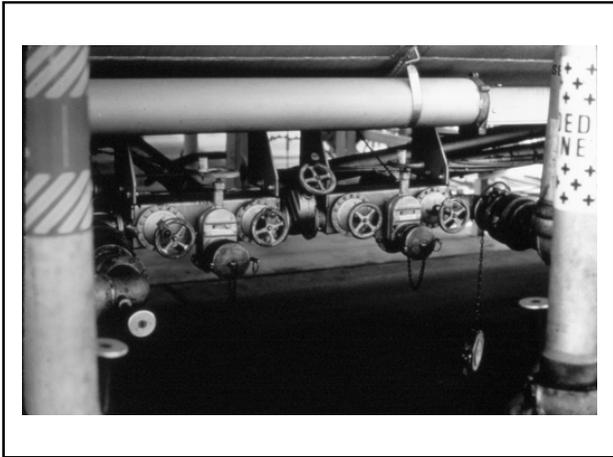
Onboard Stage II Control System

- Displaced vapors sent to onboard carbon adsorber
- Carbon regenerated while vehicle is in operation
- Recovered vapors sent to engine air intake and burned





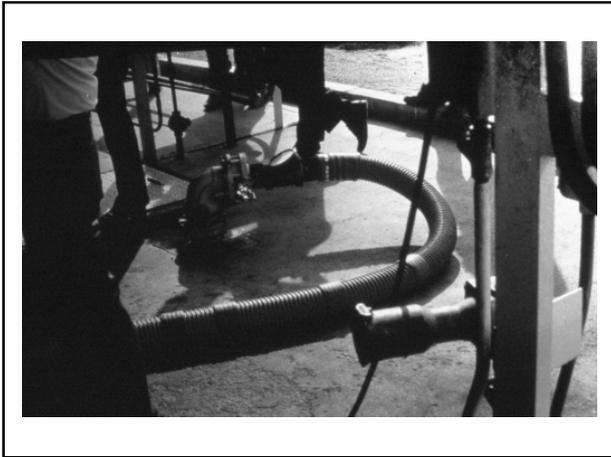
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Chapter 9: Petroleum Product Storage and Distribution



Emission Regulation

Process Inspection

- Obtain source information
- Check tank truck and storage tank equipment
- Observe operating procedures
- Check for vapor and liquid leaks
- Check vapor recovery system operation

Chapter 9: Petroleum Product Storage and Distribution

Obtain Source Information

- Determine method of refueling
- Determine daily maximum and annual throughput
- Determine number and location of loading stations and what materials are loaded
- Determine emission control method
- Review maintenance records

Check Tank Truck and Storage Tank Equipment

- Determine if properly equipped for vapor recovery
- Determine if tank truck has valid leak-tightness certification
- Verify submerged fill

Observe Operating Procedures

- Verify that vapor return line is connected
- Verify that other return lines are closed
- Verify that overfill sensor is connected
- Verify that relief valves do not open
- Check for switch loading

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Check for Vapor and Liquid Leaks

- Check piping, hoses, connectors, covers and relief valves for vapor leaks
- Check piping, hoses, connectors, covers and tank shell for liquid leaks
- Verify no spills or excessive drips when lines are disconnected

Check Vapor Recovery System Operation

- Verify system is operating during loading or when accumulator is full
- If not operating, verify accumulator is filling
- Verify that pressure relief valves are closed
