

Oklahoma DEQ's Development of Loading Loss and Representative Sampling Guidance

By:

Joseph K. Wills, P.E.

February 25, 2020

Background

- Why draft guidance document(s)?
 - Uncertainty of methodology used by regulated community.
 - Get a better grasp on data submitted.
 - Implementation of consistency in emissions calculations for:
 - Permitting;
 - Emissions Inventory; and
 - Compliance Demonstrations.

Why focus on Oil and Gas Facilities?

- Facilities (as of February 3, 2020):
 - 16,193 operating facilities.
 - 11,569 operating oil and gas facilities (71.4%).
- Permit Applications Received (2019):
 - 2,453 total.
 - 1,961 oil and gas facilities (79.9%).
- These numbers are based on:
 - Well sites / centralized tank batteries.
 - Compressor stations (gathering & transmission).
 - Natural gas plants.

Guidance Developed

- Guidance on Estimating Condensate and Crude Oil Loading Losses from Tank Trucks:
 - Published in August 2017.
- Representative Sampling Guidance:
 - Under development.
 - Through several rounds of industry comment.
 - Near finalizing.

Loading Losses Concerns

- Use of reduced VOC content of total vapors.
- Not using vapor pressure of the entire stream/analysis.
- Vapor balancing/collection/recovery not properly accounted for.
- Use of samples from throughout the state.
- Incorrectly averaging lab analysis data to develop composite analyses.
- Incorrectly merging samples:
 - Gas flash gas analyses with sales gas and various stages of separator gas samples.
 - Liquids samples averaged under different sampling/analysis conditions.

Loading Loss Emission Factor Calculation

- Equation 1 of AP-42 (6/08), Section 5.2: $L_L = 12.46 \frac{SPM}{T}$, where:
 - L_L = Loading Loss, pounds per 1,000 gallons of liquid loaded;
 - S = Saturation factor;
 - P = True Vapor Pressure (TVP) of liquid loaded;
 - M = Molecular weight of vapors emitted;
 - T = Temperature of bulk liquid loaded; and
 - 12.46 = Conversion factor which incorporates the ideal gas constant and a conversion to put L_L in terms of lb/1,000 gallons.
- Estimates emissions with a probable error of $\pm 30\%$.

What are Loading Loss Emissions?

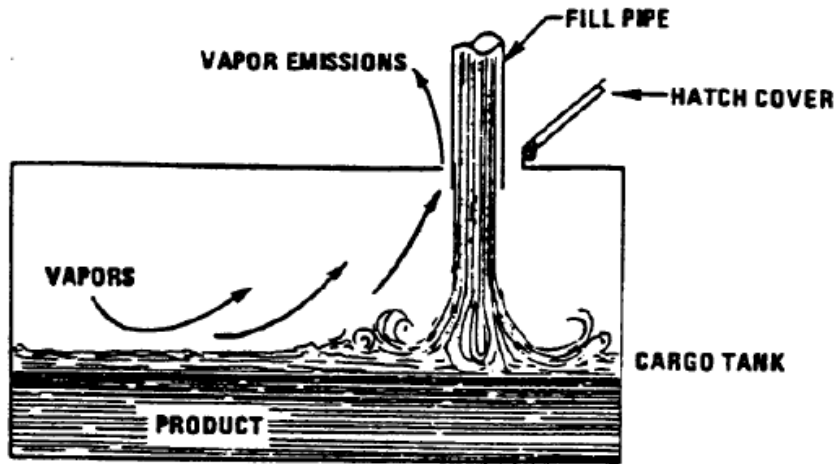


Figure 5.2-2. Splash loading method.

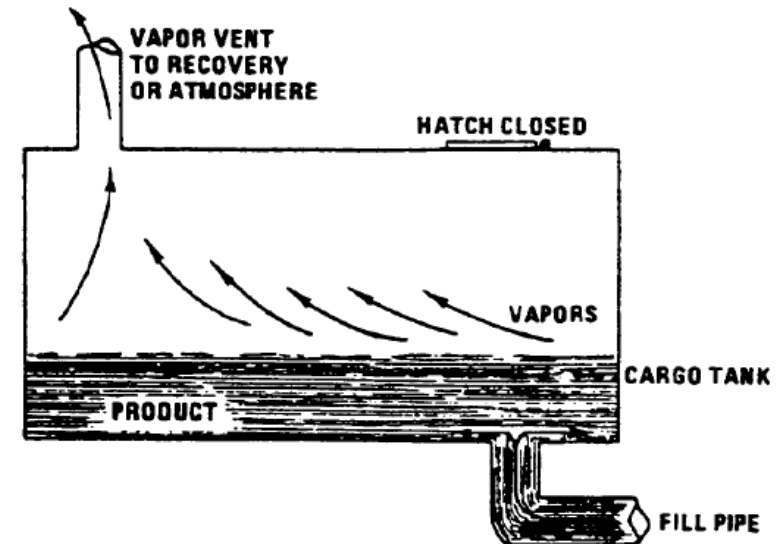


Figure 5.2-4. Bottom loading.

Loading Losses Emission Factor Data

- Emissions Inventory Data (2013-2015):

L _L Factor (lb/1,000 gal)	Condensate	Crude Oil
Average	2 to 3	3 to 4
High	4.5	7.5

- Note:
 - Errors were found in EI data.
 - EI data may include reductions.

Loading Losses Tanker Truck Cycle

Truck Loading:

- Oil Loaded.
- Vapors Expelled.

Truck Transportation:

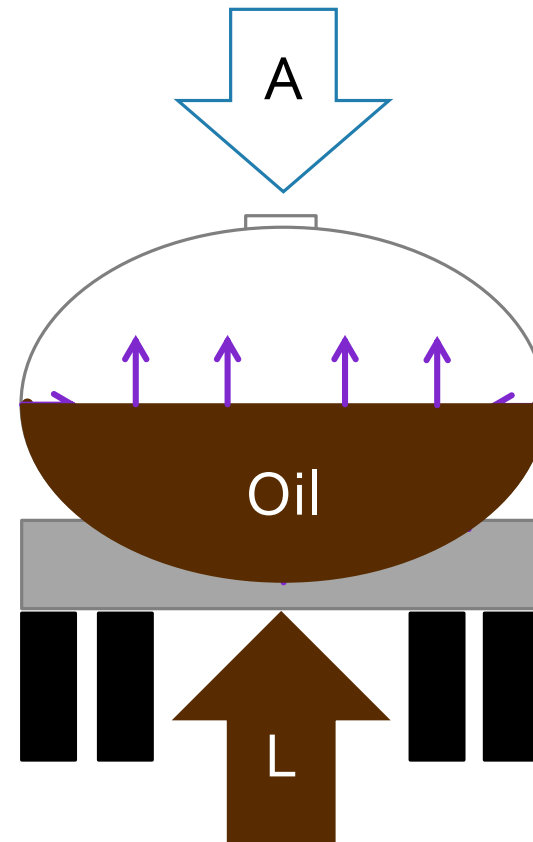
- Vapors saturate tank.

Truck Unloading:

- Oil unloaded.
- Air pulled in.

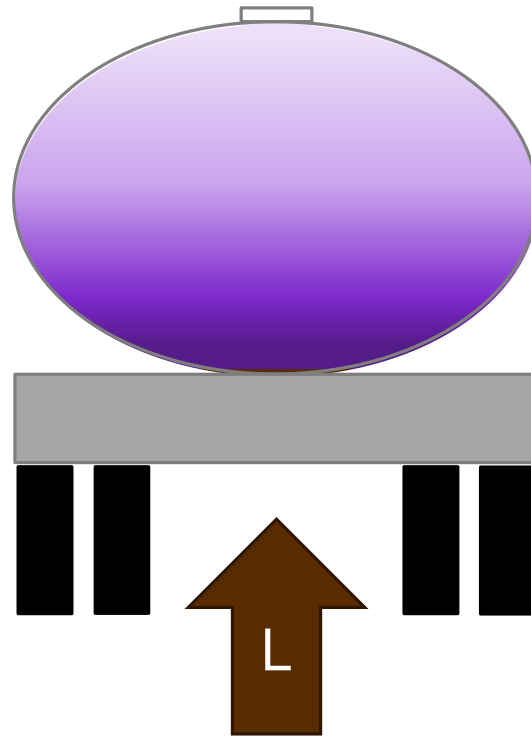
Clingage remains

- Vapors saturate tank.



Loading Losses Stratification of Emissions

Stratification of
Emissions.



Loading Losses

What does the guidance allow?

- Basic assumptions/definitions/requirements:
 - Condensate = hydrocarbon liquid with $\geq 50^\circ$.
 - Crude oil = hydrocarbon liquid that is not condensate.
 - Samples not to be older than 3 years.
 - All tanker trucks are assumed to be in dedicated normal service.
 - Vapor compositions is similar to storage tank working and standing losses.

Loading Losses

What does the guidance allow?

- New construction/modification applications:
 - Use good engineering judgement.
- All other applications:
 - Emphasis on justification for use of representative samples.
 - Well sites may use no less than 85% wt. VOC (100% for all other facilities).
 - Unless site-specific sampling is conducted and approved.
 - Account for captured emissions from vapor balancing/control/recovery.

Representative Sampling Concerns

- Applicants submitting:
 - Use of samples from across the state.
 - Only simplified justification for use of samples (e.g., same county/formation).
 - Use of sample averaging.
 - Reliance on significantly older samples.
 - Reliance on “cookie cutter” data.

Representative Sampling Challenges

- Oklahoma formations are not uniform:
 - Significant changes in emissions can occur even from neighboring zones.
 - Horizontal drilling.
- Lack of data to analyze.
- Industry request for:
 - “reasonable” default values.
 - Allowance of exceptions to the guidance.
 - Limit the imposed burden of the guidance.

Representative Sampling Where We Began

- Turned to other state agency guidance.
- Turned to federal regulations.
- Asked several companies to verify their methodologies via site-specific sampling:
 - 3 companies asked to sample one facility.
 - Of those, only one facility was confirmed to have underestimated emissions in their application.

Representative Sampling Applies to

Facility Types

- Well sites.
- Gathering compressor stations.
- Transmission compressor stations.
- Gas plants.

Emissions Sources

- Glycol Dehydration Units.
- Amine Sweetening Units.
- Hydrocarbon Storage Tanks.
- Fugitive VOC Equipment Leaks.

Representative Sampling Requirements – All Sites

- Site-specific sampling for:
 - H₂S content.
 - Glycol dehydration units.
- Samples shall not to be older than 3 calendar years.

Representative Sampling Requirements – Well Sites & Gathering Stations (Hydrocarbon Storage Tanks)

- Representative sample must be:
 - Within 10 miles of permitting facility;
 - API Gravity $\pm 5^\circ$;
 - Sampling point must be similar;
 - Sample temperature within 20°C ; and
 - Sample pressure:
 - If < 30 psig, must be **$> \frac{1}{2}$ of the facility.**
 - If ≥ 30 psig, must be **within 20 psig.**
- Do not need to meet the items if:
 - Throughput < 10 bbl/day; or
 - Throughput $< 1,200$ bbl/day and storage tanks controlled.
- Site-specific sampling required if any of the following are met:
 - None of the previously listed conditions are met.
 - Uncontrolled tanks with > 4 TPY VOC.
 - Exceeds 80% of an emissions threshold.

Representative Sampling Requirements – Transmission Stations & Gas Plants (Hydrocarbon Storage Tanks)

Transmission Stations

- May use representative sample if:
 - Sample is upstream on the same pipeline
- Does not have to meet this conditions if:
 - Throughput below 10 bbl/day (actual or potential).
- Site-specific sampling if none of these conditions are met.

Gas Plants

- May use representative sample if:
 - Emissions are reduced by 95% or greater with VRU and/or combustion device.
- Site-specific sampling in all other instances.



Question & Answer