

4.8 Tank And Drum Cleaning

4.8.1 General

Rail tank cars, tank trucks, and drums are used to transport about 700 different commodities. Rail tank cars and most tank trucks and drums are in dedicated service (carrying one commodity only) and, unless contaminated, are cleaned only prior to repair or testing. Nondedicated tank trucks (about 20,000, or 22 percent of the total in service) and drums (approximately 5.6 million, or 12.5 percent of the total) are cleaned after every trip.

4.8.1.1 Rail Tank Cars -

Most rail tank cars are privately owned. Some cars, like those owned by the railroads, are operated for hire. The commodities hauled are 35 percent petroleum products, 20 percent organic chemicals, 25 percent inorganic chemicals, 15 percent compressed gases, and 5 percent food products. Petroleum products considered in this study are glycols, vinyls, acetones, benzenes, creosote, etc. Not included in these figures are gasoline, diesel oil, fuel oils, jet fuels, and motor oils, the greatest portion of these being transported in dedicated service.

Much tank car cleaning is conducted at shipping and receiving terminals, where the wastes go to the manufacturers' treatment systems. However, 30 to 40 percent is done at service stations operated by tank car owners/lessors. These installations clean waste of a wide variety of commodities, many of which require special cleaning methods.

A typical tank car cleaning facility cleans 4 to 10 cars per day. Car capacity varies from 40 to 130 cubic meters (m^3) (10,000 to 34,000 gallons [gal]). Cleaning agents include steam, water, detergents, and solvents, which are applied using steam hoses, pressure wands, or rotating spray heads placed through the opening in the top of the car. Scraping of hardened or crystallized products is often necessary. Cars carrying gases and volatile materials, and those needing to be pressure tested, must be filled or flushed with water. The average amount of residual material cleaned from each car is estimated to be 250 kilograms (kg) (550 pounds [lb]). Vapors from car cleaning not flared or dissolved in water are dissipated to the atmosphere.

4.8.1.2 Tank Trucks -

Two-thirds of the tank trucks in service in the United States are operated for hire. Of these, 80 percent are used to haul bulk liquids. Most companies operate fleets of 5 trucks or less, and whenever possible, these trucks are assigned to dedicated service. Commodities hauled and cleaned are 15 percent petroleum products (except as noted in Part 4.8.1.1), 35 percent organic chemicals, 5 percent food products, and 10 percent other products.

Interior washing is carried out at many tank truck dispatch terminals. Cleaning agents include water, steam, detergents, bases, acids, and solvents, which are applied with hand-held pressure wands or by Turco or Butterworth rotating spray nozzles. Detergent, acidic, or basic solutions are usually used until spent and then sent to treatment facilities. Solvents are recycled in a closed system, with sludges either incinerated or landfilled. The average amount of material cleaned from each trailer is 100 kg (220 lb). Vapors from volatile material are flared at a few terminals, but most commonly are dissipated to the atmosphere. Approximately $0.23 m^3$ (60 gal) of liquid are used per tank truck steam cleaning and $20.9 m^3$ (5500 gal) for full flushing.

4.8.1.3 Drums -

Both 0.2- and 0.11-m³ (30- and 55-gal) drums are used to ship a vast variety of commodities, with organic chemicals (including solvents) accounting for 50 percent. The remaining 50 percent includes inorganic chemicals, asphaltic materials, elastomeric materials, printing inks, paints, food additives, fuel oils, and other products.

Drums made entirely of 18-gauge steel have an average life, with total cleaning, of 8 trips. Those with 20-gauge bodies and 18-gauge heads have an average life of 3 trips. Not all drums are cleaned, especially those of thinner construction.

Tighthead drums that have carried materials that are easy to clean are steamed or washed with base. Steam cleaning is done by inserting a nozzle into the drum, with vapors going to the atmosphere. Base washing is done by tumbling the drum with a charge of hot caustic solution and some pieces of chain.

Drums used to carry materials that are difficult to clean are burned out, either in a furnace or in the open. Those with tightheads have the tops cut out and are reconditioned as open head drums. Drum burning furnaces may be batch or continuous. Several gas burners bathe the drum in flame, burning away the contents, lining, and outside paint in a nominal 4-minute period and at a temperature of at least 480°C (900°F) but not more than 540°C (1000°F) to prevent warping of the drum. Emissions are vented to an afterburner or secondary combustion chamber, where the gases are raised to at least 760°C (1400°F) for a minimum of 0.5 seconds. The average amount of material removed from each drum is 2 kg (4.4 lb).

4.8.2 Emissions And Controls

4.8.2.1 Rail Tank Cars And Tank Trucks -

Atmospheric emissions from tank car and truck cleaning are predominantly volatile organic chemical vapors. To achieve a practical but representative picture of these emissions, the organic chemicals hauled by the carriers must be known by classes of high, medium, and low viscosities and of high, medium, and low vapor pressures. High-viscosity materials do not drain readily, affecting the quantity of material remaining in the tank, and high-vapor-pressure materials volatilize more readily during cleaning and tend to lead to greater emissions.

Practical and economically feasible controls of atmospheric emissions from tank car and truck cleaning do not exist, except for containers transporting commodities that produce combustible gases and water soluble vapors (such as ammonia and chlorine). Gases displaced as tanks are filled are sent to a flare and burned. Water soluble vapors are absorbed in water and are sent to the waste water system. Any other emissions are vented to the atmosphere.

Tables 4.8-1 and 4.8-2 give emission factors for representative organic chemicals hauled by tank cars and trucks.

4.8.2.2 Drums -

There is no control for emissions from steaming of drums. Solution or caustic washing yields negligible air emissions, because the drum is closed during the wash cycle. Atmospheric emissions from steaming or washing drums are predominantly organic chemical vapors.

Air emissions from drum burning furnaces are controlled by proper operation of the afterburner or secondary combustion chamber, where gases are raised to at least 760°C (1400°F) for a minimum of 0.5 seconds. This normally ensures complete combustion of organic materials and

Table 4.8-1 (Metric And English Units). EMISSION FACTORS FOR RAIL TANK CAR CLEANING^a

EMISSION FACTOR RATING: D

Compound	Chemical Class		Total Emissions ^a	
	Vapor Pressure	Viscosity	g/car	lb/car
Ethylene glycol ^b	low	high	0.3	0.0007
Chlorobenzene ^b	medium	medium	15.7	0.0346
o-Dichlorobenzene ^b	low	medium	75.4	0.1662
Creosote ^c	low	high	2350	5.1808

^a Reference 1. Emission factors are in terms of average weight of pollutant released per car cleaned.

^b Two-hour test duration.

^c Eight-hour test duration.

Table 4.8-2 (Metric And English Units). EMISSION FACTORS FOR TANK TRUCK CLEANING^a

EMISSION FACTOR RATING: D

Compound	Chemical Class		Total Emissions ^a	
	Vapor Pressure	Viscosity	g/truck	lb/truck
Acetone	high	low	311	0.686
Perchloroethylene	high	low	215	0.474
Methyl methacrylate	medium	medium	32.4	0.071
Phenol	low	low	5.5	0.012
Propylene glycol	low	high	1.07	0.002

^a Reference 1. One-hour test duration.

prevents the formation, and subsequent release, of large quantities of NO_x, CO, and particulates. In open burning, however, there is no feasible way of controlling the release of incomplete combustion products to the atmosphere. The conversion of open cleaning operations to closed-cycle cleaning, and the elimination of open-air drum burning seem to be the only control alternatives immediately available.

Table 4.8-3 gives emission factors for representative criteria pollutants emitted from drum burning and cleaning.

Table 4.8-3 (Metric And English Units). EMISSION FACTORS FOR DRUM BURNING^a

EMISSION FACTOR RATING: E

Pollutant	Total Emissions			
	Controlled		Uncontrolled	
	g/drum	lb/drum	g/drum	lb/drum
Particulate	12 ^b	0.02646	16	0.035
NO _x	0.018	0.00004	0.89	0.002
VOC	Neg	Neg	Neg	Neg

^a Reference 1. Emission factors are in terms of weight of pollutant released per drum burned, except for VOC, which are per drum washed. Neg = negligible.

^b Reference 1, Table 17, and Appendix A.

Reference For Section 4.8

1. T. R. Blackwood, *et al.*, *Source Assessment: Rail Tank Car, Tank Truck, And Drum Cleaning, State Of The Art*, EPA-600/2-78-004g, U. S. Environmental Protection Agency, Cincinnati, OH, April 1978.