Truck or Railcar Loadout

Depending on the particular situation, a transfer of material to a truck or railcar may be modeled as a point source or a volume source(s). If a sleeve, "spout sock," or auger system is used to deliver the material to a delimited area within the receiving volume and the entrainment of material from winds across the receiving volume are not significant, then consider this a point source for particulate emissions. In accordance with DNR's Dispersion Modeling Guidelines available on the [Air Quality Bureau's Dispersion Modeling Webpage](), the exit velocity associated with the point source should be set to 0.001 m/s since the discharge is downward directed.

If the delivery process and/or re-entrainment are not well-controlled, consider modeling the source as a volume source. DNR recommends using the length, width, and height of the truck trailer or railcar to determine parameters. The length/width ratio (rounded to nearest integer) determines the number of volume sources. The usual approach would be to set the release height at ½ the structure height, corresponding to the middle of the volume. This may be acceptable for internal emissions being released from a building; however a more appropriate approach for loading operations may be to assume the release height is at the top of the truck trailer or railcar.[1]

Release height = h = height of truck trailer or railcar

Treat the source as an elevated volume source ($h_e > 0 = h$) and as if it were on or adjacent to a building—the building being the trailer or railcar. Therefore,

$\sigma_z = h/2.15$

If the length-to-width ratio of the trailer or railcar (rounded to the nearest integer) is 1, then the initial lateral plume spread is:

$\sigma_y = w/4.3$ where w is the side-to-side width of the trailer or railcar

If the length-to-width ratio is 2 or greater and the source is represented by separated volumes (*this is usually the way it is represented*), then

$\sigma_y = d/2.15$, where d is the center-to-center distance between the volumes

If the length-to-width ratio is 2 or greater and the source is represented by adjacent (continuous) volumes, then

$\sigma_y = w/2.15$.[2]

If the railcar or truck dimensions are unknown, they can be reasonably estimated using the default values found in the Dimensions of Trucks & Railcars document in the Non-Standard Sources folder.

If the loadout emissions are at the ambient (outside) air temperature and modeled as a point source, the exit temperature can be allowed to match the ambient air on an hour-by-hour basis. This feature is enabled in AERMOD by setting the exit temperature to zero degrees Kelvin (-459.67 ºF).[3]

---

[1]In some cases, loadout operations may take place within a building. It may then be appropriate to treat the entire building as a typical volume source with a building enclosure credit factor applied.

[2]These procedures are consistent with the descriptions of modeling volume sources found in the user's manual for AERMOD.

[3] User's Guide for the AMS/EPA Regulatory Model – AERMOD, EPA-454/B-03-001, September 2004, p. 3-18.

Figure 1. Example loadout operation. (Trinity Consultants, 2004)

What if the loadout operation is a more complex scenario, such as pictured in Figure 1? In this case, emissions may be found at the opening where the conveyor enters the structure as well as where the truck bins drop materials into open bed haul trucks. In this case, the sources could be modeled either as two separate volume sources or as a single volume source with a release height equal to the weighted average of the release heights of the identifiable sources.

Dimensions of Trucks and Railcars

Occasionally during a modeling analysis, it may be appropriate to use the length, width, and height of a truck trailer or railcar in order to determine the parameters of a volume source. The length/width ratio (rounded to nearest integer) determines the number of volume sources.

Although both semi-trucks and railcars come in all shapes and sizes, it is possible to determine default values to use in modeling analyses by taking an average value of the length, width, and height of various truck trailers and railcars.

Hopper Trucks:

Hopper trucks are used to transport and deliver wet or dry bulk commodities such as corn, soybeans, grains, cement, fertilizers, etc. Commodities are loaded into the top of the trailer, which is either open and can be covered by a tarp, or is permanently closed but allows access through hatches. After shipping, the commodity is unloaded via gates or discharge outlets from the bottom of the truck by gravity or pneumatic means. Hopper trucks are generally smaller in nature than standard semi-trailers that are used for cargo.

Hopper trucks typically have the following size ranges[1]-
22' to 42' long
8' to 8.5' wide
10.25' to 11.5' high

Default values based on the averages (roughly) of these size ranges would yield:
32' long
8' wide (more typical than 8.5' wide)
11' high

Semi-Trucks:

On rare occasion, a modeling analysis may require the dimensions of a more typical semi-truck trailer (used to carry cargo) to determine the parameters of a volume source.

Semi-truck trailers typically have the following size ranges-
28' to 53' long
8' to 8.5' wide
11.5' to 13.5' high

Default values based on the averages (roughly) of these size ranges would yield:
40' long
8' wide (more typical than 8.5' wide)
12.5' high

Railcars- Hoppers:

There are two types of hoppers; the standard hopper which is completely open at the top and is generally used to transport coal, and the covered hopper, which is used to transport a variety of dry or wet bulk commodities, such as corn, soybeans, grains, salt, sugar, phosphates, cement, plastic resins, etc. The hoppers are loaded through load-out process at the top of the car, and discharge through gates or outlets from the bottom by gravity or pneumatic means.

Hopper cars typically have the following size ranges[2]-
39' to 60' long
8' wide
13' to 15.5' high

Default values based on the
averages (roughly) of these ranges
would yield:
50' long
8' wide
14' high

Cargo Containers:

Cargo containers are used to ship goods nationally and internationally by ocean freighter, barge, rail or plane.

Cargo containers typically have the following size ranges[3] -
10' to 40' long
8' wide
8.5' to 9.5' high

Rather than use a default values based on the averages of these ranges, it may be more appropriate to try and obtain information on the length of the container, and then use the standard **width (8') and height (8.5').** If this is not possible, a **length of 20'** may be used as a more conservative estimate to determine the lateral dimension of the volume source.

Above information based on:
1. standard truck dimensions by trailer manufacturers such as Dakota, Dangola, and Jet
2. information from Union Pacific regarding the range of sizes for covered hoppers
3. information from Export911 shipping department