

## **Volume Sources: General Rules for Determining Initial Lateral and Vertical Dimensions**

Volume sources are used in AERMOD in a variety of modeling scenarios when emissions initially disperse three-dimensionally with no upward velocity of the plume due to momentum or buoyancy, thus with no associated flow rate. They have an initial plume width ( $\sigma_{Y_0}$ ) and an initial plume depth ( $\sigma_{Z_0}$ ).<sup>1</sup> Some examples of emissions modeled as volume sources are: roof vents, open windows and doors of industrial buildings, conveyor transfer points, loadout operations, haul roads.

There are several types of volume sources, each defined by its own method of determining the initial dimensions ( $\sigma_{Y_0}$  and  $\sigma_{Z_0}$ ): single or multiple volume sources which may be either surface-based, elevated sources on or adjacent to a structure, or elevated sources *not* on or adjacent to a structure. Whether it is a single volume source or multiple volume sources (representing a line source such as a haul road) determines the initial lateral dimension  $\sigma_{Y_0}$ . Whether it is surface-based (includes area sources such as storage piles) or elevated and adjacent to or not adjacent to a structure determines the initial vertical dimension  $\sigma_{Z_0}$ .

The initial lateral and vertical dimensions of a volume source may be determined by the following rules:<sup>2</sup>

### ***Initial Lateral Dimension ( $\sigma_{Y_0}$ )***

Single Volume Source

$\sigma_{Y_0}$  = length of side divided by 4.3

Line Source Represented by Adjacent Volume Sources

$\sigma_{Y_0}$  = length of side divided by 2.15

Line Source Represented by Separated Volume Sources

$\sigma_{Y_0}$  = center to center distance divided by 2.15

### ***Initial Vertical Dimension ( $\sigma_{Z_0}$ ) ( $h_e$ = effective emission height)***

Surface-based Volume (or Area) Source ( $h_e \sim 0$ )

$\sigma_{Z_0}$  = vertical dimension of source divided by 2.15

Elevated Volume Source ( $h_e > 0$ ) on or adjacent to a Structure

$\sigma_{Z_0}$  = *structure height* divided by 2.15 (NOTE:  $\sigma_{Z_0}$  is determined by the structure size, not by the opening from which emissions are coming.)

Elevated Volume Source ( $h_e > 0$ ) not on or adjacent to a Structure

$\sigma_{Z_0}$  = vertical dimension of source divided by 4.3

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<sup>1</sup> AERMOD uses a virtual point-source algorithm to model a volume source. A virtual point source is placed a certain distance upwind of the volume source to account for the initial plume dimensions.

<sup>2</sup> *User's Guide for the AMS/EPA Regulatory Model – AERMOD*, Table 3-1. EPA-454/B-03-001, September 2004. (document under revision)