

4.5.4 Estimated Concentrations from Area Sources

The SCREEN3 area source algorithm is based on the numerical integration algorithm implemented in the Industrial Source Complex (ISC3)²¹ model. This algorithm allows for rectangular shaped area sources. Areas which have irregular shapes can be simulated by dividing the area source into multiple rectangles that approximate the geometry of the area source. The ground-level concentration at a receptor located downwind of all or a portion of the source area is given by a double integral in the upwind (x) and crosswind (y) directions as:

$$X = \frac{Q_A K}{2\pi u_s} \int_x \frac{V}{\sigma_y \sigma_z} \left(\int_y \exp \left[-0.5 \left(\frac{y}{\sigma_y} \right)^2 \right] dy \right) dx \quad (4.15)$$

where:

- Q_A = area source emission rate (mass per unit area per unit time)
- K = a scaling coefficient to convert calculated concentrations to desired units (default value of 1×10^6 for Q_A in $g/(m^2s)$ and concentration in $\mu g/m^3$)
- V = vertical term which accounts for the vertical distribution of the Gaussian plume, including the effects of source elevation, receptor elevation, and limited mixing in the vertical

The numerical integration algorithm for area sources allows for impacts to be estimated at receptors located within the area source. Since this algorithm involves a numerical estimate of a double integral over the area source, the calculations are very intensive and cannot practically be performed by hand. The SCREEN3 model should therefore be used to estimate maximum short term (1-hr) concentrations from area sources. Do not use the multiplying factors in Step 5 of Section 4.2 to correct for averaging times greater than 1 hour. Concentrations close to an area source will not vary as much as those for point sources in response to varying wind directions, and the meteorological conditions which are likely to give maximum 1-hour concentrations (Procedures (b) and (c) of Section 4.2) can persist for several hours. Therefore it is recommended that the maximum 1-hour concentration be conservatively assumed to apply for averaging periods out to 24 hours.