The definite integral in the numerator of Equation (9) is evaluated as

$$\sigma_y (\pi/2)^{½}$$

Since $y_s = x \tan(11.25^o)$,

$$f = \frac{6.300836\ \sigma_y}{x} \qquad \text{(Equation 10)}$$

The equation for sector-averaged ground level concentration in air is therefore:

$$\chi = \frac{Q}{0.15871\ \pi\ x\ \sigma_z\ \mu} \exp[-½(H/\sigma_z)^2]$$

(Equation 11)

This method of sector-averaging compresses the plume within the bounds of each of the sixteen 22.5^o sectors for unstable Pasquill atmospheric stability categories in which horizontal dispersion is great enough to extend significantly beyond the sector edges. It is not a precise method, however, because the integration over the y-axis, which is perpendicular to the downwind direction, x, involves increasing values for x as y is increased from zero to infinity.

An average lid for the assessment area is provided as part of the input data. The lid is assumed not to affect the plume until x becomes equal to $2x_L$, where x_L is the value of x for which $\sigma_z = 0.47$ times the height of the lid (Tu69). For values of x greater than $2x_L$, vertical dispersion is restricted and radionuclide concentration in air is assumed to be uniform from ground to lid.

The average concentration between ground and lid, which is the ground-level concentration in air for values of x greater than $2x_L$, may be expressed by:

$$\chi_{ave} = \int_0^\infty \frac{\chi}{L} dz \qquad \text{(Equation 12)}$$

where χ is taken from Equation (6) and L is lid height. The value of H in Equation (6) may be set at zero since χ_{ave} is not a function of the effective stack height.

The resulting simplified expression may be evaluated for constant x and y values (σ_y and σ_z held constant) by using a definite integral similar to that in Equation (10):

$$\chi_{ave} = \left(\frac{1}{L}\right) \int_0^\infty \left(\frac{Q}{\pi \sigma_y \sigma_z}\right) \exp\left(\frac{-z^2}{2\sigma_z^2}\right) \exp\left(\frac{-z^2}{2\sigma_y^2}\right) dz \qquad \text{(Equation 13)}$$

The result is:

For precipitation scavenging losses, the depletion fraction is:

$$f_1 \exp(-\Phi x) + f_2 \exp[-\Phi(x/\mu_a)] + f_3 \exp[-\Phi(x/6)]$$

where Φ is the scavenging coefficient (sec^{-1}).

The overall depletion fraction is calculated by multiplying the depletion fraction for dry deposition by the fraction for radioactive decay and precipitation scavenging.

12.1.6 Dispersion Coefficients

Horizontal and vertical dispersion coefficients (σ_y and σ_z) used for dispersion calculation in CONCEN and for depletion fraction determination in QY are taken from recommendations by G.A. Briggs of the Atmospheric Turbulence and Diffusion Laboratory at Oak Ridge, Tennessee (Mo79, Gi76). The coefficients are different functions of the downwind distance x for each Pasquill stability category for open-country conditions, as shown:

Pasquill category	σ_y (m)	σ_z (m)
A	$0.22\,x\,(1+0.0001x)^{-1/2}$	$0.20\,x$
B	$0.16\,x\,(1+0.0001x)^{-1/2}$	$0.12\,x$
C	$0.11\,x\,(1+0.0001x)^{-1/2}$	$0.08\,x\,(1+0.0002x)^{-1/2}$
D	$0.08\,x\,(1+0.0001x)^{-1/2}$	$0.06\,x\,(1+0.0015x)^{-1/2}$
E	$0.06\,x\,(1+0.0001x)^{-1/2}$	$0.03\,x\,(1+0.0003x)^{-1}$
F	$0.04\,x\,(1+0.0001x)^{-1/2}$	$0.016\,x\,(1+0.0003x)^{-1}$
G	calculated by subtracting half the difference between values for categories E and F from the value for category F.	

where:

x = downwind distance

CAP88-PC uses the functions in the form of

$$\sigma_y = x^A / C$$
$$\sigma_z = x^D / F$$

to facilitate integrations over x. Values for A, C, D, and F for each stability category and downwind distance are stored in a data statement.