

$f_{ijk}$  = joint probability of occurrence of stability category  $i$ , with wind direction into sector  $j$ , and windspeed interval  $k$

**Note:** The summation in Equation 5.2 is taken over all atmospheric stability categories ( $i$ ) and windspeed intervals ( $k$ ). The effect of mixing layer depths has not been included because the effect is minor within 20 km for most situations.

#### 5.1.1.4

The parameters  $f_{ijk}$  should be determined from a minimum of 3 years' relevant meteorological data.\* In the event that reliable local stability category data are not available, the long-term average dispersion characteristics may be estimated by using a site-specific wind rose and the default frequency distribution defined in Table D1.

\*Such data are available for a large number of sites across Canada from Environment Canada, Canadian Climate Center, 4905 Dufferin Street, Downsview, Ontario. The output of the STAR computer program provides monthly and annual frequency distributions of the 6 Pasquill stability classes distributed over 16 angular sectors of 22.5° and 6 windspeed intervals.

#### 5.1.1.5

The transfer parameter at ground level ( $z = 0$ ) is given by the following Equation:

$$P_{01} = \frac{f_j n}{(2\pi)^{3/2} x} \sum_{i=1}^6 \frac{f_i}{\sigma_{zi} \bar{u}_i} F(h, 0, \sigma_{zi}) \quad (\text{s} \cdot \text{m}^{-3}) \quad (5.3)$$

where

$$F(h, 0, \sigma_{zi}) = 2 \exp \left[ -\frac{h^2}{2\sigma_{zi}^2} \right]$$

and

$f_i$  = frequency of occurrence of stability category  $i$  (Table D1)

$f_j$  = frequency with which the wind blows into sector  $j$  (from site wind rose)

$n$  = number of sectors ( $n = \frac{2\pi}{\theta_j}$ )

$\bar{u}_i$  = the mean windspeed at a height of 10 m.

**Notes:**

(1) The concentration of the air pollutant is relatively insensitive to the stability category frequency within the normal range of distribution across Canada. Hence, the values calculated using the default frequency distribution (Table D1) will, in most cases, be within 30% of those calculated using site-specific stability category data. Equation 5.3 is most sensitive to  $f_j$ .

(2) The plume dispersion parameter,  $\sigma_{zi}$ , is a function of downwind distance,  $x$ , stability category, and the type of terrain. It can be calculated from the equations of Hosker, Smith, Briggs, Gifford, or Pasquill (see Appendix G, Items 8, 15, 19, 45, and 49). The default values given in this Standard are derived from the equations of Hosker given in Appendix D, Tables D2, D3, and D4.

#### 5.1.1.6

Default values of the parameter  $P_{01}$  are calculated from

(a) Equation 5.3 for uniform frequency of the wind into all sectors ( $f_j = 1/n$ );

(b) the default frequency distribution (Table D1); and

(c) a surface roughness length of 40 cm.

Figure A1 (Appendix A) plots default values for  $P_{01}$  for various effective stack heights. The value of  $P_{01}$  may be estimated as follows:

(i) Where the frequency with which the wind blows into the various sectors differs by less than a factor of two from the average, then  $P_{01}$  may be taken directly from Figure A1.

(ii) Where the frequency with which the wind blows into the various sectors differs by more than a factor of two from the average, then transfer parameters should be calculated for each sector from Equation 5.3 by substituting appropriate values of  $f_j$  and  $n$  (or  $\theta_j$ ) from the wind rose. The transfer parameter appropriate to the critical group may then be chosen.

(iii) If no wind rose is available, then  $P_{01}$  should be taken as three times the value taken from Figure A1 for a uniform wind rose.

### 5.1.2 Effective Height of Release

In most cases the physical stack height may be used for the effective stack height in the dispersion formulae in Clause 5.1.1.

**Note:** See Appendix F for a discussion of the applicability of this Clause.

### 5.2 External Dose from a Plume [ $P(e)_{19}$ ]

**Note:** The exact calculation of the gamma dose rate in tissue from a finite plume of radioactive material is quite complex and requires a knowledge of the radionuclide composition of the cloud. In order to simplify the calculation, the semi-infinite cloud model may be used under conditions where it will not lead to a significant under-estimation of the dose. The semi-infinite cloud model is conservative for releases at ground level at any downwind distance, or for elevated releases with an effective release height less than 50 m at downwind distances greater than 1 km. At shorter distances for elevated releases the semi-infinite cloud model may