

there are no hours categorized as unstable in the record. The model description and user instructions are contained in Volume 1 of the User's Guide.³⁰ Separate publications^{32,31} describe the terrain preprocessor system and the meteorological preprocessor program. In *Part I* of a technical article³⁷ is a discussion of the model and its preprocessors; the model's performance characteristics are discussed in *Part II* of the same article.³⁸ The size of the CTDMPPLUS executable file on a personal computer is approximately 360K bytes. The model produces hourly average concentrations of stable pollutants, *i.e.*, chemical transformation or decay of species and settling/deposition are not simulated. To obtain concentration averages corresponding to the NAAQS, *e.g.*, 3- or 24-hour, or annual averages, the user must execute a postprocessor program such as CHAVG. CTDMPPLUS is applicable to all receptors on terrain elevations above stack top. However, the model contains no algorithms for simulating building downwash or the mixing or recirculation found in cavity zones in the lee of a hill. The path taken by a plume through an array of hills cannot be simulated. CTDMPPLUS does not explicitly simulate calm meteorological periods, and for those situations the user should follow the guidance in subsection 9.3.4. The user should follow the recommendations in the User's Guide under General Program Specifications for: (1) Selecting mixed layer heights, (2) setting minimum scalar wind speed to 1 m/s, and (3) scaling wind direction with height. Close coordination with the Regional Office is essential to insure a consistent, technically sound application of this model.

c. The performance of CTDMPPLUS is greatly improved by the use of meteorological data from several levels up to plume height.

However, due to the vast range of source-plume-hill geometries possible in complex terrain, detailed requirements for meteorological monitoring in support of refined analyses using CTDMPPLUS should be determined on a case-by-case basis. The following general guidance should be considered in the development of a meteorological monitoring protocol for regulatory applications of CTDMPPLUS and reviewed in detail by the Regional Office before initiating any monitoring. As appropriate, EPA guidance (see reference 100) should be consulted for specific guidance on siting requirements for meteorological towers, selection and exposure of sensors, etc. As more experience is gained with the model in a variety of circumstances, more specific guidance may be developed.

d. Site specific meteorological data are critical to dispersion modeling in complex terrain and, consequently, the meteorological requirements are more demanding than for simple terrain. Generally, three different meteorological files (referred to as surface, profile, and rawin files) are needed to run CTDMPPLUS in a regulatory mode.

e. The surface file is created by the meteorological preprocessor (METPRO)³¹ based on site specific measurements or estimates of solar and/or net radiation, cloud cover and ceiling, and the mixed layer height. These data are used in METPRO to calculate the various surface layer scaling parameters (roughness length, friction velocity, and Monin-Obukhov length) which are needed to run the model. All of the user inputs required for the surface file are based either on surface observations or on measurements at or below 10m.

f. The profile data file is prepared by the user with site specific measurements (from at

least three levels) of wind speed, wind direction, turbulence, and potential temperature. These measurements should be obtained up to the representative plume height(s) of interest (*i.e.*, the plume height(s) under those conditions important to the determination of the design concentration). The representative plume height(s) of interest should be determined using an appropriate complex terrain screening procedure (*e.g.*, CTSCREEN) and should be documented in the monitoring/modeling protocol. The necessary meteorological measurements should be obtained from an appropriately sited meteorological tower augmented by SODAR if the representative plume height(s) of interest exceed 100m. The meteorological tower need not exceed the lesser of the representative plume height of interest (the highest plume height if there is more than one plume height of interest) or 100m.

g. Locating towers on nearby terrain to obtain stack height or plume height measurements for use in profiles by CTDMPPLUS should be avoided unless it can clearly be demonstrated that such measurements would be representative of conditions affecting the plume.

h. The rawin file is created by a second meteorological preprocessor (READ62)³¹ based on NWS (National Weather Service) upper air data. The rawin file is used in CTDMPPLUS to calculate vertical potential temperature gradients for use in estimating plume penetration in unstable conditions. The representativeness of the off-site NWS upper air data should be evaluated on a case-by-case basis.

i. In the absence of an appropriate refined model, screening results may need to be used to determine air quality impact and/or emission limits.

TABLE 5-1A.—NEUTRAL/STABLE METEOROLOGICAL MATRIX FOR CTSCREEN

Variable	Specific values				
U (m/s)	1.0	2.0	3.0	4.0	5.0
σ_v (m/s)	0.3	0.75	.....	.....	.....
σ_w (m/s)	0.08	0.15	0.30	0.75	.....
$\Delta\theta/\Delta z$ (K/m)	0.01	0.02	0.035	.....	.....
WD	(Wind direction optimized internally for each meteorological combination)				

Exceptions:

- (1) If $U \leq 2$ m/s and $\sigma_v \leq 0.3$ m/s, then include $\sigma_w = 0.04$ m/s.
- (2) If $\sigma_w = 0.75$ m/s and $U \geq 3.0$ m/s, then $\Delta\theta/\Delta z$ is limited to ≤ 0.01 K/m.
- (3) If $U \geq 4$ m/s, then $\sigma_w \geq 0.15$ m/s.
- (4) $\sigma_w \leq \sigma_v$

TABLE 5-1B.—UNSTABLE/CONVECTIVE METEOROLOGICAL MATRIX FOR CTSCREEN

Variable	Specific values				
U (m/s)	1.0	2.0	3.0	4.0	5.0
u_* (m/s)	0.1	0.3	0.5	.....	.....
L (m)	-10	-50	-90	.....	.....
$\Delta\sigma/\Delta z$ (K/m)	0.030 (potential temperature gradient above z_i)				
z_i (m)	0.5h	1.0h	1.5h	.....	.....
	(where h = terrain height)				