⊕EPA

Project Summary

Addendum to the User's Guide for MPTER

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MPTER (*M*ultiple *P*oint source model with *TER*rain adjustment) was developed by the U.S. Environmental Protection Agency (EPA) in 1979 to estimate air quality concentrations of relatively non-reactive pollutants from multiple sources with adjustments made for slight terrain differences. The model was first released as part of the User's Network for Applied Modeling of Air Pollution (UNAMAP) Version 4 and re-released with minor modifications in UNAMAP Version 5. This addendum provides a complete description of the MPTER revisions and outlines the modifications required for updating the user's guide and the earlier versions of the FORTRAN source code to result in the code included in UNAMAP (Version 6).

This Project Summary was developed by EPA's Atmospheric Sciences Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Summary of Modifications

Important features added to the MPTER model are as follows:

- Urban and rural modes, for wind-profile exponents and dispersion parameters,
- Treatment of calm conditions according to methods developed by EPA (1984)*, and a
- Default option, primarily for regulatory application.

These features were designed to satisfy the requirements outlined in "Guideline on Air Quality Models (Revised)." The default option feature is designed as a convenience for the user to avoid inadvertent errors in setting the appropriate options for regulatory applications. The reader is cautioned to refer to the current regulatory guidance contained in EPA's "Guideline on Air Quality Models" and to confer with the appropriate regional meteorologist when this model is being used to satisfy regulatory requirements. With the addition of the above features, the model is acceptable for regulatory applications and is considered a guideline model by the EPA. The revisions are discussed in greater detail next; user's guide and computer code modifications follow the revisions.

The numerical values in the original test case output remain unchanged.

Urban and Rural Modes

Separate urban and rural default wind-profile exponents were added to MPTER and are presented in Table 1. These exponents are used by the model when the user exercises the default option. The rural exponents correspond to a surface roughness of about 0.1 meters; the urban exponents result from a roughness of about 1 meter (plus urban heat release influences).

An urban dispersion algorithm has been added to the rural scheme in the original MPTER. The urban dispersion parameter values are those recommended by Briggs.

The urban or rural setting is indicated by the user by input variable MUOR on card 4.

Treatment of Calm Conditions

When the default option is exercised, calm conditions are handled according to methods developed by the EPA (1984) which are summarized here. A calm hour is indicated by an hour with a

Table 1. Default Urban and Rural Wind-Profile Exponents

	Stability class					
Mode	A	B	C	D	E	F
Urban	0.15	0.15	0.20	0.25	0.30	0.30
Rural	0.07	0.07	0.10	0.15	0.35	0.55

wind speed of 1.0 m/sec and a wind direction equal to that of the previous hour. When a calm is detected in the meteorological data, the concentrations at all receptors are set to zero, and the number of hours being averaged is reduced by one, except that the divisor used in calculating the average is never less than 75 per cent of the averaging time. For any simulation, this results in the following:

- 3-hour averages are determined by dividing the sum of the hourly contributions by 3;
- 8-hour averages are calculated by dividing the sum of the hourly contributions by the number of non-calm hours or 6, whichever is greater;
- 24-hour averages are determined by dividing the sum of the hourly contributions by the number of non-calm hours or 18, whichever is greater; and
- Period of record averages, regardless of length, are calculated by dividing the sum of all the hourly contributions by the number of non-calm hours during the period of record. This is the only exception to the 75 per cent rule.

This calms procedure is not available in MPTER outside of the default option. The user can employ this procedure, however, through the use of the CALM-PRO postprocessor program (EPA, 1984). CALMPRO is available as part of UNAMAP Version 6.

Default Option

An option has been added to the model to facilitate compliance with regulatory requirements. Exercising the default option (i.e., IOPT (25) = 1) overrides other user-input selections and results in the following:

- Final plume rise is used (gradual or transitional plume rise is not exercised for plume height but is used to calculate the magnitude of the buoyancy induced dispersion),
- Buoyancy induced dispersion is exercised,
- Terrain adjustment factors are set to zero for all stabilities,

- Stack tip downwash is considered,
- Default urban or rural wind profile exponents are used (see Table 1), and
- Calms are treated according to methods developed by the EPA (1984) as noted previously.
- Decay half-life is set to 4.0 hours for SO_2 for the urban option, and infinite half-life (no decay) for all other cases.

Other Features

There are additional regulatory features that are inherent in the UNAMAP Version 5 and later versions of MPTER. These are summarized below.

(1) Momentum plume rise is always considered.
(2) Terrain adjustments are used for receptors below stack base elevation in the same manner as elevated receptors. The difference, defined as the receptor ground level elevation minus source ground level elevation, is computed and subtracted from the effective plume height. This has the effect of raising the plume at receptors below the source ground level elevation and lowering the plume at receptors above the source ground level elevation.
(3) Mixing height is compared with the final plume height without regard to plume height changes due to terrain.
(4) Exponential decay (half-life) is available if required by the simulation.

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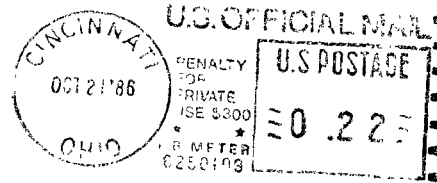
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