BLP-2

Sigma Research Corporation

Telephone: (508) 692-0330
Telefax: (508) 692-8547

234 Littleton Road, Suite 2E • Westford, Massachusetts 01886, U.S.A.

30 January 1991

Mr. Corrado Ratto
Universita Di Genova
Dipartimento di Fisica
Via Dodecaneso, 33
CAP 16146 Genova
Italy

Dear Mr. Ratto:

Your letter of 16 January to the U.S. EPA was forwarded to me by James Dicke for reply. The BLP and POSTBLP models were developed by Joseph Scire and me.

I have enclosed a copy of the BLP User's Guide Addendum that should provide the information you are missing. If you have additional questions, please contact Joseph Scire or me.

Sincerely,

Lloyd Schulman

Lloyd L. Schulman, Ph.D.
Principal Scientist

LLS/tw

Enclosure

cc: James Dicke (EPA) w/encl.
Joseph Scire

BLP USER'S GUIDE ADDENDUM

At the request of the Aluminum Association, Inc., Environmental Research & Technology, Inc. (ERT) has modified the BLP model and the POSTBLP postprocessing program to enhance their utility and flexibility. The changes include:

- an option to reduce BLP output storage requirements by elimination from the concentration arrays values equal to zero;
- an optional, user-specified averaging period in POSTBLP in additional to the 1-, 3-, 24-hour, and annual averages calculated by default;
- an option in POSTBLP to eliminate concentrations during calm hours from the calculation of multiple-hour average concentrations;
- an option in POSTBLP to scale each source contribution with different user-specified scaling factors; and
- the addition of a second postprocessing program, BLPSUM, with the capability of summing and scaling concentrations from two BLP runs (POSTBLP operates on only one BLP output file at a time).

The updated version numbers for BLP, POSTBLP, and BLPSUM are 4.1, 2.1, and 1.0, respectively. BLPSUM and the new version of POSTBLP are completely backward-compatible (i.e., they can be run with output generated with previous versions of BLP).

Array Compression Option

In many modeling applications, a substantial number of receptors have calculated hourly concentrations of zero. The size of the BLP output concentration arrays can be substantially reduced by flagging and eliminating these zero concentrations from the output file. The array compression option in BLP and BLPSUM flags zero concentrations

with negative numbers to reduce the size of the output array. For example, an array containing the following concentrations:

121., 10., 0., 0., 0., 0., 15., 12., 0., 0., 0., 0., 0., 0., 17.

is stored as:

121., 10., -4., 15., 12., -6., 17.

where -4 replaces four zeroes, and -6 replaces six zeros. Although use of the array compression option increases computation time slightly, the reduction in the size of the output file, in many instances, can result in substantial cost savings (lower disk storage charges). This option is most useful when modeling with large numbers of receptors and/or many source contributions.

Elimination of Calm Hours

The new version of POSTBLP contains an option to treat concentrations during calm hours as missing. With the use of this option, multiple-hour average concentrations are calculated based only on the concentrations during the remaining non-calm hours. The number of non-calm hours in each averaging period must exceed a user-specified minimum; otherwise, the average is considered missing and is not included in the tables of the highest concentrations.

The treatment of predicted concentrations during calm hours (wind speeds $\leq$1.0 m/s) as missing is due to the considerable uncertainties associated with plume transport and dispersion during these conditions. As the wind speed approaches zero and the wind direction becomes undefined, obvious problems are encountered in determining transport of the plume (which depends on wind direction) and plume rise and dilution (which are both inversely proportional to wind speed). In EPA preprocessors, wind speeds less than 1.0 m/s are set equal to 1.0 m/s and the previous hour's wind direction is persisted. This, however, can result in unrealistic predicted concentrations because wind directions are likely to be quite variable during these conditions.

Averaging Period Option

An option has been added to POSTBLP to allow the user to select an averaging period in addition to the 1-, 3-, 24-hour, and annual averages calculated by default. When this option is used, tables of the top five 'NAVG'-hour concentrations at each receptor and the top 50 'NAVG'-hour concentrations overall will be printed. Frequency distribution and print options are available for the 'NAVG'-hour averaging period as well as for the default averaging periods.

Scaling Option

The BLPSUM program and the new version of POSTBLP have a useful source contribution or source group scaling option. This feature allows concentration predictions of different pollutants to be obtained for multi-pollutant sources at only a small fraction of the cost of making separate BLP runs for each pollutant. The concentrations are scaled in the following way:

$$\chi(\text{new}) = A * \chi(\text{old}) + B$$

where χ is the concentration and A and B are user-specified constants for each source or source group. Negative values for the constants are allowed.

BLPSUM Postprocessing Program

The BLPSUM postprocessing program sums BLP concentrations from two separate BLP runs and produces a third output file for further processing with POSTBLP. BLPSUM extracts and sums the source contributions or total concentrations selected by the user from each BLP input file, and optionally, scales each source contribution with different scaling constants. This summing capability is useful in situations when dissimilar line source characteristics (line length, buoyancy flux, etc.) make separate BLP runs necessary. It can also be used to add the contributions of previously modeled sources to new

modeling results for additional sources in a much more cost-effective way than remodeling the entire source inventory.

It is important to note when adding line source contributions that because of the enhanced plume rise effects of multiple line sources, the source contribution of any single line source implicitly contains the effects of the buoyancy of the other lines. Thus, the addition or removal of line sources may change the contributions of the existing line sources.

Additional inputs in BLP - Version 4.1

Namelist - GEN

Variable	Type	Description	Default
LCOMPR	LOGICAL	Control variable for array compression option. If 'LCOMPR' is .TRUE., zero concentration values will be flagged and eliminated from the output BLP concentration file, thus reducing the size of the output file. If 'LCOMPR' is .FALSE., the output concentration arrays will not be compressed.	.FALSE.

Additional inputs in POSTBLP - Version 2.1

Namelist - OPTS

Variable	Type	Description	Default
LDCALM	LOGICAL	Control variable for the DECALM option. If 'LDCALM' is .TRUE., concentrations during hours with wind speeds $\leq$1.0 m/s are treated as "missing," and are not used in the calculation of multiple-hour averages.	.FALSE.
LPRT	LOGICAL	Control variable for output of a table of hours with wind speeds $\leq$1.0 m/s (used only if LDCALM is .TRUE. - should not be used if LECH1, LECH3, LECH24, or LECHN is .TRUE.). If 'LPRT' is .TRUE., a table containing the date, hour, wind speed, wind direction, stability class, mixing height and highest three concentrations for each hour with a wind speed $\leq$1.0 m/s is printed; if .FALSE., this table is not printed.	.FALSE.
MIN3	INTEGER	Minimum number of hours of data needed in calculation of 3-hour averages (used only if LDCALM is .TRUE.). If fewer than 'MIN3' hours during a particular 3-hour period have wind speeds > 1.0 m/s, the 3-hour average for this period is not calculated; otherwise, it is calculated based only on the hours with wind speeds >1.0 m/s. $1 \leq$ MIN3 ≤ 3.	3

Variable	Type	Description	Default
MIN24	INTEGER	Minimum number of hours of data needed in the calculation of 24-hour averages (used only if 'LDCALM' is .TRUE.). If fewer than 'MIN24' hours during a particular 24-hour period have wind speeds >1.0 m/s, the 24-hour average for this period is not calculated; otherwise it is calculated based only on the hours with wind speeds >1.0 m/s. $1 \leq MIN24 \leq 24$.	18
NAVG	INTEGER	Optional user-specified averaging time (hours). If 'NAVG' >0, concentrations with an averaging time of 'NAVG' hours are calculated, in addition to the 1-, 3-, 24-hour, and annual average concentrations calculated by default. If 'NAVG' = 0, only the default averaging times are calculated.	0
MINN	INTEGER	Minimum number of hours of data needed in the calculation of 'NAVG'-hour averages (used only if 'NAVG' >0 and LDCALM is .TRUE.). If fewer than 'MINN' hours during a particular 'NAVG'-hour period have wind speeds >1.0 m/s, the 'NAVG'-hour average for this period is not calculated; otherwise, it is calculated based only on the hours with wind speeds >1.0 m/s. $1 \leq MINN \leq NAVG$.	0

Variable	Type	Description	Default
LECHN	LOGICAL	Control variable for output of 'NAVG'-hour average concentrations (used only if 'NAVG' >0). If 'LECHN' is .TRUE. and 'NAVG' $\leq$24, 'NAVG'-hour average concentrations at each receptor are printed for each day with a '1' indicated in the corresponding element of the 'IECHO' array. If 'LECHN' is .TRUE. and 'NAVG' >24, 'NAVG'-hour average concentrations are printed for all periods. If 'LECHN' is .FALSE., these 'NAVG'-hour average concentration tables are not printed.	.FALSE.
LFRQN	LOGICAL	Control variable for 'NAVG'-hour average concentration frequency distributions (used only if 'NAVG' >0). If 'LFRQN' is .TRUE., a frequency distribution of 'NAVG'-hour averaged concentrations at receptor 'IRECEP' with concentration intervals specified in the 'XINTN' array is produced. If 'LFRQN' is .FALSE., no distribution is produced.	.FALSE.
NINTN	INTEGER	Number of concentration intervals specified in the 'XINTN' array (used only if 'NAVG' >0 and 'LFRQN' is .TRUE.). NINTN $\leq$25.	0
XINTN(25)	Real Array	Array containing the concentration intervals used in the 'NAVG'-hour averaged concentration frequency distribution (used only if 'NAVG' >0 and 'LFRQN' is .TRUE.).	25*0

Variable	Type	Description	Default
LSCALE	LOGICAL	Control variable for concentration scaling option. If 'LSCALE' is .TRUE., concentrations are scaled in the following way: $\chi(new) = ASCALE * \chi(old) + BSCALE$ Where χ is the concentration and ASCALE and BSCALE are user input scaling factors for each source or source group. If 'LSCALE' is .FALSE., no concentration scaling is done.	.FALSE.

Formatted Input Data (Incuded only if 'LSCALE' is .TRUE.)

The formatted POSTBLP input data consists of the source code and scaling constants for each source or source group. Concentrations are scaled in the following way:

$$\chi(\text{new}) = \text{ASCALE} * \chi(\text{old}) + \text{BSCALE}$$

If 'LSUM' is .FALSE., the scaling data consists of one card; if 'LSUM' is .TRUE., the scaling data consists of 'NSUM' cards (one card for each source group).

Columns	Format	Variable	Description
1-3	I3	ISCALE*	Source code identifying the source or source group to be scale. If 'ISCALE' is 1 to 10, the concentration output scaled is the source contribution or line number 'ISCALE'. If 'ISCALE' is 11, the sum of all the line sources is scaled. If 'ISCALE' is 101 to 150, the concentration output scaled is the source contribution of point source 'ISCALE'-100. If 'ISCALE' is 151, the concentration scaling is performed for the sum of all the point sources. If 'ISCALE' is 999, the concentration scaling is performed for the total concentration resulting from the sum of all the line and point sources.

*If 'LSUM' is .FALSE., 'ISCALE' should be equal to 'IJCODE'. If 'LSUM' is .TRUE., each element of 'ISCALE' should be equal to the corresponding element of 'ISCODE'.

Columns	Format	Variable	Description
11-20	F10.5	ASCALE	Multiplicative scaling constant for the source or source group identified by 'ISCALE'.
21-30	F10.5	BSCALE	Additive scaling constant ($\mu g/m^3$) for the source or source group identified by 'ISCALE'.

BLPSUM User's Instructions

The BLPSUM postprocessing program sums and scales concentrations from two separate BLP output files. The line printer output from BLPSUM is routed to Logical Unit 6. Card-image inputs are read from Logical Unit 5. The two BLP input files are read from Logical Units 10 and 11 (BLP input Files 1 and 2, respectively). The resulting BLP output file is written to Logical Unit 20. A detailed description of the BLPSUM input parameters follows.

1)	Title Card (up to 80 characters)	(must be included)
2)	INPUTS Namelist	(must be included)
3)	Formatted Inputs	(included only if 'LSCALE' is .TRUE.)

Title - Run Identification

Columns	Format	Variable	Description
1-80	20A4	TITLE	Title or run identification information up to 80 characters in length.

Namelist - INPUTS

Variable	Type	Description	Default
IJCOD1	INTEGER	Source code specifying the concentration output from File 1 summed (not used if 'LSUM' is .TRUE.). If 'IJCOD1' is 1 to 10, the concentration output summed from File 1 is the source contribution of line number 'IJCOD1'. If 'IJCOD1' is 11, the concentration output summed from File 1 is the sum of all the line sources. If 'IJCOD1'is 101 to 150, the concentration output summed	999

Variable	Type	Description	Default
		is the source contribution of point source 'IJCOD1'-100. If 'IJCOD1' is 151, the concentration output summed is the sum of all the point sources. If 'IJCOD1' is 999, the concentration output summed is the total concentration from all the line and point sources in File 1.	
IJCOD2	INTEGER	Source code specifying the concentration output summed from File 2 (not used if LSUM is .TRUE.). Also see description of 'IJCOD1'.	999
LCOMPR	LOGICAL	Control variable for array compression option. If 'LCOMPR' is .TRUE., zero concentration values will be flagged and eliminated from the output BLPSUM concentration file, thus reducing the size of the output file. If 'LCOMPR' is .FALSE., the output concentration arrays will not be compressed.	.FALSE.
LSCALE	LOGICAL	Control variable for concentration scaling option. If 'LSCALE' is .TRUE., concentrations are scaled in the following way: χ(New--File 1) = ASCAL1 * χ(Old--File 1) + BSCAL1 χ(New--File 2) = ASCAL2 * χ(Old--File 2) + BSCAL2 Where ASCAL1, BSCAL1, ASCAL2, and BSCAL2 are user-input scaling factors for each source or source group. If 'LSCALE' is .FALSE., no concentration scaling is done.	.FALSE.

Variable	Type	Description	Default
LSUM	LOGICAL	Control variable for source contribution summing option within individual BLP output files. If 'LSUM' is .TRUE., the source contributions of the sources specified in the array 'ISCOD1' (input File 1) are summed and then added to the source contributions of the sources specified in the array 'ISCOD2' (input File 2). If 'LSUM' is .FALSE., the source contributions of the sources specified by the variables 'IJCOD1' and 'IJCOD2' are summed.	.FALSE.
ISCOD1	INTEGER ARRAY	Array containing up to 62 source codes specifying the source contributions summed from File 1 (used only if 'LSUM' is .TRUE.) This variable in analogous to 'ISCODE' in POSTBLP. Also see description of 'IJCOD1'.	62*0
ISCOD2	INTEGER ARRAY	Array containing up to 62 source codes specifying the source contributions summed from File 2 (used only if 'LSUM' is .TRUE.). Also see description of 'IJCOD1'.	62*0
NSUM1	INTEGER	Number of source contributions specified in 'ISCOD1' array (used only if 'LSUM' is .TRUE.). 'NSUM1' $\leq$62.	0
NSUM2	INTEGER	Number of source contributions specified in 'ISCOD2' array (used only if 'LSUM' is .TRUE.). 'NSUM2' $\leq$62	0

Formatted Input Data (Included only if 'LSCALE' is .TRUE.).

The formatted BLPSUM input data consists of the source code and scaling constants for each source or source group. The parameters for input File 1 are entered first, followed by those for File 2. Concentrations are scaled in the following way:

$$\chi(\text{New--File 1}) = \text{ASCAL1} * \chi(\text{Old--File 1}) + \text{BSCAL1}$$
$$\chi(\text{New--File 2}) = \text{ASCAL2} * \chi(\text{Old--File 2}) + \text{BSCAL2}$$

If 'LSUM' is .FALSE., the scaling data consists of two cards (one each for Files 1 and 2). If 'LSUM' is .TRUE., the scaling data consists of 'NSUM1' cards for File 1 followed by 'NSUM2' cards for File 2 (one card for each source group).

Columns	Format	Variable	Description
1-3	I3	ISCAL1*	Source code identifying the source or source group scaled from input File 1. (See description of 'ISCALE' in POSTBLP inputs).
11-20	F10.5	ASCAL1	Multiplicative scaling constant for source or source group identified by 'ISCAL1'.
21-30	F10.5	BSCAL1	Additive scaling constant ($\mu g/m^3$) for source or source group identified by 'ISCAL1'.

*If 'LSUM' is .FALSE., 'ISCAL1' and 'ISCAL2' should be equal to 'IJCOD1' and 'IJCOD2', respectively. If 'LSUM' is .TRUE., each element of 'ISCAL1' and 'ISCAL2' should be equal to the corresponding elements of 'ISCOD1' and 'ISCOD2', respectively.

Columns	Format	Variable	Description
1-3	I3	ISCAL2*	Source code indentifying the source or source group scaled from input File 2. (See description of 'ISCALE' in POSTBLP inputs).
11-20	F10.5	ASCAL2	Multiplicative scaling constant for source or source group identified by 'ISCAL2'.
21-30	F10.5	BSCAL2	Additive scaling constant ($\mu g/m^3$) for source or source group identified by 'ISCAL2'.

*If 'LSUM' is .FALSE., 'ISCAL1' and 'ISCAL2' should be equal to 'IJCOD1' and 'IJCOD2', respectively. If 'LSUM' is .TRUE., each element of 'ISCAL1' and 'ISCAL2' should be equal to the corresponding elements of 'ISCOD1' and 'ISCOD2', respectively.