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Buoyant line and point source (BLP) dispersion model user's guide

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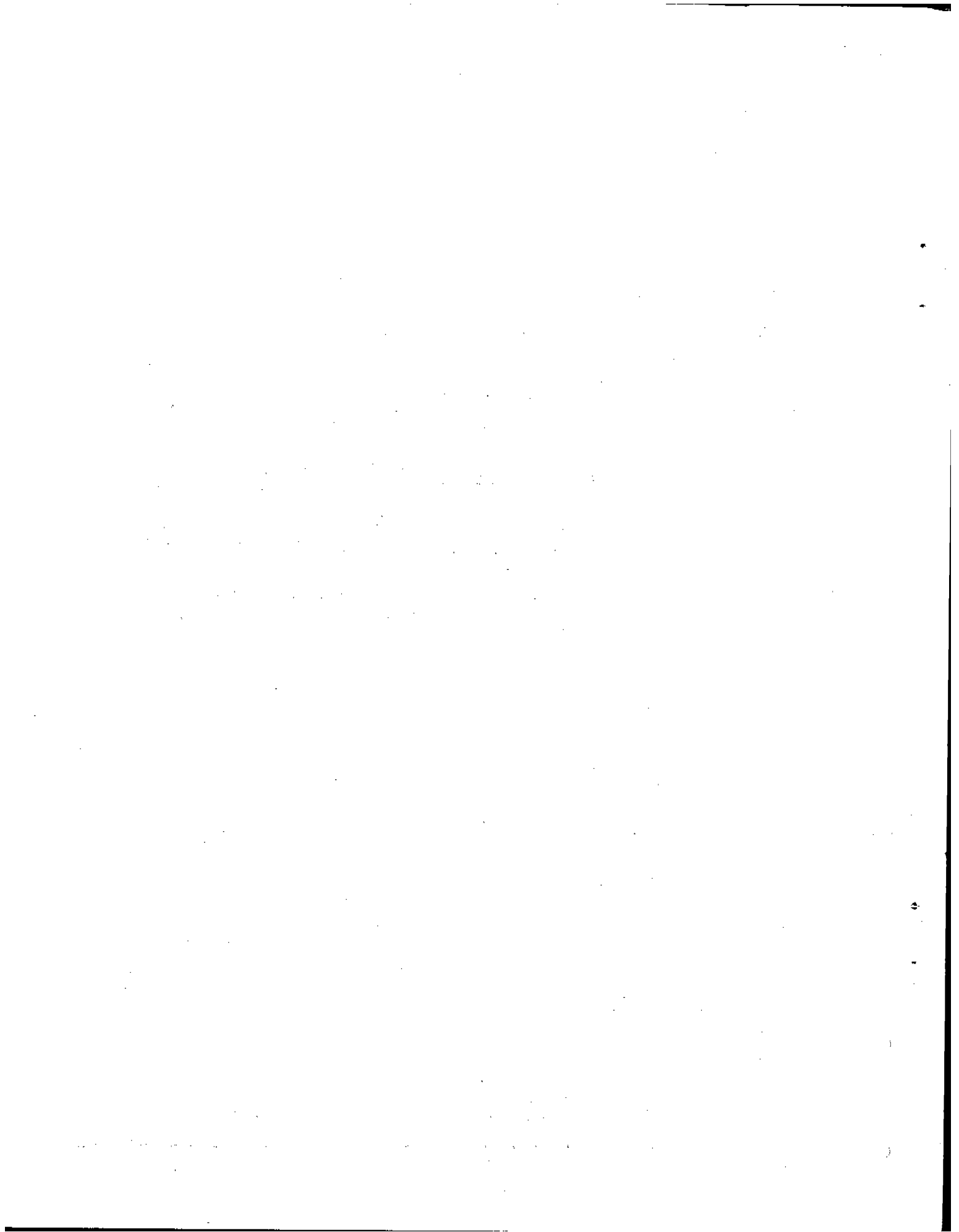


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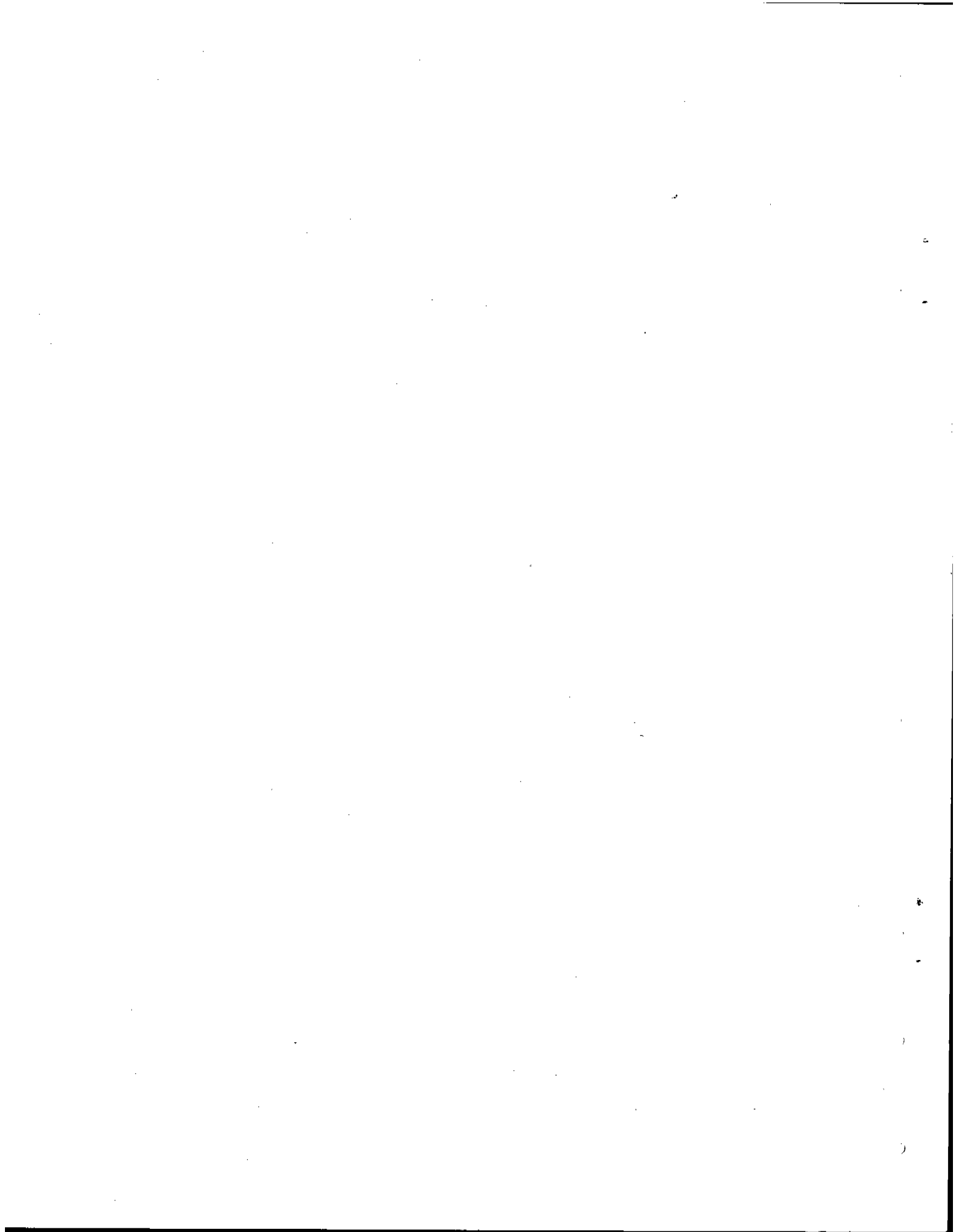
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1. INTRODUCTION

1.1 Project Objective

Environmental Research & Technology, Inc. (ERT) was retained by The Aluminum Association, Inc. to develop an air quality dispersion model to simulate the transport and diffusion of emissions from aluminum reduction plants. Aluminum reduction plants are a complex arrangement of emission sources, composed of parallel, low-level, buoyant line sources called potrooms interspersed, typically, by short point sources. Alumina is reduced through electrolysis to aluminum in the potrooms. A reduction facility usually consists of 2 to 20 potroom buildings about 500 meters long. Some of the buoyant emissions from the reduction process escape through a continuous ridge ventilator, which is a few meters wide running the length of the potroom. Most of the emissions, however, are collected by hooding above the reduction cells and are treated and exhausted through nearby stacks. There are typically 2 to 20 point sources, usually low-level, for each potroom primary control system.

Since a buoyant line source has one less degree of freedom than an isolated point source in entraining ambient air, the plume rise will be enhanced. In addition, the line source rise will be dependent on wind direction, line length, the number of parallel lines, and their spacing. Both the line source and the short point sources are subject initially to building downwash effects. The dispersion of effluents from aluminum reduction plants, because of these complexities, is not correctly handled by currently available air quality models. The model developed during this project, the Buoyant Line and Point Source (BLP) model, is in direct response to this need. BLP can simulate the complexities of aluminum reduction plants, but, importantly, also has the flexibility to duplicate point source contributions predicted by the CRSTER model.

1.2 Model Applications

The BLP dispersion model was developed specifically for aluminum reduction plants and, in addition to theoretical considerations, is based on extensive wind tunnel simulations of two reduction plants and an SF_6 field study tracer program at one of the plants. The model has been verified using two years of SO_2 measurements at the second reduction plant. (Refer to the companion document P-7304A for a description of the project and the model verification results.)

The complex source configuration of an aluminum reduction facility dictated that many innovative modeling techniques be developed. The major features of the BLP dispersion model are illustrated in Table 1-1. Plume rise from multiple finite buoyant line sources and the effects of vertical wind shear and building downwash on the plume rise of both line and point sources are the key innovative features.

Line source plume rise is determined analytically and is dependent on line length, wind direction, initial building downwash effects, the number of parallel lines, and line spacing. Plume rise is increased as the line length decreases, the wind direction becomes parallel to the line, and as the number of lines increases. If the building downwash effect is neglected, then as the line length approaches zero, the plume rise relationships reduces to the conventional Briggs formulations.

Because both the line and point sources of an aluminum reduction facility are low-level sources, the wind speeds encountered by the rising plumes are typically much greater than the wind speed at release height. Since current plume rise formulations assume the release height wind speed is constant with height, the resulting plume rise can be greatly overestimated. The BLP model contains an option that analytically determines the reduced plume rise that results when the effects of vertical wind speed shear are considered. Once again, as the wind speed shear approaches zero, the plume rise relationship reduces to the familiar Briggs formulation.

TABLE 1-1
MAJOR FEATURES OF THE BLP MODEL

- UTM or line source oriented (SCS) coordinate system.
- Multiple point source and finite buoyant line source capability.
- Finite buoyant line source plume rise.
- Plume enhancement due to multiple line sources.
- Vertical wind shear in plume rise formulations for both point and line sources.
- Transitional plume rise.
- Incorporation of building downwash in both dispersion and plume rise calculations for point and line sources.
- Terrain adjustment plume path coefficients.
- Time-dependent pollutant decay.
- Source contribution concentrations.
- Flexible post-processing package.

Although the BLP model was specifically developed and verified for aluminum reduction plants, its analytical, theoretically based treatment of buoyant line source plume rise, building downwash, and vertical wind speed shear effects readily lends BLP to similar complex sources where these effects may be important.

1.3 BLP Modeling Package

The BLP modeling package is schematically illustrated in Figure 1-1. The BLP dispersion model accepts processed meteorological data from the CRSTER meteorological preprocessor program. The preprocessor requires hourly surface data and twice daily mixing height data (for further information about the preprocessor program, consult the Handbook for the Single Source (CRSTER) Model (EPA 1977)). For short-term runs up to 24 hours of card-image type user-specified meteorological data may be input. Source, receptor, and program control data are also input by card deck. All BLP concentration output is stored on a disk or tape file for further processing by the BLP post-processing program, POSTBLP. The user inputs POSTBLP program control parameters by card deck. Printouts of the appropriate processed concentration and meteorological data are generated by POSTBLP.

1.4 Summary of Input Data and Program Options

Four types of input data are required for the BLP dispersion model:

- meteorological data,
- source data,
- receptor data, and
- program control parameters.

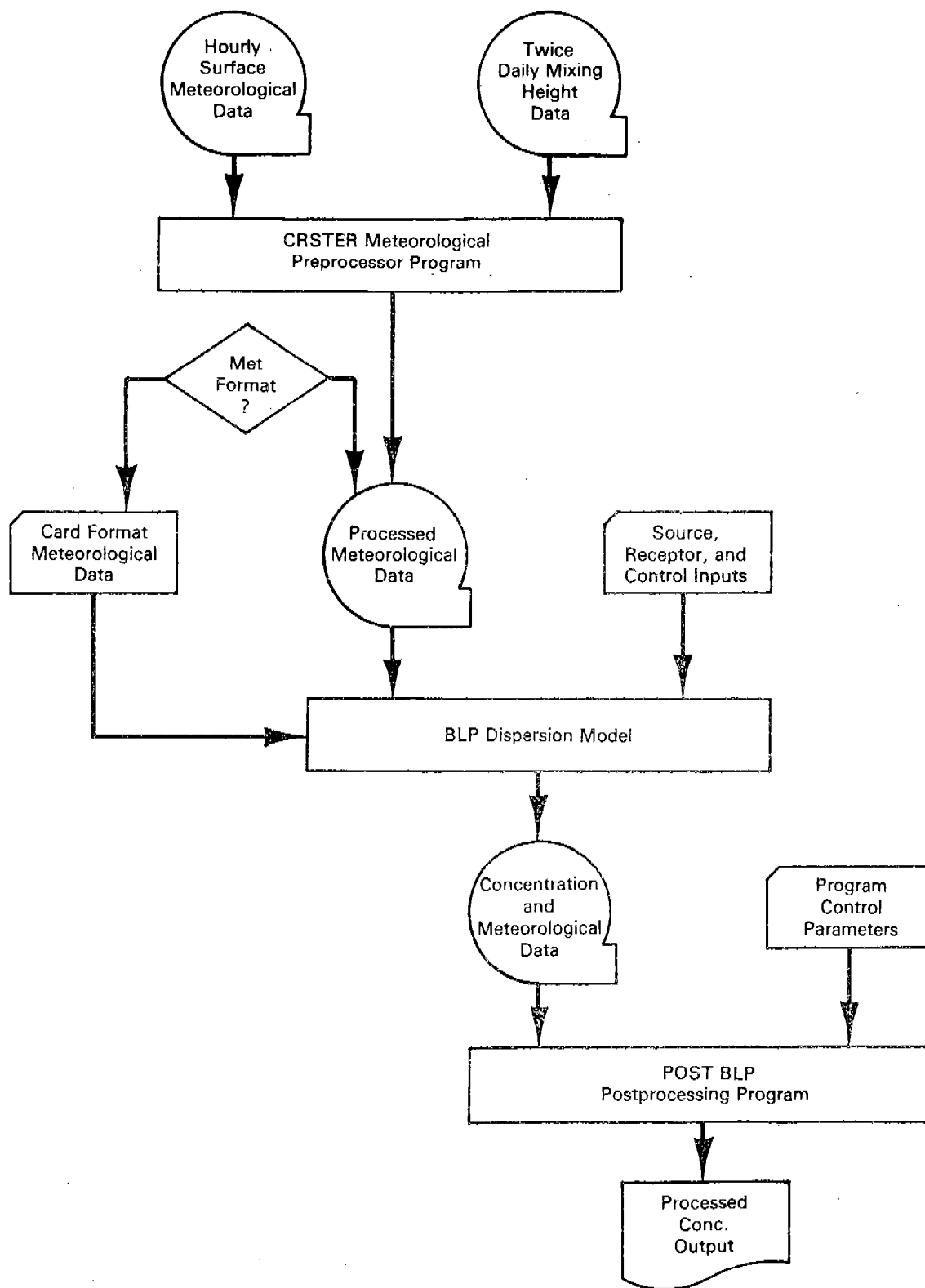


Figure 1-1 BLP Modeling Package

1.4.1 Meteorological Data

The BLP model will accept two types of meteorological data: preprocessor data or user-specified card-image meteorological input. The preprocessor data is generated by the CRSTER meteorological preprocessor program from hourly surface observations and twice daily mixing height data. The preprocessor data includes for each hour:

- PGT stability class,
- wind speed in meters per second,
- wind direction in degrees,
- randomized wind direction in degrees,
- mixing height (urban and rural) in meters, and
- ambient air temperature in degrees Kelvin.

For further information on the output and input requirements of the CRSTER preprocessor program, refer to the Handbook for the Single Source (CRSTER) Model (EPA 1977).

The other possible format of meteorological input data is user-specified hourly card-image type data. Up to 24 hours of meteorological data may be specified in this format and should include hourly values of:

- PGT stability class,
- wind speed in meters per second,
- wind direction in degrees,
- ambient air temperature in degrees Kelvin, and
- mixing height in meters.

1.4.2 Source Data

The BLP program is intended to model both buoyant line and point sources. The required point source data requirements are:

- stack location X and Y coordinates in meters,
- stack base elevation in meters,

- physical stack height in meters,
- pollutant emission rate in grams per second,
- stack inner diameter in meters,
- stack gas exit velocity in meters per second, and
- stack gas temperature in degrees Kelvin.

Up to 50 point sources are allowed.

The required input data for the buoyant line sources consist of a set of averaged parameters for use in the buoyant line sources plume rise calculations and a more detailed set of parameters used in the dispersion calculations. To calculate line source plume rise, it is assumed that there are up to 10 parallel lines of equal length and width equally spaced with identical buoyancy fluxes and release heights. If all these conditions are not satisfied, it may be necessary for the user to calculate appropriately averaged values for the following parameters:

- line length in meters,
- release height in meters,
- line source width in meters,
- building width in meters,
- spacing between buildings in meters, and
- buoyancy parameter in m^4/s^3 (Note: the buoyancy parameter, F' , differs from the buoyancy flux defined by Briggs.)

Although the height of an individual plume element is determined from the above averaged information, no restriction is made on the symmetry or spacing of the line sources for the dispersion calculations. The following input parameters, used in the dispersion calculations, are required for each line source:

- X and Y coordinates of start of line in meters,
- X and Y coordinates of end of line in meters,
- building height in meters,

- pollutant emission rate in grams per second, and
- building base elevation in meters.

A maximum of 10 line sources is allowed.

1.4.3 Receptor Data

The user has the option of either specifying the X and Y coordinates and the elevation of each receptor location or generating a rectangular grid of receptors by specifying the endpoints and X and Y spacing of the proposed receptor grid. If the receptors are generated by BLP, the elevations of all receptors are zero. With either option, up to 100 receptors are allowed.

1.4.4 Program Control Parameters

The BLP dispersion model has several optional features that the user may select through the program control parameters. The default values of the program control parameters are discussed in the user's instructions section.

- Coordinate system option--allows the coordinates of all sources and receptors to be specified in Universal Transverse Mercator (UTM) coordinates or in an internal (line source oriented) source coordinate system (SCS).
- Source contribution option--specifies whether the contribution of any particular line or point source is to be separately written to the output file for analysis with the POSTBLP program. (Note: 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 line sources. The addition or removal of line sources will change the contributions of existing line sources.)

- Wind shear option--specifies whether the effect of vertical wind speed shear in determining plume rise from the buoyant point and line sources is to be estimated. The stability-dependent wind speed power law exponents can be changed from the default values by the user.
- Point source downwash option--specifies whether the effects of building downwash are to be estimated for those points within two building heights of any line source. The line sources are assumed to always downwash.
- Transitional plume rise option--specifies whether transitional point source plume rise is to be calculated. Transitional line source plume rise is always calculated.
- Vertical potential temperature gradient option--allows the user to input site-specific vertical potential temperature gradient values for PGT stability classes E and F different from the default values.
- Wind speed power law exponent option--allows the user to change the stability-dependent default power law exponents to more appropriate site-specific values. These exponents are used to calculate wind speed at stack height for use in the dispersion equation and also in the wind shear plume rise formulas. The measurement height of the mean wind speed can also be specified by the user.
- Stability class restriction option--restricts vertical variation of the PGT stability class to a user-specified number of classes per hour. (Note: the CRSTER meteorological preprocessor program may restrict the stability class variation to one class per hour, so if a different variation rate is more appropriate, some modification to the CRSTER preprocessor may also be required.)
- Mixing height option--allows the user to specify whether urban or rural mixing heights are to be used in the dispersion calculations.
- Pollutant decay option--allows for pollutant removal by a linear approximation to a exponential decay process.

- Background concentration option--allows the user to specify a background concentration value.
- Terrain adjustment option--allows the user to specify plume path coefficients for use in plume height calculations.

2. TECHNICAL DESCRIPTION

2.1 Introduction

The source and meteorological data requirements of BLP and a brief summary of the meteorological data generated by the CRSTER meteorological preprocessor program are presented in Section 2.2. A detailed description of the BLP model dispersion equations and assumptions is contained in Section 2.3. Section 2.4 describes the line and point source plume rise equations used in the BLP model. The BLP post-processing program, POSTBLP, is described in Section 2.5.

2.2 Model Input Requirements

2.2.1 Meteorological Inputs

The BLP dispersion model requires hourly values of the following meteorological parameters: PGT stability class, wind speed, wind direction, ambient air temperature, and mixing height. There are two input modes for meteorological data: (1) CRSTER meteorological preprocessor (unformatted) input and (2) card-image type (formatted) meteorological input. Up to 366 days of hourly CRSTER preprocessor data or up to 24 hours of formatted meteorological data can be input to the BLP model.

The stability classification scheme is based on the work of Pasquill (1974), Gifford (1961), and Turner (1964). Six stability categories (Classes A through F) are permitted by BLP. Stability Class G is not allowed; occurrences of stability class G are changed to stability class F by BLP. The CRSTER meteorological preprocessor program calculates hourly values of PGT stability class, and restricts stability class variations to one class per hour. It is possible, however, that the dispersive characteristics of the atmosphere change more rapidly than one class change per hour, especially in the lowest layer of the atmosphere. BLP, therefore, allows the user to specify a maximum stability class variation greater than one class per hour. This option with the CRSTER preprocessor meteorological data requires

modification to the CRSTER preprocessor program to remove the one stability class per hour restriction. In formatted card-image input mode, BLP uses the stability classes as specified in the input, with no stability class variation restriction.

The mean wind speed, U_1 , at measurement height, Z_1 , must be specified hourly. The wind speed variation wind height is assumed to follow a stability dependent power law:

$$U_z = U_1 (Z/Z_1)^P \quad (2-1)$$

where U_z is the wind speed at height Z and P is a stability dependent wind shear exponent. The user may specify site-specific values of the wind shear exponent or use the default values provided (see Table 2-1). The wind speed measurement height, Z_1 , can also be specified by the user. A default value of 7 meters is assumed. Because the Gaussian dispersion equation contains a $1/U$ dependence, a minimum measurement height wind speed of 1 meter per second (m/s) is assumed by the CRSTER preprocessor program.

Wind direction is specified in terms of the direction toward which the wind is blowing. The CRSTER preprocessor program converts the National Weather Service (NWS) wind observations (direction from which the wind is blowing) to the proper format by shifting the direction by 180° . The NWS observations, reported only in 10° increments, are randomized by the preprocessor within the 10° sectors to eliminate wind directional bias.

Hourly ambient air temperatures are used in the point source plume rise equation in the calculation of buoyancy flux (the line source buoyancy parameter for aluminum reduction plants has generally been assumed to be independent of ambient temperature). In preprocessor input mode, a missing temperature value defaults to 293°K (68°F). The vertical potential temperature gradients used in the stable plume rise calculations have the default values specified in Table 2-2. The user may specify more appropriate site-specific values if they are available.

The CRSTER meteorological preprocessor computes hourly mixing heights by interpolation of the twice daily estimated mixing height data. For the details of the interpolation scheme, refer to the

TABLE 2-1
DEFAULT VALUES FOR THE WIND SHEAR EXPONENT, P

<u>PGT Stability Class</u>	<u>P</u>
A	0.10
B	0.15
C	0.20
D	0.25
E	0.30
F	0.30

TABLE 2-2
DEFAULT VALUES FOR THE VERTICAL POTENTIAL
TEMPERATURE GRADIENT, $\partial\theta/\partial z$

<u>PGT Stability Class</u>	<u>$\partial\theta/\partial z(^{\circ}\text{K/m})$</u>
E	0.020
F	0.035

Handbook for the Single Source (CRSTER) Model (EPA 1977) The preprocessor calculates two mixing heights for each hour: one primarily representative of an urban environment and the other for a rural environment. The user must specify which mixing height (rural or urban) is most appropriate for a particular application of the BLP model.

2.2.2 Source Inputs

The BLP program can be used to model multiple buoyant line and point sources. Table 2-3 summarizes the source data requirements of BLP. For each point source, the stack location, base elevation, physical stack height, inside stack diameter, stack gas exit velocity, stack gas temperature, and pollutant emission rate must be included as input. Up to 50 point sources are allowed. For the line sources, two sets of source parameters must be included. For each line source, the coordinates of the line endpoints, base elevation, release height, and pollutant emission rate are required. A maximum of 10 line sources is allowed. This detailed information is used in the dispersion calculations (see Section 2.3.2). Each line can be a different length, height, and so forth. The plume rise formulation for multiple buoyant finite line sources (described in Section 2.4.2), however, assumes the line sources are equally spaced, with identical heights, widths, buoyancy parameters, and line lengths (see Figure 2-1). These assumptions allow evaluation of the plume rise enhancement effects of multiple line sources. For the plume rise calculations, therefore, a set of averaged line source characteristics must be input. No restriction is placed on the symmetry of the line sources for the dispersion calculation. The averaged parameters determine only the height of individual line source plume elements; for rows of lines with reasonably similar characteristics, the use of averaged parameters is probably not a critical approximation.

All source and receptor locations can be specified as UTM coordinates or in a line-source oriented (SCS) Cartesian coordinate system. The SCS coordinate system has an origin at the endpoint of the first line source, and is oriented with the X-axis parallel to the

TABLE 2-3
REQUIRED SOURCE INPUT DATA

<u>Parameters</u>	<u>Required Point Source Data</u>	<u>Units</u>
X	X coordinate of the stack	m
Y	Y coordinate of the stack	m
E _P	Elevation of the stack base above a reference height (such as sea level)	m
H _s	physical stack height	m
d	stack inner diameter	m
W	stack gas exit velocity	m/s
T _s	stack gas temperature	°K
Q	pollutant emission rate	g/s

Required Line Sources Data - Dispersion Calculations

<u>Parameters</u>	<u>Definition</u>	<u>Units</u>
X _B	X coordinate of the most westerly end of the line source	m
Y _B	Y coordinate of the most westerly end of the line source	m
X _E	X coordinates of the most easterly end of the line source	m
Y _E	Y coordinate of the most easterly end of the line source	m
H _L	release height of the line source	m
Q _L	pollutant emission rate of the line source	g/s

TABLE 2-3 (Continued)

Required Line Source Data - Plume Rise Calculations

<u>Parameters</u>	<u>Definition</u>	<u>Units</u>
L	average line length	m
H _B	average building height	m
W _m	average line source width	m
W _B	average building width	m
δx	average spacing between buildings	m
F'	average line source buoyancy parameter (Note: the buoyancy parameter, F', differs from the buoyancy flux defined by Briggs by a factor of π - see Equation 2-47)	m ⁴ /s ³

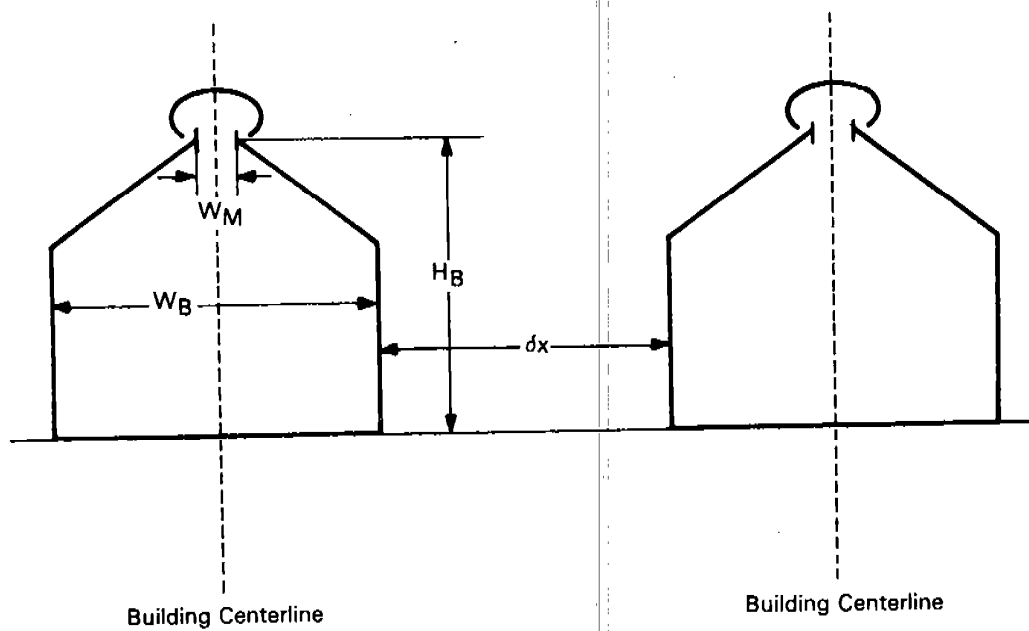


Figure 2-1 Cross-Sectional View of Line Sources

lines. Figure 2-2(a) illustrates the SCS coordinate system. With SCS coordinates, an orientation angle, TCOR, must also be specified. Figure 2-2(b) shows the TCOR variation with different line source orientations.

2.2.3 Receptor Inputs

The BLP model allows the user to either specify a grid of arbitrarily spaced receptor locations or select an option to automatically generate a rectangular grid of receptors, with the boundaries and receptor spacing determined by the user. The location and elevation of each receptor must be specified for arbitrarily located receptors. If the option to generate a rectangular grid is chosen, all receptor elevations are set equal to zero. Figure 2-3 illustrates this receptor generation option. In this example, a grid of 58 receptors, specified in SCS coordinates, are generated. The user must input the SCS coordinates of two points (X_B, Y_B) and (X_E, Y_E), along with the X and Y grid spacing, δX and δY . No receptors are allowed within the "line source rectangle," defined in Figure 2-3 by the dashed lines encompassing the four line sources. It should be noted that because the Pasquill-Gifford Gaussian dispersion parameter curves are defined only for distances greater than 100 meters, the receptor grid should be defined so that no receptor is located within 100 meters of a line or point source.

2.3 Gaussian Modeling Approach

The BLP model calculates ambient air concentrations due to emission from multiple buoyant line and point sources based on the well-known Gaussian plume equation. Adjustments for the effects of limited mixing, and optionally, pollutant decay, downwash, and terrain features are incorporated into the model. For line sources, the point source Gaussian plume equation is numerically integrated over the finite length of the line. The Gaussian dispersion equation and its application to point and line sources are discussed in this section.

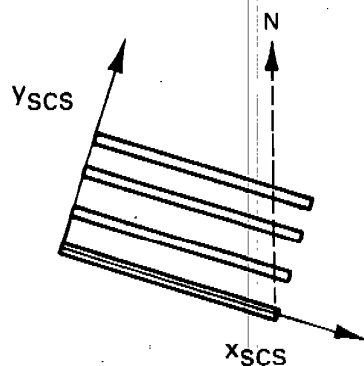


Figure 2-2(a) SCS Coordinate System

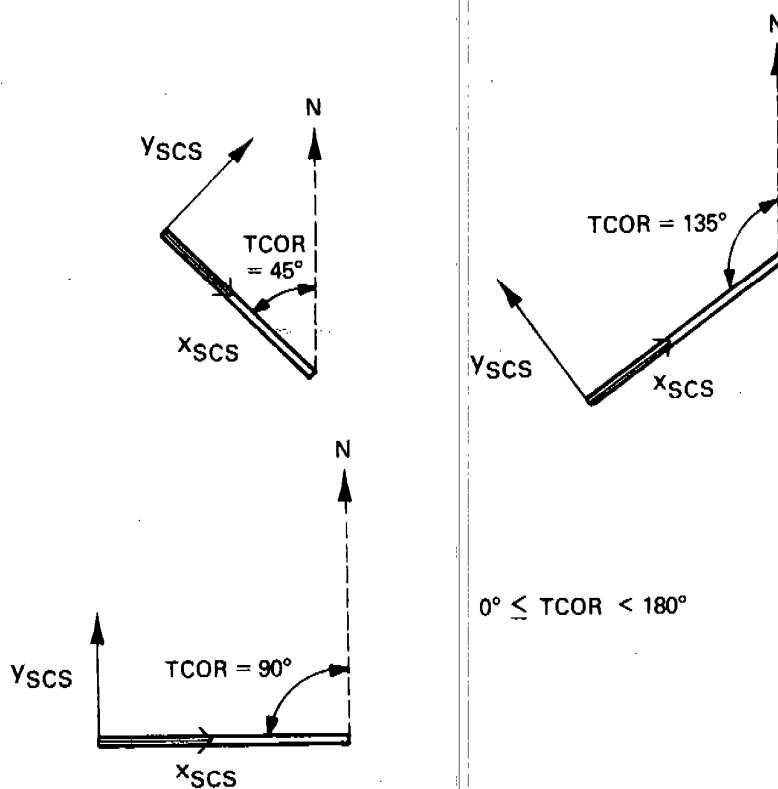


Figure 2-2(b) SCS Orientation Angle, TCOR

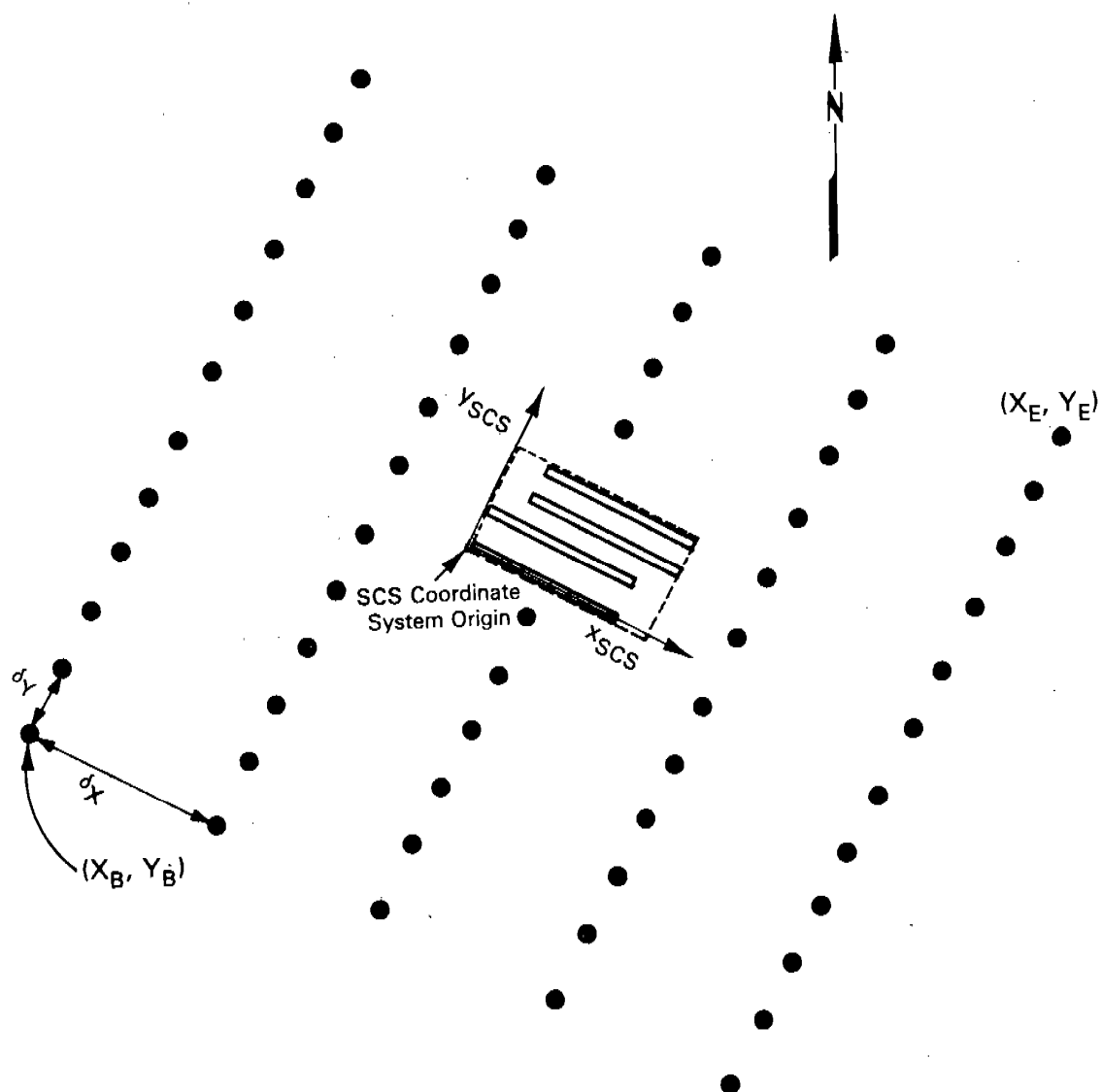


Figure 2-3 Receptor Generation Option

2.3.1 Gaussian Plume Equations for Point Sources

The basic Gaussian plume equation for the concentration, at a ground-level receptor is given by:

$$X = \frac{Q}{\pi \sigma_y \sigma_z U_s} \exp \left[-\frac{y^2}{2 \sigma_y^2} \right] \exp \left[-\frac{H^2}{2 \sigma_z^2} \right] \quad (2-2)$$

where

X is concentration (g/m^3)

y is crosswind distance (m)

Q is pollutant emission rate (g/s)

U_s is mean wind speed (m/s) at stack height

σ_y is crosswind standard deviation of the concentration distribution (m)

σ_z is vertical standard deviation of the concentration distribution (m)

H is effective stack height (m)

The empirical dispersion coefficients, σ_y and σ_z , used in the BLP model are piecewise fits to the stability and distance dependent curves in Turner (1970). The effective stack height, H , is the sum of the physical stack height, H_s , and the plume rise, Δh . The equations used to calculate the plume rise are described in Section 2.4. The mean wind speed used in Equation 2-2 is the stack height wind speed as calculated by the stability dependent power law wind speed profile equation (Equation 2-1).

In the neutral atmospheric boundary layer, the vertical diffusion of a plume is sometimes limited by a stably stratified inversion layer above the mixed layer. The plume is assumed to be reflected at this interface as well as at the ground. The method of image sources is used to model these reflections (Turner 1970). The Gaussian equation for a ground-level receptor, with multiple reflections is:

$$\chi = \frac{Q}{\pi \sigma_y \sigma_z U_s} \exp \left[\frac{-y^2}{2 \sigma_y^2} \right] \left\{ \sum_{n=-\infty}^{\infty} \exp \left[-\frac{1}{2} \left(\frac{H+2nD}{\sigma_z} \right)^2 \right] \right\} \quad (2-3)$$

where D is the height of the base of the inversion (mixing height).

Equation 2-3 is used only for PGT stability classes A-D. The multiple reflector terms, F_1 ,

$$F_1 = \sum_{N=-\infty}^{\infty} \exp \left[-\frac{1}{2} \left(\frac{H + 2nD}{\sigma_z} \right)^2 \right] \quad (2-4)$$

rapidly converge for small values of $T = (\sigma_z/D)^2$.

For large values of T, however, more terms of the summation are needed. To optimize the computational efficiency of evaluating the infinite series, it is possible to express the series in an equivalent form, which converges rapidly for large values of T, using a Fourier series:

$$F_1 = \frac{\sigma_z}{D} \left(\frac{\pi}{2} \right)^{1/2} \left[1 + \sum_{j=1}^{\infty} 2 \cos(j \pi h) \exp(-j^2 \pi^2 T/2) \right] \quad (2-5)$$

where $h = H/D$. Equation 2-4 converges quickly for small values of T and Equation 2-5 converges quickly for large T. For $T = T^* \approx 0.6$, both equations converge at about the same rate. For $T < T^*$, therefore, Equation 2-4 is used, and for $T > T^*$, Equation 2-5 is used. For these restricted values of T, only a few terms are needed to evaluate the series. Keeping a sufficient number of terms to obtain a high degree of accuracy (about eight decimal places), the equations for F_1 , become:

$$F_1 = \begin{cases} \exp \left[-h^2/(2T) \right] \left\{ 1 + \exp \left[-2(1-h)/T \right] + \exp \left[-2(1+h)/T \right] \right. \\ \quad \left. + \exp \left[-4(2-h) \right] + \exp \left[-4(2+h)/T \right] \right\} & T < 0.6 \\ \left(\frac{\sigma_z}{D} \right) \left(\frac{\pi}{2} \right)^{1/2} \left\{ 1 + 2 \cos(\pi h) \exp \left[-\pi^2 T/2 \right] \right. \\ \quad \left. + 2 \cos(2\pi h) \exp \left[-2\pi^2 T \right] \right\} & T \geq 0.6 \end{cases} \quad (2-6)$$

to optimize even further, it is possible to compute the exponential terms of Equation 2-6 by:

$$\exp(-a) = \begin{cases} 1-a & a < a_{\min} \\ \exp(-a) & a_{\min} \leq a \leq a_{\max} \\ 0 & a > a_{\max} \end{cases} \quad (2-7)$$

where $a_{\min} = 0.0512$ and $a_{\max} = 9.21$ will give an accurate estimate of the exponential to within about three decimal places.

As the ratio (σ_z/D) becomes larger, the vertical concentration distribution becomes more and more uniform. For values of (σ_z/D) greater than 1.6, the vertical distribution can be assumed to be uniform; Equation 2-8 is then used to calculate concentrations:

$$= \frac{Q}{\sqrt{2\pi} \sigma_y D u} \exp \left[\frac{-y^2}{2 \sigma_y^2} \right] \quad (2-8)$$

For stable conditions, or for very high mixing heights ($D > 5,000$ m), the multiple reflection terms can be ignored, and Equation 2-2 is used. For any stability condition, if the effective height of the plume, H , is greater than the mixed layer height, D , the ground-level concentration is assumed to be zero.

2.3.2 Point Source Building Downwash

Typically, aluminum reduction plants consist of rows of parallel line sources potrooms with point sources (scrubber stacks) located between the lines. In many cases, the scrubber stacks are not sufficiently tall to avoid building downwash. The BLP model, therefore, allows the effects of building downwash to be evaluated for sources within two building heights of the line sources. The point source downwash modeling is based upon an initial dilution of the plume, R_o , caused by the high entrainment rate associated with the building wake region. The initial plume dilution radius is used to calculate an enhanced initial vertical dispersion parameter, σ_{zo} , and possibly an enhanced horizontal dispersion parameter, σ_{yo} as well (depending upon the degree to which the plume downwashes). Dispersion coefficients are then increased using the method of virtual sources. At any downwind distance, X , the virtual distance, X_v , is added to the actual distance (i.e., X) in the computation of the distance dependent dispersion parameters, σ_y and σ_z . The initial virtual distance for σ_{yo} (i.e., $X_v(\sigma_{yo})$) is usually not equal to the virtual distance for σ_{zo} ($X_v(\sigma_{zo})$), so each is calculated independently. The effect of the initial plume dilution on reducing plume buoyancy is also included in the plume rise modeling (see Section 2.4.1.2).

If point source building downwash effects are not to be considered, the user must request this in the input data (see Section 3). The BLP model will otherwise determine which point sources are within the region of influence of the buildings (within two building heights of any line source). For those point sources, the following four step procedure is followed to evaluate building downwash effects.

- 1) Evaluate effective stack height due to momentum rise at a downwind distance of two building heights using Equations 2-9 to 2-13.

$$H_e \text{ (momentum)} = H_s + \Delta H_m \quad (2-9)$$

$$\Delta H_m = \left(\frac{3 F_m X}{\beta_m^2 U_s^2} \right)^{1/2} \quad (2-10)$$

$$X = 2H_B \quad (2-11)$$

$$F_m = \frac{T_a}{T_s} \frac{w_s^2 d^2}{4} \quad (2-12)$$

$$\beta_m = \frac{1}{3} + \frac{U_s}{w_s} \quad (2-13)$$

where

- β_m is momentum entrainment coefficient
- d is stack diameter (m)
- F_m is momentum flux (m^4/s^2)
- H_B is building height (m)
- H_e is effective stack height (m)
- ΔH_m is plume rise due to momentum (m)
- T_a is ambient air temperature ($^{\circ}K$)
- T_s is stack gas temperature ($^{\circ}K$)
- U_s is mean wind speed at stack height (m/s)
- w_s is stack gas exit velocity (m/s)
- X is downwind distance (m)

- 2) Determine initial dilution radii, R_{y0} and R_{z0} :

$$A = H_e/H_B \quad (2-14)$$

$$(a) \text{ if } A \geq 3.0, \quad R_{y0} = 0.0 \quad (2-15)$$

$$R_{z0} = 0.0$$

(no enhancement of σ_y or σ_z)

(b) if $1.2 < A < 3.0$,

$$\begin{aligned} R_{yo} &= 0.0 \\ R_{zo} &= (H_B/2) (3-A) \\ &\text{(only } \sigma_z \text{ is enhanced)} \end{aligned} \quad (2-16)$$

(c) if $A \leq 1.2$,

$$R_{yo} = (H_B/2) (6-5A) \quad (2-17)$$

$$R_{zo} = (H_B/2) (3-A) \quad \text{and } A = \text{maximum } (1.0, A)$$

(both σ_z and σ_y are enhanced).

3) From R_{yo} and R_{zo} , calculate σ_{yo} and σ_{zo} :

$$\begin{aligned} \sigma_{yo} &= \sqrt{\frac{2}{\pi}} R_{yo} \\ \sigma_{zo} &= \sqrt{\frac{2}{\pi}} R_{zo} \end{aligned} \quad (2-18)$$

4) Calculate virtual distances, $X_v (\sigma_{yo})$ and $X_v (\sigma_{zo})$:

$$X_v (\sigma_{yo}) = \left(\frac{\sigma_{yo}}{a_y} \right)^{b_y} \quad (2-19)$$

$$X_v (\sigma_{zo}) = \left(\frac{\sigma_{zo}}{a_z} \right)^{b_z} \quad (2-20)$$

where a_y , b_y , a_z , b_z are stability-dependent coefficients (see Tables 2-4, 2-5). The coefficients b_y and b_z are related to $\sigma_z = A_z X^{B_z}$ and $\sigma_y = A_y X^{B_y}$ by $b_z = 1/B_z$ and $b_y = 1/B_y$.

TABLE 2-4
COEFFICIENTS USED TO CALCULATE VIRTUAL DISTANCE, $X_v (\sigma_{y0})$

<u>PGT Stability Class</u>	<u>a_y</u>	<u>b_y</u>
A	213.0	1.1148
B	155.0	1.0970
C	103.0	1.0920
D	68.0	1.0760
E	50.0	1.0860
F	33.5	1.0830

TABLE 2-5
COEFFICIENTS USED TO CALCULATE VIRTUAL DISTANCE, $X_v (\sigma_{zo})$

PGT Stability Class	σ_{zo}	a_z	b_z
A	$0 < \sigma_{zo} \leq 13.95$	122.80	1.0585
	$13.95 < \sigma_{zo} \leq 21.40$	158.08	0.9486
	$21.40 < \sigma_{zo} \leq 29.30$	170.22	0.9147
	$29.30 < \sigma_{zo} \leq 37.67$	179.52	0.8879
	$37.67 < \sigma_{zo} \leq 47.44$	217.41	0.7909
	$47.44 < \sigma_{zo} \leq 71.16$	258.89	0.7095
	$71.16 < \sigma_{zo} \leq 104.65$	346.75	0.5786
	$104.65 < \sigma_{zo}$	453.85	0.4725
B	$0 < \sigma_{zo} \leq 20.23$	90.673	1.0730
	$20.23 < \sigma_{zo} \leq 40.00$	98.483	1.0170
	$40.00 < \sigma_{zo}$	109.300	0.9115
C	$0 < \sigma_{zo}$	61.141	1.0933
D	$0 < \sigma_{zo} \leq 12.09$	34.459	1.1498
	$12.09 < \sigma_{zo} \leq 32.09$	32.093	1.2336
	$32.09 < \sigma_{zo} \leq 65.12$	32.093	1.5527
	$65.12 < \sigma_{zo} \leq 134.90$	33.504	1.6533
	$134.90 < \sigma_{zo} \leq 251.20$	36.650	1.7671
	$251.20 < \sigma_{zo}$	44.053	1.9539
E	$0 < \sigma_{zo} \leq 3.534$	24.260	1.1953
	$3.534 < \sigma_{zo} \leq 8.698$	23.331	1.2202
	$8.698 < \sigma_{zo} \leq 21.628$	21.628	1.3217
	$21.628 < \sigma_{zo} \leq 33.489$	21.628	1.5854
	$33.489 < \sigma_{zo} \leq 49.767$	22.534	1.7497
	$49.767 < \sigma_{zo} \leq 79.070$	24.703	1.9791
	$79.070 < \sigma_{zo} \leq 109.300$	26.970	2.1407
	$109.300 < \sigma_{zo} \leq 141.860$	35.420	2.6585
	$141.860 < \sigma_{zo}$	47.618	3.3793
F	$0 < \sigma_{zo} \leq 4.093$	15.209	1.2261
	$4.093 < \sigma_{zo} \leq 10.930$	14.457	1.2754
	$10.930 < \sigma_{zo} \leq 13.953$	13.953	1.4606
	$13.953 < \sigma_{zo} \leq 21.627$	13.953	1.5816
	$21.627 < \sigma_{zo} \leq 26.976$	14.823	1.8348
	$26.976 < \sigma_{zo} \leq 40.000$	16.187	2.1510
	$40.000 < \sigma_{zo} \leq 54.890$	17.836	2.4092
	$54.890 < \sigma_{zo} \leq 68.840$	22.651	3.0599
	$68.840 < \sigma_{zo} \leq 83.250$	27.074	3.6448
	$83.250 < \sigma_{zo}$	34.219	4.6049

The point source building downwash model presented above is appropriate only for squat buildings (aluminum reduction plant potlines are always long squat buildings). The height of the plume centerline based on only the momentum plume rise, as suggested by Huber and Snyder (1976), is used to determine if building downwash effects are important. If the ratio of effective stack height to building height, A , is greater than 3, the plume is assumed not to downwash; otherwise, σ_z is enhanced. If A is less than 1.2, σ_y is enhanced as well. The maximum σ_y and σ_z enhancement is:

$$\sigma_{zo} \text{ (maximum)} = 0.80 H_B \quad (2-21)$$

$$\sigma_{yo} \text{ (maximum)} = 0.40 H_B \quad (2-22)$$

$$\text{at } A = H_e/H_B = 1.0.$$

For values of A between 1.0 and 3.0, σ_{zo} is linearly interpolated between $0.80 H_B$ and zero; σ_{yo} is similarly interpolated between H_B and zero for values of A between 1.0 and 1.2 (personnel communication, Huber 1980). The initial dilution radius, R_{zo} (step 2) is also used in the plume rise calculations (see Section 3).

2.3.3 Decay Mechanism

The BLP model simulates pollutant decay mechanisms with a constant pollutant decay rate, κ . At any receptor i , the travel time from source, j , to the receptor, τ_{ij} , is calculated assuming a constant transport wind $(U_s)_j$.

$$\tau_{ij} = \frac{X_{ij}}{(U_s)_j} \quad (2-23)$$

where X_{ij} is the downwind distance from source j to receptor i . The new source contribution, x'_{ij} , is:

$$X'_{ij} = (1 - \tau_{ij} \kappa) X_{ij} \quad (2-24)$$

where X_{ij} is the source contribution predicted with the Gaussian equation assuming no decay. For example, if the decay rate is 10% per hour,

$$\kappa = \frac{0.10}{\text{hr}} \cdot \frac{1}{3600 \text{ s/hr}} = 2.78 \times 10^{-5} \text{ s}^{-1}$$

if $\tau_{ij} = 0.5 \text{ hr} = 1800 \text{ sec}$,

$$X'_{ij} = 0.95 X_{ij}.$$

The BLP model also allows the user to specify a constant background concentration which is not subject to decay.

2.3.4 Terrain Correction

The effects of terrain elevation on the height of the plume centerline are calculated using stability-dependent plume path coefficients. Table 2-6 contains the default values for the plume path coefficients in the BLP model. For neutral and unstable conditions with the default plume path coefficients, the plume is lifted one-half of the difference between the elevation of the receptor and the elevation of the stack base, with the additional restriction that the plume always be at least half the height above the ground that it would be with no topography. With stable conditions, the default plume path coefficient is 0.3, indicating the plume is lifted only about one-third of the difference between receptor elevation and stack elevation and is restricted to be at least one-third the height above the ground that it would be with no topography. The plume path coefficients can be changed by the user, however, to simulate a constant elevation plume (as with the CRSTER model) by setting the plume path coefficients equal to zero.

TABLE 2-6
DEFAULT VALUES FOR THE PLUME PATH COEFFICIENT

<u>PGT Stability Class</u>	<u>Plume Path Coefficient, T</u>
A	0.5
B	0.5
C	0.5
D	0.5
E	0.3
F	0.3

The terrain adjusted plume centerline height is calculated with Equations 2-25 to 2-26.

$$h_c = (1-T) (\text{minimum } \{h_s + \Delta h, E_R - E_p\}) \quad (2-25)$$

$$H = H_o - h_c \quad (2-26)$$

where

E_R is receptor elevation

E_p is stack base elevation

h_c is plume height correction factor

Δh is plume rise

H is terrain corrected effective stack height

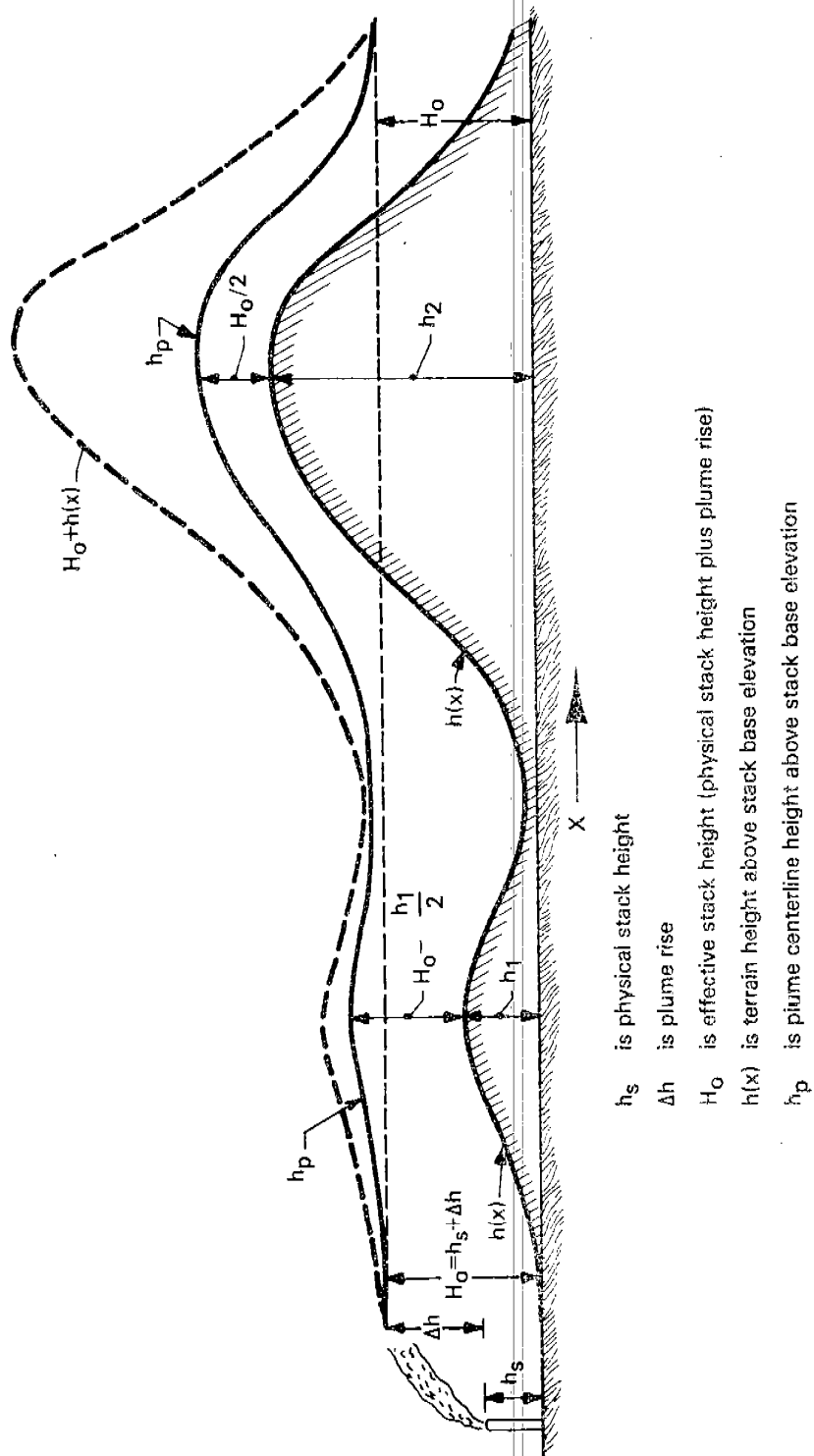
H_o is effective stack height above stack base elevation

T is plume path coefficient

The plume height adjustment is illustrated in Figure 2-4 for $T = 0.5$.

2.3.5 Plume Width Considerations

To eliminate unnecessary computations, the BLP model calculates concentrations only at downwind receptors within $4\sigma_y$ of the plume centerline. Defining the plume edge to be $4\sigma_y$ from the plume centerline allows virtually all of the source contributions to be evaluated. For a plume with a Gaussian distribution, the concentration at a crosswind distance $4\sigma_y$ from the plume centerline is three hundredths of one percent (0.0003) of the centerline concentration. Figure 2-5 illustrates the plume width-receptor location considerations in calculating concentrations. Concentrations are calculated only for the receptors within the shaded area; the source contribution for any of the other receptors is assumed to be zero.

Figure 2-4 Terrain Plume Height Adjustment (for $T = 0.5$)

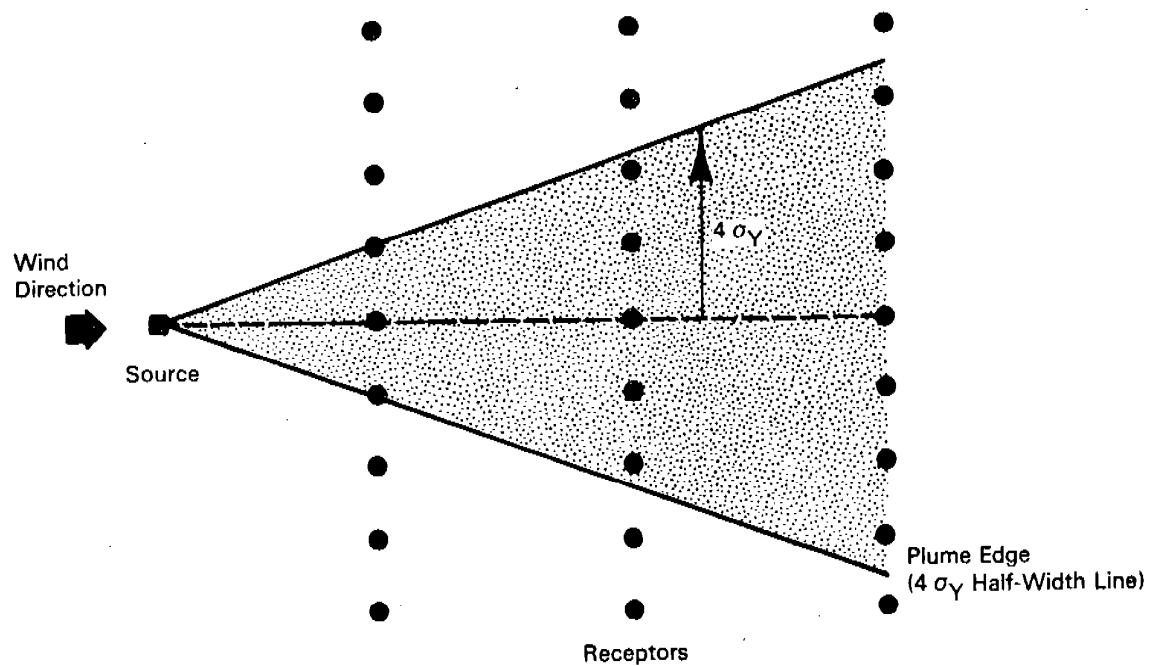


Figure 2-5 Point Source Plume Width - Receptor Location Considerations

2.3.6 Gaussian Plume Equation for Line Sources

To calculate concentrations due to line source emissions, the BLP model numerically integrates the Gaussian point source equation over the finite extent of the line.

The integral of the Gaussian plume equation can be written as:

$$\chi = \frac{(q_l)}{U} \int_0^L g \, dl \quad (2-27)$$

where

q_l is emission rate per unit length of the line, $g \, s^{-1} \, m^{-1}$

L is line length, m

g is dispersion function, m^{-2}

The dispersion function, g , consists of the lateral and vertical dispersion terms of the Gaussian point source equation (see Equation 2-2 to 2-8). For stable conditions, or if the mixing height is greater than 5,000 m,

$$g = \frac{1}{\pi \sigma_y \sigma_z} \exp \left[\frac{-y^2}{2 \sigma_y^2} \right] \exp \left[\frac{-H^2}{2 \sigma_z^2} \right] \quad (2-28)$$

For unstable or neutral conditions,

$$g = \frac{1}{\pi \sigma_y \sigma_z} \exp \left[\frac{-y^2}{2 \sigma_y^2} \right] F_1 \quad (2-29)$$

(the function F_1 is given in Equation 2-6),

unless the ratio σ_z/D is greater than 1.6,

$$g = \frac{1}{\sqrt{2\pi}\sigma_y D} \exp\left[\frac{-y^2}{2\sigma_y^2}\right] \quad (2-30)$$

The effective plume height is determined with the line source plume rise equation in Section 2.4.2.

Using the trapezoidal rule to approximate the integral in Equation 2-27, the equation becomes:

$$X = \frac{q_L \Delta L}{U} \left[\frac{1}{2} (g_0 + g_N) + \sum_{i=1}^{N-1} g_i \right] \quad (2-31)$$

where

N is number of points used to approximate the line

ΔL is L/N

The number of points (or line segments) needed for Equation 2-31 to give a good estimate of the integral depends on atmospheric stability, line length, and the line segment-receptor distance. For each receptor, therefore, Equation 2-31 is initially solved with $N = 3$ and then $N = 5$. The value of N increases with each iteration (see Table 2-7) until all of the following criteria are satisfied:

- 1) at least one point (line segment) is within one σ_y of the receptor;
- 2) at least two line segments contribute to the concentration at the receptor (i.e., two line segments are within $4\sigma_y$ of the receptor);
- 3) two successive iterations yield X estimates which differ by less than a user's input convergence criterion (default value is 2%) OR the difference between two successive estimates is less than $0.1 \mu\text{g}/\text{m}^3$.

TABLE 2-7
ITERATIVE INTEGRATION OF THE GAUSSIAN PLUME
EQUATION FOR LINE SOURCES

<u>Number of Line Segments</u>	<u>Number of New Line Segments</u>	<u>Iteration</u>
3	-	1
5	2	2
9	4	3
17	8	4
33	16	5
65	32	6
129	64	7

A minimum of two iterations is always required, that is, the line will be divided into at least five points (line segments). The first criterion is not applied if the receptor is not directly downwind of the line source because the crosswind distance to the nearest part of the line may be greater than σ_y . The concentration at each receptor is obtained by breaking the line source into as many segments as is necessary to satisfy the criteria above. All receptors upwind of the line source, or outside the $4\sigma_y$ plume width are assigned concentration contributions of zero. Receptors 1, 6, and 7 in Figure 2-6 are in this category. The concentration at Receptor 2, which is not directly downwind of any part of the line, but is within the line source plume, is determined by applying Equation 2-31 through as many iterations as is required to satisfy criteria 2 and 3. The first criterion is waived because the receptor is not directly downwind of the line source. The iteration procedure at Receptors 3, 4, and 5 must satisfy all the criteria.

All dispersion calculations are done in a "relative (RCS) coordinate system." The RCS X-axis is aligned parallel to the wind direction; the RCS Y-axis is perpendicular to the wind direction. This allows the downwind and crosswind distances needed in the Gaussian plume equation to be computed as a difference of two numbers. The RCS coordinates of each possible line segment (up to 129 segments per line), point source, and receptor are calculated once per simulated hour. Thus, even if the line source calculations require many iterations at each receptor, the predetermined line segments with the line segment-receptor geometry already calculated are utilized at each receptor. This allows the concentrations at many receptors to be calculated efficiently.

In some cases, seven iterations of the line source calculations may still be insufficient to allow convergence of the integral. This may be due to the following circumstances:

- a receptor is located very close to the line source or
- the line source is very long (such that $L/128$ is $\geq \sigma_y$ at the receptor).

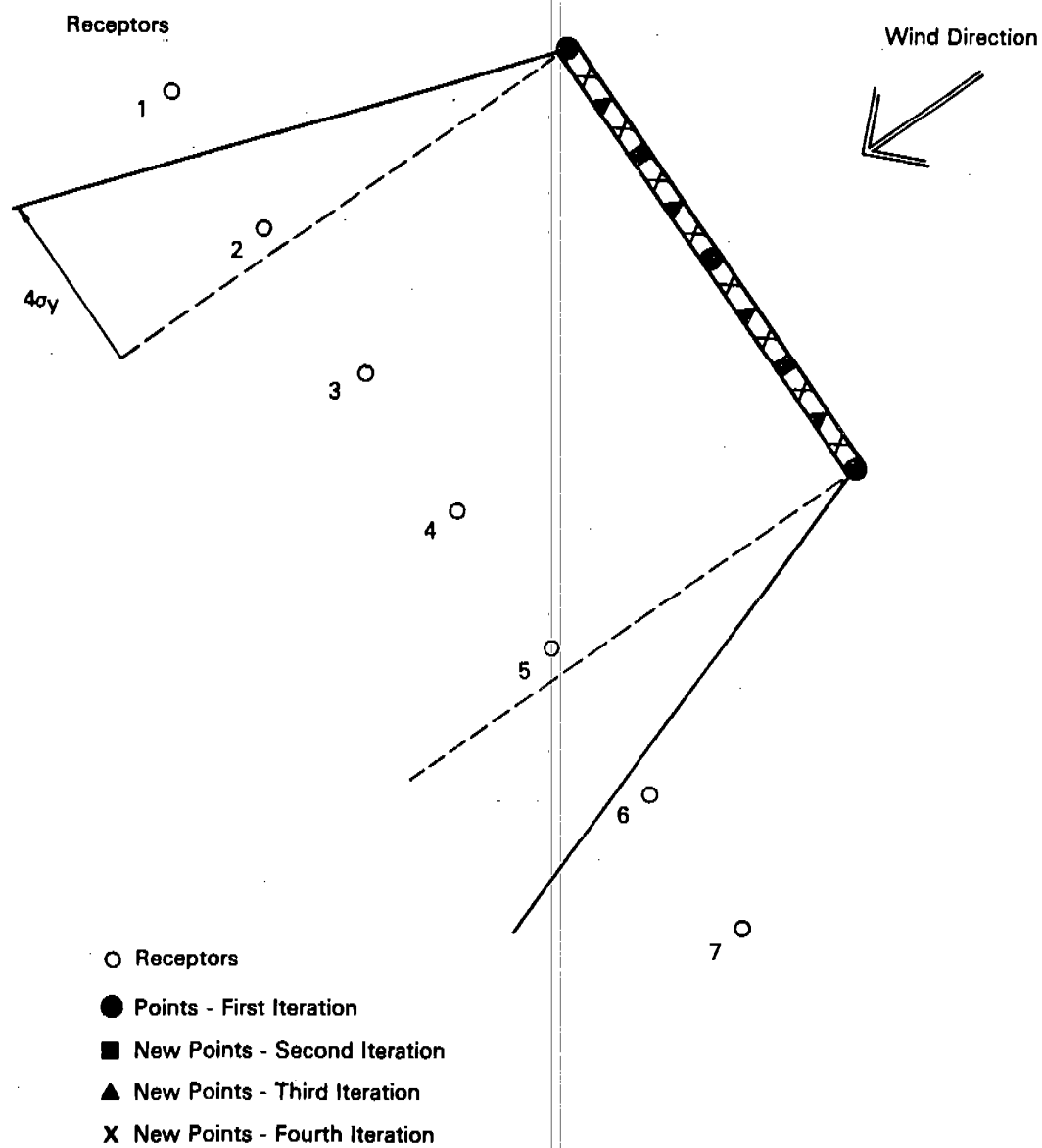


Figure 2-6 Line Source Plume Width - Receptor Location Considerations

The BLP model will continue to iterate a special high resolution algorithm until convergence is achieved or up to a user specified iteration maximum (default value = 14 iterations). With each iteration over seven, new line segments are generated, but only over the portion of the line source contributing to the concentration at the receptor of interest. If the iteration maximum is reached without convergence, execution will continue using the latest X value generated. Execution will terminate, however, if the iteration maximum is exceeded more than 100 times and an error message indicating this has occurred will be printed. It should be noted that under most conditions, the execution of this high resolution loop will not be required for proper convergence of the integral--only when a receptor is located very close to the line source (and σ_y values at the receptor are $\leq \Delta x$) will it be necessary. Anyway, receptors should not be located within 100 meters of a source because the PGT dispersion curves are defined only for downwind distances greater than 100 meters.

2.4 Plume Rise

Plume rise from tall, buoyant point sources has been extensively studied and is well represented by the equations of Briggs (1969, 1970, 1975). Plume rise from low-level sources, however, can be affected by vertical wind shear and downwash. These effects are generally not important for taller stacks and are not treated by the Briggs equations. The BLP model uses a set of plume rise equations developed to incorporate the effects of vertical wind shear and downwash on plume rise. These equations are consistent with and reduce to the Briggs point source plume rise equations when there is no vertical wind shear or downwash.

Observational studies of rows of point sources (e.g., Briggs 1974) and wind tunnel studies of line sources (Hoydysh et al. 1975, 1979) indicate that the plume rise from closely spaced point sources or line sources is substantially different than that from an isolated point source. Plumes from line sources tend to rise higher when the wind is aligned along the long axis of the line source than when the

wind is perpendicular to the line. Also, line source plumes exhibit dependencies on the buoyancy, mean wind speed, and distance different from those of a point source plume. Multiple rows of closely spaced line sources (the typical configuration of aluminum reduction plant line sources) can result in significant plume rise enhancement over that of an isolated line source plume. Roof-level line source releases, however, are susceptible to building downwash, which tends to reduce plume rise. Also, vertical wind shear is often important for these low-level sources. The plume rise relationships used in the study of tall, isolated point sources are not adequate to represent these complex low-level line sources.

A new set of line source plume rise equations has been developed for the BLP model. These equations incorporate the following important effects: multiple-line plume rise enhancement, plume rise wind direction dependence, vertical wind shear, and building downwash. In the limit as the line length approaches zero, the line source plume rise equations reduce to the point source equations; if wind shear and downwash effects are neglected, the line source plume rise equations will reduce to the Briggs point source plume rise equations.

2.4.1 Point Source Plume Rise

Many of the point source emissions from complex industrial facilities, such as aluminum reduction plants, are released in the lowest layer of the atmosphere. These low-level plumes may be subjected to the effects of building downwash and vertical wind shear. Plume rise equations separately incorporating both these effects are presented in Section 2.4.1.1 and 2.4.1.2. Because both shear and downwash may be important in reducing plume rise, the BLP model will use the minimum of the shear plume rise and the downwash plume rise prediction if both the shear and downwash options are chosen.

2.4.1.1 Point Source Plume Rise with Vertical Wind Shear

The power law wind speed profile (Equation 2-1) can be rewritten in terms of a vertical coordinate system with the origin at stack top:

$$U_z = U_s \left[(Z' + Z_s) / Z_s \right]^P \quad (2-32)$$

where

Z_s is stack height

Z' is $Z - Z_s$

The wind speed at stack height U_s can be determined from the measured wind speed with Equation 2-1. For short stacks, a good approximation of Equation 2-32 is:

$$U_s \approx U_s (Z' / Z_s)^P \quad (2-33)$$

Integrating the entrainment equation and conservation equations described by Briggs (1970) for a bent-over plume and using the approximate vertical wind speed equation, it is possible to arrive at the following analytic solution for the neutral and unstable plume rise, Z' :

$$Z' = \left\{ \frac{\epsilon^2}{2(3+P)} \left(\frac{F Z_s^{3P}}{\beta^2 U_s^3} \right) \right\}^{1/\epsilon} (X')^{2/\epsilon} \quad (2-34)$$

$$\epsilon = 3 + 3P \quad (2-35)$$

$$F = \frac{g w d^2}{4} \frac{(T_s - T_a)}{T_s} \quad (2-36)$$

$$X' = \begin{cases} X & X \leq 3.5 X^* \\ 3.5 X^* & X > 3.5 X^* \end{cases} \quad (2-37)$$

$$X^* = \begin{cases} 14 F^{5/8} & F \leq 55 \text{ m}^4/\text{s}^3 \\ C_3 F^{2/5} & F > 55 \text{ m}^4/\text{s}^3 \end{cases} \quad (2-38)$$

where

- C_3 is a constant (default value 34.49)
- β is entrainment parameter (0.6)
- F is buoyancy flux (m^4/s^3)
- g is acceleration due to gravity (9.8 m/s^2)
- w is stack gas exit velocity (m/s)
- T_a is ambient air temperature ($^\circ\text{K}$)
- T_s is stack gas temperature ($^\circ\text{K}$)
- d is stack inner diameter (m)

With $P = 0$ (i.e., constant wind speed with height), the shear plume rise equation reduces to the Briggs expression:

$$Z'_B = \left(\frac{3F}{2\beta^2 U_s^3} \right)^{1/3} X^{2/3} \quad (2-39)$$

where Z'_B is the Briggs plume rise.

Because the approximate form of the power law wind speed profile equation becomes invalid for $Z'/Z_s \lesssim 1$, the following restriction must be imposed:

$$Z' = \text{minimum} \{ Z', Z'_B \} \quad (2-40)$$

For neutral and unstable conditions, terminal plume rise is reached at a downwind distance of $3.5 X^*$ (Briggs 1970). The constant, C_3 , in Equation 2-38 has a default value of 34.49 in the BLP model instead of 34.0 (which is assumed in some models) to allow a matching of the two equation for X^* at $F = 55 \text{ m}^4/\text{s}^3$.

Transitional plume rise is an option in the BLP model; if desired, only final plume rise will be calculated.

For stable atmosphere conditions (PGT stability classes E and F), a similar analysis will yield the following plume rise equation for final rise with vertical wind shear:

$$Z' \text{ (final)} = \left\{ \frac{2(3+P)Z_s^P F}{\beta^2 U_s s} \right\}^{1/(3+P)} \quad (2-41)$$

$$s = \frac{g}{T_a} \frac{\partial \theta}{\partial Z}$$

where

$\frac{\partial \theta}{\partial Z}$ is the vertical potential temperature gradient ($^{\circ}\text{K/m}$) and

s is a stability parameter.

If there is no vertical wind shear ($P = 0$), Equation 2-41 reduces to the Briggs stable point source plume rise equation for final rise:

$$Z'_B \text{ (final)} = \left\{ \frac{6F}{\beta^2 U_s s} \right\}^{1/3} \quad (2-42)$$

Transitional plume rise (i.e., $Z' < Z' \text{ (final)}$) as defined by Equation 2-41) is calculated with Equation 2-34 for stable conditions.

2.4.1.2 Point Source Plume Rise with Building Downwash

If an emission source is located in the vicinity of a building, the plume may experience greatly enhanced dispersion in the wake region of the building. The intense turbulence in the building wake region causes the enhanced dispersion and a rapid decrease in the buoyancy of the plume, which will decrease the rise of the plume. As pointed out by Huber and Snyder (1976), however, the turbulence rapidly decays downwind of the building; in the far wake, plume dispersion is determined by the background atmospheric turbulence. In the calculation of plume rise, the initially large entrainment of

ambient air into the plume can be represented with an initial "downwash" plume radius, R_o . Thus, the plume buoyancy is immediately decreased, but the subsequent entrainment rate is not modified.

The initial plume dilution is a function of the degree to which the plume downwashes. The downwash dilution radius, R_o , is assumed equal to R_{zo} , used in dispersion coefficient calculation (Equation 2-9 to 2-17). Once R_o is determined, the plume rise including downwash effects, Z'_D , is calculated by the following equation:

$$(Z'_D)^3 + \frac{3R_o}{\beta} (Z'_D)^2 + \frac{3R_o^2}{\beta^2} Z'_D = \frac{3F X'^2}{2\beta^2 U_s^3} \quad (2-43)$$

This cubic equation is relatively easy to solve for Z'_D by standard mathematical techniques (see subroutine CUBIC).

With stable atmospheric conditions, the maximum stable plume rise is given by:

$$(Z'_D)^3 + \frac{3R_o}{\beta} (Z'_D)^2 + \frac{3R_o^2}{\beta^2} Z'_D = \frac{6F}{\beta^2 U_s^3} \quad (2-44)$$

Transitional plume rise for stable conditions is calculated with Equation 2-43. Both Equations 2-43 and 2-44 reduce to the Briggs point source plume rise equations when the downwash radius, R_o , approaches zero.

If both the building downwash and vertical wind shear options have been requested in a BLP run, the plume rise used is the minimum of that given by the shear and downwash plume rise formulations. As

noted by Briggs (1970), the stable vertical plume formulation of Morton, Taylor, and Turner (Equation 2-45) is more appropriate than the bent-over plume rise equation with very light winds.

$$Z' \text{ (maximum)} = \frac{5 F^{1/4}}{s^{3/8}} \quad (2-45)$$

Equation 2-45 is used if it yields a lower plume rise estimate than Equation 2-44.

2.4.2 Line Source Plume Rise

The plume from a buoyant line source can be expected to show different behavior than that from an isolated point source. The proximity of adjacent plume elements of a line source plume tends to block entrainment of ambient air. The initial buoyancy, however, is spread over the length of the line instead of being concentrated at one point. Also, the "effective" line length of a line source depends on the wind direction relative to the line, leading to a wind direction dependence of the plume rise. The line source emissions, such as those from aluminum reduction facility potrooms, may experience building downwash. Finally, multiple rows of closely spaced line sources tend to enhance the plume rise. These considerations indicate that a point source plume rise equation is not adequate to represent the plume rise behavior of a line source plume, especially for aluminum reduction facilities where all these factors are important.

2.4.2.1 Line Source Plume Rise with Vertical Wind Shear

The plume rise of a rectangular plume from a finite line source of length L in a neutral atmosphere is:

$$Z' = \left(\frac{F'}{2 \beta L U_s^3} \right)^{1/2} X' \quad (2-46)$$

$$F' = \frac{g L W_m w (T_s - T_a)}{T_s} \quad (2-47)$$

where

F' is the average line source buoyancy parameter (m^4/s^3)

g is the acceleration of gravity ($9.81 m/s^2$)

L is the line source length (m)

W_m is the line source width (m)

w is the exit velocity (m/s)

T_s is the exit temperature ($^{\circ}K$)

T_a is the ambient air temperature ($^{\circ}K$)

(Note: For multiple line sources of comparable buoyancy flux, the buoyancy parameter is calculated for each line source and then averaged to obtain F' .)

Equation 2-46 neglects horizontal entrainment of ambient air at the edges of the plume (i.e., the plume width remains to be L , but the plume's vertical dimension grows). The linear X dependence of the line (versus $X^{2/3}$ for a point source) reflects the decreased ability of the plume to entrain ambient air.

Integrating the rectangular plume equation and analytically incorporating vertical wind speed variation with the approximate power law relationship, Equation 2-33, the following solution is obtained:

$$Z' = \left\{ \left(\frac{\epsilon_L}{2} \right)^2 \left(\frac{F' Z_s^{3P}}{(2+P) \beta L U_s^3} \right) \right\}^{1/\epsilon_L} X^{2/\epsilon_L} \quad (2-48)$$

where ϵ_L is $2 + 3P$.

With $P = 0$, Equation 2-48 reduces to the line source plume rise without wind shear, Equation 2-44. It is assumed that the distance of final plume rise for PGT stability classes A through D can be obtained with the point source expressions, Equation 2-37 and 2-38, with $F = F'/\pi$.

In the BLP model, the effect of the wind speed variation with height on line source plume rise is estimated by using an "effective" wind speed, U_e , in the generalized line source plume rise equations in Section 2.4.2.2 rather than the stack height wind speed, U_s . (The equations in Section 2.4.2.2 include building downwash, plume rise enhancement, and wind direction dependencies, but do not implicitly incorporate wind shear effects. Wind shear effects which are included in Equation 2-48 are explicitly included in the generalized line source equations by using the "effective" wind speed (which is always greater than or equal to the stack height wind speed) in these equations.) The effective wind speed, U_e , is calculated by matching Equations 2-46 and 2-48 at the final rise distance, X_F . This matching procedure consists of (1) calculating Z' (shear) at $X = X_F$ with Equation 2-48 and (2) solving Equation 2-46 for wind speed using $Z' = Z'$ (shear) and $X = X_F$. This effective wind speed is then used in the generalized line source plume rise equations. Stack height wind speed, however, is used in the Gaussian dispersion equation.

For stable atmospheric conditions, the rectangular plume rise equation (without wind shear) is:

$$Z' = \left(\frac{F'}{\beta L U_s s} \right)^{1/2} \left\{ 1 - \cos \frac{\sqrt{s} X}{U_s} \right\}^{1/2} \quad (2-49)$$

Final rise is reached at a distance $X = \frac{U_s \pi}{\sqrt{s}}$,

so the final plume rise is:

$$Z' \text{ (final)} = \left(\frac{2 F'}{\beta L U_s s} \right)^{1/2} \quad (2-50)$$

The appropriate stable rectangular plume equation including vertical wind shear is:

$$Z' \text{ (final)} = \left(\frac{(2+P) Z_s^P F'}{\beta L U_s s} \right)^{\frac{1}{2+P}} \quad (2-51)$$

The effective wind speed is calculated by matching Equation 2-50 and 2-51 subject to the constraint $U_e = \text{minimum}(U_e, U_s)$.

2.4.2.2 Line Source Plume Rise with Downwash and Wind Direction Dependence

Although a linear distance dependence of plume rise from a buoyant line source is reasonable in the near field with perpendicular winds, it would be expected that the plume would eventually approach an $X^{2/3}$ point source dependence as the plume height approaches and exceeds the line length. Figure 2-7 illustrates a rectangular (line source) plume with half-circular (entrained) edges. This edge entrainment is relatively unimportant in the near field, but grows in importance with distance (and plume height). Figure 2-8 illustrates the increasing importance of the entrained edges of the initially rectangular plume. In the near field, the plume height, Z' , is small, and because $R = \beta Z' = 0.6 Z'$, the half-circular plume edges compose a relatively small portion of the plume's cross-sectional area (see Figures 2-8a and b). With increasing distance, however, Z' and therefore R become larger; the ratio R/L increases (see Figure 2-8c, d, e) until eventually the plume cross section begins to look more and more circular. For a short line source or for winds parallel to the line source, the effective length of the line source is small. The ratio R/L may be large even in the near field (Figure 2-8d and e). It is apparent that as the line source length approaches zero, the plume cross section becomes circular (as with a point source). In fact, the line source plume can be visualized as being composed of circular cross-sectional plumes originating from an infinite number of point

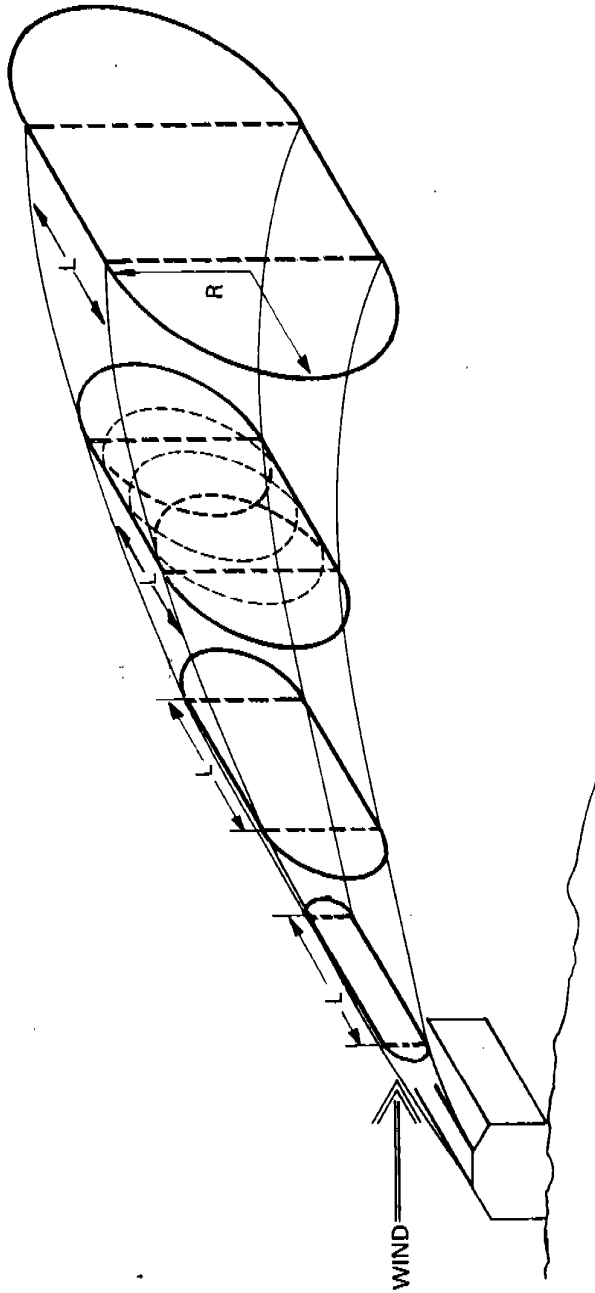


Figure 2-7 Rectangular (Line Source) Plume Rise Half-Circular (Entrained) Edges

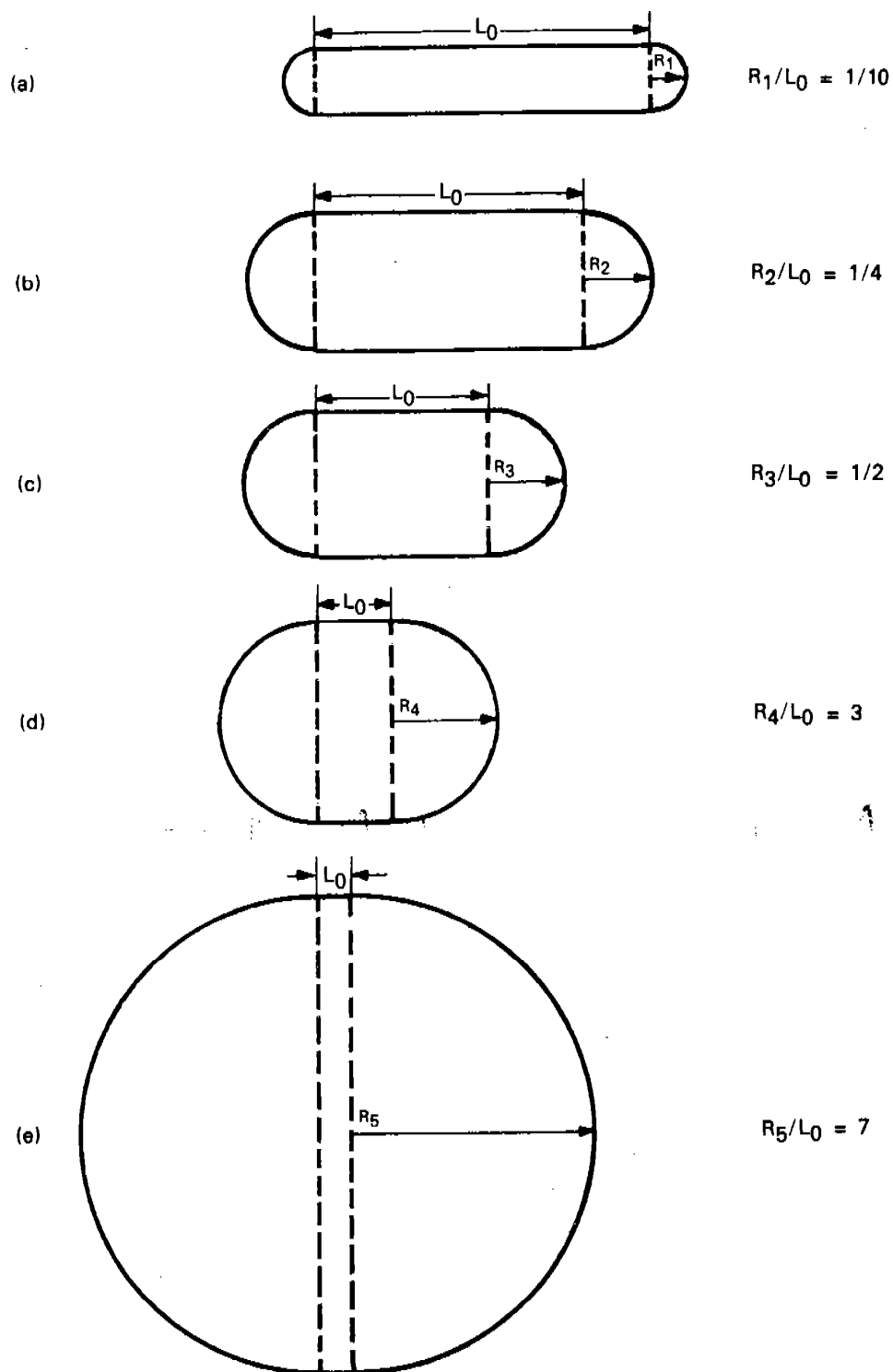


Figure 2-8 Cross Section of Line Source Plume at Various Distances Downwind

sources along the length of the line source (see Figures 2-7 and 2-9). This formulation for the line source plume will result in the approach to the $X^{2/3}$ dependency at large X . The solution of the neutral line source plume rise equation with entrainment at the edges of the plume is:

$$(Z'_L)^3 + \frac{3L}{\pi\beta} (Z'_L)^2 = \frac{3 F' X^2}{2 \pi \beta^2 U_e^3} \quad (2-52)$$

where Z'_L is the line source plume rise and U_e is the effective wind speed (see Section 2.4.2.1). With $L = 0$, Equation 2-52 reduces to the Briggs point source equation. The line source buoyancy parameter, F' , divided by π is the point source buoyancy flux, F , defined by Equation 2-36. If the edge effects are neglected [$(Z'_L)^3$ term ≈ 0], the linear X dependence is obtained. Designating the first term of Equation 2-52 as the point source term (because it is responsible for the $X^{2/3}$ component of the equation) and the second term as the line source term (because it is responsible for the X component), it can be seen that the line source term initially dominates the equation, but gradually (depending on L , F' , and U_e) the point source term will become increasingly important.

Observational and wind tunnel studies indicate that the line source plume rise equation should contain a wind direction dependence. For winds aligned parallel to the long axis of a line source, consider the path of a plume element originating from the upwind end of the line source. As the plume element rises and travels along the length of the line, it merges with other buoyant elements. At the downwind edge of the line source, the input of buoyant plume elements stops. Figure 2-9 is a cross section of the plume at the downwind edge of the line source. The plume elements originating from the most upwind section of the line source have risen substantially more than the plume elements near the downwind edge of the line source. The integration of the Gaussian plume equation over the length of the line source consists of breaking the line source into a number of points or line segments; this approach allows different

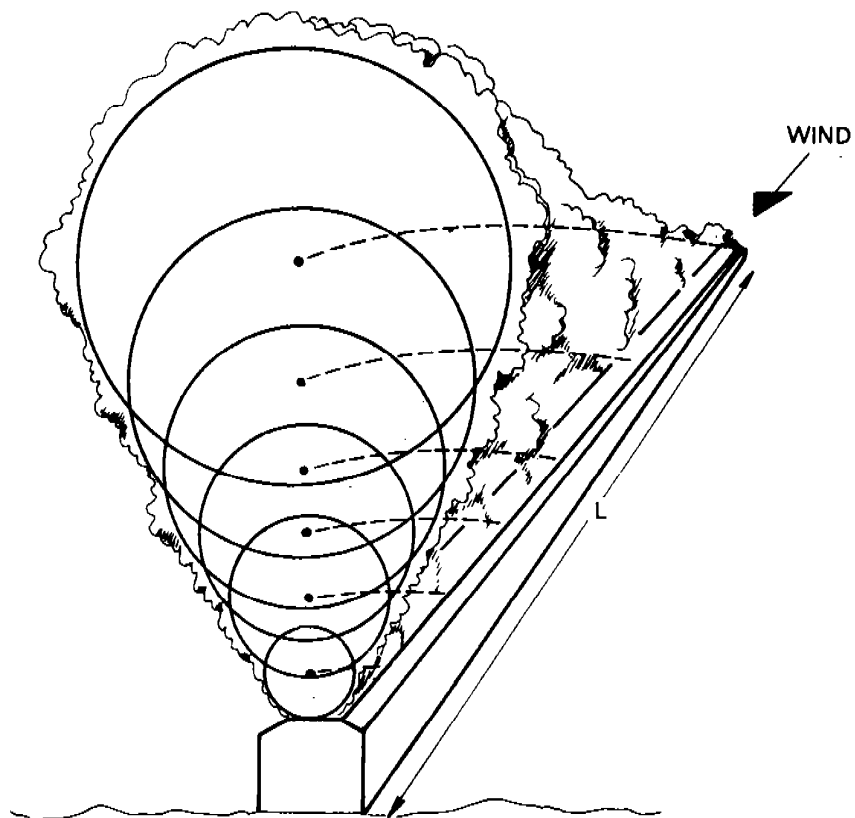


Figure 2-9 Cross Section of Line Source at $X = X_{PB}$ with Parallel Winds

plume elements to have different effective stack heights. If a linear variation in F' along the line is assumed, the value of the buoyancy parameter at any downwind distance, X , is given by:

$$F'(X) = \begin{cases} F' \left(\frac{X}{X_{FB}} \right) & X < X_{FB} \\ F' & X \geq X_{FB} \end{cases} \quad (2-53)$$

where X_{FB} is the distance of the release of the last buoyant plume element ($X_{FB} = L$ for parallel winds and $X_{FB} = 0$ for perpendicular winds), and F' is the buoyancy parameter for the entire line source, as given by Equation 2-47. Equation 2-52, now predicting the height of the plume element originating from the most upwind end of the line source, becomes:

$$(Z'_L)^3 + \left(\frac{3L_e}{\pi B} \right) (Z'_L)^2 = \begin{cases} \frac{F' X^3}{2\pi B^2 X_{FB} U_e^3} & X < X_{FB} \\ \frac{3F'}{2\pi B^2 U_e^3} \left[\frac{X_{FB}^2}{3} + X^2 - X_{FB} X \right] & X \geq X_{FB} \end{cases} \quad (2-54)$$

where the effective line length, L_e , replaces L .

For a single line source,

$$L_e = |L \sin \theta| + W_m |\cos \theta| \quad (2-55)$$

$$X_{FB} = |L \cos \theta| + W_m |\sin \theta| \quad (2-56)$$

where θ is the angle between the line source and the wind direction (see Figure 2-10).

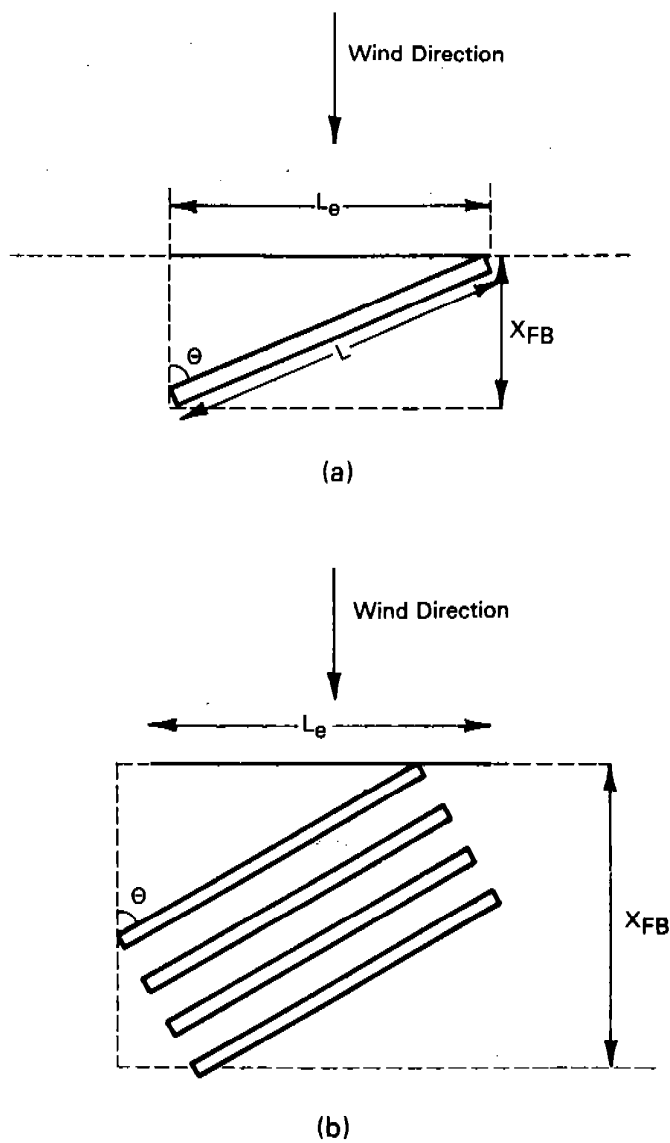


Figure 2-10 Calculation of the Effective Line Length, L_e , and the Downwind Distance of Full Buoyancy, X_{FB}

In most cases, the width of the line source, W_m , is much less than the length of the line, so $L_e \approx L \sin \theta$ and $X_{FB} \approx L \cos \theta$. For N line sources of equal length and separated by a distance of δX_m , the buoyancy parameter is the sum of the buoyancy parameters of the individual lines, and the equation for X_{FB} becomes:

$$X_{FB} = L \cos \theta + (N-1) \delta X_m \sin \theta \quad (2-57)$$

$$F'_T = \sum_{i=1}^N (F')_i \quad (2-58)$$

The effective line length for multiple line sources is a weighting of L_e for perpendicular winds (i.e., L) and L_v for parallel winds, L_v .

$$L_e = L \sin \theta + L_v \cos \theta \quad (2-59)$$

To calculate the effective line length for parallel winds, L_v , the following three step procedure is used.

- 1) Determine the height at which plumes from adjacent lines interact, Z_I . With $R = \beta Z$, R must be equal to $\delta X_m/2$ for interaction, so $Z_I = \delta X_m/(2\beta)$.
- 2) Determine the downwind distance, X_I , at which the plumes interact (i.e., X such that $Z'_L = Z_I$), by solving Equation 2-54 for X with $L_e = W_m$ and F_T = buoyancy parameter of one line. First assume $X < X_{FB}$ and solve for X ; if this estimate of X is greater than X_{FB} , solve again for X assuming $X \geq X_{FB}$.
- 3) Calculate the effective line length, L_v , that will yield $Z'_L = Z_I$ at $X' = X_I$ with F_T equal to N times the buoyancy flux of one line, again using Equation 2-54.

The distance of final rise, X_F , for neutral and unstable conditions is calculated by Equations 2-37 and 2-38 with $F = F'_T/\pi$.

Building downwash effects can be incorporated in the line source plume rise equation using the same "downwash radius" approach used in the point source plume rise formulation. The line source emission of aluminum reduction facilities are roof-level releases with negligible momentum rise. The line source plume rise downwash radius, R_o , is determined from Equation 2-17 with $A = 1.0$ to be:

$$R_o = R_{Zo} = H_B \quad (2-60)$$

With an initial dilution plume radius, the line source plume rise equation becomes:

$$(Z'_L)^3 + \frac{3L_e}{\pi\beta} (Z'_L)^2 + \left(\frac{3R_o}{\beta} Z'_L + \frac{6R_o L_d}{\pi\beta^2} + \frac{3R_o^2}{\beta^2} \right) Z'_L = \quad (2-61)$$

$$\left\{ \begin{array}{ll} \frac{F'_T X^3}{2\pi\beta^2 X_{FB} U_e^3} & X < X_{FB} \\ \frac{3F'_T}{2\pi\beta^2 U_e^3} \left[\frac{X_{FB}^2}{3} + X^2 - X_{FB}X \right] & X \geq X_{FB} \end{array} \right.$$

where L_d is an effective downwash length. In the BLP model L_d is:

$$L_d = L_e \sin \theta \quad (2-62)$$

The third term in parentheses of Equation 2-61 containing R_o and L_d is the downwash term.

Equation 2-61 is a simple cubic equation that is solved in the BLP model by subroutine CUBIC. This line source plume rise expression reduces to the Briggs point source plume rise equation when the line length and downwash effects are negligible (i.e., L_e , L_d , and R_o approach zero).

For stable atmospheric conditions, final line source plume rise is calculated with the following equation.

$$(z'_L)^3 + \frac{3L_e}{\pi\beta} (z'_L)^2 + \left\{ \frac{3R_o}{\beta} z'_L + \frac{6R_o L_d}{\pi\beta^2} + \frac{3R_o^2}{\beta^2} \right\} z'_L = \frac{6 F' T}{\pi\beta^2 U_e s} \quad (2-63)$$

Transitional plume rise for stable conditions is calculated with Equation 2-61. The stable line source plume rise equations reduces to the Briggs stable plume rise equation for final rise when L_e , L_d , and R_o approach zero.

To save the computation time required to solve the cubic line source plume rise equation many times, the BLP model calculates line source plume rise each simulated hour at six downwind distances: X_{FB} , X_F , and four intermediate distances. The plume rise at distances other than these six distances are interpolated linearly. This allows the plume trajectory to be accurately approximated in a computationally efficient manner. As illustrated in Figure 2-9, the plume element originating from the most upwind end of the line source rises higher than plume elements released at other portions of the line. The plume rise equations in this section predict the height of the plume element originating from the most upwind part of the line source. To find the heights of other plume elements, the BLP model uses a linear interpolation scheme. The entire line source plume rise algorithm is summarized below with the aid of Figure 2-11.

- 1) Calculate the heights of the plume elements originating from the most upwind portion of the line source (line segment No. 1) at X_{FB} , X_F , and four intermediate distances.
- 2) Find the height, z_X^1 , of this plume element (plume element No. 1) at a downwind distance X_d by linear interpolation of the results of Step 1.

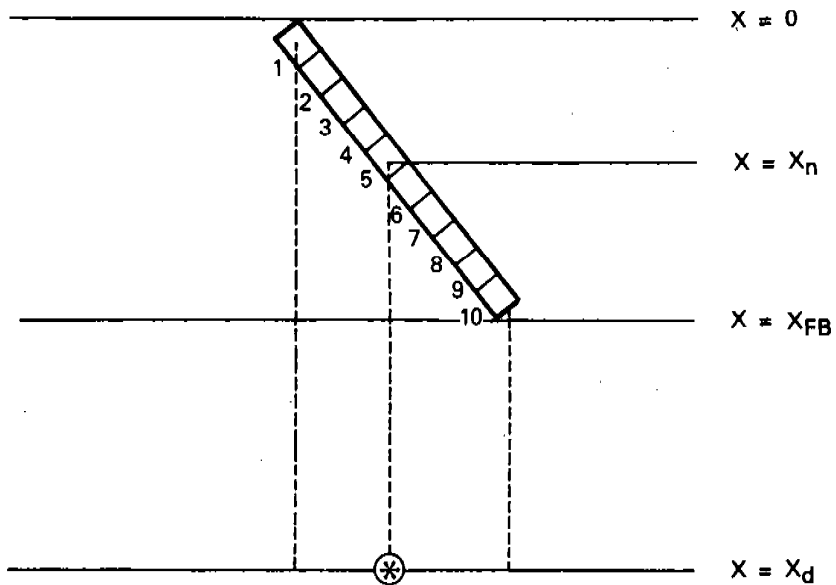


Figure 2-11 Calculation of Plume Rise of Individual Plume Elements of the Line Source Plume

- 3) Because the height of plume element No. 10 is zero at X_{FB} , the height, $Z_{X_{FB}}^n$, of plume element No. n at $X = X_{FB}$ can be obtained by interpolation:

$$Z_{X_{FB}}^n = Z_{X_{FB}}^1 \left[1 - X_n/X_{FB} \right]$$

- 4) The height, $Z_{X_d}^n$, of plume element No. n at a downwind distance, X_d , is:

$$Z_{X_d}^n = Z_{X_{FB}}^n + \left[Z_X^1 - Z_{X_{FB}}^1 \right]$$

2.5 BLP Postprocessing Capabilities (POSTBLP)

As indicated in the BLP modeling package flowchart, Figure 1-1, all analysis of the concentration output of the BLP model is done with the BLP postprocessing program, POSTBLP. The use of a separate program for averaging and analysis operations decreases the computer time and computer memory requirements of the BLP model. Because computer costs are associated with the amount of memory required as well as the computer time used, the use of a separate postprocessing program can be very cost effective.

The capabilities of the POSTBLP program are outlined in Table 2-8. The user has the option of analyzing total concentration data or the source contribution of any single line or point source (or any combination of line and point sources) that have been specified as source contribution sources in the original BLP run. The POSTBLP program will always generate tables of the top fifty 1-, 3-, and 24-hour average concentrations, five highest 1-, 3-, and 24-hour average concentrations at each receptor, and the average concentrations over the length of the BLP run for the concentration data (total or source contribution) selected by the user. The table of the top fifty 1-hour average concentrations include the wind speed, wind direction, stability class, and mixing height for those hours.

TABLE 2-8
MAJOR FEATURES OF THE POSTBLP PROGRAM

- Total concentration or source contribution analysis.
- Monthly and annual frequency distributions for 1-, 3-, and 24-hour average concentrations.
- Tables of 1-, 3-, and 24-hour average concentrations at each receptor.
- Table of the annual (or length of the BLP run) average concentrations at each receptor.
- Five highest 1-, 3-, and 24-hour average concentrations at each receptor.
- Fifty highest 1-, 3-, and 24-hour average concentration over the receptor field.

Optional POSTBLP output consists of monthly and annual frequency distributions for 1-, 3-, and 24-hour average concentrations (total or source contribution) at a user-specified receptor. Also, tables of 1-, 3-, and 24-hour average concentrations at each receptor for any (or every) 24-hour period of the BLP run can be printed.

The BLP model results are stored on a magnetic tape or disk file which can be repeatedly accessed by the POSTBLP program. Multiple runs of the POSTBLP program can be made, first in only a screening mode to scan the concentration output data to determine the time periods and receptors with the highest predicted concentrations; the results at these time periods can be examined more closely with subsequent POSTBLP runs. Typically, the days with the highest total concentrations can be obtained with an initial POSTBLP screening run; the contributions of sources of interest for these days be generated with subsequent POSTBLP runs.

3. USERS INSTRUCTIONS

3.1 BLP Users Instructions

A detailed description of all the card-image input requirements of the BLP model is contained in this section. Figure 3-1 is a flowchart of the main program of the BLP model. All BLP concentration output is written (unformatted) to Logical Unit 20. Unformatted CRSTER preprocessor program meteorological data, if used, is read from Logical Unit 2; otherwise, card-image user input meteorological data, along with all other card-image inputs, are read from Logical Unit 5. Printout of the data entered into the BLP program is obtained through Logical Unit 6. The card-image input deck setup is shown in Figure 3-2. Some of the cards need to be included only if certain options have been requested. A description of all the 12 types of card-image inputs with the default values provided for the program control parameters is presented below.

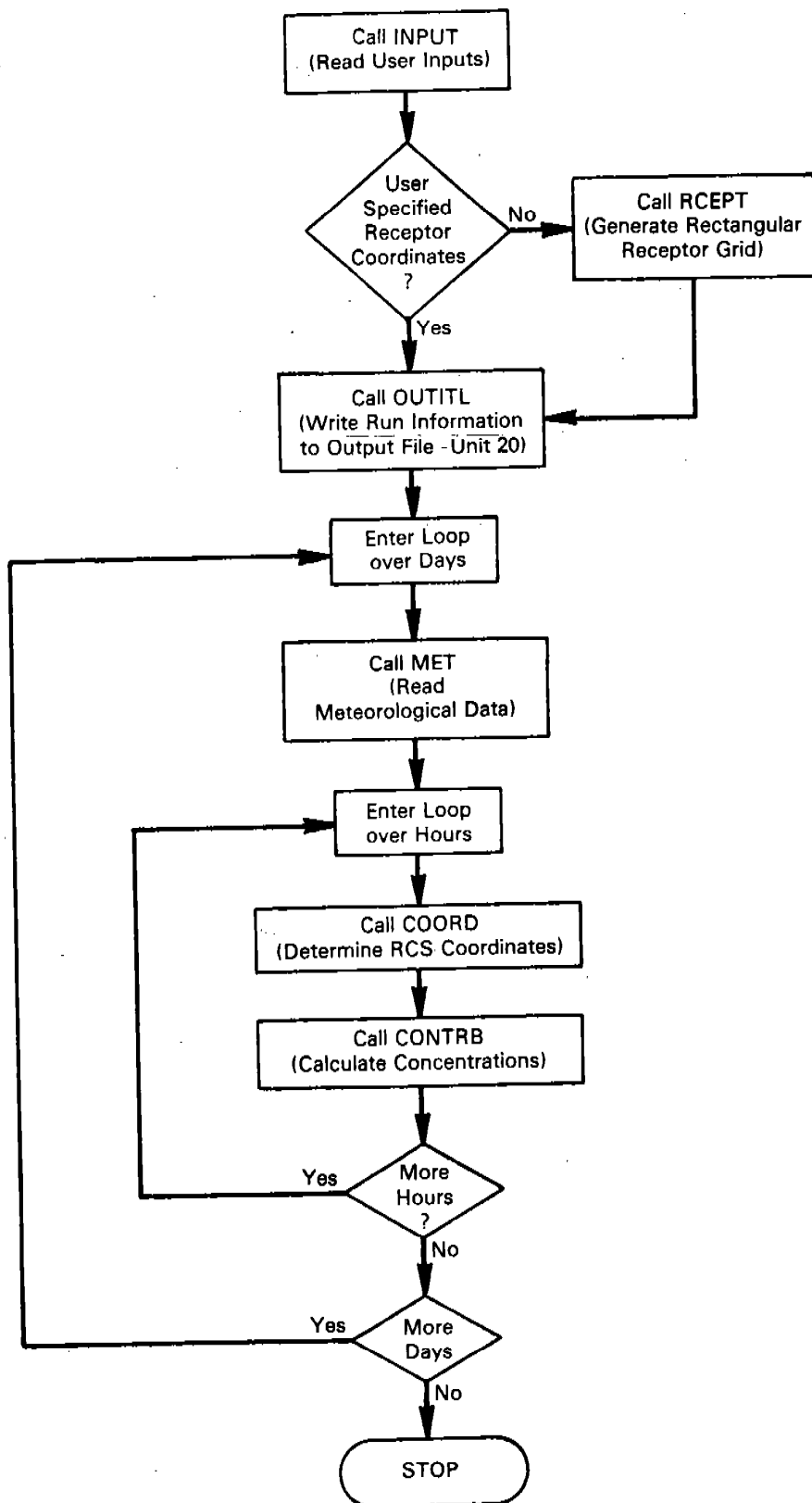


Figure 3-1 Flow Chart of the BLP Model Main Program

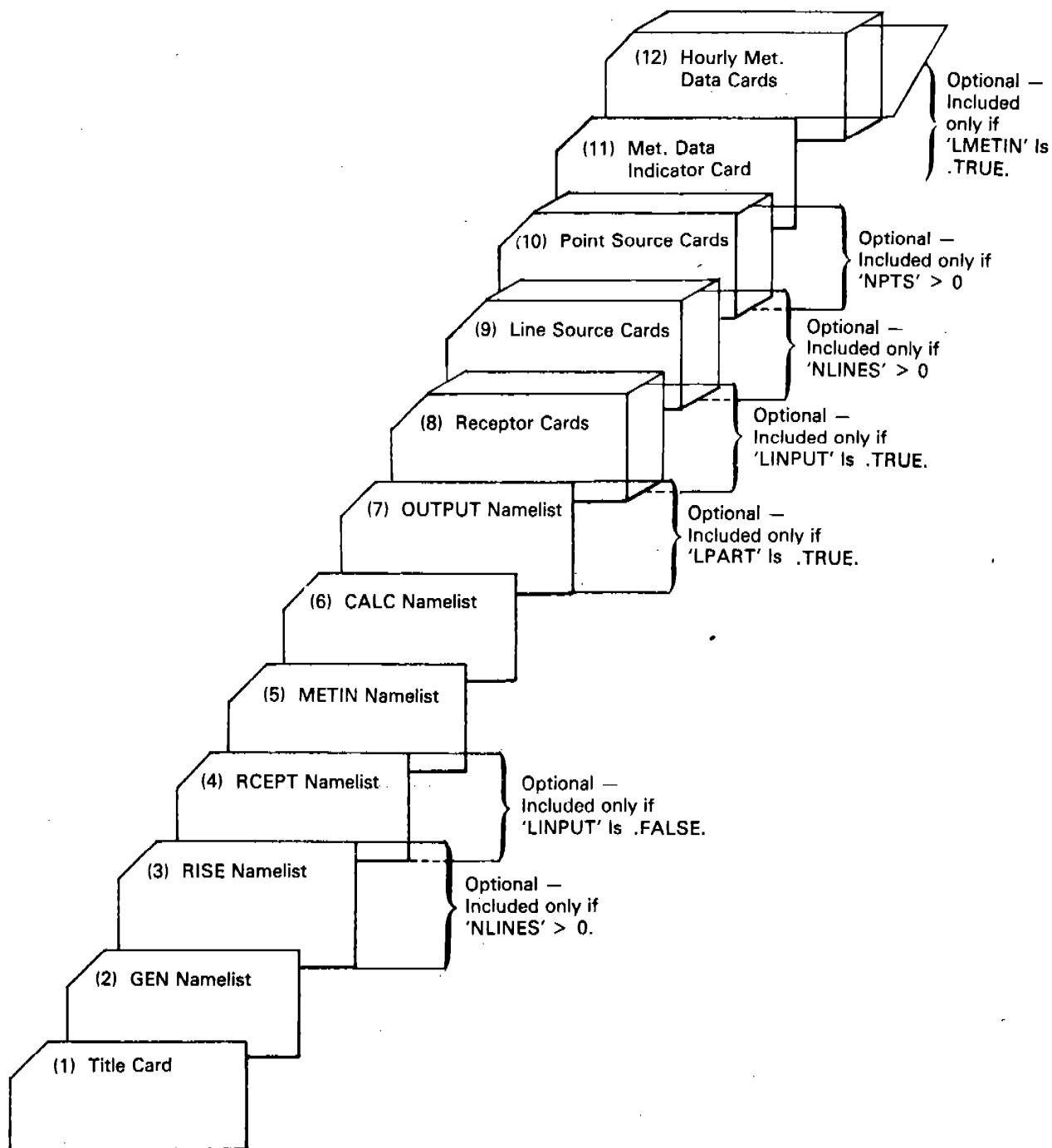


Figure 3-2 Input Deck Setup for BLP Dispersion Model

- 1) Title Card (up to 80 characters) (always included)

Namelist Inputs

- | | |
|--------------------|--|
| 2) GEN Namelist | (always included) |
| 3) RISE Namelist | (included only if 'NLINES' > 0) |
| 4) RCEPT Namelist | (included only if 'LINPUT' is .FALSE.) |
| 5) METIN Namelist | (always included) |
| 6) CALC Namelist | (always included) |
| 7) OUTPUT Namelist | (included only if 'LPART' is .TRUE.) |

Formatted Input

- | | |
|---|---------------------------------------|
| 8) One card for each receptor | (included only if 'LINPUT' is .TRUE.) |
| 9) One card for each line source | (included only if 'NLINES' > 0) |
| 10) One card for each point source | (included only if 'NPTS' > 0) |
| 11) One card indicating the number
of hours of formatted meteorological data to follow | (included only if 'LMETIN' is .TRUE.) |
| 12) One card of formatted meteorological data for each hour | (included only if 'LMETIN' is .TRUE.) |

Title-Run Identification Card

<u>Columns</u>	<u>Format</u>	<u>Variable</u>	<u>Description</u>
1-80	20A4	TITLE	Any title or run identification information up to 80 characters in length.

Namelist--GEN

GEN assigns values to the number of sources and receptors and initializes control variables.

<u>Variable</u>	<u>Type</u>	<u>Description</u>	<u>Default</u>
NLINES	Integer	Number of line sources. 'NLINES' ≤ 10 .	0
NPTS	Integer	Number of point sources. 'NPTS' ≤ 50 .	0
NREC	Integer	Number of receptors (input only if 'LINPUT' is .TRUE., otherwise, 'NREC' is calculated by BLP. 'NREC' ≤ 100).	0
LINPUT	Logical	Control variable for receptor input option. If 'LINPUT' is .TRUE., the user will input the X and Y coordinates and elevation of each receptor; if .FALSE., a rectangular receptor grid will be generated by BLP using user input boundary coordinates and X and Y spacings (see RCEPT Namelist).	.FALSE.
LUTMS	Logical	Control variable for the coordinate system used to input all source and receptor coordinates. If 'LUTMS' is .TRUE., all input coordinates are specified in UTM coordinates. If .FALSE., an internal, line source oriented (SCS) coordinate system is assumed.	.FALSE.
LPART	Logical	Control variable for the source contribution option. If 'LPART' is .TRUE., source contributions of user specified sources are included in the output file (see OUTPUT Namelist); otherwise, no source contributions are included.	.FALSE.
LDOWNW	Logical	Control variable for the point source building downwash option. If 'LDOWNW' is .TRUE., the effects of building downwash are evaluated. If .FALSE., point source building downwash effects are not computed.	.TRUE.
LSHEAR	Logical	Control variable for plume rise wind shear option. If 'LSHEAR' is .TRUE., wind shear is included in point and line source plume rise calculations, otherwise, wind shear is not included.	.TRUE.

<u>Variable</u>	<u>Type</u>	<u>Description</u>	<u>Default</u>
LTRANS	Logical	Control variable for the transitional point source plume rise option. If 'LTRANS' is .TRUE., transitional point source plume rise is calculated, otherwise, only final point source plume rise is calculated.	.TRUE.
TCOR	Real	Line source orientation angle. 'TCOR' is the angle (in degrees) between the Y-axis of the UTM coordinate system and the X-axis of the SCS coordinate system - see Figure 2-2 (input only if 'LUTMS' is .FALSE., otherwise, 'TCOR' is calculated by BLP). $0^{\circ} \leq \text{TCOR} < 180^{\circ}$.	90.0

Namelist--RISE

This namelist is included only if 'NLINES' > 0 (see GEN Namelist). RISE assigns values to the parameters used in the buoyant line source plume rise calculations.

<u>Variable</u>	<u>Type</u>	<u>Description</u>	<u>Default*</u>
L	Real	Average Building Length (m).	-
HB	Real	Average Building Height (m) (see Figure 2-1).	-
WB	Real	Average Building Width (m) (see Figure 2-1).	-
WM	Real	Average Line Source Width (m) (see Figure 2-1).	-
DX	Real	Average Building Separation (m) (see Figure 2-1).	-
FPRIME	Real	Average Buoyancy Parameter (m^4/s^3) (see Equation 2-47).	-

*A dash indicates that no default value is provided.

Namelist--RCEPT

This namelist is included only if 'LINPUT' is .FALSE. (See GEN Namelist). RCEPT defines the rectangular receptor grid to be generated by BLP (see Figure 2-3).

<u>Variable</u>	<u>Type</u>	<u>Description</u>	<u>Default</u>
RXBEG	Real	X-coordinate of lower left corner of receptor grid.	0.0
RYBEG	Real	Y-coordinate of lower left corner of receptor grid.	0.0
RXEND	Real	X-coordinate of upper right corner of receptor grid.	0.0
RYEND	Real	Y-coordinate of upper right corner of receptor grid.	0.0
RDX	Real	Incremental X-spacing of receptors.	0.0
RDY	Real	Incremental Y-spacing of receptors.	0.0

Namelist--METIN

METIN initializes meteorological parameters and assigns values to the array which determines which days are to be modeled.

<u>Variable</u>	<u>Type</u>	<u>Description</u>	<u>Default*</u>
LMETIN	Logical	Meteorological input data control variable. If 'LMETIN' is .TRUE., up to 24 hours of card-image formatted meteorological data is read; if .FALSE., up to 366 days of CRSTER meteorological preprocessor output is read.	.FALSE.
LMETOT	Logical	Meteorological output control parameter-used only if 'LMETIN' is .FALSE. If 'LMETOT' is .TRUE., the hourly meteorology is printed for each day the model is run; if .FALSE., hourly meteorology is not printed. (Note: If 'LMETIN' is .TRUE., hourly meteorology is always printed.)	.FALSE.
IDSURF	Integer	NWS surface station number-used only if 'LMETIN' is .FALSE. 'IDSURF' must be the same as the surface station number input to the CRSTER preprocessor.	-
IYSURF	Integer	Year of record for the surface meteorological data-used only if 'LMETIN' is .FALSE. 'IYSURF' must be the same as the year of the surface data input to the CRSTER preprocessor.	-
IDUPER	Integer	NWS upper air station number-used only if 'LMETIN' is .FALSE. 'IDUPER' must be the same as the upper air station number input to the CRSTER preprocessor.	-
IYUPER	Integer	Year of record for the upper air meteorological data-used only if 'LMETIN' is .FALSE. 'IYUPER' must be the same as the year of the upper air (mixing height) data input to the CRSTER preprocessor.	-
ZMEAS	Real	Measurement height of mean wind speed (m).	7.0
DTHTA(2)	Real Array	Vertical potential temperature gradient for PGT stability classes E and F (Deg. K/m).	0.020, 0.035

<u>Variable</u>	<u>Type</u>	<u>Description</u>	<u>Default*</u>
PEXP (6)	Real Array	Vertical wind speed power law profile exponents for PGT stabilities A-F.	0.10, 0.15, 0.20, 0.25, 0.30, 0.30
IDELS	Integer	Maximum variation in the number of stability classes per hour (used only if 'LMETIN' is .FALSE.). (Note: the CRSTER meteorological preprocessor already may have restricted stability class variations to 1 class/hour.)	5
IRU	Integer	Rural/urban mixing height selector (used only if 'LMETIN' is .FALSE.). 'IRU' is 1 for rural mixing heights and 'IRU' is 2 for urban mixing heights.	1
IDAYS(366)	Integer Array	Array of 366 elements with each element corresponding to a Julian day of the year (used only if 'LMETIN' is .FALSE.). A '1' in element N indicates that Julian day N is to be modeled. A '0' in element N indicates that Julian day N is <u>not</u> to be modeled.	366*0

*A dash indicates that no default is provided.

Namelist--CALC

CALC initializes certain computational, terrain adjustment, decay, and background concentration parameters.

<u>Variable</u>	<u>Type</u>	<u>Description</u>	<u>Default</u>
TERAN (6)	Real Array	Plume path coefficients for PGT stabilities A-F.	0.5, 0.5, 0.5, 0.5 0.3, 0.3
DECFAc	Real	Pollutant decay rate (s ⁻¹)	0.0
XBACKG	Real	Background concentration (µg/m ³)	0.0
CONST2	Real	Constant in Briggs stable point source plume rise equation of the form $\Delta h = \text{CONST2} * (F / (U * S))^{1/3}$. (Used only if 'LSHEAR' is .FALSE.)	2.6
CONST3	Real	Constant in Briggs neutral final plume rise distance equation of the form $X(\text{final}) = \text{CONST3} * 3.5 * F^{0.4}$, where $F > 55 \text{ m}^4/\text{s}^3$.	34.49
CRIT	Real	Convergence criterion for the line source calculations.	0.02
MAXIT	Integer	Maximum number of iterations allowed in the line source calculations.	14

Namelist--OUTPUT

This namelist is included only if 'LPART' is .TRUE. (See GEN Namelist). OUTPUT defines which sources are to have source contributions included in the output file.

<u>Variable</u>	<u>Type</u>	<u>Description</u>	<u>Default</u>
IPCL (11)	Integer Array	Array of 11 elements with each of the first 10 elements corresponding to a line source. For $N \leq 10$, a '1' in element N signifies that the source contribution of line source N is to be written in the output file; A '0' signifies that the source contribution of line source N is <u>not</u> to be written in the output file. The value of element 11 has the same meaning applied to the sum of the source contributions of lines 1 to 'NLINES'.	11*0
IPCP (51)	Integer Array	Array of 51 elements with each of the first 50 elements corresponding to a point source. for $N \leq 50$, a '1' in element N signifies that the source contribution of point source N is to be written in the output file; a '0' signifies that the source contribution of point source N is <u>not</u> to be written in the output file. The value of element 51 has the same meaning applied to the sum of the source contributions of points 1 to 'NPTS'.	51*0

The following formatted input follow the Namelist inputs described above.

Receptor Information (included only if 'LINPUT' is .TRUE.). One card must be included for each receptor.

<u>Columns</u>	<u>Format</u>	<u>Variable</u>	<u>Description</u>
1-10	F10.1	XRSCS	X-coordinate of receptor (m).
11-20	F10.1	YRSCS	Y-coordinate of receptor (m).
21-30	F10.1	RELEV	Receptor elevation (m).

Line Source Information-used in dispersion calculations (included only if 'NLINES' > 0). One card must be included for each line source.

<u>Columns</u>	<u>Format</u>	<u>Variable</u>	<u>Description</u>
1-10	F10.1	XLBEG	X-coordinate of beginning of line source (m).
11-20	F10.1	YLBEG	Y-coordinate of beginning of line source (m).
21-30	F10.1	XLEND	X-coordinate of end of line source (m).
31-40	F10.1	YLEND	Y-coordinate of end of line source (m).
41-50	F10.4	H\$	Release height of line source (m).
51-60	F10.4	QT	Pollutant emission rate of line source (g/s).
61-70	F10.1	LELEV	Line source base elevation (m).

Point Source Information (including only if 'NPTS' > 0). One card must be included for each point source.

<u>Columns</u>	<u>Format</u>	<u>Variable</u>	<u>Description</u>
1-10	F10.1	XCOORD	X-coordinate of point source (m).
11-20	F10.1	YCOORD	Y-coordinate of point source (m).
21-30	F10.4	PHS	Stack height of point source (m).
31-40	F10.4	PQ	Pollutant emission rate of point source (g/s).
41-50	F10.4	D	Inner stack diameter (m).
51-60	F10.4	W	Exit velocity (m/s).
61-70	F10.4	TSTACK	Stack exit temperature (°K).
71-80	F10.1	PELEV	Point source base elevation (m).

Formatted Meteorological Input Data (included only if 'LMETIN' is .TRUE.) The formatted meteorological input data consists of one card indicating the number of hours of meteorological data followed by one card for each hour (up to 24 hours).

<u>Columns</u>	<u>Format</u>	<u>Variable</u>	<u>Description</u>
1-2	I2	IHRMAX	Number of hours of formatted meteorological data to follow.

One card with the following format for each of the 'IHRMAX' hours of formatted meteorological data must be included.

<u>Columns</u>	<u>Format</u>	<u>Variable</u>	<u>Description</u>
1	I1	KST	PGT stability class
11-20	F10.2	SPEED	Mean wind speed (m/s)
21-30	F10.2	RANDWD	Wind direction in degrees
31-40	F10.2	TEMP	Ambient air temperature (°K)
41-50	F10.2	HMIX	Mixing height (m)

3.2 POSTBLP User's Instructions

The POSTBLP program is used to process all the BLP concentration output. POSTBLP reads the unformatted BLP output from Logical Unit 20. All POSTBLP output is routed to the line printer (Logical Unit 6). All POSTBLP inputs are specified in Namelist OPTS, which is the only card-image input required by the program. The card-image input is read from Logical Unit 5. A detailed description of Namelist OPTS inputs follows.

Namelist--OPTS

<u>Variable</u>	<u>Type</u>	<u>Description</u>	<u>Default</u>
IJCODE	INTEGER	Coded integer specifying the concentration output (source contribution or summed concentrations) to be processed in this run (not used if 'LSUM' is .TRUE.) If 'IJCODE' is 1 to 10, the concentration output to be processed is the source contribution of line number 'IJCODE'. If 'IJCODE' is 11, the concentration output is the source contribution of the sum of all the line sources. If 'IJCODE' is 101 to 150, the concentration output is the source contribution of point source 'IJCODE'. If 'IJCODE' is 151, the concentration input is the source contribution of the sum of all the point sources. If 'IJCODE' is 999, the concentration output is the total concentration resulting from the sum of all the line and point sources.	999
LECH1	Logical	Control variable for output of 1-hour average concentrations. If 'LECH1' is .TRUE., the 1-hour average concentration at each receptor is printed for each day with '1' indicated in the corresponding element of the 'IECHO' array; if .FALSE., no 1-hour average concentrations are printed.	.FALSE.
LECH3	Logical	Control variable for output of 3-hour average concentrations. If 'LECH1' is .TRUE., the 3-hour average concentration at each receptor is printed for each day with '1' indicated in the corresponding element of the 'IECHO' array; if .FALSE., no 3-hour average concentrations are printed.	.FALSE.
LECH24	Logical	Control variable for output of 24-hour average concentrations. If 'LECH24' is .TRUE., the 24-hour average concentration at each receptor is printed for	.FALSE.

<u>Variable</u>	<u>Type</u>	<u>Description</u>	<u>Default</u>
		each day with a '1' indicated in the corresponding element of the 'IECHO' array, if .FALSE., no 24-hour average concentrations are printed.	
IECHO(366)	Integer	Array of 366 elements with each element corresponding to a Julian day (used only if 'LECH1', or 'LECH3', or 'LECH24' is .TRUE.). IECHO controls output of the 1-, 3-, and 24-hour average concentrations. The concentrations at each receptor will be printed for each Julian day with a '1' in the corresponding element or the 'IECHO' array. For each day with a '0' in the corresponding element, no concentrations will be printed.	366*0
LFRQ1	Logical	Control variable for 1-hour average concentration frequency distributions. If 'LFRQ1' is .TRUE., a frequency distribution of 1-hour averaged concentrations at receptor 'IRECEP' with concentration intervals specified in the 'XINT' array will be produced; otherwise, no distribution will be produced.	.FALSE.
XINT (25)	Real Array	Array containing the concentration intervals used in the 1-hour averaged concentration frequency distribution (used only if 'LFRQ1' is .TRUE.).	25*0.0
NINT	Integer	Number of concentration intervals specified in the 'XINT' array (used only if 'LFRQ1' is .TRUE.). NINT<25.	0
LFRQ3	Logical	Control variable for 3-hour averaged concentration frequency distributions. If 'LFRQ3' is .TRUE., a frequency distribution of 3-hour average concentration at receptor 'IRECEP' with concentration intervals specified in the 'XINT3' array will be produced; otherwise, no distribution will be printed.	.FALSE.
XINT3(25)	Real Array	Array containing the concentration intervals used in the 3-hour averaged concentration frequency distribution (used only if 'LFRQ3' is .TRUE.).	25*0.0

<u>Variable</u>	<u>Type</u>	<u>Description</u>	<u>Default</u>
NINT3	Integer	Number of concentration intervals specified in the 'XINT3' array (used only if 'LFRQ3' is .TRUE.). NINT3 $\leq$ 25.	0
LFRQ24	Logical	Control variable for 24-hour averaged concentration frequency distributions. If 'LFRQ24' is .TRUE., a frequency distribution of 24-hour averaged concentrations at receptor 'IRECEP' with concentration intervals specified in the 'XINT24' array will be produced; otherwise, no distribution will be produced.	.FALSE.
XINT24(25)	Real	Array containing the concentrations intervals used in the 24-hour averaged concentration frequency distribution (used only if 'LFRQ24' is .TRUE.).	25*0.0
NINT24	Integer	Number of concentration intervals specified in the 'XINT24' array (used only if 'LFRQ24' is .TRUE.). NINT24 $\leq$ 25.	0

<u>Variable</u>	<u>Type</u>	<u>Description</u>	<u>Default</u>
IRECEP	Integer	Number of the receptor used in the frequency distribution calculations (used only if LFRQ1, LFRQ3, or LFRQ34 is .TRUE.).	1
LSUM	Logical	Control variable for source contribution summing option. If 'LSUM' is .TRUE., the source contributions of the sources specified in the array 'ISCODE' are summed; if .FALSE., no source contributions are summed.	.FALSE.
ISCODE(62)	Integer Array	Array containing up to 62 coded integers specifying the source concentrations to be summed (used only if 'LSUM' is .TRUE.). Also see description of 'IJCODE'.	62*0
NSUM	Integer	Number of source contributions specified in 'ISCODE' to be summed (used only if 'LSUM' is .TRUE.). 'NSUM'≤62.	0



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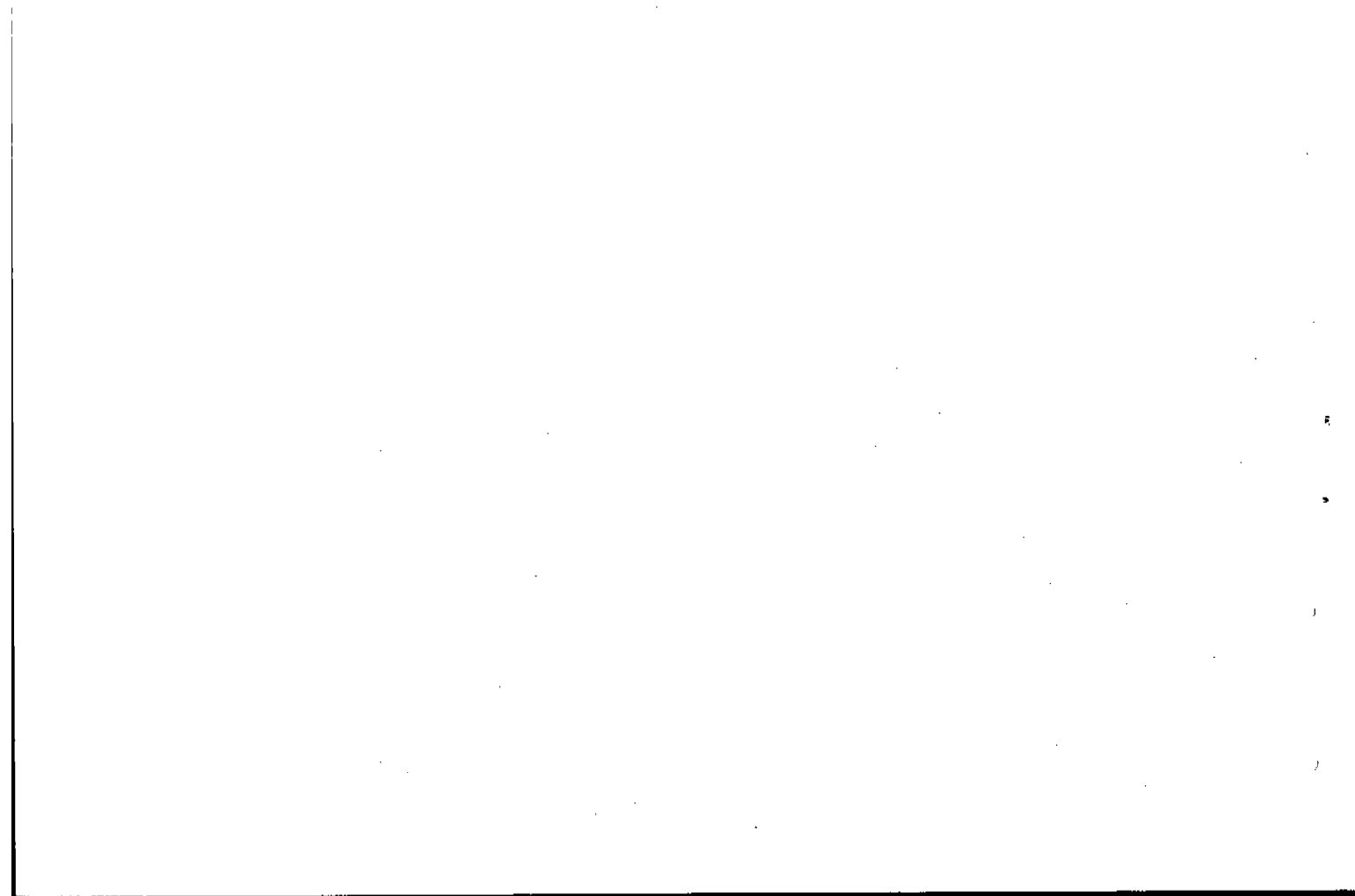
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APPENDIX A
FORTRAN SOURCE LISTING OF BLP



```

C
C*****00000010
C*****00000020
C00000030
C    RLP -- MULTIPLE BUOYANT LINE AND POINT SOURCE00000040
C    DISPERSION MODEL00000050
C00000060
C    RLP    VERSION 1.1    LEVEL 800702    MAIN00000070
C00000080
C    DEVELOPED BY:00000090
C00000100
C    JOE SCIRE AND LLOYD SCHULMAN00000110
C    ENVIRONMENTAL RESEARCH AND TECHNOLOGY00000120
C    696 VIRGINIA ROAD00000130
C    CONCORD, MASSACHUSETTS 0174200000140
C00000150
C*****00000160
C00000170
C    REAL TITLE(20)00000180
C    REAL L,LEFF,LD,LELEV00000190
C    INTEGER*2 IDAYS00000200
C    LOGICAL RINPUT,LSHEAR,RDOWNW00000210
C    LOGICAL LMETIN,LMETOT,LTRANS00000220
C    COMMON/SOURCE/NLINES,XLBEG(10),XLEND(10),DEL(10),YSCS(10),QT(10),00000230
C    1 HS(10),XRCS(10,129),YRCS(10,129),TCOR,LELEV(10),00000240
C    2 NPTS,XPSCS(50),YPSCS(50),PD(50),PHS(50),XPRCS(50),YPRCS(50),00000250
C    3 TSTACK(50),APTS(50),BPTS(50),VEXIT(50),PELEV(50),TDOWNW(50)00000260
C    COMMON/RCPT/RXBEG,RXBEG,RXFEND,RYEND,RDX,RDY,XRSCS(100),00000270
C    1 YRSCS(100),XRRC(100),YRRC(100),RELEV(100),NRFC00000280
C    COMMON/PR/L,HR,AR,WM,FPRIME,FP,XMATCH,DX,AVFACT,TWOHR,N,LSHEAR,00000290
C    1 LTRANS00000300
C    COMMON/PRLS/XFR,LEFF,LD,RD,XFINAL,XFS00000310
C    COMMON/RINTP/XDIST(7),DH(7)00000320
C    COMMON/METD/ZMEAS,WS,RD,1STAR,TDEGK,DPRL,THETA,S,P,IYR,JDAY,IHOUR00000330
C    COMMON/METD24/KST(24),SPEED(24),RANDOM(24),HMX(24),TEMP(24),00000340
C    1 DTHA(2),PEXP(6),IDFLS,IDSURF,IYSURF,JDUPER,IYUPER,TERAN(6),00000350
C    2 IRU,IHRMAX,LMETIN,LMETOT,IDAYS(366)00000360
C    COMMON/PHLDAT/TWOPRL,PRL1P600000370
C    COMMON/OUTPT/IPCL(11),IPCP(51)00000380
C    COMMON/PARK/CRIT,TER1,DECFAC,XBACKG,CONST2,CONST3,MAXIT00000390
C    COMMON/QA/VERSION,LEVEL00000400
C    DATA PI/3.1415927/00000410
C00000420
C    IDENTIFY VERSION AND LEVEL NUMBERS OF RLP -- MAIN PROGRAM00000430
C00000440
C    VERSION=1.100000450
C    LEVEL=80070200000460
C00000470
C    READ INPUTS00000480
C00000490
C    CALL INPUT(RINPUT,RDOWNW,TITLE)00000500
C    IF(.NOT.RINPUT)CALL RECEP00000510
C00000520
C    WRITE RUN INFORMATION TO RECORD #1 OF OUTPUT FILE (20)00000530
C00000540
C    CALL OUTITL(TITLE,NRFC,NPTS,NLINES,IPCL,IPCP,IYR,IDAYS)00000550
C    IF(NLINES.LT.1)GO TO 2100000560
C    DO 20 I=1,NLINES00000570
C20 DEL(I)=XLEND(I)-XLBEG(I)00000580
C21 CONTINUE00000590
C    IF(NPTS.LE.0)GO TO 5200000600
C00000610
C    IF THE POINT SOURCE DOWNWASH OPTION IS REQUESTED,00000620
C    DEFINE THE RECTANGLE OF INFLUENCE (IN SCS COORDINATES)00000630

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C	FOR THE DOWNWASH CALCULATIONS	00000640
C	IF (.NOT.RODOWN) GO TO 520	00000650
	THREHR=3.*HR	00000660
	TWOHR=2.*HR	00000665
	HALFWR=WR/2.	00000670
	XAMIN=-TWOHR	00000680
	XAMAX=L+TWOHR	00000690
	YAMIN=-HALFWR-TWOHR	00000700
	YAMAX=(NLJNES-1)*(DX+WR)+HALFWR+TWOHR	00000710
C	FOR THOSE POINTS WITHIN THE REGION OF BUILDING DOWNWASH	00000720
C	EFFECTS AND WITH STACK HEIGHTS < 3*HB, SET	00000730
C	IDOWNW (POINT #) = 1	00000740
	DO 505 I=1,NPTS	00000741
	IF (PHS(I).GE.THREHR) GO TO 505	00000750
	IF (XPSCS(I).LT.XAMIN.OR.XPSCS(I).GT.XAMAX) GO TO 505	00000755
	IF (YPSCS(I).LT.YAMIN.OR.YPSCS(I).GT.YAMAX) GO TO 505	00000760
	IDOWNW(I)=1	00000770
505	CONTINUE	00000780
520	CONTINUE	00000790
	IF (LMFTIN) GO TO 1212	00000800
C	READ STATION CODES AND YEAR OF METEOROLOGICAL DATA	00000810
	READ(2)IDS,IYS,IDU,IYU	00000820
	IF (IDS.EQ.IDSURF.AND.IYS.EQ.IYSURF.AND.IDU.EQ.IDUPER.AND.	00000830
	1 IYU.EQ.IYUPER) GO TO 1212	00000840
	WRITE(6,1211)IDSURF,IYSURF,IDS,IYS,IDUPER,IYUPER,IDU,IYU	00000850
1211	FORMAT('1','REQUESTED STATION ID OR YEAR DOES NOT MATCH ',	00000860
	1 'THAT READ FROM THE MET. DATA FILE -- RUN TERMINATED'/	00000870
	2 '0',2X,'REQUESTED SURFACE DATA: ID = ',I4,3X,'YEAR = ',I4/	00000880
	3 10X,'MET. DATA READS: ID = ',I4,3X,'YEAR = ',I4/	00000890
	4 '0', 'REQUESTED UPPER AIR DATA: ID = ',I4,3X,'YEAR = ',I4/	00000900
	5 10X,'MET. DATA FILE READS: ID = ',I4,3X,'YEAR = ',I4)	00000910
	STOP	00000920
1212	CONTINUE	00000930
C	CALCULATE DISTANCE (FROM XFR) TO FINAL NEUTRAL PLUME RISE	00000940
C	ASSUMING PLUMES INTERACT BEFORE REACHING TERMINAL RISE	00000950
	FBRG=N*FPRIME/PI	00000960
	IF (FBRG.GT.55.) GO TO 10	00000970
C	THE CONSTANT 49 = 3.5*14.	00000980
	XFINAL=49.*FBRG**0.625	00000990
	GO TO 15	00001000
10	XFINAL=3.5*CONST3*FBRG**0.4	00001010
15	CONTINUE	00001020
	XMATCH=XFINAL	00001030
C		00001040
C	ENTER MAIN LOOP	00001050
C		00001060
	ISTART=1	00001070
	DO 135 I=1,366	00001080
	II=367-I	00001090
	IF (IDAYS(II).NE.1) GO TO 135	00001100
	LASTDY=II	00001110
	GO TO 137	00001120
135	CONTINUE	00001130
	WRITE(6,136)	00001140
136	FORMAT('///'0','EXECUTION TERMINATING -- NO ELEMENTS OF ',	00001150
	1 'IDAYS ARRAY ARE EQUAL TO ONE')	00001160
	STOP	00001170
137	CONTINUE	00001180
	IF (LMETIN) LASTDY=1	00001190
	WRITE(6,1401)	00001200
1401	FORMAT('1')	00001210
	DO 1002 IDAY=1, LASTDY	00001220
		00001230

	JDAY=IDAY	00001240
C	READ METEOROLOGICAL DATA	00001250
	CALL MFT	00001260
	IF (IDAYS(IDAY).NE.1)GO TO 1002	00001270
C		00001280
	DO 1000 IHR=1,IHRMAX	00001290
C		00001300
	IHOUR=IHR	00001310
	ISTAR=KST(IHR)	00001320
	TER1=1.-TERAN(ISTAR)	00001330
	P=PEXP(ISTAR)	00001340
	TDEGK=TEMP(IHR)	00001350
	IF (ISTAR.GT.4)S=9.40616*DTHTA(ISTAR-4)/TDEGK	00001360
	WS=SPEED(IHR)	00001370
	WD=RANDWD(IHR)	00001380
C	CONVERT WD (FROM PREPROCESSOR) TO WD IN THE REGULAR	00001390
C	METEOROLOGICAL SENSE (I.E., 0=NORTH WIND,90=EAST WIND,	00001400
C	180=SOUTH WIND,270=WEST WIND)	00001410
	WD1=WD+180.	00001420
	WD1=AMOD(WD1,360.)	00001430
	THETA=360.-(WD1+TCOR)	00001440
	IF (THETA.LT.0.0)THETA=360.+THETA	00001450
	THETA=AMOD(THETA,360.)	00001460
	DPBL=HMX(IHR)	00001470
	TWOPBL=2.*DPBL	00001480
	PBL1P6=1.6*DPBL	00001490
	CALL COORD(THETA,ISTAR)	00001500
	CALL CONTR	00001510
1000	CONTINUE	00001520
1002	CONTINUE	00001530
	WRITE(6,1005)JDAY	00001540
1005	FORMAT(///// '0',30X,'LAST DAY PROCESSED = ',I3)	00001550
	STOP	00001560
	END	00001570
	SUBROUTINE INPUT(RINPUT,RDOWNW,TITLE)	00001580
C	RLP VERSION 1.1 LEVEL 800212 INPUT	00001590
	REAL*8 RXREG,RYREG,RXEND,RYEND,XBASE,YBASE,XCOORD,YCOORD	00001600
	REAL*8 XLREG,XLEND,YLREG,YLEND	00001610
	REAL YLREG1(10),YLEND1(10)	00001620
	REAL L,LELEV	00001630
	REAL TITLE(20)	00001640
	INTEGER*2 IDAYS,NDYS	00001650
	LOGICAL RINPUT,LINPUT,LUTMS,LPART,LSHEAR,RDOWNW,LDOWNW,LFALSE	00001660
	LOGICAL LMETOT,LMETIN,LTRANS	00001670
C		00001680
C	COMMON BLOCKS	00001690
C		00001700
	COMMON/SOURCE/NLINES,XLBEG1(10),XLEND1(10),DEL(10),YSCS(10),	00001710
	1 GT(10),HS(10),XRCS(10,129),YRCS(10,129),TCOR,LELEV(10),	00001720
	2 NPTS,XPSCS(50),YPSCS(50),PO(50),PHS(50),XPRCS(50),YPRCS(50),	00001730
	3 ISTACK(50),APTS(50),BPTS(50),VFXT(50),PELEV(50),IDOWNW(50)	00001740
	COMMON/RCPT/RXBEG1,RYREG1,RXEND1,RYEND1,RDX,RDY,XRCS(100),	00001750
	1 YRCS(100),XPRCS(100),YPRCS(100),RELEV(100),NREC	00001760
	COMMON/PR/L,H8,W8,WM,FPRIME,FP,XMATCH,DY,AVFACT,TWOHR,N,I SHEAR,	00001770
	1 LTRANS	00001780
	COMMON/OUTPT/IPCL(11),IPCP(51)	00001790
	COMMON/PARM/CRIT,TER1,DECFAC,XRACKG,CONST2,CONST3,MAXIT	00001800
	COMMON/METD24/KST(24),SPEED(24),RANDWD(24),HMX(24),TEMP(24),	00001810
	1 DTHTA(2),PEXP(6),IDELS,IDSURF,ISURF,IDUPER,IYUPER,TERAN(6),	00001820
	2 IRU,IHRMAX,LMETIN,LMETOT,IDAYS(366)	00001830
	COMMON/METD/ZKEAS,WS,WD,ISTAR,TDEGK,DPBL,THETA,S,P,IYR,JDAY,IHOUR	00001840
	COMMON/QA/VERSION,LEVEL	00001850
C		00001860

C	NAMelist STATEMENTS	00001870
C		00001880
	NAMelist/GEN/NLINES,NPTS,NREC,LINPUT,LUTMS,LPART,LDOWNW,LSHEAR,	00001890
	1 LTRANS,TCOR	00001900
	NAMelist/RRISE/L,HR,WB,WM,FPRIME,DX	00001910
	NAMelist/LMETIN/ZMEAS,DTHTA,PEXP,IDSURE,IYSURE,IDUPER,IYUPER,	00001920
	1 IDELS,IRU,IDAYS,LMETIN,LMETOT	00001930
	NAMelist/CALC/CRIT,TERAN,DECFAC,XBACKG,CONST2,CONST3,MAXIT	00001940
	NAMelist/OUTPUT/IPCL,IPCP	00001950
	NAMelist/RCEPT/RXBEG,RYRFG,RXEND,RYEND,RDX,RDY	00001960
C		00001970
	DATA LINPUT/.FALSE./,LUTMS/.FALSE./,LPART/.FALSE./	00001980
	DATA LDOWNW/.TRUE./,LFALSE/.FALSE./	00001990
	DATA ALPYES/'YES'/,ALP1/'NO'/	00002000
	DATA ALP2/'NO'/,ALP3/'NO'/,ALP4/'NO'/,ALP5/'NO'/	00002010
	DATA PI/3.1415927/,RAD/0.017453293/	00002020
	DATA MAXL/10/,MAXP/50/,MAXR/100/	00002030
	DATA TEN6/1.E6/	00002040
C		00002050
C	READ TITLE CARD	00002060
C		00002070
	READ(5,7)TITLE	00002080
7	FORMAT(20A4)	00002090
	WRITE(6,1400)VERSION,LEVEL	00002100
1400	FORMAT('1',11x,'BLP -- MULTIPLE BUOYANT LINE AND POINT ',	00002110
	1 'SOURCE DISPERSION MODEL VERSION ',F4.1,3x,'LEVEL ',I6/	00002120
	2 '0',13('*****'))	00002130
	WRITE(6,8)TITLE	00002140
8	FORMAT(/'0',20A4)	00002150
C		00002160
C	READ NUMBER OF SOURCES AND FORMAT OF INPUTS -(GEN NAMelist)	00002170
C		00002180
	READ(5,GEN)	00002190
	WRITE(6,GEN)	00002200
	N=NLINES	00002210
	RINPUT=LINPUT	00002220
	IF(NLINES.LE.0)LDOWNW=LFALSE	00002230
	RDOWNW=LDOWNW	00002240
	IF(NLINES.GT.MAXL)GO TO 700	00002250
	IF(NPTS.GT.MAXP)GO TO 702	00002260
	IF(NREC.GT.MAXR)GO TO 704	00002270
C		00002280
C	READ PARAMETERS USED IN LINE SOURCE PLUME RISE	00002290
C	CALCULATIONS (RISE NAMelist)	00002300
C		00002310
	IF(NLINES.LT.1)GO TO 49	00002320
	READ(5,RISE)	00002330
	WRITE(6,RISE)	00002340
		00002350
C		00002360
C	READ RECEPTOR INFORMATION (RCEPT NAMelist)	00002370
C		00002380
C	IF LINPUT (RINPUT) = .TRUE., INPUT COORDINATES OF EACH RECEPTOR	00002390
C	OTHERWISE, INPUT RECEPTOR GRID BOUNDARIES AND SPACING AND A	00002400
C	RECTANGULAR RECEPTOR GRID WILL BE GENERATED (UP TO 100 RECEPTORS)	00002410
49	CONTINUE	00002420
	IF(RINPUT)GO TO 25	00002430
	READ(5,RCEPT)	00002440
	WRITE(6,RCEPT)	00002450
	XBASE=0.0	00002460
	YBASE=0.0	00002470
	IF(.NOT.LUTMS)GO TO 61	00002480
	XBASE=RXBEG	00002490
	YBASE=RYBEG	

61	CONTINUE	00002500
	RXBEG1=RXBEG-XBASE	00002510
	RYBEG1=RYBEG-YBASE	00002520
	XXEND1=XXEND-XBASE	00002530
	RYEND1=RYEND-YBASE	00002540
25	CONTINUE	00002550
C		00002560
C	READ MET. DATA PARAMETERS (METIN NAMLIST)	00002570
C		00002580
	READ(5,METIN)	00002590
	WRITE(6,METIN)	00002600
	IF(IYSURF.EQ.IYUPER)GO TO 55	00002610
	WRITE(6,56)IYSURF,IYUPER	00002620
56	FORMAT('1','RUN TERMINATED -- YEAR REQUESTED FOR SURFACE AND ',	00002630
	1 'UPPER AIR MET. DATA DO NOT MATCH'/10','IYSURF = ',I4,	00002640
	2 5X,'IYUPER = ',I4)	00002650
	STOP	00002660
55	CONTINUE	00002670
	IYR=IYSURF	00002680
	IF(LMETIN)IDAYS(1)=1	00002690
	IF(MOD(IYSURF,4).NE.0)IDAYS(366)=0	00002700
C		00002710
C	READ DECAY RATE, TERRAIN CORRECTION FACTOR, CONVERGENCE	00002720
C	CRITERION, ITERATION LIMIT (CALC NAMLIST)	00002730
C		00002740
	READ(5,CALC)	00002750
	WRITE(6,CALC)	00002760
C		00002770
C	READ WHICH SOURCES (IF ANY) TO HAVE PARTIAL	00002780
C	CONCENTRATION OUTPUT (OUTPUT NAMLIST)	00002790
C		00002800
	IF(.NOT.LPART)GO TO 118	00002810
	READ(5,OUTPUT)	00002820
	WRITE(6,OUTPUT)	00002830
118	CONTINUE	00002840
C		00002850
C	READ COORDINATES OF USER SPECIFIED RECEPTORS	00002860
C		00002870
	IF(.NOT.RINPUT)GO TO 40	00002880
	IF(LUTMS)GO TO 36	00002890
C	READ RECEPTOR COORDINATES IN SCS UNITS	00002900
	DO 27 I=1,NREC	00002910
27	READ(5,28)XRSCS(I),YRSCS(I),RELEV(I)	00002920
28	FORMAT(3F10.1)	00002930
	XBASE=0.0	00002940
	YBASE=0.0	00002950
	GO TO 40	00002960
C	READ RECEPTOR COORDINATES IN UTM UNITS	00002970
36	READ(5,28)XBASE,YBASE,RELEV(1)	00002980
	XRSCS(1)=0.0	00002990
	YRSCS(1)=0.0	00003000
	IF(NREC.LE.1)GO TO 40	00003010
	DO 37 I=2,NREC	00003020
	READ(5,28)XCOORD,YCOORD,RELEV(I)	00003030
	XRSCS(I)=XCOORD-XBASE	00003040
	YRSCS(I)=YCOORD-YBASE	00003050
37	CONTINUE	00003060
40	CONTINUE	00003070
C		00003080
C	READ LINE SOURCE PARAMETERS USED IN DISPERSION CALCULATIONS	00003090
C		00003100
	IF(NLINES.LT.1)GO TO 59	00003110
	DO 46 I=1,NLINES	00003120

	READ(5,48)XLREG,YLREG,XLEND,YLEND,HS(I),QT(I),LELEV(I)	00003130
48	FORMAT(4F10.1,2F10.4,F10.1)	00003140
C	CHANGE EMISSION RATE TO MICROGRAMS/SECOND	00003150
	QT(I)=QT(I)*TEN6	00003160
	IF(XLREG.GT.XLEND)GO TO 706	00003170
	XLREG1(I)=XLREG-XBASE	00003180
	YLREG1(I)=YLREG-YBASE	00003190
	XLEND1(I)=XLEND-XBASE	00003200
	YLEND1(I)=YLEND-YBASE	00003210
	YSCS(I)=YLREG1(I)	00003220
46	CONTINUE	00003230
59	CONTINUE	00003240
C		00003250
C	READ POINT SOURCE INFORMATION	00003260
C		00003270
	IF(NPTS.LT.1)GO TO 22	00003280
	DO 15 I=1,NPTS	00003290
	READ(5,14)XCOORD,YCOORD,PHS(I),PQ(I),D,W,TSTACK(I),PELEV(I)	00003300
14	FORMAT(2F10.1,5F10.4,F10.1)	00003310
C	CHANGE EMISSION RATE TO MICROGRAMS/SECOND	00003320
	PQ(I)=PQ(I)*TEN6	00003330
	XPSCS(I)=XCOORD-XBASE	00003340
	YPSCS(I)=YCOORD-YBASE	00003350
C	CONSTANT 2.45154 = G/4. (9.80616/4.)	00003360
	APTS(I)=2.45154*D*D*W/TSTACK(I)	00003370
C	WHEN MULTIPLIED BY THE AMBIENT TEMPERATURE, BPTS GIVES 3. * FM	00003380
C	CONSTANT 0.75 = 3./(2.*2.)	00003390
	BPTS(I)=0.75*W*W*D*D/TSTACK(I)	00003400
	VEXIT(I)=W	00003410
15	CONTINUE	00003420
22	CONTINUE	00003430
C		00003440
C	WRITE INPUT PARAMETERS	00003450
C		00003460
	WRITE(6,1400)VERSION,LEVEL	00003470
	WRITE(6,8)TITLE	00003480
	NDYS=0	00003490
	DO 135 J=1,366	00003500
135	NDYS=NDYS+IDAYS(I)	00003510
	WRITE(6,136)NDYS,JDAYS	00003520
136	FORMAT(// '0', 'TOTAL NUMBER OF DAYS INCLUDED IN THIS RUN: ',I3//	00003530
	1 1X, '(0=NOT INCLUDED,1=INCLUDED)')//	00003540
	2 3('0',10(10I1,3X)/), '0',6(10I1,3X),6I1)	00003550
	NT=NPTS+NLines	00003560
	WRITE(6,112)NT,NLines,NPTS	00003570
112	FORMAT(// '0', 'TOTAL NUMBER OF SOURCES: ',I3//12X, 'LINE SOURCES: ',	00003580
	1 13/11X, 'POINT SOURCES: ',I3)	00003590
	IF(LPART)ALP1=ALPYES	00003600
	WRITE(6,113)ALP1	00003610
113	FORMAT(// '0', 'PARTIAL CONCENTRATIONS REQUESTED FOR ANY LINE OR ',	00003620
	1 'POINT SOURCES. ? ',A3)	00003630
	IF(LDOWNW)ALP2=ALPYES	00003640
	WRITE(6,1110)ALP2	00003650
1110	FORMAT('0', 'POINT SOURCE BUILDING DOWNWASH OPTION REQUESTED ? ',	00003660
	1 A3)	00003670
	IF(LSHEAR)ALP3=ALPYES	00003680
	WRITE(6,1111)ALP3	00003690
1111	FORMAT('0', 'VERTICAL WIND SHEAR (IN PLUME RISE) REQUESTED ? ',A3)	00003700
	IF(LTRANS)ALP5=ALPYES	00003710
	WRITE(6,1212)ALP5	00003720
1212	FORMAT('0', 'TRANSITIONAL POINT SOURCE PLUME RISE REQUESTED ? ',A3)	00003730
	IF(LMETOT)ALP4=ALPYES	00003740
	WRITE(6,1112)ALP4	00003750

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1112  FORMAT('0','OUTPUT OF METEOROLOGICAL DATA REQUESTED ? ',A5)      00003760
C                                          00003770
C  WRITE THE LINE SOURCE PLUME RISE PARAMETERS      00003780
C                                          00003790
      IF(NLINES.L1.1)GO TO 122      00003800
      DXM=DX+WM      00003810
      WRITE(6,50)HR,WB,L,DX,DXM,WM,FPRIME      00003820
50  FORMAT(//'0','PARAMETERS USED IN THE LINE SOURCE PLUME RISE ',      00003830
      1 'CALCULATIONS')/      00003840
      1 '0','BUILDING DIMENSIONS:  HEIGHT = ',F7.2,1X,'(M)'/      00003850
      2 24X,'WIDTH = ',F7.2,1X,'(M)'/      00003860
      3 23X,'LENGTH = ',F7.2,1X,'(M)'/      00003870
      4 '0',9X,'BUILDING SEPARATION = ',F7.2,1X,'(M)'/      00003880
      5 '0',6X,'LINE SOURCE SEPARATION = ',F7.2,1X,'(M)'/      00003890
      6 '0',11X,'LINE SOURCE WIDTH = ',F7.2,1X,'(M)'/      00003900
      7 '0','BUOYANCY FLUX PER LINE (FPRIME) = ',F7.1,1X,'(M**4/S**3)')      00003910
122  CONTINUE      00003920
C                                          00003930
C  WRITE THE METEOROLOGICAL PARAMETERS      00003940
C                                          00003950
      WRITE(6,1400)VERSION,LEVEL      00003960
      WRITE(6,1120)      00003970
1120  FORMAT(//'0','METEOROLOGICAL PARAMETERS')      00003980
      WRITE(6,1121)/MEAS,PEXP,DTHTA      00003990
1121  FORMAT(//'0','MEAN WIND SPEED MEASUREMENT HEIGHT = ',F4.1,' (M)'/      00004000
      1 '0','WIND SPEED POWER LAW EXPONENTS (STABILITIES 1-6) = ',      00004010
      2 6(F4.2,2X)'/0','VERTICAL POTENTIAL TEMPERATURE GRADIENT = ',      00004020
      3 F5.3,1X,'DEG K/M  (STABILITY 5)',5X,F5.3,1X,'DEG K/M  ',      00004030
      4 '(STABILITY 6)')      00004040
      IF(LMETIN)WRITE(6,1122)      00004050
1122  FORMAT('0','METEOROLOGICAL DATA -- FORMATTED USER INPUT')      00004060
      IF(.NOT.LMETIN)WRITE(6,1123)IDFLS,IRU,IDSURF,IYSURF,IDUPPER,IYUPER      00004070
1123  FORMAT('0','METEOROLOGICAL DATA -- PREPROCESSOR FORMAT'/      00004080
      1 '0','STABILITY CLASS VARIATION RESTRICTED TO ',T1,' CLASSES'/,      00004090
      2 'HOUR'/'0',1X,'MIXING HEIGHTS USED: ',I1,2X,'(1=RURAL,2=URBAN)'/      00004100
      3 ' SURFACE STATION ID: ',I5,5X,'YEAR: ',I2/      00004110
      4 1X,'UPPER AIR STATION ID: ',I5,5X,'YEAR: ',I2)      00004120
C                                          00004130
C  WRITE THE COMPUTATIONAL PARAMETERS      00004140
C                                          00004150
      WRITE(6,1130)CRIT,MAXIT      00004160
1130  FORMAT(///'0','COMPUTATIONAL PARAMETERS'/'0','CONVERGENCE ',      00004170
      1 'THRESHOLD FOR LINE SOURCE CALCULATIONS = ',F6.3,1X,      00004180
      2 '(MICROGRAMS/M**3)'/      00004190
      3 '0','MAXIMUM NUMBER OF ITERATIONS IN LINE SOURCE CALCULATIONS = '      00004200
      4 ,I2)      00004210
      IF(.NOT.LSHEAR)WRITE(6,1131)CONST2      00004220
1131  FORMAT('0','STABLE POINT SOURCE PLUME RISE CONSTANT (CONST2) = ',      00004230
      1 F4,2)      00004240
      WRITE(6,11131)CONST3      00004250
11131  FORMAT('0','FINAL NEUTRAL PLUME RISE CONSTANT (CONST3) = ',      00004260
      1 F5,2)      00004270
      WRITE(6,1132)XBACKE,DECFAC,TERAN      00004280
1132  FORMAT('0','BACKGROUND CONCENTRATION = ',F8.2,1X,'(MICROGRAMS/',      00004290
      1 'M**3)'/0','POLLUTANT DECAY FACTOR = ',E12.5,1X,' (1/SEC)'/      00004300
      2 '0','TERRAIN ADJUSTMENT FACTORS (STABILITIES 1-6) = ',      00004310
      3 6(F4.2,2X))      00004320
C                                          00004330
C  WRITE THE RECEPTOR INFORMATION      00004340
C                                          00004350
      WRITE(6,1400)VERSION,LEVEL      00004360
      IF(RINPUT)GO TO 85      00004370
      WRITE(6,114)      00004380

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114  FORMAT(/'0','RECEPTOR LOCATIONS GENERATED FROM USER DEFINED ', 00004700
1  'RECEPTOR RECTANGLE') 00004400
WRITE(6,70)RXSEG,RYEND,RXEND,RYEND,RXREG,RYREG,RXEND,RYREG,PDX,RDY 00004410
70  FORMAT(/'0',10X,'RECEPTOR NETWORK DEFINED BY THE FOLLOWING ', 00004420
1  'RECTANGLE') 00004430
2  '0',10X,'('',F10.1,'',',',F10.1,'')',5X,'('',F10.1,'',',',F10.1,'')' 00004440
3  '0',10X,'('',F10.1,'',',',F10.1,'')',5X,'('',F10.1,'',',',F10.1,'')' 00004450
4  '0',10X,'X GRID SPACING = ',F7.2/ 00004460
5  '0',10X,'Y GRID SPACING = ',F7.2/ 00004470
GO TO 99 00004480
85  WRITE(6,115)NREC 00004490
115  FORMAT(/'0','ALL RECEPTOR LOCATIONS SPECIFIED BY THE USER -- ', 00004500
1  'TOTAL NUMBER OF RECEPTOR: ',I3) 00004510
WRITE(6,89)NREC 00004520
89  FORMAT(/'0',10X,'RECEPTOR NETWORK (USER INPUT)') 00004530
1  '0','NUMBER OF RECEPTORS: ',I4//1X,'RECEPTOR NUMBER',10X, 00004540
2  'X',14X,'Y',10X,'ELEVATION'/25X,'(M)',12X,'(M)',12X,'(M)') 00004550
DO 92 I=1,NREC 00004560
XCOORD=XRSCS(I)+XBASE 00004570
YCOORD=YRSCS(I)+YBASE 00004580
92  WRITE(6,93)I,XCOORD,YCOORD,RELEV(I) 00004590
93  FORMAT(7X,I3,11X,F10.1,5X,F10.1,2X,F10.1) 00004600
99  CONTINUE 00004610
IF(.NOT.LUTMS)WRITE(6,116)TCOR 00004620
116  FORMAT('0','SOURCE AND RECEPTOR LOCATIONS SPECIFIED IN SCS ', 00004630
1  'COORDINATES -- TCOR = ',F6.2,' DEGREES') 00004640
IF(LUTMS)WRITE(6,117) 00004650
117  FORMAT('0','SOURCE AND RECEPTOR LOCATIONS SPECIFIED IN UTM ', 00004660
1  'COORDINATES') 00004670
C 00004680
C 00004690
C 00004700
WRITE THE LINE SOURCE PARAMETERS 00004710
IF(NLINES.LT.1)GO TO 1133 00004720
WRITE(6,1400)VERSION,LEVEL 00004730
WRITE(6,60)NLINES 00004740
60  FORMAT(/'0','LINE SOURCE PARAMETERS'/'0','NUMBER OF LINES: ',I4 00004750
1  //1X,'LINE NUMBER',4X,'X START',6X,'Y START',9X,'X END',9X, 00004760
2  'Y END',11X,'0',10X,'HEIGHT',5X,'PARTIAL CHI OUTPUT', 00004770
3  3X,'ELEVATION' 00004780
4  18X,'(M)',10X,'(M)',12X,'(M)',11X,'(M)',8X,'(GM/SEC)',9X, 00004790
5  '(M)',8X,'(0=NO,1=YES)',10X,'(M)') 00004800
DO 65 I=1,NLINES 00004810
XLREG=XLREG1(I)+XBASE 00004820
YLREG=YLREG1(I)+YBASE 00004830
XLEND=XLEND1(I)+XBASE 00004840
YLEND=YLEND1(I)+YBASE 00004850
QGMS=QT(I)/TEN6 00004860
65  WRITE(6,62)I,XLREG,YLREG,XLEND,YLEND,QGMS,HS(I),IPCL(I),LELEV(I) 00004870
62  FORMAT(4X,I3,7X,4(F10.1,4X),2X,F7.2,6X,F7.2,13X,I1,8X,F10.1) 00004871
WRITE(6,212) 00004872
212  FORMAT(/'0','SOURCE CONTRIBUTIONS FROM THE FOLLOWING ', 00004873
1  'LINE SOURCES ARE AVAILABLE: '/'0','(0=NOT AVAILABLE; ', 00004874
2  '1=AVAILABLE)'/0','LINE SOURCE NUMBER',5X,'AVAILABILITY') 00004875
DO 219 I=1,NLINES 00004876
WRITE(6,215)I,IPCL(I) 00004877
215  FORMAT('0',7X,I2,19X,I1) 00004878
219  CONTINUE 00004879
WRITE(6,216)NLINES,IPCL(11) 00004880
216  FORMAT('0',5X,') - ',I2,17X,I1) 00004885
1133  CONTINUE 00004886
C 00004887
C 00004888
C 00004889
WRITE THE POINT SOURCE PARAMETERS

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	IF (NPTS.LT.1) GO TO 127	00004890
	WRITE(6,1400) VERSION, LEVEL	00004900
	WRITE(6,160) NPTS	00004910
150	FORMAT('0', 'POINT SOURCE PARAMETERS' // '0', 'NUMBER OF POINTS: ',	00004920
1	14//1X, 'POINT NUMBER', 8X, 'X', 14X, 'Y', 11X, '0', 10X, 'HEIGHT', 4X,	00004930
2	'VOL. FLUX', 5X, 'STACK TEMP.', 5X, 'PARTIAL CHI OUTPUT',	00004940
3	3X, 'ELEVATION' /	00004950
4	20X, '(M)', 12X, '(M)', 6X, '(GM/SEC)', 9X, '(M)', 5X, '(M**3/SEC)',	00004960
5	6X, '(DEG K)', 9X, '(0=NO, 1=YES)', 10X, '(M)') /	00004970
	DO 132 I=1, NPTS	00004980
	XC00RD=XPSCS(I)+XBASE	00004990
	YC00RD=YPSCS(I)+YBASE	00005000
	VFLUX=APTS(I)*TSTACK(I)*PI/9.8	00005010
	QGMS=PQ(I)/TEN6	00005020
132	WRITE(6,133) I, XC00RD, YC00RD, QGMS, PHS(I), VFLUX, TSTACK(I), IPCP(I),	00005030
1	PELEV(I)	00005040
133	FORMAT(5X, I3, 8X, F10.1, 5X, F10.1, 4X, F7.2, 6X, F7.2, 4X, F10.0, 7X,	00005050
1	F5.1, 16X, I1, 8X, F10.1)	00005060
	WRITE(6,222)	00005061
222	FORMAT('0', 'SOURCE CONTRIBUTIONS FROM THE FOLLOWING ',	00005062
1	'POINT SOURCES ARE AVAILABLE: ' // '0', '(0=NOT AVAILABLE; ',	00005063
2	'1=AVAILABLE)' // '0', 'POINT SOURCE NUMBER', 5X, 'AVAILABILITY') /	00005064
	DO 239 I=1, NPTS	00005065
	WRITE(6,235) I, IPCP(I)	00005066
235	FORMAT('0', 8X, I2, 19X, I1)	00005067
239	CONTINUE	00005068
	WRITE(6,236) NPTS, IPCP(51)	00005069
236	FORMAT('0', 6X, '1 - ', I2, 17X, I1)	00005070
127	CONTINUE	00005075
C		00005080
C	CALCULATE SCS COORDINATES FROM UTM COORDINATES	00005090
C		00005100
	IF (.NOT. LUTMS) RETURN	00005110
	IF (N.LINES.LE.0) RETURN	00005120
	XOR=XLBEG1(1)	00005130
	YOR=YLBEG1(1)	00005140
	DX=XLEND1(1)-XOR	00005150
	DY=YLEND1(1)-YOR	00005160
	ANGRAD=ATAN2(DY, DX)	00005170
	TCOR=90.+ANGRAD/RAD	00005180
	SINT=SIN(ANGRAD)	00005190
	COST=COS(ANGRAD)	00005200
	WRITE(6,189)	00005210
189	FORMAT('1')	00005220
C		00005230
C	TRANSLATE ORIGIN AND ROTATE COORDINATES	00005240
C		00005250
C	LINE SOURCE COORDINATES	00005260
	DO 260 I=1, N.LINES	00005270
	XLBEG1(I)=XLBEG1(I)-XOR	00005280
	XLEND1(I)=XLEND1(I)-XOR	00005290
	YLBEG1(I)=YLBEG1(I)-YOR	00005300
	YLEND1(I)=YLEND1(I)-YOR	00005310
	YLBEG1(I)=-XLBEG1(I)*SINT+YLBEG1(I)*COST	00005320
	XLBEG1(I)=(XLBEG1(I)+YLBEG1(I)*SINT)/COST	00005330
	YSCS(I)=-XLEND1(I)*SINT+YLEND1(I)*COST	00005340
	XLEND1(I)=(XLEND1(I)+YSCS(I)*SINT)/COST	00005350
260	CONTINUE	00005360
C	POINT SOURCE COORDINATES	00005370
	IF (NPTS.LT.1) GO TO 275	00005380
	DO 270 I=1, NPTS	00005390
	XPSCS(I)=XPSCS(I)-XOR	00005400
	YPSCS(I)=YPSCS(I)-YOR	00005410

	YPCSCS(I)=-XPSCS(I)*SINT+YPCSCS(I)*COST	00005420
	XPSCS(I)=(XPSCS(I)+YPCSCS(I)*SINT)/COST	00005430
	CONTINUE	00005440
270	CONTINUE	00005450
275	RECEPTOR COORDINATES	00005460
C	IF(LINPUT)GO TO 290	00005470
	RXBEG1=RXBEG1-XOR	00005480
	RXEND1=RXEND1-XOR	00005490
	RYBEG1=RYBEG1-YOR	00005500
	RYEND1=RYEND1-YOR	00005510
	RYBEG1=-RXBEG1*SINT+RYBEG1*COST	00005520
	RXBEG1=(RXBEG1+RYBEG1*SINT)/COST	00005530
	RYEND1=-RXEND1*SINT+RYEND1*COST	00005540
	RXEND1=(RXEND1+RYEND1*SINT)/COST	00005550
	GO TO 299	00005560
290	DO 295 I=1,NREC	00005570
	XRSCS(I)=XRSCS(I)-XOR	00005580
	YRSCS(I)=YRSCS(I)-YOR	00005590
	YRSCS(I)=-XRSCS(I)*SINT+YRSCS(I)*COST	00005600
	XRSCS(I)=(XRSCS(I)+YRSCS(I)*SINT)/COST	00005610
295	CONTINUE	00005620
299	CONTINUE	00005630
	RETURN	00005640
700	WRITE(6,701)NLines,MAXI	00005650
701	FORMAT('1','NUMBER OF LINE SOURCES INPUT EXCEEDS MAXIMUM NUMBER ',	00005660
	1 'ALLOWED'/ '0','NUMBER OF LINE SOURCES INPUT (NLines): ',I5/	00005670
	2 '0','MAXIMUM NUMBER OF LINE SOURCES ALLOWED: ',I5)	00005680
	STOP	00005690
702	WRITE(6,703)NPIS,MAXP	00005700
703	FORMAT('1','NUMBER OF POINT SOURCES INPUT EXCEEDS MAXIMUM ',	00005710
	1 'NUMBER ALLOWED'/ '0','NUMBER OF POINT SOURCES INPUT (NPIS): ',I5/	00005720
	2 '0','MAXIMUM NUMBER OF POINT SOURCES ALLOWED: ',I5)	00005730
	STOP	00005740
704	WRITE(6,705)NREC,MAXR	00005750
705	FORMAT('1','NUMBER OF RECEPTORS INPUT EXCEEDS MAXIMUM NUMBER ',	00005760
	1 'ALLOWED'/ '0','NUMBER OF RECEPTORS INPUT (NREC): ',I5/	00005770
	2 '0','MAXIMUM NUMBER OF RECEPTORS ALLOWED: ',I5)	00005780
	STOP	00005790
706	WRITE(6,707)XLBEG,XLEND	00005800
707	FORMAT('1','ENTER COORDINATES OF THE LINE SOURCE ENDPOINTS FROM ',	00005810
	1 'WEST TO EAST -- '/IX,'I.E., XLBEG MUST BE LESS THAN OR EQUAL ',	00005820
	2 'TO XLEND'/ '0','XLBEG INPUT AS ',F10.1/ '0','XLEND INPUT AS ',	00005830
	3 F10.1)	00005840
	STOP	00005850
	END	00005860
	SUBROUTINE RECEPT	00005870
C	BLP VERSION 1.1 LEVEL 800702 RECEPT	00005880
	REAL LELEV	00005890
	COMMON/SOURCE/NLines,XLBEG(10),XLEND(10),DEL(10),YSCS(10),QT(10),	00005900
	1 HS(10),XRCS(10,129),YRCS(10,129),TCOR,LELEV(10),	00005910
	2 NPTS,XPSCS(50),YPCSCS(50),PQ(50),PHS(50),XPRCS(50),YPRCS(50),	00005920
	3 TSTACK(50),APTS(50),HPIS(50),VFXT(50),PELEV(50),IDOWNW(50)	00005930
	COMMON/RCEPT/RXBEG,RYBEG,RXEND,RYEND,RDX,RDY,XRSCS(100),	00005940
	1 YRSCS(100),XRRCs(100),YRRCs(100),RELEV(100),NREC	00005950
	COMMON/QA/VFPERSON,LEVEL	00005955
	IF(NLines.LE.0)GO TO 151	00005960
	YLMAX=YSCS(1)	00005970
	YLMIN=YSCS(NLines)	00005980
	XLMAX=XLEND(1)	00005990
	XLMIN=XLBEG(1)	00006000
	DO 5 I=1,NLines	00006010
	XLMIN=AMIN1(XLMIN,XLBEG(I))	00006020
	XLMAX=AMAX1(XLMAX,XLEND(I))	00006030

	YLMIN=AMINI(YLMIN,YSCS(I))	00006040
	YLMAX=AMAXI(YLMAX,YSCS(I))	00006050
5	CONTINUE	00006060
C	DEFINE THE SOURCE RECTANGLE	00006070
	WRITE(6,105)XLMIN,YLMAX,XLMAX,YLMAX,XLMIN,YLMIN,XLMAX,YLMIN	00006080
105	FORMAT('0','THE SOURCE RECTANGLE IS DEFINED BY THE FOLLOWING ',	00006090
	1 'POINTS:')	00006100
	2 /'0','(',F10.2,',',F10.2,')',10X,'(',F10.2,',',F10.2,')'	00006110
	3 /'0','(',F10.2,',',F10.2,')',10X,'(',F10.2,',',F10.2,')')	00006120
	GO TO 161	00006130
C	IF THERE ARE NO LINE SOURCES, SOURCE RECTANGLE IS	00006140
C	UNDEFINED -- ASSIGN VALUES TO XLMIN,XLMAX,YLMIN,YLMAX	00006150
C	SUCH THAT NO RESTRICTION IS PLACED ON THE LOCATIONS OF	00006160
C	RECEPTORS	00006170
151	CONTINUE	00006180
	XLMIN=1.E10	00006190
	XLMAX=-1.E10	00006200
	YLMIN=1.E10	00006210
	YLMAX=-1.E10	00006220
161	CONTINUE	00006230
	NRINX=(RXEND-RXBEG)/RDX+1	00006240
	NRINY=(RYEND-RYBEG)/RDY+1	00006250
C	NIHTOT IS THE NUMBER OF RECEPTORS BEFORE ELIMINATING	00006260
C	THOSE IN THE SOURCE RECTANGLE	00006270
	NIHTOT=NRINX*NRINY	00006280
	NREC=0	00006290
	DO 10 I=1,NRINX	00006300
	RXSAVE=RXBEG+(I-1)*RDX	00006310
	DO 10 J=1,NRINY	00006320
	RYSAVE=RYBEG+(J-1)*RDY	00006330
C	IF A RECEPTOR IS OUTSIDE THE SOURCE RECTANGLE, RECORD ITS	00006340
C	X AND Y COORDINATES, OTHERWISE, IGNORE IT	00006350
	IF(RYSAVE.GT.YLMAX.OR.RYSAVE.LT.YLMIN)GO TO 9	00006360
	IF(RXSAVE.GT.XLMAX.OR.RXSAVE.LT.XLMIN)GO TO 9	00006370
	GO TO 10	00006380
9	NREC=NREC+1	00006390
	IF(NREC.GT.100)GO TO 200	00006400
	XMSCS(NREC)=RXSAVE	00006410
	YMSCS(NREC)=RYSAVE	00006420
10	CONTINUE	00006430
	WRITE(6,1400)VERSION,LEVEL	00006431
1400	FORMAT('1',11X,'BLP -- MULTIPLE BUOYANT LINE AND POINT ',	00006433
	1 'SOURCE DISPERSION MODEL VERSION ',F4.1,3X,'LEVEL ',I6/	00006435
	2 '0',13('*****'))	00006437
	WRITE(6,26)	00006440
26	FORMAT(//'0','RECEPTOR NO.',11X,'LOCATION',19X,'RECEPTOR NO.',11X,	00006450
	1 'LOCATION'/16X,'X',16X,'Y',32X,'X',16X,'Y')	00006460
	IH=NREC/2	00006470
	DO 30 I=1,IH	00006480
	IP=IH+I	00006490
	WRITE(6,29)I,XMSCS(I),YMSCS(I),IP,XMSCS(IP),YMSCS(IP)	00006500
29	FORMAT(3X,I3,10X,F6.0,10X,F6.0,13X,I3,10X,F6.0,10X,F6.0)	00006510
30	CONTINUE	00006520
	IEVEN=MOD(NREC,2)	00006530
	IF(IEVEN.NE.0)WRITE(6,33)NREC,XMSCS(NREC),YMSCS(NREC)	00006540
33	FORMAT(51X,I3,10X,F6.0,10X,F6.0)	00006550
	WRITE(6,35)NIHTOT,NREC	00006560
35	FORMAT(///1X,'NUMBER OF POSSIBLE RECEPTOR LOCATIONS = ',I5/	00006570
	1 '0','NUMBER OF ACTUAL RECEPTOR LOCATIONS = ',I5)	00006580
	RETURN	00006590
200	WRITE(6,205)RXBEG,RYBEG,RXEND,RYEND,RDX,RDY	00006600
205	FORMAT('0','TOO MANY RECEPTOR LOCATIONS REQUESTED.'/0',	00006610
	1 'RECEPTORS AT: ',F13.6,',',F13.6,')',2X,'TO ',F13.6,',',	00006620

	2 E13.6,10X,'WITH (DX,DY) = ('E13.6','E13.6')')	00006630
	STOP	00006640
	END	00006650
	SUBROUTINE OUTTIL(TITLE,NREC,NPTS,NLINES,IPCL,IPCP,IYR,IDAYS)	00006660
C	HLP VERSION 1.1 LEVEL 800212 OUTTIL	00006670
	REAL TITLE(20)	00006680
	INTEGER IPCL(11),IPCP(51)	00006690
	INTEGER*2 IDAYS(366)	00006700
C		00006710
C	THIS SUBROUTINE WRITES THE TITLE CARD AND OTHER RUN	00006720
C	INFORMATION TO RECORD #1 OF THE OUTPUT FILE (UNIT 20)	00006730
C		00006740
	WRITE(20)TITLE,NREC,NPTS,NLINES,IPCL,IPCP,IYR,IDAYS	00006750
	RETURN	00006760
	END	00006770
	SUBROUTINE MET	00006780
C	HLP VERSION 1.1 LEVEL 800212 MET	00006790
	LOGICAL LMETIN,LMETOT	00006800
	INTEGER IDM(12,2)/0,31,60,91,121,152,182,213,244,274,305,335,	00006810
	1 0,31,59,90,120,151,181,212,243,273,304,334/	00006820
	INTEGER*2 IDAYS	00006830
	DIMENSION REPWD(24),HLH(2,24)	00006840
	COMMON/METD24/KST(24),SPEED(24),RANDWD(24),HMX(24),TEMP(24),	00006850
	1 DHTA(2),PEXP(6),IDELS,IDSURF,IYSURF,IDUPER,IYUPER,TFRAN(6),	00006860
	2 IRU,IHRMAX,LMETIN,LMETOT,IDAYS(366)	00006870
	COMMON/OA/VERSION,LEVEL	00006880
	DATA KSTOLD/5/	00006890
C		00006900
C	READ PROCESSED UNFORMATTED METEOROLOGICAL DATA	00006910
C		00006920
	IF(LMETIN)GO TO 185	00006930
	READ(2)IYR,IMO,DAY,KST,SPEED,TEMP,REPWD,RANDWD,HLH	00006940
	IDAY=DAY+0.01	00006950
		00006960
C		00006970
C	CALCULATE JULIAN DAY	00006980
C		00006990
C	ILEAP=1 FOR A LEAP YEAR	00007000
C	ILFAP=2 FOR A NON-LEAP YEAR	00007010
C		00007020
	ILFAP=2	00007030
	IF(MOD(IYR,4).EQ.0)ILEAP=1	00007040
	IDAY>IDM(IMO,ILEAP)+IDAY	00007050
C	IRU=1 FOR RURAL MIXING HEIGHTS, IRU=2 FOR URBAN MIXING HEIGHTS	00007060
	DO 5 I=1,24	00007070
	HMX(I)=HLH(IRU,I)	00007080
	CONTINUE	00007090
S		00007100
C		00007110
C	ALLOW ONLY STABILITIES 1 TO 6 AND	00007120
C	RESTRICT STABILITY VARIATION TO 'IDELS' CLASSES/HOUR	00007130
C		00007140
	DO 75 I=1,24	00007150
	ISTAB=KST(I)	00007160
	ISTAB=MIN0(ISTAB,6)	00007170
	IDUSTAB=ISTAB-KSTOLD	00007180
	IF(IABS(IDUSTAB).GT.IDELS)ISTAB=KSTOLD+ISIGN(IDELS,IDUSTAB)	00007190
	KSTOLD=ISTAB	00007200
	KST(I)=ISTAB	00007210
C	IF AMBIENT TEMPERATURE IS MISSING, ASSUME T=293.0 DEG. K	00007220
	IF(TEMP(I).LE.0.0)TEMP(I)=293.	00007230
75	CONTINUE	00007240
C		00007250
C	IF LMETOT = .TRUE., WRITE HOURLY METEOROLOGY	
C		

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      IF(.NOT.LF101)RETURN                                00007260
      IF(1DAYS(TDAY),NF,1)RETURN                          00007270
      WRITE(6,12)IYR,IMO,DAY,(NH,NH=1,24),KST,SPEED,TEMP,REFWD,RANDWD, 00007280
1      (HLH(1,N),N=1,24),(HLH(2,N2),N2=1,24)              00007290
12     FORMAT('0','IYR = ',12,3X,'IMO = ',12,3X,'DAY = ',F4.0/ 00007300
1      1 4X,'HR=',3X,I4,2315/                             00007310
1      1 4X,'ISTAR=',I4,2315/4X,'WS= ',24F5.1/4X,'TEMP=',24F5.0/ 00007320
2      2 4X,'WD-A=',24F5.0/4X,'WD-R=',24F5.0/4X,'H-RURAL=',12F6.0/ 00007330
3      3 12X,12F6.0/4X,'H-URBAN=',12F6.0/12X,12F6.0)    00007340
      RETURN                                              00007350
185    CONTINUE                                           00007360
C                                           00007370
C      READ UP TO 24 HOURS OF FORMATTED METEOROLOGICAL DATA 00007380
C      FROM UNIT 5                                       00007390
C                                           00007400
      READ(5,110)IHRMAX                                  00007410
110    FORMAT(I2)                                          00007420
      IF(IHRMAX.LE.24.AND.IHRMAX.GE.1)GO TO 161          00007430
      WRITE(6,159)IHRMAX                                  00007440
159    FORMAT(/////10X,'EXECUTION TERMINATING -- IHRMAX MUST ', 00007450
1      1 'BE SPECIFIED BY THE USER TO BE '/'0',9X,'BETWEEN ', 00007460
2      2 '1 AND 24 WHEN THE FORMATTED METEOROLOGICAL USER INPUT '/ 00007470
3      3 '0',9X,'OPTION IS REQUESTED -- (IHRMAX = ', 00007480
4      4 IS,')')                                          00007490
      STOP                                              00007500
161    CONTINUE                                           00007510
      WRITE(6,1400)VERSION,LEVEL                         00007520
1400   FORMAT(1X,11X,'HLP -- MULTIPLE BUOYANT LINE AND POINT ', 00007530
1      1 'SOURCE DISPERSION MODEL      VERSION ',F4.1,3X,'LEVEL ',I6/ 00007540
2      2 '0',13('*****'))                               00007550
      WRITE(6,171)                                         00007560
171    FORMAT('/'0',20X,'USER INPUT FORMATTED METEOROLOGICAL DATA'// 00007570
1      1 '0',5X,'HOUR',3X,'STABILITY',3X,'WIND SPEED',3X,'WIND ', 00007580
2      2 'DIRECTION',3X,'TEMPERATURE',3X,'MIXING HEIGHT'/ 00007590
3      3 15X,'CLASS',8X,'(M/S)',8X,'(DEGREES)',6X,'(DEG. K)',9X, 00007600
4      4 '(M)')                                           00007610
      DO 100 I=1,IHRMAX                                  00007620
      READ(5,112)KST(I),SPEED(I),RANDWD(I),TEMP(I),HMIX(I) 00007630
112    FORMAT(I1,9X,F10.2,F10.2,F10.2,F10.2)             00007640
      WRITE(6,114)I,KST(I),SPEED(I),RANDWD(I),TEMP(I),HMIX(I) 00007650
114    FORMAT('0',6X,12,8X,I1,9X,F5.2,10X,F5.1,11X,F5.1,9X,F5.0) 00007660
100    CONTINUE                                           00007670
      RETURN                                              00007680
      END                                                00007690
      SUBROUTINE COORD(THETA,ISTAR)                       00007700
C      HLP  VERSION 1.1  LEVEL 800212      COORD          00007710
      DIMENSION XSCS(10,129)                             00007720
      REAL L,LFLEV                                         00007730
      REAL TCHK(4)/90.,180.,270.,360./                  00007740
      INTEGER IL(4)/4*1/,ISFG(4)/1,129,129,1/          00007750
      COMMON/SOURCE/NLINES,XLHEG(10),XLEND(10),DEL(10),YSCS(10),QT(10), 00007760
1      1 HS(10),XRCS(10,129),YRCS(10,129),TCOR,LFLEV(10), 00007770
2      2 NPTS,XPSCS(50),YPSCS(50),PD(50),PHS(50),XPRCS(50),YPRCS(50), 00007780
3      3 ISTACK(50),APTS(50),BPTS(50),VEXIT(50),PELEV(50),IDOWNW(50) 00007790
      COMMON/RCEFT/RXHEG,RXHEG,RXFND,RXEND,RDX,RDY,XRCS(100), 00007800
1      1 YRCS(100),XRCS(100),YRCS(100),RELEV(100),NREC 00007810
      EQUIVALENCE (XRCS(1,1),XSCS(1,1))                 00007820
      DATA RAD/57.29578/                                00007830
      TRAD=THETA/RAD                                       00007840
      CUST=COS(TRAD)                                       00007850
      SINT=SIN(TRAD)                                       00007860
      IF(NLINES.LT.1)GO TO 250                            00007870
C                                                         00007880

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	CALCULATE SOURCE COORDINATES FOR EACH SOURCE LINE SEGMENT	00007890
	DO 25 I=1,NLINES	00007900
	DXX=DEL(I)/128.	00007910
	XSCS(I,1)=XLBEG(I)	00007920
	DO 25 J=2,129	00007930
	XSCS(I,J)=XSCS(I,J-1)+DXX	00007940
15	CONTINUE	00007950
	IL(3)=NLINES	00007960
	IL(4)=NLINES	00007970
		00007980
		00007990
	CALCULATE XN, YN (ORIGINS OF TRANSLATED COORDINATE SYSTEM	00008000
	IN TERMS OF THE SCS COORDINATES	00008010
		00008020
	DO 5 I=1,4	00008030
	IF(THETA.GE.TCHK(I))GO TO 5	00008040
	ISAVE=I	00008050
	ILINE=IL(I)	00008060
	ISEGN=ISEG(I)	00008070
	XN=XSCS(ILINE,ISEGN)	00008080
	YN=YSCS(ILINE)	00008090
	GO TO 6	00008100
5	CONTINUE	00008110
6	CONTINUE	00008120
		00008130
	TRANSLATE COORDINATES	00008140
		00008150
	TRANSLATE LINE SOURCE SEGMENT COORDINATES	00008160
	DO 10 I=1,NLINES	00008170
	DO 10 J=1,129	00008180
	XPCS(I,J)=XSCS(I,J)-XN	00008190
	YPCS(I,J)=YSCS(I,J)-YN	00008200
10	CONTINUE	00008210
	TRANSLATE POINT SOURCE COORDINATES	00008220
	DO 11 I=1,NPTS	00008230
	XPRCS(I)=XPCS(I)-XN	00008240
	YPRCS(I)=YPCS(I)-YN	00008250
11	CONTINUE	00008260
	TRANSLATE RECEPTOR COORDINATES	00008270
	DO 12 I=1,NREC	00008280
	XRRCS(I)=XPRCS(I)-XN	00008290
	YRRCS(I)=YPRCS(I)-YN	00008300
12	CONTINUE	00008310
		00008320
	ROTATE COORDINATE SYSTEM	00008330
		00008340
	ROTATE LINE SOURCE SEGMENT COORDINATES	00008350
	DO 20 I=1,NLINES	00008360
	DO 20 J=1,129	00008370
	XSAVE=XPCS(I,J)	00008380
	YSAVE=YPCS(I,J)	00008390
	XPCS(I,J)=XSAVE*COST+YSAVE*SINT	00008400
	YPCS(I,J)=YSAVE*COST-XSAVE*SINT	00008410
20	CONTINUE	00008420
	IF(NPTS.LT.1)GO TO 260	00008430
	ROTATE POINT SOURCE COORDINATES	00008440
	DO 21 I=1,NPTS	00008450
	XSAVE=XPRCS(I)	00008460
	YSAVE=YPRCS(I)	00008470
	XPRCS(I)=XSAVE*COST+YSAVE*SINT	00008480
	YPRCS(I)=YSAVE*COST-XSAVE*SINT	00008490
21	CONTINUE	00008500
260	CONTINUE	00008510

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C      ROTATE RECEPTOR COORDINATES                                00008520
      DO 22 I=1,NREC                                                00008530
      XSAVE=XRRCS(I)                                                00008540
      YSAVE=YRRCS(I)                                                00008550
      XRRCS(I)=XSAVE*COST+YSAVE*SINT                                00008560
      YRRCS(I)=YSAVE*COST-XSAVE*SINT                                00008570
22     CONTINUE                                                    00008580
      RETURN                                                         00008590
250    CONTINUE                                                    00008600
C
C      WITH NO LINE SOURCES, JUST ROTATE THE POINT SOURCE AND    00008610
C      RECEPTOR COORDINATES                                     00008620
C
C      IF(NPTS.LT.1)GO TO 360                                       00008640
C      ROTATE POINT SOURCE COORDINATES                             00008650
      DO 321 I=1,NPTS                                               00008660
      XSAVE=XPRCS(I)                                                00008670
      YSAVE=YPRCS(I)                                                00008680
      XPRCS(I)=XSAVE*COST+YSAVE*SINT                                00008690
      YPRCS(I)=YSAVE*COST-XSAVE*SINT                                00008700
321    CONTINUE                                                    00008710
360    CONTINUE                                                    00008720
C      ROTATE RECEPTOR COORDINATES                               00008730
      DO 322 I=1,NREC                                               00008740
      XSAVE=XRRCS(I)                                                00008750
      YSAVE=YRRCS(I)                                                00008760
      XRRCS(I)=XSAVE*COST+YSAVE*SINT                                00008770
      YRRCS(I)=YSAVE*COST-XSAVE*SINT                                00008780
322    CONTINUE                                                    00008790
      RETURN                                                         00008800
      END                                                            00008810
      SUBROUTINE CONTRK                                             00008820
C      MLP VERSION 1.1 LEVEL 800702 CONTRK                        00008830
      REAL CHT(100),PARTCH(100),CHIL(100),FTSAVE(129)             00008840
      REAL L,LEFF,LD,LELEV                                          00008850
      INTEGER NSEGA(7)/3,5,0,17,33,65,129/                        00008860
      LOGICAL L SHEAR,L TRANS                                       00008870
      COMMON/PRIS/XPR,LEFF,LD,RO,XFINAL,XFS                        00008880
      COMMON/SOURCE/ZLINES,XLBEG(10),XLENG(10),DEL(10),YSCS(10),QT(10), 00008890
      1 HSC(10),XRCS(10,129),YRCS(10,129),ICOR,LELEV(10),         00008900
      2 NPTS,XPRCS(50),YPRCS(50),PU(50),PHS(50),XPRCS(50),YPRCS(50), 00008910
      3 ISTACK(50),APTS(50),RPTS(50),VEXIT(50),PELEV(50),IDOWN(50) 00008920
      COMMON/RDEPT/RXBEG,RXBEG,RXFED,RXFED,RDX,RDY,XRSCS(100),     00008930
      1 YRSCS(100),XRRCS(100),YRRCS(100),PELEV(100),NREC          00008940
      COMMON/HINP/XDIST(7),DH(7)                                    00008950
      COMMON/VFID/ZMEAS,WS,SD,ISTAR,DEGK,DPHL,THETA,S,P,IYP,JDAY,INHR 00008960
      COMMON/PR/L,RH,RE,NO,FPRIME,FP,XMATCH,DX,AVFACT,TWGR,N,L SHEAR, 00008970
      1 LTRANS                                                       00008980
      COMMON/PR/DAT/IDUPRL,PHL1R6                                  00008990
      COMMON/OUTPT/IPCL(11),IPCP(51)                                00009000
      COMMON/PARM/CRIT,IFX1,DECFAC,XRACK6,CONST2,CONST3,MAXIT      00009010
      DATA PI/3.14159277,SRI2OP/0.79788467,TSFHI/07,JTICT/0/    00009020
      DO 5 I=1,NREC                                                 00009030
      CHIL(I)=0.0                                                    00009040
5      CHI(I)=0.0                                                    00009050
      IF(DLINES.LT.1)GO TO 2000                                     00009060
      THETA=THETA+0.5                                                00009070
      WSST=WS*(DEFF/ZMEAS)**P                                        00009080
C      SET EFFECTIVE WIND SPEED USED IN PLUME RISE                00009090
C      CALCULATIONS, U, TO STACK HEIGHT WIND SPEED, WSST --      00009100
C      IF USING WIND SHEAR OPTION IN PLUME RISE, U WILL BE        00009110
C      CALCULATED IN SUBROUTINE WSC                                00009120
      U=WSST                                                         00009130

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	IF(LSHEAR)CALL WSC(ISTAB,ASST,U,S,P)	00009150
	CALL LENG(THETA,U)	00009160
C		00009170
C	CALCULATE DISTANCE TO FINAL RISE	00009180
C		00009190
	IF(ISTAB.LE.4)GO TO 6	00009200
C	CALCULATE DISTANCE TO FINAL RISE FOR STABLE CONDITIONS	00009210
	UNSR=16.*U*U/S-XFB*XFB/3.	00009220
	IF(UNSR.LE.0.0)GO TO 105	00009230
	XFS=0.5*(XFB+SQRT(UNSR))	00009240
	GO TO 106	00009250
105	XFS=(12.*XFB*U*U/S)**0.3333333	00009260
106	IF(XFS.GT.XFB)GO TO 7	00009270
	DO 18 I=2,7	00009280
18	XDIST(I)=XFS	00009290
	GO TO 10	00009300
6	XFS=XFB+XFINAL	00009310
7	CONTINUE	00009320
C	FIND 5 INTERMEDIATE DOWNWIND DISTANCES (IN ADDITION TO XFB)	00009330
C	AT WHICH PLUME RISE WILL BE CALCULATED	00009340
	DO 9 I=2,7	00009350
	RI=FLOAT(I)	00009360
	XDIST(I)=XFS-(XFS-XFB)*(7.-PI)/5.	00009370
9	CONTINUE	00009380
10	CONTINUE	00009390
	CALL RISE(U,THETA,ISTAB,S)	00009400
C		00009410
C	CALCULATE PARTIAL CONCENTRATIONS DUE TO THE LINE SOURCES	00009420
C		00009430
C	LOOP OVER LINES	00009440
C		00009450
	DO 1000 LNUM=1,NLINES	00009460
	DLMIN=DEL(LNUM)/128.	00009470
	ZB=LELEV(LNUM)	00009480
	ZLINE=HS(LNUM)	00009490
	WSST=WS*(ZLINE/ZMEAS)**P	00009500
	CUR=QT(LNUM)/((NSEGA(1)-1)*WSST)	00009510
C	SRT2OP = SQRT(2./PI)	00009520
	SZ0=R0*SRT2OP	00009530
	ZV=1000.*XVZ(SZ0,ISTAB)	00009540
	SY0=SZ0/2.	00009550
	YV=1000.*XVY(SY0,ISTAB)	00009560
	XB=XRCS(LNUM,1)	00009570
	YB=YRCS(LNUM,1)	00009580
	XE=XRCS(LNUM,129)	00009590
	YE=YRCS(LNUM,129)	00009600
	XMAXL=AMAX1(XB,XE)	00009610
	XMINL=AMIN1(XB,XE)	00009620
	YMAXL=AMAX1(YB,YE)	00009630
	YMINL=AMIN1(YB,YE)	00009640
	DXEL=XE-XB	00009650
	DYEL=YE-YB	00009660
C		00009670
C	LOOP OVER RECEPTORS	00009680
C		00009690
	DO 500 I=1,NREC	00009700
	SUM=0.0	00009710
	PARTCH(I)=0.0	00009720
	NSEG=0	00009730
	NCONTR=0	00009740
	XRECEP=XRCS(I)	00009750
	THET=RELEV(I)-ZB	00009760
C		00009770

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C      IF RECEPTOR IS OFF END OF THE LINE, CONT = 0.0      00009780
C      IF (XRECEP.LT.XMIN) GO TO 500      00009790
      YRECEP=YRXC(1)      00009800
C      IY SIG KEEPS TRACK OF WHETHER ANY LINE SEGMENT IS WITHIN      00009810
C      ONE SIGMA Y OF THE CURRENT RECEPTOR (0=NO,1=YES)      00009820
      IASIG=0      00009830
C      DEFINE REGION OF INFLUENCE      00009840
C      MAX DISTANCE FROM ANY SOURCE SEGMENT TO CURRENT RECEPTOR      00009850
C      IS EQUAL TO (XRECEP-XMINL)/1000.      00009860
      XNXXKM=(XRECEP-XMINL)/1000.      00009870
      CALL SIGMAY(XNXXKM,ISTAR,SYG)      00009880
      YLOW=YMINL-4.*SYG      00009890
      YHIGH=YMAXL+4.*SYG      00009900
      IF (YRECEP.LT.YLOW.OR.YRECEP.GT.YHIGH) GO TO 500      00009910
      YLOW=YLOW+PLN1M      00009920
      YHIGH=YHIGH-PLN1M      00009930
      IF (YRECEP.LT.YLOW.OR.YRECEP.GT.YHIGH) GO TO 500      00009940
C      CHECK IF RECEPTOR IS DIRECTLY DOWNWIND OF      00009950
C      THE LINE (IDW=0=NO, IDW=1=YES)      00009960
      IDW=1      00009970
      IF (YRECEP.LT.YMINL.OR.YRECEP.GT.YMAXL) IDW=0      00009980
C      CHECK IF RECEPTOR IS ON THE DOWNWIND SIDE OF THE LINE      00009990
      IF (XRECEP.GE.XMAXL) GO TO 477      00010000
      IF (MOD((TIME1A,90),90.0) GO TO 477      00010010
      FM=DYFL/DXFL      00010020
      R=YF-FM*XF      00010030
      IF (XRECEP.LT.(YRECEP-R)/FM) NCONTR=999      00010040
477      CONTINUE      00010050
      NSEGO=NSEGA(1)      00010060
      NNEW=NSEGO      00010070
      ITER=0      00010080
      INDL=1      00010090
      IDELTA=128/(NSEGO-1)      00010100
498      CONTINUE      00010110
      NSEGO=NSEGO+NNEW      00010120
C      00010130
C      00010140
C      LOOP OVER LINE SEGMENTS      00010150
C      00010160
      DO 499 ISFG=1,NNEW      00010170
      FTSAVE(INDL)=0.0      00010180
C      IF CURRENT RECEPTOR IS UPWIND OF A SOURCE SEGMENT, THEN      00010190
C      THIS SOURCE SEGMENT DOES NOT CONTRIBUTE      00010200
      IF (XRC(LNUM,INDL).GE.XRECEP) GO TO 495      00010210
      DOWNX=XRECEP-XRC(LNUM,INDL)      00010220
      CROSSY=YRECEP-YRC(LNUM,INDL)      00010230
      VIRTIXZ=DOWNX+ZV      00010240
      VIRTXY=DOWNX+YV      00010250
      VXXKM=VIRTIXY/1000.      00010260
      VYXKM=VIRTIXZ/1000.      00010270
      CALL DRISIG(VXXKM,VYXKM,ISTAR,SIGY,SIGZ)      00010280
C      00010290
C      IF CROSSWIND DISTANCE > 4 * SIGY, THEN THIS SOURCE SEGMENT      00010300
C      DOES NOT CONTRIBUTE      00010310
      IF (4.*SIGY.LT.ABS(CROSSY)) GO TO 495      00010320
      IF (ABS(CROSSY).LT.SIGY) IASIG=1      00010330
      CALL ZRISF(LNUM,INDL,1,Z)      00010340
C      00010350
C      INCLUDE TERRAIN CORRECTION IN DETERMINING THE PLUME HEIGHT      00010360
C      00010370
      HNT=Z+ZLINE      00010380
C      TER1=(1.-TERRA(ISTAR)); INT=REFLEV(1)-(ELEV(LNUM)      00010390
      TERRA=TER1*AVLN1(HNT,INT)      00010400

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	H=NHT-TERRAP	00010410
	IF (H.GT.DPBL) GO TO 495	00010420
C		00010430
C	SOLVE THE GAUSSIAN POINT SOURCE EQUATION	00010440
C		00010450
	CALL GAUSS(CROSSY,SIGY,SIGZ,H,FT)	00010460
C	INCLUDE DECAY IN DETERMINING CHI	00010470
	DELTAT=DOWNX/WSST	00010480
	FT=FT*(1.-DELTAT*DECFA)	00010490
	FTSAVE(INDL)=FT	00010500
	NCONTR=NCONTR+1	00010510
495	INDL=INDL+IDELTA	00010520
499	CONTINUE	00010530
C		00010540
C	FIRST TIME THROUGH LOOP, CALCULATE THE FIRST CHI ESTIMATE	00010550
C		00010560
	IF (NNEW.NE.NSEGO) GO TO 714	00010570
	INDL=1	00010580
	NSEGM1=NSFG0-1	00010590
	SUM=(FTSAVE(1)+FTSAVE(129))/2.	00010600
	DO 712 ISEG2=2,NSEGM1	00010610
	INDL=INDL+IDELTA	00010620
	SUM=SUM+FTSAVE(INDL)	00010630
712	CONTINUE	00010640
C	IF RECEPTOR IS WITHIN REGION OF INFLUENCE BUT NOT DIRECTLY	00010650
C	DOWNWIND OF ANY PART OF THE LINE, AND SUM=0.0, CHI=0.0	00010660
	IF (SUM.LE.0.0.AND.IDW.NF.1) GO TO 500	00010670
C		00010680
C	CALCULATE THE REFINED CHI ESTIMATE	00010690
C		00010700
713	CONTINUE	00010710
	ITER=ITER+1	00010720
	IDIV=MIN0(ITER,2)	00010730
	IDELTA=IDELTA/IDIV	00010740
	INDL=1+IDELTA/2	00010750
C	INDL IS THE SUBSCRIPT OF THE FIRST NEW LINE SEGMENT	00010760
C	(SAVE AS INDL SV)	00010770
	INDLSV=INDL	00010780
	NNEW=NSEGM1**ITER+0.1	00010790
C	IF MORE THAN 129 LINE SEGMENTS (I.E., 64 NEW SEGMENTS)	00010800
C	ARE REQUIRED, CONTINUE TO INCREASE THE NUMBER OF	00010810
C	SEGMENTS BUT ONLY OVER THE SECTION OF THE LINE	00010820
C	WHICH IS CONTRIBUTING	00010830
	IF (NNEW.GT.64) GO TO 759	00010840
	GO TO 498	00010850
714	CONTINUE	00010860
C	SUBSCRIPT OF THE FIRST NEW LINE SEGMENT IS INDL SV	00010870
C	SUBSCRIPT OF THE LAST NEW LINE SEGMENT IS INDLLN	00010880
	INDLLN=129-IDELTA/2	00010890
C	SUM THE FIRST AND LAST NEW LINE SEGMENTS	00010900
	SUM2=FTSAVE(INDL SV)+FTSAVE(INDLLN)	00010910
C	IF THERE ARE ONLY 2 NEW LINE SEGMENTS, SKIP THIS LOOP	00010920
	IF (NNEW.LE.2) GO TO 717	00010930
	INDL=INDLSV	00010940
	I2=NNEW-1	00010950
C		00010960
C	FIND THE SUM OF ALL THE NEW LINE SEGMENTS	00010970
C		00010980
	DO 715 ISEG3=2,I2	00010990
	INDL=INDL+IDELTA	00011000
	SUM2=SUM2+FTSAVE(INDL)	00011010
715	CONTINUE	00011020
717	CONTINUE	00011030

C		00011040
C	COMPARE THE NEW ESTIMATE WITH THE PREVIOUS ESTIMATE	00011050
C		00011060
	SUM2=SUM/2.+SUM2/(2.**ITER)	00011070
C	AT LEAST ONE LINE SEGMENT MUST BE WITHIN ONE SIGMA Y OF	00011080
C	THE LINE (IF THE RECEPTOR IS DIRECTLY DOWNWIND OF ANY PART	00011090
C	OF THE LINE)	00011100
	IF(IDW.EQ.1.AND.IWOSIG.NE.1)GO TO 758	00011110
	DIFF=ABS(SUM2-SUM)	00011120
	IF(DIFF*CUQ.LT.0.1)GO TO 720	00011130
	CORR=DIFF/SUM2	00011140
	IF(CORR.LT.CRIT)GO TO 720	00011150
758	CONTINUE	00011160
	SLW=SUM2	00011170
	GO TO 713	00011180
C	IF 129 SOURCE SEGMENTS NOT SUFFICIENT, CONTINUE	00011190
C	TO INCREASE NUMBER OF SEGMENTS, BUT ONLY OVER THE	00011200
C	SECTION OF LINE WHICH IS CONTRIBUTING	00011210
759	CONTINUE	00011220
	CALL SORT(FTSAVE,IRMIN,IRMAX,IWPBL)	00011230
	IF(IWPBL.NE.999)GO TO 4949	00011240
	IWPBL=0	00011250
	PATCH(T)=0.0	00011260
	GO TO 500	00011270
4949	CONTINUE	00011280
	IRMAX1=IRMAX-1	00011290
	IR=0	00011300
	IGMAX=1	00011310
939	CONTINUE	00011320
	SUM2=0.0	00011330
	XGMAX1=IGMAX+1	00011340
	DO 940 IG=IRMIN,IRMAX1	00011350
C	XCLN = X COORDINATE (RCS) OF CURRENT (NEWEST) LINE SEGMENT	00011360
C	YCLN = Y COORDINATE (RCS) OF CURRENT (NEWEST) LINE SEGMENT	00011370
	XSEG1=XRCS(LNUM,IG)	00011380
	XDIFF=XRCS(LNUM,IG+1)-XSEG1	00011390
	YSEG1=YRCS(LNUM,IG)	00011400
	YDIFF=YRCS(LNUM,IG+1)-YSEG1	00011410
	DO 940 IGSUB=1,IGMAX	00011420
	WEIGHT=FLOAT(IGSUB)/XGMAX1	00011430
	XCLN=XSEG1+WEIGHT*XDIFF	00011440
	YCLN=YSEG1+WEIGHT*YDIFF	00011450
	DOWNX=XRECEP-XCLN	00011460
	CROSSY=YRECEP-YCLN	00011470
	VIRTXZ=DOWNX+ZV	00011480
	VIRTXY=DOWNX+YV	00011490
	VXYKM=VIRTXY/1000.	00011500
	VXZKM=VIRTXZ/1000.	00011510
	CALL DBTSIG(VXZKM,VXYKM,ISTAB,SIGY,SIGZ)	00011520
	CALL 7RISE(LNUM,IG,1,Z)	00011530
C	INCLUDE TERRAIN CORRECTION IN DETERMINING THE PLUME HEIGHT	00011540
	HNT=Z+ZLINE	00011550
C	TER1=(1.-TERAN(ISTAB)); THT=RELEV(I)-LELEV(LNUM)	00011560
	TERRAN=TER1*AMIN1(HNT,THT)	00011570
	H=HNT-TERRAN	00011580
	CALL GAUSS(CROSSY,SIGY,SIGZ,H,FT)	00011590
C	INCLUDE DECAY IN DETERMINING CHI	00011600
	DELTAI=DOWNX/WSST	00011610
	FI=FI*(1.-DELTAI*DECFAC)	00011620
	SUM2=SUM2+FI	00011630
	NCONTR=NCONTR+1	00011640
940	CONTINUE	00011650
C	COMPARE THE NEW ESTIMATE WITH THE PREVIOUS ESTIMATE	00011660

	SUM2=SUM/2.+SUM2/(2.**ITER)	00011670
	DIFF=ABS(SUM2-SUM)	00011680
	IF (DIFF*CUQ.LT.0.1)GO TO 720	00011690
	CORR=DIFF/SUM2	00011700
	IF (CORR.LT.CRIT)GO TO 720	00011710
	SUM=SUM2	00011720
	ITER=ITER+1	00011730
	IF (ITER.GE.MAXIT)GO TO 599	00011740
	IH=IH+1	00011750
	IGMAX=2**IH	00011760
	GO TO 939	00011770
720	CONTINUE	00011780
	SUM=SUM2	00011790
C	TEST TO MAKE SURE AT LEAST TWO LINE SEGMENTS CONTRIBUTED	00011800
C	TO THE CHI ESTIMATE	00011810
C	(UNLESS RECEPTOR IS ON THE UPWIND SIDE OF THE LINE WITH	00011820
C	SOME SOURCE SEGMENTS DOWNWIND AND SOME SOURCE SFGMENTS	00011830
C	UPWIND -- IN THAT CASE JUST USE THE TEST FOR CONVERGENCE)	00011840
C	IF (NCONTR.LT.2)GO TO 713	00011850
C	CALCULATE CONCENTRATION (IN MICROGRAMS)	00011860
C	USE STACK HEIGHT WIND SPEED FOR DILUTION	00011870
	PARTCH(I)=CUQ*SUM	00011880
	CHIL(I)=CHIL(I)+PARTCH(I)	00011890
	GO TO 500	00011900
599	WRITE(6,600)MAXIT,I,LNUM,CORR,CRIT,ITER,IHOUR,IDAY,IYR	00011910
600	FORMAT(// '0', 'TOO MANY ITERATIONS IN LINE SOURCE CALCULATIONS',	00011920
	1 ' -- MAXIT = ',I2/1X, 'RECEPTOR ',I3,	00011930
	1 ' PROBABLY TOO CLOSE TO LINE ',I2/	00011940
	2 1X, 'CORR = ',F6.2/1X, 'CRIT = ',F6.2/1X, 'ITER = ',I3/	00011950
	3 1X, '(IHOUR,IDAY,IYR) = ',('(',I2,',',I3,',',I2,')')	00011960
	JITCT=JITCT+1	00011970
	IF (JITCT.GT.100)GO TO 6491	00011980
	SUM=SUM2	00011990
	PARTCH(I)=CUQ*SUM	00012000
	CHIL(I)=CHIL(I)+PARTCH(I)	00012010
	GO TO 500	00012020
6491	WRITE(6,6492)	00012030
6492	FORMAT(// '0', 'TOO MANY EXCEEDENCES OF LINE SOURCE ',	00012040
	1 ' ITERATION MAXIMUM -- EXECUTION TERMINATING')	00012050
	STOP	00012060
500	CONTINUE	00012070
	IF (IPCL(LNUM).EQ.1)CALL OUTPUT(LNUM,PARTCH,NREC)	00012080
1000	CONTINUE	00012090
	IF (IPCL(11).EQ.1)CALL OUTPUT(11,CHIL,NREC)	00012100
C		00012110
C	CALCULATE PARTIAL CONCENTRATIONS DUE TO THE POINT SOURCES	00012120
C		00012130
C	LOOP OVER POINTS	00012140
C		00012150
2000	IF (NPTS.LT.1)GO TO 9999	00012160
	IF (ISTAR.GT.4)SQRTS=SQRT(S)	00012170
	DO 2100 NUMPT=1,NPTS	00012180
	ZB=PELEV(NUMPT)	00012190
	XSTACK=XPRCS(NUMPT)	00012200
	YSTACK=YPRCS(NUMPT)	00012210
	ZSTACK=PHS(NUMPT)	00012220
	WSST=WS*(ZSTACK/ZMEAS)**P	00012230
	CUQ=PQ(NUMPT)/WSST	00012240
	RUOYFX=APTS(NUMPT)*(TSTACK(NUMPT)-TDEGK)	00012250
	IF (ISTAR.GT.4)GO TO 7150	00012260
C	CALCULATE DISTANCE TO FINAL RISE	00012270
	IF (RUOYFX.GT.55.)GO TO 7010	00012280
C	THE CONSTANT 49. = 3.5*14.	00012290

	XSMT=49.*RHOYFX**0.625	00012300
	GO TO 7015	00012310
7010	XSMT=3.5*CONST3*RHOYFX**0.4	00012320
	GO TO 7015	00012330
7150	XSMT=3.14159*WSST/SQRTS	00012340
7015	CONTINUE	00012350
C		00012360
C	IF THE POINT SOURCE BUILDING DOWNWASH OPTION IS REQUESTED,	00012370
C	DETERMINE THE EFFECTS (IF ANY) OF BUILDING DOWNWASH	00012380
C		00012390
	ZV=0.0	00012400
	YV=0.0	00012410
	IF (IDOWNW(NUMPT).NE.1) GO TO 512	00012420
C	CALCULATE THE MOMENTUM RISE AT A DOWNWIND DISTANCE OF 2.*HB	00012430
C	FM3 = 3.*FM (I.E., 3.*VERTICAL MOMENTUM FLUX TERM)	00012440
	FM3=HPTS(NUMPT)*TDFGK	00012450
	BETAM=0.3333333+WSST/VEXIT(NUMPT)	00012460
	IF (ISTAB.GT.4) GO TO 509	00012470
	EFFHT=ZSTACK+(FM3*TWOHB/(BETAM*BETAM*WSST*WSST))*0.3333333	00012480
	GO TO 511	00012490
509	EFFHT=ZSTACK+(FM3*SIN(SQRIS*TWOHB/WSST)/	00012500
	1 (BETAM*BETAM*WSST*SQRIS))*0.3333333	00012510
511	CONTINUE	00012520
	RATIO=EFFHT/HB	00012530
	RATIO=AMAX1(RATIO,1.0)	00012540
C	IF RATIO GE 3.0, SIGY AND SIGZ ARE NOT MODIFIED	00012550
C	IF RATIO LT 3.0 AND GT 1.2, ONLY SIGZ IS MODIFIED	00012560
C	IF RATIO LE 1.2, BOTH SIGY AND SIGZ ARE MODIFIED	00012570
	IF (RATIO.GE.3.0) GO TO 512	00012580
	R0Z=HB*(1.5-RATIO/2.)	00012590
	SZ0=SR12DP*R0Z	00012600
	ZV=1000.*XVZ(SZ0,ISTAB)	00012610
	A=5.0*R0Z	00012620
	R=A.3333333*R0Z*R0Z	00012630
	IF (RATIO.GT.1.2) GO TO 512	00012640
	R0Y=HB*(6.-5.*RATIO)/2.	00012650
	SY0=SR12DP*R0Y	00012660
	YV=1000.*XVY(SY0,ISTAB)	00012670
512	CONTINUE	00012680
C		00012690
C	LOOP OVER RECEPTORS	00012700
C		00012710
	DO 2050 I=1,NREC	00012720
	PATCH(I)=0.0	00012730
	DOWNX=XRRCS(I)-XSTACK	00012740
	IF (DOWNX.LE.0.0) GO TO 2050	00012750
	CROSSY=YRRCS(I)-YSTACK	00012760
	VIRTXZ=DOWNX+ZV	00012770
	VJRTXY=DOWNX+YV	00012780
	VXZKM=VIRTXZ/1000.	00012790
	VXYKM=VJRTXY/1000.	00012800
	CALL DBTSIG(VXZKM,VXYKM,ISTAB,SIGY,SIGZ)	00012810
	IF (4.*SIGY.LT.ABS(CROSSY)) GO TO 2050	00012820
	IF (IDOWNW(NUMPT).NE.1) GO TO 1517	00012830
	ZSAVE=9999.	00012840
C		00012850
C	IF THE SHEAR AND DOWNWASH OPTIONS ARE BOTH REQUESTED,	00012860
C	USE THE MINIMUM OF Z(SHEAR) AND Z(DOWNWASH)	00012870
C		00012880
	IF (LSHEAR) CALL PTRISE(RHOYFX,ZSTACK,XSMT,DOWNX,WSST,ZSAVE,LSHEAR,	00012890
	1 LTRANS)	00012900
	IF (ISTAB.GT.4) GO TO 1515	00012910
1514	CONTINUE	00012920

	EXR=AMIN1(DOWNX,XSMT)	00012930
	IF(.NOT.LTRANS)EXR=XSMT	00012940
	C=-4.1666667*BUOYFX*EXR*EXR/WSST**3	00012950
	GO TO 1516	00012960
1515	IF(DOWNX.LT.2.*SGRT(WSST/S))GO TO 1514	00012970
	C=-16.666667*BUOYFX/(WSST*S)	00012980
1516	CONTINUE	00012990
	CALL CUBIC(A,B,C,Z)	00013000
	Z=AMIN1(Z,ZSAVE)	00013010
	GO TO 1518	00013020
1517	CONTINUE	00013030
	CALL PTRISE(BUOYFX,ZSTACK,XSMT,DOWNX,WSST,Z,LSHEAR,LTRANS)	00013040
1518	CONTINUE	00013050
	HNT=Z+ZSTACK	00013060
	THT=RELEV(I)-ZR	00013070
C	TER1=(1.-TERAN(ISTAB))	00013080
	TERRAN=TER1*AMIN1(HNT,THT)	00013090
	H=HNT-TERRAN	00013100
	IF(H.GT.DPBL)GO TO 2050	00013110
	CALL GAUSS(CROSSY,SIGY,SIGZ,H,FT)	00013120
C	INCLUDE DECAY IN DETERMINING CHI	00013130
	DELTAT=DOWNX/WSST	00013140
	FT=FT*(1.-DELTAT*DECFACT)	00013150
	PARTCH(I)=C00*FT	00013160
	CHI(I)=CHI(I)+PARTCH(I)	00013170
2050	CONTINUE	00013180
	ICODE=100+NUMPT	00013190
	IF(IPCP(NUMPT).EQ.1)CALL OUTPUT(ICODE,PARTCH,NREC)	00013200
2100	CONTINUE	00013210
	IF(IPCP(51).EQ.1)CALL OUTPUT(151,CHI,NREC)	00013220
9999	CONTINUE	00013230
	DO 9050 I=1,NREC	00013240
	CHI(I)=CHI(I)+CHIL(I)+XBACKG	00013250
9050	CONTINUE	00013260
	CALL OUTPUT(999,CHI,NREC)	00013270
	RETURN	00013280
	END	00013290
	SUBROUTINE GAUSS(CROSSY,SIGY,SIGZ,H,FT)	00013300
C	BLP VERSION 1.1 LEVEL 800212 GAUSS	00013310
	COMMON/MTD/ZMEAS,WS,WD,ISTAB,TDEGK,DPBL,THETA,S,P,LYR,JDAY,IHOUR	00013320
	COMMON/PBL/DAT/TWOPBL,PBLIP6	00013330
	DATA TMIN/0.0512/,TMAX/9.21/	00013340
	T01=3.1415927*SIGY*SIGZ	00013350
	YPSIG=CROSSY/SIGY	00013360
	EXPYP=0.5*YPSIG*YPSIG	00013370
C	PREVENT UNDERFLOWS	00013380
	IF(EXPYP.GT.50.)GO TO 495	00013390
	F=EXP(-EXPYP)	00013400
	GO TO 496	00013410
495	F=0.0	00013420
	GO TO 443	00013430
496	CONTINUE	00013440
C	IF SIGZ GT 1.6*DPBL, ASSUME A UNIFORM VERTICAL DISTRIBUTION	00013450
	IF(SIGZ.GT.PBLIP6)GO TO 460	00013460
C	IF MIXING HEIGHT (DPBL) GE 5000 M OR FOR STABLE CONDITIONS,	00013470
C	NEGLECT THE REFLECTION TERMS	00013480
	IF(ISTAB.GE.5.OR.DPBL.GT.5000.)GO TO 451	00013490
C	CALCULATE MULTIPLE EDDY REFLECTIONS TERMS	00013500
C	USING A FOURIER SERIES METHOD -- SEE FRT MEMO CS 093	00013510
	F1=1	00013520
	T=(SIGZ/DPBL)**2	00013530
	H2=H/DPBL	00013540
	IF(T.GE.0.6)GO TO 500	00013550

	ARG=2.*(1.-H2)/T	00013560
	IF (ARG.GE.TMAX)GO TO 400	00013570
	IF (ARG.LT.TMIN)F1=F1+1.-ARG	00013580
	IF (ARG.GE.TMIN)F1=F1+EXP(-ARG)	00013590
	ARG=2.*(1.+H2)/T	00013600
	IF (ARG.GE.TMAX)GO TO 400	00013610
	F1=F1+EXP(-ARG)	00013620
	ARG=4.*(2.-H2)/T	00013630
	IF (ARG.GE.TMAX)GO TO 400	00013640
	F1=F1+EXP(-ARG)	00013650
	ARG=4.*(2.+H2)/T	00013660
	IF (ARG.LT.TMAX)F1=F1+EXP(-ARG)	00013670
400	ARG=-0.5*H2*H2/T	00013680
	IF (ARG.LT.-90.)F1=0.0	00013690
C	CONSTANT 0.797885 = SQRT(2./PI)	00013700
	IF (ARG.GE.-90.)F1=0.797885*F1*EXP(ARG)/SIGZ	00013710
	IF (F1.LT.1.E-30)F1=0.0	00013720
	GO TO 1500	00013730
C	CONSTANT 4.934802 = PI*PI/2.	00013740
500	ARG=4.934802*T	00013750
	IF (ARG.GE.TMAX)GO TO 900	00013760
	F1=F1+2.*EXP(-ARG)*COS(3.141593*H2)	00013770
C	CONSTANT 19.739209 = 2.*PI*PI	00013780
	ARG=19.739209*T	00013790
	IF (ARG.LT.TMAX)F1=F1+2.*EXP(-ARG)*COS(6.283185*H2)	00013800
900	F1=F1/DPBL	00013810
	IF (F1.LT.1.E-30)F1=0.0	00013820
1500	CONTINUE	00013830
C	THE CONSTANT 1.25331414 = SQRT(PI/2.)	00013840
	F1=1.25331414*SIGZ*F1	00013850
	GO TO 445	00013860
451	CONTINUE	00013870
	HPSIG=H/SIGZ	00013880
	EXPHP=0.5*HPSIG*HPSIG	00013890
	IF (EXPHP.GT.50)GO TO 443	00013900
	F1=EXP(-EXPHP)	00013910
	GO TO 445	00013920
443	F1=0.0	00013930
445	CONTINUE	00013940
C	FIND PRODUCT OF EXPONENTIAL TERMS DIVIDED BY (PI*SIGY*SIGZ)	00013950
	FT=F*F1/TD1	00013960
	GO TO 470	00013970
460	CONTINUE	00013980
C	VERTICAL DISTRIBUTION ASSUMED UNIFORM	00013990
C	THE CONSTANT 2.5066283 = SQRT(2.*PI)	00014000
	FT=F/(2.5066283*SIGY*DPBL)	00014010
470	RETURN	00014020
	END	00014030
	SUBROUTINE SORT(FTSAVE,IRMIN,IRMAX,IWPBL)	00014040
C	BLP VERSION 1.1 LEVEL 80012 SORT	00014050
	REAL FTSAVE(129)	00014060
	ISAFE=0	00014070
	IR=0	00014080
	IF (FTSAVE(129).NE.0.0)IR=129	00014090
	IF (FTSAVE(1).NE.0.0)IR=1	00014100
	IF (IR.NE.0)GO TO 970	00014110
	DO 950 ILEVFL=1,7	00014120
	NEACHL=2*(ILEVEL-1)	00014130
	INCR=2*(8-ILEVEL)	00014140
	INDEX=1+INCR/2	00014150
	DO 945 NC=1,NEACHL	00014160
	IF (FTSAVE(INDEX).EQ.0.0)GO TO 944	00014170
	IR=INDEX	00014180

	GO TO 970	00014190
944	INDEX=INDEX+INCR	00014200
945	CONTINUE	00014210
950	CONTINUE	00014220
	IF (IB.NE.0) GO TO 970	00014230
	IAPRL=999	00014240
	RETURN	00014250
970	IRMIN=IB-1	00014260
	IBMAX=IB+1	00014270
	IBMIN=AMAX0(IRMIN,1)	00014280
	IBMAX=AMIN0(IBMAX,129)	00014290
975	CONTINUE	00014300
	INCRM=0	00014310
	INCRP=0	00014320
	IF (FTSAVE(IRMIN).NE.0.0) INCRM=1	00014330
	IF (IRMIN.EQ.1) INCRM=0	00014340
	IF (FTSAVE(IBMAX).NE.0.0) INCRP=1	00014350
	IF (IBMAX.EQ.129) INCRP=0	00014360
	IRMIN=IRMIN-INCRM	00014370
	IBMAX=IBMAX+INCRP	00014380
	IF (INCRM.EQ.0.AND.INCRP.EQ.0) GO TO 980	00014390
	ISAFE=ISAFE+1	00014400
	IF (ISAFF.GT.129) GO TO 980	00014410
	GO TO 975	00014420
980	CONTINUE	00014430
	RETURN	00014440
	END	00014450
	SUBROUTINE OUTPUT(ICODE,CHIS,NREC)	00014460
C	HLP VERSION 1.1 LEVEL 800212 OUTPUT	00014470
	REAL CHIS(NREC)	00014480
	COMMON/METO/ZMEAS,WS,W0,ISTAR,IDECK,DPRL,THETA,S,P,IYR,JDAY,IHOUR	00014490
C		00014500
C	THIS SUBROUTINE OUTPUTS ALL CHI ARRAYS TO TAPE (OR DISK)	00014510
C		00014520
C	ICODE IDENTIFIES THE CHI ARRAY TO FOLLOW:	00014530
C		00014540
C	ICODE = 1 TO 10 IMPLIES THE CHI ARRAY IS THE PARTIAL	00014550
C	CONTRIBUTION OF LINE NUMBER "ICODE" AT EACH RECEPTOR	00014560
C		00014570
C	ICODE = 11 IMPLIES THE CHI ARRAY IS THE PARTIAL	00014580
C	CONTRIBUTION OF ALL THE LINES AT EACH RECEPTOR	00014590
C		00014600
C	ICODE = 101 TO 150 IMPLIES THE CHI ARRAY IS THE PARTIAL	00014610
C	CONTRIBUTION OF POINT SOURCE NUMBER "ICODE - 100" AT	00014620
C	EACH RECEPTOR	00014630
C		00014640
C	ICODE = 151 IMPLIES THE CHI ARRAY IS THE PARTIAL	00014650
C	CONTRIBUTION OF ALL THE POINT SOURCES AT EACH RECEPTOR	00014660
C		00014670
C	ICODE = 999 IMPLIES THE CHI ARRAY IS THE TOTAL	00014680
C	CONCENTRATION SUMMED OVER ALL THE POINT AND LINE SOURCES AT	00014690
C	EACH RECEPTOR	00014700
	IDAYHR=JDAY*100+IHOUR	00014710
C	ROUND THE WS (NEAREST TENTHS OF M/S) AND	00014720
C	THE DPRL (NEAREST METER)	00014730
	IWS=(WS+0.05)*10	00014740
	IDPRL=DPRL+0.5	00014750
	IWD=W0	00014760
	ICD=IWS*10000+ISTAR*1000+ICODE	00014770
	IMET2=IWD*10000+IDPRL	00014780
	WRITE(20)IDAYHR,ICD,IMET2,CHIS	00014790
	RETURN	00014800
	END	00014810

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SUBROUTINE PIRISE(BUOYFX,ZSTACK,XSMT,DOWNX,WSST,Z,LSHEAR,LTRANS) 00014820
C   BLP   VERSION 1.1   LEVEL 800212   PIRISE 00014830
REAL LELEV 00014840
LOGICAL LSHEAR,LTRANS 00014850
COMMON/METD/ZMEAS,WS,WD,ISTAR,TOEGK,DPRL,THETA,S,P,IYR,JDAY,IHOUR 00014860
COMMON/PRM/CRIT,TER1,DECFAC,XRACKG,CONST2,CONST3,MAXIT 00014870
C 00014880
C   THIS SUBROUTINE CALCULATES POINT SOURCE PLUME RISE 00014890
C   WITH AN OPTIONAL VERTICAL WIND SPEED SHEAR CORRECTION FOR 00014900
C   BOTH NEUTRAL AND STABLE PLUME RISE 00014910
C 00014920
C   A VALUE OF 0.6 IS ASSUMED FOR THE ENTRAINMENT 00014930
C   PARAMETER (BETA) 00014940
C 00014950
C   X=DOWNX 00014960
C   IF(.NOT.LSHEAR)GO TO 145 00014970
C   CONSTANT 2.777778 = 1./(BETA*BETA) WITH BETA=0.6 00014980
CS=2.777778*BUOYFX 00014990
CS2=ZSTACK**P 00015000
EP=3.*(1.+P) 00015010
P3=3.+P 00015020
TP3=2.*P3 00015030
145 CONTINUE 00015040
X=AMIN1(X,XSMT) 00015050
IF(.NOT.LTRANS)X=XSMT 00015060
IF(ISTAR.GT.4)GO TO 150 00015070
IF(.NOT.LSHEAR)GO TO 170 00015080
C 00015090
C   NEUTRAL-UNSTABLE PLUME RISE WITH SHEAR 00015100
C 00015110
C   CONTINUE 00015120
C   BETA (ENTRAINMENT PARAMETER) IS ASSUMED TO BE 0.6 00015130
A1=CS*X*X/WSST**3 00015140
C   CONSTANT 0.8735805 = (2./3.)*(1./3.) 00015150
RMULT=0.8735805*(EP*EP*CS2**3/(TP3*A1**P))*(1./EP) 00015160
RMULT=AMIN1(RMULT,1.0) 00015170
Z=RMULT*(1.5*A1)**0.333333 00015180
IF(ISTAR.LE.4)GO TO 39 00015190
Z=AMIN1(Z,(6./CSV1)**0.333333) 00015200
Z=AMIN1(Z,5.0*BUOYFX**0.25/S**0.375) 00015210
39 CONTINUE 00015220
RETURN 00015230
C 00015240
C   NEUTRAL-UNSTABLE PLUME RISE -- NO SHEAR 00015250
C 00015260
C   CONTINUE 00015270
Z=1.6*(BUOYFX*X*X)**0.333333/WSST 00015280
IF(ISTAR.GT.4)Z=AMIN1(Z,ZR) 00015290
RETURN 00015300
C 00015310
C   STABLE PLUME RISE -- NO SHEAR 00015320
C 00015330
C   CONTINUE 00015340
ZMTT=5.0*BUOYFX**0.25/S**0.375 00015350
C   CONST2 HAS A DEFAULT VALUE OF 2.6 (BRIGGS, 1975) 00015360
ZR=CONST2*(BUOYFX/(WSST*S))**0.333333 00015370
Zb=AMIN1(ZR,ZMTT) 00015380
IF(X.LI.XSMT)GO TO 170 00015390
Z=ZR 00015400
RETURN 00015410
C 00015420
C   STABLE PLUME RISE WITH SHEAR 00015430
C 00015440

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150 CONTINUE                                00015450
IF (.NOT. LSHEAR) GO TO 175                00015460
XPF5=SQRT((TP3*CS2*CS/(WSST*S))*((EP/P3)*TP3*WSST**3/(EP*EP*CS2**300015470
1 *CS)))                                00015480
CSV1=WSST*S/CS                            00015490
IF (X.LT.XPF5) GO TO 16                   00015500
C CONSTANT 0.5503212 = (1./6.)*(1./3.)    00015510
RMULT=0.5503212*CSV1**((P/(3.*P3))*(TP3*CS2)**(1./P3)) 00015520
RMULT=AMIN1(RMULT,1.0)                   00015530
Z=RMULT*(6./CSV1)**0.333333              00015540
Z=AMIN1(Z,5.0*BUOYFX**0.25/S**0.375)    00015550
RETURN                                    00015560
END                                        00015570
SUBROUTINE CUBIC(A,B,C,Z)                 00015580
BLP VERSION 1.1 LEVEL 800212 CUBIC      00015590
C                                          00015600
C SOLVES FOR ONE ROOT OF THE CUBIC EQUATION: 00015610
C  $Z^3 + A*Z^2 + B*Z + C = 0$            00015620
C                                          00015630
C                                          00015640
DATA ONE/1.0/                            00015650
A3=A/3.                                   00015660
AP=B-A*A3                                 00015670
BP=2.*A3**3-A3*B+C                       00015680
AP3=AP/3.                                 00015690
BP2=BP/2.                                 00015700
TROOT=BP2*BP2+AP3*AP3*AP3                00015710
IF (TROOT.LE.0.0) GO TO 50                00015720
TR=SQRT(TROOT)                            00015730
APP=(-BP2+TR)**0.333333                   00015740
BSV=-BP2-TR                               00015750
SGN=SIGN(ONE,BSV)                         00015760
RPP=SGN*(ABS(BSV))**0.333333             00015770
Z=APP+RPP-A3                              00015780
RETURN                                    00015790
50 CM=2.*SQRT(-AP3)                       00015800
ALPHA=ARCOS(BP/(AP3*CM))/3.              00015810
Z=CM*COS(ALPHA)-A3                       00015820
RETURN                                    00015830
END                                        00015840
SUBROUTINE WSC(ISTAB,UM,U,S,P)            00015850
BLP VERSION 1.1 LEVEL 800212 WSC        00015860
REAL L                                    00015870
LOGICAL LSHEAR,LTRANS                    00015880
COMMON/PR/L,H3,WB,WB,FPRIME,EP,XMATCH,DX,AVFACT,TWOHB,N,LSHEAR,
1 LTRANS                                00015900
C CALCULATES AN EFFECTIVE U USING THE LINE SOURCE PLUME 00015910
C RISE EQUATION (LINE SOURCE TERM ONLY) 00015920
C MATCHED AT X = XF (FINAL RISE)         00015930
C IF (ISTAB.GT.4) GO TO 50                00015940
C                                          00015950
C NEUTRAL (OR UNSTABLE) CONDITIONS       00015960
C                                          00015970
P3=3.*P                                   00015980
EP=2.*P3                                  00015990
EPI=1./EP                                 00016000
C CONSTANT 2.4=4.*BETA WITH BETA=0.6    00016010
T1=(EP*EP*N*FPRIME*HB**P3/(2.4*(P.+P)*L*UM**3))*EPI 00016020
Z=T1*XMATCH**(2.*EPI)                    00016030
C CONSTANT 1.2 = 2.*BETA WITH BETA=0.6  00016040
U=(N*FPRIME/(1.2*L))*(XMATCH/7)**2**0.333333 00016050
U=AMAX1(U,UM)                            00016060
RETURN                                    00016070
50 CONTINUE

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C		00016080
C	STARLF CONDITIONS	00016090
C		00016100
	P2=2.*P	00016110
C	CONSTANT 0.6 = 4ETA	00016120
	Z=(P2*HB**F*N*FPRIME/(0.6*L*UM*S))**(1./P2)	00016130
C	CONSTANT 3.333333 = 2./BETA WITH BETA=0.6	00016140
	U=3.333333*N*FPRIME/(L*S*Z)	00016150
	U=AMAX1(U,UM)	00016160
	RETURN	00016170
	END	00016180
	SUBROUTINE LENG(THETA,U)	00016190
C	BLP VERSION 1.1 LEVEL 800212 LENG	00016200
	REAL L,LEFF,LD,LEFF1,LEFFV	00016210
	LOGICAL LSHEAR,LTRANS	00016220
	COMMON/PR/L,HB,WB,WM,FPRIME,FP,XMATCH,DX,AVFACT,TWOHB,N,LSHEAR,	00016230
	1 LTRANS	00016240
	COMMON/PRLS/XFB,LEFF,LD,R0,XFINAL,XFS	00016250
	DATA PI/3.1415927/,RAD/0.0174533/	00016260
C		00016270
C	THIS SUBROUTINE CALCULATES XFB,LEFF,LD,R0	00016280
C		00016290
C	FPRIME IS THE BUOYANCY FLUX OF ONE LINE; FP IS THE EFFECTIVE	00016300
C	BUOYANCY FLUX OF N LINES	00016310
	FP=N*FPRIME	00016320
	TRAD=THETA*RAD	00016330
	SINT=ABS(SIN(TRAD))	00016340
	COST=ABS(COS(TRAD))	00016350
C	CALCULATE DISTANCE OF FULL BUOYANCY (XFB)	00016360
	DXM=DX*WB	00016370
	XFB=L*COST+(N-1)*DXM*SINT	00016380
C	CALCULATE EFFECTIVE LINE SOURCE LENGTH (LEFF) AND	00016390
C	EFFECTIVE DOWNWASH LINE LENGTH (LD)	00016400
	LEFF1=L*SINT	00016410
	IF(N.EQ.1)GO TO 112	00016420
C	CONSTANT 0.8333333 = 1./(2.*BETA) WITH BETA=0.6	00016430
	ZI=0.8333333*DXM	00016440
C	CONSTANT 2.2619467 = 2.*PI*BETA*BETA WITH BETA=0.6	00016450
C	CONSTANT 1.5915494 = 3./(PI*BETA) WITH BETA=0.6	00016460
	T1=(2.2619467*U**3/FPRIME)*ZI*ZI*(ZI+1.5915494*WM)	00016470
	XI=(T1*L)**0.333333	00016480
	IF(XI.LE.L)GO TO 55	00016490
	XI=L/2.+SQRT(12.*T1-3.*L*L)/6.	00016500
C	CONSTANT 1.2 = 2.*BETA WITH BETA=0.6	00016510
C	CONSTANT 0.6283185 = PI*BETA/3. WITH BETA=0.6	00016520
	LEFFV=FP*(L*L/3.+XI*(XI-L))/(1.2*U**3*ZI*ZI)+0.6283185*ZI	00016530
	GO TO 110	00016540
55	CONTINUE	00016550
C	CONSTANT 3.6 = 6.*BETA WITH BETA=0.6	00016560
C	CONSTANT 0.6283185 = PI*BETA/3. WITH BETA=0.6	00016570
	LEFFV=FP/(3.6*L*ZI*ZI)*(XI/U)**3+0.6283185*ZI	00016580
110	LEFF=LEFF1+LEFFV*COST	00016590
	LD=LEFF*SINT	00016600
C	CALCULATE DOWNWASHED EDGE RADIUS	00016610
	R0=AMIN1(HB,LD)/AVFACT	00016620
	RETURN	00016630
C	IF N = 1, NO INTERACTION AT ANY Y, I.E.,	00016640
C	LEFFV = WM; FP = FPRIME; XFB = L * COST + WM * SINT	00016650
112	LEFFV=WM	00016660
	FP=FPRIME	00016670
	XFB=XFB+WM*SINT	00016680
	GO TO 110	00016690
	END	00016700

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SUBROUTINE WISE (U, ITHETA, ISTAR, S)
C   BLP VERSION 1.1 LEVEL 800212 WISE
REAL L, LEFF, LD
LOGICAL LSHEAR, LTRANS
COMMON/PRZL, HB, WB, WM, FPRIME, FP, XMATCH, DX, AVFACT, TROHB, N, LSHEAR,
1 LTRANS
COMMON/PRLS/XFB, LEFF, LD, RO, XFINAL, XFS
COMMON/RTNTP/XDIST(7), DH(7)

C   THIS SUBROUTINE CALCULATES LINE SOURCE PLUME RISE
C   USING AN OPTIONAL VERTICAL WIND SHEAR CORRECTED 'EFFECTIVE' WIND
C   SPEED FOR BOTH NEUTRAL AND STABLE CONDITIONS
C
C   CONSTANT 1.5915494 = 3./(PI*BETA) WITH BETA=0.6
C   CONSTANT 5.0 = 3./BETA WITH BETA=0.6
C   A=1.5915494*LEFF+5.*RO
C   CONSTANT 5.3051648 = 6./(PI*BETA*BETA) WITH BETA=0.6
C   CONSTANT 8.3333333 = 3./(BETA*BETA) WITH BETA=0.6
C   R=RO*(5.3051648*LD+8.3333333*RO)
DO 1000 I=2,7
X=XDIST(I)
IF (ISTAR.LE.4) GO TO 90
WITH STABLE CONDITIONS, USE NEUTRAL RISE EQUATION
FOR TRANSITIONAL RISE CALCULATIONS, BUT CALCULATE
FINAL RISE BASED ON THE FINAL STABLE RISE EQUATION
IF (X.LT.XFS) GO TO 90
CALCULATE FINAL (STABLE) PLUME RISE
C   CONSTANT 5.3051648 = 6./(PI*BETA*BETA) WITH BETA=0.6
92 C=-5.3051648*FP/(U*S)
GO TO 8
90 CONTINUE
IF (X.LE.XFB) GO TO 80
7 CONTINUE
C   CONSTANT 1.3262912 = 3./(2.*PI*BETA*BETA) WITH BETA=0.6
C   C=-1.3262912*FP*(XFB*XFB/3.+X*X-XFB*X)/U**3
8 CONTINUE
CALL CURIC(A,B,C,Z)
12 CONTINUE
DH(I)=Z
GO TO 1000
C   CONSTANT 0.4420971 = 1./(2.*PI*BETA*BETA) WITH BETA=0.6
80 C=-0.4420971*(FP/XFB)*(X/U)**3
GO TO 8
1000 CONTINUE
RETURN
END
SUBROUTINE ZRISE (IL, IS, IR, Z)
C   BLP VERSION 1.1 LEVEL 800212 ZRISE
REAL LEFF, LD, LELEV
COMMON/RCEPT/RXHEG, RYHEG, RXEND, RYEND, RDX, RDY, XRSCS(100),
1 YRSCS(100), XRRCS(100), YRRCS(100), RELEV(100), NRFC
COMMON/SOURCE/NLINES, XLBEG(10), XLEND(10), DEL(10), YSCS(10), QT(10),
1 HS(10), XRCS(10,129), YRCS(10,129), ICOR, LFLEV(10),
2 NPTS, XPSCS(50), YPSCS(50), PQ(50), PHS(50), XPRCS(50), YPRCS(50),
3 ISTACK(50), APTS(50), BPTS(50), VEXIT(50), PELEV(50), IDOWNW(50)
COMMON/PRLS/XFB, LEFF, LD, RO, XFINAL, XFS
COMMON/RTNTP/XDIST(7), DH(7)

C   Z1 IS THE PLUME HEIGHT OF THE HIGHEST PLUME SEGMENT AT X = XFB
C   (EXCEPT IN THE SPECIAL CASE OF STABLE CONDITIONS WITH
C   THE DISTANCE TO FINAL RISE (XFS) LESS THAN XFB -- IN
C   THAT CASE, Z1 IS THE HEIGHT OF THE HIGHEST PLUME ELEMENT
C   AT X=XFS)

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C      XI IS THE DISTANCE OF THE CURRENT LINE SEGMENT TO XFB      00017340
C      Z1=DH(2)                                                    00017350
      XFXFB=XDIST(2)                                                00017360
      XI=XFXFB-XRCS(IL,IS)                                          00017370
      ZXFB=Z1+(1.-(XFXFB-XI)/XFXFB)                                00017380
C      Z2 IS THE PLUME HEIGHT OF THE HIGHEST SEGMENT AT X        00017390
      CALL INTRSE(XRRCS(IR),Z2)                                     00017400
      DELTAZ=Z2-Z1                                                  00017410
      Z=ZXFB+DELTAZ                                                 00017420
      RETURN                                                         00017430
      END                                                            00017440
      SUBROUTINE INTRSE(X,Z)                                         00017450
C      BLP VERSION 1.1 LEVEL 800212      INTRSE                   00017460
      REAL LEFF,LD                                                  00017470
      COMMON/PRLS/XFB,LEFF,LD,R0,XFINAL,XFS                        00017480
      COMMON/RJNTP/XDIST(7),DH(7)                                  00017490
C      THIS SUBROUTINE INTERPOLATES THE PLUME RISE OF THE TOP (HIGHEST) 00017500
C      PLUME ELEMENT AT ANY DISTANCE X USING THE CALCULATED      00017510
C      PLUME RISE AT SEVEN POINTS (XDIST(1-7))                   00017520
C      IF (X.GT.XDIST(7))GO TO 55                                  00017530
      DO 10 I=2,6                                                    00017540
      IF (X.GT.XDIST(I))GO TO 10                                     00017550
      INDEX=I                                                         00017560
      GO TO 11                                                        00017570
10     CONTINUE                                                      00017580
      INDEX=5                                                         00017590
11     CONTINUE                                                      00017600
      INDEX1=INDEX-1                                                 00017610
      Z=DH(INDEX)-(DH(INDEX)-DH(INDEX1))*(XDIST(INDEX)-X)/        00017620
1 (XDIST(INDEX)-XDIST(INDEX1))                                     00017630
      RETURN                                                         00017640
55     CONTINUE                                                      00017650
C      PLUME REACHES FINAL RISE                                     00017660
      Z=DH(7)                                                        00017670
      RETURN                                                         00017680
      END                                                            00017690
      SUBROUTINE DBTSIG (X,XY,KST,SY,SZ)                             00017700
C      BLP VERSION 1.1 LEVEL 800212      DBTSIG                   00017710
      DIMENSION XA(7),XB(2),XD(5),XE(8),XF(9),AA(8),BA(8),AB(3),BB(3), 00017720
1 AD(6),BD(6),AE(9),BE(9),AF(10),BF(10)                          00017730
      DATA XA/.5,.4,.3,.25,.2,.15,.1/                            00017740
      DATA XB/.4,.2/                                                00017750
      DATA XD /30.,10.,3.,1.,.3/                                    00017760
      DATA XE /40.,20.,10.,4.,2.,1.,.3,.1/                        00017770
      DATA XF /60.,30.,15.,7.,3.,2.,1.,.7,.2/                    00017780
      DATA AA /453.85,346.75,258.84,217.41,179.52,170.22,158.08,122.8/ 00017790
      DATA BA /2.1166,1.7283,1.4094,1.2644,1.1262,1.0932,1.0542,.9447/ 00017800
      DATA AB /109.30,98.483,90.673/                                00017810
      DATA BB /1.0971,0.98332,0.93198/                              00017820
      DATA AD /44.053,36.650,33.504,32.093,32.093,34.459/        00017830
      DATA BD /0.51179,0.56589,0.60486,0.64403,0.81066,0.86974/ 00017840
      DATA AE /47.618,35.420,26.970,24.703,22.534,21.628,21.628,23.331, 00017850
1 24.26/                                                            00017860
      DATA BE /0.29592,0.37615,0.46713,0.50527,0.57154,0.63077,0.75660, 00017870
1 0.81956,0.8366/                                                  00017880
      DATA AF /34.219,27.074,22.651,17.836,16.187,14.823,13.953,13.953, 00017890
1 14.457,15.209/                                                  00017900
      DATA BF /0.21716,0.27436,0.32681,0.41507,0.46490,0.54503,0.63227, 00017910
1 0.68465,0.78407,0.81558/                                       00017920
      GO TO (10,20,30,40,50,60),KST                                00017930

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C	STABILITY A (10)	00017970
10	TH = (24.167 - 2.5334*ALOG(XY))/57.2958	00017980
	IF (X.GT.3.11) GO TO 69	00017990
	DO 11 ID = 1,7	00018000
	IF (X.GE.XA(ID)) GO TO 12	00018010
11	CONTINUE	00018020
	ID = 8	00018030
12	SZ = AA(ID) * X ** BA(ID)	00018040
	GO TO 71	00018050
C	STABILITY B (20)	00018060
20	TH = (18.333 - 1.8096*ALOG(XY))/57.2958	00018070
	IF (X.GT.35.) GO TO 69	00018080
	DO 21 ID = 1,2	00018090
	IF (X.GE.XB(ID)) GO TO 22	00018100
21	CONTINUE	00018110
	ID = 3	00018120
22	SZ = AB(ID) * X ** BB(ID)	00018130
	GO TO 70	00018140
C	STABILITY C (30)	00018150
30	TH = (12.5 - 1.0857*ALOG(XY))/57.2958	00018160
	SZ = 61.141 * X ** 0.91465	00018170
	GO TO 70	00018180
C	STABILITY D (40)	00018190
40	TH = (8.3333-0.72382*ALOG(XY))/57.2958	00018200
	DO 41 ID = 1,5	00018210
	IF (X.GE.XD(ID)) GO TO 42	00018220
41	CONTINUE	00018230
	ID = 6	00018240
42	SZ = AD(ID) * X ** BD(ID)	00018250
	GO TO 70	00018260
C	STABILITY E (50)	00018270
50	TH = (6.25 - 0.54287*ALOG(XY))/57.2958	00018280
	DO 51 ID = 1,8	00018290
	IF (X.GE.XE(ID)) GO TO 52	00018300
51	CONTINUE	00018310
	ID = 9	00018320
52	SZ = AE(ID) * X ** BE(ID)	00018330
	GO TO 70	00018340
C	STABILITY F (60)	00018350
60	TH = (4.1667 - 0.36191*ALOG(XY))/57.2958	00018360
	DO 61 ID = 1,9	00018370
	IF (X.GE.XF(ID)) GO TO 62	00018380
61	CONTINUE	00018390
	ID = 10	00018400
62	SZ = AF(ID) * X ** BF(ID)	00018410
	GO TO 70	00018420
69	SZ = 5000.	00018430
	GO TO 71	00018440
70	IF (SZ.GT.5000.) SZ = 5000.	00018450
71	SY = 1000. * XY * SIN(TH)/(2.15 * COS(TH))	00018460
	RETURN	00018470
	END	00018480
	SUBROUTINE SIGMAY(XKM,KST,SY)	00018490
C	BLP VERSION 1.1 LEVEL 800212 SIGMAY	00018500
C		00018510
C	THIS SUBROUTINE CALCULATES SIGMA Y	00018520
C		00018530
	GO TO (10,20,30,40,50,60),KST	00018540
10	TH=(24.167-2.5334*ALOG(XKM))/57.2958	00018550
	GO TO 70	00018560
20	TH=(18.333-1.8096*ALOG(XKM))/57.2958	00018570
	GO TO 70	00018580
30	TH=(12.5-1.0657*ALOG(XKM))/57.2958	00018590

	GO TO 70	00018600
40	TH=(8.3333-0.72385*ALOG(XKM))/57.2958	00018610
	GO TO 70	00018620
50	TH=(6.25-0.54287*ALOG(XKM))/57.2958	00018630
	GO TO 70	00018640
60	TH=(4.1667-0.36191*ALOG(XKM))/57.2958	00018650
70	SY=1000.*XKM*SIN(TH)/(2.15*COS(TH))	00018660
	RETURN	00018670
	END	00018680
	FUNCTION XVZ (SZ0,KST)	00018690
C	RLP VERSION 1.1 LEVEL 800212 XVZ	00018700
	DIMENSION SA(7),SB(2),SD(5),SE(8),SF(9),AA(8),AB(3),AD(6),AE(9),	00018710
	* AF(10),CA(8),CH(3),CD(6),CE(9),CF(10)	00018720
	DATA SA /13.95,21.40,29.3,37.67,47.44,71.16,104.65/	00018730
	DATA SB /20.23,40./	00018740
	DATA SD /12.09,32.09,65.12,134.9,251.2/	00018750
	DATA SE /3.534,8.698,21.628,33.489,49.767,79.07,109.3,141.86/	00018760
	DATA SF /4.093,10.93,13.953,21.627,26.976,40.,54.89,68.84,83.25/	00018770
	DATA AA /122.8,158.08,170.22,179.52,217.41,258.89,346.75,453.85/	00018780
	DATA AB /90.673,98.483,109.3/	00018790
	DATA AD /34.459,32.093,32.093,33.504,36.650,44.053/	00018800
	DATA AE /24.26,23.331,21.628,21.628,22.534,24.703,26.97,35.42,	00018810
	* 47.618/	00018820
	DATA AF /15.209,14.457,13.953,13.953,14.823,16.187,17.836,22.651,	00018830
	* 27.074,34.219/	00018840
	DATA CA /1.0585,.9486,.9147,.8879,.7909,.7095,.5786,.4725/	00018850
	DATA CH /1.073,1.017,.9115/	00018860
	DATA CD /1.1498,1.2336,1.5527,1.6533,1.7671,1.9530/	00018870
	DATA CE /1.1953,1.2202,1.3217,1.5854,1.7497,1.9791,2.1407,2.6585,	00018880
	* 3.3793/	00018890
	DATA CF /1.2261,1.2754,1.4606,1.5816,1.8348,2.151,2.4092,3.0599,	00018900
	* 3.6448,4.6049/	00018910
	GO TO (10,20,30,40,50,60),KST	00018920
C	STABILITY A(10)	00018930
10	DO 11 ID = 1,7	00018940
	IF (SZ0.LE.SA(ID)) GO TO 12	00018950
11	CONTINUE	00018960
	ID = 8	00018970
12	XVZ = (SZ0/AA(ID))*CA(ID)	00018980
	RETURN	00018990
C	STABILITY B(20)	00019000
20	DO 21 ID = 1,2	00019010
	IF (SZ0.LE.SB(ID)) GO TO 22	00019020
21	CONTINUE	00019030
	ID = 3	00019040
22	XVZ = (SZ0/AB(ID))*CH(ID)	00019050
	RETURN	00019060
C	STABILITY C(30)	00019070
30	XVZ = (SZ0/61.141)*1.0933	00019080
	RETURN	00019090
C	STABILITY D(40)	00019100
40	DO 41 ID = 1,5	00019110
	IF (SZ0.LE.SD(ID)) GO TO 42	00019120
41	CONTINUE	00019130
	ID = 6	00019140
42	XVZ = (SZ0/AD(ID))*CD(ID)	00019150
	RETURN	00019160
C	STABILITY E(50)	00019170
50	DO 51 ID = 1,8	00019180
	IF (SZ0.LE.SE(ID)) GO TO 52	00019190
51	CONTINUE	00019200
	ID = 9	00019210
52	XVZ = (SZ0/AF(ID))*CE(ID)	00019220

	RETURN	00019230
C	STABILITY F(60)	00019240
60	DO 61 ID = 1,9	00019250
	IF (SZO,LE,SF(ID)) GO TO 62	00019260
61	CONTINUE	00019270
	ID = 10	00019280
62	XVZ = (SZO/AF(ID))*CF(ID)	00019290
	RETURN	00019300
	END	00019310
	FUNCTION XZY (SYO,KST)	00019320
C	BLP VERSION 1.1 LEVEL 800212 XZY	00019330
	GO TO (1,2,3,4,5,6),KST	00019340
1	XZY = (SYO/213.)*1.1148	00019350
	RETURN	00019360
2	XZY = (SYO/155.)*1.097	00019370
	RETURN	00019380
3	XZY = (SYO/103.)*1.092	00019390
	RETURN	00019400
4	XZY = (SYO/68.)*1.076	00019410
	RETURN	00019420
5	XZY = (SYO/50.)*1.086	00019430
	RETURN	00019440
6	XZY = (SYO/33.5)*1.083	00019450
	RETURN	00019460
	END	00019470
	BLOCK DATA	00019480
C	BLP VERSION 1.1 LEVEL 800212 BLOCK DATA	00019490
	REAL L,LELEV	00019500
	INTEGER*2 IDAYS	00019510
	LOGICAL LSHFAR,LMTIN,LMTOT,LTRANS	00019520
	COMMON/PR/L,H3,H4,H5,FP,PRIME,FP,XMATCH,DY,AVFACT,TWOHB,N,LSHFAR,	00019530
1	LTRANS	00019540
	COMMON/METD/ZMEAS,WS,WD,ISTAR,IDECK,DPRL,THETA,S,P,IYR,JDAY,IHOUR	00019550
	COMMON/SOURCE/NLINES,XLHEG(10),XLEND(10),DEL(10),YSCS(10),QT(10),	00019560
1	HS(10),XRCS(10,129),YRCS(10,129),TCOR,LELEV(10),	00019570
2	NPTS,XPSCS(50),YPSCS(50),PQ(50),PHS(50),XPSCS(50),YPRCS(50),	00019580
3	TSTACK(50),APTS(50),BPIS(50),VEXIT(50),PELEV(50),IDOWNW(50)	00019590
	COMMON/RCEPT/RXHEG,RYHEG,RXEND,RYEND,RDX,RDY,XRSCS(100),	00019600
1	YRSCS(100),XRSCS(100),YRSCS(100),RELEV(100),NREC	00019610
	COMMON/RINTP/XDIST(7),DH(7)	00019620
	COMMON/OUTPT/IPCL(11),IPCP(51)	00019630
	COMMON/PARM/CRIT,TER1,DECFAC,XBACKG,CONST2,CONST3,MAXIT	00019640
	COMMON/METD24/KST(24),SPEED(24),RANDWD(24),HMIX(24),TEMP(24),	00019650
1	DIHTA(2),PEXP(6),IDELS,IOSURF,IYSURF,IOUPER,IYUPER,TERAN(6),	00019660
2	IRU,THRMAX,LME11N,LMTOT,IDAYS(366)	00019670
	DATA AVFACT/1.0/	00019680
	DATA NLINES/0/,NPTS/0/,NREC/0/,TCOR/90.0/	00019690
	DATA ZMEAS/7.0/,DIHTA/0.02,0.035/,IDELS/5/,IDAYS/366*0/	00019700
	DATA IRU/1/,THRMAX/24/	00019710
	DATA LSHFAR/.TRUE./,LMTIN/.FALSE./,LMTOT/.FALSE./,LTRANS/.TRUE./	00019720
	DATA PEXP/0.10,0.15,0.20,0.25,0.30,0.30/	00019730
	DATA IYSURF/0/,IYUPER/0/	00019740
	DATA CRIT/0.02/,DECFAC/0.0/,XBACKG/0.0/,CONST2/2.6/,CONST3/34.49/,	00019750
1	TERAN/0.5,0.5,0.5,0.5,0.30,0.30/,MAXIT/14/	00019760
	DATA IPCL/11*0/,IPCP/51*0/	00019770
	DATA RXHEG/0.0/,RYHEG/0.0/,RXEND/0.0/,RYEND/0.0/,RDX/0.0/,RDY/0.0/	00019780
	DATA XRSCS/100*0.0/,YRSCS/100*0.0/,PELEV/100*0.0/	00019790
	DATA XLHEG/10*0.0/,XLEND/10*0.0/,YSCS/10*0.0/,	00019800
1	HS/10*0.0/,QT/10*0.0/,LELEV/10*0.0/	00019810
	DATA XPSCS/50*0.0/,YPSCS/50*0.0/,PHS/50*0.0/,PQ/50*0.0/,	00019820
1	APTS/50*0.0/,TSTACK/50*0.0/,PELEV/50*0.0/,IDOWNW/50*0/	00019830
	END	00019840

APPENDIX B
POSTBLP FORTRAN SOURCE LISTING


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C
C*****00000010
C*****00000020
C00000030
C    POSTRLP -- MULTIPLE BUOYANT LINE AND POINT SOURCE00000040
C    DISPERSION MODEL (RLP) POST-PROCESSOR00000050
C00000060
C    POSTRLP  VERSION 1.1  LEVEL R00702      MATN00000070
C00000080
C    DEVELOPED BY:00000090
C00000100
C    JOE SCIRE AND LLOYD SCHULMAN00000110
C    ENVIRONMENTAL RESEARCH AND TECHNOLOGY00000120
C    696 VIRGINIA ROAD00000130
C    CONCORD, MASSACHUSETTS 0174200000140
C00000150
C*****00000160
C00000170
C    REAL CHIS(100),CHI3(100),CHT24(100),CHIANN(100)00000180
C    REAL TSOC1(50),TSRC1(100,5)00000190
C    REAL TSOC3(50),TSRC3(100,5)00000200
C    REAL TSOC24(50),TSRC24(100,5)00000210
C    REAL TITLE(20)00000220
C    INTEGER TSOC1(50),JSOC1(50),K5OC1(50)00000230
C    INTEGER ISRC1(100,5)00000240
C    INTEGER TSOC3(50),ISRC3(100,5)00000250
C    INTEGER JSOC24(50),ISRC24(100,5)00000260
C    INTEGER IPCL(11),IPCP(51)00000270
C    INTEGER KDAY(5),KHR(5)00000280
C    INTEGER IDH(12,2),IFM(12)00000290
C    INTEGER*2 IDAYS(366),NDYS,IFCHO(366)00000300
C    INTEGER*2 INTM,INTY,INTM3,INTY3,INTM24,INTY24,IRECEP00000310
C    INTEGER*2 ISCODE00000320
C    LOGICAL LFRQ1,LFRQ3,LFRQ2400000330
C    LOGICAL LECH1,LECH3,LECH2400000340
C    LOGICAL LSUM00000350
C    LOGICAL LEND/.FALSE./00000360
C    LOGICAL LFRQ/.FALSE./,LTRUF/.TRUE./00000370
C    EQUIVALENCE (CHIL0W,TSOC1(50)),(CHIL3,TSOC3(50))00000380
C    EQUIVALENCE (CHIL24,TSOC24(50))00000390
C    COMMON/ACODE/IYR,IPAY,IPHOUR,ICODE,ISTAR,WS,IWD,IDPRL00000400
C    COMMON/BCODE/ICD,IMET2,ICD1,ICD3,IDAYHR00000410
C    COMMON/FRDIST/XINT(25),XINT3(25),XINT24(25),NINT,NINT3,NINT24,00000420
C    1 INTM(25,12),INTY(25),INTM3(25,12),INTY3(25),INTM24(25,12),00000430
C    2 INTY24(25),IRECEP00000440
C    COMMON/CHIPRT/NTA,NSUM,ISCODE(62),LSUM,IJCODE00000450
C    NAMELIST/OPTS/XINT,XINT3,XINT24,NINT,NINT3,NINT24,00000460
C    1 LFRQ1,LFRQ3,LFRQ24,IRECEP,IFCHO,LECH1,LECH3,LECH24,00000470
C    2 NSUM,ISCODE,LSUM,IJCODE00000480
C    DATA TSOC1/50*0.0/,TSRC1/500*0.0/00000490
C    DATA JSOC1/50*0./,JSOC1/50*0./,K5OC1/50*0/00000500
C    DATA TSOC3/50*0.0/,TSRC3/500*0.0/00000510
C    DATA ISOC3/50*0./,ISRC3/500*0/00000520
C    DATA TSOC24/50*0.0/,TSRC24/500*0.0/00000530
C    DATA ISOC24/50*0./,ISRC24/500*0/00000540
C    DATA CHIANN/100*0.0/,IDANN/0/00000550
C    DATA IDH/31,60,91,121,152,182,213,244,274,305,335,366,00000560
C    1 31,59,90,120,151,181,212,243,273,304,334,365/00000570
C    DATA IFCHO/366*0./,IFM/12*0/00000580
C    DATA LFRQ1/.FALSE./,LFRQ3/.FALSE./,LFRQ24/.FALSE./00000590
C    DATA LECH1/.FALSE./,LECH3/.FALSE./,LECH24/.FALSE./00000600
C    DATA ALPYES/'YES'/,ALP1/'NO'/,ALP2/'NO'/,ALP3/'NO'/00000610
C    DATA ALP4/'NO'/,ALP5/'NO'/,ALP6/'NO'/00000620
C    DATA ALPAR/'/'00000630

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		00000640
C	IDENTIFY VERSION AND LEVEL NUMBERS OF BLP POSTPROCESSOR	00000650
C		00000660
C	VERSION=1.1	00000670
	LEVEL=800702	00000680
	WRITE(6,1400)VERSION,LEVEL	00000690
1400	FORMAT('1',40X,'BLP POSTPROCESSOR VERSION ',F4.1,3X,'LEVEL ',I6/	00000700
	1 '0',13('*****'))	00000710
C		00000720
C	READ BLP POSTPROCESSOR USER INPUTS	00000730
C		00000740
	READ(5,0PTS)	00000750
	WRITE(6,1402)	00000760
1402	FORMAT(///)	00000770
	WRITE(6,0PTS)	00000780
	WRITE(6,1400)VERSION,LEVEL	00000790
C		00000800
C	READ TITLE CARD AND OTHER GENERAL INFORMATION	00000810
C	ON RECORD #1 OF THE OUTPUT FILE (20)	00000820
C		00000830
	READ(20)TITLE,NREC,NPTS,NLINES,IPCL,IPCP,IYR,IDAYS	00000840
	WRITE(6,8)TITLE,IYR	00000850
8	FORMAT(// '0',20A4,5X,'YEAR: ',I2)	00000860
C	ILEAP = 1 (LEAP YEAR); ILEAP = 2 (NON-LEAP YEAR)	00000870
	ILEAP=2	00000880
	IF(MOD(IYR,4).EQ.0)ILEAP=1	00000890
	NPH=MIN0(NREC,50)	00000900
	NK2=NREC/2	00000910
	NPL=0	00000920
	DO 121 I=1,11	00000930
121	NPL=NPL+IPCL(I)	00000940
	NPP=0	00000950
	DO 122 I=1,51	00000960
122	NPP=NPP+IPCP(I)	00000970
C	NTA IS THE NUMBER OF RECORDS FOR EACH HOUR	00000980
	NTA=1+NPL+NPP	00000990
	NDYS=0	00001000
	DO 135 I=1,366	00001010
135	NDYS=NDYS+IDAYS(I)	00001020
	WRITE(6,136)NDYS,IDAYS	00001030
136	FORMAT(// '0','TOTAL NUMBER OF DAYS INCLUDED IN THIS RUN: ',I3//	00001040
	1 1X,'(0=NOT INCLUDED; 1=INCLUDED)')//	00001050
	2 3('0',10(10I1,3X)/),'0',6(10I1,3X),611)	00001060
	NT=NPTS+NLINES	00001070
	WRITE(6,112)NT,NLINES,NPTS,NREC	00001080
112	FORMAT(// '0','TOTAL NUMBER OF SOURCES: ',I3//12X,'LINE SOURCES: ',	00001090
	1I3//11X,'POINT SOURCES: ',I3//1X,'TOTAL NUMBER OF RECEPTORS: ',I3)	00001100
	IF(NLINES.LE.0)GO TO 57	00001110
	WRITE(6,212)	00001120
212	FORMAT(// '0','SOURCE CONTRIBUTIONS FROM THE FOLLOWING LINE ',	00001130
	1 'SOURCES ARE AVAILABLE: '// '0','(0=NOT AVAILABLE; 1=AVAILABLE)')//	00001140
	2 '0','LINE SOURCE NUMBER',5X,'AVAILABILITY')	00001150
	DO 219 I=1,NLINES	00001160
	WRITE(6,215)I,IPCL(I)	00001170
215	FORMAT('0',7X,I2,19X,I1)	00001180
219	CONTINUE	00001190
	WRITE(6,216)NLINES,IPCL(11)	00001200
216	FORMAT('0',5X,'1 - ',I2,17X,I1)	00001210
57	CONTINUE	00001220
	IF(NPTS.LE.0)GO TO 58	00001230
	WRITE(6,1400)VERSION,LEVEL	00001240
	WRITE(6,222)	00001250
222	FORMAT(// '0','SOURCE CONTRIBUTIONS FROM THE FOLLOWING ',	00001260

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1 'POINT SOURCES ARE AVAILABLE: '/0','(0=NOT AVAILABLE; 1,
2 '1=AVAILABLE)'/0','POINT SOURCE NUMBER',5X,'AVAILABILITY')
DO 239 I=1,NPTS
WRITE(6,235)I,IPCP(I)
235 FORMAT('0',8X,12,19X,I1)
239 CONTINUE
WRITE(6,236)NPTS,IPCP(51)
236 FORMAT('0',6X,'1 - ',12,17X,I1)
58 CONTINUE
WRITE(6,1400)VERSION,LEVEL
IF(.NOT.LSUM)WRITE(6,2000)IJCODE
2000 FORMAT(//0',9X,'IJCODE = ',I3)
IF(.NOT.LSUM)WRITE(6,2001)
2001 FORMAT('0','(IJCODE SPECIFIES THE BLP CONCENTRATION ',
1 'OUTPUT DATA USED IN THIS RUN OF POSTBLP.'/2X,'THE ',
1 'CONCENTRATION DATA ASSOCIATED WITH IJCODE IS AS FOLLOWS: '/
2 '0',9X,'IJCODE',
2 18X,'CONCENTRATION DATA'/0',10X,'1-10',5X,'SOURCE CONTRIBUTION '
3,'- LINE SOURCE NUMBER "IJCODE"'/12X,'11',6X,'SOURCE ',
4 'CONTRIBUTION - ALL LINE SOURCES'/10X,'101-150',3X,'SOURCE ',
5 'CONTRIBUTION - POINT SOURCE NUMBER "IJCODE - 100"'/
6 11X,'151',6X,'SOURCE CONTRIBUTION - ALL POINT SOURCES'/
7 11X,'999',6X,'TOTAL CONCENTRATION)')
IF(LSUM)WRITE(6,2012)NSUM,(ALPAR,NXX,ISCODE(NXX),NXX=1,NSUM)
2012 FORMAT(//0','THE BLP CONCENTRATION DATA USED IN THIS RUN OF ',
1 'POSTBLP IS THE SUM OF THE FOLLOWING ',I3,' SETS'/2X,'OF ',
2 'SOURCE CONTRIBUTION DATA: '/0','ISCODE = ',
3 9(A1,I1,' '),I3,3X),6(/9X,10(A1,I2,' '),I3,2X)))
IF(LSUM)WRITE(6,2013)
2013 FORMAT(/9X,'WHERE THE CONCENTRATION DATA ASSOCIATED WITH EACH ',
1 'ISCODE IS IDENTIFIED AS FOLLOWS: '/0',9X,'ISCODE',
2 18X,'CONCENTRATION DATA'/0',10X,'1-10',5X,'SOURCE CONTRIBUTION '
3,'- LINE SOURCE NUMBER "ISCODE"'/12X,'11',6X,'SOURCE ',
4 'CONTRIBUTION - ALL LINE SOURCES'/10X,'101-150',3X,'SOURCE ',
5 'CONTRIBUTION - POINT SOURCE NUMBER "ISCODE - 100"'/
6 11X,'151',6X,'SOURCE CONTRIBUTION - ALL POINT SOURCES'/
7 11X,'999',6X,'TOTAL CONCENTRATION)')
IF(LFRQ1)ALP1=ALPYES
IF(LFRQ3)ALP2=ALPYES
IF(LFRQ24)ALP3=ALPYES
WRITE(6,2005)ALP1,ALP2,ALP3
2005 FORMAT(///0','FREQUENCY DISTRIBUTIONS REQUESTED IN THIS',
1 ' POSTBLP RUN: '/0',4X,'1-HOUR AVERAGES ? ',A3/5X,
2 '3-HOUR AVERAGES ? ',A3/4X,'24-HOUR AVERAGES ? ',A3)
IF(LFRQ1.OR.LFRQ3.OR.LFRQ24)LFRQ=LTRUE
IF(LFRQ)WRITE(6,2010)IRECFP
2010 FORMAT('0','FREQUENCY DISTRIBUTION(S) FOR RECEPTOR NUMBER ',
1 I3)
WRITE(6,1400)VERSION,LEVEL
IF(LECH1)ALP4=ALPYES
IF(LECH3)ALP5=ALPYES
IF(LECH24)ALP6=ALPYES
WRITE(6,2015)IECHO
2015 FORMAT(///0','CONCENTRATIONS AT EACH RECEPTOR ARE PRINTED ',
1 'FOR THE FOLLOWING DAYS: '/0','(0=NOT PRINTED; 1=PRINTED)'
2 //3('0',10(10I1,3X)/),0',6(10I1,3X),6I1)
WRITE(6,2016)ALP4,ALP5,ALP6
2016 FORMAT(/0','AND FOR THE FOLLOWING AVERAGING TIMES: '/
1 '0',4X,'1-HOUR AVERAGES ? ',A3/5X,'3-HOUR AVERAGES ? ',A3/
2 4X,'24-HOUR AVERAGES ? ',A3)
IMOLST=1
IMD=1
DO 1000 JDAY=1,366

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	IF (JDAYS(JDAY).NE.1)GO TO 1000	00001900
	IF (JDAY.LE.TOM(IMOLST,ILEAP))GO TO 285	00001910
	IMOLST=IMOLST+1	00001920
	DO 282 J=IMOLST,12	00001930
	IF (JDAY.LE.TOM(IMOLST,ILEAP))GO TO 283	00001940
	IMOLST=IMOLST+1	00001950
282	CONTINUE	00001960
283	IMO=IMOLST	00001970
285	CONTINUE	00001980
	IFM(IMO)=1	00001990
	MPERID=0	00002000
	DO 900 JHR=1,24	00002010
	CALL GETDAT(NREC,CHIS,LEND)	00002020
	IF (LEND)GO TO 1001	00002030
C		00002040
C	ONE HOUR AVERAGES	00002050
C		00002060
	IF (LFRQ1)CALL FREQ(CHIS,IMO,1)	00002070
	IF (LFCH1.AND.IFCHO(JDAY).EQ.1)CALL OUTDAT(CHIS,IYR,JDAY,JHR,1,	00002080
	1 NREC,NR2)	00002090
C		00002100
C	FIND THE TOP 50 ONE HOUR CONCENTRATIONS	00002110
C		00002120
	DO 310 J=1,NREC	00002130
C	CHLOW HAS BEEN EQUIVALENCED TO T50C1(50)	00002140
	IF (CHIS(J).LE.CHLOW)GO TO 310	00002150
	CHIV=CHIS(J)	00002160
	ICD2=ICD1*1000+J	00002170
C	T50C1 IS THE ARRAY OF THE TOP 50 HOURLY CONCENTRATIONS	00002180
C	I50C1 IS A CORRESPONDING ARRAY CONTAINING THE WS, STAR., AND	00002190
C	RECEPTOR NUMBER	00002200
C	J50C1 IS ANOTHER ARRAY CONTAINING THE WIND DIR. AND DPRL	00002210
C	INSERT THE NEW VALUE IN THE ARRAY OF TOP 50 VALUES (T50C1) AND	00002220
C	INCREMENT THE APPROPRIATE PORTION OF THE ARRAY UP BY ONE	00002230
C	DO THE SAME FOR THE ARRAYS I50C1 AND J50C1	00002240
	IP=24	00002250
	MAG=24.	00002260
	DO 350 I=1,3	00002270
	MAG=MAG/2	00002280
	ISGN=1.	00002290
	IF (CHIV.GT.T50C1(IP))ISGN=-1	00002300
	IP=IP+ISGN*MAG	00002310
350	CONTINUE	00002320
	IL=IP-2	00002330
	IH=IP+3	00002340
	DO 360 I=IL,IH	00002350
	IF (CHIV.LT.T50C1(I))GO TO 360	00002360
	IRPLAC=I	00002370
	GO TO 361	00002380
360	CONTINUE	00002390
	IRPLAC=50	00002400
	IF (CHIV.GE.T50C1(49))IRPLAC=49	00002410
361	CONTINUE	00002420
	INDEX=50-IRPLAC	00002430
	IF (INDEX.EQ.0)GO TO 375	00002440
	DO 370 I=1,INDEX	00002450
	II=50-I	00002460
	T50C1(II+1)=T50C1(II)	00002470
	I50C1(II+1)=I50C1(II)	00002480
	J50C1(II+1)=J50C1(II)	00002490
	K50C1(II+1)=K50C1(II)	00002500
370	CONTINUE	00002510
375	CONTINUE	00002520

	T50C1(IRPLAC)=CHIV	00002530
	T50C1(IRPLAC)=ICD2	00002540
	J50C1(IRPLAC)=IMET2	00002550
	K50C1(IRPLAC)=IDAYHR	00002560
310	CONTINUE	00002570
C		00002580
C	FIND THE 5 HIGHEST HOURLY CONCENTRATIONS AT EACH RECEPTOR	00002590
C		00002600
	DO 410 J=1,NREC	00002610
	IF(CHIS(J).LE.TSRC1(J,5))GO TO 410	00002620
	CHIV=CHIS(J)	00002630
	DO 415 I=1,4	00002640
	IF(CHIV.LT.TSRC1(J,I))GO TO 415	00002650
	IRPLAC=I	00002660
	GO TO 420	00002670
415	CONTINUE	00002680
	IRPLAC=5	00002690
420	CONTINUE	00002700
	INDEX=5-IRPLAC	00002710
	IF(INDEX.EQ.0)GO TO 435	00002720
	DO 430 I=1,INDEX	00002730
	II=5-I	00002740
	TSRC1(J,II+1)=TSRC1(J,II)	00002750
	ISRC1(J,II+1)=ISRC1(J,II)	00002760
430	CONTINUE	00002770
435	CONTINUE	00002780
	TSRC1(J,IRPLAC)=CHIV	00002790
	TSRC1(J,IRPLAC)=IDAYHR	00002800
410	CONTINUE	00002810
C		00002820
C	3-HOUR AVERAGES	00002830
C		00002840
	IF(MOD(JHR,3).EQ.1)GO TO 502	00002850
	DO 501 NR=1,NREC	00002860
501	CHI3(NR)=CHI3(NR)+CHIS(NR)	00002870
	GO TO 504	00002880
502	CONTINUE	00002890
	MPERID=MPERID+1	00002900
	DO 503 NR=1,NREC	00002910
503	CHI3(NR)=CHIS(NR)	00002920
	GO TO 549	00002930
504	CONTINUE	00002940
	IF(MOD(JHR,3).NE.0)GO TO 549	00002950
	DO 505 NR=1,NREC	00002960
505	CHI3(NR)=CHI3(NR)/3.	00002970
	ICD4=IDAY*10+MPERID	00002980
	IF(LFRQ3)CALL FRFO(CHI3,IMD,3)	00002990
	IF(LECH3.AND.IECHO(JDAY).EQ.1)CALL OUTDAT(CHI3,IYR,IDAY,MPERID,3,	00003000
	1 NREC,NR2)	00003010
C		00003020
C	FIND THE TOP 50 3-HOUR AVERAGE CONCENTRATIONS	00003030
C		00003040
	DO 510 J=1,NREC	00003050
C	CHI3 HAS BEEN EQUIVALENCED TO T50C3(50)	00003060
	IF(CHI3(J).LT.CHIL3)GO TO 510	00003070
	CHIV=CHI3(J)	00003080
	IPDATE=ICD4*1000+J	00003090
	IP=24	00003100
	MAG=24	00003110
	DO 550 I=1,3	00003120
	MAG=MAG/2	00003130
	ISGN=1	00003140
	IF(CHIV.GT.T50C3(IP))ISGN=-1	00003150

	IP=IP+ISGN*MAG	00003160
550	CONTINUE	00003170
	IL=IP-2	00003180
	IH=IP+3	00003190
	DO 560 I=IL,IH	00003200
	IF(CHIV.LT.T50C3(I))GO TO 560	00003210
	IRPLAC=I	00003220
	GO TO 561	00003230
560	CONTINUE	00003240
	IRPLAC=50	00003250
	IF(CHIV.GF.T50C3(49))IRPLAC=49	00003260
561	CONTINUE	00003270
	INDEX=50-IRPLAC	00003280
	IF(INDEX.EQ.0)GO TO 575	00003290
	DO 570 I=1,INDEX	00003300
	II=50-I	00003310
	T50C3(II+1)=T50C3(II)	00003320
	T50C3(II+1)=T50C3(II)	00003330
570	CONTINUE	00003340
575	CONTINUE	00003350
	T50C3(IRPLAC)=CHIV	00003360
	T50C3(IRPLAC)=IPDATE	00003370
510	CONTINUE	00003380
C		00003390
C	FIND THE 5 HIGHEST 3-HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR	00003400
C		00003410
	DO 590 J=1,NREC	00003420
	IF(CHI3(J).LE.TSRC3(J,5))GO TO 590	00003430
	CHIV=CHI3(J)	00003440
	DO 515 I=1,4	00003450
	IF(CHIV.LT.TSRC3(J,I))GO TO 515	00003460
	IRPLAC=I	00003470
	GO TO 520	00003480
515	CONTINUE	00003490
	IRPLAC=5	00003500
520	CONTINUE	00003510
	INDEX=5-IRPLAC	00003520
	IF(INDEX.EQ.0)GO TO 535	00003530
	DO 530 I=1,INDEX	00003540
	II=5-I	00003550
	TSRC3(J,II+1)=TSRC3(J,II)	00003560
	TSRC3(J,II+1)=TSRC3(J,II)	00003570
530	CONTINUE	00003580
535	CONTINUE	00003590
	TSRC3(J,IRPLAC)=CHIV	00003600
	TSRC3(J,IRPLAC)=ICD4	00003610
590	CONTINUE	00003620
599	CONTINUE	00003630
C		00003640
C	24-HOUR AVERAGES	00003650
C		00003660
	IF(JHR.NE.1)GO TO 605	00003670
	DO 602 NR=1,NREC	00003680
602	CHI24(NR)=CHIS(NR)	00003690
	GO TO 699	00003700
605	CONTINUE	00003710
	DO 604 NR=1,NREC	00003720
604	CHI24(NR)=CHI24(NR)+CHIS(NR)	00003730
	IF(JHR.NE.24)GO TO 699	00003740
	DO 606 NR=1,NREC	00003750
606	CHI24(NR)=CHI24(NR)/24.	00003760
	IF(LFREQ24)CALL FREQ(CHI24,IMD,24)	00003770
	IF(LECHO24.AND.IECHO(JDAY).EQ.1)CALL OUTDAT(CHI24,IYR,IDAY,0,24,	00003780

	1 NREC,NR2)	00003790
C		00003800
C	FIND THE TOP 50 24-HOUR AVERAGE CONCENTRATIONS	00003810
C		00003820
	DO 610 J=1,NREC	00003830
C	CHIL24 HAS BEEN EQUIVALENCED TO T50C24(50)	00003840
	IF(CHI24(J),LE,CHIL24)GO TO 610	00003850
	CHIV=CHI24(J)	00003860
	IPDAY=IDAY*1000+J	00003870
	IP=24	00003880
	MAG=24	00003890
	DO 650 I=1,3	00003900
	MAG=MAG/2	00003910
	ISGN=1	00003920
	IF(CHIV.GT.T50C24(IP))ISGN=-1	00003930
	IP=IP+ISGN*MAG	00003940
650	CONTINUE	00003950
	IL=IP-2	00003960
	IH=IP+3	00003970
	DO 660 I=IL,IH	00003980
	IF(CHIV.IT.T50C24(I))GO TO 660	00003990
	IRPLAC=I	00004000
	GO TO 651	00004010
660	CONTINUE	00004020
	IRPLAC=50	00004030
	IF(CHIV.GE.T50C24(49))IRPLAC=49	00004040
651	CONTINUE	00004050
	INDEX=50-IRPLAC	00004060
	IF(INDEX.EQ.0)GO TO 675	00004070
	DO 670 I=1,INDEX	00004080
	II=50-I	00004090
	T50C24(II+1)=T50C24(II)	00004100
	T50C24(II+1)=T50C24(II)	00004110
670	CONTINUE	00004120
675	CONTINUE	00004130
	T50C24(IRPLAC)=CHIV	00004140
	T50C24(IRPLAC)=IPDAY	00004150
610	CONTINUE	00004160
C		00004170
C	FIND THE 5 HIGHEST 24-HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR	00004180
C		00004190
	DO 690 J=1,NREC	00004200
	IF(CHI24(J),LE,T5RC24(J,5))GO TO 690	00004210
	CHIV=CHI24(J)	00004220
	DO 615 I=1,4	00004230
	IF(CHIV.LT.T5RC24(J,I))GO TO 615	00004240
	IRPLAC=I	00004250
	GO TO 620	00004260
615	CONTINUE	00004270
	IRPLAC=5	00004280
620	CONTINUE	00004290
	INDEX=5-IRPLAC	00004300
	IF(INDEX.EQ.0)GO TO 635	00004310
	DO 630 I=1,INDEX	00004320
	II=5-I	00004330
	T5RC24(J,II+1)=T5RC24(J,II)	00004340
	T5RC24(J,II+1)=T5RC24(J,II)	00004350
630	CONTINUE	00004360
635	CONTINUE	00004370
	T5RC24(J,IRPLAC)=CHIV	00004380
	T5RC24(J,IRPLAC)=IDAY	00004390
690	CONTINUE	00004400
699	CONTINUE	00004410

C		00004420
C	ANNUAL AVERAGES	00004430
C		00004440
	DO 705 J=1,NREC	00004450
705	CHIANN(J)=CHIANN(J)+CHIS(J)	00004460
	IDANN=IDANN+1	00004470
900	CONTINUE	00004480
1000	CONTINUE	00004490
1001	CONTINUE	00004495
C		00004500
C	WRITE THE ANNUAL AVERAGE CONCENTRATIONS AT EACH RECEPTOR	00004510
C		00004520
	XHRS=IDANN	00004530
	XDAYS=XHRS/24.	00004540
	WRITE(6,1020)XDAYS,IDANN	00004550
1020	FORMAT('1',35X,F5.1,' DAY (' ,I4,' HR) AVERAGE CONCENTRATIONS ',	00004560
	1 'AT EACH RECEPTOR')	00004570
	IF(NREC.EQ.1)GO TO 1030	00004580
	WRITE(6,1021)XDAYS,XDAYS	00004590
1021	FORMAT(/'0',14X,'RECEPTOR',5X,F5.1,' DAY AVERAGE CONCENTRATION',	00004600
	1 15X,'RECEPTOR',5X,F5.1,' DAY AVERAGE CONCENTRATION'/	00004610
	2 39X,' (UG/M**3)',50X,' (UG/M**3)')	00004620
	DO 1025 I=1,NR2	00004630
	I2=NR2+I	00004640
	CHI1=CHIANN(I)/XHRS	00004650
	CHI2=CHIANN(I2)/XHRS	00004660
	WRITE(6,1024)I,CHI1,I2,CHI2	00004670
1024	FORMAT(17X,I3,18X,F9.1,29X,I3,18X,F9.1)	00004680
1025	CONTINUE	00004690
	IF(MOD(NREC,2).EQ.0)GO TO 1040	00004700
	WRITE(6,1026)NREC,CHIANN(NREC)	00004710
1026	FORMAT(76X,I3,18X,F9.1)	00004720
	GO TO 1040	00004730
1030	CONTINUE	00004740
	WRITE(6,1031)XDAYS	00004750
1031	FORMAT(/'0',44X,'RECEPTOR',5X,F5.1,' DAY AVERAGE ',	00004760
	1 'CONCENTRATION'/69X,' (UG/M**3)')	00004770
	CHI1=CHIANN(1)/XHRS	00004780
	WRITE(6,1046)NREC,CHI1	00004790
1046	FORMAT(47X,I3,18X,F9.1)	00004800
1040	CONTINUE	00004810
C		00004820
C	WRITE THE TOP 5 1-HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR	00004830
C		00004840
	WRITE(6,1120)	00004850
1120	FORMAT('1',38X,'5 HIGHEST 1-HOUR AVERAGE CONCENTRATIONS AT ',	00004860
	1 'EACH RECEPTOR'/16X,'RECEPTOR',5X,'HIGHEST',15X,	00004870
	2 '2ND HIGHEST',10X,'3RD HIGHEST',10X,'4TH HIGHEST',10X,	00004880
	3 '5TH HIGHEST'/	00004890
	4 29X,' (UG/M**3)',15X,3(' (UG/M**3)',12X),' (UG/M**3)')	00004900
	DO 1126 I=1,NPH	00004910
	DO 1124 NN=1,5	00004920
	JDAYHR=ISRC1(I,NN)	00004930
	KDAY(NN)=JDAYHR/100	00004940
	KHR(NN)=JDAYHR-KDAY(NN)*100	00004950
1124	CONTINUE	00004960
	WRITE(6,1125)I,(ISRC1(I,N),KDAY(N),KHR(N),N=1,5)	00004970
1125	FORMAT(19X,I3,4X,5(F9.1,1X,' (' ,I3,' ',',I2,' ')',3X))	00004980
1126	CONTINUE	00004990
	IF(NREC.LE.50)GO TO 1140	00005000
	WRITE(6,1120)	00005010
	DO 1136 I=51,NREC	00005020
	DO 1134 NN=1,5	00005030

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      JDAYHR=ISRC1(I,NN)                                00005040
      KDAY(NN)=JDAYHR/100                                00005050
      KHR(NN)=JDAYHR-KDAY(NN)*100                        00005060
1134  CONTINUE                                           00005070
      WRITE(6,1125)I,(ISRC1(I,N),KDAY(N),KHR(N),N=1,5) 00005080
1136  CONTINUE                                           00005090
1140  CONTINUE                                           00005100
C                                           00005110
C      WRITE THE TOP 5 3-HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR 00005120
C                                           00005130
      WRITE(6,1220)                                       00005140
1220  FORMAT('1',38X,'5 HIGHEST 3-HOUR AVERAGE CONCENTRATIONS AT ', 00005150
1     'EACH RECEPTOR'/'0',16X,'RECEPTOR',5X,'HIGHEST',14X, 00005160
2     '2ND HIGHEST',9X,'3RD HIGHEST',9X,'4TH HIGHEST',9X,'5TH HIGHEST', 00005170
3     29X,'(UG/M**3)',14X,3(' (UG/M**3)',11X),'(UG/M**3)') 00005180
      DO 1224 I=1,NPH                                     00005190
      DO 1224 NN=1,5                                       00005200
      JDATE=ISRC3(I,NN)                                    00005210
      KDAY(NN)=JDATE/10                                    00005220
C      MPERID IS STORED IN THE KHR ARRAY                  00005230
      KHR(NN)=JDATE-KDAY(NN)*10                           00005240
1224  CONTINUE                                           00005250
      WRITE(6,1225)I,(ISRC3(I,N),KDAY(N),KHR(N),N=1,5) 00005260
1225  FORMAT(19X,13,4X,5(F9.1,1X,'(',13,',',1,1,')',3X)) 00005270
1226  CONTINUE                                           00005280
      IF(NREC.LE.50)GO TO 1240                            00005290
      WRITE(6,1220)                                       00005300
      DO 1236 I=51,NREC                                   00005310
      DO 1234 NN=1,5                                       00005320
      JDATE=ISRC3(I,NN)                                    00005330
      KDAY(NN)=JDATE/10                                    00005340
      KHR(NN)=JDATE-KDAY(NN)*10                           00005350
1234  CONTINUE                                           00005360
      WRITE(6,1225)I,(ISRC3(I,N),KDAY(N),KHR(N),N=1,5) 00005370
1236  CONTINUE                                           00005380
1240  CONTINUE                                           00005390
C                                           00005400
C      WRITE THE TOP 5 24-HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR 00005410
C                                           00005420
      WRITE(6,1320)                                       00005430
1320  FORMAT('1',37X,'5 HIGHEST 24-HOUR AVERAGE CONCENTRATIONS AT ', 00005440
1     'EACH RECEPTOR'/'0',16X,'RECEPTOR',5X,'HIGHEST',14X, 00005450
2     '2ND HIGHEST',9X,'3RD HIGHEST',9X,'4TH HIGHEST',9X,'5TH HIGHEST', 00005460
3     29X,'(UG/M**3)',14X,3(' (UG/M**3)',11X),'(UG/M**3)') 00005470
      DO 1326 I=1,NPH                                     00005480
      WRITE(6,1325)I,(ISRC24(I,N),ISRC24(I,N),N=1,5) 00005490
1325  FORMAT(19X,13,4X,5(F9.1,1X,'(',13,',',1,1,')',5X)) 00005500
1326  CONTINUE                                           00005510
      IF(NREC.LE.50)GO TO 1340                            00005520
      WRITE(6,1320)                                       00005530
      DO 1336 I=51,NREC                                   00005540
      WRITE(6,1325)I,(ISRC24(I,N),ISRC24(I,N),N=1,5) 00005550
1336  CONTINUE                                           00005560
1340  CONTINUE                                           00005570
C                                           00005580
C      WRITE THE TOP 50 1-HOUR CONCENTRATIONS              00005590
C                                           00005600
      WRITE(6,1100)                                       00005610
1100  FORMAT('1',40X,'TOP 50 1-HOUR AVERAGE CONCENTRATIONS') 00005620
      WRITE(6,1101)                                       00005630
1101  FORMAT('1',10X,'DAY',3X,'HOUR',3X,'WIND SPEED',3X,'WIND DIRECTION' 00005640
1     '1',3X,'STABILITY',3X,'MIXING HEIGHT',3X,'RECEPTOR',4X,'1-HOUR ', 00005650
2     'CONCENTRATION'/'26X,'(M/S)',9X,'(DEGREES)',19X,'(METERS)', 00005660

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3	22X, '(UG/M**3)')	00005670
	DO 1110 I=1,50	00005680
	JCD2=I50C1(I)	00005690
	JMET2=J50C1(I)	00005700
	JDAYHR=K50C1(I)	00005710
	JWS=JCD2/10000	00005720
	JSTAR=JCD2/1000-10*JWS	00005730
	JRECEP=JCD2-JSTAR*1000-JWS*10000	00005740
	XWS=FLOAT(JWS)/10.	00005750
	JWD=JMET2/10000	00005760
	JDPRL=JMET2-10000*JWD	00005770
	JDAY=JDAYHR/100	00005780
	JHR=JDAYHR-JDAY*100	00005790
	WRITE(6,1105)JDAY,JHR,XWS,JWD,JSTAR,JDPRL,JRECEP,I50C1(I)	00005800
1105	FORMAT(11X,I3,4X,I2,6X,F4.1,I3,I2X,I1,10X,I5,10X,I3,10X,F9.1)	00005810
1110	CONTINUE	00005820
C		00005830
C	WRITE THE TOP 50 3-HOUR CONCENTRATIONS	00005840
C		00005850
	WRITE(6,1200)	00005860
1200	FORMAT('1',48X,'TOP 50 3-HOUR AVERAGE CONCENTRATIONS')	00005870
	WRITE(6,1201)	00005880
1201	FORMAT('/0',40X,'DAY',3X,'TIME PERIOD',3X,'RECEPTOR',3X,	00005890
1	'3-HOUR CONCENTRATION'/75X,'(UG/M**3)')	00005900
	DO 1210 I=1,50	00005910
	JDATE=I50C3(I)	00005920
	JDAY=JDATE/10000	00005930
	JTIME=JDATE/1000-JDAY*10	00005940
	JRECEP=JDATE-JDAY*10000-JTIME*1000	00005950
	WRITE(6,1215)JDAY,JTIME,JRECEP,I50C3(I)	00005960
1215	FORMAT(41X,I3,8X,I1,10X,I3,8X,F9.1)	00005970
1210	CONTINUE	00005980
C		00005990
C	WRITE THE TOP 50 24-HOUR CONCENTRATIONS	00006000
C		00006010
	WRITE(6,1300)	00006020
1300	FORMAT('1',41X,'TOP 50 24-HOUR AVERAGE CONCENTRATIONS')	00006030
	WRITE(6,1301)	00006040
1301	FORMAT('/0',40X,'DAY',3X,'RECEPTOR',3X,'24-HOUR ',	00006050
1	'CONCENTRATION'/63X,'(UG/M**3)')	00006060
	DO 1310 I=1,50	00006070
	JPDAY=I50C24(I)	00006080
	JDAY=JPDAY/1000	00006090
	JRECEP=JPDAY-JDAY*1000	00006100
	WRITE(6,1315)JDAY,JRECEP,I50C24(I)	00006110
1315	FORMAT(41X,I3,5X,I3,8X,F9.1)	00006120
1310	CONTINUE	00006130
C		00006140
C	WRITE THE MONTHLY FREQUENCY DISTRIBUTIONS	00006150
C		00006160
	IF(.NOT.LFRQ1)GO TO 1491	00006170
C	WRITE THE MONTHLY SUMMARIES FOR THE 1-HOUR AVERAGES	00006180
	DO 1490 IJ=1,12	00006190
	IF(IEM(IJ).NE.1)GO TO 1490	00006200
	WRITE(6,1480)IRECEP,IJ	00006210
1480	FORMAT('1',15X,'RECEPTOR: ',I3,6X,'FREQUENCY DISTRIBUTION FOR ',	00006220
1	'MONTH: ',I2,6X,	00006230
1	'1-HOUR AVERAGE CONCENTRATIONS (UG/M**3)'/	00006240
2	'0',24X,'INTERVAL NO.',3X,'HOURS',5X,'PERCENT',5X,'CUMULATIVE')	00006250
	IF(IJ.EQ.1)GO TO 1420	00006260
	XHRM=24.*(IOM(IJ,I LEAP)-IOM(IJ-1,I LEAP))	00006270
	GO TO 1425	00006280
1420	XHRM=744.	00006290

1425	CONTINUE	00006300
	CALL FRQOUT(NINT,IJ,XHRM,INTM,XINT)	00006310
1490	CONTINUE	00006320
1491	CONTINUE	00006330
	IF(.NOT.LFRQ3)GO TO 1591	00006340
C	WRITE THE MONTHLY SUMMARIES FOR THE 3-HOUR AVERAGES	00006350
	DO 1590 IJ=1,12	00006360
	IF(IFM(IJ).NE.1)GO TO 1590	00006370
	WRITE(6,1580)IRECEP,IJ	00006380
1580	FORMAT('1',15X,'RECEPTOR: ',I3,6X,'FREQUENCY DISTRIBUTION FOR ',	00006390
	1 'MONTH: ',I2,6X,	00006400
	1 '3-HOUR AVERAGE CONCENTRATIONS (UG/M**3)')///	00006410
	2'0',24X,'INTERVAL NO.',37X,'PERIODS',4X,'PERCENT',5X,'CUMULATIVE')	00006420
	IF(IJ.EQ.1)GO TO 1520	00006430
	XHRM=8.*(IDM(IJ,ILFAP)-IDM(IJ-1,ILEAP))	00006440
	GO TO 1525	00006450
1520	XHRM=248.	00006460
1525	CONTINUE	00006470
	CALL FRQOUT(NINT3,IJ,XHRM,INTM3,XINT3)	00006480
1590	CONTINUE	00006490
1591	CONTINUE	00006500
C	WRITE THE MONTHLY SUMMARIES FOR THE 24-HOUR AVERAGES	00006510
	IF(.NOT.LFRQ24)GO TO 1691	00006520
C	WRITE THE MONTHLY SUMMARIES FOR THE 24-HOUR AVERAGES	00006530
	DO 1690 IJ=1,12	00006540
	IF(IFM(IJ).NE.1)GO TO 1690	00006550
	WRITE(6,1680)IRECEP,IJ	00006560
1680	FORMAT('1',15X,'RECEPTOR: ',I3,6X,'FREQUENCY DISTRIBUTION FOR ',	00006570
	1 'MONTH: ',I2,6X,	00006580
	1 '24-HOUR AVERAGE CONCENTRATIONS (UG/M**3)')///	00006590
	2 '0',24X,'INTERVAL NO.',39X,'DAYS',5X,'PERCENT',5X,'CUMULATIVE')	00006600
	IF(IJ.EQ.1)GO TO 1620	00006610
	XHRM=IDM(IJ,ILEAP)-IDM(IJ-1,ILFAP)	00006620
	GO TO 1625	00006630
1620	XHRM=31.	00006640
1625	CONTINUE	00006650
	CALL FRQOUT(NINT24,IJ,XHRM,INTM24,XINT24)	00006660
1690	CONTINUE	00006670
1691	CONTINUE	00006680
C		00006690
C	WRITE THE ANNUAL FREQUENCY DISTRIBUTIONS	00006700
C		00006710
	XHRSY=8760.	00006720
	IF(ILEAP.EQ.1)XHRSY=8784.	00006730
	IF(.NOT.LFRQ1)GO TO 1791	00006740
C	WRITE THE ANNUAL SUMMARY FOR THE 1-HOUR AVERAGES	00006750
	WRITE(6,1780)IRECEP,IYR	00006760
1780	FORMAT('1',15X,'RECEPTOR: ',I3,6X,'FREQUENCY DISTRIBUTION FOR ',	00006770
	1 'YEAR: ',I2,6X,	00006780
	1 '1-HOUR AVERAGE CONCENTRATIONS (UG/M**3)')///	00006790
	2 '0',24X,'INTERVAL NO.',38X,'HOURS',5X,'PERCENT',5X,'CUMULATIVE')	00006800
	CALL FRQOUT(NINT,I,XHRSY,INTY,XINT)	00006810
1791	CONTINUE	00006820
	IF(.NOT.LFRQ3)GO TO 1891	00006830
C	WRITE THE ANNUAL SUMMARY FOR THE 3-HOUR AVERAGES	00006840
	WRITE(6,1880)IRECEP,IYR	00006850
1880	FORMAT('1',15X,'RECEPTOR: ',I3,6X,'FREQUENCY DISTRIBUTION FOR ',	00006860
	1 'YEAR: ',I2,6X,	00006870
	1 '3-HOUR AVERAGE CONCENTRATIONS (UG/M**3)')///	00006880
	2'0',24X,'INTERVAL NO.',37X,'PERIODS',4X,'PERCENT',5X,'CUMULATIVE')	00006890
	X3=XHRSY/3.	00006900
	CALL FRQOUT(NINT3,I,X3,INTY3,XINT3)	00006910
1891	CONTINUE	00006920

	IF(.NOT.LFRQ24)GO TO 1991	00006930
	WRITE THE ANNUAL SUMMARY FOR THE 24-HOUR AVERAGES	00006940
C	WRITE(6,1980)IRECFP,IYR	00006950
1980	FORMAT('1',15X,'RECEPTOR: ',13,6X,'FREQUENCY DISTRIBUTION FOR ',	00006960
	1 'YEAR: ',12,6X,	00006970
	1 '24-HOUR AVERAGE CONCENTRATIONS (UG/M**3)'/	00006980
	2 '0',24X,'INTERVAL NO.',39X,'DAYS',5X,'PERCENT',5X,'CUMULATIVE')	00006990
	X24=XHRSY/24.	00007000
	CALL FROOUT(NINT24,1,X24,INTY24,XINT24)	00007010
1991	CONTINUE	00007020
	STOP	00007030
	END	00007040
	SUBROUTINE GETDAT(NREC,CHIS,LEND)	00007050
C	POSTHLP VERSION 1.1 LEVEL R00212 GETDAT	00007060
	REAL CHIA(100)	00007070
	REAL CHIS(NREC)	00007080
	INTEGER*2 ISCODE	00007090
	LOGICAL LSUM	00007100
	LOGICAL LEND,LTRUE	00007110
	COMMON/ACODE/IYR,IDAY,IHOUR,ICODE,ISTAR,WS,IWD,IDPBL	00007120
	COMMON/RCODE/ICD,IMET2,ICD1,ICD3,IDAYHR	00007130
	COMMON/CHIPRT/NTA,NSUM,ISCODE(62),LSUM,IJCODE	00007140
	DATA LTRUE/.TRUE./	00007150
	IF(.NOT.LSUM)GO TO 50	00007160
	INDEX=1	00007170
C	NTA IS THE NUMBER OF RECORDS PER HOUR	00007180
	DO 10 I=1,NTA	00007190
	READ(20,END=999)IDAYHR,ICD,IMET2,CHIS	00007200
	ICD1=ICD/1000	00007210
	ICODE=ICD-1000*ICD1	00007220
	IF(ICODE.NE.ISCODE(INDEX))GO TO 10	00007230
	INDEX=INDEX+1	00007240
	IF(INDEX.NE.2)GO TO 8	00007250
	DO 7 J=1,NREC	00007260
7	CHIA(J)=CHIS(J)	00007270
	GO TO 10	00007280
8	DO 9 J=1,NREC	00007290
9	CHIA(J)=CHIA(J)+CHIS(J)	00007300
10	CONTINUE	00007310
	IF(INDEX.EQ.NSUM+1)GO TO 15	00007320
	WRITE(6,12)NSUM,INDEX,ISCODE	00007330
12	FORMAT('/////0','EXECUTION TERMINATING -- ERROR IN SPECIFICATION '	00007340
	1 ', 'OF NSUM OR ISCODE'/'0','NSUM = ',15,5X,'INDEX = ',15,5X,	00007350
	2 6('0',10(15,2X))/'0',2(15,2X))	00007360
	STOP	00007370
15	CONTINUE	00007380
	DO 17 J=1,NREC	00007390
17	CHIS(J)=CHIA(J)	00007400
	GO TO 60	00007410
50	CONTINUE	00007420
	DO 55 I=1,NTA	00007430
	READ(20,END=999)IDAYHR,ICD,IMET2,CHIS	00007440
	ICD1=ICD/1000	00007450
	ICODE=ICD-1000*ICD1	00007460
	IF(ICODE.NE.IJCODE)GO TO 55	00007470
	NTA2=NTA-I	00007480
	IF(NTA2.EQ.0)GO TO 60	00007490
	DO 54 J=1,NTA2	00007500
	READ(20)	00007510
54	CONTINUE	00007520
	GO TO 60	00007530
55	CONTINUE	00007540
	WRITE(6,56)IJCODE	00007550

56	FORMAT(///// '0', 'EXECUTION TERMINATING -- ERROR IN ',	00007560
1	'THE SPECIFICATION OF IJCODE'/'0', 'IJCODE = ', I5)	00007570
	STOP	00007580
60	CONTINUE	00007590
C		00007600
C	DECODE IDAYHR	00007610
C		00007620
	IDAY=IDAYHR/100	00007630
	IHR=IDAYHR-IDAY*100	00007640
C		00007650
C	DECODE ICD	00007660
C		00007670
	IWS=ICD1/10	00007680
	WS=FLOAT(IWS)/10.	00007690
	ISTAB=ICD1-10*IWS	00007700
	ICD3=IDAYHR*10+ISTAB	00007710
C		00007720
C	DECODE IMET2	00007730
C		00007740
	IWD=IMET2/10000	00007750
	IDPBL=IMET2-IWD*10000	00007760
	RETURN	00007770
999	LEND=LTRUE	00007780
	RETURN	00007790
	END	00007800
	SUBROUTINE OUTDAT(CHI,IYR,IDAY,ITM,IAVG,NREC,NR2)	00007810
C	POSTBLP VERSION 1.1 LEVEL 800212 OUTDAT	00007820
	REAL CHI(100)	00007830
	IF(NREC.LT.40)GO TO 1000	00007840
	IF(IAVG.EQ.1)WRITE(6,100)IYR,IDAY,ITM,IAVG	00007850
100	FORMAT('1',24X,'YEAR: ',I2,3X,'DAY: ',I3,3X,'HOUR: ',I2,10X,	00007860
1	'12,' HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR')	00007870
	IF(IAVG.EQ.3)WRITE(6,101)IYR,IDAY,ITM,IAVG	00007880
101	FORMAT('1',23X,'YEAR: ',I2,3X,'DAY: ',I3,3X,'PERIOD: ',I2,10X,	00007890
1	'12,' HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR')	00007900
	IF(IAVG.EQ.24)WRITE(6,102)IYR,IDAY,IAVG	00007910
102	FORMAT('1',28X,'YEAR: ',I2,3X,'DAY: ',I3,12X,	00007920
1	'12,' HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR')	00007930
120	CONTINUE	00007940
	WRITE(6,121)IAVG,IAVG	00007950
121	FORMAT('0',14X,'RECEPTOR',9X,I2,' HR AVERAGE CONCENTRATION',	00007960
1	15X,'RECEPTOR',9X,I2,' HR AVERAGE CONCENTRATION'/	00007970
2	39X,'(UG/M**3)',50X,'(UG/M**3)')	00007980
	DO 125 I=1,NR2	00007990
	I2=NR2+I	00008000
	WRITE(6,124)I,CHI(I),I2,CHI(I2)	00008010
124	FORMAT(17X,I3,19X,F9.1,29X,I3,18X,F9.1)	00008020
125	CONTINUE	00008030
	IF(MOD(NREC,2).EQ.0)RETURN	00008040
	WRITE(6,126)NREC,CHI(NREC)	00008050
126	FORMAT(76X,I3,18X,F9.1)	00008060
	RETURN	00008070
1000	CONTINUE	00008080
	IF(IAVG.EQ.1)WRITE(6,200)IYR,IDAY,ITM,IAVG	00008090
200	FORMAT(// '0',24X,'YEAR: ',I2,3X,'DAY: ',I3,3X,'HOUR: ',I2,10X,	00008100
1	'12,' HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR')	00008110
	IF(IAVG.EQ.3)WRITE(6,201)IYR,IDAY,ITM,IAVG	00008120
201	FORMAT(// '0',23X,'YEAR: ',I2,3X,'DAY: ',I3,3X,'PERIOD: ',I2,10X,	00008130
1	'12,' HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR')	00008140
	IF(IAVG.EQ.24)WRITE(6,202)IYR,IDAY,IAVG	00008150
202	FORMAT(// '0',28X,'YEAR: ',I2,3X,'DAY: ',I3,12X,	00008160
1	'12,' HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR')	00008170
	IF(NREC.NE.1)GO TO 120	00008180

	WRITE(6,131)IAVG	00008190
131	FORMAT('0',44X,'RECEIVED',9X,12,' HP AVERAGE CONCENTRATION',	00008200
	1 69X,'(UG/M**3)')	00008210
	WRITE(6,146)NREC,CHI(1)	00008220
146	FORMAT(47X,13,18X,F9.1)	00008230
	RETURN	00008240
	END	00008250
	SUBROUTINE FREQ(CHI,IMO,IAVG)	00008260
C	POSTBLP VERSION 1.1 LEVEL 800212 FREQ	00008270
	REAL CHI(100)	00008280
	INTEGER*2 INTM,INTY,INTM3,INTY3,INTM24,INTY24,IRECEP	00008290
	COMMON/FRDIST/XINT(25),XINT3(25),XINT24(25),NINT,NINT3,NINT24,	00008300
	1 INTM(25,12),INTY(25),INTM3(25,12),INTY3(25),INTM24(25,12),	00008310
	2 INTY24(25),IRECEP	00008320
	XCHI=CHI(IRECEP)	00008330
	IF(IAVG.NE.1)GO TO 50	00008340
	DO 10 J=2,NINT	00008350
	IF(XCHI.GE.XINT(J))GO TO 10	00008360
	JM1=J-1	00008370
	INTM(JM1,IMO)=INTM(JM1,IMO)+1	00008380
	INTY(JM1)=INTY(JM1)+1	00008390
	GO TO 15	00008400
10	CONTINUE	00008410
	INTM(NINT,IMO)=INTM(NINT,IMO)+1	00008420
	INTY(NINT)=INTY(NINT)+1	00008430
15	CONTINUE	00008440
	RETURN	00008450
50	CONTINUE	00008460
	IF(IAVG.NE.3)GO TO 100	00008470
	DO 60 J=2,NINT3	00008480
	IF(XCHI.GE.XINT3(J))GO TO 60	00008490
	JM1=J-1	00008500
	INTM3(JM1,IMO)=INTM3(JM1,IMO)+1	00008510
	INTY3(JM1)=INTY3(JM1)+1	00008520
	GO TO 65	00008530
60	CONTINUE	00008540
	INTM3(NINT3,IMO)=INTM3(NINT3,IMO)+1	00008550
	INTY3(NINT3)=INTY3(NINT3)+1	00008560
65	CONTINUE	00008570
	RETURN	00008580
100	CONTINUE	00008590
	IF(IAVG.NE.24)RETURN	00008600
	DO 110 J=2,NINT24	00008610
	IF(XCHI.GE.XINT24(J))GO TO 110	00008620
	JM1=J-1	00008630
	INTM24(JM1,IMO)=INTM24(JM1,IMO)+1	00008640
	INTY24(JM1)=INTY24(JM1)+1	00008650
	GO TO 115	00008660
110	CONTINUE	00008670
	INTM24(NINT24,IMO)=INTM24(NINT24,IMO)+1	00008680
	INTY24(NINT24)=INTY24(NINT24)+1	00008690
115	CONTINUE	00008700
	RETURN	00008710
	END	00008720
	SUBROUTINE FRQOUT(NLEVEL,IMO,XHRS,INT,XINT)	00008730
C	POSTBLP VERSION 1.1 LEVEL 800212 FRQOUT	00008740
	REAL XINT(25)	00008750
	INTEGER*2 INT(25,12)	00008760
	NLM1=NLEVEL-1	00008770
	PCNT=100./XHRS	00008780
	PERCNT=PCNT*INT(1,IMO)	00008790
	CP=PERCNT	00008800
	WRITE(6,1481)XINT(2),INT(1,IMO),PERCNT,CP	00008810

1481	FORMAT(31X,'1',21X,'CHI LT ',F9.1,6X,I4,6X,F6.2,7X,F6.2)	00008820
	DO 1485 I=2,NLM1	00008830
	PERCNT=PCNT*INT(I,IMO)	00008840
	CP=CP+PERCNT	00008850
	WRITE(6,1484)I,XINT(I),XINT(I+1),INT(I,IMO),PERCNT,CP	00008860
1484	FORMAT(29X,I3,7X,F9.1,2X,'LE CHI LT ',F9.1,6X,I4,6X,F6.2,7X,F6.2)	00008870
1485	CONTINUE	00008880
	PERCNT=PCNT*INT(NLEVEL,IMO)	00008890
	CP=CP+PERCNT	00008900
	WRITE(6,1489)NLEVEL,XINT(NLEVEL),INT(NLEVEL,IMO),PERCNT,CP	00008910
1489	FORMAT(29X,I3,7X,F9.1,2X,'LE CHI',19X,I4,6X,F6.2,7X,F6.2)	00008920
	RETURN	00008930
	END	00008940
	BLOCK DATA	00008950
C	POSTBLP VERSION 1.1 LEVEL 800212 BLOCK DATA	00008955
	INTEGER*2 INTM,INTY,INTM3,INTY3,INTM24,INTY24,IRECEP	00008960
	INTEGER*2 JSCODE	00008970
	LOGICAL LSUM	00008980
	COMMON/FRDIST/XINT(25),XINT3(25),XINT24(25),NINT,NINT3,NINT24,	00008990
	1 INTM(25,12),INTY(25),INTM3(25,12),INTY3(25),INTM24(25,12),	00009000
	2 INTY24(25),IRECEP	00009010
	COMMON/CHIPRT/NTA,NSUM,ISCODE(62),LSUM,IJCODE	00009020
	DATA XINT/25*0.0/,XINT3/25*0.0/,XINT24/25*0.0/	00009030
	DATA NINT/0/,NINT3/0/,NINT24/0/	00009040
	DATA INTM/300*0/,INTY/25*0/,INTM3/300*0/,INTY3/25*0/,	00009050
	1 INTM24/300*0/,INTY24/25*0/	00009060
	DATA IRECEP/1/	00009070
	DATA NSUM/0/,ISCODE/62*0/,IJCODE/999/	00009080
	DATA LSUM/,FALSE./	00009090
	END	00009100

APPENDIX C
BLP TEST CASE

INPUT DATA

BLP USER'S GUIDE TEST CASE

```

AGEN NLINES=4,NPTS=2,LPART=.TRUE.,TCUR=90.0,&END
&RISE L=500.,HB=15.,WB=20.,WM=2.5,DX=30.0,FPRIME=300.,&END
&RCEPT RXBEG=-1000.,RYBEG=-1000.,RXEND=1500.,RYEND=1000.,ROX=500.,
RDY=1000.,&END
&METIN LMETIN=.TRUE.,ZMEAS=10.0,&END
&CALC XBACKG=15.0,DECFAC=4.167E-5,&END
&OUTPUT IPCL=1,1,1,1,6*0,1,IPCP=1,1,48*0,1,&END

```

0.0	0.0	500.	0.0	15.	25.5	0.0	
0.0	50.0	500.	50.0	15.	25.5	0.0	
0.0	100.0	500.	100.0	15.	30.0	0.0	
0.0	150.0	500.	150.0	15.	30.0	0.0	
166.7	75.0	15.0	75.0	3.5	12.0	340.0	0.0
333.3	75.0	25.0	80.0	4.0	15.0	350.0	0.0
24							
6	1.5	201.	263.	251.			
6	2.1	176.	261.	251.			
6	2.1	214.	262.	251.			
6	2.1	223.	262.	251.			
6	3.1	233.	261.	251.			
6	2.6	232.	261.	251.			
5	3.1	235.	261.	251.			
4	3.6	213.	261.	267.			
4	4.1	197.	263.	371.			
4	5.8	221.	265.	475.			
4	8.5	234.	265.	579.			
4	10.2	226.	266.	683.			
3	2.1	3.	267.	787.			
2	2.1	349.	268.	891.			
1	1.0	312.	269.	891.			
2	3.1	324.	270.	891.			
3	1.5	11.	270.	891.			
6	1.5	7.	269.	825.			
6	2.1	24.	267.	703.			
6	1.5	17.	267.	582.			
6	2.1	220.	265.	460.			
6	1.5	222.	265.	338.			
6	3.1	230.	264.	216.			
5	4.1	220.	265.	94.			

1

2

3

4

5

6

7

8

OUTPUT DATA

[illegible]

0.0 -- CONTINUED CONSTANT LINE AND POINT SOURCE DISPERSION MODEL VERSION 1.1 LFVEL 800702

METEOROLOGICAL PARAMETERS

MEAN WIND SPEED MEASUREMENT HEIGHT = 10.0 (M)

WIND SPEED POWER LAW EXPONENTS (STABILITIES 1-6) = 0.10 0.15 0.20 0.25 0.30 0.30

VERTICAL POTENTIAL TEMPERATURE GRADIENT = 0.020 DEG K/M (STABILITY 5) 0.035 DEG K/M (STABILITY 6)

METEOROLOGICAL DATA -- FORMATTED USER INPUT

COMPUTATIONAL PARAMETERS

CONVERGENCE THRESHOLD FOR LINE SOURCE CALCULATIONS = 0.020 (MICROGRAMS/M**3)

MAXIMUM NUMBER OF ITERATIONS IN LINE SOURCE CALCULATIONS = 14

FINAL NEUTRAL PLUME RISE CONSTANT (CONST3) = 34.49

BACKGROUND CONCENTRATION = 15.00 (MICROGRAMS/M**3)

POLLUTANT DECAY FACTOR = 0.41670E-04 (1/SEC)

TERMINAL ADJUSTMENT FACTORS (STABILITIES 1-6) = 0.50 0.50 0.50 0.50 0.30 0.30

 RECEPTOR LOCATIONS GENERATED FROM USER DEFINED RECEPTOR RECTANGLE

RECEPTOR NETWORK DEFINED BY THE FOLLOWING RECTANGLE

(	-1000.0,	1000.0)	(	1500.0,	1000.0)
(	-1000.0,	-1000.0)	(	1500.0,	-1000.0)

X GRID SPACING = 500.00

Y GRID SPACING = 1000.00

SOURCE AND RECEPTOR LOCATIONS SPECIFIED IN SCS COORDINATES -- TCR = 90.00 DEGREES

LINE SOURCE PARAMETERS

LINE NUMBER	X START (F)	Y START (F)	X END (W)	Y END (M)	Q (GM/SEC)	HEIGHT (M)	PARTIAL CH1 OUTPUT (0=NO,1=YES)	ELEVATION (M)
1	0.0	0.0	500.0	0.0	25.50	15.00	1	0.0
2	0.0	50.0	500.0	50.0	25.50	15.00	1	0.0
3	0.0	100.0	500.0	100.0	30.00	15.00	1	0.0
4	0.0	150.0	500.0	150.0	30.00	15.00	1	0.0

SOURCE CONTRIBUTIONS FROM THE FOLLOWING LINE SOURCES ARE AVAILABLE:

(0=NOT AVAILABLE; 1=AVAILABLE)

LINE SOURCE NUMBER AVAILABILITY

1	1
2	1
3	1
4	1
1 - 4	1

POINT SOURCE PARAMETERS

POINT NUMBER	X (M)	Y (M)	Q (GM/SEC)	HEIGHT (M)	VOL. FLUX (M**3/SEC)	STACK TEMP. (DEG K)	PARTIAL CHI OUTPUT (0=NO,1=YES)	ELEVATION (M)
1	166.7	75.0	75.00	15.00	116.	340.0	1	0.0
2	333.3	75.0	80.00	25.00	189.	350.0	1	0.0

SOURCE CONTRIBUTIONS FROM THE FOLLOWING POINT SOURCES ARE AVAILABLE:

(0=NOT AVAILABLE; 1=AVAILABLE)

POINT SOURCE NUMBER AVAILABILITY

1	1
2	1
1 - 2	1

THE SOURCE RECTANGLE IS DEFINED BY THE FOLLOWING POINTS:

(	0.0	,	150.00)	(	500.00,	150.00)
(	0.0	,	0.0)	(	500.00,	0.0)

INPUT -- MULTIPLE SOURCE LIDR AND POINT SOURCE DISPERSION MODEL VERSION 1.1 LEVEL 800702

RECEPTION NO.	LOCATION		RECEPTOR NO.	LOCATION	
	X	Y		X	Y
1	-1000.	-1000.	9	500.	-1000.
2	-1000.	0.	10	500.	1000.
3	-1000.	1000.	11	1000.	-1000.
4	-500.	-1000.	12	1000.	0.
5	-500.	0.	13	1000.	1000.
6	-500.	1000.	14	1500.	-1000.
7	0.	-1000.	15	1500.	0.
8	0.	1000.	16	1500.	1000.

NUMBER OF POSSIBLE RECEPTION LOCATIONS = 18

NUMBER OF ACTUAL RECEPTION LOCATIONS = 16

 USER INPUT FORMATTED METEOROLOGICAL DATA

HOUR	STABILITY CLASS	WIND SPEED (M/S)	WIND DIRECTION (DEGREES)	TEMPERATURE (DEG. K)	MIXING HEIGHT (M)
1	6	1.50	201.0	265.0	251.
2	6	2.10	176.0	261.0	251.
3	6	2.10	214.0	262.0	251.
4	6	2.10	225.0	262.0	251.
5	6	3.10	233.0	261.0	251.
6	6	2.00	232.0	261.0	251.
7	5	3.10	235.0	261.0	251.
8	4	3.00	213.0	261.0	267.
9	4	4.10	197.0	263.0	371.
10	4	5.00	221.0	265.0	475.
11	4	6.50	234.0	265.0	579.
12	4	10.20	226.0	266.0	683.
13	3	2.10	5.0	267.0	787.
14	2	2.10	349.0	268.0	891.
15	1	1.00	312.0	269.0	891.
16	2	3.10	324.0	270.0	891.
17	3	1.50	11.0	270.0	891.
18	6	1.50	7.0	269.0	825.
19	6	2.10	24.0	267.0	703.
20	6	1.50	17.0	267.0	582.
21	6	2.10	220.0	265.0	460.
22	6	1.50	222.0	265.0	338.
23	6	3.10	230.0	264.0	216.
24	5	4.10	220.0	265.0	94.

LAST DAY PROCESSED = 1

APPENDIX D
POSTBLP TEST CASES

INPUT DATA FOR POSTBLP

TEST CASE NO. 1

1

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3

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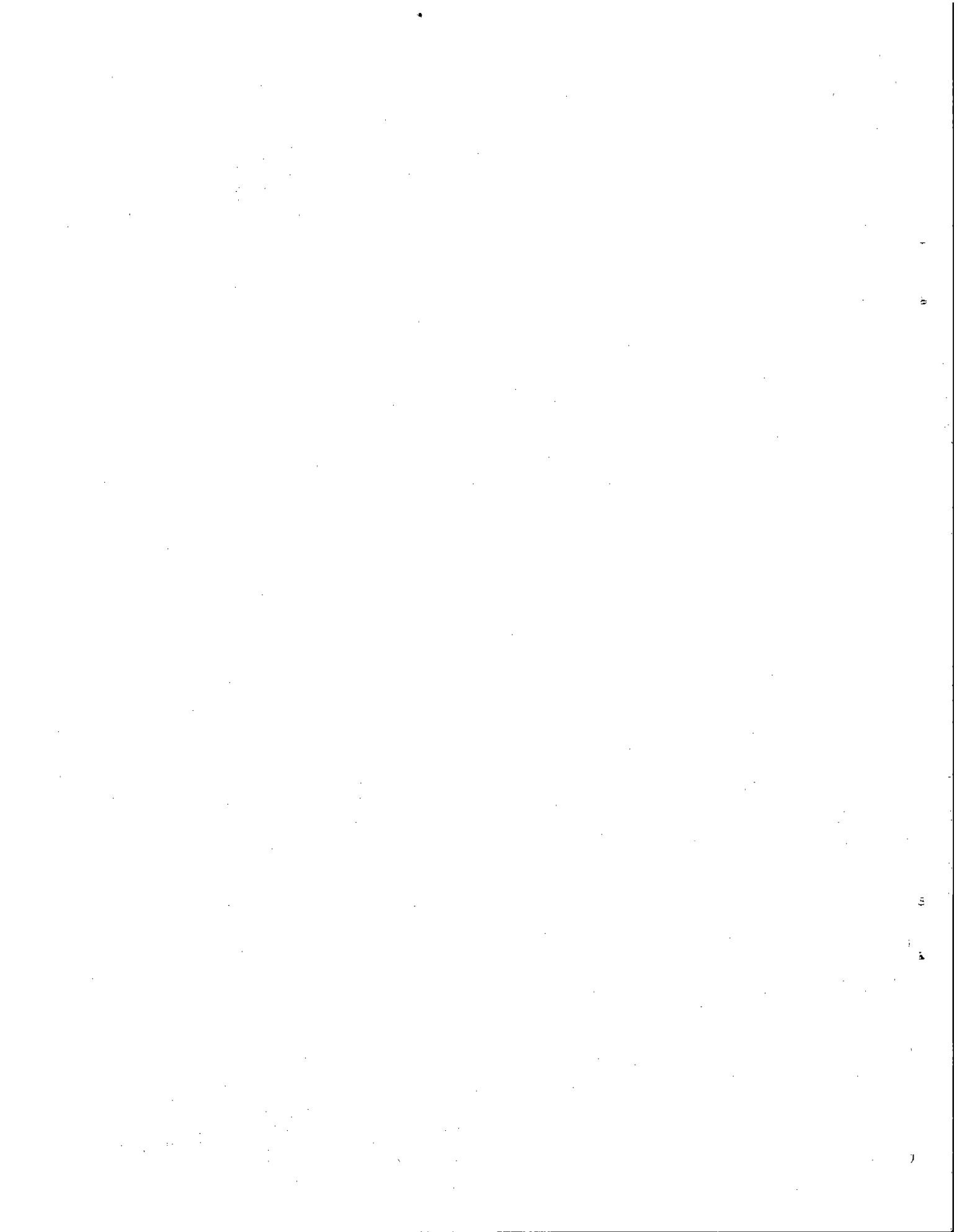
17

18

&OPTS IJCODE=999,LECH3=.TRUE.,LECH24=.TRUE.,LECHU=1,365*0,&END



OUTPUT DATA FOR POSTBLP
TEST CASE NO. 1



[illegible]

1000

YEAR: 0

1

INDEX; 1-INCL 10ED)

[illegible]

£

LINE SOURCE: 4

POINT SOURCES: 2

9

SOURCE CONTRIBUTIONS FROM THE FOLLOWING LINE SOURCES ARE AVAILABLE:

```
(j=NOT AVAILABLE; I=AVAILABLE)
```

LINE	SOURCE	NUMBER	AVAILABILITY
1	...	...	...
2	...	...	...
3	...	...	...
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92	...	...	...
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100	...	...	...

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PLP POSTPROCESSOR VERSION 1.1 LEVEL 800702

SOURCE CONTRIBUTORS FROM THE FOLLOWING POINT SOURCES ARE AVAILABLE:

(0=NOT AVAILABLE; 1=AVAILABLE)

POINT SOURCE NUMBER	AVAILABILITY
1	1
2	1
1 - 2	1

IJCODE = 999

(IJCODE SPECIFIES THE PLP CONCENTRATION OUTPUT DATA USED IN THIS RUN OF POSTPLP.
THE CONCENTRATION DATA ASSOCIATED WITH IJCODE IS AS FOLLOWS:

IJCODE	CONCENTRATION DATA
1-10	SOURCE CONTRIBUTION - LINE SOURCE NUMBER "IJCODE"
11	SOURCE CONTRIBUTION - ALL LINE SOURCES
101-150	SOURCE CONTRIBUTION - POINT SOURCE NUMBER "IJCODE - 100"
151	SOURCE CONTRIBUTION - ALL POINT SOURCES
999	TOTAL CONCENTRATION

FREQUENCY DISTRIBUTIONS REQUESTED IN THIS POSTPLP RUN:

1-HOUR AVERAGES ? NO
3-HOUR AVERAGES ? NO
24-HOUR AVERAGES ? NO

CONCENTRATIONS AT EACH RETENTION ARE PRINTED FOR THE FOLLOWING DAYS:

$(123101234=1 \quad 123101234 \quad (0N=0))$

[illegible]

AND FOR THE FOLLOWING AVERAGE TIMES:

- | | 1-HOUR | AVERAGES | ? NO |
|--|---------|----------|-------|
| | 3-HOUR | AVERAGES | ? YES |
| | 24-HOUR | AVERAGES | ? YES |

RECEPTOR	YEAR: 0	DAY: 1	PERIOD: 1	3 HR AVERAGE CONCENTRATION (UG/M**3)	RECEPTOR	3 HR AVERAGE CONCENTRATION (UG/M**3)
1				15.1	9	342.6
2				15.0	10	15.0
3				15.0	11	15.0
4				402.5	12	15.0
5				15.0	13	15.0
6				15.0	14	15.0
7				533.7	15	15.0
8				15.0	16	15.0

RECEPTOR	YEAR: 0	DAY: 1	PERIOD: 2	3 HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR
	5 HR AVERAGE CONCENTRATION (UG/M**5)			3 HR AVERAGE CONCENTRATION (UG/M**3)
1	1590.5			15.0
2	15.0			15.0
3	15.0			15.0
4	229.9			15.0
5	15.0			15.0
6	15.0			15.0
7	15.0			15.0
8	15.0			15.0

TIME:	DAY:	STATION:	3 HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR
3 PM	RECEIVER	1000/114100	3 HR AVERAGE CONCENTRATION (UG/M**3)
1300	1300	1300	15.0

2	5	15.0	10	15.0
3	5	15.0	11	15.0
4	5	14.6	12	15.0
5	5	15.0	13	15.0
6	7	15.0	14	15.0
7	6	53.7	15	15.0
8	6	15.0	16	15.0

RECEPTOR	YEAR: 0	DAY: 1	PERIOD: 4	3 HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR

YEAR: 0	DAY: 1	PERIOD: 5	3 HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR	
RECEPTION	3 HR AVERAGE CONCENTRATION (UG/M**3)	RECEPTION	3 HR AVERAGE CONCENTRATION (UG/M**3)	
1	15.0	9	15.0	
2	15.0	10	33.6	
3	113.5	11	15.0	
4	15.0	12	15.0	
5	15.0	13	15.0	
6	119.9	14	15.0	
7	15.0	15	15.0	
8	121.0	16	15.0	

RECEPTOR	YEAR: 0	DAY: 1	PERIOD: 6	5 HR AVERAGE CONCENTRATION (UG/M**3)	RECEPTOR	3 HR AVERAGE CONCENTRATION (UG/M**3)
1		15.0			9	15.0
2		15.0			10	715.8
3		32.4			11	15.0
4		15.0			12	15.0
5		15.0			13	15.0
6		160.2			14	15.0
7		15.0			15	15.0
8		40.3			16	15.0

RECEPTOR	YEAR: 0	DAY: 1	PERIOD: 7	3 HR AVERAGE CONCENTRATION AT EACH RECEPTOR

94.3
15.0
15.0
15.0

13
14
15
16

15.0
15.0
15.0
15.0

RECEPTOR	YEAR: 0	DAY: 1	PERIOD: 8	3 HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR
				RECEPTOR
1			5 HR AVERAGE CONCENTRATION (UG/M**3)	3 HR AVERAGE CONCENTRATION (UG/M**3)
2			1260.1	15.0
3			15.0	15.0
4			15.0	15.0
5			586.9	15.0
6			15.0	15.0
7			15.0	15.0
8			15.0	15.0

RECEPTOR	YEAR: 0	DAY: 1	24 HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR
			RECEPTOR
1			24 HR AVERAGE CONCENTRATION (UG/M**3)
2			414.0
3			15.0
4			29.7
5			277.9
6			15.0
7			46.3
8			84.7
			31.4
			55.9
			243.1
			15.0
			15.0
			18.7
			15.0
			15.0
			15.0

1.0 DAY (24 HR) AVERAGE CONCENTRATIONS AT EACH RECEPTION

RECEPTION	1.0 DAY AVERAGE CONCENTRATION (UG/M ³)	RECEPTION	1.0 DAY AVERAGE CONCENTRATION (UG/M ³)
1	414.0	9	55.9
2	15.0	10	243.1
3	24.7	11	15.0
4	277.9	12	15.0
5	15.0	13	18.7
6	46.3	14	15.0
7	84.7	15	15.0
8	31.4	16	15.0

5. FIDDEST 1-HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR

RECEPTOR	HIGHEST (UG/M**3)	2ND HIGHEST (UG/M**3)	3RD HIGHEST (UG/M**3)	4TH HIGHEST (UG/M**3)	5TH HIGHEST (UG/M**3)
1	2064.0 (1, 2)	1842.7 (1, 4)	1556.5 (1, 23)	1386.9 (1, 6)	941.4 (1, 5)
2	15.0 (1, 5)	15.0 (1, 4)	15.0 (1, 3)	15.0 (1, 2)	15.0 (1, 1)
3	316.4 (1, 15)	67.3 (1, 16)	15.0 (1, 5)	15.0 (1, 4)	15.0 (1, 3)
4	2206.9 (1, 3)	1317.2 (1, 21)	1162.6 (1, 22)	659.6 (1, 4)	581.2 (1, 24)
5	15.0 (1, 15)	15.0 (1, 5)	15.0 (1, 4)	15.0 (1, 3)	15.0 (1, 2)
6	450.5 (1, 16)	324.3 (1, 15)	20.5 (1, 14)	15.0 (1, 5)	15.0 (1, 4)
7	1342.1 (1, 1)	129.0 (1, 9)	43.9 (1, 2)	17.1 (1, 8)	15.1 (1, 3)
8	294.1 (1, 14)	89.3 (1, 16)	33.4 (1, 13)	30.4 (1, 15)	16.3 (1, 18)
9	947.7 (1, 2)	15.0 (1, 5)	15.0 (1, 4)	15.0 (1, 3)	15.0 (1, 1)
10	2187.8 (1, 20)	2113.7 (1, 18)	1157.2 (1, 19)	49.3 (1, 13)	36.7 (1, 14)
11	15.0 (1, 5)	15.0 (1, 4)	15.0 (1, 3)	15.0 (1, 2)	15.0 (1, 1)
12	15.0 (1, 5)	15.0 (1, 4)	15.0 (1, 3)	15.0 (1, 2)	15.0 (1, 1)
13	102.9 (1, 19)	15.0 (1, 17)	15.0 (1, 5)	15.0 (1, 4)	15.0 (1, 3)
14	15.0 (1, 5)	15.0 (1, 4)	15.0 (1, 3)	15.0 (1, 2)	15.0 (1, 1)
15	15.0 (1, 5)	15.0 (1, 4)	15.0 (1, 3)	15.0 (1, 2)	15.0 (1, 1)
16	15.0 (1, 5)	15.0 (1, 4)	15.0 (1, 3)	15.0 (1, 2)	15.0 (1, 1)

5 HIGHEST 3-HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR

RECEPTOR	HIGHEST (UG/M**3)	2ND HIGHEST (UG/M**3)	3RD HIGHEST (UG/M**3)	4TH HIGHEST (UG/M**3)	5TH HIGHEST (UG/M**3)
1	150.5 (1.2)	1260.1 (1.8)	297.2 (1.4)	160.8 (1.7)	158.2 (1.3)
2	15.0 (1.5)	15.0 (1.4)	15.0 (1.3)	15.0 (1.2)	15.0 (1.1)
3	115.5 (1.5)	32.4 (1.6)	15.0 (1.4)	15.0 (1.3)	15.0 (1.2)
4	602.5 (1.1)	586.9 (1.4)	449.1 (1.7)	229.9 (1.2)	90.2 (1.4)
5	15.0 (1.5)	15.0 (1.4)	15.0 (1.3)	15.0 (1.2)	15.0 (1.1)
6	160.2 (1.6)	119.9 (1.5)	15.0 (1.4)	15.0 (1.3)	15.0 (1.2)
7	555.7 (1.1)	53.7 (1.3)	15.0 (1.3)	15.0 (1.5)	15.0 (1.2)
8	121.0 (1.5)	40.3 (1.6)	15.0 (1.4)	15.0 (1.3)	15.0 (1.2)
9	562.6 (1.1)	15.0 (1.5)	15.0 (1.4)	15.0 (1.3)	15.0 (1.3)
10	1128.0 (1.7)	715.8 (1.6)	33.6 (1.5)	15.0 (1.4)	15.0 (1.3)
11	15.0 (1.5)	15.0 (1.4)	15.0 (1.3)	15.0 (1.2)	15.0 (1.1)
12	15.0 (1.5)	15.0 (1.4)	15.0 (1.3)	15.0 (1.2)	15.0 (1.1)
13	44.3 (1.7)	15.0 (1.6)	15.0 (1.5)	15.0 (1.4)	15.0 (1.3)
14	15.0 (1.5)	15.0 (1.4)	15.0 (1.3)	15.0 (1.2)	15.0 (1.1)
15	15.0 (1.5)	15.0 (1.4)	15.0 (1.3)	15.0 (1.2)	15.0 (1.1)
16	15.0 (1.5)	15.0 (1.4)	15.0 (1.3)	15.0 (1.2)	15.0 (1.1)

5 HIGHEST 24-HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR

RECEPTOR	HIGHEST (UG/M**3)	2ND HIGHEST (UG/M**3)	3RD HIGHEST (UG/M**3)	4TH HIGHEST (UG/M**3)	5TH HIGHEST (UG/M**3)
1	414.0 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
2	15.0 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
3	29.7 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
4	271.9 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
5	15.0 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
6	46.5 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
7	44.7 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
8	51.4 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
9	55.9 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
10	243.1 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
11	15.0 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
12	15.0 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
13	14.7 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
14	15.0 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
15	15.0 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
16	15.0 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)

TOP 50 1-HOUR AVERAGE CONCENTRATIONS

DAY	HOUR	WIND SPEED (M/S)	WIND DIRECTION (DEGREES)	STABILITY	MIXING HEIGHT (METERS)	RECEPTOR	1-HOUR CONCENTRATION (UG/M*3)
1	3	2.1	214	6	251	4	2208.9
1	20	1.5	17	6	582	10	2187.8
1	16	1.5	7	6	825	10	2113.7
1	22	1.5	222	6	338	1	2024.0
1	4	2.1	223	6	251	1	1842.7
1	25	3.1	230	6	216	1	1556.5
1	1	1.5	201	6	251	7	1542.1
1	6	2.6	232	6	251	1	1386.9
1	21	2.1	220	6	460	4	1317.2
1	22	1.5	222	6	338	4	1162.6
1	19	2.1	24	6	703	10	1157.2
1	2	2.1	176	6	251	9	997.7
1	5	3.1	233	6	251	1	941.4
1	4	2.1	223	6	251	4	659.6
1	24	4.1	220	5	94	4	581.2
1	12	10.2	226	4	683	1	524.5
1	21	2.1	220	6	460	1	450.5
1	16	3.1	324	2	891	6	452.4
1	7	3.1	235	5	251	1	444.3
1	15	1.0	312	1	891	6	324.3
1	15	1.0	312	1	891	3	316.4
1	14	2.1	349	2	891	8	299.1
1	11	8.5	234	4	579	1	259.6
1	24	4.1	220	5	94	1	199.9
1	1	1.5	201	6	251	4	182.9
1	9	4.1	221	4	475	4	163.2
1	10	5.8	197	4	371	7	129.0
1	10	5.8	221	4	475	1	107.6
1	19	2.1	24	6	703	13	102.9
1	12	10.2	226	4	683	4	91.3
1	16	3.1	324	2	891	6	89.3
1	6	3.6	213	4	267	4	71.2
1	16	3.1	324	2	891	3	67.3
1	13	2.1	3	3	787	10	49.3
1	2	2.1	176	6	251	7	43.9
1	14	2.1	349	2	891	10	36.7
1	13	2.1	312	3	891	8	33.4
1	15	1.0	349	1	891	8	30.4
1	14	2.1	11	2	891	6	20.5
1	17	1.5	197	3	891	10	18.8
1	9	4.1	213	4	371	4	17.4
1	8	3.6	230	4	267	7	17.1
1	23	3.1	7	6	216	4	16.8
1	18	1.5	234	6	825	8	16.3
1	11	4.5	11	4	579	4	16.1
1	17	1.5	213	5	891	8	15.3
1	8	3.6	214	4	267	1	15.2
1	3	2.1	235	6	251	1	15.1
1	7	3.1	232	5	251	4	15.1
1	6	2.0		6			

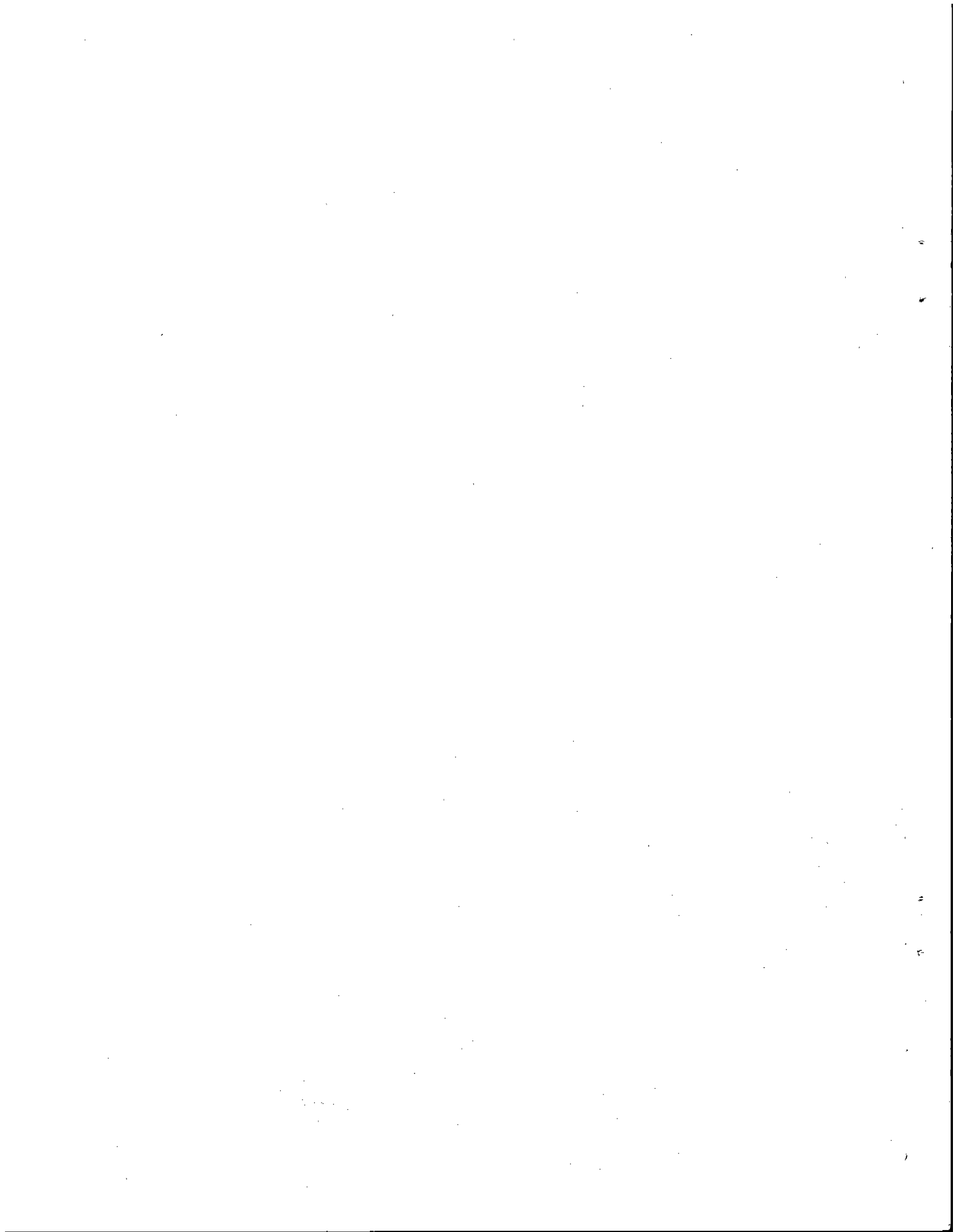
TOP 50 3-HOUR AVERAGE CONCENTRATIONS

DAY	TIME PERIOD	RECEPTOR	3-HOUR CONCENTRATION (UG/M**3)
1	2	1	1390.5
1	6	1	1260.1
1	7	10	1120.0
1	1	4	802.3
1	6	10	715.8
1	8	4	586.9
1	1	7	533.7
1	1	4	449.1
1	1	9	342.6
1	4	1	297.2
1	2	4	229.9
1	7	1	160.8
1	6	6	160.2
1	3	1	158.2
1	5	8	121.0
1	5	6	119.9
1	5	3	115.5
1	4	4	90.2
1	5	7	53.7
1	7	13	44.3
1	6	8	40.3
1	3	4	34.6
1	5	10	33.6
1	6	5	32.4
1	1	1	15.1
1	5	5	15.0
1	4	7	15.0
1	6	13	15.0
1	1	6	15.0
1	1	5	15.0
1	1	12	15.0
1	1	11	15.0
1	1	10	15.0
1	1	5	15.0
1	1	8	15.0
1	2	2	15.0
1	1	2	15.0
1	1	16	15.0
1	1	15	15.0
1	1	14	15.0
1	1	8	15.0
1	2	7	15.0
1	2	6	15.0
1	2	5	15.0
1	1	13	15.0
1	1	3	15.0
1	2	14	15.0
1	2	13	15.0
1	2	12	15.0
1	2	11	15.0
1	2	11	15.0

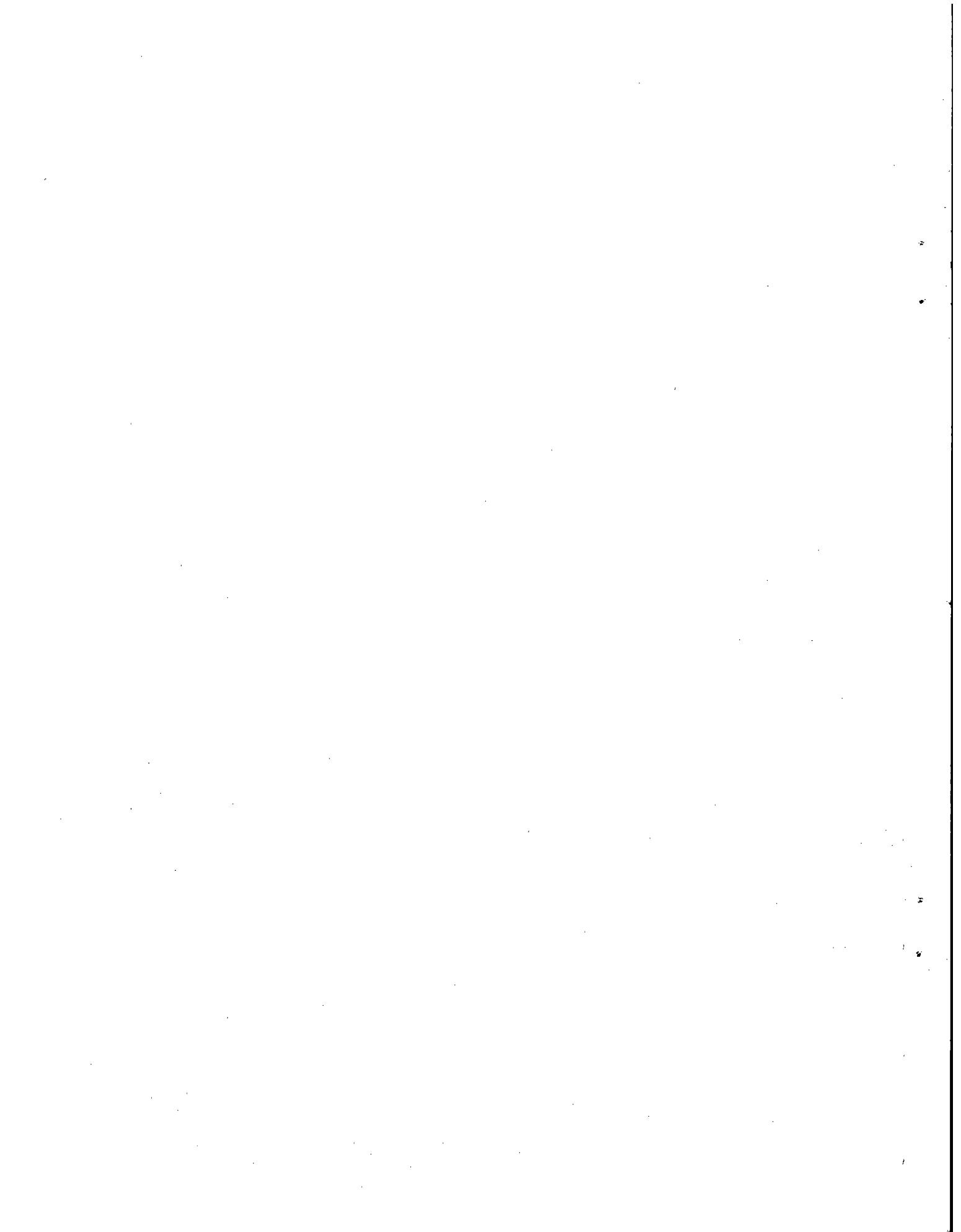
TOP 50 24-HOUR AVERAGE CONCENTRATIONS

[illegible]

INPUT DATA FOR POSTBLP
TEST CASE NO. 2



```
&OPTS LECH5=.TRUE.,LECH24=.TRUE.,LECHD=1,365*0,  
LSUM=.TRUE.,NSUM=6,ISCODE=1,2,3,4,101,102,56*0,&END
```



OUTPUT DATA FOR POSTBLP
TEST CASE NO. 2

YEAR: 0

(1) $\text{Zn} + \text{H}_2\text{SO}_4 = \text{ZnSO}_4 + \text{H}_2 \uparrow$

Account	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	1975	1974	1973	1972	1971	1970	1969	1968	1967	1966	1965	1964	1963	1962	1961	1960	1959	1958	1957	1956	1955	1954	1953	1952	1951	1950	1949	1948	1947	1946	1945	1944	1943	1942	1941	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931	1930	1929	1928	1927	1926	1925	1924	1923	1922	1921	1920	1919	1918	1917	1916	1915	1914	1913	1912	1911	1910	1909	1908	1907	1906	1905	1904	1903	1902	1901	1900	1899	1898	1897	1896	1895	1894	1893	1892	1891	1890	1889	1888	1887	1886	1885	1884	1883	1882	1881	1880	1879	1878	1877	1876	1875	1874	1873	1872	1871	1870	1869	1868	1867	1866	1865	1864	1863	1862	1861	1860	1859	1858	1857	1856	1855	1854	1853	1852	1851	1850	1849	1848	1847	1846	1845	1844	1843	1842	1841	1840	1839	1838	1837	1836	1835	1834	1833	1832	1831	1830	1829	1828	1827	1826	1825	1824	1823	1822	1821	1820	1819	1818	1817	1816	1815	1814	1813	1812	1811	1810	1809	1808	1807	1806	1805	1804	1803	1802	1801	1800	1799	1798	1797	1796	1795	1794	1793	1792	1791	1790	1789	1788	1787	1786	1785	1784	1783	1782	1781	1780	1779	1778	1777	1776	1775	1774	1773	1772	1771	1770	1769	1768	1767	1766	1765	1764	1763	1762	1761	1760	1759	1758	1757	1756	1755	1754	1753	1752	1751	1750	1749	1748	1747	1746	1745	1744	1743	1742	1741	1740	1739	1738	1737	1736	1735	1734	1733	1732	1731	1730	1729	1728	1727	1726	1725	1724	1723	1722	1721	1720	1719	1718	1717	1716	1715	1714	1713	1712	1711	1710	1709	1708	1707	1706	1705	1704	1703	1702	1701	1700	1699	1698	1697	1696	1695	1694	1693	1692	1691	1690	1689	1688	1687	1686	1685	1684	1683	1682	1681	1680	1679	1678	1677	1676	1675	1674	1673	1672	1671	1670	1669	1668	1667	1666	1665	1664	1663	1662	1661	1660	1659	1658	1657	1656	1655	1654	1653	1652	1651	1650	1649	1648	1647	1646	1645	1644	1643	1642	1641	1640	1639	1638	1637	1636	1635	1634	1633	1632	1631	1630	1629	1628	1627	1626	1625	1624	1623	1622	1621	1620	1619	1618	1617	1616	1615	1614	1613	1612</
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LINE SAMPLES: 4

ESSAYS IN LITERATURE

TOTAL NUMBER OF RECEPTORS: 16

SOURCE CONTRIBUTIONS FROM THE FOLLOWING LINE SOURCES ARE AVAILABLE:

$$\{U=V\cap \text{AVAILABLE}; \text{ } 1=\text{AVAILABLE} \wedge L \neq F\}$$

LINE SUPPLY NUMBER AVAILABLE

—

2

—

47

1-1-1

REP POSTPROCESSOR VERSION 1.1 LEVEL 800702

SOURCE COLLECTIONS FOR FOLLOWING POINT SOURCES ARE AVAILABLE:
(0=NOT AVAILABLE; 1=AVAILABLE)

POINT SOURCE NUMBER AVAILABILITY

1	1
2	1
1 - 2	1

THE REP COMPUTABLE DATA USED IN THIS RUN OF POSTALP IS THE SUM OF THE FOLLOWING 6 SETS
OF SOURCE CONTRIBUTION DATA:

ISCODE = (1) 1 (2) 2 (3) 3 (4) 4 (5) 101 (6) 102

WHERE THE CONTRIBUTION DATA ASSOCIATED WITH EACH ISCODE IS IDENTIFIED AS FOLLOWS:

ISCODE	CONCENTRATION DATA
1-10	SOURCE CONTRIBUTION - LINE SOURCE NUMBER "ISCODE"
11	SOURCE CONTRIBUTION - ALL LINE SOURCES
101-150	SOURCE CONTRIBUTION - POINT SOURCE NUMBER "ISCODE - 100"
151	SOURCE CONTRIBUTION - ALL POINT SOURCES
999	TOTAL CONTRIBUTION

FREQUENCY DISTRIBUTIONS REQUESTED IN THIS POSTALP RUN:

1-HOUR AVERAGES ? NO
3-HOUR AVERAGES ? NO
24-HOUR AVERAGES ? NO

CO₂ Uptake (Tons) at Each Plot Att. to Each Tree Full 100 Days:

$$(U=0) \quad \text{for } U \in \mathbb{N}; \quad 1 \leq U \leq U_0$$
[illegible]

AND FOR THE FULFILLING AVERAGE, INC. 4415 S.

1-HOUR	3-HOUR	24-HOUR	AVG RATES ?	NO
			AVG RATES ?	YES
			AVG RATES ?	YES

RECEPTOR	YEAR: 0	DAY: 1	PERIOD: 1	3 HR AVERAGE CONCENTRATION (UG/M ³)	3 HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR
1		0.1			327.6
2		0.0			0.0
3		0.0			0.0
4		0.0			0.0
5		87.5			0.0
6		0.0			0.0
7		0.0			0.0
8		120.7			0.0
9		0.0			0.0
10					0.0
11					0.0
12					0.0
13					0.0
14					0.0
15					0.0
16					0.0

RECEPTION	YEAR: 0	DAY: 1	PERIOD: 2	5 HR AVERAGE CONCENTRATIONS AT EACH RECEPTOR	
				5 HR AVERAGE CONCENTRATION (UG/M**3)	5 HR AVERAGE CONCENTRATION (UG/M**3)
1					
2					
3					
4					
5					
6					
7					
8					

YIELD (%)	DAYS	TREATMENT	3 HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR	RECEPTOR	3 HR AVERAGE CONCENTRATION (UG/M ³)	9	0.0
		A					
		B					
		C					
		D					
		E					
		F					
		G					
		H					
		I					
		J					
		K					
		L					
		M					
		N					
		O					
		P					
		Q					
		R					
		S					
		T					
		U					
		V					
		W					
		X					
		Y					
		Z					

0.0
0.0
0.0
0.0
0.0
0.0
0.0

10
11
12
13
14
15
16

3 HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR

YEAR: 0 DAY: 1 PERIOD: 4
3 HR AVERAGE CONCENTRATION
(UG/M**3)

RECEPTOR

RECEPTOR 3 HR AVERAGE CONCENTRATION
(UG/M**3)

1 262.2
2 0.0
3 0.0
4 75.2
5 0.0
6 0.0
7 0.0
8 0.0

9
10
11
12
13
14
15
16

5 HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR

YEAR: 0 DAY: 1 PERIOD: 5
3 HR AVERAGE CONCENTRATION
(UG/M**3)

RECEPTOR

RECEPTOR 3 HR AVERAGE CONCENTRATION
(UG/M**3)

1 0.0
2 0.0
3 100.5
4 0.0
5 0.0
6 100.4
7 0.0
8 100.0

9
10
11
12
13
14
15
16

3 HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR

YEAR: 0 DAY: 1 PERIOD: 6
3 HR AVERAGE CONCENTRATION
(UG/M**3)

RECEPTOR

RECEPTOR 3 HR AVERAGE CONCENTRATION
(UG/M**3)

1 0.0
2 0.0
3 17.0
4 0.0
5 0.0
6 145.2
7 0.0
8 25.5

9
10
11
12
13
14
15
16

3 HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR

YEAR: 0 DAY: 1 PERIOD: 7
3 HR AVERAGE CONCENTRATION
(UG/M**3)

RECEPTOR

RECEPTOR 3 HR AVERAGE CONCENTRATION
(UG/M**3)

1 145.2
2 0.0
3 0.0
4 145.1

9
10
11
12

RECEPTOR	YEAR: 0	DAY: 1	PERIOD: H	3 HR AVERAGE CONCENTRATIONS AT EACH RECEPTOR
				3 HR AVERAGE CONCENTRATION (UG/M**3)
1				29.3
2				0.0
3				0.0
4				0.0
5				0.0
6				0.0
7				0.0
8				0.0
9				0.0
10				0.0
11				0.0
12				0.0
13				0.0
14				0.0
15				0.0
16				0.0

RECEPTOR	YEAR: 0	DAY: 1	24 HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR
			24 HR AVERAGE CONCENTRATION (UG/M**3)
1			40.9
2			228.1
3			0.0
4			0.0
5			0.0
6			3.7
7			0.0
8			0.0
9			0.0
10			0.0
11			0.0
12			0.0
13			0.0
14			0.0
15			0.0
16			0.0

1.0 DAY (2 nd IN) AVERAGE CONCENTRATIONS AT EACH RECEPTOR		
RECEPTOR	1.0 DAY AVERAGE CONCENTRATION (UG/M**3)	1.0 DAY AVERAGE CONCENTRATION (UG/M**3)
1	594.0	40.9
2	0.0	226.1
3	14.7	0.0
4	262.9	0.0
5	0.0	3.7
6	31.3	0.0
7	64.7	0.0
8	16.4	0.0

5. FIVE-POINT 1-HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTION

RECEIVER	1ST HIGHEST (UG/M**3)	2ND HIGHEST (UG/M**3)	3RD HIGHEST (UG/M**3)	4TH HIGHEST (UG/M**3)	5TH HIGHEST (UG/M**3)
1	2469.0 (1, 0)	1021.7 (1, 0)	1541.5 (1, 25)	1371.9 (1, 6)	926.4 (1, 5)
2	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)
3	501.3 (1, 15)	52.5 (1, 16)	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)
4	2195.9 (1, 5)	1502.2 (1, 21)	1147.6 (1, 22)	644.6 (1, 4)	566.2 (1, 24)
5	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)
6	445.5 (1, 16)	309.3 (1, 15)	5.5 (1, 14)	0.0 (0, 0)	0.0 (0, 0)
7	1527.1 (1, 1)	114.0 (1, 9)	28.9 (1, 2)	2.1 (1, 8)	0.1 (1, 3)
8	284.1 (1, 14)	74.3 (1, 14)	16.4 (1, 13)	15.4 (1, 15)	1.3 (1, 18)
9	942.7 (1, 2)	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)
10	2176.8 (1, 20)	2048.7 (1, 18)	1142.2 (1, 19)	34.3 (1, 13)	21.7 (1, 14)
11	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)
12	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)
13	87.9 (1, 14)	0.0 (1, 17)	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)
14	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)
15	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)
16	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)	0.0 (0, 0)

5 HIGHEST 2-HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTION

RECEIVER	1ST HIGHEST (UG/M**3)	2ND HIGHEST (UG/M**3)	3RD HIGHEST (UG/M**3)	4TH HIGHEST (UG/M**3)	5TH HIGHEST (UG/M**3)
1	1575.5 (1.2)	1405.3 (1.8)	2802.2 (1.4)	145.8 (1.7)	143.2 (1.3)
2	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
3	105.5 (1.5)	17.2 (1.6)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
4	787.5 (1.1)	571.9 (1.8)	434.1 (1.7)	214.4 (1.2)	75.2 (1.4)
5	0.0 (1.5)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
6	145.2 (1.6)	104.9 (1.5)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
7	515.7 (1.1)	36.7 (1.3)	0.0 (1.4)	0.0 (0.0)	0.0 (0.0)
8	105.0 (1.5)	25.5 (1.6)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
9	527.6 (1.1)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
10	1105.0 (1.7)	760.8 (1.6)	18.6 (1.5)	0.0 (0.0)	0.0 (0.0)
11	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
12	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
13	29.5 (1.7)	0.0 (1.6)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
14	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
15	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
16	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)

5 HIGHEST 24-HOUR AVERAGE CONCENTRATIONS AT EACH RECEPTOR

RECEPTOR	100% HIGHEST (UG/M**3)	200% HIGHEST (UG/M**3)	500% HIGHEST (UG/M**3)	4TH HIGHEST (UG/M**3)	5TH HIGHEST (UG/M**3)
1	100.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
2	350.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
3	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
4	19.7 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
5	262.9 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
6	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
7	31.3 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
8	69.7 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
9	16.4 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
10	40.9 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
11	220.1 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
12	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
13	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
14	3.7 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
15	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
16	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)

TOP 50 1-HOUR AVERAGE CONCENTRATIONS

DAY	TIME	WIND SPEED (MPH)	WIND DIRECTION (DEGREES)	STABILITY	MIXING HEIGHT (FEET)	RECEPTOR	1-HOUR CONCENTRATION (UG/M**3)
1	3	2.1	214	6	251	4	2193.9
1	4	1.5	17	6	562	10	2172.8
1	10	1.5	7	6	425	10	2098.7
1	20	1.5	222	6	358	1	2009.0
1	4	2.1	224	6	251	1	1827.7
1	23	3.1	250	6	216	1	1541.5
1	1	1.5	201	6	251	7	1527.1
1	1	2.6	252	6	251	1	1371.9
1	6	2.1	220	6	460	4	1302.2
1	21	1.5	222	6	338	4	1147.6
1	22	2.1	24	6	703	10	1142.2
1	14	2.1	176	6	251	9	982.7
1	2	3.1	233	6	251	1	926.4
1	5	2.1	223	6	251	4	644.6
1	4	4.1	220	5	94	4	566.2
1	24	10.2	226	4	683	1	509.5
1	12	2.1	220	6	460	1	437.4
1	16	3.1	324	2	891	6	435.5
1	7	3.1	235	5	251	1	429.3
1	15	1.0	312	1	891	6	309.3
1	15	2.1	312	1	891	3	301.4
1	14	2.1	344	2	891	8	284.1
1	11	4.5	234	4	579	1	244.6
1	24	4.1	220	5	94	1	184.9
1	1	1.5	201	6	251	4	167.9
1	10	4.1	221	4	475	4	148.2
1	9	5.8	197	4	371	7	114.0
1	10	2.1	221	4	475	1	92.6
1	10	2.1	24	6	703	13	87.9
1	15	2.1	226	4	643	4	76.3
1	12	10.2	324	2	891	8	74.3
1	16	3.1	213	4	267	4	56.2
1	16	3.6	324	2	891	3	52.3
1	16	3.1	324	2	787	10	34.3
1	13	2.1	176	3	251	7	28.9
1	13	2.1	309	6	891	10	21.7
1	14	2.1	312	3	891	8	18.4
1	15	1.0	344	1	891	8	15.4
1	14	2.1	11	2	891	6	5.5
1	17	1.5	197	3	891	10	3.8
1	9	4.1	213	4	371	4	2.4
1	4	3.6	250	6	267	7	2.1
1	23	3.1	7	6	216	4	1.8
1	16	1.5	240	6	825	8	1.3
1	11	4.5	11	4	579	4	1.1
1	17	1.5	213	5	891	6	0.3
1	18	3.6	214	4	267	1	0.3
1	3	2.1	251	6	251	1	0.2
1	7	3.1	255	5	251	4	0.1
1	6	1.5	252	6	251	4	0.1

4.4. 5-HOUR AVERAGE CONCENTRATIONS

[illegible]

24-11106 AVF KAGF CONCLUSIONS

[illegible]