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OPERATORS GUIDE: ATMOSPHERIC RELEASE ADVISORY CAPABILITY (ARAC) SITE FACILITY

Edward Cassaro and Linda Lomonaco

January 1979

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SITE FACILITY

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PREFACE

This guide is an expansion of UCID-17490 (July 13, 1977) which was the original Atmospheric Release Advisory Capability (ARAC) site facility operators guide written by Bryan Lawver and Richard Orphan. Edward Cassaro and Linda Lomonaco have modified the original guide to include an expanded operational view of the system and to include specific operator/hardware interactions. This expanded version of the operators guide will be incorporated into a forthcoming ARAC operations manual as a functional chapter.

TABLE OF CONTENTS

	<u>Page</u>
PREFACE	i
INTRODUCTION.	4
Site Facility Hardware.	5
Site Facility Controls.	5
RESTARTING THE SITE SYSTEM.	7
DATE AND TIME	8
Gaussian Diffusion Calculation.	8
Regional Model Calculations	10
KEYBOARD OPERATION OF THE SITE SYSTEM	13
OPERATOR MENU INTERACTION	18
1. Set Parameters.	18
2. Wind Rose	21
3. Meteorological Data	22
4. Site Map (Detailed)	25
5. Site Map.	29
6. and 7. Regional Model Map/Trajectory Map.	30
8. Gaussian Diffusion.	32
9. Regional Model Calculations	34
10. Communications with ACF	37
11. Set Emergency	38
12. Clear Emergency and Hang Up	38
13. Plot.	39
REFERENCES.	41

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ATMOSPHERIC RELEASE ADVISORY CAPABILITY (ARAC)

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ABSTRACT

The Atmospheric Release Advisory Capability (ARAC) is designed to help officials at designated DOE sites and other locations in estimating the effects of atmospheric releases of radionuclides or other hazardous materials by issuing real-time advisories to guide them in their planning. This report outlines the capabilities and sources of ARAC, and in more detail describes an ARAC Site Facility, its operating procedures and interactions with the ARAC Central Facility (ACF) located at LLL.

INTRODUCTION

ARAC is a service to assist designated DOE sites and other locations in estimating the effects of the releases of radionuclides or other toxic materials to the atmosphere. ARAC provides, in real-time, a series of advisories from which responsible officials can act in the event of a sudden emergency or routine atmospheric release. These advisories are based on calculations from numerical models with input data from the site of release, as well as on meteorological data from national weather agencies. State-of-the-art technology for communications, data handling, and dose conversion are used in the ARAC system.

ARAC responds to releases from those designated DOE sites that have been properly equipped for the purpose (site facilities) and can also respond to releases or threats at other locations around the world, provided information about the source of release can be obtained. The ARAC central facility (ACF), located at Lawrence Livermore Laboratory, serves as the center for data acquisition, assessments, and communications for ARAC. During normal operating conditions, environmental data are transmitted at 4-hr intervals to the central facility for processing and storage. In event of an emergency, a data and message modem to modem communication link can be immediately established between the site and the central facility.

Each ARAC-serviced site has a minicomputer that can acquire, access, and communicate local data. The site facility continuously calculates and displays Gaussian diffusion estimates for close (< 5 km) downwind locations using current local meteorological data. The site facility also

transmits local meteorological measurements to the ACF, and from the ACF it receives for graphic display estimates of regional (<100 km) effects.

Site Facility Hardware

The site facility hardware is illustrated in Figure 1. The central processor is a DEC PDP-11 with a 28k word memory. The system uses a Dec-tape system for storing data. There are two graphical output devices for displaying maps, overlays, and similar information. One such device is a 17 in. CRT monitor that uses a 28k memory to refresh the graphic display. The other device is an 11 in. printer/plotter which will document the display on paper. The keyboard, joystick and light pen are the three devices the operator uses for communicating with the computer. There is a "watch-dog" timer and bootstrap function for restarting the system when it is stopped by unexplained or unknown errors. There are also data lines used to collect data from meteorological towers and to communicate them to the ACF.

Site Facility Controls

The site facility minicomputer has three functions: (1) calculation of a Gaussian diffusion estimate every 15 minutes based upon averaged data collected from the meteorological towers, (2) interactive responses to the operations data input, and (3) reception and display of the contour plots sent by the central facility.

The site facility is used by the operator to format and display available data and to communicate with the ACF. The scale and area of plots and displays can be chosen by the operator. Communication is initiated

Fig. 1. ARAC site facility hardware.

automatically from the ACF in most cases; however, the site operator can initiate and control communications to the ACF in both emergency and non-emergency situations.

RESTARTING THE SITE SYSTEM

The present hardware configuration allows for the automatic reboot of the site software following a system crash. System crashes can be classified under two categories, recoverable and nonrecoverable. Recoverable crashes include temporary power failures or other power related problems such as line noise. A system halt will occur through operator error or software error such as the removal of the Dectape from the system by write locking it or switching it to the local mode. The Watch Dog Timer hardware of the PDP11/04 processor will return the system to an operable state in the event of a recoverable crash. If the system refuses to restore itself, try cycling the power to the processor by turning the DC OFF/ON switch in the lower right corner of the processor off and then on. This should reboot the system; however, if the system does not reboot itself, a non-recoverable crash has occurred. This is normally the result of a hardware component failure and corrective maintenance is required by trained personnel.

A manual restart is done by using the programmer's console on the PDP11/04. Either turning the DC OFF/ON switch off then on or by simultaneously pressing the CNTRL and HLT/SS buttons, then CNTRL and BOOT buttons on the PDP11/04 programmer's console will restart the system.

The site system hardware is temperature sensitive and should at all times be kept in a room with temperatures not above 80°F (26°C). 74°F (23°C) is the optimum temperature.

DATE AND TIME

When a boot occurs, the system is automatically started and an introductory message is typed on the console printer. This message consists of an "RT-11 version" line followed by periods, and a line that reports LOADED and XXX and more periods. When the console printer stops writing, the month, year, day and time is entered as requested on the display.

The Central Facility routinely calls the sites once every four hours for meteorological data. Each time that connection is made the date and time will be automatically set. Therefore the site system is a self-sustaining unit.

Gaussian Diffusion Calculation

The Continuous Point Source (CPS) Gaussian diffusion is calculated and displayed every 15 minutes on most site system screens.¹ This calculation will not interrupt other operator commands if the site facility is in use.

The site system Gaussian diffusion calculation, adapted from the CPS code, provides concentration contours. The dispersion parameters are

¹The release center and release height are site specific, and programmed into the 15 minute calculation, but may be changed by the operator.

based on releases lasting about 30 minutes. The wind is assumed constant in direction and speed. For a quick first estimate, these assumptions are valid in flat terrain; however, we suggest that the limits of the Gaussian diffusion estimate be restricted to 5 to 10 km or less than one hour travel time downwind from the source. Most of the variables affecting the Gaussian estimate may be entered by the operator if he so desires (see GAUSSIAN DIFFUSION description).

Because the source amount and rate of release may vary and will usually be unknown initially, ARAC has assumed the release rate to be unity. When a release rate (in units/sec) is available, the user (at the site) can re-label his ACF contours (multiply contours by release rate).

Both the release height and the sampling height determine, in part, how far the downwind contours at sampling height will extend. The release height is the distance above ground at which the effluent stabilizes; the sampling height is the distance above ground for which the concentrations of released materials are to be estimated. The sampling height of most interest is normally 2 m, which is near the breathing level for most persons. There is no adjustment for topography in the Gaussian diffusion calculation. However, surface deposition and plume depletion are included.

A release of radioactive material will decrease the concentration due to decay downwind from the source. Half-life, when set to 10 billion seconds, will have no detectable effect on the Gaussian estimate.

The Pasquill-Gifford stability classification is used to determine the crosswind and vertical σ 's used in the calculation. The stability classes are related to the degree of spreading, or dilution of the plume.

For a very unstable stability class (category A = 1), the plume meanders greatly, resulting in wide contours; for a very stable class (category F = 6) the plume meanders very little, resulting in narrow contours. The σ 's associated with each class increase with distance from the release point. The stability category is determined automatically from the standard deviation of the 15 minute average wind direction.

The release point coordinates are pre-programmed into the 15 minute calculation. The coordinates remain the same until changed by the operator, using the site map and joy stick or light pen.

The above factors influencing the Gaussian diffusion estimate can be used as defaults after the operator has selected those of interest. These factors are specified by using SET PARAMETER (selected from the MENU). Once the parameters are set, an update of the time and tower height wind data are the only additional measurements that are required when the system is queried.

Regional Model Calculations

The regional model calculations are more complex than those for the Gaussian. The regional models account for variations in topography, wind shear, and the duration of the release. With these data, ACF personnel can more accurately calculate for a specific area the shape and size of the plume or puff in terms of its concentration and deposition.

Under present operating conditions, the ARAC emergency team must be assembled, and the regional codes MATHEW/ADPIC, or PATRIC run on the CDC 7600 computers at LLL. In the future when the ACF is staffed 24 hours a day, a team will be available to initiate these calculations within

minutes. Then after ARAC is notified of a release, the site operator should receive calculations from the ACF within 40 minutes. The site operator can then display the ACF produced contours of concentration and dose. At present these calculations will not be available for one to three hours after notification; the time span depends upon time of day and availability of the ARAC staff. Some members of this staff carry radio pagers which can be activated by the LLL Security Department.

Abstracts of the regional model codes used in the ACF are described below.

ADPIC is a hybrid Lagrangian-Eulerian transport and diffusion code used to calculate the three-dimensional distribution of atmospheric pollutants in transient flow fields. The code employs the particle-in-cell method and has been shown to give results to within 5% of selected analytic solutions to the transport-diffusion equation. Modeling capabilities include: inert or radioactive pollutants, multiple sources, deposition, particle size distribution, washout and topography. Output is in form of concentration isopleths for instantaneous and time-integrated air concentration and deposition.

The three-dimensional hourly varying mean flow-fields must be provided to ADPIC in mass conservative form. ADPIC uses the gradient transport model to compute particle dispersal.

The MATHEW set of codes process meteorological and topographical data for a region of complex terrain to create a three-dimensional, mass-consistent wind field. Three codes, TOPOG, MEDIC, and MATHEW, perform this calcula-

tion. TOPOG creates a block representation of the terrain of a region from topography data. This representation defines the lower boundary for the adjustment calculation. Meteorological data is read by MEDIC. This data includes surface wind speed and directions, upper air wind speed and direction profiles, surface and boundary layer heights, and other appropriate data. Interpolating from this data, MEDIC computes two-dimensional wind fields at two levels above terrain. MATHEW interpolates between these fields to produce a three-dimensional field. To create a mass-consistent field a function is defined that minimizes the variance of the difference between the adjusted values and the original values, subject to the constraint that the three-dimensional adjusted wind field is non-divergent. This leads to a set of finite difference equations that are solved by a successive over-relaxation method. The calculated flow-fields are provided as needed (typically hourly) to ADPIC to define the transporting mean winds.

PATRIC is a hybrid Lagrangian-Eulerian transport and diffusion code used to calculate the three-dimensional distribution of atmospheric pollutants in transient flow fields over flat terrain. The code employs the particle-in-cell method and has been shown to give results to within 5% of selected analytic solutions to the transport-diffusion equation. Modeling capabilities include treatment of inert or radioactive pollutants, multiple sources, deposition, particle size distribution, and wash-out. Output is in the form of concentration isopleths for instantaneous and time-integrated air concentration and deposition.

The hourly varying mean flow-fields are computed in PATRIC from interpolated meteorological station data. No vertical velocities are calculated, but speed and directional shear are modeled by permitting vertical variation of horizontal mean winds. The diffusion calculation in PATRIC is based on a Gaussian distribution.

KEYBOARD OPERATION OF THE SITE SYSTEM

The keyboard of the site system, in addition to the alphabetical and numerical keys, has special keys with the specific functions described below. The symbols < > surrounding a word indicate that it is a key that is touched rather than the word to be typed.

ESCAPE <ESC>. This key, located in the upper left corner of the keyboard, is used to return the screen to the display MENU (Fig 2). Some programs may require more than one <ESC> function, while others may delay a number of seconds before responding. This function may also be used to interrupt any display option at the time operator input is called for.

CARRIAGE RETURN <RETURN>. This key is located on the console's far right edge. Any numerical input by the operator must be followed by <RETURN>, this includes MENU selections as well as parameter inputs. The <RETURN> will enter that numeric input into the system. This allows any non-numeric key to be used sequentially if desired. In the display option SET PARAMETERS, striking <RETURN> will enter 0 if no numeric key is struck

SITE SYSTEM CONTROL MENU

1. SET PARAMETERS	9. REGIONAL MODEL CALCULATIONS
2. WIND ROSE	10. COMMUNICATIONS WITH ACT
3. METEOROLOGICAL DATA	11. SET EMERGENCY
4. SITE MAP (DETAILED)	12. CLEAR EMERGENCY AND HANGUP
5. SITE MAP	13. PLOT
6. REGIONAL MODEL MAP	14.
7. TRAJECTORY MAP	15.
8. GAUSSIAN DIFFUSION	16.

Figure 2

first. In the REGIONAL and TRAJECTORY MAP display options, <RETURN> is used after the selection of a new scale or center is chosen; this brings the new map up on the screen.

LINE FEED <LINE FEED>. The <LINE FEED> key is located above the <RETURN> key on the console. The <LINE FEED> key allows the operator to ignore, skip or reject the current input. More explicit information on the use of this key will be given as each display option is discussed.

NUMERIC KEYS. These keys are located at the top of the keyboard or on the optional keypad on the right side of the console. Both sets are available and may be used interchangeably. Upon entry of a numeric key, <RETURN> must be hit to complete the function.

ALPHABETIC KEYS. Other than typing messages to the central facility, the only alphabetic keys which are in use are , <C>, <D>, <I>, <N>, <O>, <P>, <R>, <S>, <T> and <Y>.

 is the input symbol used to make the trajectory map scale larger (Bigger) if it is less than its maximum 200 km scale.

<C> is the input symbol to key the Gaussian calculation (#8 on main menu) to a plume type release.

<D> (Detailed Site Map) is the input symbol for using the Detailed Site Map as a background map for the Gaussian calculation contours. It is only available for use in the GAUSSIAN DIFFUSION display option.

<P> is the input symbol to key the Gaussian calculation (#8 on main menu) to a puff release.

<N> is the input symbol to designate that you do not want to use trial data in the Gaussian calculation. If <N> is used, you supply values.

<O> is the input symbol to return the trajectory map to its original scale if and/or <S> had been used previously.

<P> (PLOT) is the input symbol used to make a hardcopy of almost all the displays. To use this function the option PLOT must be on the display screen.

<R> (Regular Site Map or Regional Map). In the GAUSSIAN DIFFUSION display option an input of R will give the Regular Site Map as the background map for the Gaussian calculation contours. In the REGIONAL MODEL CALCULATIONS, the display option and input of <R> will give the Regional Map as the background map for the contours transmitted by the ACF.

<S> (Site Map) is the input symbol for using the Site Map (not detailed) as the background map for REGIONAL MODEL CALCULATIONS performed by the ACF. <S> is also used to reduce the scale of the trajectory map (S for smaller).

<T> (Trajectory Map) is the input symbol for using the Trajectory Map as the background map for the contours, transmitted by the ACF, in the display option REGIONAL MODEL CALCULATIONS.

<Y> is the input symbol to designate the use of trial data in the Gaussian calculation.

JOY STICK. The joy stick is used to move and locate the tracking cross to new positions on the display screen. The use of the joy stick is only necessary in map functions. It is used to locate a source release point for the Gaussian calculation in either the SITE MAP or DETAILED SITE MAP display options. In the REGIONAL MODEL MAP and TRAJECTORY MAP display options it is used to locate a new center for the map. The light pen may be used in place of the joy stick. The joy stick is a part of the keyboard, therefore if it starts to malfunction, the keyboard will also appear to malfunction.

LIGHT PEN. The light pen is an instrument used for computing and pointing, and can be used in place of the keyboard in many instances. The light pen may be used only when a word or letter with a solid box preceding it appears on the display screen (e.g. ■ PLOT). When touched with the light pen, the desired item will start to blink indicating that it has been selected. Although the entire word is light sensitive, the easiest way to select one item is to touch the solid box directly to the left of the word. If the screen brightness is too high, the light pen can activate items while still several inches from the screen. For that reason, use of the keyboard is preferred.

The light pen can be used in place of the joy stick to move the tracking cross to new locations.

OPERATOR MENU INTERACTION

Two hits to the <ESC> key will bring up the MENU (Fig. 2) which is the starting place for selecting individual display options. To select a display option from the MENU, the appropriate numeric key indicating a specific option is hit followed by a <RETURN> command. Prior to striking the <RETURN> key, the operator may decide to choose another MENU option, to do this <LINE FEED> or <DELETE> must be hit and then input the desired display option number followed by a <RETURN> command.

The list of display options is presented in a single rather than a two stage list, and in certain instances this can be misleading. Two display options require input from other options, these functions are the GAUSSIAN DIFFUSION and the REGIONAL MODEL CALCULATIONS. The GAUSSIAN DIFFUSION option uses inputs from SET PARAMETERS and a source location from either SITE MAP or DETAILED SITE MAP. The REGIONAL MODEL CALCULATIONS uses map scaling and centering from the REGIONAL MODEL MAP and/or the TRAJECTORY map.

The display options currently available on the site system are listed and their usage is described below.

1. SET PARAMETERS

SET PARAMETERS is a display option that the operator uses to define the parameters of the release used in the Gaussian calculation (Fig. 3). Included in these parameters are sample height and release height, both input in metres. The half-life is input in powers of 10 in seconds, a maximum of $10^{*}30$ is allowed. The last three input parameters are for

trial wind data, i.e., rather than using actual wind data for the Gaussian calculation this gives the option to use a trial wind speed and direction. The Pasquill-Gifford stability category is input as an integer from 1-6, corresponding to the stability categories A-F. Wind speed is input in metres/sec and wind direction in degrees clockwise from North. The current date and time (GMT) is displayed on the screen.

When SET PARAMETERS is selected, the values shown on the screen will be the previous operator selected values or if a reboot has occurred since the last parameter input, the default values will be site specific values used for the 15 minute Gaussian calculation.

All parameters must be input using the keyboard; <RETURN> must be hit following each numeric entry, allowing continuation on to the next parameter. In the event the Pasquill-Gifford stability category was input with a number greater than 6, or if wind direction was input with greater than 360, the appropriate value should be re-entered followed by a <RETURN>.

Flashing zeros indicate the maximum number of digits allowed in that entry. When the integers are entered by hitting <RETURN>, the next parameter available for input will begin flashing. To enter zeros, <RETURN> may be hit. Striking <LINE FEED> will retain that parameter's current value.

The choice of SET PARAMETERS from the main menu does not offer a PLOT capability. If a hard copy of the data is required, the operator should hit <ESC> after all inputs have been entered. The main menu will now appear on the CRT and #13 will bring forth the plot menu. Item #1 of the plot menu should then be selected.

1.

SET PARAMETERS

mm/dd/yy

hh:mm (GMT)

UNIT RELEASE RATE

SAMPLE HEIGHT ____ METERS

RELEASE HEIGHT ____ METERS

HALF LIFE *10** ____ SECONDS

PASQUILL-GIFFORD STABILITY (1-6) ____

TRAIL WIND SPEED (OPT) ____ METERS/SEC

TRIAL WIND DIRECTION FROM ____ DEGREES

Figure 3

To exit this option at any time hit <ESC> twice or touch the display
■ EXIT with the light pen.

2. WIND ROSE

The WIND ROSE is a plotting option using site meteorological data. The winds are displayed in a graphical format for one tower level at a time.

To use this display option, the operator must first choose the tower and level for which the wind rose will be plotted from (Fig 4). This is done by either typing the line number of the appropriate tower and level and <RETURN> or by touching the light pen to the appropriate number and <RETURN>. When using the light pen, the chosen line number will flash, signalling the user which tower and level entry has been chosen for plotting, similarly with keyboard entry of line numbers; the chosen line number will appear in the lower left corner of the screen. Striking <LINE FEED> or <DELETE> will displace the current entry and allow the operator to make another choice.

<RETURN> is the signal to the program to begin the calculation of the wind rose; the tower and level will appear on the screen until the wind rose calculation has been completed.

On the wind rose plot the last two hours of wind data are displayed as vectors on a compass rose. The eight vectors represent 15 minute averages of wind direction and speed. The vector labeled 1 is the most recent 15 minute average, and 8 is the 15 minute vector average of winds two hours in the past. Wind speed is in metres/sec as scaled vector lengths, and the vectors are located so that the wind direction is along them towards the center.

The WIND ROSE option also has the temperature range for the last four hours and the current temperature displayed on one line in the lower left corner of the screen. The format is maximum temperature ($^{\circ}\text{C}$), minimum temperature ($^{\circ}\text{C}$), and current temperature ($^{\circ}\text{C}$).

There is no way to exit this option without first plotting the wind rose. Line number 1 is the default plotting option, and will appear as the information in the wind rose if either $\langle\text{ESC}\rangle$ or $\blacksquare\text{EXIT}$ is touched prior to $\langle\text{P}\rangle$ or $\blacksquare\text{PLOT}$.

To plot the wind rose on the line printer hit $\langle\text{P}\rangle$ and $\langle\text{RETURN}\rangle$ or touch $\blacksquare\text{PLOT}$ with the light pen.

To exit this option after the plot has been completed, hit $\langle\text{ESC}\rangle$ or use the light pen and touch $\blacksquare\text{EXIT}$.

3. METEOROLOGICAL DATA

The METEOROLOGICAL DATA option displays in tabular form the available meteorological data stored at the site for the last 4 hours. This data can be viewed in two formats. The operator can select the data at all times for one tower level, or the data viewed at a specific time for all towers (Figures 5a,b,c).

To select the 15 minute average meteorological data for the last four hours, the selection of TOWER must be made when the meteorological data is chosen and appears on the screen; TOWER will be flashing when the display first appears on the screen. This selection may also be made by striking $\langle\text{LINE FEED}\rangle$ until TOWER begins to flash, which is a signal to the operator that the selection of the tower option has been completed. Only when TOWER is flashing can the operator then type in the number of the

2.

WIND ROSE

SELECT TOWER

IN CR I'UT = N
LF <IP INPUT

1.

2. tower levels

3.

TOWER XX

Figure 4

desired tower and level, which then will appear in the lower left corner of the screen. The tower and level can also be selected by touching the appropriate line number with the light pen and that number will begin to flash. Once a selection of the line number is made, the chosen TOWER is fixed; only by returning to the main menu and selecting METEOROLOGICAL DATA again will the operator be able to choose TIME. To obtain the tabular data from that tower <RETURN> must be hit, or touch TOWER with the light pen.

To select the meteorological data for a specific time (one 15 minute average) for all the towers at a site, the selection of TIME must be made. The choice of TIME is made by striking <LINE FEED> until TIME begins to flash, or by touching SKIP INPUT with the light pen. When TIME is flashing, the operator then types the line number for the time of interest. The time selection line number will appear in the lower left corner of the screen. The time can also be selected by using the light pen, and this selection is noted by the flashing of the selected line. To obtain the tabular data for that time and towers, <RETURN> must be hit or touch TIME with the light pen.

<LINE FEED> may be used to skip a particular input as well as select TOWER and TIME options. If an incorrect line number was input, before <RETURN> was hit, striking <LINE FEED> twice will return the display to the appropriate TOWER or TIME selection, thus allowing the operator to choose another line number.

The data from the TOWER or TIME options selected will appear on the screen along with the date. The format of the data is: time (GMT) at the end of the 15 minute averaging period, sample location (i.e. tower and

level in metres), wind speed (m/sec), wind direction (degrees from), sigma theta (degrees), temperature ($^{\circ}\text{C}$), and sample count. The sample count is the number of measurements recorded in that 15 minute averaging period. The sample count is a good indication of whether or not the tower was 'down', or if a reboot of the system occurred (both indicated by small sample count numbers.

If a hard copy of this data is required, the operator should choose PLOT off of the main menu. METEOROLOGICAL DATA should be chosen off of the plot menu. When all selections for data have been completed, the data will print out on the printer.

At any time this option may be aborted by hitting <ESC> or touching ■ EXIT with the light pen.

4. SITE MAP (DETAILED)

The SITE MAP (DETAILED) is used only for Gaussian diffusion calculations with the parameters of the release defined in SET PARAMETERS. The SITE MAP (DETAILED) option will give a map of the site plan including building numbers (LLL 2.8 x 2.8 km, MLM 1.6 x 1.6 km, RFP 2. x 2. km, SRP 12.5 x 12.5 km). The coordinates of the release center is set with this option, and must be set prior to a Gaussian calculation. The tracking cross, which marks the current release center can be moved to a new position by the joy stick or light pen. The Universal Transverse Mercator (UTM) coordinates of the tracking cross are constantly updated and displayed in the upper left corner of the display.

This is the map on which the 15 minute Gaussian calculations will be overlayed, and on which the GAUSSIAN DIFFUSION option will overlay the

3.

METEOROLOGICAL DATA

SELECT TOWER AND/OR TIME

#N	CR	INPUT N
LF		SKIP INPUT

1.	10 m	or	19:15
2.	40 m	or	19:00
3.			18:45
4.	(Towers
and
levels)	or	(Time in
15 minute
intervals)
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			

TOWER XX

TIME XX

Figure 5a

mm/dd/yy TIME	SAMPLE LOCATION	WIND SPEED (M/SEC)	WIND DIRECTION (FROM)	SIGMA THETA (DEG)	TEMP (C)	SMPL CNT
19:30	40 M	1.9	32	114.2	13.6	134
19:15	40 M	1.3	47	188.3	13.6	134
19:00	40 M	1.6	49	167.6	13.2	135
18:45	40 M	1.0	14	153.7	12.7	134
18:30	40 M	1.2	8	54.7	12.7	134
18:15	40 M	1.6	12	107.9	12.2	135
18:00	40 M	1.4	23	178.5	12.1	134
17:45	40 M	1.0	23	126.8	11.7	134
17:30	40 M	1.0	10	39.8	11.2	135
17:15	40 M	.6	7	50.1	10.7	134
17:00	40 M	1.2	57	39.8	11.2	135
16:45	40 M	1.5	70	43.2	9.3	135
16:30	40 M	1.9	64	122.5	8.9	134
16:15	40 M	1.6	92	161.3	8.4	134
16:00	40 M	1.6	89	149.7	8.0	135
15:45	40 M	1.8	90	118.5	7.1	134

Example of LLL meteorological data displayed for one tower level.

Figure 5b

mm/dd/yy TIME	SAMPLE LOCATION	WIND SPEED (M/SEC)	WIND DIRECTION (FROM)	SIGMA THETA (DEG)	TEMP (C)	SMPL CNT
19:15	10 M	1.5	28	179.6	12.7	134
19:15	40 M	1.3	47	188.3	13.6	134
19:15	5 300	3.4	328	10.4	5.7	134

Example of LLL meteorological data displayed at one time interval for all towers.

Figure 5c

contours. If DETAILED SITE MAP is chosen in that option, the Gaussian contours are calculated from the release location defined by the tracking cross.

To obtain a printed copy of this map the operator should strike <P> (PLOT) on the keyboard, or touch PLOT with the light pen.

To exit this option, hit <ESC> or touch EXIT with the light pen; either will return the display screen to the MENU.

If <ESC> is hit before the plot is finished, plotting will stop.

5. SITE MAP

The option SITE MAP will give a map areas that depend upon the site as follows: LLL 25 x 25 km, MLM 20 x 20 km, RFP 12.5 x 12.5 km, SRP 50 x 50 km, within which the specific site is included.

If the operator wishes to overlay the Gaussian calculation on this map (rather than the smaller more detailed site map) the coordinates for the release center must be set with this function, prior to calculating the GAUSSIAN DIFFUSION. The tracking cross, which marks the current release center, can be moved to a new position by the light pen or joy stick. The UTM coordinates of the tracking cross are constantly updated and displayed in the upper left corner of the display.

To obtain a printed copy of this map the operator should hit <P> or the keyboard, or touch PLOT with the light pen.

To exit this option, hit <ESC> or touch EXIT with the light pen; either will return the display screen back to the MENU.

If <ESC> is hit before the plot is finished, the plotting will stop.

6. and 7. REGIONAL MODEL MAP/TRAJECTORY MAP

The display options REGIONAL MODEL MAP and TRAJECTORY MAP are identically operating functions and shall be discussed as one in this section.

The REGIONAL MODEL MAP and TRAJECTORY MAP are initially 200 x 200 km geographic maps, incorporating the site, which can be centered and scaled down to operator specification. The reason there are two identical functions is to aid the operator in the option REGIONAL MODEL CALCULATIONS. Here the regional model concentration and deposition contours are viewed by overlaying them on geographic maps of the area involved. In this function, a choice of viewing maps is given and the REGIONAL MODEL MAP and TRAJECTORY MAP are two of the choices. This will enable the operator prior to the REGIONAL MODEL CALCULATION to choose two appropriate maps for contour viewing. Thus the contours can be viewed in the REGIONAL MODEL CALCULATION on two previously centered and scaled maps allowing interpretation of dose contours.

When this function is chosen, a geographic map of 200 x 200 km surrounding the site will appear on the display screen. Each map will have the following information listed: the UTM coordinates of the center of the magnification window will be in the upper left corner. The light pen options ☐PLOT and ☐NEXT MAP are in the upper right corner of the dashed scaling map. The lower left corner has the light pen option ☐ORIGINAL MAP, which will return the display to the original 200 x 200 km map.

The light pen ☐EXIT option is in the lower right corner.

To change the centering of the map, the operator locates the tracking cross by using the light pen or joy stick. The UTM coordinates of the tracking cross (center of the magnification window) will be constantly

updated in the upper left corner of the display. If a new center of the map is chosen, strike <RETURN> or touch ■NEXT MAP with the light pen, and the map with the newly chosen center will shortly appear on the screen.

The operator can select a new scale for the map by typing <S> to reduce or to increase the scale or by touching the appropriate magnification factor with the light pen. Either way the present magnification factor will be flashing. As the map scale decreases, the resolution and detail of the geographical map increases. The scale will be indicated, as the map scaling box decreases or increases, in the upper right corner. When the appropriate scale is selected, <RETURN> is hit or ■NEXT MAP is touched by the light pen.

To obtain a scale of .20 the operator must strike <S> or use the light pen until *8 is flashing. Then hit <RETURN>, or touch ■NEXT MAP with the light pen and wait for the new map of scale 25. Again hit <S> or use the light pen until *8 is flashing. Hit <RETURN> or touch ■NEXT MAP with the light pen and wait for the new map of scale 3.125. Then hit <S> until the scaling box will not decrease any further and .20 is in the upper right corner of the scaling box. Hit <RETURN> or touch ■NEXT MAP with the light pen and the most detailed map available will appear on the screen.

Each map can be plotted by either typing <P> or by touching ■PLOT with the light pen. At any time the operator can go back to the original map by typing <O> (original map), or touching ■ORIGINAL MAP with the light pen (CAUTION: Do not attempt to go back to original map unless the magnification factor is 1). To exit this option the operator must hit <ESC> twice or touch ■EXIT with the light pen.

The final map on the screen will be the one that will appear in the REGIONAL MODEL CALCULATION. This last map will appear the next time the display option is requested unless the system is rebooted, and then the original 200 x 200 km map will be displayed.

8. GAUSSIAN DIFFUSION

The GAUSSIAN DIFFUSION option is used to calculate Continuous or Instantaneous Point Source Gaussian diffusion air concentration contours. The operator must define the parameters of the release by first using the SET PARAMETER option; then define the source release point by using the tracking cross in either the SITE MAP (DETAILED) or SITE MAP options.

The operators first choice in using the GAUSSIAN DIFFUSION option is whether to use the trial stability, wind speed, and direction in SET PARAMETERS (TRIAL will be flashing), or to use one of the tower levels and a designated time as input into the code (Fig. 6). A yes, <Y> instruction indicates that the trial wind speed and direction will be used. Typing a no, <N> will use the tower levels as wind input. If <N> is typed, the operator types the line number of the desired tower and <RETURN> and then types in the number of the desired time interval and <RETURN>. All of the above choices are available by touching the appropriate choices with the light pen.

After the wind speed and direction data have been selected the choice of site maps is next presented. After selecting the (DETAILED) SITE MAP <D> or REGULAR SITE MAP <R>, the desired map choice will flash.

The next option for the operator is to choose the Continuous Point Source Gaussian (CPS) <C> or Instantaneous Point Source Gaussian (IPS) <I>

8. GAUSSIAN DIFFUSION

SELECT TOWER AND/OR TIME

#N	CR	INPUT N
LF		SKIP INPUT

1. 10 m	or	15:00
---------	----	-------

2. 40 m	or	14:45
---------	----	-------

3.		14:30
----	--	-------

4. (Towers)	or	(Time in)
5. (and)		(15 minute)
6. (levels)		(intervals)

7.

8.

9.

10.

11.

12.

13.

14.

15.

16.

TOWER XX

TIME XX

TRIAL DATA (Y/N)

Figure 6

calculation. If a puff of material is emitted, the IPS option should be used. For a release over 5 minutes in duration the CPS should be used. Pressing either <I> or <C> should be followed by a <RETURN>. The calculation requires 5 to 20 seconds to complete. During this time the screen displays the words SITE MAP.

To obtain a hardcopy of the calculation display touch **■PLOT** with the light pen or hit <P>. To exit touch **■EXIT** with the light pen or hit <ESC>.

If <ESC> is hit before the plot is finished, plotting will stop.

9. REGIONAL MODEL CALCULATIONS

The REGIONAL MODEL CALCULATION option will display the contours of the regional models that are calculated at the central facility. The contours will be sent to the site via the ACF - site system link. The contours will be overlayed on predefined geographic maps which may be chosen from functions 5, 6 and/or 7.

This display option has two sub-menus. The operator first selects one of the desired model results (Fig 7), and then determines the type of contours. A choice is made of instantaneous, integrated, or deposition contours for either the ADPIC or PATRIC codes. The line number of the operator's choice is typed when the line begins to flash; hit <RETURN> or touch the appropriate choice with the light pen. A new menu will appear and the operator must select the date and time range of the contour plots for the desired model result (Figure 8). Included in that choice is information regarding the valid and observation times. There are up to six available contour plots from which to choose. These are placed in a queue and, as new contour packages are sent from the ACF, the last (#6)

9.

REGIONAL MODEL CALCULATIONS

	CURRENT	T/D	mm/dd/yy	hh:mm	(GMT)
1.	INTEGRATED SURFACE AIR-ADPIC				
2.	INSTANTANEOUS AIR-ADPIC				
3.	GROUND DEPOSITION-ADPIC				
4.	INTEGRATED SURFACE AIR-PATRIC				
5.	INSTANTANEOUS AIR-PATRIC				
6.	GROUND DEPOSITION-PATRIC				
7.	TRAJECTORY PUFF				
8.	TRAJECTORY PLUME				

Figure 7

#2

INSTANTANEOUS AIR - ADPIC

	CURRENT	T/D	mm/dd/yy	hh:mm	(QNT)
	DATE		OBSERVATION TIME		VALID TIME
1.	01/11/79		09:00		10:00
2.	01/11/79		10:00		11:00
3.	XX/XX/XX		XX:XX		XX:XX
4.	XX/XX/XX		XX:XX		XX:XX
5.	XX/XX/XX		XX:XX		XX:XX
6.	XX/XX/XX		XX:XX		XX:XX

REGIONAL MAP

TRAJECTORY MAP

SITE MAP

DISPLAY CONTOURS OVER MAP

EXIT

Figure 8

contour package will be deleted, and the new plots placed in the #1 position. The previous #1 is moved to #2 and so on.

When the appropriate contour number is typed or touched with the light pen, the chosen number flashes. The operator must next choose the type of geographical map upon which the contours will be displayed. The REGIONAL MAP <R>, TRAJECTORY MAP <T>, or SITE MAP <S> are selected by typing or using the light pen over one of the above letters followed by <RETURN>. The chosen map choice will flash. The regional and trajectory maps with their center and scale have previously been viewed in functions 6 and 7. The site map is the same as in function 5 (SITE MAP) without the option of locating the source release point with the tracking cross.

When the map choice has been made and <RETURN> hit, the screen will go blank momentarily and the map choice appears on the screen. After 10-120 seconds, the map and contours appears on the screen. The contours calculated in the regional model codes are located by grid points on the large area maps. Then by using grid point matching over the site, regional, or trajectory maps, this will give the proper placement to the contours on the map chosen in this function.

Touching **PLOT** with the light pen or typing <P> and <RETURN> will plot the map and contours on the printer. To exit, hit <ESC> or touch **EXIT** with the light pen and the screen will return to the original menu.

10. COMMUNICATIONS WITH ACF

COMMUNICATIONS WITH ACF opens a telephone communication link between the site and the ACF thus allowing a transfer of data. Once the SEND

MESSAGE is displayed in the upper left corner of the screen the system is ready to accept a keyboard typed message from the operator. The message will be displayed on the screen as it is typed, a message up to '28 characters is allowed. To transmit to the ACF the <RETURN> key must be touched. The message will disappear from the screen and will be sent to the ACF and to the teletype printer for a hard copy log of all messages. Messages from the ACF will appear on the screen and the teletype. The log contains the message and the time and date that the communication was initiated.

11. SET EMERGENCY

SET EMERGENCY does the same as COMMUNICATIONS WITH ACF except it alerts the ACF to an emergency situation. This communication would only be used in the event of a real emergency since it is seen by the ACF as an immediate request for assistance.

12. CLEAR EMERGENCY AND HANG UP

When communications are complete, the phone must be hung up. In normal operations the ACF will call, communicate, and then hang up. If the site initiates communications (items 10 and 11) he must hang up. This is done with CLEAR EMERGENCY AND HANG UP. This function will hang up the phone and clear the emergency message if one exists. To see if the phone is off the hook or if some one set an emergency condition the operator must bring up the main menu. This is done by pressing the ESC key. If the phone is off the hook, a message will be displayed in the upper right corner saying 'TELEPHONE OFF HOOK'. If an emergency situation is in effect, a message is displayed in the upper left corner saying 'EMERGENCY'.

13. PLOT

After choosing PLOT, the plot menu will be displayed (Figure 9). This allows the operator to choose a display option follow through with its procedures and immediately after the last "RETURN" is hit a hard copy will begin to print. This function may be used in place of the PLOT capabilities within each display option of the main menu.

13.

PLOT

1. SET PARAMETERS
2. WIND ROSE
3. METEOROLOGICAL DATA
4. SITE MAP (DETAILED)
5. SITE MAP
6. REGIONAL MODEL MAP
7. TRAJECTORY MAP
8. GAUSSIAN DIFFUSION

9. REGIONAL MODEL CALCULATIONS

Figure 9

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