The fourth distribution (ROGCONL) was considered the most reliable and was given twice the weight (64 percent) of the third (SEXCONWL, 32 percent). Mobile-home distributions were weighted equally, at 2 percent each, because they reflect results for two different seasons (summer and winter) from the same study. The random number seed of 7777 was again used.

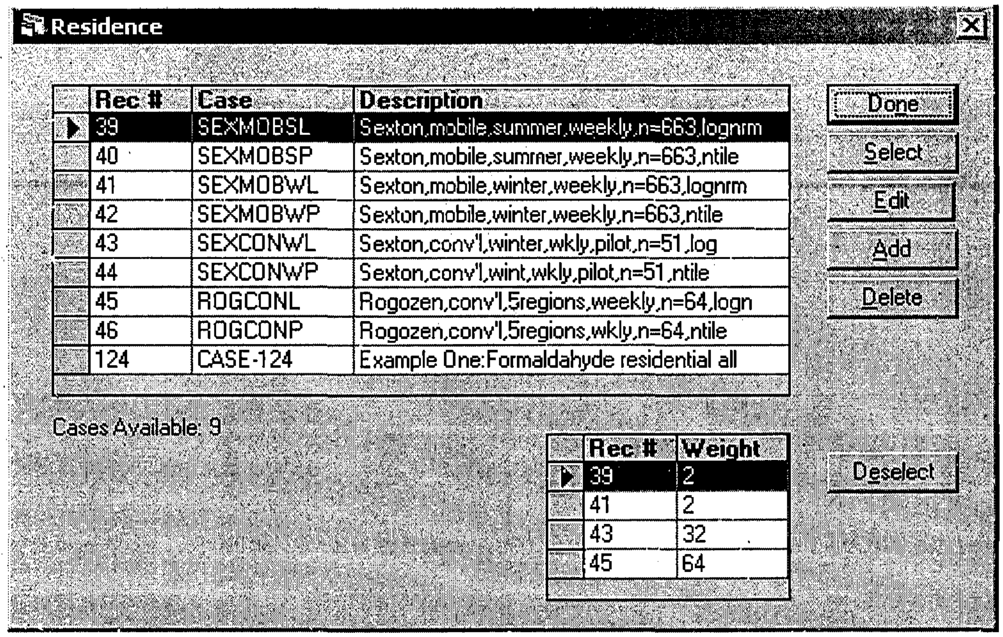


Figure 6-6 Weights for residences in 6.1.1b example

Results for the second example run are shown below. The arithmetic and geometric means for the second run are similar to, but somewhat smaller than, those from the first run. The arithmetic standard deviation is slightly larger for the second run, whereas the geometric standard deviation is slightly smaller. The maximum dose for the second run (7784 μg) is substantially higher than that for the first run.

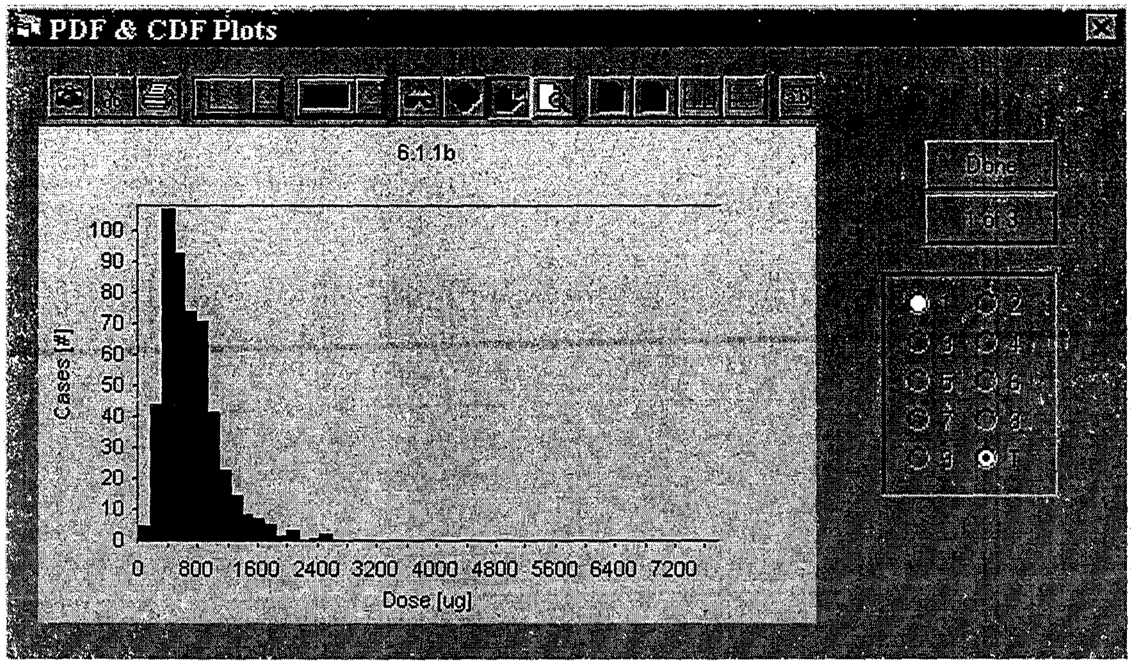


Figure 6-7 Probability density function graph of results for 6.1.1b example

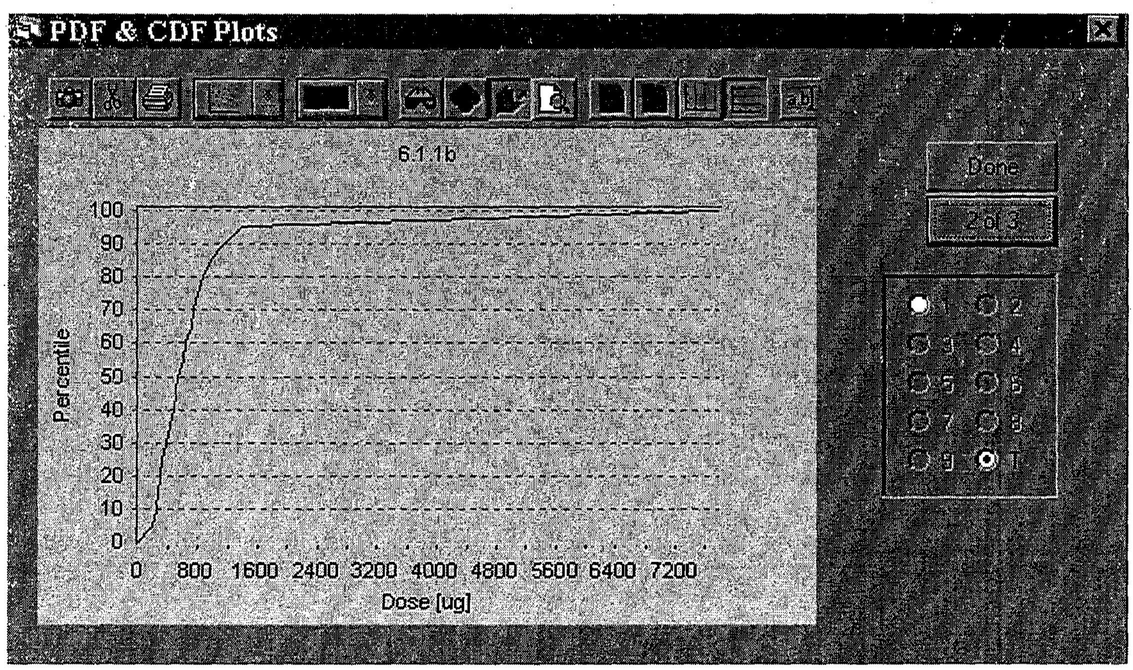


Figure 6-8 Cumulative distribution function graph of results for 6.1.1b example

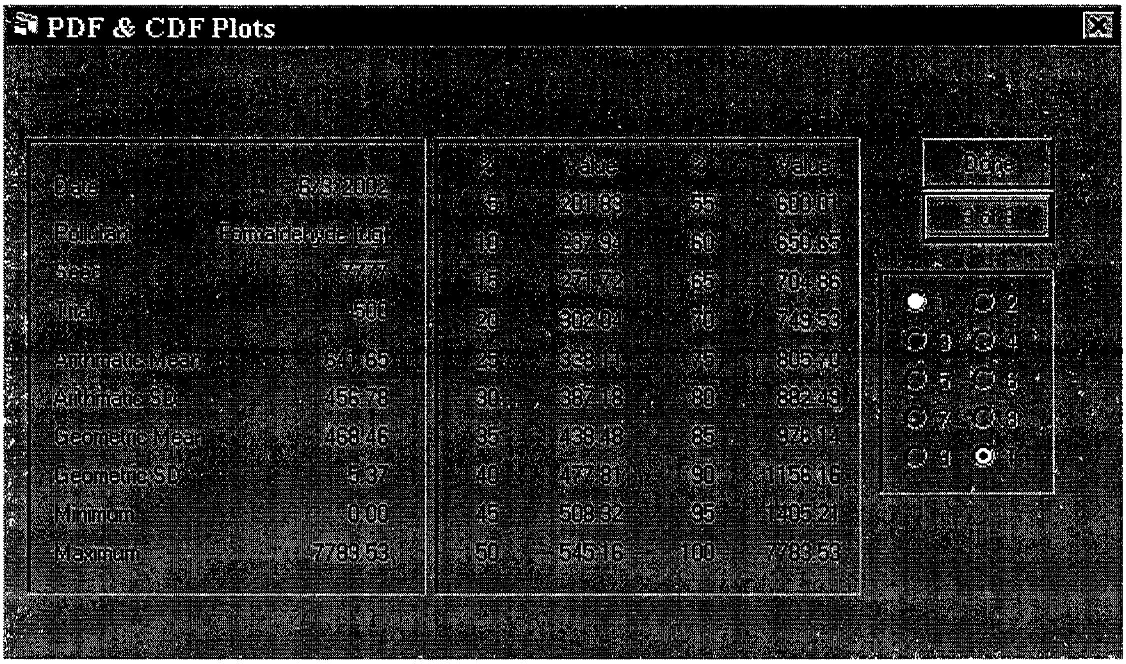


Figure 6-9 Statistical Summary for 6.1.1b example

6.1.2. Model Run for Two Environments

For the third example, the selections of formaldehyde as the pollutant and 24 hours as the integration period were retained. The population subgroup was chosen to be all workers in the South Coast region. There were 209 activity profiles that met these criteria for population subgroup; all were used in the simulation, once each, by selecting the Use All option. The two environments selected were residence and office. For residence, the weights for four concentration distributions used in the previous example were retained. For office, two concentration distributions were used, with weights as shown below. A random number seed of 9113 was chosen.

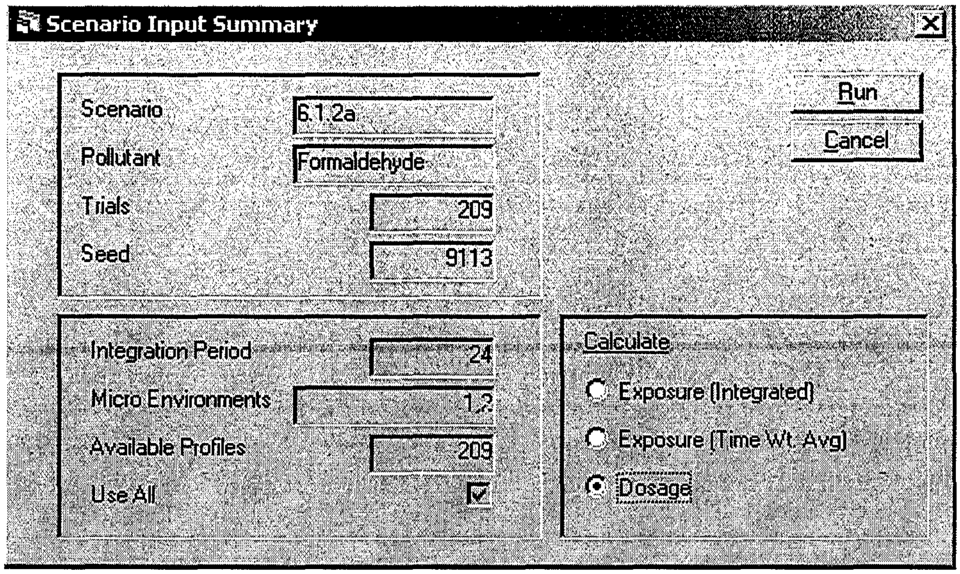


Figure 6-10 Scenario Input Summary for 6.1.2 example

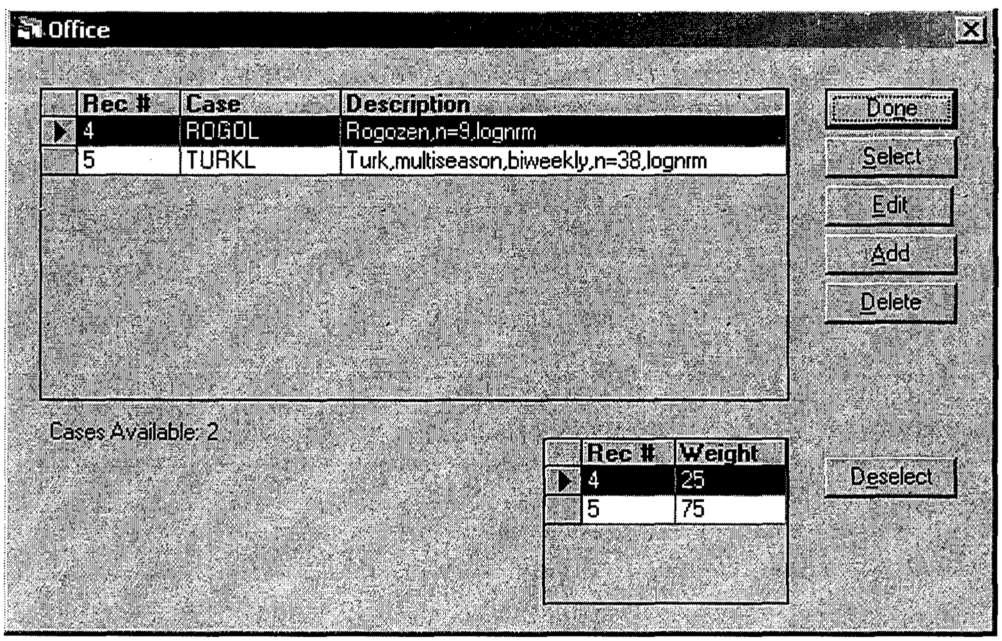


Figure 6-11 Weights for office in 6.1.2 example

When a scenario that contains two micro environments is run, as in the third example, CPIEM will display the PDF and CDF graphics for either of the microenvironments or the total. The user can toggle among the choices by clicking the appropriate circle on the graphic display. Similarly, the data files that are generated will contain data for each of the micro environments as well as the total.

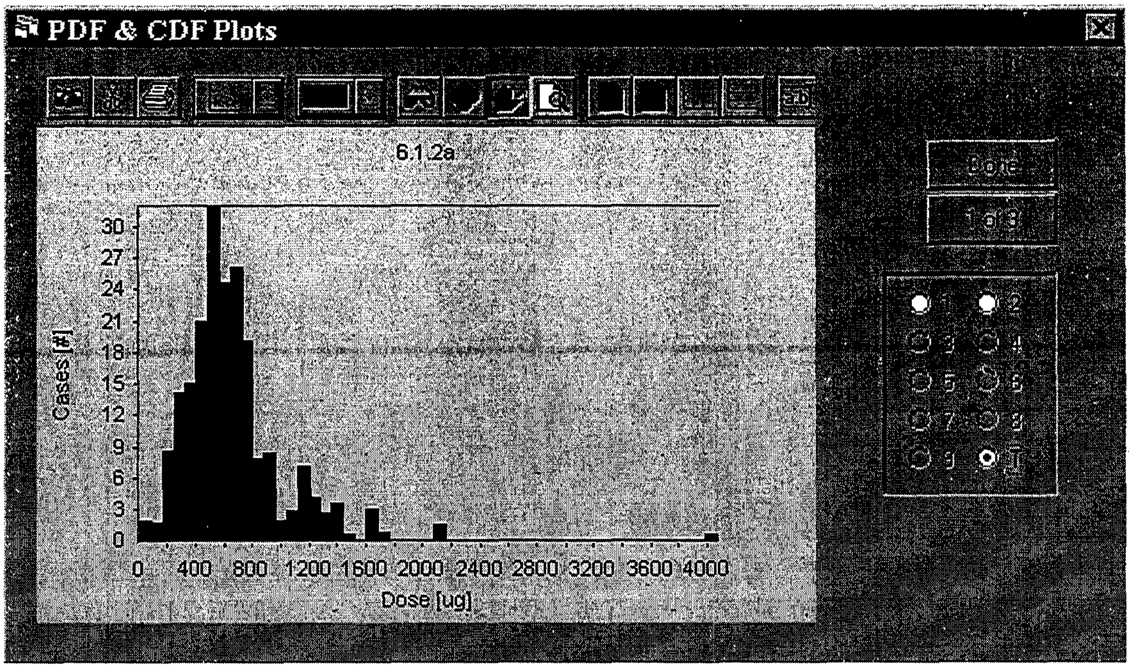


Figure 6-12a Probability density function graph of results for 6.1.2 dose example: total

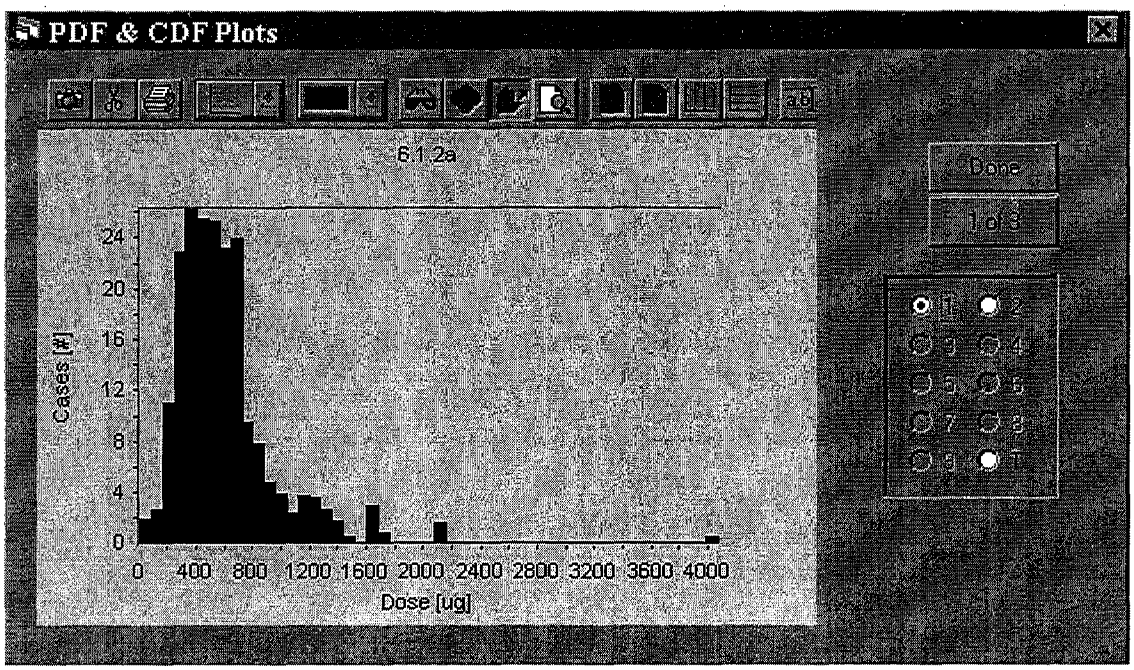


Figure 6-12b Probability density function graph of results for 6.1.2 dose example: environment 1

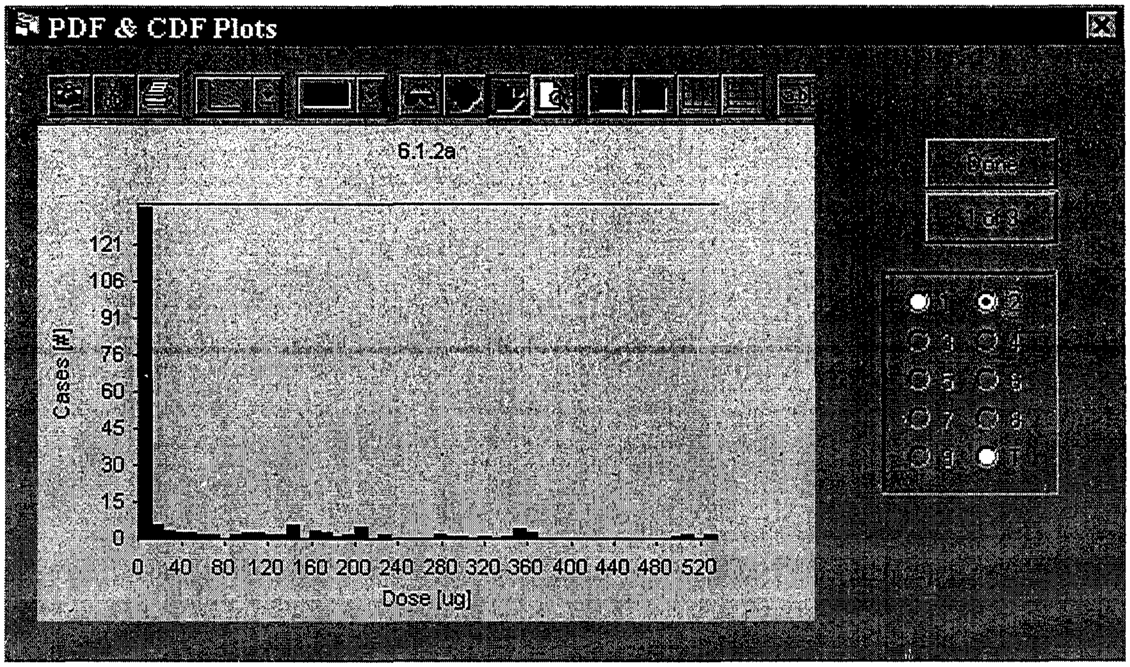


Figure 6-12c Probability density function graph of results for 6.1.2 dose example: environment 2

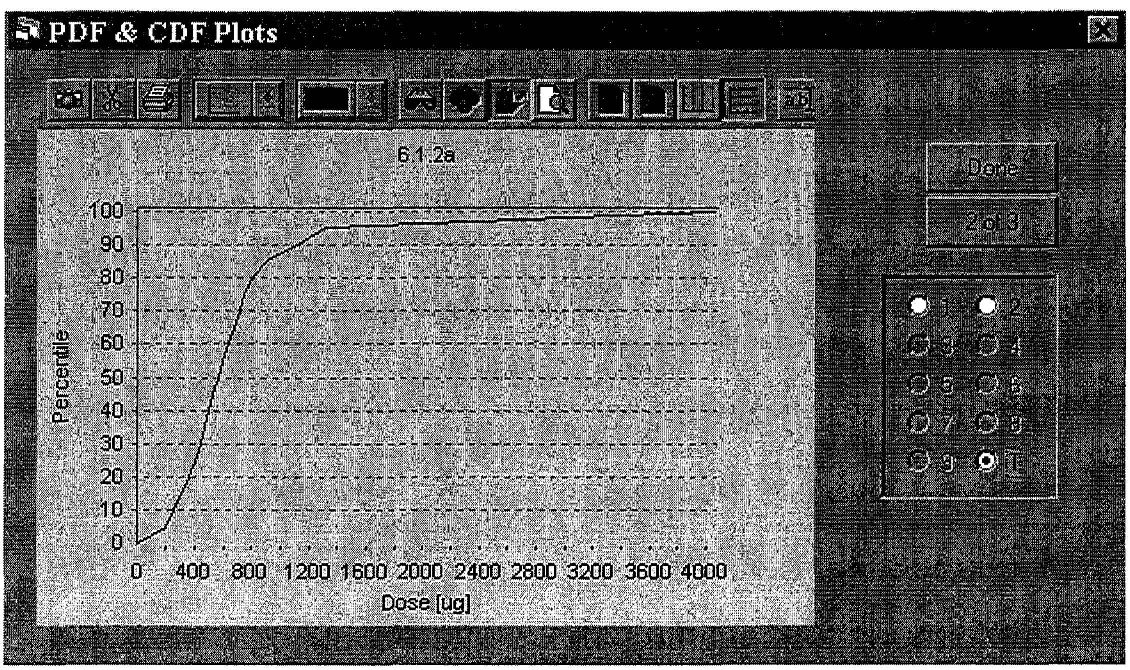


Figure 6-13a Cumulative distribution function graph of results for 6.1.2 dose example: total

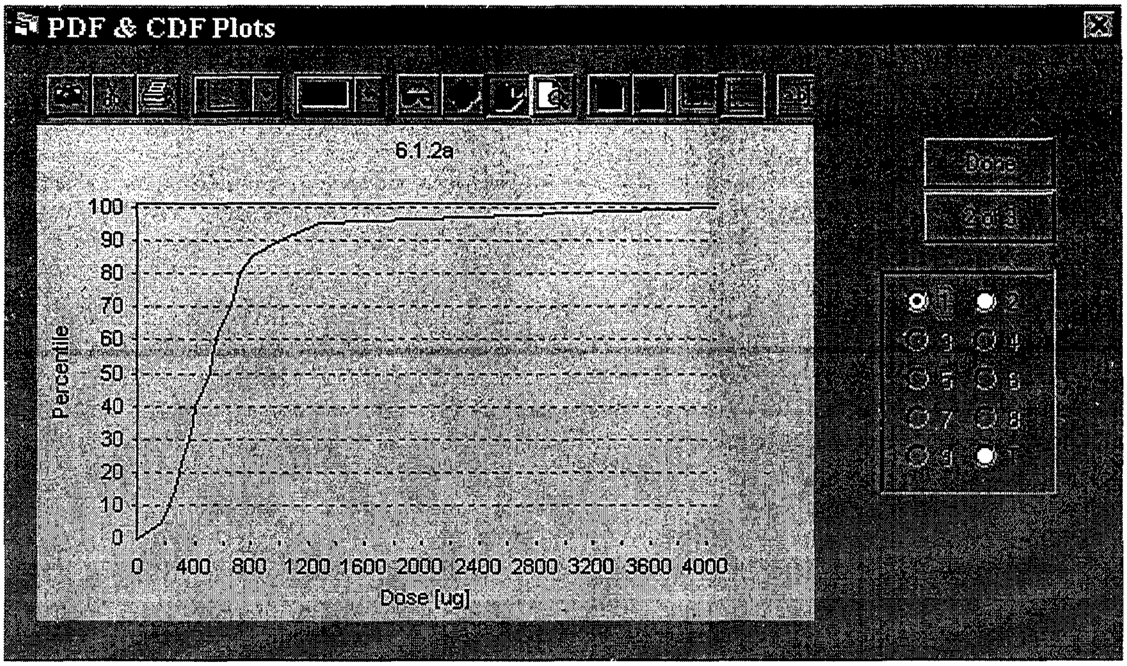


Figure 6-13b Cumulative distribution function graph of results for 6.1.2 dose example: environment 1

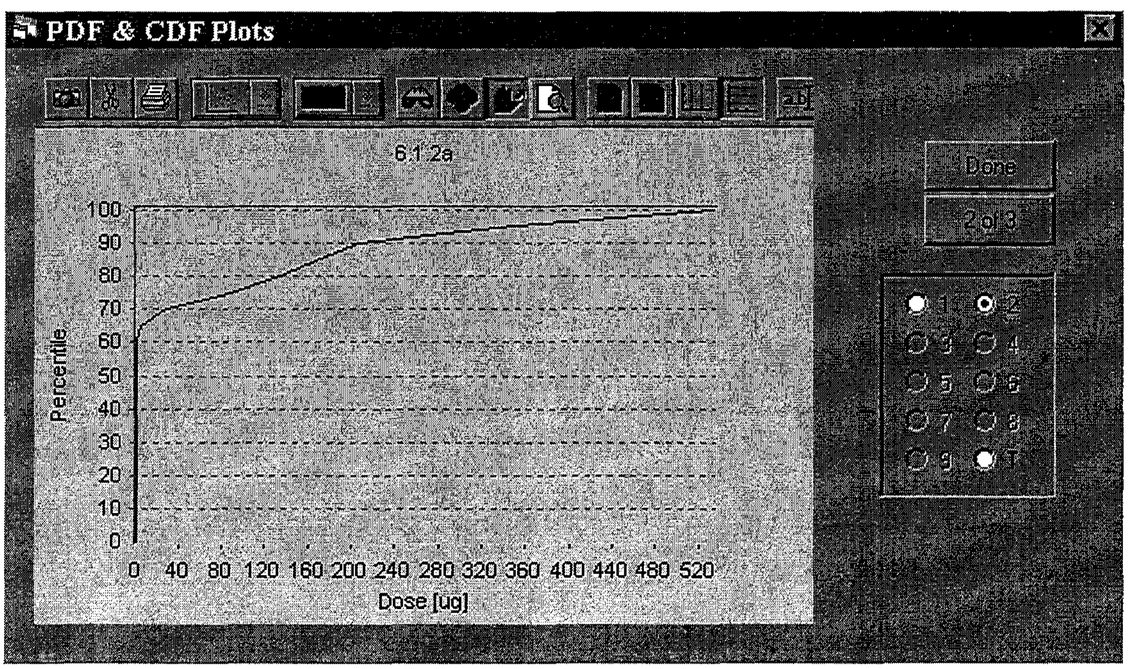


Figure 6-13c Cumulative distribution function graph of results for 6.1.2 dose example: environment 2

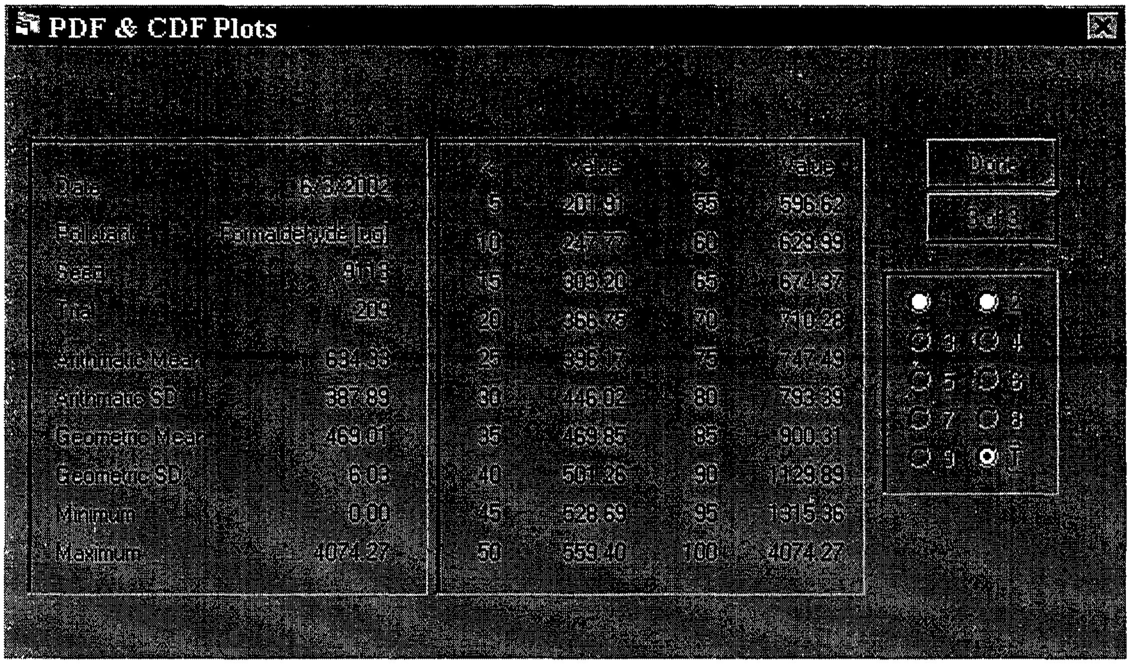


Figure 6-14a Statistical Summary for 6.1.2 dose example: total

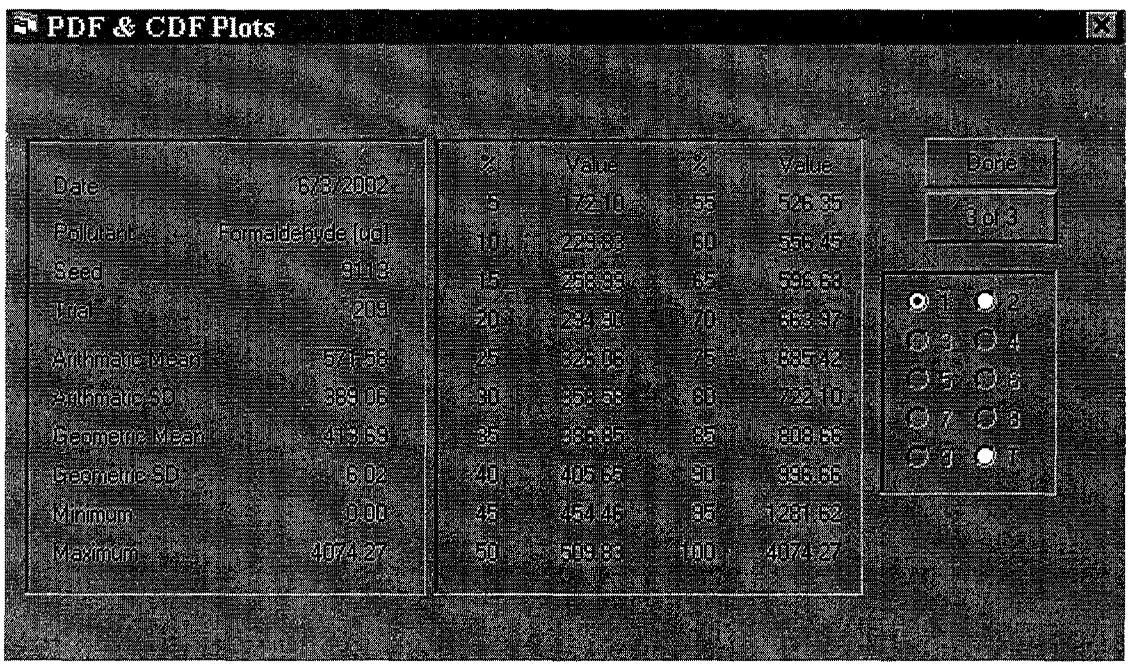


Figure 6-14b Statistical Summary for 6.1.2 dose example: environment 1

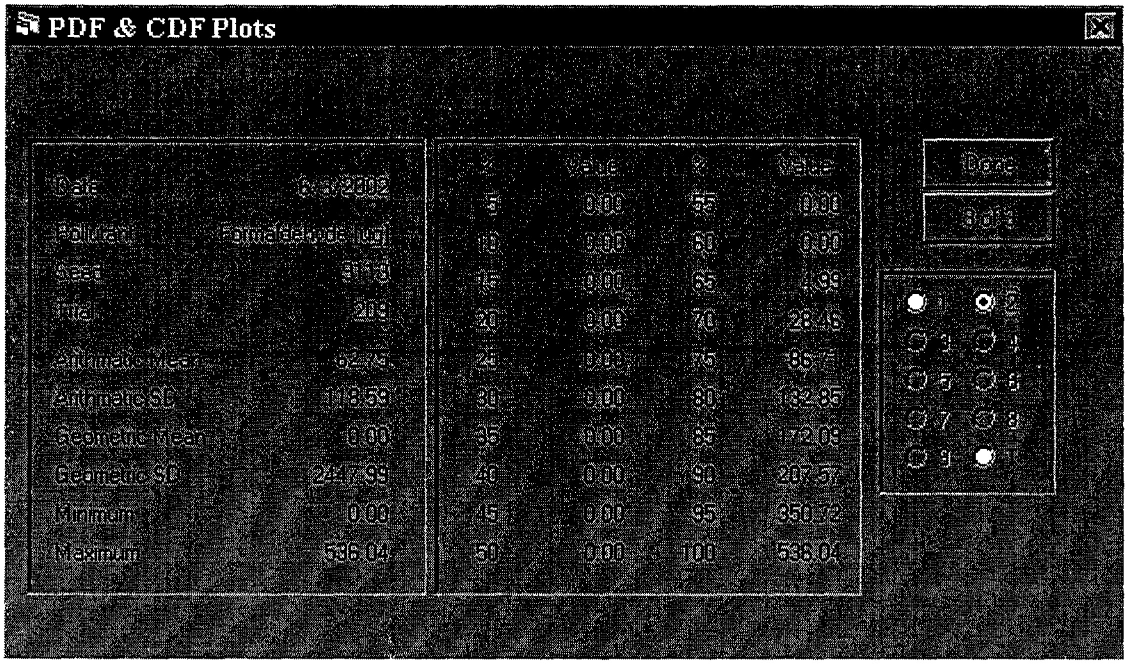


Figure 6-14c Statistical Summary for 6.1.2 dose example: environment 2

On average, the dose received while in the residence accounted for nearly 90 percent (572 µg/634 µg) of the total dose. The office component of total dose was relatively small because more than 60 percent of the workers spent no time in office settings; this is indicated by zero-dose values for the office environment up through the 60th percentile. The maximum value (4074 µg) was identical for residential and total dose, indicating that the individual who received the highest residential dose spent no time in an office.

The model was rerun [Example 6.1.2(b)] with all inputs the same but with the option to calculate exposure rather than dose. Summary exposure statistics (Figures 6-15a,b,c) indicate that, on average, the residential exposure (840 µg-h/m^3) accounted for more than 90 percent of the total exposure (910 µg-h/m^3).

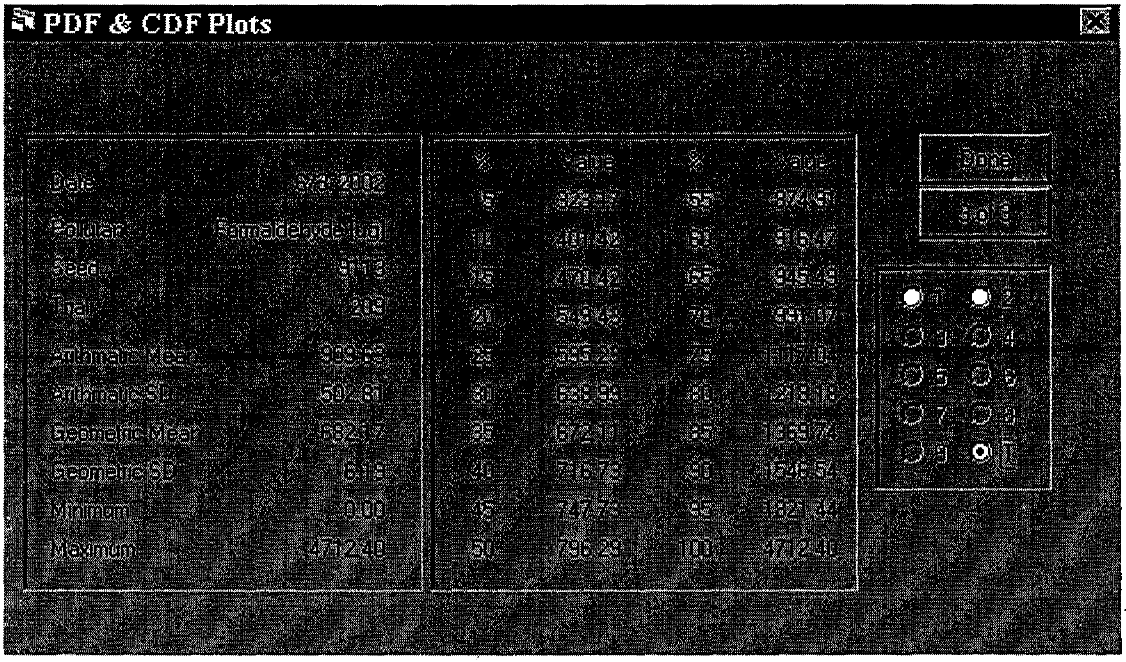


Figure 6-15a Statistical Summary for 6.1.2 exposure (integrated) example: total

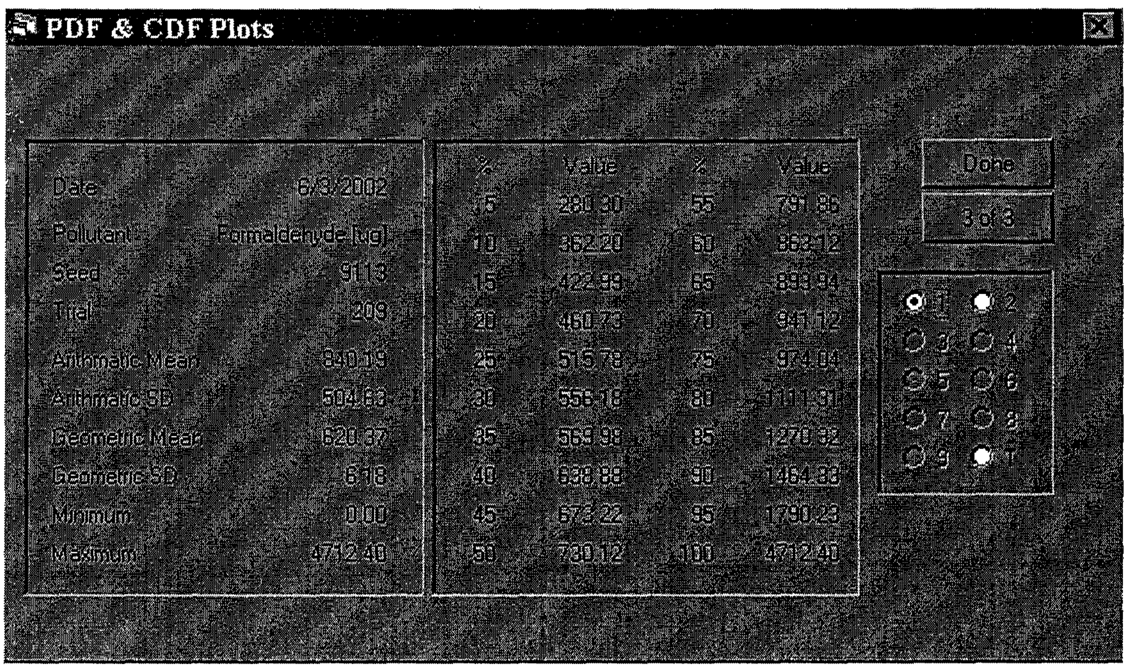


Figure 6-15b Statistical Summary for 6.1.2 exposure (integrated) example: environment 1

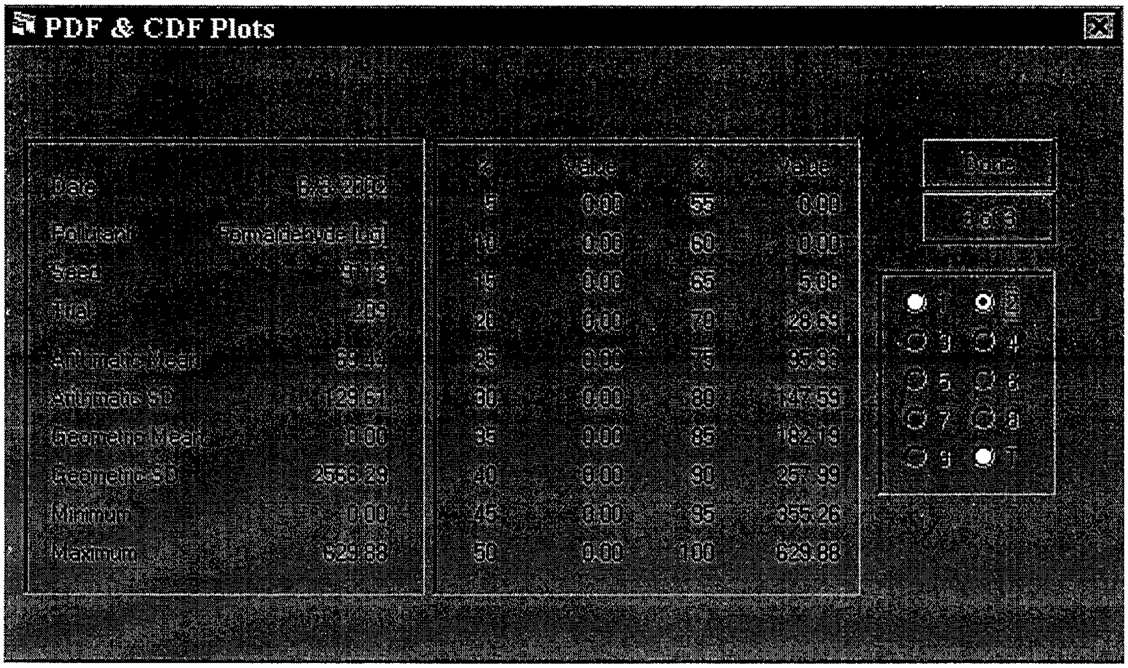


Figure 6-13 Statistical Summary for 6.1.2 exposure (integrated) example: environment 2

6.2. Concentration Distributions

The example applications below involve runs to estimate residential concentration distributions. Options related to indoor sources, outdoor concentrations, penetration factors, indoor sinks, volumes, and air exchange rates are demonstrated. The focus, however, is on indoor sources.

6.2.1. Model Run with Long-term Source

Potential indoor sources of benzo[a]pyrene (BaP) include combustion processes such as wood burning and tobacco smoking. Although such sources are not used continuously, the primary information on emission rates (from the PTEAM study sponsored by EPA and ARB) assumes steady-state conditions (i.e., sources operating continuously). Given this type of information, it is appropriate to treat the BaP source as a long-term source that is not related to the indoor volume (i.e., no loading). Information from the PTEAM study indicates that a BaP source was present in 28 percent of the study homes with an average emission rate of 390 hg/h and a standard deviation of 1285. This information ("Initial Emission Rate") was input to the model (Example 6.2.1) as a lognormal distribution (Figure 6-14). The "Percent of Cases" with the source was input as 28 (not shown).

Because the emission rate represents all indoor sources of BaP combined, it was input as a single source for each house using a normal distribution with a mean of one and a standard deviation of zero (Figure 6-15) for the "Quantity Present." Since the emission rate was assumed to be constant over time, the "Decline of Rate" was set uniformly to zero by inputting a normal distribution with values of zero for both the mean and standard deviation. Because the emission rate does not decline over time, the distribution for "When Installed" does not apply; a normal distribution with a mean of 12 months and a standard deviation of zero was arbitrarily chosen.

Input Parameter	Distribution/Values
Percent Cases	28%
Quantity Percent	Normal (1, 0)
When Installed	Normal (12, 0)
Initial Emission Rate	Lognormal (390, 1285)
Decline in Rate	Normal (0, 0)

Table 6-1 Inputs for Indoor Sources for Example 6.2.1

Inputs for other model parameters, summarized in Table 6-1, were expressed as either normal or lognormal distributions. Daily-average outdoor concentrations, volumes, and air exchange rates were input as lognormal distributions. The values for outdoor concentrations and air exchange rates were taken from the PTEAM study from which the emission rates were estimated. This study did not report the house volumes; instead, distributions form three other studies (Figure 6-16) in the same geographic area were given equal weights. The penetration factor estimated from the study, 0.6, was input as a constant value using a normal distribution with a standard duration of zero, and no pollutant decay was assumed (i.e., indoor sinks were set uniformly to zero.)

Input Parameter	Distribution/Values
Outdoor Concentrations	Daily, Lognormal (0.30, 0.36)
Penetration Factors	Normal (0.6, 0)
Indoor Sinks	Normal (0, 0)
Volumes*	Lognormal (274.9, 110.6) Lognormal (309.5, 159.8) Lognormal (354, 101)
Air Exchange Rates	Lognormal (1.25, 1.02)

* *Three different distributions given virtually equal weights (34% for first case, 33% each for second and third cases).*

Table 6-2 Inputs for Other Mass-Balance Parameters for Example 6.2.1

The graphical outputs for daily-average concentrations from this model run are shown in Figures 6-17, 6-18, and 6-19. As illustrated in the PDF plot, the modeled distribution has a rather broad tail; this outcome, also evidenced by a standard deviation that is approximately twice the mean, is largely due to the broad distribution for the emission rate, with a standard deviation more than three times the mean.

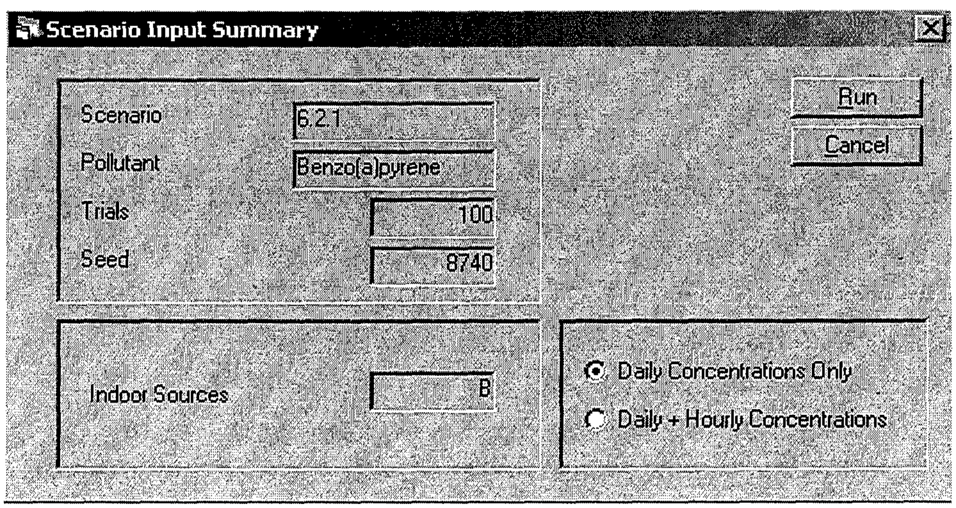


Figure 6-14 Scenario Input Summary for 6.2.1 example

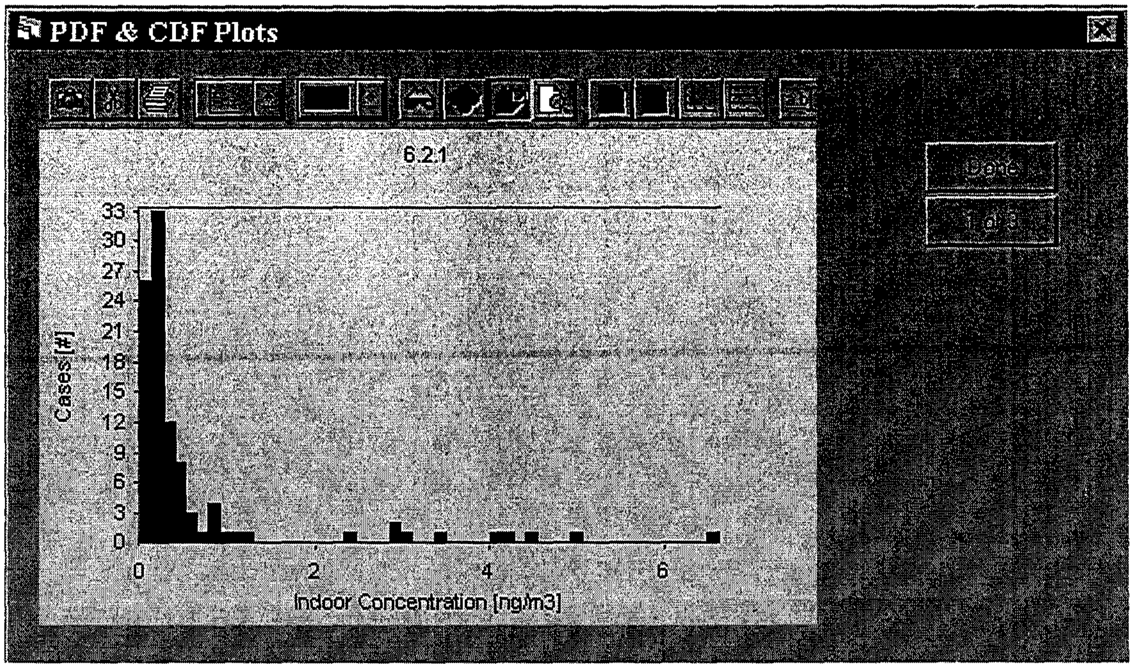


Figure 6-15 Probability density function graph of results for 6.2.1 example

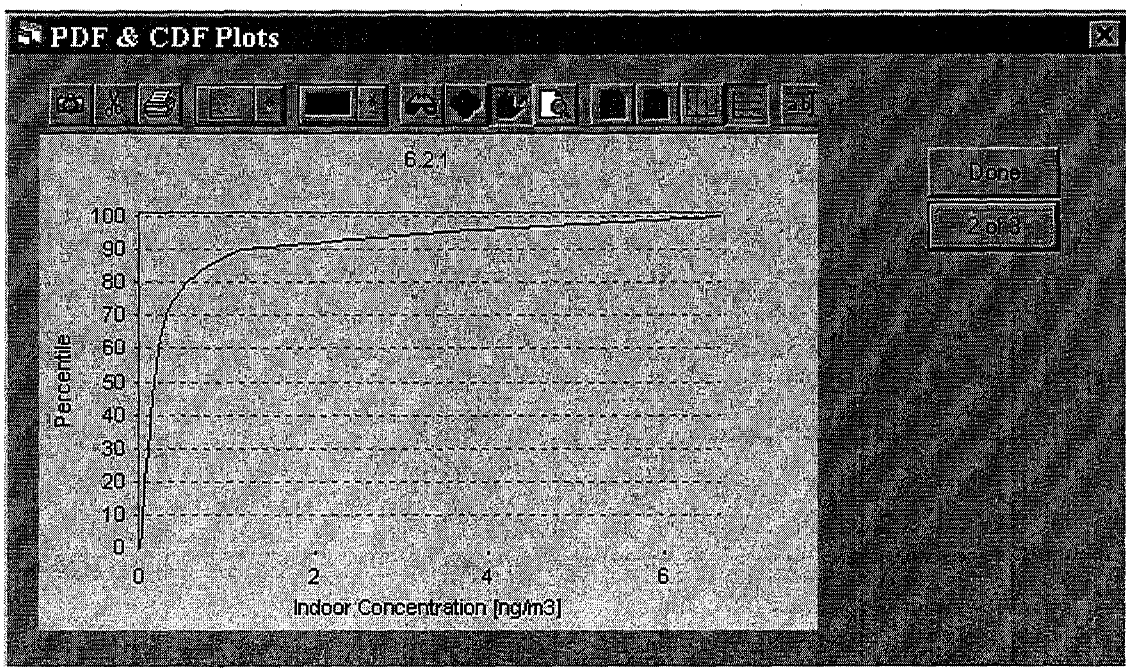


Figure 6-16 Cumulative distribution function graph of results for 6.2.1 example

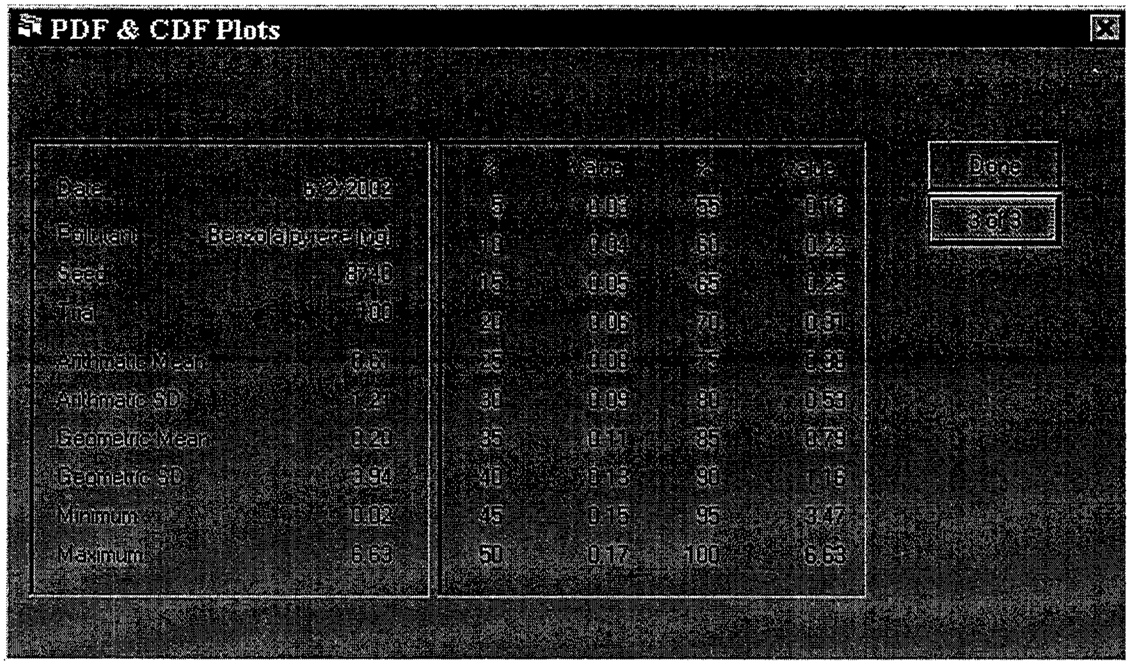


Figure 6-17 Statistical Summary for 6.2.1 example

6.2.2. Model Run with Episodic Source

This run (Example 6.2.2) was made for a hypothetical pollutant unique to latex paint, an indoor source that is used sporadically in households. Data from an EPA-sponsored survey (WESTAT, Inc., *Household Solvent Products: A National Usage Survey*, Report No. EPA-OTS 560/5-87-005, July 1987) indicated that 55.2 percent of households had ever used latex paint at the time of the survey and that the mean time since last use was 16.7 months (500 days). Thus, the "Percent of Cases" with this source was entered as 55.2; the percentile distribution for "Time Since Use" reported from the survey was input as shown in Figure 6-19 (1st percentile is 1 day since last use, 5th percentile is 4 days since last use, etc.).

Assuming that a gallon of paint weighing 3629 g will paint a room of 40 m^3 volume, the load factor for painting is 90.72 g/m^3. This input for load factor (Figure 6-20) was provided as a lognormal distribution with a standard deviation arbitrarily set at half the mean. The emission rate for a chemical tends to exponentially decline over time as the reservoir of volatile material is gradually depleted. Based on an assumed emission half-life of 12 hours (0.5 days), the rate constant for exponential decline in the emission rate was calculated to be 0.693 days $^{-1}$ using the procedure described in Section 4.1 (page 4-8). The initial emission rate (E_o) per unit quantity (1 g) of paint used can be calculated from the relationship from which E_o is calculated to be 0.693 g/h. Assuming that the hypothetical pollutant constitutes 1 percent of the paint's total weight, the initial emission rate for the pollutant is 0.00693 g/h, or 6930 μg/h. Both the "Initial Emission Rate" and the "Decline in Rate" were input as constants using a normal distribution with a standard deviation of zero. The duration of use was arbitrarily assigned a mean value of 3 hours with standard deviation of 1.5 and input as a lognormal distribution.

Table 6-3 Inputs for Indoor Sources for Example 6.2.2

Input Parameter	Distribution/Values
Percent Cases	55.2%
Quantity Percent	Lognormal (90.7, 45.4)
Time Since Use	Percentile (.0,.0; 1.0,1.0; 5.0,4.0; 10.0,14.0; 25.0,60.0; 50.0,240.0; 75.0,720.0; 90.0,1080.0; 95.0,1800.0; 99.0,4320.0; 100.0,9000.0; .0,.0)
Duration of Use	Lognormal (3, 1.5)
Initial Emission Rate	Lognormal (6930, 0)
Decline in Rate	Normal (0.693, 0)

The hypothetical pollutant was assumed to be unique to the indoor environment; thus, the outdoor concentration was uniformly set to zero. Other inputs included constant penetration factor of 1, a constant decay rate (indoor sink) of 0, and lognormal distributions for volume (320 ± 160 cubic meters) and air exchange (1.0 ± 0.5 air changes per hour). The graphical outputs from this model run are shown in Figure 6-21. In most cases the concentration is zero, as one would find in the residential population because only a few households have painted recently enough for traces of the pollutant to remain. The output is in scientific notation because the maximum (181,000 $\mu g/m^3$) is fairly large. This example, although hypothetical, illustrates how limited data could be used to estimate a concentration distribution for a specific type of indoor source of a pollutant.

Table 6-4 Inputs for Other Mass-Balance Parameters for Example 6.2.2

Input Parameter	Distribution/Values
Outdoor Concentrations	Daily, Normal (0.0, 0.0)
Penetration Factors	Normal (1, 0)
Indoor Sinks	Normal (0, 0)
Volumes	Lognormal (320, 160)
Air Exchange Rates	Lognormal (1.0, 0.5)

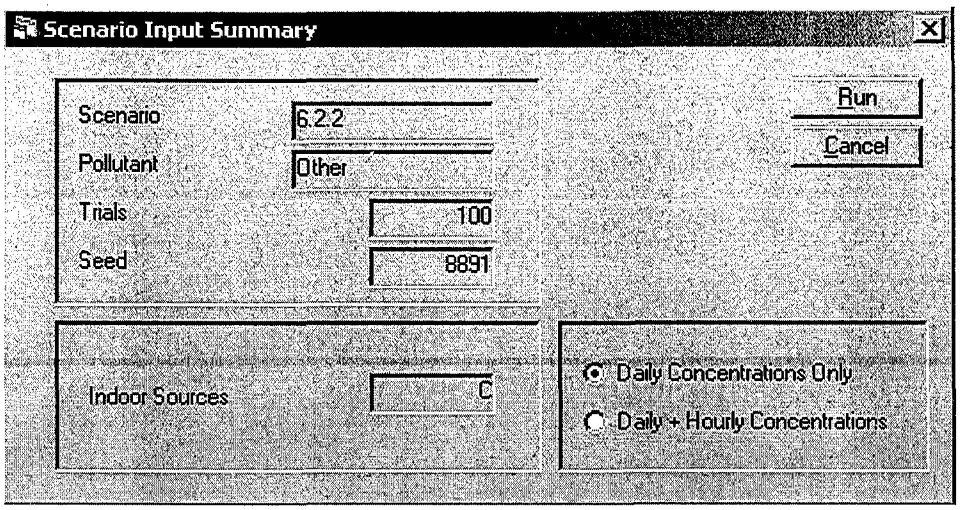


Figure 6-18 Scenario Input Summary for 6.2.2

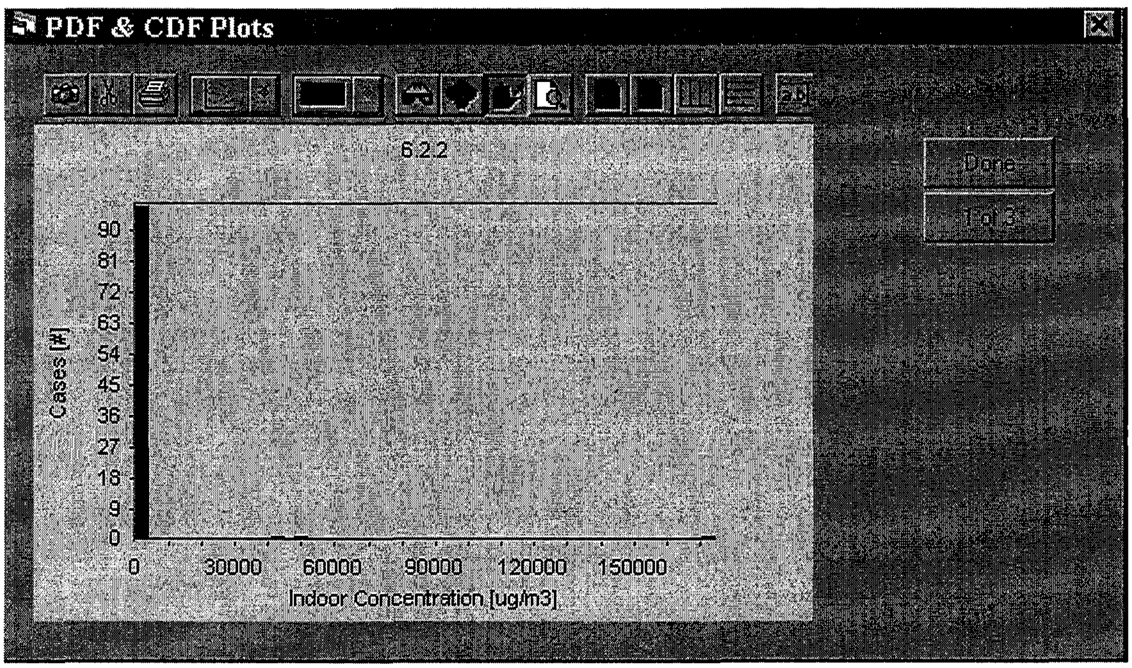


Figure 6-19 Probability density function graph of results of 6.2.2 example

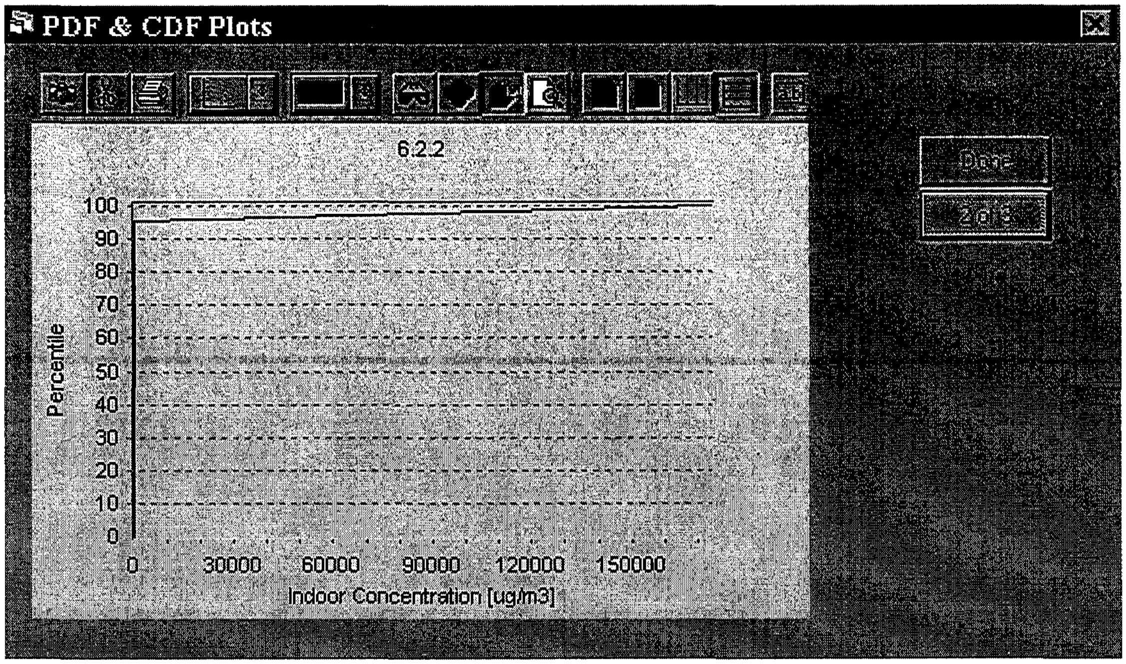
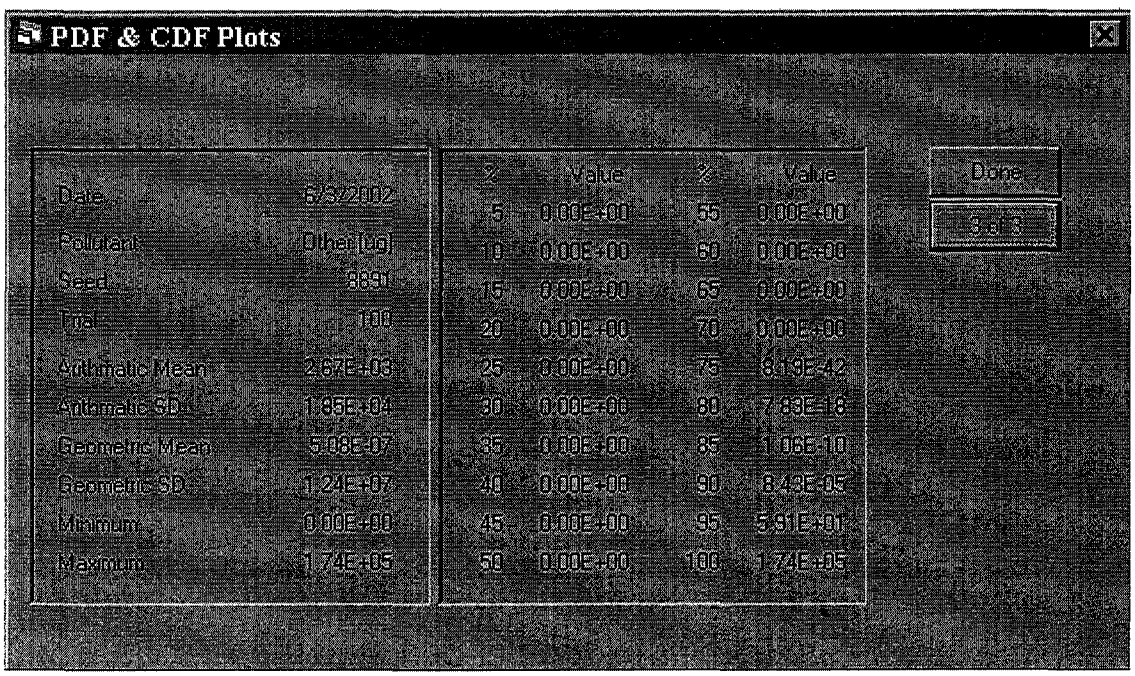


Figure 6-20 Cumulative distribution function graph of results for example 6.2.2



Date	6/3/2002
Pollutant	Other [ug]
Seed	8891
Trial	100
Arithmatic Mean	2.67E+03
Arithmatic SD	1.85E+04
Geometric Mean	5.08E-07
Geometric SD	1.24E+07
Minimum	0.00E+00
Maximum	1.74E+05

%	Value	%	Value
5	0.00E+00	55	0.00E+00
10	0.00E+00	60	0.00E+00
15	0.00E+00	65	0.00E+00
20	0.00E+00	70	0.00E+00
25	0.00E+00	75	8.19E-42
30	0.00E+00	80	7.83E-18
35	0.00E+00	85	1.06E-10
40	0.00E+00	90	8.43E-05
45	0.00E+00	95	5.91E+01
50	0.00E+00	100	1.74E+05

Figure 6-21 Statistical Summary for 6.2.2 example

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7. Files and Setup Options

7.1. Files

CPIEM uses installed databases and files, and generates output files when the population subgroup data is generated for a run and when the scenarios themselves are run.

7.2. Installed Files

There are a number of files that are installed when you install CPIEM. There is one executable file, four Microsoft Access databases, and several files that CPIEM uses internally when generating population subgroups.

Note that unless you are a database administrator tasked with adding or changing the data in the database files, do not directly change or delete any of these files.

File Name	Function
Cpiem.exe	Executable file that instantiates the program, handles overall program flow, and controls the user interface.
ST6UNST.log	This installation log file contains information about the installation of CPIEM and is used to remove all application components from your computer when you delete CPIEM. Do not modify or delete this file.
Cpiem.mdb	Main Microsoft Access database for CPIEM, it contains program data in tables that are used for scenarios and concentration distributions.
Cdf.mdb	Microsoft Access database that contains temporary files for Level 1-2. CPIEM uses this to store information about a specific run of a scenario.
Pop.mdb	Microsoft Access database that contains input files for activity profiles and population sub group information. It is used to determine cases match user criteria for population subgroup when creating a file of activity patterns (Wc_act.act) for those cases.
Pop_New.mdb	This is the similar to Pop.mdb database but holds new activity profiles. To use this newer dataset, you must first rename Pop.mdb to Pop_Old.mdb and then rename Pop_New.mdb to Pop.mdb. CPIEM will use whichever database is named Pop.mdb.
Wc_act.act	This is an output file for population subgroup used internally by CPIEM to generate the population subgroup. This file should not be opened or changed.
Residnt2.dbf	Population subgroup model file that is used to generate the population subgroup. This file should not be opened or changed.
Dataset.dbf	This is dBase file is included as template for creating datasets (see 7.5) Several of such dataset files are also included that are referred by other CL_* input files internally.

Table 7-1 Installed Files and Associated Functions