Hazard Response Modeling Uncertainty (A Quantitative Method)

Volume II
Evaluation of Commonly Used Hazardous Gas Dispersion Models

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Volume II
Evaluation of Commonly Used Hazardous Gas Dispersion Models

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Health and Environmental Sciences Department
and
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ABSTRACT

This volume of the final report provides documentation of some of the results of a two year project entitled Hazard Response Modeling Uncertainty (A Quantitative Method). Work that has been accomplished on the technical work tasks related to evaluating the performance of commonly used hazardous gas dispersion models is summarized.

Eight datasets are used in the evaluation. Those field experiments that involve the release of dense-gas clouds are Burro, Coyote, Desert Tortoise, Goldfish, Maplin Sands, and Thorney Island. Those field experiments that involve the release of passive clouds are Hanford (Kr^{85} tracer studies) and Prairie Grass. Data from these experiments are placed in a common format as a Modelers' Data Archive (MDA), and an extensive set of software was developed to prepare data-files for each model evaluated.

Fourteen dispersion models are evaluated, including six publicly-available computer models (AFTOX, DEGADIS, HEGADAS, INPUFF, OB/DG, and SLAB) and six proprietary computer models (AIRTOX, CHARM, FOCUS, GASTAR, PHAST, and TRACE). A simple Gaussian plume formula and a set of nomograms (Britter and McQuaid) are also evaluated for comparative purposes.

The statistical evaluation indicates that there are a few models that can successfully predict concentrations with a mean bias of 20 percent or less, a relative mean square error of 50 percent or less, and little variability of the residual errors with the input parameters. These models are identified in Section VII. It is also clear that model performance is not dependent upon model complexity.

It is necessary to point out that this evaluation exercise has been by no means independent, since all of the models have been previously tested by the developers with at least one of the datasets. Furthermore, some of the results may be fortuitous, since, in a few cases, certain models have been applied to source scenarios for which they were not originally intended.

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EXECUTIVE SUMMARY

A. OBJECTIVE

The overall objective of this project is to develop and test computer software containing a quantitative method for estimating the uncertainty in PC-based hazard response models. This software is to be used by planners and engineers in order to evaluate the predictions of hazard response models with field observations and determine the confidence intervals on these predictions. This particular volume (II) provides an example of the application of the software to 14 typical hazard response models and 8 sets of field data.

B. BACKGROUND

The U.S. Air Force and the American Petroleum Institute, among others, have increased emphasis on calculating toxic corridors due to releases of hazardous chemicals into the air. There are dozens of PC-based computer models recently developed in order to calculate these toxic corridors. However, the uncertainties in these models have not been adequately determined, partly due to the lack of a standardized quantitative method that could be applied to these models. Individual model developers generally present a limited evaluation of their own model, and the USEPA has published some partial evaluations, but a comprehensive study has not been completed.

C. SCOPE

The scope of the overall project has included acquisition and testing of databases and models, development and application of model evaluation software, and assessment of the components of uncertainty. The current volume (II) emphasizes an example application of the model to a reasonably comprehensive set of 14 hazard response models and 8 independent field experiments. Both proprietary and publicly-available models are considered, and the field data cover a wide variety of source scenarios and thermodynamic behavior.

D. METHODOLOGY

The statistical performance measures are tabulated and discussed for six publicly-available computer models (AFTOX, DEGADIS, HEGADAS, INPUFF, OB/DG, and SLAB) and six proprietary computer models (AIRTOX, CHARM, FOCUS, GASTAR, PHAST, and TRACE). In addition, results are presented for two simple analytical models--the Gaussian plume model (GPM) and the Britter and McQuaid model (B&M). These models were applied to data from eight field tests, where the source scenarios include continuous dense gas releases (Burro, Coyote, Desert Tortoise, Goldfish, Maplin Sands, and Thorney Island-C), instantaneous dense gas releases (Thorney Island-I), continuous passive gas releases (Prairie Grass and Hanford-C), and instantaneous passive gas releases (Hanford-I).

The report contains discussions of the following major topics:

- Creation of Modelers Data Archive (MDA)--Each field experiment is described in detail and the data from all experiments are combined in a consistent Modelers Data Archive (MDA) that can be used to initialize and evaluate all of the models. The MDA is listed in an Appendix to Volume II, and a floppy disk containing the MDA is available to all interested persons.

- Application of Models to MDA--The 14 models are reviewed and methods of applying them to the MDA are discussed. In many cases, preprocessor and postprocessor software had to be written so that all 14 models could begin from the same set of input data and could produce consistent output data.

- Statistical Model Evaluation--The model performance measures (mean bias, mean square error, correlation coefficient, fraction within a factor of two) and their confidence limits are calculated for each model and each data group and are presented in tables and figures. The primary mode of graphical presentation is a figure with mean square error on the vertical axis and mean bias on the horizontal axis, on which points are plotted for each model. Summary tables are provided.

- Residual Plots-- Many figures are given, in which ratios of prediction to observation are plotted versus input parameter (for example, wind speed or stability) for each model. Conclusions are given in summary tables.

- Sensitivity Study--The Monte Carlo sensitivity software is used to determine the sensitivity of the SLAB model to variations in input parameters.

E. CONCLUSIONS

- A few models can successfully predict concentrations with a mean bias of 20 percent or less, a relative scatter of 50 percent or less, and little variability of the residual errors with input parameters.

- The four models (BM, GPM, SLAB, and HEGADAS) that produce the best "Factor of Two" agreement are on the list of six models (BM, GPM, SLAB, HEGADAS, CHARM, and PHAST) that produce the most consistent performance for the statistics describing the mean bias and the variance.

- The performance of any model is not related to its cost or complexity.

- In two of the three data groups, the "best" model is one which was not originally developed for that scenario (that is, GPM for continuous dense gas releases and SLAB for continuous passive gas releases).

- The BM, GPM, SLAB, and HEGADAS models demonstrate the most consistent performance for the "fraction within a factor of two" (FAC2) statistic.

- The results of the analyses in this section lead to the recommendation that the following simple, analytical formulas can be confidently used for screening purposes for sources over flat, open terrain:

BM (Britter and McQuaid) for continuous and instantaneous dense gas releases.

GPM (Gaussian Plume Model) for continuous passive gas releases.

There are insufficient field data to justify recommendations for instantaneous passive gas releases. However, the EPA's INPUFF model appears to perform reasonably well for the Hanford dataset in Figure 14b.

These screening models would not be appropriate for source scenarios and terrain types outside of those used in the model derivations. For example, because the screening models neglect variations in roughness length, they would be inappropriate for urban areas or heavily industrialized areas.

F. RECOMMENDATIONS

This evaluation exercise has been by no means independent, since all of the models have been previously tested by the developers with at least one of the datasets. Furthermore, some of the results may be fortuitous, since, in a few cases, certain models have been applied to source scenarios for which they were not originally intended.

In the future, our model evaluation software should be used to evaluate models with new independent datasets. An attempt should be made to set up standards for models so that they all conform to certain scenarios and to certain input and output data requirements.

SECTION I

INTRODUCTION

A. OBJECTIVES

This is Volume II of a three volume set describing the results of a project in which a quantitative method has been developed to determine the uncertainties in hazardous gas models. The first volume discusses the user's guide for this model evaluation method and the third volume discusses the three components of model uncertainty--data input errors, stochastic fluctuations, and model physics errors. The current volume provides an example of the application of the procedures.

The Phase II research has had the following eight technical objectives or tasks. The volume of the final report that deals with each of the following tasks is listed in parentheses at the end of the paragraphs.

Task 1: **Archival of Data Sets and Preparation of Modelers Data Bases.** A computerized archive of field data sets has been prepared. This archive includes a broad range of source conditions, meteorological conditions, and averaging times. The information in the data base is sufficient to run any of the models. (Volume II)

Task 2: **Archival of Hazard Response Models, including Testing.** A comprehensive archive of available microcomputer-based hazard response models has been prepared. This includes recently developed or modified publicly-available models such as SLAB and DEGADIS, as well as proprietary models that are in common use. (Volume II)

Task 3: **Application of Models to Test Data.** Predictions from the models obtained under Task 2 were produced for the field tests obtained under Task 1. In some cases it was necessary to make additional calculations so that the input data are in the form acceptable by the model, or so that the model output data are in the form required by the model evaluation software. (Volume II)

Task 4: **Further Development of Model Evaluation Software.** The statistical model evaluation software has been refined and further developed so that it is sufficiently general to take a wide variety of input data sets and calculate a complete set of possible performance measures. It is possible to calculate confidence intervals (that is, model uncertainties) from this procedure. (Volume I)

Task 5: **Application of Model Evaluation Software.** The model evaluation software was applied to the model predictions and data sets in our archive. Estimates of typical confidence limits for certain classes of models and sizes of data set were made. (Volume II)

Task 6: **Assessment of Data Uncertainties.** The contribution of data uncertainties to total model error were estimated. Part of this research involves investigation of Air Force meteorological instrumentation and quality control/quality assurance procedures, as well as field tests by NCAR scientists of instrument accuracy and representativeness. (Volume III)

Task 7: **Assessment of Stochastic Uncertainties.** The contribution of stochastic or random uncertainties to total model error was further studied, and a quantitative procedure was developed for estimating this component as a function of receptor position, source type, sampling and averaging time, and meteorological conditions. The effect of these fluctuations on relations for toxic response were studied. (Volume III)

Task 8: **Assessment of Model Physics Errors.** Dimensional analysis and various reduction procedures were applied to the complete archive of data sets and models in order to isolate the contribution of errors in model physics assumptions to the total model uncertainty. (Volume III)

B. BACKGROUND

The U.S. Air Force and the American Petroleum Institute, among others, have increased emphasis on calculating "toxic corridors" due to potential release of hazardous chemicals. The Ocean Breeze/Dry Gulch (OB/DG) model was originally used for calculating these corridors, and does contain an estimate of model uncertainty. However, the OB/DG model does not account for many important scientific phenomena, such as two-phase jets, evaporative emissions, and dense gas slumping. The new models mentioned above are more advanced scientifically, but do not include model uncertainty. The intent of this research is to fully develop quantitative model evaluation procedures, better estimate the components of the uncertainty (data input errors, stochastic uncertainties, and model physics errors), and test the procedures using a wide spectrum of field and laboratory experiments.

Several evaluations of dispersion models applicable to the release of toxic material to the atmosphere were reviewed in the Phase I report for this project. We repeat reviews of the more recent studies, and include an overview of a recent evaluation program sponsored by EPA.

1. EPA Model Evaluation Program

The EPA has been sponsoring a related dense gas model evaluation project being performed by TRC Environmental Consultants. We have exchanged ideas and information with the EPA scientists, and have reviewed a preliminary draft copy of their final report (Reference 1). The purpose of this section is to briefly compare the methods and results of the two studies.

The two studies are evaluating the models in the list below:

	EPA	USAF/API
Publicly Available	SLAB DEGADIS	SLAB DEGADIS GAUSSIAN PLUME MODEL INPUFF AFTOX HEGADAS OB/DG Britter & McQuaid

	EPA	USAF/API
Proprietary	AIRTOX CHARM TRACE FOCUS SAFEMODE	AIRTOX CHARM TRACE FOCUS PHAST GASTAR

It is seen that the USAF/API study includes six more publicly-available models and one more proprietary model.

The following field data sets are used:

	EPA	USAF/API
Dense Gas	Burro Desert Tortoise Goldfish	Burro Desert Tortoise Goldfish Coyote Maplin Sands Thorney Island

	EPA	USAF/API
Passive Gas		Prairie Grass Hanford Kr85

The EPA study was deliberately restricted to data sets in which dense gases were continuously released for periods of three to ten minutes. The total numbers of individual field tests in the EPA and USAF/API studies are 9 and 118, respectively.

The EPA contractor permitted the model developers to advise them on how to run the models (for example, definitions of input conditions and choices of model options), whereas the models were run in a more independent manner in the USAF/API study. The developers were asked to comment on the way their models were set up in the USAF/API study, but the final decision was made by us.

The model performance measures used in the two studies are similar. Both considered maximum concentrations and plume widths on monitoring arcs. In any given field test, there were about two to seven monitoring arcs.

The results of the EPA study were inconclusive. The TRACE, CHARM, DEGADIS, and SLAB model performances were not significantly different, and "none demonstrated good performance consistently for all three experimental programs". In contrast, as will be shown below, the USAF/API results were more conclusive, perhaps because of the much larger set of data.

2. Model Sensitivity Studies

During 1986 and 1987, Professor Carney of Florida State University prepared several papers for the AFESC on the sensitivity of the AFTOX, CHARM, and PUFF models to uncertainties in input data (Reference 2). His 1987 paper applied the uncertainty formula suggested by Freeman et al. (Reference 3), which has also been applied by Hanna (Reference 4) to a simplified air quality model. If concentration, C, is an analytical function of the variables x_i (i = 1 to n), then the uncertainty or variance $V_c = \sigma_c^2$ is given by the equation

$$V_c = \sum_{i=1}^{n} \left(\partial C/\partial x_i\right)^2 V_{xi} + \sum_{i=1}^{n} \sum_{j=1}^{n} \left(\partial^2 C/\partial x_i \partial x_j\right)^2 V_{xi} V_{xj} \quad (1)$$

$$+ \ 0.5 \sum_{i=1}^{n} \left(\partial^2 C/\partial x_i^2\right) V_{xi}^2$$

where V_{xi} is the uncertainty or variance in input variable x_i. This equation is a Taylor expansion and implicitly assumes that the individual uncertainties are much less than one. Carney (Reference 2) finds that the wind speed, u, contributes the most uncertainty to the concentration, C, predicted by the AFTOX model.

3. Summary of Field Data

Ermak et al. (Reference 5) has put together a comprehensive summary of 26 "bench mark" field experiments, including data from Burro (LNG), Coyote (LNG), Eagle (N_2O_4), Desert Tortoise (NH_3), Maplin Sands (LNG and LPG) and Thorney Island (Freon). This study (funded by AFESC) presents input data required by models and includes observed peak concentrations, average centerline concentrations, and average height and width of the cloud as a function of downwind distance. These data are sufficiently complete for anyone to run and evaluate his model.

4. A Methodology for Evaluating Heavy Gas Dispersion Models

In another recent draft report prepared for AFESC, Ermak and Merry (Reference 6) review methods for evaluating heavy gas dispersion models. They first list several specific criteria of interest to the Air Force:

- The methodology is to be based on comparison of model predictions with field-scale experimental observations.

- The methods of comparison must be quantitative and statistical in nature.

- The methods must help identify limitations of the models and levels of confidence.

- The methodology must be compatible with atmospheric dispersion models of interest to the Air Force.

These criteria are similar to those for our present study.

The Ermak and Merry (Reference 6) report is a review of general evaluation methods and heavy gas model data sets, and does not contain examples of applications of any new evaluation methods with field data sets. They first review the general philosophy of model evaluation, pointing out that sometimes evaluations of model physics are just as important as quantitative statistical evaluations. Much of their philosophical discussion follows the points made in a review paper by Venkatram (Reference 7). For example, a model whose predictions agree with field data but which contains an irrational physical assumption (for example, dense gas plumes accelerate upward) is not a good model. Also, they recognize that most model predictions represent ensemble averages, whereas field experiments represent only a single realization of the countless data that make up an ensemble. They emphasize that observed concentrations are strong functions of averaging time, and that most heavy gas dispersion models do not include the effects of averaging time.

Heavy gas dispersion models are distinguished from other dispersion models by three effects: reduced turbulent mixing, gravity spreading, and lingering. The main parameters of interest in evaluations of these models are the maximum concentration, the average concentration over the cloud, and the cloud width and height (all as a function of downwind distance, x). Ermak and Merry emphasize the ratio of predicted to observed variables and define several statistics, such as the mean and the variance. Methods of estimating confidence limits on these statistics are suggested, and the report closes with an example of the application of some of their suggested procedures to a concocted data set drawn from a Gaussian distribution.

5. Comprehensive Model Evaluation Studies

Mercer's (Reference 8) review emphasizes estimation of variability or uncertainty in model predictions, which he finds is typically an order of magnitude when outliers are considered. He includes the following quote from Lamb (Reference 9), which is also appropriate for our discussion.

"The predictions even of a perfect model cannot be expected to agree with observations at all locations. Consequently, the common goal of model validation should be one of determining whether observed concentrations fall within the interval indicated by the model with the frequency indicated, and if not, whether the failure is attributable to sampling fluctuations or is due to the failure of the hypotheses on which the model is based. From the standpoint of regulatory needs the utility of a model is measured partly by the width of the interval in which a majority of observations can be expected to fall. If the width of the interval is very large, the model may provide no more information than one could gather simply by guessing the expected concentration. In particular, when the width of the interval of probable concentration values exceeds the allowable error bounds on the model's predictions, the model is of no value in that particular application."

Mercer (Reference 8) then produces concentration predictions of ten different models for a dense gas source equivalent to that used in the Thorney Island experiments. This comparison shows that the 10 model predictions range over an order of magnitude at any given downwind distance.

6. CMA Model Evaluation Program

The Chemical Manufacturers' Association (CMA) sponsored an evaluation of eight dense gas dispersion models and nine spill evaporation models (References 10 and 11). The authors ran some of the models themselves and requested the developers of proprietary models to run their own models using standard input data sets. Model uncertainty is typically a factor of two to five. The comparisons are clouded by the use of some data sets that had already been used to "tune" certain of the models tested.

C. SCOPE

This introductory section has provided an overview of the objectives of the entire project, which was initiated because there are no standard objective quantitative means of evaluating microcomputer-based hazard response models. There are dozens of such models including several sponsored wholly or in part by the U.S. Air Force and the American Petroleum Institute: ADAM, AFTOX, CHARM, DEGADIS, SLAB, and OB/DG. A few data sets exist for testing these models, but, up until now, the models have not been tested or intercompared with these data on the basis of standard statistical significance tests. The U.S. EPA recently sponsored a related model evaluation project (Reference 1), which had a more limited scope and considered fewer models and datasets.

In this volume, we focus on a demonstration of the system to evaluate the performance of micro-computer-based dispersion models that are applicable to releases of toxic chemicals into the atmosphere. The study includes a total of 14 models and 8 datasets. The datasets are described in Section II, and the models are described in Section III. Results of the statistical evaluations are presented in Section IV, and a scientific evaluation of the distribution of residuals is presented in Section V. One example of how Monte Carlo procedures described in Volume I can be used to investigate the sensitivity of a model to uncertainties in the input data is discussed in Section VI. The overall results are presented in Section VII.

When reading about the evaluations presented in Section IV and V, it is important to remember that, in many cases, there can be more than one way to apply a given model to a given dataset. Our approach has been to retain a fair degree of "independence" from the developers of the models being tested. We assembled/developed the data required as input to the models, assembled/developed the data against which the models are compared, applied the models, and then requested comments on our approach from the developers of the models. We supplied each developer with a description of the datasets and the procedure used to apply the developer's model to each dataset. We also provided a list of the concentrations obtained from the model, and those concentrations against which the modeled concentrations are compared, but we did not provide any indication of model performance relative to other models used in the study. Comments solicited in this way resulted in changes to our evaluation only if errors in the application were discovered. In this way, we were able to maintain a uniform approach to all of the models, and we consider the results indicative of what would be obtained by modelers "in the field."

This approach did not, however, preclude earlier discussions with the model developers. Upon reading the user's manuals, clarifications were sometimes needed, and these were addressed by means of telephone conversations and/or letters. Some of the models in the study underwent revisions during the study, so that some interaction focused on implementing new versions of the models. Such new versions sometimes contained bugs that became obvious as we began to use them, and this information was immediately passed on to the developer, and generally resulted in a revision. We emphasize, however, that none of these interactions focused on model performance issues arising from work performed during this study. Section III B characterizes the nature of our interactions with each of the model developers.

SECTION II

DATASETS

A. CRITERIA FOR CHOOSING DATASETS

The hazard response models included in this study (see Section 3) possess widely varying capabilities, but the majority do have several traits that influence the choice of datasets for evaluating this group of models. Chief among these is a preference for treating near-surface releases. As a result, we have not included datasets in which an elevated (say, more than a meter or two above the surface) source is used. Beyond this restriction, our criteria for selecting the datasets include:

1. Concurrent meteorological data must be available, obtained from sensors located near the site of the trials.

2. Concentrations should be available at more than one distance downwind, with sufficient lateral resolution to document the spatial structure of the cloud.

3. Temporal resolution of the concentration measurements should be less than the smaller of the duration of the release or the time-of-travel from the point of release to the nearest monitor.

4. Datasets chosen should document dispersion over a wide range of meteorological dispersion regimes.

5. Datasets chosen should include passive or "tracer" gas releases as well as dense-gas releases.

6. Datasets chosen should include instantaneous releases and continuous releases.

Many field experiments have been conducted for the purpose of evaluating dispersion models. Draxler (Reference 12) reviews many carried out with positively or neutrally buoyant sources. Hanna and Drivas (Reference 13) review many carried out with negatively buoyant sources. A total of 16 datasets derived from these reviews were considered for inclusion in this

TABLE 1. LIST OF EXPERIMENTS THAT WERE CONSIDERED FOR THE MODEL EVALUATION DATA ARCHIVE.

Name	Material Released	Dense Gas	Type of Release	
			Quasi-Continuous	Instantaneous
Burro	LNG	√	√	
Coyote	LNG, LCH_4	√	√	
Desert Tortoise	NH_3	√	√	
*Eagle	N_2O_4	√	√	
*Falcon	LNG	√	√	
Goldfish	HF	√	√	
*Porton Down	Freon-12	√		√
Thorney Island	Freon-12(N_2)	√	√	√
Maplin Sands	LNG, LP	√	√	√
Prairie Grass	SO_2		√	
*Dry Gulch	FP		√	
*Ocean Breeze	FP		√	
*Green Glow	FP		√	
Hanford Kr^{85}	Kr^{85}		√	√
*Sandstorm	Be		√	
*Adobe	Be		√	

* Not included in the modeling data archive

project, and are listed in Table 1. Nine involve releases of denser-than-air gases, while seven involve the release of gases or suspended particles in amounts small enough to act as passive tracers.

Based on a review of the data and the documentation for these 16 experiments, a decision was made not to consider seven of them. Neither the ADOBE nor Sandstorm experiments were included in the study, since they were concerned with the transport and diffusion of buoyant exhaust clouds from rocket motors. Few of the models tested in this project can accommodate a buoyant cloud, and furthermore, there are not sufficient data on the exhaust characteristics of the rocket motors in the data reports to adequately define the temperature and volume flux of the jet. Data from the Falcon Experiments were excluded from the study for two reasons: only one of the trials was successful from the point of view of evaluating diffusion models, and a data report is not available. The Eagle tests were also excluded, since some of the tests involved the use of a barrier to the flow, which sets them apart from the remainder of the datasets used in the study, and there were instrument problems with the remaining tests.

Of the remaining 11 experiments, 5 are tracer experiments (that is, the chemical that is released behaves as an inert or passive non-buoyant substance as it disperses downwind). The Prairie Grass experiment provides high quality dispersion data over a wide range of turbulence regimes at an ideal site. The Dry Gulch, Ocean Breeze, and Green Glow data are not included because they are similar to the Prairie Grass data, yet cover a more limited range of stabilities. The Kr^{85} tracer experiment conducted in Hanford, WA is included because it provides good data for puff releases as well as quasi-continuous releases of neutral-density or passive gases.

One of the remaining dense-gas dispersion datasets was recently dropped from consideration as well. The Porton Down dataset includes 42 trials in which mixtures of Freon-12 and air were released in the form of an instantaneous cloud. Those trials include variations in initial cloud density, wind speed, and surface roughness, but they lack an extensive array of monitors capable of providing continuous concentration measurements. The primary monitors provided only dosage measurements. These dosages can be used to estimate a mean concentration during the time over which the cloud passed through the monitoring array, but we found that these estimates contribute little to the goal of quantifying model performance. We expected that the models would tend to produce estimates of peak concentration which would exceed the average concentrations estimated from the dosages--and all of the models did. No additional information could be obtained from the dataset. As a result, we have excluded the Porton Down trials from any further discussion in this report.

Hence, the performance evaluations are based on a total of 8 datasets. In the remainder of this section, we provide: a description of each of the field studies (Section II B); a description of the MDA containing data from each dataset (Section II C); a summary of the methods used to calculate information required by the MDA (Section II D); and an overall summary of the datasets (Section II E).

B. DESCRIPTION OF INDIVIDUAL FIELD STUDIES

1. Burro and Coyote

Both the Burro (Reference 14) and Coyote (Reference 15) series of trials were conducted at the Naval Weapons Center (NWC) at China Lake, California. Sponsored by the U.S. Dept. of Energy and the Gas Research Institute, the trials consisted of releases of LNG onto the surface of a 1 m deep pool of water, 58 m in diameter. In addition, the Coyote series expanded on the earlier Burro trials by studying the occurrence of rapid-phase-transitions (RPT), and included releases of liquefied methane and liquid nitrogen. The Burro series focused on the transport and diffusion of vapor from spills of LNG on water. The Coyote series focused on the characteristics of fires resulting from ignition of clouds from LNG spills, and the series also focused on the RPT explosions. In all, eight trials from the Burro series and four trials from the Coyote series are suitable for testing transport and diffusion models.

For the Burro series, twenty cup-and-vane anemometers were located at a height of 2 m at various positions within the test array in order to map the wind field. There were six 10 m tall turbulence stations, one upwind and five downwind, which had bivane anemometers at three levels and thermocouples at four levels. Humidities were measured close to the array centerline at eight stations, including the upwind turbulence station. Ground heat-flux sensors were mounted at seven downwind stations along with the humidity sensors. Figure 1 shows the configuration of the test site.

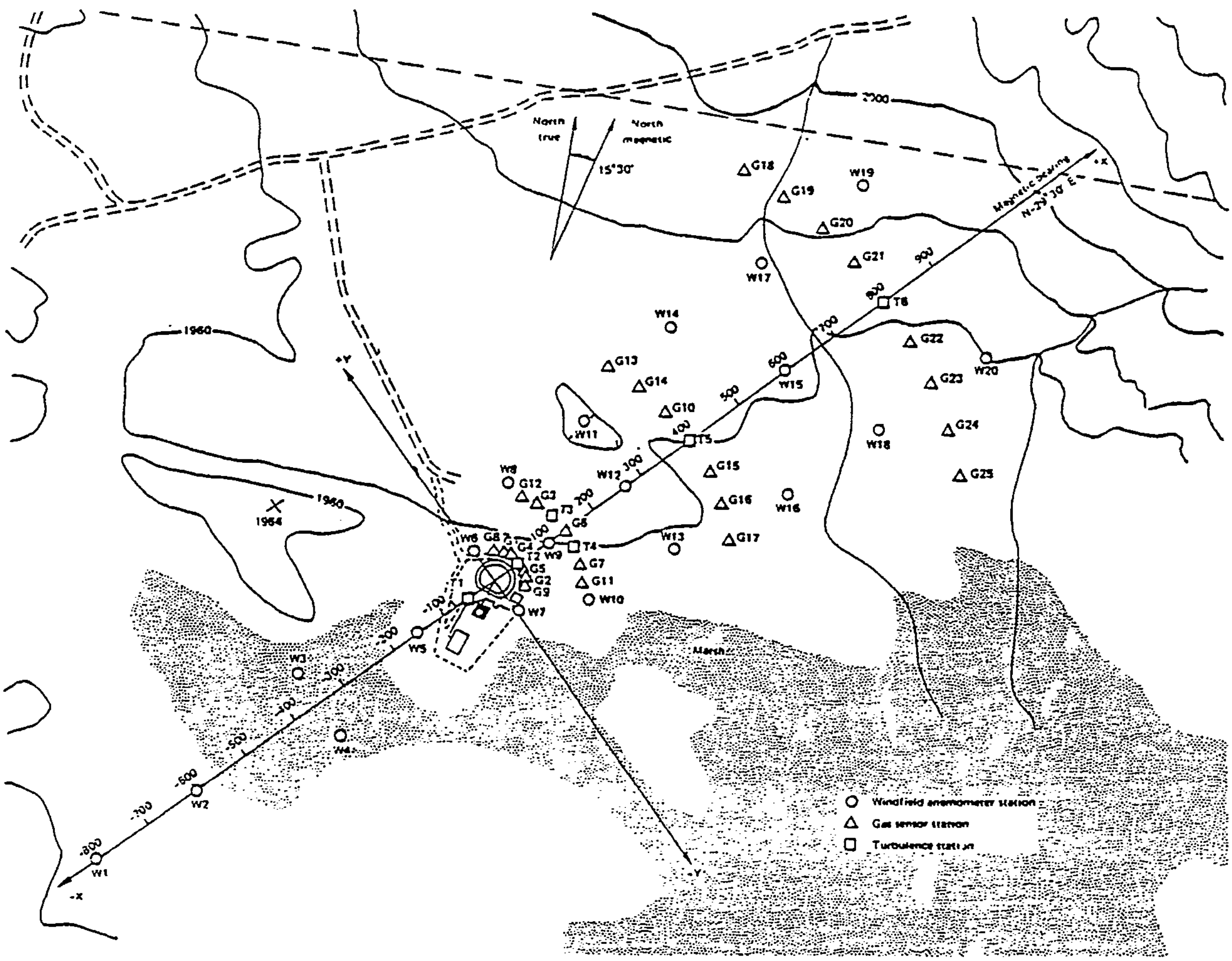


Figure 1. Instrumentation Array for the 1980 LNG Dispersion Tests at NWC, China Lake (Reference 14).

Concentrations were measured at heights of 1 m, 3 m, and 8 m at 25 gas-sampling stations and 5 turbulence stations arranged in arcs at distances of 57 m, 140 m, 400 m, and 800 m downwind from the spill point. The turbulence stations sample the data at a higher rate than the gas stations (3-5 Hz compared to 1 Hz). The lateral spacing between stations varied from 13 m at stations closer to the spill point, to 80 m at stations located 800 m downwind.

The Coyote series maintained a similar array of instrumentation. However, only two of the turbulence stations (one upwind, one at 300 m downwind of the spill site) were instrumented with bivane anemometers because of a concern that they might be damaged. Gas concentrations were measured at heights of 1 m, 3 m, and 8 m at 24 gas-sampling stations and 5 turbulence stations arranged in arcs at distances of 110 m, 140 m, 200 m, 300 m, 400 m and 500 m downwind from the spill point. Note that there were in fact only one and two gas sensors deployed at distances of 110 m and 500 m downwind, respectively. The lateral spacing between stations varied from 30 m at a distance of 140 m downwind to 60 m at a distance of 800 m downwind. Figure 2 shows the configuration of the test site.

Data from all eight Burro trials and three of the four Coyote trials are available on 9-track tape prepared by Lawrence Livermore National Laboratory (LLNL). Comparison data-reports (Burro, (Reference 14); Coyote, (Reference 15)) are also available, and proved very useful in preparing the data for use in the evaluations. The individual trials contained in these reports include

Burro: 2, 3, 4, 5, 6, 7, 8, 9

Coyote: 3, 5, 6

A brief summary of the characteristics of the source emissions and the meteorological conditions for the eight Burro trials and four Coyote trials is given in Table 2.

2. Desert Tortoise and Goldfish

These two series of field experiments were conducted at the Frenchman Flat area of the Nevada Test Site. The first in the series, Desert Tortoise (Reference 16) was designed to document the transport and

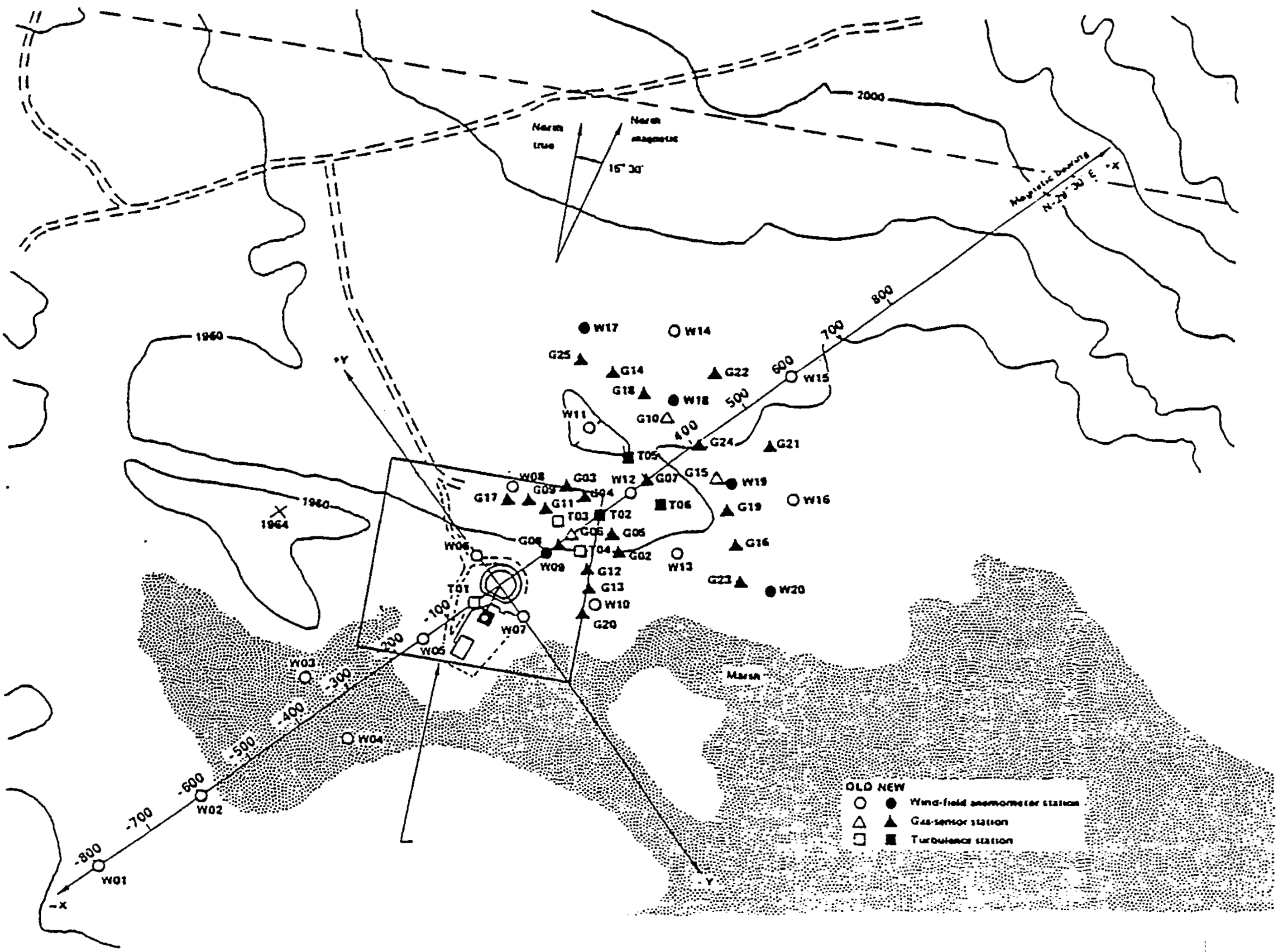


Figure 2. Instrumentation Array for the Coyote Series at NWC, China Lake. "Old" Locations Mark those used in the Burro Series (Reference 15).

TABLE 2. SUMMARY OF THE BURRO AND COYOTE TRIALS.

Test Name	Date	Material Spilled	Spill Volume (m^3)	Spill Rate (m^3/min)	Averaged Wind Speed (m/s)	Averaged Wind Direction (degrees)	Atmospheric Stability Class
Burro 2	18 June	LNG	34.3	11.9	5.4	221	C
Burro 3	2 July	LNG	34.0	12.2	5.4	224	C
Burro 4	9 July	LNG	35.3	12.1	9.0	217	C
Burro 5	16 July	LNG	35.8	11.3	7.4	218	C
Burro 6	5 Aug.	LNG	27.5	12.8	9.1	220	C
Burro 7	27 Aug.	LNG	39.4	13.6	8.4	208	C/D
Burro 8	3 Sept.	LNG	28.4	16.0	1.8	235	E
Burro 9	17 Sept.	LNG	24.2	18.4	5.7	232	D
Coyote 3	2 Sept.	LNG	14.6	13.5	6.0	205	C
Coyote 5	7 Oct.	LNG	28.0	17.1	9.7	229	C
Coyote 6	27 Oct.	LNG	22.8	16.6	4.6	220	D

diffusion of ammonia vapor resulting from a cryogenic release of liquid ammonia. For each of the four trials, pressurized liquid NH_3 was released from a spill pipe pointing downwind at a height of about 1 m above the ground. The liquid jet flashed as it exited the pipe and its pressure decreased, resulting in about 18 percent of the liquid changing phase to become a gas. The remaining 82 percent of the NH_3-jet remained as a liquid, which was broken up into an aerosol by the turbulence inside the jet. Very little, if any of the unflashed liquid was observed to form a pool on the ground. Dispersion of the vapor-aerosol cloud was dominated by the dynamics of the turbulent jet near the point of release, but the slumping and horizontal spreading of the cloud downwind of the jet zone indicated the dominance of dense-gas dynamics at later stages.

Figure 3 shows the configuration of instrumentation used during Desert Tortoise. Eleven cup-and-vane anemometers were located at a height of 2 m at various positions within the test array in order to define the wind field for the planning of field experiments and the subsequent calculation of plume trajectories. In addition, a 20 m tall meteorological tower was located just upwind of the spill area, with temperature measured at four levels and wind speed and turbulence at three levels. Ground heat fluxes were measured at that tower and at three locations just downwind of the spill.

NH_3 concentrations and temperatures were obtained at elevations of 1, 2.5, and 6 m on seven towers located along an arc at a distance of 100 m downwind of the source. In most cases, nearly all of the plume was below the 6 m level of the towers and within the lateral domain of the towers. Additional NH_3 concentration observations at elevations of 1, 3.5, and 8.5 m were taken on five monitoring towers at a distance of 800 m from the source, where the lateral spacing of the towers was 100 m. Finally there were two arcs with up to eight portable ground-level stations at distances of 1400 m or 2800 m, and on occasion at 5500 m downwind. No information on vertical distribution of NH_3 concentration was available from these more distance arcs.

The Goldfish trials are very similar to the Desert Tortoise NH_3 trials described above. Hydrogen fluoride (HF) was released using a similar release mechanism and some of the same sets of instruments. Note that

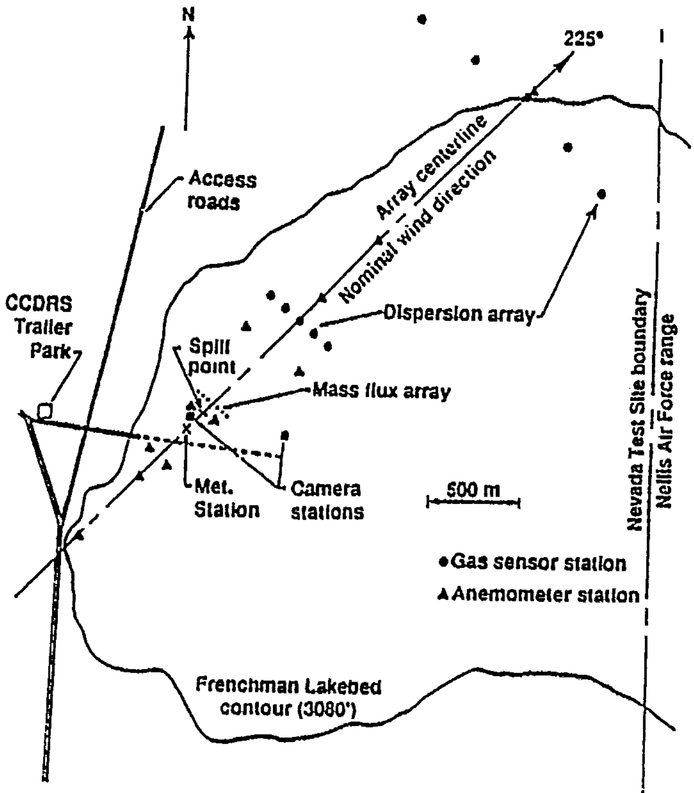


Figure 3. Sensor Array for the Desert Tortoise Series Experiments.

although six trials were conducted, the last three involved a study of the effectiveness of water sprays, and are not included in this evaluation demonstration. A portion of the liquid HF flashed upon release, creating a turbulent jet in which the unflashed liquid was broken up into an aerosol that remained in the jet-cloud. No pooling of the liquid was observed.

HF samplers were located on cross-wind lines at distance of 300, 1000, and 3000 m from the source. The closest line has 11 sampling locations, with instruments at heights of 1, 3, and 8 m at the inner 5 positions and instruments at a height of 1 m on the outer 6 positions. The 1000 m line has 13 sampling locations, with three levels of measurement on the inner 9 and only one level on the outer 4. The 3000 m line has 11 sampling locations, with a similar variation in sampler heights. In general the observed height of the HF cloud was less than the highest sampler level at the 300 m sampling line, but appeared to extend above the highest sample levels at the larger distances. The maximum ground level concentration and the cloud width could be accurately estimated in each test.

Data from the Desert Tortoise experiment are available on a 9-track tape from LLNL, and a companion report similar to the ones prepared for Burro and Coyote is also available (Reference 16). No such report is scheduled to be produced for the Goldfish experiment. Data for the 3 dispersion trials (not the three mitigation effectiveness trials) were obtained from Mr. D. Blewitt of AMOCO (one of the sponsors of Goldfish), and much of the documentation for these trials may be found in a paper that appeared in the International Conference on Vapor Cloud Modeling (Reference 17). The individual trials contained in these reports include:

Desert Tortoise:	1, 2, 3, 4
Goldfish:	1, 2, 3

Table 3 provides an overview of these two field experiments. Most of the trials were performed during "neutral" stability conditions, with moderate wind speeds of 3 to 7 m/s. Although generally similar, note that Desert Tortoise trials differ from Goldfish trials in that the spill rates are about an order of magnitude greater.

3. Hanford Kr^{85}

The results from 13 dispersion trials conducted at the Atomic Energy Commission's Hanford reservation are reported by Nickola (Reference 18). Five of these trials involved the instantaneous release of small quantities of the inert radioactive gas krypton-85 (Kr^{85}), and the other eight involved short-period releases of Kr^{85} over periods of ten to twenty minutes.

Up to as many as 64 detectors were operated along arcs located 200 m and 800 m downwind of the point of release. This section of the Hanford field diffusion grid is nearly flat, and is covered with sagebrush and steppe grasses. Most of the detector locations consisted of one detector set at 1.5 m above the surface. However, each row also included three towers on which five detectors provided a vertical profile of the Kr^{85} clouds. The configuration is shown in Figure 4. Note that the uppermost detectors did not extend above the top of the diffusing clouds.

Meteorological data are reported for averaging periods of 1 minute, 5 minutes, and the period over which data were collected during a trial. These data are taken from the faster-response instruments mounted on the 25 m tower located near the source, when available. Otherwise, the data are reported from strip-charts recorded by instruments on the 122 m tower. Tabulations of time-series of meteorological and concentration data for both the instantaneous and continuous releases of Kr^{85} are printed in the data report for the study (Reference 18). Wind speed, the standard deviation of wind speed and wind direction, and temperature are reported for consecutive 1-minute periods during each trial. Concentration data from the near-surface samplers (1.5 m above the ground) and the elevated sampling masts are reported at intervals of 38.4 seconds for the continuous release trials, and are reported at intervals of either 1.2, 2.4, or 4.8 seconds for the instantaneous release trials.

TABLE 3. SUMMARY OF DESERT TORTOISE AND GOLDFISH EXPERIMENTS.

Trial Name	Date	Duration (sec)	Spill Rate (m^3/min)	Averaged Wind Speed (m/s)	Averaged Wind Direction (degrees)	Atmospheric Stability Class
DT 1	24 Aug.	126	7.0	7.4	224	D
DT 2	29 Aug.	255	10.3	5.7	226	D
DT 3	1 Sept.	166	11.7	7.4	219	D
DT 4	6 Sept.	381	9.5	4.5	229	E
GF 1	1 Aug.	125	1.78	5.6	-	D
GF 2	14 Aug.	360	0.66	4.2	-	D
GF 3	20 Aug.	360	0.65	5.4	-	D

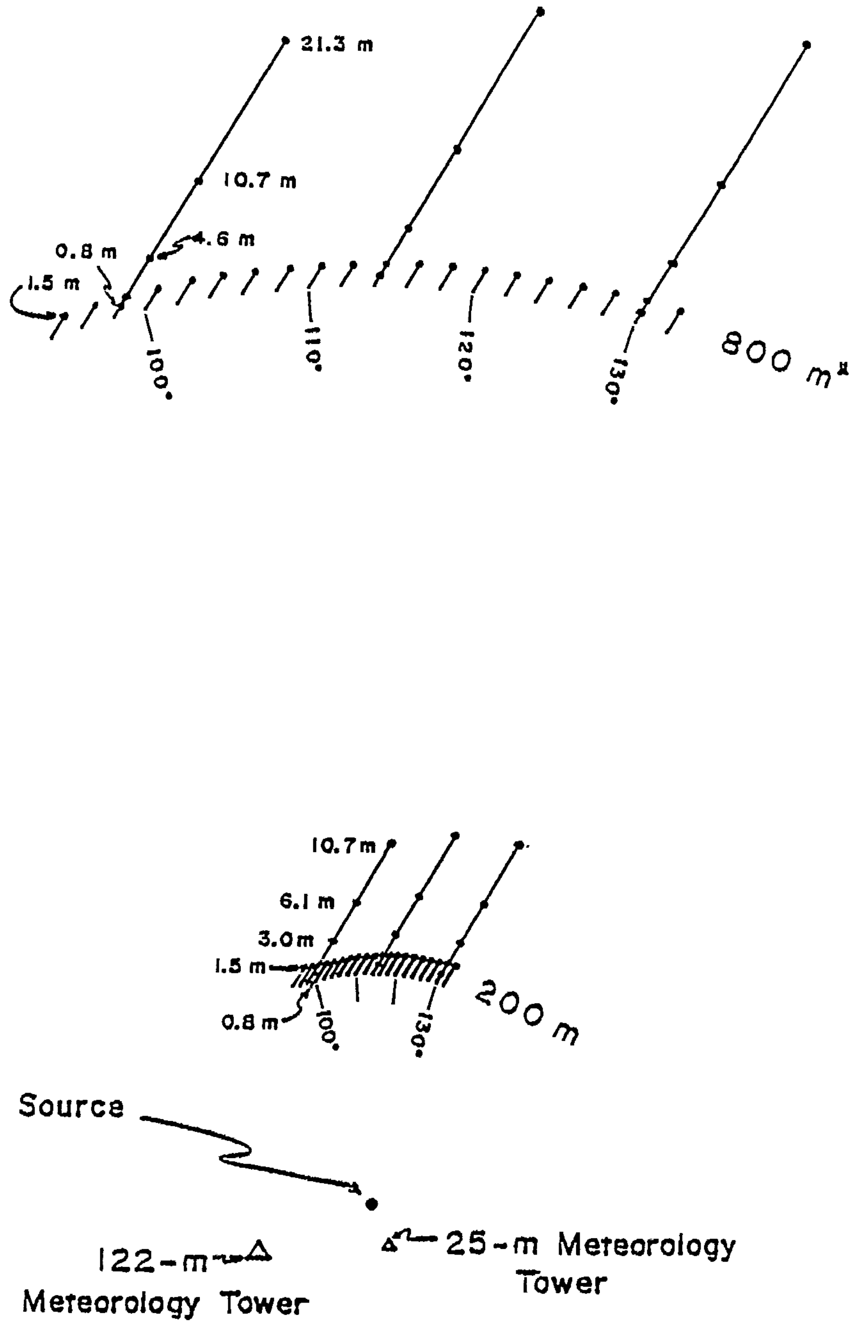


Figure 4. Configuration of Meteorological Towers and Kr^{85} Detectors for the Hanford Kr^{85} Trials (Reference 18).

As part of a project funded by the EPA, TRC Environmental Consultants, Inc. had entered the concentration data and meteorological data for six of the eight instantaneous release trials into computer files. The two trials dropped from use for this project were less desirable than the others because portions of the clouds drifted to the side of the array of detectors. We obtained these data and entered data for the five continuous-release trials into LOTUS 1-2-3 worksheets, preserving all of the information and structure of the original tables. The following trials comprise the data recorded on magnetic media:

Continuous-Release Trials: C1, C2, C3, C4, C5
Instantaneous Release Trials: P2, P3, P5, P6, P7, P8

A summary of the meteorological data for six of the eight instantaneous-release trials and all five continuous-release trials is presented in Table 4.

4. Maplin Sands

The dispersion and combustion trials conducted at Maplin Sands in 1980 (Reference 19) involved the release of liquefied natural gas (LNG) and refrigerated liquid propane (LPG) onto the surface of the sea. Each liquid was released in both a continuous and an instantaneous mode. The size of a spill during each trial was approximately 20 m^3.

Because the objective of the trials was to study the behavior of LNG and LPG vapor clouds over the sea, the site was located on the tidal flats of the Thames estuary. A shallow dike 300 m in diameter was constructed around the spill area to meet the requirement that the spill occur on the sea surface. Pontoons with either 4 m masts or 10 m masts were used to position meteorological instruments and sampling instruments along arcs downwind of the spill area. Figure 5 shows the pontoon configuration at the start of the series, and Figure 6 shows the revised configuration used after Trial 35. A

TABLE 4. SUMMARY OF HANFORD KRYPTON-85 TRACER RELEASES.

Trial No.*	Date (1967)	Start (PST)	End (PST)	Duration (min & sec)	Total Emitted (Ci)	Release Rate (Ci/Sec)	Wind Speed at 1.5 m (mps)	Qualitative Thermal Stability
P2	Sep 14	2300:00	-	-	10.0	-	1.3	Very Stable
C1	Sep 15	0000:00	0015:28	15:28	10.9	0.0117	1.3	Very Stable
P3	Oct 17	0738:00	-	-	10.0	-	4.2	Neutral
C2	Oct 17	0801:50	0801:50	15:05	10.9	0.0120	3.9	Unstable
P5	Oct 23	1052:40	-	-	10.0	-	8.0	Unstable
C3	Oct 23	1101:25	1115:40	14:15	23.8	0.0278	7.1	Unstable
P6	Oct 23	1130:00	-	-	10.0	-	7.3	Unstable
P7	Oct 24	1052:30	-	-	10.0	-	4.6	Unstable
C4	Oct 24	1104:30	1114:28	9:58	22.8	0.0388	3.9	Unstable
C5	Nov 8	0512:22	0532:13	19:51	20.4	0.0171	2.6	Stable
P8	Nov 8	0602:00	-	-	10.0	-	1.5	Stable

* P: Denotes a puff (instantaneous) release
C: Denotes a continuous (short-period) release

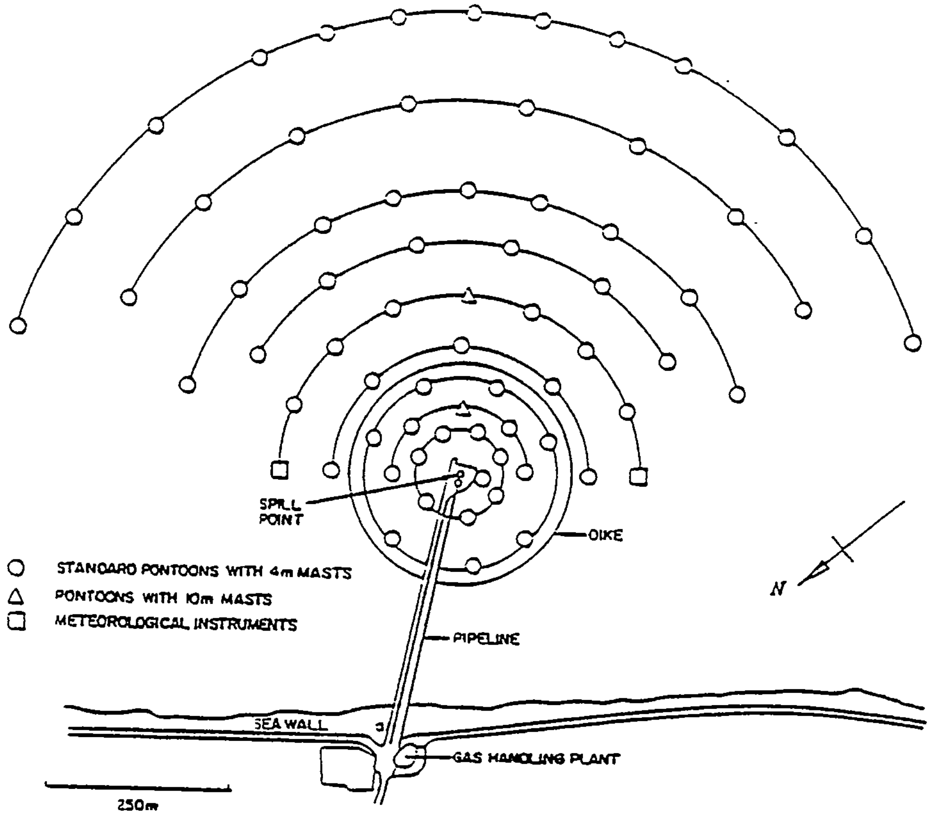


Figure 5. Initial Configuration of the Maplin Sands Site.

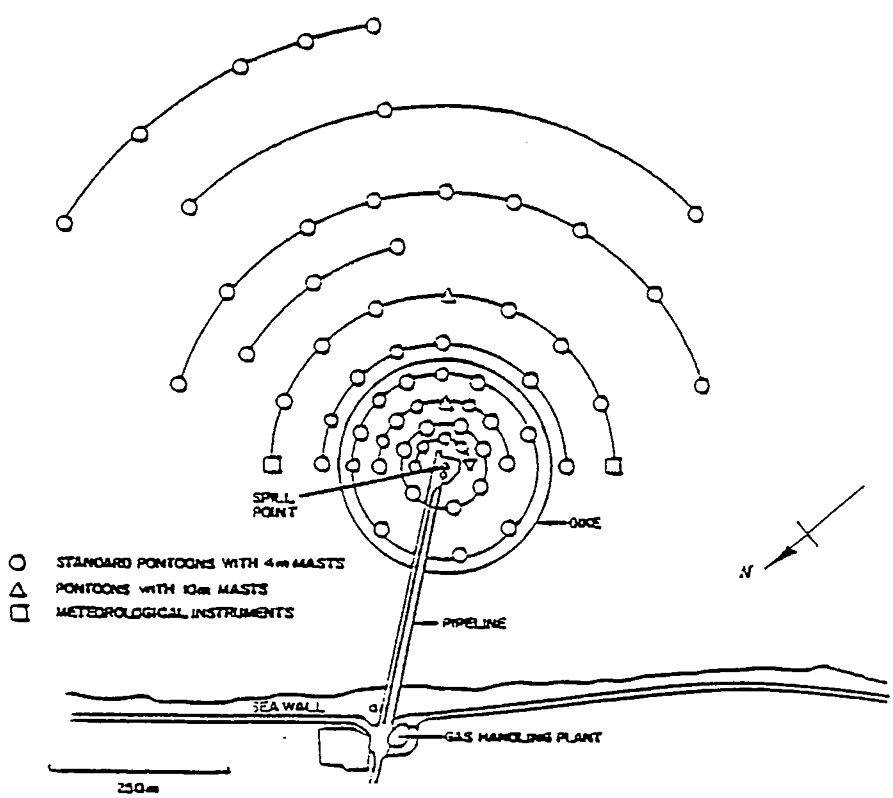


Figure 6. Revised Configuration of the Maplin Sands Site (After Trial 35).

total of 360 sensors were deployed in these trials, 200 of which were gas concentration sensors. Other types of sensors included:

Parameter	Instrument Type	Number Of Sensors
Wind speed	Cup anemometer	5
Wind direction	Vane	5
Turbulence	Ultrasonic anemometer	6
Air temperature	Platinum resistance	8
Relative humidity	Humicap	2
Insolation	Solarimeter	2
Sea surface roughness	Conductivity probe	1
Sea current	Turbine	2
Sea temperature	Platinum resistance	2
Cloud temperature	Thermocouple	66

Table 5 summarizes features of each of the Maplin Sands trials. The combustion aspects of some of these trials removes the vapor cloud, so the dispersion data are available only up to the moment of ignition. Not all of these trials are used in the performance evaluations. None of the instantaneous trials are retained. Within the continuous propane trials, trial 45 is dropped due to unsteady winds, and trials 51 and 55 are dropped because the vapor-clouds largely "missed" the sampler array. Within the continuous LNG trials, trial 37 is dropped due to the buoyant nature of the cloud, trial 39 is dropped because the cloud was ignited within 1 minute of the release, and trial 56 is dropped because much of the cloud did not pass through the sensor array. Trials 9, 12, and 15 are also dropped from the study because much of the LNG evaporated in the air prior to reaching the water (Reference 20), thereby complicating the nature of the release (a simple evaporating pool description is not appropriate). Therefore, the trials actually used in the performance evaluation are:

LNG: 27, 29, 34, 35

LPG: 42, 43, 46, 47, 49, 50, 52, 54

5. Prairie Grass

Project Prairie Grass, designed by Air Force Cambridge Research Center personnel, was held in north central Nebraska near O'Neill in the summer of 1956 (Reference 21). Small amounts of SO_2 were released continuously over 10-minute periods from ground level in the 70 trials that

TABLE 5. SUMMARY OF THE MAPLIN SANDS EXPERIMENT.

Trial Number	Volume (m^3)	Rate (m^3/min)	Duration of steady flow (s)	Wind Speed (m/s)	Comments
Continuous Propane					
42		2.5	180	3.7	Underwater release
43		2.3	330	5.5	
•45		4.6	330	~2	Wind very unsteady
46		2.8	360	8.1	
47		3.9	210	5.6	
49		2.0	90	6.2	Ignited
50		4.3	160	7.9	Ignited
*51		5.6	140	6.9	Ignited Plume center missed sensors
52		5.3	140	7.9	Underwater release
54		2.3	180	3.8	
*55		5.2	150	5.5	At edge of sensor array
Continuous LNG					
* 9		1.6	300	8.9	
*12		0.7-1.1	340	1.5	
*15		2.9	285	3.6	
27		3.2	160	5.5	Ignited
29		4.1	225	7.4	
34		3.0	95	8.6	
35		3.8	135	9.8	
*37		4.1	230	4.7	Pipe end below water surface Buoyant plume
*39		4.7	60	4.1	Ignited
*56		2.5	80	5.1	Plume only briefly over sensors
Instantaneous Propane					
*63	17.	-	-	3.4	
Instantaneous LNG					
*22	12.	-	-	5.5	Ignited
*23	8.5	-	-	6.6	Ignited briefly

• These trials are not included in the performance evaluation comprised the project. Dosage measurements were made on arcs located at distances of 50, 100, 200, 400, and 800 meters downwind. About half of the trials were conducted during unstable daytime conditions and the rest were held at night with temperature inversions present. Meteorological measurements included wind speed, direction, and fluctuations in direction from cup anemometers and airfoil type wind vanes. Micrometeorological data, rawinsonde data, and aircraft soundings were also taken.

The site was located on virtually flat land covered with natural prairie grasses. The roughness length determined for the site by some of the researchers was 0.6 centimeters. Dosages were measured at a height of 1.5 meters along the arcs using midget impingers. The meteorological data were given as 10-minute averages.

Earlier, the Porton Down dataset was dropped because most of the data obtained in the monitoring array are in the form of dosages. Why, then, are the dosages obtained during Prairie Grass acceptable? The reason is that the duration of the Prairie Grass releases (10 minutes) is long enough to create a quasi-steady plume over the monitoring array. In the absence of meandering, the time series of concentrations that might have been measured would have a plateau-like appearance. The average concentration estimated from the dosage (assuming a time-scale equal to the duration of the release = 10 minutes) would then be a fair estimate of the peak concentration. The Porton Down data, on the other hand, involve instantaneous releases, which would result in a time series of concentrations that might have been measured which would have a peak-like appearance. The mean concentration estimated from the dosage and the time it takes such a cloud to pass a monitor is a poor estimate of the peak concentration. Hence, the dosages from the Prairie Grass dataset are more useful for evaluating model performance. Note, however, that the average concentrations are still expected to be less than the peak concentrations.

Table 6 provides a summary of the meteorology for a subset of 44 trials that will be used on this project. These 44 represent the best of the program, and have been used extensively by other researchers (for example, Reference 22; Reference 23; Reference 24).

TABLE 6. SUMMARY OF SELECTED METEOROLOGICAL DATA FROM PRAIRIE GRASS TRIALS.

TRIAL	U (m/s)	STABILITY CLASS	TRIAL	U (m/s)	STABILITY CLASS
7	4.2	B	37	4.6	D
8	4.9	C	38	4.1	D
9	6.9	C	41	4.0	E
10	4.6	B	42	5.8	D
13	1.3	F	43	5.0	C
15	3.4	A	44	5.7	C
16	3.2	A	45	6.1	D
17	3.3	D	46	5.2	D
18	3.5	E	48	8.0	D
19	5.8	C	49	6.3	C
20	8.6	D	50	6.6	C
21	6.1	D	51	6.1	D
22	6.4	D	53	2.5	F
23	5.9	D	54	4.0	D
24	6.2	D	55	5.4	D
25	2.8	A	56	4.3	D
28	2.6	E	57	6.7	D
29	3.5	D	58	1.9	F
32	2.2	F	59	2.6	F
33	8.5	D	60	4.9	D
34	9.0	D	61	8.0	D
36	1.9	F	62	5.2	C

6. Thorney Island

The Heavy Gas Dispersion Trials project at Thorney Island (Reference 25) organized by the British Health and Safety Executive consists of the following five types of trials:

(1) Phase I - the instantaneous release of a preformed cloud of approximated 2000 m^3 of dense gas over flat terrain. Sixteen trials were carried out.

(2) Phase II - Ten trials were carried out to study the effects of obstacles on Phase I-type releases.

(3) Continuous release trials - Three trials in which approximately 2000 m^3 of heavy gas was released at a rate of 5 m^3/sec over flat terrain.

(4) GRI trial - A single Phase I-type of release.

(5) Phase III- Six continuous release trials in which a fenced enclosure surrounded the gas container.

For this project, we are focusing on the Phase I trials (item #1) and the continuous-release trials (item #3). The instantaneous-release trials of Phase I are similar in design to those conducted earlier at Porton Down, but the size of the source is approximately fifty times larger, and continuous monitors were used to obtain concentration measurements.

A gas container with a volume of 2000 m^3 was filled with a mixture of freon and nitrogen. For instantaneous release trials, the sides of the gas container collapsed to the ground upon release. For continuous release trials, the gas container simply served as a storage tank. The gas would then be ducted below the ground to the chosen release position. The release mechanism was designed to give a ground-level release with zero vertical momentum.

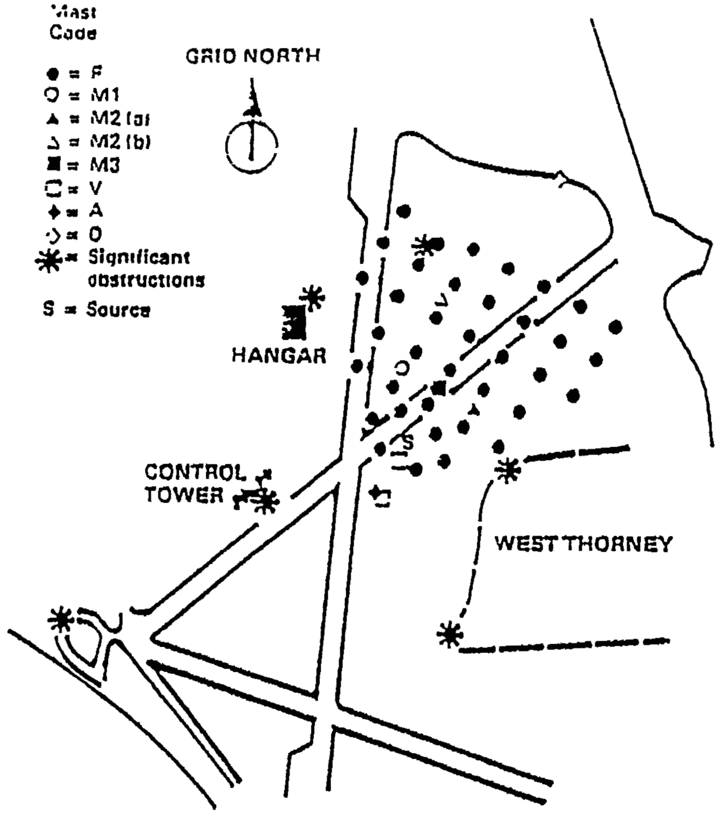
A 30 m tall meteorological tower was was located 150 m upwind from the release point. The instrumentation consisted of five cup anemometers, five temperature sensors, two sonic anemometers, and one sensor each for relative humidity, solar radiation and barometric pressure. Four trailer-mounted towers, with a total of eight sonic anemometers, were also deployed. Note that the 30 m tall tower was replaced by a 20 m tall tower for continuous release trials.

Thirty-eight towers were used to measure gas concentrations. Measurements were taken at four levels. The lowest gas sensor was positioned at a height of 0.4 m; and the highest at 4 m on towers close to the spill point, 10 m at most other towers, and 14.5 m at towers in the far field. The towers were placed on a rectangular grid with distances up to about 800 m from the release point. The four trailer-mounted towers mentioned previously also had gas sensors mounted at four different heights. The configuration of instrumentation at the site is shown in Figure 7.

Copies of the 9-track tapes containing data for the instantaneous release trials were obtained through the API, who had contributed to the experiments, and who are co-funding this model performance evaluation. We have averaged the 20-Hz data in blocks of 0.6 seconds each. Data for the continuous release trials were obtained from TRC Environmental Consultants, Inc., who had digitized plots of the data to produce data corresponding to 30-s averages. A total of 9 of the 16 continuous release trials and 2 of the 3 instantaneous release trials were retained for the evaluation. Trials 10, 11, and 46 were dropped because of wind-shifts during the trial; trial 4 was dropped because the cloud became elevated; trial 5 was dropped because the release mechanism malfunctioned, producing 2 clouds rather than 1; and trials 14, 15, and 16 were dropped because the density of the initial cloud appeared to be stratified. The trials included in this study are:

Instantaneous releases: 6, 7, 8, 9, 12, 13, 17, 18, 19
Continuous releases: 45, 47

A brief summary of the characteristics of the source emissions and the meteorological conditions for the Phase I and continuous release trials is given in Table 7.



Mast Code	Instrumentation
A	5 cup anemometers 2 sonic anemometers 6 thermometers 1 solarimeter 2 relative humidity sensors 1 wind vane
V	1 wind vane
F	4 gas sensors (1 Hz)
M1	1 sonic anemometer 4 gas sensors (1 Hz) 2 gas sensors (10 Hz)
M2 (a)	4 gas sensors (1 Hz) 2 sonic anemometers 2 gas sensors (10 Hz)
M2 (b)	4 gas sensors (1 Hz) 2 sonic anemometers 1 gas sensor (10 Hz)
M3	4 gas sensors (1 Hz) 3 sonic anemometers 3 gas sensors (10 Hz)
D	4 gas sensors (1 Hz) 1 cup anemometer 1 wind vane 1 relative humidity sensor 1 thermometer

Figure 7. Configuration of Instrumentation Used for the Phase I Trials at Thorney Island (Reference 25).

TABLE 7. SUMMARY DESCRIPTION OF PHASE I TRIALS AND CONTINUOUS RELEASE TRIALS.

Trial Number	Date	Wind[1] Speed m/s	Stability[2] Class	Volume Released m^3	Initial Relative Density
Phase I					
006	8/4/82	2.6	D/E	1580	1.60
007	8/9/82	3.2	E	2000	1.75
008	9/9/82	2.4	D	2000	1.63
009	9/15/82	1.7	F	2000	1.60
012	10/15/82	2.6	E	1950	2.37
013	10/19/82	7.5	D	1950	2.00
017	6/9/83	5.0	D/E	1700	4.20
018	6/10/83	7.4	D	1700	1.87
019	6/10/83	6.4	D/E	2100	2.12
Continuous					
045	6/9/84	2.1	E/F	2000	2.0
047	6/15/84	1.5	F	2000	2.05

1 Wind speeds are at 10 m height on the 'A' mast averaged over the duration of each experiment.

2 Pasquill Stability Categories are assessed from observation, solar radiation, vertical temperature gradient, standard deviation of horizontal wind direction and Richardson number.

C. CREATION OF A MODELERS' DATA ARCHIVE

Application of 14 dissimilar models to 8 databases containing a total of 96 trials demands that the data be placed in a common format. Furthermore, this format must include enough information to satisfy the input requirements of all of the models. We have developed what may be called a Modelers' Data Archive (MDA) to perform this function. It certainly does not contain all of the data from each experiment; rather, it contains only that information that we have used in running the 14 models. As such, the MDA is a subset of the complete database. Table 8 lists the information contained in an MDA file. Most of the entries are self-explanatory.

At the beginning of the MDA, information is given that defines the experiment and trial, followed by a listing of several chemical properties of the released substance. Chemical properties include the molecular weight, normal boiling point, latent heat of evaporation, heat capacity of the vapor phase, heat capacity of the liquid phase, the density of the liquid, and the Antoine coefficients. The coefficients for the Antoine equation for calculating vapor pressure as a function of temperature are taken from the SLAB user's guide, since only SLAB requires these as input. Physical properties of the release are then given, which not only provide specific dimensions, but also information on the general type of the release (source type and source phase) so that appropriate information can be passed to each of the models. Meteorological data appear next. Temperatures at two specified heights and wind speed at one specified height used to estimate the Monin-Obukhov length scale, L (although this may be specified directly). What is termed "domain average" values of wind speed and two measures of turbulence follow. This speed is the value actually used in the models, along with either the calculated value of L, or that observed. The earlier wind speed is used only in estimating L. If many near-surface measurements of wind speed are available, than a true "domain-average" speed can be used. However, if only one tower is available, then the speed measured near the surface (for near-surface releases) should be used as the "domain-average" speed. Site information includes the surface roughness length, soil (or water) temperature, and a soil moisture indicator. The Bowen ratio is a measure of the importance of the latent heat flux in computing the Monin-Obukhov length.

TABLE 8. LIST OF INFORMATION CONTAINED IN AN MDA FILE.

[illegible]								.
Liquefied natural gas								. Methane is at least 91% in composition
LNG								. 3-char. abbreviation of chemical
8								: number of trials included in MDA
8								: time zone designation
BU2	BU3	BU4	BU5	BU6	BU7	BU8	BU9	: trial ID
6	7	7	7	8	8	9	9	: month
18	2	9	16	5	27	3	17	: day
80	80	80	80	80	80	80	80	: year
15	15	14	16	16	18	19	18	: hour
59	08	07	20	05	12	09	37	: minute
17.46	17.26	17.05	17.08	17.24	18.22	18.12	18.82	: mol. weight (g/mole)
111.6	111.6	111.6	111.6	111.6	111.6	111.6	111.6	: normal boiling point (K)
511900.	511900.	511900.	511900.	511900.	511900.	511900.	511900.	: latent heat of evaporation (J/kg)
2238.	2238.	2238.	2238.	2238.	2238.	2238.	2238.	: specific heat - vapor (J/kg-K)
3348.5	3348.5	3348.5	3348.5	3348.5	3348.5	3348.5	3348.5	: specific heat - liquid (J/kg-K)
434.1	432.7	431.2	431.4	432.3	438.8	438.5	443.4	: density of liquid (kg/m**3)
8.8083	8.8083	8.8083	8.8083	8.8083	8.8083	8.8083	8.8083	: coefficient A for vapor pressure equation
983.89	983.89	983.89	983.89	983.89	983.89	983.89	983.89	: coefficient B for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: exit pressure (atm)
111.6	111.6	111.6	111.6	111.6	111.6	111.6	111.6	: source temperature (K)
35.91	36.30	36.09	34.89	37.17	38.60	41.85	45.13	: source diameter (m)
0	0	0	0	0	0	0	0	: source elevation (m)
EP	EP	EP	EP	EP	EP	EP	EP	: source type (IR,HJ,AS,EP)
L	L	L	L	L	L	L	L	: source phase (L,C,G)
58	58	58	58	58	58	58	58	: source containment diameter (m)
86.10	87.98	86.96	81.25	92.22	99.46	116.93	135.98	: spill/evaporation rate (kg/s)
173.	167.	175.	190.	129.	174.	107.	79.	: spill duration (s)
14980.	14712.	15221.	15444	11888.	17289	12453	10730.	: total released (kg)
1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	: initial concentration (ppm)
.927	.936	.933	.929	.923	.928	.929	.928	: ambient pressure (atm)
7.1	5.2	2.7	5.9	5.1	7.4	4.5	14.4	: relative humidity (%)
311.27	307.75	309.05	314.27	312.67	306.96	306.02	308.52	: ambient temperature #1-lower (K)
1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	: measurement height for temperature #1 (m)
310.22	306.03	307.97	313.28	311.64	306.53	306.28	308.42	: ambient temperature #2-upper (K)
10.	10.	10.	10.	10.	10.	10.	10.	: measurement height for temperature #2 (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: soil temperature (K)
3	3	3	3	3	3	3	3	: soil moisture (1:dry,2:moist,3:water)
5.59	5.58	9.35	7.79	9.35	8.75	1.94	5.94	: wind speed (m/s)
3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	: measurement height for wind speed (m)
5.4	5.4	9.0	7.4	9.1	8.4	1.8	5.7	: domain-avg wind speed (m/s)
1.8	1.19	1.19	1.13	1.08	1.16	0.27	0.74	: domain-avg sigma-u (m/s)
13.5	13.3	7.3	11.1	6.72	5.21	5.57	4.4	: domain-avg sigma-theta (deg)
2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	: measurement ht for domain-avg wind data (m)
360	360	360	360	360	360	360	360	: averaging time for domain-avg data (s)
.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	: roughness length z0 (m)
0.248	0.250	0.404	0.332	0.406	0.375	0.074	0.250	: friction velocity u-star (m/s)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: bowen ratio estimate
-.0085	-.1104	-.0270	-.0392	-.0210	-.0088	-.0606	-.0071	: inverse Monin-Obukhov length (1/m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	15.	: cloud cover (%)
3	3	3	3	3	4	5	4	: Pasquill-Gifford stability class (A-1;D-4;F-6)
35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	: latitude (deg)
117.7	117.7	117.7	117.7	117.7	117.7	117.7	117.7	: longitude (deg)
1.	1.	1.	1.	1.	1.	1.	1.	: averaging time for peak concentration (s)
40.	100.	80.	130.	70.	140.	80	50.	: averaging time for averaged concentration (s)
100.	100.	100.	100.	100.	100.	100.	100.	: concentration of interest for modeling (ppm)
1.	1.	1.	1.	1.	1.	1.	1.	: suggested receptor height for modeling (m)
2	2	2	2	2	3	4	4	: number of distances downwind
57.	57.	57.	57.	57.	57.	57.	57.	: distance downwind (m)
140.	140.	140.	140.	140.	140.	140.	140.	: distance downwind (m)
-99.9	-99.9	-99.9	-99.9	-99.9	400.	400.	400.	: distance downwind (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	800.	800.	: distance downwind (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: distance downwind (terminal record: -99.9)

It is the ratio of the sensible heat flux to the latent heat flux, and is generally estimated rather than calculated or measured. The last information in the file describes what specific information should be obtained from the model when applied to a particular experiment and trial: concentration averaging time, concentration of interest (for specifying the lateral extent of the cloud or signaling how far downwind the model calculations should extend), and receptor height and distances. Two averaging times are given. These correspond to the shortest averaging time contained in a dataset, and a longer averaging time that corresponds to the duration of the release (for quasi-continuous releases).

In many cases, not all of the entries are needed to characterize a trial. For example, no heat exchange or changes in phase occur in the Thorney Island trials, so the thermal properties of the gas are not used. Whenever this is the case, a value of "-99.9" may be contained in the MDA file.

The structure of the MDA file allows information describing a turbulent, two-phase jet-release to be specified within the same framework as a single-phase, evaporating pool-release. We have developed a set of programs to read the MDA files and produce tables of data needed to run each model. These tables provide all data in the units requested by the model. At the same time, the programs create all input files read by many of the models at the time of execution, so that these models are essentially driven directly from the MDA files. The goals satisfied in producing the MDA and software in this way are:

1. To document assumptions used to initialize the models in a consistent way,
2. To automate the process of preparing model-runs to the maximum possible extent,
3. To develop a way to easily implement alternate methods of initialization, and
4. To develop a framework for investigating the influence of data uncertainty on assessing model performance.

In addition to an MDA file for each experiment, concentration files were also prepared for the distances and averaging times contained in the MDA. Concentrations reported in these files represent the largest values measured at each distance, for each averaging time. For some datasets, a measure of the scale of the lateral half-width of the concentration distribution is characterized as σ_y at each location downwind. Both the concentrations and the values of σ_y are compared to predicted values to produce measures of model performance as described in Section IV.

D. METHODS FOR CALCULATING REQUIRED VARIABLES

Much of the information required to complete the MDA for each dataset is readily obtained. However, some entries do require explanation. In the following sections, we discuss how the MDA for each of the datasets was prepared. The MDA for each dataset is listed in Appendix A.

Measures of the observed concentration field must also be derived from the datasets. The performance of the models is assessed by comparing modeled "centerline" or "peak" concentrations and crosswind cloud-widths (σ_y) with those derived from the measured concentrations. The method used to characterize the observed values is best illustrated by considering a generic dataset in which time series of measured concentrations are available at several heights and locations along several monitoring arcs downwind of the point of release. For each arc, the peak concentrations and σ_y are obtained as follows:

A peak "instantaneous" concentration is found by selecting the single largest measured concentration from among all concentrations reported by all samplers at all heights, along the arc. No "instantaneous" σ_y is estimated. Next, a peak average concentration is found. To do this, we review the time series of concentrations along the arc, and define an averaging window that excludes the leading and trailing edges of the cloud. The length of this window is typically of the same order as the duration of the release for a quasi-continuous source. Concentrations are averaged over this window at each receptor, thereby producing a cross-section of average concentrations along the arc (across the cloud). The largest concentration in the cross-section is selected to represent the peak average concentration. Note that there is a likelihood that this method will slightly underestimate the peak, which may fall between receptors. A second-moment calculation involving the averaged concentrations at the lowest measurement-height along the arc then determines σ_y. However, several conditions must be satisfied before such a σ_y can be considered valid:

1. There must be at least four monitors reporting non-zero values of average concentration.

2. The receptor showing the maximum concentration must not be located at either end of the arc.

3. The lateral distribution must not exhibit a clear bi-modal pattern.

Departures from this treatment of a generic dataset are identified in the following discussions for each dataset.

1. Burro

The data report (Reference 14) contains summary sheets for the trials, which serve as the basis for most of the data placed in the MDA. The following comments should be noted:

- The mixture of methane, ethane, and propane that makes up the LNG is reported in the summary sheets. We use this information to calculate the molecular weight of the mixture, but all other properties in the MDA are for pure methane.

- The source diameter is calculated by assuming that the spill rate is equal to the total evaporation rate. Using an evaporation rate per unit area of 0.085 $kg/m^2/s$ for LNG on water, the diameter varies as a function of the rate of release.

- The source containment diameter is set equal to the diameter of the water test basin created for the series of experiments.

- The relative humidity is that termed "downwind humidity" in the summary sheets.

- The temperatures and wind speed used in calculating the Monin-Obukhov length are obtained from the "upwind vertical profile" data.

- The domain-averaged wind speed and turbulence data use the average values listed on the summary sheets.

- The Pasquill-Gifford stability class values are assigned on the basis of characterizations such as "neutral", slightly stable", etc.

  The following correspondence was assumed:

unstable, slightly unstable	C
neutral	D
slightly stable	E

- Peak concentrations (both "instantaneous" and average), and the σ_y, for the average concentration distribution along each monitoring arc are found as described for the generic dataset. Cross-sections of concentrations along each arc, which are plotted in the data report, provided the means for defining the windows for averaging the concentrations.

2. Coyote

The structure and documentation for the Coyote dataset is nearly the same as that for Burro, so that the process of preparing the MDA is virtually the same. The only departure is in specifying the Pasquill-Gifford stability class. The data report for Coyote (Reference 15) does not provide the stability classification. However, a later summary of a dataset for dispersion modeling (Reference 26) does report the stability class for each of the three trials in the MDA.

3. Desert Tortoise

The information placed in the MDA for this experiment is taken from the data report (Reference 16). The following comments should be noted:

- The exit pressure is assumed to equal the pressure measured prior to the point of discharge. It is not the tank pressure that is listed.

- The wind speed and the temperatures used to calculate the Monin-Obukhov length are those measured at site G01.

- The domain-averaged wind data are those reported as the average values at 2 m.

- The spill rate is the rate actually listed, with no adjustments for the results of the mass-flux estimates made from the data obtained along the arc at 100m downward of the point of release.

- Peak concentrations and values of σ_y for the arcs at distances of 100 m and 800 m downwind of the point of release are obtained in the manner described for the generic dataset.

4. Goldfish

The MDA for the Goldfish experiment was prepared from information contained in Blewitt (Reference 17), and from information obtained directly from Mr. D. Blewitt of AMOCO, one of the sponsors of the experiment. The following points should be noted:

- Some chemical properties listed for HF vary among several references. The latent heat of vaporization listed in Perry's Handbook (Reference 27) is 7460 cal/mol, which is equivalent to 1.558×10^6 J/kg. But Lange's Handbook of Chemistry (Reference 28) and a basic chemistry textbook (Reference 29) list the latent heat of vaporization as 1.8 Kcal/mol, which is equivalent to 3.76×10^5 J/kg. Several of the models that are evaluated also list the physical properties of HF. PHAST uses 1.266×10^6 J/kg at 293 K, and the user's guide for SLAB contains an example in which the latent heat of vaporization for HF is 3.732×10^5 J/kg. These differences may be due to different assumptions by the references regarding the degree of polymerization of the HF. We have chosen the number used by SLAB for this property of HF, because personnel at LLNL have developed SLAB and have conducted the Goldfish tests.

- The diameter of the discharge orifice is not listed in any of the references for this experiment. The values used in the MDA were obtained from Mr. D. Blewitt of AMOCO.

- Concentration measurements for short sampling times (of order 1s) are not available. Instead, averaging times are assumed to be either 66.6s, or 88.3s, depending on the sampler position. As a result, we only characterize the peak concentration for the averaging time associated with all samplers in a particular arc. A corresponding value of σ_y is calculated from the concentrations reported at monitors along the arc during the same period that contains the peak concentration. The methodology follows that for the generic case except no averaging is performed. Hence, the averaging time associated with σ_y is either 88.3 or 66.6s.

5. Hanford Kr^{85}

Kr^{85} is a radioactive gas, and was released in very small quantities both as a continuous release and as an instantaneous release. The instantaneous releases were accomplished by sealing a small volume of the gas in a quartz vial, and then dropping a weight onto the container to crush it. The continuous releases were accomplished by adding a very small amount of Kr^{85} to a cylinder of compressed argon gas, and releasing the mixture at a controlled rate. In both cases, the Kr^{85} was quantified in terms of its disintegration rate: Ci/s for the continuous releases, and Ci for the instantaneous releases. Concentrations downwind of the release were measured as radiation counts, and converted to the equivalent Ci/m^3 (actually expressed as $\mu Ci/m^3$).

Using a half-life of 10.4 years, we calculate that there are $2x10^{-8}$ kg-moles of Kr^{85} associated with 1 Ci. Because the instantaneous release made use of only 10 Ci, the mass and volume of the gas in the vial was very small. The continuous release rate did not exceed 0.0388 Ci/s of Kr^{85}, which amounts to approximately $7.8x10^{-10}$ kg-mole/s. However, because the Kr^{85} was introduced into an argon carrier-gas at an unspecified mixing ratio, we do not know the initial dilution of Kr^{85}.

Based on these considerations, we have modeled the Hanford Kr^{85} trials with a neutral-density gas, released at a small rate. The gas is taken to be "dry air", which ensures that dense-gas effects will not be significant in the simulations. Emission rates (kg/s) or total mass released (kg) of the "dry air" are established by arbitrarily assigning 1 kg of mass to 1 Ci, so that the instantaneous releases are modeled as if 10 kg (~ 1/3 kg-mole) of "dry air" were released, and the continuous releases are modeled as if 0.0388 kg/s (at most) of "dry air" were released.

Smaller amounts of "dry air" could have been modeled. For example, we could have assigned 1 g of mass to 1 Ci. This may alter model predictions. To gauge the effect of choosing 1 kg/Ci rather than 1 g/Ci in obtaining modeled normalized concentrations (that is, C/Q in $\mu s/m^3$ or μ/m^3), we ran the SLAB model both ways. The results are:

SLAB

TRIAL	DIST	1 kg/Ci C(ppm)	1 g/Ci C(ppm)	RATIO/1000
HC1	200	110.3	0.1093	1.009
	800	13.21	0.0132	1.001
HC2	200	3.384	0.00338	1.001
	800	0.255	0.000255	1.000
HC3	200	6.121	0.00612	1.000
	800	0.467	0.000467	1.000
HC4	200	6.785	0.00679	0.999
	800	0.486	0.000486	1.000
HC5	200	15.44	0.0155	0.996
	800	1.274	0.00127	1.003
HI2	200	1583	2.489	0.636
	800	87.85	0.0995	0.883
HI3	200	430.5	0.5049	0.853
	800	14.61	0.01526	0.957
HI5	200	388.2	0.4497	0.863
	800	14.31	0.01486	0.963
HI6	200	375.6	0.4346	0.864
	800	13.58	0.0141	0.963
HI7	200	328.8	0.3784	0.869
	800	10.88	0.01127	0.965
HI8	200	785.5	0.979	0.802
	800	29.99	0.0318	0.943

These results indicate that the initial size of the source (within SLAB at least) has a minor influence on scaled concentrations predicted at distances of 200 and 800 m from the source for the continuous release trials (HC's), but can have a significant influence on the prediction of concentrations for the instantaneous release trials (HI's). Note that 10 kg of "dry air" at standard temperature and pressure occupies approximately 7.7 m^3, which corresponds to a cube that is almost 2 m on a side.

Tables for INPUFF and GPM were also prepared to see to what extent the size of the source affects the scaled concentrations that are predicted. In applying both of these models, we specified an initial σ_y and σ_z to assure that the peak concentration at the source did not exceed the density of the gas at the source. Therefore, we expect to see at least a small effect of initial source volume on the predicted concentrations.

INPUFF Model

TRIAL	DIST	1 kg/Ci C(ppm)	1 g/Ci C(ppm)	RATIO/1000
HC1	200	69.21	0.06942	0.997
	800	7.53	0.007535	0.999
HC2	200	2.366	0.002369	0.999
	800	0.1933	0.000193	0.999
HC3	200	3.054	0.003058	0.999
	800	0.2534	0.000253	1.000
HC4	200	7.677	0.007691	0.998
	800	0.6247	0.000625	1.000
HC5	200	21.69	0.02173	0.998
	800	2.281	0.002282	1.000
HI2	200	3408	3.68	0.926
	800	110.2	0.1133	0.973
HI3	200	452	0.4415	1.024
	800	12.94	0.01305	0.992
HI5	200	111.3	0.1132	0.983
	800	3.034	0.003048	0.995
HI6	200	113.7	0.1156	0.984
	800	3.029	0.003044	0.995
HI7	200	132.1	0.1349	0.979
	800	3	0.003016	0.995
HI8	200	1059	1.136	0.932
	800	31.11	0.03167	0.982

GPM Model

TRIAL	DIST	1 kg/Ci C(ppm)	1 g/Ci C(ppm)	RATIO/1000
HC1	200	86.62	0.08803	0.984
	800	7.661	0.007695	0.996
HC2	200	2.139	0.002145	0.997
	800	0.1465	0.000146	0.999
HC3	200	3.463	0.003475	0.997
	800	0.2373	0.000237	0.999
HC4	200	8.71	0.008758	0.995
	800	0.5978	0.000598	0.999
HC5	200	23.68	0.02386	0.992
	800	1.875	0.001879	0.998

The continuous release trials show little influence, as was found for the SLAB runs. A greater effect is seen in the predictions at 200 m for the instantaneous releases, but it is not as large as the effect seen in the SLAB runs.

Because the trials are modeled as if "dry air" were released, the information on chemical properties in the MDA is taken from standard references. Release rates and meteorological data are taken from the data report (Reference 18). The following points should be noted:

- The source temperature is set equal to the ambient temperature measured at the lower instrument-height.
- The release rate of Kr^{85} in Ci/s is numerically equal to the release rate of our surrogate in kg/s.
- No distinction is made between the "wind speed" entry, and the "domain-averaged wind speed."
- Concentrations reported in units of Ci/m^3 are converted to ppm by dividing by the factor $\rho \times 10^{-6}$, where ρ is the density of dry air at ambient temperature and pressure.
- For the instantaneous releases, only peak concentrations for an averaging time of 4.8s are available. No σ_y values are calculated.
- For the continuous releases, short-term peak concentrations are obtained for an averaging time of 38.4s. Longer averages are calculated, and values of σ_y are calculated following the methodology of the generic dataset.

6. Maplin Sands

A series of data reports (Reference 30), one for each trial, contains information used to prepare the MDA for the LNG and the LPG trials. The following points should be noted:

- Molecular weights are calculated on the basis of the listed composition of the LNG or LPG for each trial. All other properties are those for methane (for LNG) or propane (for LPG).

- The temperature of the source is the boiling point temperature.
- The source diameter is calculated by assuming that the spill rate is equal to the total evaporation rate. We use an evaporation rate per unit area of 0.085 $kg/m^2/m$ for LNG on water, and a rate of 0.120 $kg/m^2/s$ for LPG on water.
- The duration of the spill is that listed as the period of steady discharge.
- Relative humidity for trials 29, 34, and 35 is not that listed in the data reports. Dr. J. Puttock informed us that the fetch for these three trials was over open water, rather than land. Relative humidities derived from measurements made at 1 m above the surface near the point of release are more representative than those listed in the data reports. We have placed the revised values in the MDA.
- Cloud cover is not reported, but photographs are included for each trial. We have estimated the cloud cover on the basis of these photographs.
- Concentration data are available in the form of plots, rather than on magnetic tape. We have obtained the peak concentration at a number of distances downwind of the release from plots of maximum concentration versus distance. Because the spacing of samplers along each arc was not small relative to the size of the vapor-clouds, reported concentrations cannot be considered good measures of the "true" peak concentrations, and no calculations of σ_y were attempted.

7. Prairie Grass

Data used to prepare the MDA for this dataset are derived from several sources. The 44 trials chosen for this evaluation are those deemed most useful by Briggs (Reference 22). Much of the meteorological data, and all source data and concentration data were obtained from Mr. B. Kunkel of AFGL, who had created data files from the original data report (Reference 21). Later analyses of the Prairie Grass data provided estimates of u_* and L (Reference 24), and σ_y (Reference 23). The following points should be noted:

- SO_2 is the tracer-gas released, so all chemical properties are those for SO_2.

- Concentrations are derived from dosages, for releases of 10 min duration. Therefore, no short-term concentrations are available.

- Because the Prairie Grass data are frequently cited as having been used in the development of the Pasquill-Gifford (PG) dispersion curves, which are said to be applicable for a surface roughness of 0.03 m, the roughness length for the Prairie Grass site might be thought to be 0.03 m. This is not true. All values of σ_z obtained from Prairie Grass had been "re-scaled" to be consistent with the roughness length 0.03 m when these data were used to develop the PG curves. The actual roughness for the site is 0.006 m.

8. Thorney Island

The data report (Reference 31) provided most of the information used to prepare the MDA. Additional analyses by Puttock (Reference 32) provided estimates of the roughness length for each trial (this varied by wind direction), and provided computed values of u_* and heat flux, from which the Monin-Obukhov length was calculated without requiring surrogate methods (as were employed for the other datasets). The following additional points should be noted:

- Molecular weight is calculated from the relative density of the cloud. The density of the air at ambient temperature and pressure is computed, and multiplied by the relative density. Knowing the molar volume of a perfect gas at ambient conditions, the molecular weight of the Freon/Nitrogen mixture is found. All other chemical properties listed in the MDA are those for pure Freon-12.

- The temperature of the cloud is set equal to the ambient temperature at "level 1."

- No distinction is made between the tower wind speed and the domain-averaged wind speed.

- Peak concentrations for the continuous releases are limited to averaging times of 30s, because these data were digitized from plots of the time series. No further averaging was applied, and no estimates of σ_y were attempted due to the nature of the monitoring array. The array is rectangular, but the orientation was generally not orthogonal to the wind direction, which means that sampling rows or arcs across the cloud could not be formed. However, it was still possible to determine peak concentrations at certain distances with reasonable accuracy.

- Peak concentrations for the instantaneous releases represent an averaging time of 0.6s, so these are considered "instantaneous" values. Because the release was not quasi-continuous, and because of the nature of the monitoring array, no values of σ_y were estimated.

E. SUMMARY OF DATASETS

An overview of the general characteristics of each of the experiments contained in the MDA is useful when interpreting the performance of the models that have been evaluated. Table 9 lists important characteristics of each dataset.

Three experiments document releases of LNG on water: Burro, Coyote, and Maplin Sands. A small pool of water was used in the 11 trials of Burro and Coyote, while the 4 Maplin Sands LNG trials were performed over shallow water at the coast. The duration of spills during these trials covers a similar range, but the total spilled during Maplin Sands trials was less than that at the other sites. The most significant difference between Maplin Sands and the Burro-Coyote trials is seen in the averaging times and the qualitative assessment of the lateral resolution of the sampling array. Concentrations from both Burro and Coyote were averaged over a period of "steady" release conditions, which correspond to periods when each sampler was within the vapor-cloud. With good spatial coverage along each sampling arc, the resulting concentrations are viewed as being representative of average, in-cloud concentrations (but not peak concentrations). Spatial coverage of the Maplin Sands vapor clouds was not good, and we have used the peak

TABLE 9. SUMMARY OF CHARACTERISTICS OF THE DATASETS.

	Burro	Coyote	Desert Tortoise	Goldfish	Hanford Kr^{85} (Continuous)	Hanford Kr^{85} (Instantaneous)	Maplin Sands	Prairie Grass	Thorney Island (Instantaneous)	Thorney Island (Continuous)
Number of Trials	8	3	4	3	5	6	4,8	44	9	2
Material	LNG	LNG	NH_3	HF	K^{85}	K^{85}	LNG, LPG	SO_2	Freon & N_2	Freon & N_2
Type of Release	Boiling Liquid	Boiling Liquid	2-Phase Jet	2-Phase Jet	Gas	Gas	Boiling Liquid	Gas Jet	Gas	Gas
Total Mass (kg)	10700-17300	6500-12700	10000-36800	3500-3800	11-24*	10*	LNG: 2000-6600 LPG: 100-380	23-63	3150-8700	4800
Duration (s)	79-190	65-98	126-381	125-360	598-1191	(Instantaneous)	60-360	600	(Instantaneous)	460
Surface	Water	Water	Soil	Soil	Soil	Soil	Water	Soil	Soil	Soil
Roughness (m)	.0002	.0002	.003	.003	.03	.03	.0003	.006	.005-.018	.01
Stability Class	C-E	C-D	D-E	D	C-E	C-F	D	A-F	D-F	E-F
Max. Distance (m)	140-800	300-400	800**	3000	800	800	400-650	800	500-580	472
Min Averaging Time (s)	1	1	1	66.6-88.3	38.4	4.8	3	(Dosage)	0.06	30
Averaging Time (s)	40-140	50-90	80-300	66.6-88.3	270-845	4.8	3	600	0.06	30
Qualitative Assessment:										
Lateral Resolution	Good	Good	Good	Good	Good	Good	Marginal	Good	Good	Good
Temporal Resolution	Good	Good	Good	Fair	Good	Good	Good	Fair	Good	Good

* Curies, rather than kg, are used as a measure of the amount of this radioactive tracer released.

** Concentrations are measured beyond 800 m, but these are not well-instrumented measurement arcs.

3-second-average concentration data. Thus, we may have a good measure of peak, short-term concentrations at some distances during some trials, but not others. We would expect there to be greater scatter in the performance of models on the Maplin Sands trials than on the Burro and Coyote trials as a result of these differences. As a separate model comparison, short term peaks are also evaluated for the continuous dense gas data sets.

The Desert Tortoise and Goldfish experiments document two-phase turbulent jets. Although similar in many respects, the difference in the minimum averaging time of the concentrations is significant. This minimum averaging time is only 1 second in the Desert Tortoise experiments, but is 66.6 or 88.3 seconds (approximately half the duration of the releases), in the Goldfish experiments. Consequently it is difficult to assess whether or not reported concentrations in the Goldfish experiments represent in-cloud averages.

One experiment, Thorney Island, involves the release of mixtures of freon and nitrogen to simulate a generic dense gas release in which density differences are controlled only by dilution. Because the total mixture was sampled, rather than just the freon, these trials need not be modeled as releases of freon that are initially diluted.

Finally, two experiments involve the release of "trace" amounts of gases which are meant to document passive dispersion processes. Both are "continuous" releases of at least 10 minutes duration (the longest durations in the study). Because of the long duration, use of dosage data from Prairie Grass to infer average concentrations does not raise the same problems found in the Porton Down dataset. We have modeled the Kr^{85} releases as a neutral gas, with mass taken to be equivalent to its radioactive content (in Curies). The SO_2 released in the Prairie Grass trials is denser than air, but it is released in small quantity as a jet, so that it behaves as a neutral-density gas cloud. We have initialized each of the dense-gas models with the actual conditions of the release so that some dense-gas calculations may actually be performed for the initial stages of the dispersion, especially for those models that do not simulate the effects of entrainment of air into turbulent jets.

SECTION III

MODELS

A. CRITERIA FOR CHOOSING MODELS

Several dispersion models that are either publicly available or proprietary were initially considered for inclusion in this demonstration of the system to evaluate the performance of micro-computer-based models applicable to releases of toxic chemicals into the atmosphere. The list of potential models was derived from the tabulation presented in the Phase I report for this project, and from the list of models of interest to the two sponsors of this project (USAF and API). Criteria considered in selecting the models for the demonstration included the following:

1. The model must be available in a version that runs on a "PC."

2. If the model is proprietary, the developers must be willing to "loan" a copy for use on this project.

3. Models that obtain chemical properties from an internal database must either include all the chemicals required for the datasets included in the evaluation, or they must provide a mechanism for altering the chemical database.

Models that satisfy these criteria were also judged on the ease with which they can be applied to many trials. Those that are readily "automated" and for which a postprocessor can be prepared to extract specific information for each trial, were given preference over similar models that require far more user-involvement.

A total of 24 candidate models are listed below: 14 that have been included in this demonstration are marked with an asterisk:

ACTOR	CADM	*INPUFF
ADAM	*CHARM	LCMPUFF

•AFTOX	•DEGADIS	•OB/DG
•AIRTOX	•FOCUS (EAHAP)	•PHAST (SAFETI/WHAZAN)
ALOHA	•GASTAR	•SLAB
ARCHIE	•GPM	•TRACE
•Britter & McQuaid	•HEGADAS	•TRACE

Three of the models not chosen are closely related to models that are included, and so are listed in parentheses. FOCUS is essentially a later version of EAHAP. SAFETI and WHAZAN, along with PHAST, are part of the family of models developed by Technica Ltd. for different computer systems. PHAST, the representative that we include in the evaluation, is the version specifically designed for use on micro-computers. Also, LOMPUFF, which requires a VAX computer rather than a micro-computer, uses the INPUFF dispersion model, which is included in the evaluation. Reasons for not including the remaining six models are:

ACTOR (Analysis of Consequences of Toxic Releases): This model was developed by the New Jersey Department of Environmental Protection (Reference 33). It operates within the framework of a LOTUS worksheet, and contains algorithms for treating negatively and neutrally buoyant vapors resulting from either continuous or instantaneous releases. This was submitted to us as a new model late in the program, so there was not sufficient time to incorporate ACTOR in our model evaluation software system.

ADAM (Air Force Dispersion Assessment Model): The ADAM model was originally developed for the U.S. Air Force by Raj and Morris (Reference 34) as an improvement to the OB/DG model, which does not account for dense gases or in-plume chemistry and thermodynamic effects. The model was recently modified to include the special chemical properties of HF and liquid fluorine (LF_2). With this change, ADAM can be applied to releases of nitrogen tetroxide (N_2O_4), phosgene ($COCl_2$), anhydrous ammonia (NH_3), chlorine (Cl_2), sulfur dioxide (SO_2), hydrogen sulfide (H_2S), fluorine (F_2), and hydrogen fluoride (HF). For these chemicals, it includes algorithms for chemical reactions, aerosols, and mixing processes for up to 16 types of releases. It was not included in this demonstration because several chemicals required for the datasets are not among those treated by ADAM, and no simple facility is provided to incorporate "new" chemicals in the database.

ALOHA (Areal Locations of Hazardous Atmospheres): The NOAA (National Oceanic and Atmospheric Administration) ALOHA air model is designed to provide atmospheric dispersion estimates based on the Gaussian equations. Version 4 of the ALOHA air model is equivalent to a simple Gaussian plume model with an averaging time of ten minutes, and does not consider effects of dense gases, chemical reactions, liquid-vapor mixtures, and liquid releases. The ALOHA model is the "air" part of the comprehensive NOAA CAMEO model (Reference 35), and is still under active development. For example, Version 5 has been under development during the past two years, and contains algorithms that approximate the dense gas dispersion model DEGADIS. It is intended for application to hazardous vapors released at ground-level. As implemented on Macintosh machines, ALOHA is straightforward and easy to use. We have not included ALOHA in our evaluation because (1) version 5 is designed to emulate the DEGADIS model, which is included in the evaluation, (2) version 4 is functionally equivalent to the simple Gaussian plume calculation coded as GPM in the evaluation, and (3) both versions are designed for the Macintosh computer environment, and are not compatible with the systems used for the rest of the models. We note that a windows-based DOS version is under development, but is unavailable for this effort.

ARCHIE (Automated Resources for Chemical Hazard Incident Evaluation): ARCHIE was developed for the Federal Emergency Management Agency (FEMA), the U.S. Department of Transportation (DOT), and the U.S. Environmental Protection Agency (EPA), and is described in a handbook that can be obtained from regional FEMA offices (Reference 36). The primary purpose of ARCHIE is to provide emergency preparedness personnel with several integrated estimation methods that may be used to assess the vapor dispersion, fire, and explosion impacts associated with episodic discharges of hazardous materials into the terrestrial (that is, land) environment. The program is also intended to facilitate a better understanding of the nature and sequence of events that may follow an accident and their resulting consequences.

The dispersion model within ARCHIE is essentially the Gaussian plume model for point-source releases, with correction terms for releases of finite-duration. No heat transfer, chemical effects, or dense-gas effects are simulated. We do not include ARCHIE in the evaluation because the Gaussian plume and puff calculations of GPM and INPUFF are representative of this class of dispersion modeling techniques.

CADM (Calm Air Dispersion Model): CADM was developed by and is available from SoftSkills, Inc. Moser (Reference 37) describes it as a generalized program for modeling the spreading and dispersion of dense-gas clouds during calm periods. We have not included CADM in this evaluation because the number of trials in which dense-gas clouds are released during calm or low-wind-speed meteorological conditions is small.

HGSYSTEM (Heavy Gas System): HGSYSTEM is a recently-developed revision to the HEGADAS model, designed especially for modeling releases of hydrogen fluoride (HF). The development of the model, first known as HFSYSTEM, focused on three areas (Reference 38): (1) the modeling of the complex thermodynamics of HF/H_2O/Air mixtures (including aerosol effects on cloud density); (2) the treatment of a wide range of surface roughness conditions (including possible multiple surface roughness conditions); and (3) jet flow and air entrainment for pressurized releases of HF, followed by transition to ground-based dense gas dispersion. First, the HEGADAS model was modified to meet these objectives. The HFPLUME model was developed and tested to simulate jet flows from pressurized releases, dispersing initially as an elevated HF plume. The touchdown and slumping of an initially-elevated dense HF plume were also modeled in HFPLUME, with a link into HEGADAS to complete the modeling of the transition from an elevated to grounded dense gas cloud. Later, a source estimation model, a pool evaporation model, and a far-field Gaussian model (linked to HFPLUME) were added to provide a more complete source and dispersion modeling package.

We have not included HGSYSTEM in this evaluation because the code was not received until late in the study and there was insufficient time to thoroughly test the program and correct the few "bugs" that were found during initial test runs. Furthermore, it was found that the formats of the outputs vary depending upon which of the major modules is used in a simulation, so that significant work still remains in being able to efficiently obtain results from the model when simulating the many trials used in the evaluation.

B. DESCRIPTION OF MODELS EVALUATED

14 models were evaluated--8 of these are publicly-available (AFTOX, Britter & McQuaid, DEGADIS, GPM, HEGADAS, INPUFF, OB/DG, and SLAB), and 6 are proprietary (AIRTOX, CHARM, FOCUS, GASTAR, PHAST, and TRACE). Those termed "publicly-available" can be obtained from published texts, from their developers, or from the EPA for the cost of reproduction. The source-code for these models is distributed along with the user's guides. Those termed "proprietary" are sold by individual companies, which typically provide technical support for the product and reference materials, but do not provide the source-code. Primary references for these 14 models are listed below:

AFTOX (3.1)	Kunkel (Reference 39)
AIRTOX	Heinold et al. (Reference 40), Mills (Reference 41)
BM	Britter & McQuaid (Reference 42)
CHARM (6.1)	Eltgroth (Reference 43)
DEGADIS (2.1)	Havens (Reference 44), Spicer and Havens (Reference 45)
FOCUS (2.1)	Quest Consultants (Reference 46)
GASTAR (2.22)	CERC (Reference 47)
GPM (Gaussian Plume Model)	Hanna et al. (Reference 48)
HEGADAS (NTIS)	Witlox (Reference 49)
INPUFF (2.3)	Peterson and Lavdas (Reference 50)
OB/DG	Nou (Reference 51)
PHAST (2.01)	Technica (Reference 52)
SLAB (Feb, 1990)	Ermak (Reference 53)
TRACE II	DuPont (Reference 54)

All of the developers of the proprietary models have provided us with copies of the software, with the stipulation that the models be used only for this one project. We have independently applied these proprietary models to the datasets, and have discussed the procedures for doing this with the model developers only when user's guides were unclear or when problems were encountered, much as any purchaser of the models would. Comments on our methods of applying all of the models were solicited from the developers only after the evaluations were completed, and responses were incorporated into revisions to the evaluation only when these were considered major. In this way, we believe that the results of this evaluation are consistent with "routine" use of the models.

1. AFTOX 3.1 (Air Force Toxic Chemical Dispersion Model)

The U.S. Air Force AFTOX model, version 3.1, was developed by Kunkel (Reference 39), and is based on the SPILLS model developed by the Shell Oil Company (Reference 55). AFTOX is intended to be an improvement over the Ocean Breeze/Dry Gulch (OB/DG) dispersion model, which is an empirical regression equation derived more than two decades ago from a series of diffusion experiments conducted by the Air Force at Cape Canaveral, Florida, Vandenberg AFB, California, and in Kansas . The data from over 200 diffusion tests were used to derive the OB/DG equation, and these same data have been used in the development and testing of the AFTOX model.

AFTOX is an interactive Gaussian puff/plume model. AFTOX does not consider dense gas effects, but does treat five different types of releases:

- Continuous gas
- Continuous liquid
- Instantaneous gas
- Instantaneous liquid
- Continuous buoyant gas released from a stack

The model determines whether the release is a gas or liquid based on whether the air temperature is above or below the boiling point temperature of the chemical. Gas releases are assumed to be point sources and liquid releases are assumed to be area sources. For the latter case, the geometry of the area source is assumed to have little affect on concentrations at most distances of interest.

AFTOX uses either one of two methods to determine stability:

1) wind speed and solar elevation angle (Reference 56), or
2) observed σ_θ (Reference 57)

Concentration estimates are adjusted for the effect of averaging time on the degree of lateral meandering. Default values of the concentration averaging time are assumed by the model for quasi-continuous releases. For release durations equal to or greater than fifteen minutes, the default averaging time is fifteen minutes[1]. For shorter releases, the default averaging time is equal to the actual duration of release. The user can override the default averaging times in the range from one to fifteen minutes. For instantaneous releases, the averaging time is one minute and the user does not have the option of choosing other values.

AFTOX does not accept a variable emission rate. For continuous releases, the release duration can be specified as either finite or infinite, and a duration of 10,000 minutes will be assumed internally by AFTOX for the latter case.

Because AFTOX runs only in the interactive mode, repeated runs become very time-consuming, and repeated runs are frequently needed because solutions are given as a function of time. The user must specify the elapsed time after the spill as an input parameter for the diffusion calculation. Multiple AFTOX runs, each one with a different elapsed time, are necessary in order to find the maximum concentration at a fixed distance downwind of the source. A more efficient way to find the maximum concentration at a given location is to run AFTOX using the assumption that the release duration is infinite, and specify a relatively long elapsed time, say 30 minutes. However, such a procedure is appropriate only if the source duration is longer than the averaging time.

The latest version of AFTOX was received in August, 1989. Among other changes, version 3.1 has remedied several problems encountered by Sigma in running version 2.1 and reported to the developer. Changing times and locations of interest is handled properly now, and the model now considers distances of travel greater than 1000 m during unstable meteorological regimes. However, another problem has been identified that affects concentrations calculated within 100 m downwind of an instantaneous release. We found that the time-series of such concentrations shows an abrupt (nearly instantaneous) rise from zero.

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1 A previous version of AFTOX only lets the user specify the concentration averaging time if the release is equal to or greater than one hour duration. For shorter releases, the model assumes a default ten-minute averaging time.

This results in a distorted time-series of calculated concentration. At receptors further downwind, the calculated time-series of concentration agrees with that from a simple Gaussian puff model. Because AFTOX is based on the simple puff model, modeled concentrations near the source are considered suspicious. This apparent problem was reported to the developer, but has not been rectified.

2. AIRTOX

The AIRTOX modeling system was developed and is distributed by ENSR Consulting and Engineering. The system operates within a user-interface developed as a LOTUS 1-2-3 spreadsheet. ENSR provided Sigma with a configuration of AIRTOX that requires the user to specify the "release profile" (the information required to initialize the dispersion model). They point out that a number of auxiliary programs (spreadsheets) are available from ENSR for calculating release characteristics for a wide range of source types. However, because our model evaluation and comparison activities focus on simulating trials in which the characteristics of the release are known, the auxiliary programs are not required.

AIRTOX calculates concentrations of toxic or flammable chemical concentrations downwind of time dependent releases. The chemical releases can take the form of a liquid, gas, or a two-phase combination of liquid and gas. The model user must input the release rate and meteorological conditions as a function of time. For each release scenario, the user must specify whether the release is a "catastrophic" (non-jet) or an "engineered" (jet) release. A catastrophic release would occur in conjunction with a general failure of a containment vessel. Engineering releases would occur through specially designed orifices such as relief valves or rupture disks.

All emissions from a release, including those attributed to a liquid pool, are assumed to occur at ground level. Concentrations due to the directly-released gas, flashed gas, and suspended aerosol are calculated separately from the concentrations due to pool emissions. These component concentrations are later combined by the model in the calculation of the temporal and spatial concentration profiles.

Three different types of dispersion are treated in the AIRTOX model. For jet releases, the growth and dilution of the plume is controlled by the turbulence generated by the difference in velocity between the ambient air and the core of the jet. The effective gravitational acceleration felt by the jet is proportional to the relative density difference between the jet and the ambient air. Either one of two criteria are used to determine the transition of the jet to a buoyancy dominated plume. The first is the criterion that the jet velocity falls to a value equal to the ambient wind speed. The second criterion is that the upward or downward velocity, due solely to buoyancy effects, equals the jet velocity.

When it reaches the ground, whether from a catastrophic or jet release, a heavier-than-air plume will spread in the lateral direction due to gravitational slumping. The height and width of a jet release plume, which falls to the ground, are assumed to be the same. For catastrophic releases, the height is assumed to be equal to one-fourth of the width. The rate of air entrainment is modeled as a function of plume height, atmospheric stability, wind speed and surface roughness. The plume rate of spread in the lateral direction is slowed as more ambient air is entrained into the plume, thereby reducing its density with respect to air. An analytical expression is used to compute the height and width of the slumping plume as a function of downwind distance. When the lateral growth rate of the plume equals that which would occur under passive dispersion, then the concentrations downwind from that point are calculated by use of a conventional Gaussian plume model. The Gaussian model uses the Briggs dispersion coefficients for rural surroundings. The influence of building wakes upon the passive dispersion coefficients is modeled in a fashion similar to that used in the EPA Industrial Source Complex (ISC) model.

Prior to soliciting comments on our modeling approach, interaction between Sigma Research and the developer of AIRTOX was limited to clarifying aspects of the "snap shot" representation of the predicted concentrations. During the review, the developer noted an inappropriate specification of the cloud temperature within the model. This was corrected in the final statistics used in our evaluation, as noted in section III.C.2.

3. Britter & McQuaid Model

The Britter and McQuaid (B&M) model is given as a set of simple equations and nomograms in their Workbook on the Dispersion of Dense Gases (Reference 42). The authors collected the results of many laboratory and field studies of dense gas dispersion, plotted the data in dimensionless form, and drew curves that best fit the data. The model is best suited to instantaneous or continuous ground level area or volume sources of dense gases. Sigma has reduced the nomograms to electronic form to create the model referred to as "BM."

The following parameters are used in the model:

Q_o (m^3)	Initial cloud volume	
q_o (m^3/s)	Initial plume volume flux	
u (m/s)	Wind speed at z = 10 m	
T_o (s)	Duration of release	
x (m)	Downwind distance	
ρ_o (kg/m^3)	Initial gas density	
ρ_a (kg/m^3)	Ambient gas density	
$g_o' = g\,(\rho_o - \rho_a)/\rho_a$	Initial buoyancy term	
D (m)	Characteristic source dimension	
	$D_i = Q_o^{1/3}$	instantaneous release
	$D_c = (q_o/u)^{1/2}$	continuous release

Roughness length, averaging time, and atmospheric stability class are not included in this list because the available data do not show any strong influence of these parameters. It can be stated that the representative averaging time for the continuous plumes in these experiments is about 3 to 10 minutes, the representative roughness length is a few cm (that is, a flat grassy surface), and the representative stability class is about C or D (that is, neutral to slightly unstable).

The following criteria are used to decide whether the release should be considered to be instantaneous or continuous:

$uT_o/x \geq 2.5$ → Continuous

$uT_o/x \leq 0.6$ → Instantaneous

$0.6 \leq uT_o/x \leq 2.5$ → Calculate both ways, take minimum concentration.

The following criteria are used to decide whether the release is sufficiently dense that dense gas formulas should be used:

$$(g_o' q_o / u^3 D_c)^{1/3} \geq 0.15 \qquad \text{Continuous}$$

$$(g_o' Q_o)^{1/2} / uD_i \geq 0.20 \qquad \text{Instantaneous}$$

where $g_o' = g(\rho_o - \rho_a)/\rho_a$ is the reduced buoyancy parameter, $D_c = (q_o/u)^{1/2}$ is the representative source dimension for the continuous case, and $D_i = Q_o^{1/3}$ is that for the instantaneous case.

Computer software containing equations for the two nomograms presented in Figures 8 and 9 are then used to estimate the normalized downwind distance (x/D_i for an instantaneous release or x/D_c for a continuous release) that a given normalized concentration (C_m/C_o, where C_m is the maximum concentration in the cloud or plume and C_o is the initial concentration) occurs, as a function of the initial stability parameter $((g_o' Q_o^{1/3})^{1/2}/u$ for an instantaneous release or $(g_o'^2 q_o)^{1/5}/u$ for a continuous release).

In order to assure that C_m/C_o smoothly approaches 1 as x approaches 0.0, we include the following interpolation formulas at small x (that is, for $x \leq 30\ D_c$ or $x \leq 3\ D_i$):

$$C_m/C_o = \frac{306(x/D_c)^{-2}}{1 + 306(x/D_c)^{-2}} \qquad \text{Continuous} \qquad (2)$$

$$C_m/C_o = \frac{3.24\ (x/D_i)^{-2}}{1 + 3.24(x/D_i)^{-2}} \qquad \text{Instantaneous} \qquad (3)$$

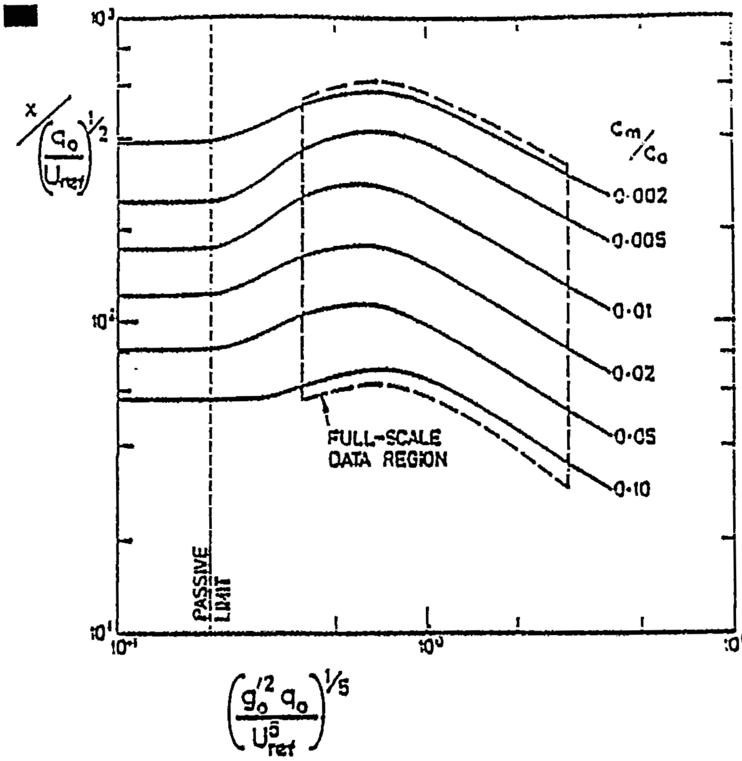


Figure 8. Correlation for continuous releases from Britter and McQuaid (Reference 42).

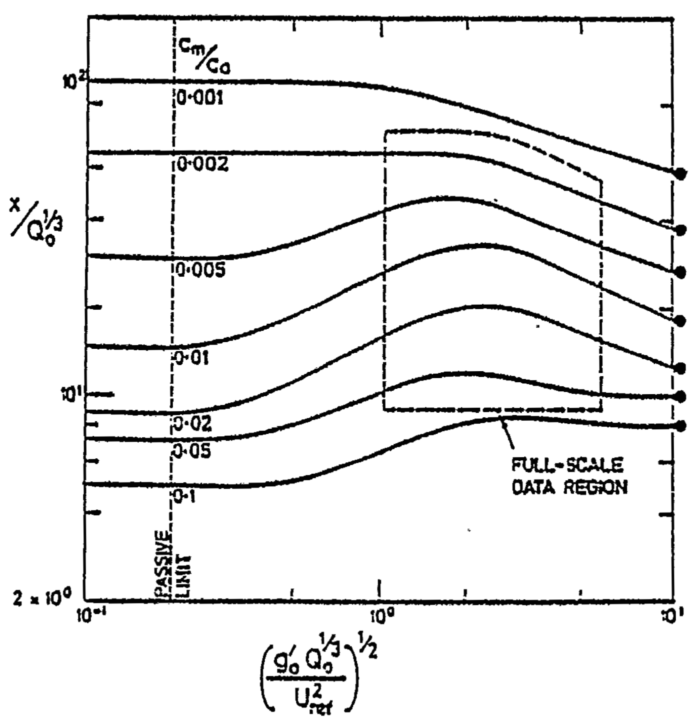


Figure 9. Correlation for instantaneous release from Britter and McQuaid (Reference 42).

The B&M method is not really appropriate for the near-source region of jets or for two-phase plumes. However, the authors point out that the jet effect is usually minor at downwind distances beyond about 100 m. Furthermore, they suggest a method for accounting for the effects of a two-phase ammonia cloud. For example, on page 73 of the Workbook they discuss the cloud initialization procedure for the Potchefstroom ammonia accident. They assume that enough ambient air is mixed into the ammonia plume to completely evaporate the unflashed liquid and that the initial density equals the air-ammonia mixture density at the normal boiling point of ammonia ($T = 240^\circ K$). After calculating this initial density, ρ_o, and volume, Q_o, they assume that there are no thermodynamic processes acting in the cloud (that is, $T_{cloud} = T_a$) in subsequent calculations. We have used this method for simulating the datasets that involve 2-phase clouds.

We emphasize that the B&M model is included in this analysis as a benchmark screening model. It should not be applied to scenarios outside of its range of derivation. For example, it would be inappropriate for application in urban areas.

4. CHARM 6.1 (Complex and Hazardous Air Release Model)

The CHARM model, developed by the Radian Corporation (Reference 43), is a Gaussian puff model. CHARM treats any release to be a series of puffs, each of which can be described by procedures reviewed below. The following four types of releases are considered by CHARM:

- Continuous liquid
- Continuous gas
- Instantaneous liquid
- Instantaneous gas

If the release is continuous, the user is asked to input the emission duration together with information on whether the emission rate is constant, decreasing linearly, or decreasing exponentially.

CHARM allows the puff characteristics of the source to be calculated from the input release data, or it accepts puff information directly from the user. For continuous or instantaneous liquid releases, CHARM calculates, if required by the user, the rate of emission of mass from the storage container. It then uses the Shell SPILLS (Reference 55) model to calculate the length of time required for the liquid to evaporate into the air, the size of the liquid pool which will form, and ultimately, the puff dimension. No water vapor or air is assumed to be mixed with the puff material during the source term calculation. However, the newly released version 6 does include an entrainment algorithm for jet-releases.

CHARM uses the conventional Pasquill-Gifford dispersion parameters to estimate the widths for elevated puffs (not in contact with the ground) or any puffs not heavier than air. CHARM ultimately reduces to a standard Gaussian model for neutrally buoyant material. On the other hand, CHARM uses the dispersion parameters in the Eidsvik (Reference 58) model to estimate the widths of heavier-than-air puffs on the ground. CHARM allows a variable concentration averaging time, but the effects of wind meandering are not simulated.

The CHARM model is operated by means of a sequence of menus or screens in an interactive process whereby the properties of a series of puffs are determined and meteorological data are entered. Results of the subsequent transport and dispersion calculations are presented in the form of on-screen graphics; centerline concentrations at (or near) specified distances downwind, and crosswind distance to a specific concentration are obtained from the plot of concentration contours on the screen. This process is feasible because a movable "cross-hair" can be invoked to define a position, and the concentration at this position is displayed at the bottom of the screen.

One particular refinement contained in Version 6 of the model has proven essential in applying CHARM to the datasets that include instantaneous releases and monitors placed within 100 m of the point of release. The new version can be implemented with a time-step of 1 second, rather than 1 minute. With a transport speed greater than 1.5 m/s, a puff would pass by all receptors located within 100 m by the end of the first 1-min time-step. With the resolution afforded by the 1-s time-step, all trials can be modeled with adequate resolution.

Version 6 of CHARM was sent to Sigma Research for use in this study after efforts to apply version 5 to instantaneous release trials proved unsatisfactory. We notified the developer of our problem, and were told of the release of version 6. The first copy of version 6 sent to us would not load properly, and after discussing a problem found in its replacement, one other bug was identified and fixed by the developer. All other interactions with the developer were initiated in response to our request for comments on our methods for applying CHARM in this study. These discussions are summarized in Section III.C.2.

5. DEGADIS 2.1 (DEnse Gas DISpersion Model)

The DEGADIS model was first developed by Havens and Spicer (Reference 59) for the U.S. Coast Guard for application to LNG spills from tankers. It is an adaptation of the Shell HEGADAS model, designed to model the dispersion of dense gas (or aerosol) clouds released at ground-level with zero initial momentum, into an atmospheric boundary layer flow over flat, level terrain. More recently, an algorithm for the dispersion of vertical jets emitted perpendicular to the mean wind (Reference 60) has been included by Havens (Reference 44) as a "front end" to the DEGADIS 2.1 model. Note that this model does not include a "release model", so that the characteristics of the source must be provided by the user.

The DEGADIS model uses the concept of atmospheric take-up rate, or the rate at which source material can be taken up or absorbed by the atmosphere, to determine the possible formation of a so-called secondary source blanket. If the gas release rate does not exceed the potential atmospheric take-up rate, the model assumes that the gas is taken up directly by the atmospheric flow and is dispersed downwind. However, if the gas release rate exceeds the potential atmospheric take-up rate, the model assumes that a denser-than-air secondary source blanket is formed over the primary source. The blanket is represented as a cylindrical gas volume which spreads laterally as a density-driven flow with entrainment from the top of the source blanket by wind shear and air entrainment into the advancing front edge. The blanket spreads laterally until the atmospheric take-up rate from the top is balanced by the air entrainment rate from the side and, if applicable, by the rate of gas addition from under the blanket. The blanket center is assumed stationary over the source. The atmospheric take-up rate is assumed to increase with increasing friction velocity and decreasing density excess of the gas (relative to the ambient air).

Once the secondary source blanket (if any) stops growing, DEGADIS proceeds to calculate the downwind dispersion. The model treats the dispersion of gas entrained from the secondary vapor cloud as if it were emitted from an area-source. Concentration profiles are assumed to have a horizontally homogeneous central core with Gaussian edges. Once enough air has been entrained to reduce the density of the cloud, entrainment rates (that is, dispersion rates) nearly conform to dispersion rates for passive (neutrally buoyant) clouds. The lateral length scale is consistent with the PG (Reference 61) σ_y-curves, but the vertical scale is not always consistent with the PG σ_z. The formulation for the vertical scale approaches the PG σ_z for neutral conditions in the far-field, and the values for stable conditions are similar to the corresponding PG σ_z values. But the vertical length scale in the far-field does not approach the PG σ_z values during convective conditions.

DEGADIS always requires the user to input the concentration averaging time, regardless of whether the simulation is steady or transient. DEGADIS assumes that the effects of averaging time on observed plume properties arise primarily as a result of horizontal plume meander. Spicer and Havens (Reference 45) state that for a concentration averaging time, t_a, other than 600 seconds, the σ_y contained in the model is scaled by:

$$(t_a/600s)^{0.2} \qquad (4)$$

The most recent version (2.1) of DEGADIS includes an algorithm for vertical momentum jets, based on the model of Ooms et al. (Reference 60). The "jet model" serves as a front-end for the DEGADIS model, and a "bridge" is used to initialize DEGADIS by means of the output from the jet model. However, we note that DEGADIS will not be invoked if the cloud that results from the jet model is effectively passive (not dense relative to air). In this case, the jet model calculates concentrations using dispersion rates that match the PG rates for both σ_y and σ_z. Hence, if the complete DEGADIS (2.1) system were to be applied to trials from "tracer" experiments, the jet model would be used exclusively, and the results should be similar to those obtained with a simple Gaussian plume model.

DEGADIS 2.1 is supported through an electronic bulletin board run by the EPA. Several minor updates have been made to the model during the duration of this study, and we have kept our version current. The only interaction with the developer, which was specifically related to applying DEGADIS to the datasets used in this study, was a discussion related to initializing an instantaneous, dense-gas release. The model would not run properly if the height of the cloud were large compared to its radius. In fact, the initial cloud should more closely resemble a "pancake" than a top-hat. No other interactions specifically related to the application of DEGADIS in this study occurred between Sigma Research and the developer prior to our request for comments. Issues raised by the developer at that time are summarized in Section III.C.2.

6. FOCUS 2.1

The FOCUS model is being maintained and distributed by Quest Consultants, Inc., and is descended from the EAHAP model developed by Energy Analysts, Inc. A comprehensive hazards analysis software package, it includes the following release models:

- Instantaneous gas
- Instantaneous liquid
- Regulated gas (constant emission rate with finite duration)
- Regulated liquid (constant emission rate with finite duration)
- Transient gas
- Transient liquid
- Transient two-phase

If any of the above release models produces a liquid flow, a liquid pool vaporization model will be executed before the dispersion models are run.

Release of liquid onto water, soil, concrete, and ice is treated in this pool vaporization model.

FOCUS contains the following four vapor dispersion models to determine the transient (strict steady state dispersion is not considered by FOCUS) behavior of vapor introduced to the atmosphere: (1) Instantaneous lighter-than-air gas dispersion model, where a version of the Gaussian instantaneous area source model is included; (2) Transient heavier-than-air gas dispersion model, where a version of the algorithms used in DEGADIS is included; (3) Transient lighter-than-air gas dispersion model, where a version of the Gaussian transient area source model is included; (4) Momentum jet gas dispersion model, where a version of the Ooms momentum jet gas dispersion model is included, and the jet can have any orientation.

Having an extensive set of release models, FOCUS is designed to be run with only the basic information such as chemical species, release temperature and pressure, meteorological conditions, release rate and orifice size. Other information such as the exact type of release (for example, cryogenic pool spill and horizontal jet), jet speed, and aerosol fraction will all be determined within the model. FOCUS either accepts the release rate specified by the user for a regulated release, or for an unregulated release, calculates the release rate internally according to the geometry of the release. User-specified release rates were always used for this model evaluation exercise.

In addition to the vapor dispersion, FOCUS also has models that perform hazard analyses on explosion and fire radiation. FOCUS is the only model under evaluation that is able to calculate thermodynamic properties of a mixture of many (up to ten) chemical components.

FOCUS requires the user to specify a dispersion coefficient averaging time to account for plume meandering. There is a minimum of 1 minute and a maximum of 600 minutes for the averaging time. Different averaging times for concentration estimates only affect dispersion predictions in the far field, but not in the near field due to the dominating source effect.

FOCUS is designed mainly to be run in the interactive mode. FOCUS can also be run in the batch mode; but this requires a working knowledge of the model. The execution time of FOCUS is comparable to that of DEGADIS. Comprehensive graphics capabilities are also built into the model.

The developer of FOCUS provided a tutorial at Sigma Research in the use of the model. This was especially helpful in developing the procedure used to "automate" the process of applying the model. As stated above, driving the model in batch mode rather than in interactive mode requires a working knowledge of the model. Although this interaction with the developer is different from that associated with other models in this study, we must emphasize that the tutorial was directed towards the mechanics of the modeling system, rather than the specifics for modeling each of the trials in our study.

7. GASTAR 2.22 (GASeous Transport from Accidental Releases)

The GASTAR model, developed jointly by Cambridge Environmental Research Consultants (CERC) of England and EnviroTech Research Ltd. of Canada, is a system of computer programs written in FORTRAN for simulating the dispersion of dense and passive gases released into the atmosphere. The version that Sigma currently has is 2.22. GASTAR covers a wide spectrum of different release scenarios. The following three basic types of releases are considered by GASTAR:

- Isothermal
- Thermal
- Aerosol

and each type of release can be characterized as:

- Instantaneous
- Continuous (finite duration)
- Time-varying

As a result, releases such as cryogenic pool spill, catastrophic release, and two-phase jet can all be treated by the model.

For continuous or time-varying releases, a secondary source blanket forms as a result of the balance between the emission rate and the rate of uptake by the atmosphere. The jet module of GASTAR simulates a jet of arbitrary orientation. The aerosol fraction for an aerosol release is specified by the user, rather than calculated by the model. GASTAR also simulates a release in calm wind conditions.

The basic dispersion algorithm used in GASTAR is similar to that used in HEGADAS and DEGADIS. In brief, the similarity approach is used to reduce the basic equations of motion to a set of ordinary equations. These equations are then further written in a bulk (or box-model) form, and modified to re-introduce the assumed profiles. The horizontal concentration profiles used in the model are a uniform central core with error-function edges. The vertical concentration profiles are in the form of $\exp(-z^{1.5})$ for the passive plumes, and $\exp(-z)$ when the puffs or plumes are dense. Effects of atmospheric turbulence and cloud top entrainment on the dilution of the source cloud are included in the model.

GASTAR has an averaging time option available for plumes to account for meandering. There is a minimum of 20 seconds for the averaging time, consistent with the puff dispersion parameters. The usual 0.2-power law is used by GASTAR to modify the dispersion coefficients according to the averaging time.

GASTAR is highly modular in design. It has a simple I/O structure in that all the input files, interface files between modules, and the output file are very compact. The model runs very fast among the models under evaluation, even for transient releases. It also has built-in comprehensive graphics capabilities. The model can be run in either the batch or the interactive mode.

Several interactions with the developer of GASTAR occurred prior to our request for comments. The version of the model originally sent to us did not yet have a momentum jet algorithm. When first tested, we ran the model for several hypothetical scenarios. The use of a roughness length of 1 m in our scenario caused the model to crash. When the developer was informed of this, a revision was sent to us. Later, the jet module was finished, and the new version was delivered by the developer. No other substantive interactions with the developer occurred prior to our request for comments.

8. GPM (Gaussian Plume Model)

Any evaluation of modeling techniques can benefit from comparisons with simple, well-known techniques. With this in mind, we have prepared a simple Gaussian plume model. This model follows the general practice explained in many applied air pollution modeling texts, such as Hanna et al. (Reference 48). It is designed for point-source releases with the added flexibility of accepting an initial value for the plume-spread parameters σ_y and σ_z. We use initial values to obtain peak "centerline" concentrations at the source that, when expressed in ppm, do not exceed an initial value for the concentration (most of the time, the initial concentration is one million ppm, which corresponds to a pure gas).

The curves for σ_y and σ_z are similar to the PG values, but are formulated as by Briggs (Reference 62) for open-country sites. No adjustments are made for surface roughness, density, aerosol chemistry, or wind speed measuring height, but an averaging time is included. This is done by multiplying the applicable value of σ_y by $(t/t_o)^{0.2}$, where t is the averaging time (min) and t_o is equal to 10 min.

9. HEGADAS (NTIS)

HEGADAS, a model developed by Shell U.K., is designed to model the dispersion of a ground-level, area-source dense cloud released with zero initial momentum. The basic model was first described by Colenbrander (Reference 63) and a user's guide for the latest version is written by Witlox (Reference 49). The version obtained for this project (available from NTIS) does not treat aerosols. Heavy gas effects are due to either large molecular weight or low temperature. Heat and water vapor transfer are considered. No "source-modules" are contained in the model, so that all emission information must be provided by the user.

Because HEGADAS is written in ANSI FORTRAN, the program can be transported to other computer environments with ease. The model is run in batch mode and it permits validation of the input parameters, so that the possibility of user input errors is reduced.

The algorithms in HEGADAS are similar to those in DEGADIS with regard to the area-source formulation, the secondary source blanket, and the dispersion formulation. As in DEGADIS, the lateral dispersion parameter is calculated by:

$$\sigma_y = \delta \cdot x^{\beta} \qquad (5)$$

where δ and β are functions of the stability class, but these must be specified by the user (tables are provided). Furthermore, according to the user's guide, δ for continuous releases should be scaled based on the averaging time, t_{av}.

$$\delta = \delta_{10min}(t_{av}/600s)^{0.2} \qquad (6)$$

where t is in seconds, and $\delta_{10\ min}$ are the tabulated values for an averaging time of ten minutes. In other words, HEGADAS does not accept the averaging time explicitly. Instead, it is the user's responsibility to specify a value of δ for a particular averaging time. The user's guide also tabulates values of δ_I, which are applicable to instantaneous releases. It is assumed that

$$\delta_{10min} = 2 \cdot \delta_I \qquad (7)$$

for all stability classes. Thus, a lower limit of 18.75s for the averaging time is implied. However, as just stated, HEGADAS does not accept the averaging time explicitly.

The user must also provide the Monin-Obukhov length, L, which is a measure of atmospheric stability. A figure containing the Monin-Obukhov length as a function of surface roughness is provided in the user's guide. However, the practical usefulness of such a figure is limited. Therefore, Sigma has developed the following empirical equations for different stability classes to approximate the curves in the figure:

Class A: $L = -11.43 \cdot z_0^{0.103}$ (both L and z_0 are in meters)

Class B: $L = -25.98 \cdot z_0^{0.171}$

Class C: $L = -123.40 \cdot z_0^{0.304}$

Class D: $L = \infty$ (9999 is actually input)

Class E: $L = 123.40 \cdot z_0^{0.304}$

Class F: $L = 25.98 \cdot z_0^{0.171}$

Finally, HEGADAS should not be applied to instantaneous releases. The developers note that the HEGABOX model would be needed for this class of releases. As a result, we have not applied HEGADAS to trials that involve instantaneous releases. This direction from the developer was obtained after we had requested comments on our approach. No interactions occurred before this.

10. INPUFF 2.3

INPUFF version 2.3 is the current version of EPA's Gaussian puff model that is applicable to multiple sources. The Gaussian puff diffusion equation is used to compute the contribution to the concentration of each puff at each receptor during each time step. Computations in INPUFF can be made for single or multiple point sources at up to 100 receptor locations. In the default mode, the model assumes a homogeneous wind field. However, the user has the option of specifying the wind field for each meteorological period at up to 100 user-defined grid locations. Three dispersion algorithms are utilized within INPUFF for dispersion downwind of the source. These include Pasquill's scheme as discussed by Turner (Reference 61) and a dispersion algorithm discussed by Irwin (Reference 64), which is a synthesis of Draxler's (Reference 65) and Cramer's (Reference 66) ideas. The third dispersion scheme is used for long travel times in which the growth of the puff becomes proportional to the square root of travel time. Optionally the user can incorporate his own subroutines for dispersion and plume rise. Removal is incorporated through deposition and gravitational settling algorithms (Reference 67). A software plotting package is provided to display concentration versus time for a given receptor and the puff trajectories after each simulation time.

Because INPUFF contains no dense-gas algorithm, its use on this project will highlight the importance of dense-gas effects in the near-field of the release. Farther downwind, the lack of a dense-gas module may not be as important.

11. OB/DG (Ocean Breeze/Dry Gulch)

The Ocean Breeze/Dry Gulch (OB/DG) model (Reference 51) was developed for use in support of rocket fuel handling operations at Cape Canaveral and Vandenberg. Dispersion data were collected at those two sites (Cape Canaveral, Florida = Ocean Breeze; Vandenberg AFB, California = Dry Gulch) and at the Prairie Grass, Kansas, site during the 1950s and 1960s. These data were used to develop a purely empirical correlation known as the OB/DG model:

$$C_p/Q = 0.00211\ x^{-1.96}\ \sigma_\theta^{\ -0.506}\ (\Delta T + 10)^{4.33} \qquad (8)$$

$$\text{or } C_p/Q = 0.000175\ x^{-1.95}\ (\Delta T + 10)^{4.92} \qquad (9)$$

where the ratio of the concentration to the source strength C_p/Q is in s m^{-3}, the downwind distance x is in m, the standard deviation of wind direction fluctuations σ_θ is in deg, and ΔT is defined as the temperature difference ($^\circ$F) between the 54 ft. and 6 ft. levels on a tower. Wind speed is absent because it is strongly correlated with ΔT. Equation (2), which is the version used in this evaluation, accounts for the strong correlation between σ_θ and ΔT. Stabilities ranged from neutral to unstable during most of these tests.

12. PHAST 2.01 (Process Hazard Analysis Software Tool)

PHAST is a PC-based model developed by Technica Ltd., who provided Sigma with version 2.01. The system includes modules for calculating the characteristics of a release, and for simulating initial mixing in turbulent jets, dense-cloud dispersion, and passive dispersion.

The release module includes emissions calculations for two-phase flow from an orifice in an infinite reservoir or from a pipe connected to a storage vessel. A flow rate calculated from the initial conditions is held constant in the subsequent analyses until all of the material has been released. The presence of aerosols in vapor released to the atmosphere is explicitly treated. The result of the calculation of droplet size in the cloud tends to produce "small" droplets that tend to remain suspended in the cloud. When liquid released to the atmosphere collects on the ground, PHAST uses a liquid spill model to estimate the vaporization rate.

Dense-gas dispersion is modeled after Cox and Carpenter (Reference 68). Concentrations within the cloud cross-section are uniform. Mixing occurs by means of entrainment across the top of the cloud and entrainment at the edges of the cloud. The former depends on the turbulence of the atmosphere and the Richardson number of the cloud. The latter depends on the rate at which the cloud is spreading due to gravity. This model is used until the rate of spreading by gravity becomes less than that due to passive dispersion, at which point a Gaussian model is used.

The developer of PHAST had been contacted a number of times prior to our request for comments. These earlier interactions centered on specific requests about the formulas used in the model. In particular, more guidance on the definition of the surface roughness parameter was requested, and a request was made for the equations used to model a cloud as if it were released from a virtual line-source. No other interactions occurred before comments on our methods for applying the model were requested.

13. SLAB (February, 1990)

The SLAB model was first developed at Lawrence Livermore National Laboratory (LLNL) for application to data from field experiments at their testing facility. The original SLAB model included only the transient mode and there was minimal documentation. The code has been further improved by Ermak (Reference 53) so that now both transient and steady modes are included.

To date, Sigma has received five versions of SLAB, dated 12/88, 1/89, 2/89, 11/89, and 2/90. A comprehensive user's guide was delivered with the 11/89 version. The latest version includes revisions to the plume rise formulas, the time-averaging formulas, and formulas for calculating maximum concentrations at receptors elevated above the surface. The 1989 version of the SLAB model is designed to consider the following source types:

- Continuous evaporating pool
- Horizontal jet
- Vertical jet
- Instantaneous or short duration evaporating pool

In the case of an evaporating pool release, the source is assumed to be all vapor. However, in the case of jet and instantaneous source releases, the source may be part vapor and part liquid droplets, and the user must specify the initial liquid mass fraction.

Transport and dispersion are calculated by solving the conservation equations of mass, momentum, energy, species, and half-width, with the cloud modeled as either a steady state plume, a transient puff, or a combination of both depending on the the duration of release. In the steady state plume mode, the crosswind-averaged conservation equations are solved, and all variables depend only on the downwind distance. In the transient puff mode, the volume-averaged conservation equations are solved, and all variables depend only on the downwind travel time of the puff center of mass. Time is related to downwind distance by the height-averaged ambient wind speed. The basic conservation equations are solved using the Runge-Kutta numerical integration scheme (in space or time).

The instantaneous ensemble averaged concentration is obtained as a solution to the basic conservation equations. The time-averaged concentration at any given location is then calculated using the instantaneous ensemble averaged concentration, the concentration averaging time, and the assumed profiles in the lateral and vertical directions. Calculation of the time-averaged volume concentration in SLAB includes the effects of lateral cloud meander and the finite length of the spill on the averaged value.

SLAB is not run in the interactive mode. The required input file is easily prepared and many simulations can be run in batch mode. Because SLAB is coded in ANSI FORTRAN, it can be transported to other computer environments with few problems.

In spite of the fact that five versions of SLAB were submitted during the course of this study, interactions with the developer were limited. The versions were not being developed in response to our use of the model in this study.

14. TRACE II

Version II of TRACE uses release and dispersion algorithms similar to those contained in Dupont's SAFER system. It is able to model instantaneous, steady-state, and transient releases of toxic chemicals. Dense, neutrally buoyant, and positively buoyant gas releases may be modeled as well as liquid pool evaporation, liquid release flashing, and aerosol formation. Physical properties for over 100 chemicals are available through a chemical data base that may be expanded by the user.

TRACE computes emission rates and the thermodynamic state of the emission from information on the chemical properties, environmental variables (atmospheric pressure and ambient temperature), tank specifications (length, breadth, height or diameter), rupture geometry (circular, rectangular, smooth or jagged edges) and the containment variables (pressure, temperature). Release scenarios are grouped into three categories:

1. Gas flow through a rupture
2. Two-phase flow-through rupture
3. Liquid flow-through rupture

Depending upon the initial containment variables, the release may undergo a flashing phenomena and TRACE will calculate the fraction of liquid that flashes to vapor, and the resultant temperature of the cloud. The aerosol content of this stream (liquid droplet fraction entrained) depends upon the flashing fraction, the liquid/vapor density ratio, the ratio of heat transfer between the liquid and vapor phases, the velocity of the stream, and the surface tension. Depending upon the condition during the release, it is possible to have a flash, an aerosol, and a liquid pool fraction.

The initial vapor cloud, in general, consists of a flashed vapor and liquid droplets. An initial air entrainment formulation determines the quantity of air in the cloud.

The model for the liquid stream that forms the pool consists of a system of coupled ordinary differential equations for the pool volume, pool radius, and mass evaporated. The amount of liquid evaporating from a pool is dependent upon the exposure area and the heat balance of the pool. In the case of multicomponent liquid spill, the model treats the spill as an ideal liquid solution. The mass transfer rate equation for evaporation is applied to each component, and the total evaporation rate is obtained by summing all compounds.

For dense gases, the model uses different modules for simulating behavior in the air and on the ground. When the cloud is in the air, the model solves conservation equations for mass, momentum (horizontal and vertical), and energy. On the ground, the equations additionally include the simulation of gravity slumping and frictional drag/mixing due to surface roughness effects. The motion of the cloud on the ground is determined by the height-averaged wind speed within the cloud. The dense gas model has a transition into a Gaussian phase when the density difference between the cloud and the ambient air is less than a specified ratio and/or the rate of change of cloud dimension is comparable to the rate of change of the crosswind Gaussian dispersion coefficient.

Prior to requesting comments on our use of the model, interactions with the developer were limited to questions about specifying the depth of a liquid pool, and the implementation of averaging time in the model. After requesting comments, the developer made several suggestions, which are discussed in Section III.C.2.

C. APPLICATION OF MODELS TO DATASETS

All 14 models have been "interfaced" with the Modelers' Data Archive (MDA), and 12 have been "automated." The "interface" between a model and the MDA is a program designed to extract information from the MDA file, and to prepare a table of input parameters and data required for each model. These tables would allow an analyst to enter all data in the requested units while executing each of the models. Choices about methods of initialization are made in the program. "Automated" models do not require us to manually enter data from these tables. That is, programs have been developed to construct all necessary input files, so that the automated models can be run in batch mode.

1. MDA Interface

Missing data in the MDA files are denoted by the value "-99.9", and may be present because no measurements are available, or because particular data are not relevant to the type of release. The first step in processing the data in the MDA is to replace certain types of missing data with either default or calculated values. These are summarized here.

Initial Concentration	1.0E+06 ppm (no dilution)
Ambient Pressure	1.0 atm
Exit Temperature	ambient temperature (K) measured nearest the ground
Soil Temperature	ambient temperature (K) as above
Normal Boiling Point	ambient temperature (K) as above
Relative Humidity	80 percent if over water
	50 percent if over wet soil
	20 percent if over dry land
Bowen Ratio	5 (essentially dry)
M-O Length, u_*, PG Class	estimated

The last of the entries above indicate that the Monin-Obukhov length scale (L), the friction velocity (u_*), and the Pasquill-Gifford stability class may be estimated. L and u_* are normally calculated from a pair of temperature measurements, a wind speed, the surface roughness length (z_0), and the Bowen ratio. This is accomplished by solving the surface similarity profile equations, and the calculated values usually replace any that may be reported in the MDA. This is done if values reported in the MDA were derived in a similar way (that is, from profile measurements of wind speed and temperature). A special case is the Thorney Island dataset. As pointed out in Section II, flux measurements were used to calculate the Monin-Obukhov length for these trials, rather than the profile method. Therefore, the interface program does not replace the values reported in the MDA for the Thorney Island trials. If the P-G stability class is missing, this is estimated from Golder's curves, making use of the calculated value of L, and the surface roughness.

If temperature measurements at two elevations near the surface are not available, either the reported values of L and u_* are retained, or these are estimated from the reported P-G stability class by making use of Golder's curves once again. This clearly requires that some information on the stability or turbulence regime must be provided in the MDA.

Several consistency checks are also made. Of particular note is a check on whether the diameter of the release is provided. This must be provided for releases characterized as an evaporating pool, or as a horizontal jet. If it is missing for these types of releases, processing of the dataset is halted, and an error message is written to the screen.

In addition to supplying default values and providing estimates of missing data, the MDA interface programs also provide calculated properties of the release. These calculated properties are needed to initialize models that do not have extensive modules for estimating the source-term. The MDA contains primary data obtained from data files and reports for each of the experiments used in this program. However, the application of any one of the models typically forces the modeler to, at a minimum, convert some of the units of measure, or compute a volume flux from mass flux and density information. In some cases, such as the application of a model that does not treat aerosols at all to the Desert Tortoise trials , the user needs to do far more to initialize the model in such a way that aerosol effects are simulated to some degree.

Recognizing that data in the archive are not complete in this sense, the second step in processing the data in the MDA is to calculate a number of quantities from the information provided in the MDA, which are needed to initialize one or more of the models to be evaluated. These quantities are discussed below.

Wind Speed at 1 and 10 m: Several models assume, either explicitly or implicitly, that the wind speed provided by the user is that measured at a height of 10m above the surface. Other models implicitly require a measure of the transport speed near the surface (which we take to be 1 m above the surface) in order to initialize them properly as discussed later in estimating the diameter of an area source. Many of the datasets include wind speed measured at some other height (u(z)). We have used the wind speed profile from surface similarity theory to calculate the speed at 10m from a knowledge of L, u(z), and z_0:

$$ws(10) = u(z) \frac{\ln(10/z_0) - \Psi_m(10/L)}{\ln(z/z_0) - \Psi_m(z/L)} \qquad (10)$$

The functions Ψ_m are quite complex, and are thoroughly described in equations (6) through (9) in Volume III. The wind speed at 1 m is calculated by means of the same equation, with the "10's" replaced with "1's."

The use of the symbol "u" for wind speed on the right-hand side of the equation has a specific purpose. Two wind speeds are entered into the MDA. The first is denoted as "ws", and is the speed measured on the same tower, and for the same averaging time, as the temperature measurements. This speed is used in concert with the temperature measurements to estimate the Monin-Obukhov length scale. The second is denoted as "u", and is the transport speed, which may represent an averaging time longer or shorter than "ws", or even an average of wind speed measurements from several locations. We use "u" rather than "ws" to estimate the wind speed at 1 and 10 m, because these estimates are related to transport. We assume that the Monin-Obukhov length calculated on the basis of "ws" applies to the entire duration and domain of the particular trial.

Boiling Point Temperature at Ambient Pressure: Several of the trials were performed at atmospheric pressures different from "1 atm", so the boiling point temperature is not equal to the normal boiling point temperature. If the coefficients (A,B) for the vapor pressure equation are provided in the MDA, the actual boiling point temperature is calculated. This calculation uses the same formulation as the SLAB model:

$$T_{bp} = T_{nbp} + \frac{B \quad \ln(P)}{A \, [A - \ln(P)]} \qquad (11)$$

where P is the ambient pressure in atmospheres.

Volumes and Densities: The ambient temperature, the temperature of the material at the point of release, and the boiling point temperature of the material can differ. Depending on the type of release, the properties of the release given to a model may be any one of these. Therefore, several volumes and densities are calculated for each of these temperatures, assuming ideal gas behavior. These include

Molar Volume,
Vapor Density,
Volume Flux, and
Total Volume Released.

Properties of Moist Air: Moisture in the air alters many of its properties. Those that are calculated are the molecular weight and density:

$$P_{sat} = .00603 \, e^{5417.8(1/273.2 - 1/T)} \qquad (12)$$

$$r = \frac{RH}{100} \frac{MW(water)}{(-1 + P \, MW(dry\ air)/P_{sat})} \qquad (13)$$

$$MW_a = \frac{MW(dry\ air) \, (1 + r)}{1 + r \, MW(dry\ air) \, / \, MW(water)} \qquad (14)$$

$$\rho_a = MW_a \, / \, MV(ambient) \qquad (15)$$

where MW denotes molecular weight, MV denotes molar volume, and RH is the relative humidity in percent.

Treatment of Aerosols: For cryogenic releases, a portion of the liquid that is released flashes to vapor, and the remaining liquid is frequently broken up into fine aerosols which remain suspended in the cloud. The mass fraction that flashes to vapor is calculated from the relation for simple flashing:

$$f = c_{p\ell} (T_s - T_{bp}) / \Lambda \quad (16)$$

where T_s is the storage temperature just before the liquid reaches the atmosphere (the exit temperature in the MDA), T_{bp} is the boiling-point temperature, Λ is the latent heat of vaporization, and $c_{p\ell}$ is the specific heat of the liquid. This mass fraction that is in the vapor state allows us to calculate the following properties of the <u>mixture at the boiling-point temperature</u>:

Density,
Effective Molecular Weight,
Volume Flux, and
Total Volume Released.

These properties could be used to initialize a model that does not treat two-phase vapor clouds if we assume that the aerosols evaporate so slowly that the simulation should not consider any heat exchanges due to evaporation. In this case, the cloud of suspended aerosols is treated as if it were a gas with an effective molecular weight that is adjusted so that the proper density is achieved.

A second method for initializing this type of model allows all of the liquid to evaporate, so that none of the aerosols survives. Because this requires heat from the ambient air, a substantial amount of air is mixed into the cloud, which possesses a temperature equal to the boiling-point temperature. This dilution assumption represents the extreme opposite to first method. Rather than never allowing the aerosol to evaporate, which emphasizes the importance of the initial density of the mixture, all of the aerosol is immediately evaporated, with much dilution, which emphasizes the importance of the mixing that takes place during the rapid phase changes.

The following properties are calculated for a diluted vapor cloud at the boiling point temperature:

Density,
Mole Fraction Vapor,
Contaminant Mass Fraction,
Total Volume Released, and
Volume Flux.

Models that are able to simulate the dispersion of a single-phase mixture of air and vapor can use these calculated properties of the diluted source cloud at the boiling-point temperature. Note that the molecular weight for these models is that of the chemical released. Models which cannot accept a diluted source directly must be given an effective molecular weight, as before, but this time the molecular weight is chosen to produce that density at ambient conditions which equals the density of the diluted cloud at the boiling point temperature. Several of the properties of the diluted cloud are computed as follows:

Initial mole fraction of vapor in the cloud (MFV):

$$MFV = \frac{\text{kg-moles vapor}}{\text{kg-moles air + kg-moles vapor}} = \left(1 + \frac{\text{kg-moles air}}{\text{kg-moles vapor}}\right)^{-1} \quad (17)$$

$$= \left(1 + \left[\frac{\Lambda}{dE}\frac{MW_v}{MW_a}(1-f)\right]\right)^{-1}$$

Contaminant mass fraction (CMF):

$$CMF = \frac{\text{mass contaminant}}{\text{mass contaminant + mass air}} = \left(1 + \frac{\text{mass air}}{\text{mass aerosol}}(1-f)\right)^{-1} \quad (18)$$

$$= \left(1 + \frac{\Lambda}{dE}(1-f)\right)^{-1}$$

for $\quad dE = c_p(\text{air})\left[T(\text{air}) - T_{bp}\right]$

Density of the cloud:

$$\rho = \frac{MFV\ MW_v + (1 - MFV)\ MW_a}{MV_{bp}} \qquad (19)$$

where MW_v is the molecular weight of the vapor, MW_a is the molecular weight of the air, f is the fraction of contaminant that flashes to vapor (initially), Λ is the latent heat of vaporization of the contaminant, and dE is the heat released in cooling the air to the boiling point temperature of the contaminant.

Specifying Source Dimensions: Not all models accept source dimensions that are explicitly provided in the MDA. A good example is DEGADIS, which must characterize a source as a ground-level area source, regardless of whether the source is a rapidly evaporating pool, or a turbulent horizontal jet. Also, the MDA for a cryogenic release may provide information on the physical dimensions of the point at which the material is released to the atmosphere, but the ensuing flashing process largely determines the initial character of the resulting two-phase jet, so that the initial properties of the source must be estimated. The following discussion outlines the assumptions made in estimating the dimension of the release for various types of releases, and for various types of models.

(1) Liquid Release Into an Evaporating Pool (EP)

This release is characterized as an area source in all of the models that require a source-dimension, and the diameter of the pool (either bounded or unbounded) must be provided in the MDA (a missing value indicator is not allowed). Therefore, the MDA values are used without alteration.

(2) Instantaneous Release (IR) of a Gas or a Cryogenic Liquid

This type of release is also characterized as an area source in all of the models that require a source-dimension. If the MDA should contain the diameter of the cloud resulting from the instantaneous release of a gas, as in the Thorney Island trials for example, that diameter is used without alteration. However, if the diameter is not provided, or if the cloud results from a cryogenic release, the diameter is calculated for a volume shaped as a cylinder in which the radius of the base is equal to the height:

$$\text{diameter} = 2 \left(\text{volume} / \pi\right)^{1/3} \qquad (20)$$

The volume used depends on the temperature of the cloud, and in the case of cryogenic liquids, the method selected for the simulation of aerosol effects.

(3) Extended Release of a Gas as an Area Source (AS)

The diameter of the source region contained in the MDA is used when available. However, if the diameter of the source is missing from the MDA, it is estimated in the following way. The volume flux is known, having been calculated from other information contained in the MDA. When divided by a velocity scale, an areal scale is obtained. Taking the transport wind speed at a height of 1 m as the velocity scale, we interpret the resulting scale as the area of the equivalent area source which produces the volume flux. Hence, the diameter of the source is estimated as:

$$\text{diameter} = 2 \sqrt{\frac{Q}{\pi U}} \qquad (21)$$

where Q is the volume flux for the gas at the exit temperature. Note that the volume flux must contain any air which may be mixed with the gas before reaching the atmosphere.

(4) Extended Release as a Horizontal Jet (Either a Gas or Cryogenic Liquid)

Several of the models included in the evaluation can accept information that describes a jet, while others cannot. Methods used to specify the dimension of the source will first be described for those models that do accept a jet. For gases, the diameter contained in the MDA is used without modification. (Remember that this diameter must be provided in the MDA for sources characterized as horizontal jets.) For cryogenic liquids, the initial diameter of the jet must be consistent with the total volume flux, including the fraction of the liquid that flashes to vapor. Or if all of the liquid is evaporated by mixing in air, the volume flux must include the air as well. We assume that the speed of the jet is equal to the speed of the liquid at the orifice, and that the cross-sectional area of the jet enlarges to accommodate the change in density. Denote the density of the jet as ρ_j , and the density of the liquid as ρ_l, then:

$$\text{jet diameter} = \text{orifice diameter}\ \sqrt{\rho_l/\rho_j} \qquad (22)$$

For models that simulate aerosols, ρ_j equals the density of the vapor/aerosol mixture at the boiling point temperature. It is assumed that the droplets are small enough to remain airborne. For those that do not simulate aerosols, ρ_j would equal either the density of the vapor/aerosol mixture at the boiling point temperature if we assume that the aerosols never evaporate, or ρ_j equals the density of the vapor/air mixture of the diluted jet if we assume that all of the aerosols are evaporated at the source as a result of entraining a sufficient amount of air.

Models that do not accept a jet as a source are initialized as an area source. Equation 21 is described previously. Note that the treatment of aerosols influences the value of the volume flux used in this equation, as does the presence of air.

2. Initializing Individual Models

The final step in processing the data in the MDA is the preparation of files specifically designed for each of the models that are being evaluated. A subset of the MDA "interface" files is presented in Appendix B to illustrate how each model is applied to the different types of releases. As an overview of the procedures employed in initializing the models, the following sections address each model in turn, and summarize procedures for each type of release. This discussion is organized into several categories which cover aspects of specifying chemical properties, meteorological data, treatments of various types of sources, and our approach to extracting results for comparisons with observed data. The final category summarizes major comments received from the developer of each model.

AFTOX

AFTOX does not contain algorithms for simulating dense gas effects, aerosols, or initially dilute mixtures, but it does contain an evaporative emissions algorithm. Initialization procedures in this evaluation are limited to defining the meteorology, and specifying the mass emission rate (or total mass released if the spill is an instantaneous release) and pool area (if the spill is an evaporating liquid).

CHEMICAL DATABASE: A chemical database is contained in the model, primarily to provide information on slowly evaporating pools, and to convert between mass concentrations and volume concentrations. We modified AFTOX so that it always obtains the molecular weight of the vapor-cloud from the input file, rather than making use of the chemical database. This simplifies our evaluation, because the molecular weight is the only property required to model all of the trials, and is only used in converting concentrations from mass units to volume units.

WIND SPEED MEASUREMENT HEIGHT: AFTOX requests both a wind speed and the height at which the speed is measured. These are obtained from the MDA.

AVERAGING TIME ISSUES: Averaging time for the concentrations predicted by the model are supplied by the user, and this is used to approximate the effects of meanders in the flow. However, the minimum averaging time allowed is 60 s. No dosage-type averaging is done.

INITIAL CONCENTRATION: AFTOX dispersion calculations do not consider volumetric aspects of the initial vapor cloud, which can at times lead to near-field concentrations in excess of 1 part-per-part. In the case of source clouds that are diluted with air, we have specified an effective molecular weight for the vapor-air mixture (the model has been changed to allow the user to specify this molecular weight). AFTOX uses this molecular weight to convert from mass concentrations to volume concentrations. Near the source, we have applied an adjustment to all of the concentration predicted by AFTOX to force the results to values that do not exceed 1 part-per-part. The adjustment is given by:

$$C' = C/(1 + C) \quad (23)$$

where C' and C are in parts-per-part.

EVAPORATING POOL SOURCES: This type of source is not explicitly contained in the trials used in this evaluation, because AFTOX treats a boiling pool as a gaseous release.

TWO-PHASE JET SOURCES: AFTOX does not treat aerosols or density effects, so the phase of the material release does not matter. The consequences of this neglect of density effects will be seen in the model evaluations with field data in Section IV. Note that AFTOX is basically a point-source model, so that the area of the jet is not needed.

VAPOR-JET SOURCES: This type of source is simply modeled as a point-source.

POSTPROCESSING: Concentrations and sigma-y values can be reported at distances specified by the user, so no further processing is needed to extract these.

ISSUES RAISED IN REVIEW: AFTOX computes a stability class from either σ_θ, or from the wind speed and solar elevation provided by the modeler. We have always provided a value for σ_θ. If σ_θ was not available within the MDA, we calculated a value for σ_θ that would produce the stability class listed in the MDA, or derived from other information in the MDA. This was accomplished by "inverting" the calculation contained in AFTOX. This method assures consistency in the evaluation in that all models that make use of a stability class are using the same value.

AIRTOX

The version of AIRTOX that is being evaluated does not contain a source-model, so that all emission rate, temperature, aerosol fraction, and jet velocity information is calculated from the MDA. The model will explicitly account for initial dilution, aerosol evaporation, and entrainment for turbulent jets, which simplifies initialization procedures.

CHEMICAL DATABASE: AIRTOX has an extensive chemical database, which contains most of the chemicals used in these trials. Those that are not included are:

(1) Freon-12 We have changed the molecular weight listed for Freon in the database to 121.39 g/mole, and have left all other properties unchanged.

(2) Freon+N_2 The Thorney Island trials used a mixture of Freon-12 and Nitrogen as the vapor cloud. We simulate the density of these mixtures by creating a "chemical" for each of the trials. Using Freon as the base for all other properties, we change the molecular weight to reflect the mixture.

(3) Kr^{85} The Hanford trials used the radioactive properties of Krypton-85 to track the tracer-cloud. We model these trials as if an amount of "dry air" were released, equal in mass emission rate to the radiation rate. Chemical properties of "dry air" were obtained by starting with nitrogen (MW=30), and changing the molecular weight to 29.0. This procedure essentially results in a small amount of gas being released which is nearly equal to the density of the air.

(4) LPG LPG is modeled as pure propane.

(5) LNG LNG is modeled as pure methane.

Note that the cases in which Freon-12 or a mixture of Freon-12 and Nitrogen was released are isothermal; the temperature of the cloud and air are equal, and heat transfer from the ground is not important. This aspect allowed us to modify the molecular weight without regard for any of the other properties of the gas, because the transport and dispersion processes are not influenced by the thermodynamic calculations.

WIND SPEED MEASUREMENT HEIGHT: The model assumes that wind speeds are equivalent to those measured at 10 m above the surface. We estimate winds at 10 m if the MDA contains winds measured at some other height.

AVERAGING TIME ISSUES: No averaging times can be specified. AIRTOX does not adjust for meander effects, and does not produce dosage information, as the output is in terms of concentration "snapshots."

INITIAL CONCENTRATION: A dilution factor can be provided to simulate releases that are diluted, so that any initial concentration can be matched.

EVAPORATING POOL SOURCES: The emission rate, pool area, and pool temperature can be explicitly given to the model. A nominal pool depth of 0.01 m has been assumed for these simulations.

TWO-PHASE JET SOURCES: Aerosols and jets are explicitly treated, so that the properties of the jet calculated from the MDA can be accepted by the model. The only adjustment to the initial condition of the jet is that due to flashing. As described in subsection 3.3, the initial diameter of the jet is estimated from the diameter of the orifice, and the density of the mixture (see Equation 22).

VAPOR-JET SOURCES: Jets are explicitly treated, so that no other initialization procedures are required.

POSTPROCESSING: Concentrations and sigma-y values are reported at distances that are determined within the model. We obtain information at other distances in the following way. The files produced by AIRTOX report information in the form of "snapshots" at fixed intervals in time. We search through the time-history of concentrations at each distance to locate the maximum value at each distance. Concentrations and sigma-y values at the distances listed in the MDA are then found by interpolating linearly between these.

ISSUES RAISED IN REVIEW: Two changes were made to the way in which AIRTOX was applied to the trials.

(1) Releases of boiling liquids onto water had made use of values of thermal diffusivity and conductivity for wet soil, rather than those for water. This was done because no values for water were listed as options in AIRTOX. The developers have suggested, and we have used, the following values for water:

conductivity:	1.41 E-03	kcal/m-s-K
diffusivity:	1.41 E-06	m^2/s

(2) The version of AIRTOX used in this study reports concentrations that are converted from mass units to volume units by assuming a cloud temperature equal to the ambient temperature. The actual cloud temperature should have been used, and this change has been implemented in later versions of AIRTOX. We have changed all concentrations from AIRTOX to account for the cloud temperature. The correction factor depends on the initial temperature of the cloud, the ambient temperature, the heat capacities of the cloud and air, and the concentration (mole fraction) originally reported by AIRTOX.

BRITTER & MCQUAID (BM)

BM is a "workbook" model applicable to either continuous or instantaneous releases of vapor clouds that are denser than air. The nomograms that form the basis of the model require only a limited amount of information.

CHEMICAL DATABASE: None.

WIND SPEED MEASUREMENT HEIGHT: The model implicitly assumes that a wind speed measured at 10 m will be provided. We estimate the speed at 10 m if the MDA contains winds measured at some other height.

AVERAGING TIME ISSUES: No averaging time is explicitly incorporated in the procedure.

INITIAL CONCENTRATION: The model requires an initial volume or volume flux, and an initial density, so that any initial concentration can be accommodated.

EVAPORATING POOL SURFACES: These are modeled as a continuous release of vapor; the size of the pool is not needed.

TWO-PHASE JET SOURCES: Aspects of the jet are not included, but aerosols are modeled by mixing enough air into the cloud to evaporate all aerosol.

VAPOR-JET SOURCES: Aspects of the jet are not modeled.

POSTPROCESSING: The model provides the ratio of the concentration at each distance to the initial concentration, so that concentration estimates in ppm are easily calculated without the need for interpolation. No estimate for σ_y is made.

CHARM

CHARM is operated by means of a sequence of menus or screens in an interactive process whereby the properties of a series of puffs are determined and meteorological data are entered. Because the menu system makes use of the special cursor keys (those without standard ASCII equivalent codes), the model could not be "automated" for use during this project.

CHARM allows the source data to be calculated directly from primary release information (for example, tank pressure, hole size, etc.), or it accepts puff information specified by the user. We have used the "user-specified" release option in order to obtain source-parameters directly comparable to those used in the other models being evaluated. We note that this is Version 6.1 of the model, which has only recently been released. This version allows a minimum resolution of 1 second in simulating releases, rather than the 1 minute used in Version 5, when properly initialized. This is particularly important in obtaining concentrations at receptors near the source, because concentrations are only provided at distances equal to the product of the wind speed and the time-step.

CHEMICAL DATABASE: A chemical database is used by CHARM. As in the application of AIRTOX, most of the chemicals needed for the evaluation are provided. We note the following exceptions:

(1) Freon+N_2 The Thorney Island trials used a mixture of Freon-12 and Nitrogen as the vapor cloud. We simulate the density of these mixtures by creating a "chemical" for each of the trials. Using Freon as the base for all other properties, we change the molecular weight to reflect the mixture.

(2) Kr^{85} The Hanford trials used the radioactive properties of Krypton-85 to track the tracer-cloud. We model these trials as if an amount of "dry air" were released, equal in mass emission rate to the radiation rate. The chemical properties of "dry air" were obtained by using the entry for oxygen, and changing the molecular weight to 29.0. This procedure essentially results in a small amount of gas being released which is nearly equal to the density of the air.

(3) LPG LPG is modeled as pure propane.

(4) LNG LNG is modeled as pure methane.

WIND SPEED MEASUREMENT HEIGHT: CHARM requests both a wind speed and the height at which the speed is measured. These are obtained from the MDA.

AVERAGING TIME ISSUES: We make no allowance for averaging time because meander effects are not explicitly included. CHARM 6.1 does provide average concentrations as an option, but this average is related to the predicted dose--it does not include averaging time effects on the dispersion process.

INITIAL CONCENTRATION: The initial fraction of air contained in the vapor cloud is specified by the user, so that any initial concentration can be modeled.

SOURCES: When operated in the "user-specified" mode, there is no difference in the types of data needed to initialize the different types of sources. For each type, CHARM needs characteristics to define each puff, including temperature, diameter, initial horizontal and vertical velocity, molar air fraction, and aerosol fraction.

POSTPROCESSING: No postprocessing is done in applying CHARM, because the concentration data are obtained "manually" by means of the screen options. Typically, a cursor is placed at the required distance, and time series of concentrations is generated for that distance. The peak value is read from the display. No information on the lateral scale of the cloud has been obtained. Note that all concentrations were estimated for receptors placed on the ground.

ISSUES RAISED IN REVIEW:

(1) The application procedure for the Thorney Island trials was questioned, because rather than modifying the molecular weight of "Freon-12" to represent the mixture of Freon-12 and nitrogen, the nitrogen could have been treated as "air." That is, the release could have been considered a diluted release, and the simulated concentrations of Freon could have been adjusted later to represent the original cloud (Freon + "air"). This method would be preferred if heat transfer were important. However, we have demonstrated that the methods are equivalent in this application to the Thorney Island trials.

(2) The Hanford trials were originally modeled as if carbon monoxide (MW=28) were the gas released. Although CO is only slightly less dense than air, this cloud was predicted to rise. After this problem was diagnosed by the developer, we modeled the Hanford trials with all models by using gases with molecular weight set equal to 29.0. The developer also pointed out the inherent problem of using a surrogate gas for the tracer-releases that cannot preserve the actual volumetric aspects of the release (see the discussion of the Hanford dataset in Section II).

(3) The size of the discharge orifice used during the Goldfish trials was questioned by the developer. Previous CHARM simulations of these

trials had used a larger value, which resulted in a flow speed of 1 to 3 m/s at the point of release, rather than a flow speed of about 20 m/s. However, the size of the orifice contained in our MDA is the reported value. The developer also suggested that the size of the jet be set equal to the size of the orifice, without allowing for the volume of the liquid that flashes to vapor. This latter suggestion is not consistent with methods used to initialize other models, and was not adopted for this study.

DEGADIS

Although DEGADIS 2.1 contains the Ooms jet model (JETPLUME) for vertical jets, none of the trials in this evaluation involve vertical jets. But because the two passive gas continuous source experiments (Prairie Grass and Hanford) involved releases of small volumes of tracer material from a horizontally-oriented orifice, it was possible to simulate them as vertically-oriented jets with insignificant change in the initial jet elevation. Consequently these two experiments were modeled with JETPLUME. The initializations of all other experiments were made compatible with the basic area source formulation of the dispersion model.

CHEMICAL DATABASE: Properties of a few chemicals are contained in the code, but allowance is made for modifying any of these properties when setting up individual runs. Therefore, no "database" information was relied upon in this series of evaluations.

WIND SPEED MEASUREMENT HEIGHT: DEGADIS requests both a wind speed and the height at which the speed is measured. These are obtained from the MDA.

AVERAGING TIME ISSUES: An adjustment for averaging time is made to the rate of growth of the "tails" of the lateral distribution of concentrations. The lower limit allowed varies by stability class, with the minimum value equal to approximately 18 s. No mechanism is provided to perform dosage calculations, even for the transient version of the model. Time-series of predicted concentrations could be averaged in this way, but this would require the development of additional code.

INITIAL CONCENTRATION: A chemical mass fraction can be specified by the user, so that any initial concentration can be simulated at the source.

EVAPORATING POOL SOURCES: The LNG and LPG trials involve rapidly boiling pools. These are readily simulated as an area source, with the cloud temperature and pool area specified from the MDA.

TWO-PHASE JET SOURCES: Aerosols are not treated explicitly in the model. When using the isothermal source option, a series of data describing the concentration-density relationship is supplied by the user, and this can simulate density effects resulting from evaporation of the aerosols. In these evaluations, we have used a simple form of this relationship: a series of points describing the density of the vapor-aerosol-air mixture and the mass concentration of the vapor-aerosol in the cloud (as a function of the mole fraction of vapor-aerosol in the cloud) obtained by assuming complete adiabatic mixing. That is, the heat released by cooling the air (which is entrained) to the boiling-point temperature of the vapor is used to evaporate a portion of the aerosol. Once sufficient air is entrained to evaporate all of the aerosol, additional air raises the temperature of the cloud of vapor and air. This is what a user would be able to do without access to supplementary aerosol calculations.

VAPOR-JET SOURCES: Being an area source formulation, jets must be represented as an "equivalent" area source. The approach is described in Section III.C.1.

POSTPROCESSING: Concentrations are obtained at the distances specified in the MDA by interpolating linearly between those concentrations listed in the output files. Widths are calculated from interpolated values of "half width" and "Sy", which describe the lateral distribution of concentrations. The width, measured as "σ_y", is equivalent to the distance from the center of the cloud to the point at which the concentration drops to EXP(-0.5) times the concentration at the center of the cloud.

ISSUES RAISED IN REVIEW:

(1) The developers noted initially that the area-source part of DEGADIS should not be applied to passive tracer releases. Consequently, we modified our test procedures and applied JETPLUME to those experiments.

(2) We had originally treated aerosols by providing DEGADIS with initial conditions in which all aerosol had been evaporated by the entrainment of a sufficient amount of air. The developers recommended that the fuller treatment of the evaporation process be used. Because the adiabatic mixing relationships are readily implemented, we did change our method for treating aerosols. This method was described above.

FOCUS

FOCUS is operated by means of a sequence of menus or screens in an interactive process whereby the material properties, and characteristics of the weather, release, and terrain are entered. FOCUS can be run either in batch mode or in interactive mode once the input file is created. Our approach is to create one template input file for each of the datasets by running the input module of FOCUS. The MDA then creates the input file for each trial by updating the meteorological and release conditions in the corresponding template input file, so that all FOCUS runs can be run in batch mode. We note that because the Thorney Island trials use mixtures of Freon-12 and nitrogen, which affects the thermodynamic calculations of the input module, all input files for the Thorney Island dataset were created manually.

FOCUS allows the source data to be calculated directly from primary release information (for example, vessel volume, hole size, pipe length, etc.) or it accepts regulated release information specified by the user. We have used the regulated release option in order to obtain source-parameters directly comparable to those used in the other models being evaluated. FOCUS contains algorithms to treat aerosols, turbulent entrainment for jets, and evaporating pools. FOCUS has a dispersion algorithm similar to those of DEGADIS.

CHEMICAL DATABASE: A chemical database is used by FOCUS. All of the chemicals needed for the evaluation are provided. FOCUS is the only model in this study that deals with multi-component releases explicitly, like the Thorney Island trials. The model calculates the thermodynamic properties of the mixture internally. We note the following exceptions:

(1) Kr^{85} The Hanford trials used the radioactive properties of Krypton-85 to track the tracer-cloud. We model these trials as if an amount of Carbon Monoxide were released, equal in mass emission rate to the radiation rate. CO, with a molecular weight of 28, is slightly less dense than air. Because we cannot alter the chemical properties in the database, we decided to use a gas slightly less dense than air rather than a gas that is slightly heavier than air.

(2) LPG LPG is modeled as pure propane, since its mole fraction is very close to unity.

(3) LNG LNG is modeled as pure methane, since its mole fraction is very close to unity.

WIND SPEED MEASUREMENT HEIGHT: FOCUS assumes that the wind speeds are measured at 10 m. We estimate winds at 10 m if the MDA contains winds measured at some other height.

AVERAGING TIME ISSUES: Averaging time for the dispersion coefficients is specified by the user. No dosage-type averaging is done.

INITIAL CONCENTRATION: The initial fraction of air contained in the vapor cloud can be specified as additional components of the mixture being released, so that any initial concentration can be modeled.

SOURCES: The user can either specify the release as an unregulated release, where emission rate is calculated internally based on primary release information (for example, vessel volume, hole size, pipe length, etc.), or specify the release as a regulated release, where emission rate is input by the user. Other parameters such as aerosol fraction and jet velocity are all calculated internally by FOCUS.

SURFACE ROUGHNESS: FOCUS is one of only two models in this evaluation study (the other is AFTOX) that allows the user to specify the surface roughness both at the spill point and the surrounding area. Due to the uniform sites for our datasets, we use the same roughness for both.

POSTPROCESSING: Concentrations are obtained at the distances specified in the MDA by interpolating linearly between values contained in the output files. No estimates for σ_y are provided.

GASTAR

GASTAR mainly is operated by means of a sequence of menus or screens in an interactive process whereby the material properties, and characteristics of the weather and release are entered. However, because of the simple I/O structure, GASTAR can also be easily run in batch mode.

GASTAR contains algorithms to treat aerosols, turbulent entrainment for jets, and evaporating pools. GASTAR has a dispersion algorithm similar in concept to those of HEGADAS and DEGADIS.

CHEMICAL DATABASE: GASTAR includes an extensive chemical database. Most of the chemicals included in this evaluation can be drawn directly from the database, but there are several exceptions:

(1) Freon+N_2 The Thorney Island trials used a mixture of Freon-12 and Nitrogen as the vapor cloud. We simulate the density of these mixtures by creating a "chemical" for each of the trials. Using Freon as the base for all other properties, we change the molecular weight to reflect the mixture.

(2) KR^{85} The Hanford trials used the radioactive properties of Krypton-85 to track the tracer-cloud. We model these trials as if an amount of "dry air" were released, equal in mass emission rate to the radiation rate. One of the gases in the database is dry air, so modifications were not needed. This procedure essentially results in a small amount of gas being released which is nearly equal to the density of air.

(3) LPG LPG is modeled as pure propane.

(4) LNG LNG is modeled as pure methane.

WIND SPEED MEASUREMENT HEIGHT: The model assumes that the wind speeds are equivalent to those measured at 10 m above the surface. We estimate winds at 10 m if the MDA contains winds measured at some other height.

AVERAGING TIME ISSUES: Averaging times for the dispersion coefficients is specified by values in the MDA. No dosage-type averaging is done.

INITIAL CONCENTRATION: A dilution factor can be provided to simulate releases that are diluted, so that any initial concentration can be matched.

EVAPORATING POOL SOURCES: The emission rate, pool radius, and pool temperature can be explicitly given to the model.

TWO-PHASE JET SOURCES: Aerosols and jets are explicitly treated, so that the properties of the jet calculated from the MDA can be accepted by the model. The only adjustment to the initial condition of the jet is that due to flashing. As described in Section III.C.1, the initial diameter of the jet is estimated from the diameter of the orifice, and the density of the mixture.

VAPOR-JET SOURCES: Jets are explicitly treated, so that no other initialization procedures are required.

POSTPROCESSING: Concentrations and width parameters (from which sigma-y values can be derived) are reported at distances that are determined within the model. Concentrations and sigma-y values at the distances listed in the MDA are then found by interpolating linearly between these.

GAUSSIAN PLUME MODEL/INPUFF

These models are applied in this evaluation as point source models, and contain no algorithms to simulate aerosols or density effects.

CHEMICAL DATABASE: There is no chemical database.

WIND SPEED MEASUREMENT HEIGHT: No measurement height is required, as these models assume that a wind speed representative of the transport speed is supplied. We have used the "reported" wind speed from the MDA, regardless of the height at which it was measured. Note that this is seldom equal to the wind speed estimated at 10 m for these trials.

AVERAGING TIME ISSUES: The steady-state GPM does include an adjustment to the lateral spreading parameter which is meant to incorporate meander effects on mean concentration distributions. INPUFF does not. The lower limit allowed for this adjustment is 20 s.

INITIAL CONCENTRATION: The initial concentration produced by these models is controlled by the initial size of the plume or puff. Initial values of sigma-y and sigma-z are calculated to produce a peak mass concentration at x=0 which is equal to the density of the cloud at the source. This automatically provides the proper specification of the volume concentration at the source.

EVAPORATING POOL SOURCES: These are treated as sources of pure vapor emanating from a point.

TWO-PHASE JET SOURCES: Because aerosols are not treated by these models, we have initialized these sources by including enough air to evaporate all of the aerosols, as described in subsection 3.3. Aspects related to the jets themselves are ignored.

VAPOR-JET SOURCES: Aspects related to the jets are ignored. These sources are modeled as simple point sources.

POSTPROCESSING: Concentrations are provided in the output at the distances specified in the MDA. Widths (sigma-y) are also provided by GPM at these distances, but no information on the width is provided in the output from INPUFF.

ISSUES RAISED IN REVIEW: Three options are provided in INPUFF for specifying the puff coefficients σ_y and σ_z. We used the option that invokes the PG values of σ_y and σ_z that are typically employed in plume-models. This was done to be as consistent as possible with the GPM calculations, so that together, GPM and INPUFF represent a well-known benchmark against which the performance of other models may be compared.

HEGADAS (NTIS)

This version of HEGADAS is very similar in operation to DEGADIS. The basic formulation is that of an area source from which a dense gas emanates.

CHEMICAL DATABASE: No chemical database is incorporated in HEGADAS.

WIND SPEED MEASUREMENT HEIGHT: The height at which the wind is measured is a required input to the model, and is provided by the MDA.

AVERAGING TIME ISSUES: Averaging time is included by altering the parameters that determine the growth rate of the lateral tails of the horizontal distribution. The approach is equivalent to that contained in DEGADIS, except that the user must specify the parameters rather than the averaging time.

INITIAL CONCENTRATION: There is no provision for an initial concentration other than that of a pure gas. We must use an effective molecular weight for the air/chemical mixture in those trials that require an initially dilute cloud, and adjust predicted concentrations to reflect the concentration of the chemical in air. Isothermal conditions are imposed.

EVAPORATING POOL SOURCES: The rapidly boiling pools of LNG and LPG are treated as area sources, as in DEGADIS.

TWO-PHASE JET SOURCES: The inability to accept a diluted vapor cloud results in the need to use the "pseudo-gas" approach described in Section III.C.1. Aerosols are evaporated by adding air to the source, but the resultant "chemical" is characterized by a molecular weight that depends on the mixture of gas and air at the boiling point temperature of the gas. At the suggestion of the developers of HEGADAS, we employ a non-isothermal simulation for the dispersion of this "pseudo-gas." The initial temperature of the cloud is the boiling-point temperature, and the heat capacity is the mole-fraction-weighted mean of that for the vapor, and that for air.

VAPOR-JET SOURCES: The initialization described in Section III.C.1 that allows a jet to be characterized as an area source is followed in the application of HEGADAS. However, a lower limit to the size of the area source (8 m square) was imposed in order to obtain results at distances contained in the sampler arrays. The model provides concentration estimates at internally determined distances, which are based on the scale of the area source. We had explored the sensitivity of the predictions to changes in the size of the area source, and found that to be small for those trials in which the limit-values were required.

POSTPROCESSING: Concentrations are obtained at the distances specified in the MDA by interpolating linearly between those concentrations listed in the output files. Widths are calculated from interpolated values of "MIDP" and "Sy", which describe the lateral distribution of concentrations. Note that the definition of "Sy" in HEGADAS differs by a constant factor from the definition used in DEGADIS.

ISSUES RAISED IN REVIEW: In addition to the suggestion that the non-isothermal option be used in simulating aerosols, the following were raised:

(1) The surface transfer parameter for dispersion over water should be set to 4, not 3. We have reset this parameter to 4 for the Burro, Coyote, and Maplin Sands trials.

(2) The linear interpolation used to obtain concentrations at points between those provided by the model can lead to significant underestimates of the predicted concentrations close to the source. The parameter XSTEP controls the spacing of points provided by HEGADAS. We revised the algorithm used to specify XSTEP (it depends on the length of the area-source) so that an absolute step-size of 5 m is always obtained. This minimized interpolation errors.

SLAB

SLAB explicitly allows the user to model horizontal jets, with or without aerosols, as well as evaporating pools. Therefore, much of the data contained in the MDA can go directly into the model.

CHEMICAL DATABASE: There is no chemical database. Chemical properties required by the model are listed for 14 substances in the users guide. We note that the following chemicals are not contained in the table, and must be constructed from outside sources of information:

(1) Freon+N_2 The Thorney Island trials used a mixture of Freon-12 and Nitrogen as the vapor cloud. We simulate the density of these mixtures by taking properties of Freon as the base for all other properties, and we change the molecular weight to reflect the mixture. Isothermal conditions must be assumed, and are appropriate for these trials.

(2) Kr^{85} The Hanford trials used the radioactive properties of Krypton-85 to track the tracer-cloud. We model these trials as if a small amount of "dry air" (with molecular weight equal to 29 g/mole) were released, equal in mass emission rate to the radiation rate. This procedure essentially results in a small amount of gas being released which is nearly equal to the density of the air.

(3) LPG LPG is modeled as pure propane.

(4) LNG LNG is modeled as pure methane.

WIND SPEED MEASUREMENT HEIGHT: The height at which the wind is measured is a required input to the model, and is provided by the MDA.

AVERAGING TIME ISSUES: SLAB explicitly accounts for meandering effects and time-averaging of concentrations (such as for dose calculations) for the period specified by the user. None of the other models in this evaluation do both.

INITIAL CONCENTRATION: The model assumes that the material released is pure, being undiluted.

EVAPORATING POOL SOURCES: The emission rate, size of the pool, and temperature of the pool are explicitly accepted as input.

TWO-PHASE JET SOURCES: SLAB includes algorithms for the treatment of evaporation of aerosols, and entrainment due to turbulent jets. This type of source is characterized by the liquid mass fraction, temperature, and cross-sectional area of the jet. This area includes the fraction of the material that flashes to vapor, as discussed in Section III.C.1 (Equation 22). The velocity of the jet is determined internally by conservation of mass.

VAPOR-JET SOURCES: These sources are specified in the same way as the two-phase jets, except that the liquid mass fraction is zero, and the area of the release is simply the area of the orifice through which the gas is emitted.

POSTPROCESSING: Concentrations are obtained at the distances specified in the MDA by interpolating linearly between values contained in the output files. Linear interpolation is also used to estimate the lateral distance between the center of the distribution and the point at which the concentration equals C_o* EXP(-0.5), which is our operational definition of sigma-y.

TRACE

TRACE contains algorithms to treat aerosols, and allows for sources that are initially diluted with air, but does not contain a turbulent entrainment algorithm for jets.

CHEMICAL DATABASE: TRACE includes an extensive chemical database. Most of the chemicals included in this evaluation can be drawn directly from the database, but there are several exceptions:

(1) Freon+N_2 The Thorney Island trials used a mixture of Freon-12 and Nitrogen as the vapor cloud. We simulate the density of these mixtures by creating a "chemical" for each of the trials. Using Freon as the base for all other properties, we change the molecular weight to reflect the mixture.

(2) Kr^{85} The Hanford trials used the radioactive properties of Krypton-85 to track the tracer-cloud. We model these trials as if an amount of "dry air" were released, equal in mass emission rate to the radiation rate. The chemical properties of "dry air" are obtained by modifying the file for nitrogen. We change the molecular weight to 29.0. This procedure essentially results in a small amount of gas being released which is nearly equal to the density of the air.

(3) LPG LPG is modeled as pure propane.

(4) LNG LNG is modeled as pure methane.

WIND SPEED MEASUREMENT HEIGHT: The height at which the wind is measured is a required input to the model, and is provided by the MDA.

AVERAGING TIME ISSUES: Averaging time is an input to the model, and is used to simulate the effects of meander for "longer" averaging times. However, the formulation produces insignificant adjustments to the predicted concentrations if the averaging time is less than 900 s, which is the case for most of the trials included in this evaluation.

INITIAL CONCENTRATION: The initial concentration is specified as an air/chemical mole ratio.

EVAPORATING POOL SOURCES: Evaporation from pools is characterized by the initial pool radius, pool temperature, and flow rate into the pool. These quantities are obtained from the MDA. In addition, a minimum pool depth, and an albedo is required, and we have used default values of 0.01 m for the minimum depth, and an albedo of 0.15. The emission rate for the vapor is calculated within the model.

TWO-PHASE JET SOURCES: The amount of liquid that flashes to vapor is computed by TRACE, but the amount of liquid that remains suspended as aerosol in the jet (rather than deposited on the ground) can be specified by the user in the form of an "aerosol/flash" mass ratio. The mass ratio chosen in this evaluation is 10000., which is large enough to force all of the liquid to remain in the cloud. A second option allows the user to specify how much air is entrained as some portion of the aerosol is evaporated. We have followed the recommendations contained in the manual, and selected the default mode for this option. This default mode mixes in sufficient air to evaporate all of the aerosol, but unlike the method described in Section III. C.1, the thermodynamic calculations allow the cloud to become supercooled. As a result, less air is required, and the resulting mixture is denser due to the lower temperature, and the smaller fraction of air.

VAPOR-JET SOURCES: No entrainment calculations are performed for turbulent jets, so this type of source is simply initialized as a release of gas from an area derived from the diameter of the release reported in the MDA.

POSTPROCESSING: Concentrations are predicted at up to 4 distances provided by the user. Therefore, trials that involved more than 4 distances were simulated several times in order to avoid the use of interpolations based on only 4 points. No information compatible with sigma-y is provided in the output from the model.

ISSUES RAISED IN REVIEW: The developers of TRACE suggested that linear interpolation not be used in obtaining concentrations at specific distances. As a result, no interpolation was used, as noted above. A suggestion was also made that we perform off-centerline calculations for comparisons with the Thorney Island trials. We retain the centerline calculations because a clear trajectory for the observed cloud is not well-defined and we wish to apply all of the models in a similar way.

OB/DG

This regression formula requires distance, and Δt over a specified height interval. It provides concentration in mass units, divided by the emission rate. Therefore, to perform the OB/DG calculation, we obtain two temperatures and the heights at which they were measured, and the distance to each monitor from the MDA. Concentrations are converted to ppm (volume) by means of the emission rate, molar volume, and the molecular weight of the gas. Finally, we avoid predicting concentrations in excess of 1 part-per part by using the adjustment formula discussed for AFTOX. No estimates of σ_y can be obtained from OB/DG.

PHAST

PHAST requires a release scenario, rather than specific information on the rate of release, aerosol fraction, source-induced entrainment, etc. For example, liquids may be released from some sort of container, through a hole or release valve, and the user must specify the storage conditions and the size of the hole. With this type of information, PHAST calculates the properties of the release, including the emission rate. Because our aim is to reproduce controlled experiments in which the properties of the release are fairly well known, we must "engineer" the description of the release in order to obtain the stated properties of the release. This generally requires some iteration in which tank pressure or hole size is varied. As a result, the input data listed on the top portion of each page in Appendix B are not those actually used in reproducing the stated emission rates.

CHEMICAL DATABASE: PHAST has an extensive chemical database, which contains most of the chemicals used in these trials. Those that are not included are:

(1) Freon+N_2 The Thorney Island trials used a mixture of Freon-12 and Nitrogen as the vapor cloud. We simulate the density of these mixtures by creating a "chemical" for each of the trials. Using Freon as the base for all other properties, we change the molecular weight to reflect the mixture.

(2) Kr^{85} The Hanford trials used the radioactive properties of Krypton-85 to track the tracer-cloud. We model these trials as if an amount of "dry air" were released, equal in mass emission rate to the radiation rate. Chemical properties for the "dry air" are specified by taking the property-file for NO (MW=30), and changing the molecular weight to 29.0. This procedure essentially results in a small amount of gas begin released which is nearly equal to the density of the air.

(3) LPG LPG is modeled as pure propane.

(4) LNG LNG is modeled as pure methane.

Note that the cases in which Freon-12 or a mixture of Freon-12 and Nitrogen were release are isothermal; the temperature of the cloud and air are equal, and heat transfer from the ground is not important. This aspect allowed us to modify the molecular weight without regard for any of the other properties of the gas, because the transport and dispersion processes are not influenced by the thermodynamic calculations.

WIND SPEED MEASUREMENT HEIGHT: The model assumes that wind speeds are equivalent to those measured at 10 m above the surface. We estimate winds at 10 m if the MDA contains winds measured at some other height. A related parameter is the Surface Roughness Parameter (SRP), which depends on the roughness length (z_o), and the height at which the wind speed is assumed to be measured (10 m). The SRP is defined as $SRP = 0.4/\ln(10/z_o)$.

AVERAGING TIME ISSUES: No averaging times can be specified.

EVAPORATING POOL SOURCES: The emission rate, pool area, and pool temperature are provided in the MDA, but PHAST generally performs its own evaporation calculations, so it does not use these data. We found that the evaporation rate and the size of the pool determined by PHAST results in a net emission rate that is less than that given to all of the other models. To circumvent this situation, the developer of PHAST indicated that something like a "user-specified" mode of release can be obtained by altering the chemical property database. If a chemical is listed as a "reactive liquid", PHAST allows the modeler to specify the area of the source, and the emission rate. We implemented this approach for all LNG and LPG spills.

TWO-PHASE JET SOURCES: Aerosols and jets are explicitly treated, so that the properties of the two-phase jet are calculated within PHAST on the basis of the storage conditions and exit circumstances. We use the liquid leak from a Padded Liquid Vessel scenario in which the temperature and pressure are obtained from the MDA, and the hole size is varied until the stated emission rate is obtained. Note that the chemical properties of HF (for the Goldfish trials) differ from those assumed in the MDA, and as a result, the fraction flashed is on the order of 1.5 percent, rather than the 15 percent used to initialize other models in this evaluation program.

VAPOR-JET SOURCES: Jets are explicitly treated, so the only initialization procedure required is specifying the release scenario. We use the Pressurized Gas Vessel scenario in which the vapor escapes from a hole in a short (1 m long) line or, for the Prairie Grass trials, from a hole in the vessel. The diameter of the hole is taken from the MDA, and the pressure is varied in order to obtain the stated emission rate.

POSTPROCESSING: Concentrations are reported at three fixed distances as well as at an extensive list of other distances that are determined within the model. These are tabulated manually. Measures related to σ_y are also listed at these distances. Recall that σ_y is defined as the lateral distance from the center of the cloud to the point at which the concentration equals EXP(-0.5) times the concentration at the center. A box model is used to simulate the initial development of the cloud when the material is denser than air. This produces an estimate of the mean concentration in the cloud, and its "radius." Because the box model employs a "top-hat" profile for the lateral distribution of concentration in the cloud, the distance from the center of the cloud to the point at which the concentration "equals" EXP(-0.5) times the concentration at the center of the cloud, is equal to the reported "radius." Therefore, we use the reported "radius" as our measure of σ_y. Once a transition to "passive" dispersion is signaled in the model, a virtual line-source formulation is matched to the cloud and the lateral distribution of concentration is characterized in terms of the half-width of the virtual line-source, L, and a lateral "dispersion coefficient", S_y. From the equations describing a line-source, the condition that is given by:

$$EXP(-0.5) = \left\{ ERF\left(\frac{L - \sigma_y}{\sqrt{2}\, S_y}\right) + ERF\left(\frac{L + \sigma_y}{\sqrt{2}\, S_y}\right) \right\} \Big/ 2\, ERF\left(\frac{L}{\sqrt{2}\, S_y}\right) \qquad (24)$$

where ERF is the error function. This implicit equation for σ_y as a function of L and S_y for a line-source is solved using an iterative method.

ISSUES RAISED IN REVIEW: The central issue raised by the developer was the use of the "reactive liquid" specification that allowed us to model the evaporating pools of LNG and LPG in a manner consistent with the other models. Also noted, was a difference between version 2.01 used here, and the current version--the new version accounts for upwind spread of the cloud during the slumping phase, which results in larger concentrations. This effect would be most noticeable for the Thorney Island trials.

D. SUMMARY OF MODELS

The models evaluated here have considerable variation in their capabilities and input requirements. Some models simulate all aspects of a complex release typified by the Desert Tortoise and Goldfish experiments, including aerosols, entrainment processes associated with momentum jets, variable averaging times, detailed meteorological data, and site roughness. Others contain no modules that explicitly simulate aerosols, or dense-gas effects for that matter. These attributes are summarized here in order to highlight differences among the models which influence how each is applied to the various datasets. In Section II.E, we summarized significant attributes of the datasets included in this evaluation. Table 10 summarizes the ability of each of the models to account for these and other attributes.

Table 10

Attributes of Models. A Check (√) Indicates that the Model Accounts fro Variation in that Attributes. A Double Dash Indicates that the Model does not Account for Variations in that Attribute. A Number Indicates the Value Assumed by the Model. An Asterisk Indicates that we Accounted for this Attribute in our Model Initialization Assumptions.

	AFTOX	AIRTOX	BM	CHARM	DEGADIS	FOCUS	GASTAR	GPM	HEGADAS	INPUFF	OB/DG	PHAST	SLAB	TRACE
Type of Release:														
Neutral	√	√	--	√	√	√	√	√	√	√	√	√	√	√
Dense	--	√	√	√	√	√	√	--	√	--	--	√	√	√
2-phase	--	√	--*	√	--*	√	√	--	--*	--	--	√	√	√
Character of Release:														
Non-jet	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Jet	--	√	--	√	--	√	√	--	--	--	--	√	√	√
Duration of Release:														
Continuous	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Instantaneous	√	√	√	√	√	√	√	--	--	√	--	√	√	√
Type of Surface (Heat Transfer):														
Soil	--	√	--	--	√	√	--	--	√	--	--	√	--	√
Water	--	√	--	--	√	√	--	--	√	--	--	√	--	√
Surface Roughness:	√	√	--	√	√	√	√	(0.03m)	√	(0.03m)	--	√	√	√
Averaging Time:														
Meteorological	√	(10min)	--	(10min)	√	√	√	√	√	(10min)	--	(10min)	√	√
Dosage	--	--	--	√	--	--	--	--	--	√	--	--	√	--
Receptor Height (m):	√	0	0	√	0	1	0	√	0	√	1.5	0	√	√

The type of release (neutral, dense, 2-phase) has obvious implications for the dataset. The chief question that arises is: "How well do models perform in simulating dense-gas dispersion trials when no dense-gas algorithms are included?" Four models (AFTOX, GPM, INPUFF, and OB/DG) are designed for neutral releases only, and one (BM) is designed for dense-gas releases only. The character of the release indicates if entrainment and mixing induced by the turbulence associated with jet-like releases are included. Half of the models do not treat jets, which may influence their relative performance on the Desert Tortoise and Goldfish datasets. The duration of the release identifies models that are not able to treat instantaneous releases. Three models (GPM, HEGADAS, and OB/DG) do not, and so these models are not applied to the datasets with instantaneous releases. Note that as we have defined the various releases, all that are not instantaneous are considered continuous, regardless of the actual duration. Furthermore, we use a constant emission rate for those releases, so that "transient release" modes available in some of the models are not evaluated.

The next two categories describe attributes of the surface beneath the cloud. Six models distinguish among several categories (for example, dry soil, wet soil, water) in order to better represent heat and water vapor exchanges between the cloud and the surface. The rest either ignore heat exchange altogether (these models do not treat dense-gas clouds) or request just the temperature of the surface. Most of the models do require the roughness of the surface in order to characterize the turbulent surface-layer of the atmosphere. The simple Gaussian models GPM and INPUFF do not require a roughness length, because the length of 0.03 m is implicit in the PG dispersion rates that they use. BM and OB/DG, on the other hand, do not consider the roughness of the surface.

The averaging time is broken down into a meteorological averaging time, and a dosage averaging time. The meteorological averaging time refers to the use of algorithms that recognize the effect of averaging time on the atmospheric motions which affect the dispersion process. For a continuous release, the meander of the plume over longer averaging times increases the lateral spread of the "average plume." Eight of the models allow this type of averaging to be specified, and four more implicitly fix this averaging period to approximately 10 min by their use of PG dispersion rates in the passive limit, or the far-field. The dosage averaging time refers to the process whereby a time series of predicted concentrations are averaged over some specified period. This generally is relevant to instantaneous releases, or true transient releases. Two models, CHARM and INPUFF, allow the user to control the averaging period for this type of average, but do not alter the corresponding meteorological averaging period, so the result must be interpreted carefully. SLAB, on the other hand, incorporates both types of averaging, so that when an averaging period is specified, both aspects are treated consistently.

The last attribute in the table is the height at which concentrations are provided. This height cannot be adjusted in eight of the models (six of these place receptors at the surface, which is appropriate if peak concentration estimates are needed for surface-level releases). We note that all of the other models except CHARM were applied to the datasets with the actual height of the near-surface monitors specified. The height of the receptors used in a model can be very important when evaluating model performance against observed concentrations, especially with thin, dense-gas clouds. Monitors are usually placed above the surface. Measurements made near the point of release may not capture the largest concentrations if the depth of the cloud is less than the height of the sensor. Furthermore, the modeled cloud may be very shallow, so that a receptor placed at the height of the monitors may "miss" the modeled cloud. Depending on the formulation of the model, and the details of the trial, large underpredictions <u>or</u> overpredictions may result. Given this component of uncertainty in the evaluation, the results obtained at monitors/receptors placed near the point of release may not, in general, be "reliable."

SECTION IV

STATISTICAL MODEL EVALUATION

A. PERFORMANCE MEASURES AND CONFIDENCE LIMITS

The statistical evaluation methods used in this study are those described in Volume I. The model evaluation software package, BOOT, is based on recommendations by Hanna (Reference 69), who has applied an earlier version of the software to several air quality modeling scenarios. The software package can calculate the model performance measures known as the fractional bias (FB), geometric mean bias (MG), normalized mean square error (NMSE), geometric mean variance (VG), correlation coefficient (R), and fraction within a factor of two (FA2), which are defined below:

$$FB = \frac{\overline{X_o} - \overline{X_p}}{0.5(\overline{X_o} + \overline{X_p})} \quad (25)$$

$$MG = \exp(\overline{\ell n X_o} - \overline{\ell n X_p}) \quad (26)$$

$$NMSE = \frac{\overline{(X_o - X_p)^2}}{\overline{X_o}\,\overline{X_p}} \quad (27)$$

$$VG = \exp\left[\overline{\left(\ell n X_o - \ell n X_p\right)^2}\right] \quad (28)$$

$$R = \frac{\overline{(X_o - \overline{X_o})(X_p - \overline{X_p})}}{\sigma_{X_p}\sigma_{X_o}} \quad (29)$$

$$FAC2 = \text{fraction of data for which } 0.5 \le X_p/X_o \le 2. \quad (30)$$

where X_o is an observed quantity, and X_p is the corresponding modeled quantity.

Because the logarithmic forms of the mean bias and the variance (equations 26 and 2S) are more difficult to visualize than the absolute forms (equations 25 and 27), we prefer to use the absolute versions whenever possible. However, use of the absolute performance measures (FB and NMSE) is most justified only if X_o and X_p are never very different (say, within a factor of two). For example, this situation would occur if all data were taken on a monitoring arc at a fixed distance downstream, if the source emission rate were constant over all experiments, and if meteorological conditions were similar. However, if a data set contains several pairs of data with X_o/X_p and X_p/X_o equal to 10, 100, or more, then the logarithmic forms (MG and VG) are more appropriate. Since the observed concentrations vary over many orders of magnitude in the current study, due to the use of field data from a wide range of downwind distances, for a wide range of source emission rates, and from variable meteorological conditions, and also since C_o/C_p or C_p/C_o are often large in our data sets, we use MG and VG in the following analyses.

Because of certain characteristics of the logarithm (that is, $(\ell nX_o - \ell nX_p) = \ell n(X_o/X_p)$), equations (26) and (28) can be rewritten:

$$MG = \exp[\overline{\ell n(X_o/X_p)}] \qquad (31)$$

$$VG = \exp\left[\overline{\left(\ell n(X_o/X_p)\right)^2}\right] \qquad (32)$$

A "perfect" model would have both MG and VG equal to 1.0. Geometric mean bias (MG) values of 0.5 and 2.0 can be thought of as "factor of two" overpredictions and underpredictions in the mean, respectively. A geometric variance (VG) value of about 1.6 indicates a typical factor of two scatter between the individual pairs of observed and predicted values.

If there is only a mean bias in the predictions and no random scatter, then the following relation is valid:

$$\exp[(\ell nVG)^{1/2}] = MG \qquad (33)$$

The line representing this relation is drawn on the figures presented later in this section. At a given MG, the value of VG cannot be less than the values given by equation (33).

The values for the performance measures do not, alone, "tell the whole story." We would also like to know whether the mean bias for a particular model is significantly different from zero, for example. In addition, if model A has a geometric mean bias (MG) = 1.1, and model B has MG = 1.3, we may judge model A to have a "better" MG, but this conclusion may not be significant. Therefore, we also wish to know if MG (or any other measure) for model A is significantly different from that for model B. These questions require estimates of the 95 percent confidence intervals about the performance measure, and the differences between performance measures.

Our software employs bootstrap resampling methods to estimate the standard deviation, σ, of the variable in question. Then the 95 percent confidence intervals are calculated using the student-t procedure:

$$95\% \text{ confidence limits} = \text{mean} \pm t_{95}\sigma(n/(n-1))^{1/2} \qquad (34)$$

where n is the number of data pairs. Tables in which the student-t parameter, t_{95}, is given as a function of degrees of freedom, n-1, can be found in most statistics textbooks (for example, for large n, $t_{95} \sim 2$). In the figures that follow, 95 percent confidence limits on the geometric mean bias, MG, are drawn as horizontal lines, and significant differences in MG or VG values between different models are discussed for the few models with the best performance.

B. RESULTS OF EVALUATION

Performance measures are calculated from modeled and observed concentrations, and modeled and observed cloud-widths. The individual observed values and the modeled values for each monitoring arc (distance) of each trial, for each model, are listed in Appendix C. Two groups of concentrations are presented for the continuous dense gas field trials. The first includes modeled and observed concentrations that represent the longest averaging period available for that particular field trial, up to the period over which the observed concentrations can be considered steady. The second group represents the shortest averaging period available, but only for those four datasets that include both long and short averaging times. The data for the shorter averaging time are included because the predictions of some models are intended to represent short-term maximum concentrations. Matrices of the models and datasets included in Appendix C are presented in Tables 11 and 12.

Performance measures for concentrations can be evaluated for all 14 models and eight datasets, but there are several "holes." The holes arise because GPM, HEGADAS, and OB/DG are not applicable to instantaneous releases, and because modeled concentrations could not be obtained from DEGADIS and FOCUS when applied to the Hanford instantaneous releases. Furthermore, the Britter and McQuaid (BM) model is not appropriate for passive gas releases.

Performance measures for cloud-widths can be evaluated for eight models and six datasets (in some cases, the model is incapable of predicting cloud widths, and in other cases, the dataset is insufficient for estimating the observed cloud width).

Overall statistics could be calculated by combining results from all of the trials without regard for whether individual records were from a dataset containing instantaneous releases of a dense-gas cloud, or from a dataset of quasi-continuous releases of a passive tracer-gas. However, these datasets are sufficiently different that we wish to identify the performance of models for each type of dataset separately. To do this, we have identified four distinct groups of datasets, and have divided the continuous dense gas datasets into two separate groups--one for short averaging times (Group 1), and one for long averaging times (Group 2). The five groups are defined below:

Group 1 All continuous-release dense-gas datasets, for short averaging times--that is, minimum time resolution in the data. (Burro, Coyote, Desert Tortoise, Goldfish, Maplin Sands, Thorney Island-Continuous)

Group 2 Same as Group 1 but for longer averaging times approximately equal to the duration of release (several minutes)

Group 3 All continuous-release, neutral-buoyancy passive-gas datasets (Prairie Grass and Hanford-Continuous)

TABLE 11. MATRIX OF MODELS AND DATASETS FOR WHICH LATERAL CLOUD WIDTHS ARE EVALUATED.

	Burro	Coyote	Desert Tortoise	Goldfish	Hanford Continuous	Hanford Instantaneous	Maplin Sands	Prairie Grass	Thorney Island Continuous	Thorney Island Instantaneous
AFTOX	✓	✓	✓	✓	✓	--	--	✓	--	--
AIRTOX	✓	✓	✓	✓	✓	--	--	✓	--	--
BM	--	--	--	--	--	--	--	--	--	--
CHARM	--	--	--	--	--	--	--	--	--	--
DEGADIS	✓	✓	✓	✓	✓	--	--	✓	--	--
FOCUS	--	--	--	--	--	--	--	--	--	--
GASTAR	✓	✓	✓	✓	✓	--	--	✓	--	--
GPM	✓	✓	✓	✓	✓	--	--	✓	--	--
HEGADAS	✓	✓	✓	✓	✓	--	--	✓	--	--
INPUFF	--	--	--	--	--	--	--	--	--	--
OB/DG	--	--	--	--	--	--	--	--	--	--
PHAST	✓	✓	✓	✓	✓	--	--	✓	--	--
SLAB	✓	✓	✓	✓	✓	--	--	✓	--	--
TRACE	--	--	--	--	--	--	--	--	--	--

TABLE 12. MATRIX OF MODELS AND DATASETS FOR WHICH MAXIMUM CONCENTRATIONS ARE EVALUATED. ASTERISKS IDENTIFY DATASETS FOR WHICH BOTH SHORT AND LONG AVERAGING TIMES ARE EVALUATED.

	Burro*	Coyote*	Desert* Tortoise	Goldfish	Hanford* Continuous	Hanford Instantaneous	Maplin Sands	Prairie Grass	Thorney Island Continuous	Thorney Island Instantaneous
AFTOX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
AIRTOX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CHARM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
DEGADIS	✓	✓	✓	✓	✓	--	✓	✓	✓	✓
FOCUS	✓	✓	✓	✓	✓	--	✓	✓	✓	✓
GASTAR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
GPM	✓	✓	✓	✓	✓	--	✓	✓	✓	--
HEGADAS	✓	✓	✓	✓	✓	--	✓	✓	✓	--
INPUFF	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
OB/DG	✓	✓	✓	✓	✓	--	✓	✓	✓	--
PHAST	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SLAB	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TRACE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Group 4 All instantaneous-release dense-gas datasets (Thorney Island-Instantaneous)

Group 5 All instantaneous-release neutral-buoyancy passive-gas datasets (Hanford-Instantaneous)

Groups 1, 2, and 3 each include two or more experimental sites, but groups 4 and 5 each include a single experimental site. Obtaining performance measures for a group of several datasets brings up the difficult statistical problem of the best way of combining performance measures when several different types of field experiments are being analyzed. Hanna (Reference 69) recommends a method suggested by Tukey (Reference 70) in which, if the total dataset can be broken down into m datasets or blocks consisting of i_m points each, then the mean statistical parameters are calculated for the entire group of data, and 95 percent confidence intervals are calculated by blocked bootstrap or jackknife resampling. These m groups or blocks of data are separated by some sort of difference in input variables or environmental parameters (for example, one block may be high-wind cases and another block may be low-wind cases). In this blocking procedure, the resampling is done within blocks so that there always are i_m points resampled from a given block.

Predicted cloud widths are also evaluated. Because the monitoring network in several of the field tests (for example, Maplin Sands and Thorney Island) had insufficient resolution to define cloud widths, only two distinct groups of datasets are represented:

Group 2 above, minus Maplin Sands and Thorney Island-Continuous.
Group 3 above.

1. Evaluation of Concentration Predictions

a. Group 1: Continuous Dense Gas Releases with Short Averaging Times, All Distances

Statistics calculated for Group 1 (continuous dense gas releases with short averaging times) are listed in Appendix D-1, and the overall geometric mean bias, MG, and geometric variance, VG, for each model are shown in Figure 10a. A perfect model compared against perfect observations would be placed at the MG = 1 and VG = 1 point on this figure. A model that has no random scatter but suffers a mean bias would be placed somewhere along the parabolic curve that represents the minimum possible value of VG that corresponds to a particular MG (see Equation 33). Therefore, all of the points must lie "within" the parabola. Furthermore, the dotted lines on the figures mark the values of MG that correspond to "factor-of-two" differences in the means. Models that fall between the dotted lines produce estimates that are within a factor of two of observed values, on average.

The results illustrated in Figure 10a include all trials and all monitoring arcs for the datasets that involve short-term averages from quasi-continuous releases of dense-gas clouds (Burro, Coyote, Desert Tortoise, Goldfish, Maplin Sands, and Thorney Island (continuous)). The geometric mean bias MG values for all of the models except FOCUS, AIRTOX, INPUFF, and OBDG are within the dashed vertical lines, indicating that, on average, peak modeled concentrations are within a factor of two of peak observed concentrations. The tendencies of these models to overpredict or underpredict in Figure 10a can be summarized as follows:

Models that Overpredict by More Than a Factor of Two:
FOCUS

Models that Overpredict by Less Than a Factor of Two:
GASTAR, HEGADAS, PHAST, DEGADIS

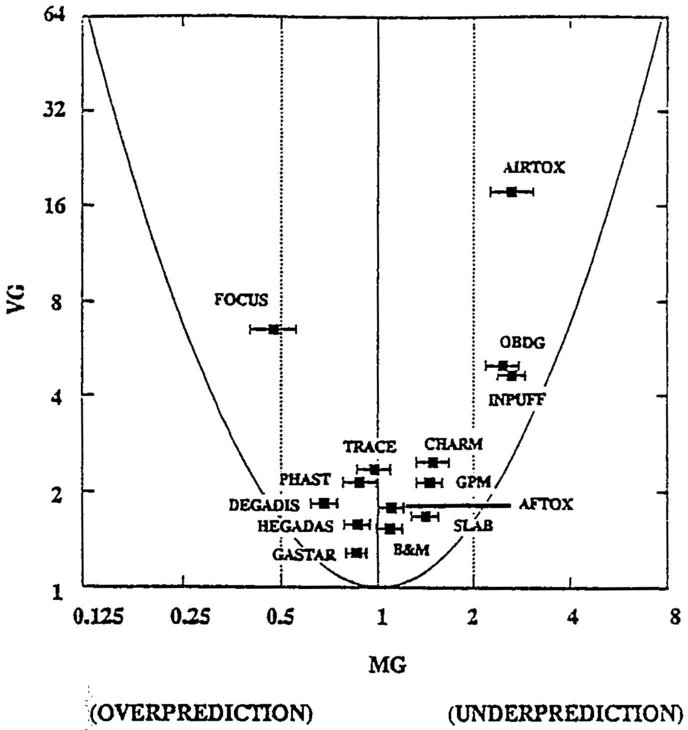
Models with No Significant Overprediction or Underprediction:
BM, AFTOX, TRACE

Models that Underpredict by Less Than a Factor of Two:
SLAB, GPM, CHARM

Models that Underpredict by More Than a Factor of Two:
AIRTOX, OBDG, INPUFF

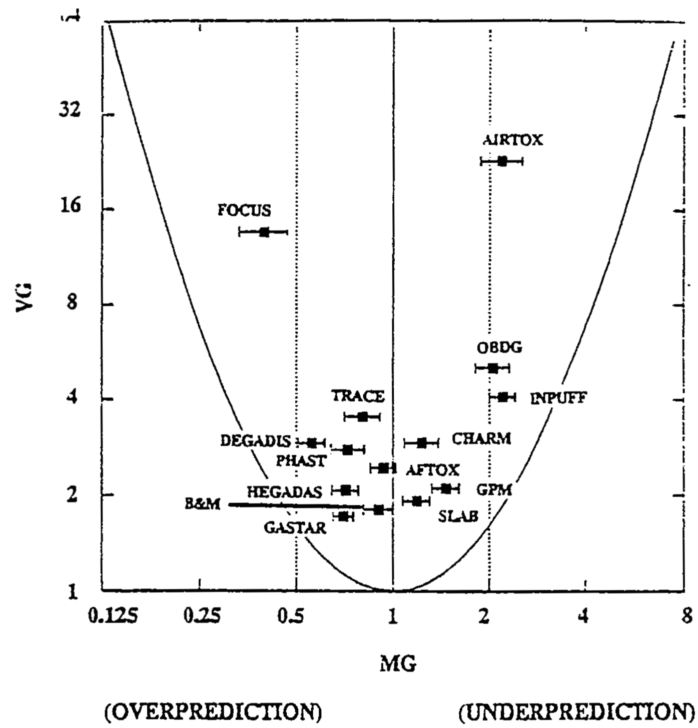
The FOCUS, AIRTOX, OBDG, and INPUFF models have a relatively large geometric variance, VG. The other models are "bunched" within a VG range of about 1.4 to 2.6. GASTAR has the smallest VG, indicating a typical

CONCENTRATIONS
CONTINUOUS DENSE GAS DATA WITH
SHORT AVERAGING TIME (GROUP 1)



a. Shortest available averaging times

CONCENTRATIONS
CONTINUOUS DENSE GAS DATA WITH
LONGER AVERAGING TIME (GROUP 2)



b. Longest available averaging times

Figure 10. Model performance measures, Geometric Mean Bias $MG = \exp(\overline{\ln C_o - \ln C_p})$ and Geometric Variance $VG = \exp[\overline{(\ln C_o - \ln C_p)^2}]$ for concentration predictions and observations for the continuous dense gas group of datasets (Burro, Coyote, Desert Tortoise, Goldfish, Maplin Sands, Thorney Island). 95 percent confidence intervals on MG are indicated. The solid line is the "minimum VG" curve, from Equation (33). The dashed lines represent "factor of two" agreement between mean predictions and observations.

scatter of slightly less than a factor of two. Note that the model (TRACE) with the best geometric mean does not have the smallest variance, and the model (GASTAR) with the smallest variance does not have the best geometric mean.

b. Group 2: Continuous Dense Gas Releases with Long Averaging Time, All Distances

Figure 10b shows the results for Group 2, for the same models and datasets as Group 1, but for concentrations associated with the "longest available" averaging times (approximately equal to the duration of the release). Actually, the only datasets that are altered by this distinction between Groups 1 and 2 are Burro, Coyote, and Desert Tortoise, which comprise approximately 1/3 of the data points in the combined set. Statistics tabulated for Group 2 that are plotted in Figure 10b are listed in Appendix D-2. Comparison of Figure 10b with Figure 10a shows, as expected, a shift of all models towards the left of the figure (that is, towards the overprediction side). The tendencies of the models to overpredict or underpredict in Figure 10b is summarized below.

Models that Overpredict by More Than a Factor of Two:
FOCUS

Models that Overpredict by Less Than a Factor of Two:
GASTAR, DEGADIS, TRACE, HEGADAS, PHAST

Models with No Significant Overprediction or Underprediction:
BM, AFTOX

Models that Underpredict by Less Than a Factor of Two:
CHARM, GPM, SLAB

Models that Underpredict by About a Factor of Two:
AIRTOX, OBDG, INPUFF

Except for the FOCUS and AIRTOX models, which have a relatively large geometric variance (VG), all models have moderate values of VG, in the range from about 2 to 5. These values indicate that the random scatter is typically about two to four times the mean. Five models (GASTAR, SLAB, GPM, and BM) have the lowest values of VG. In this figure, it is interesting that the Gaussian plume model (GPM) has relatively low geometric mean bias MG and geometric variance VG, which may be a fortuitous result, since that model is the simplest of all and does not include dense gas effects. However, another possibility is that the centerline concentration in a plume is not highly influenced by the plume density, since the changes in plume width are compensated by changes in plume depth.

c. Group 4: Instantaneous Dense Gas Releases, All Distances

In order to keep the discussions of the dense gas datasets together, we next consider Group 4, the Thorney Island (instantaneous release) trials. Figure 11 shows the results for Group 4 and the statistics are tabulated in Appendix D-3. These results are markedly different from those for the continuous releases of dense-gas clouds, since there is relatively little random scatter (except for the DEGADIS model) and the variance for all models tends to be dominated by the mean bias (that is, the points lie near the parabola marking minimum variance values, from Equation 33).

Analysis of the geometric mean bias, MG, in Figure 11 leads to the following conclusions:

Models That Overpredict by More Than a Factor of Two:
INPUFF, AFTOX

Models that Overpredict by about a Factor of Two:
TRACE, FOCUS

Models that Overpredict by Less Than a Factor of Two:
BM, PHAST, DEGADIS

Models with No Significant Overprediction or Underprediction:
AIRTOX

CONCENTRATIONS, INSTANTANEOUS DENSE
GAS DATASET (GROUP 4) THORNEY ISLAND

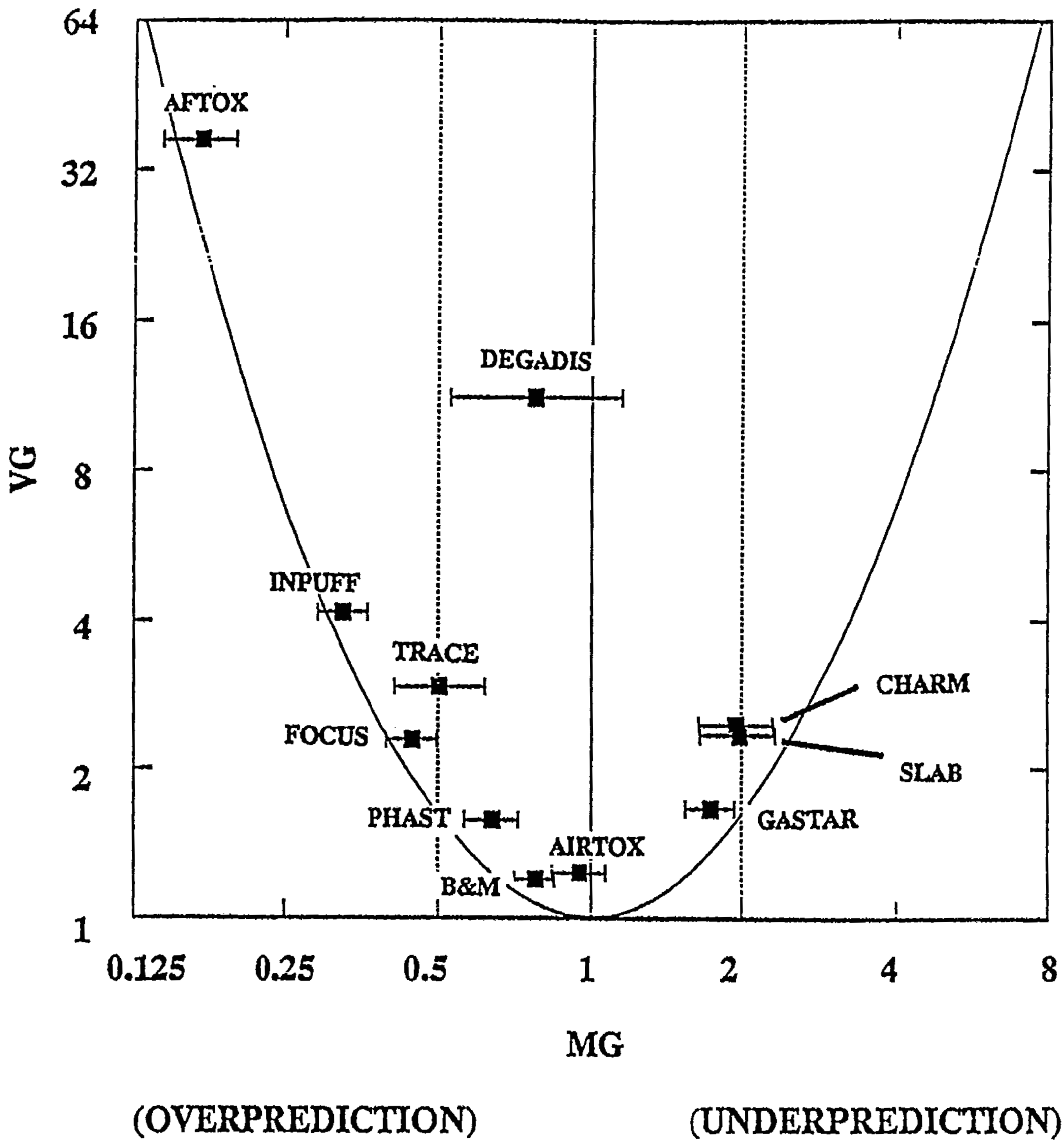


Figure 11. Model performance measures, Geometric Mean Bias MG = $\exp(\overline{\ell n C_o - \ell n C_p})$ and Geometric Variance VG = $\exp[\overline{(\ell n C_o - \ell n C_p)^2}]$ for concentration predictions and observations for the instantaneous dense gas data from Thorney Island. 95 percent confidence intervals on MG are indicated. The solid line is the "minimum VG" curve, from Equation (33). The dashed lines represent "factor of two" agreement between mean predictions and observations.

Models that Underpredict by Less Than a Factor of Two:
GASTAR

Models that Underpredict by About a Factor of Two:
SLAB, CHARM

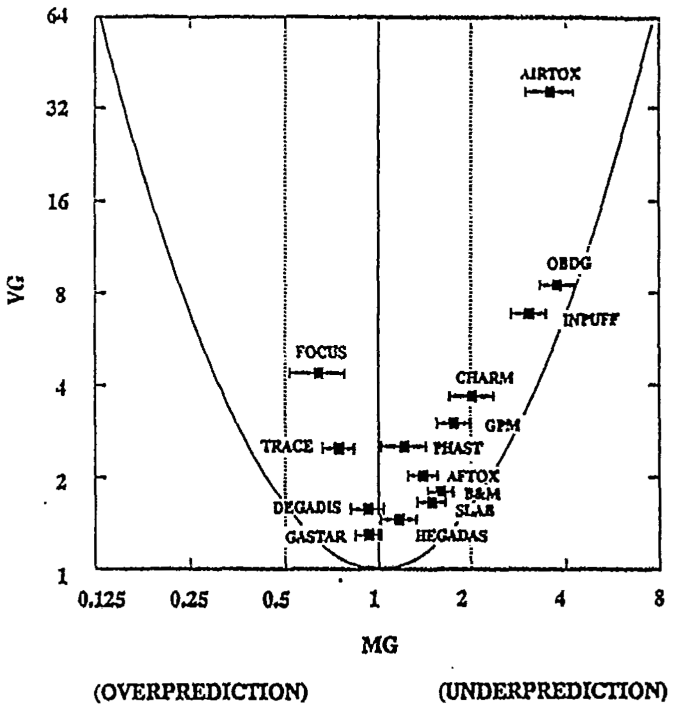
There are two models (BM and AIRTOX) with relatively low geometric variance of about 1.4 in Figure 11 indicating a typical scatter less than the mean. The AIRTOX model has the best geometric mean and the second-best variance, while the BM model has the best variance and the second-best geometric mean. The AFTOX and DEGADIS models have large variances.

d. Groups 1 and 4 (Dense Gas Releases), Distances > 200 m

Each of these evaluations for the dense-gas datasets in Groups 1, 2, and 4 include monitored and modeled concentrations at all downwind monitoring arcs. However, comparisons of predicted and modeled concentrations near the source may be misleading. Peak concentrations at the ground surface in shallow clouds may not be adequately detected by monitors placed on short masts above the ground (even at heights of 1 to 2 m), because the cloud may lie nearer the surface. A bias could result from insufficient resolution in either the vertical or lateral array of samplers. Concentrations modeled at the surface may appear to be overestimates in such cases, and overall performance evaluations that include these data may lead to inappropriate conclusions. Therefore, we have reduced the number of data points in Groups 1 and 4 by removing monitoring data from arcs closer than 200 m to the release point. This criterion removes the closest monitoring arc in all of the dense-gas datasets. The resulting statistics for this reduced set of data are tabulated in Appendices D-4 and D-5, and are summarized for Groups 1 and 4 in Figures 12a and 12b, respectively. With fewer data points, the 95 percent confidence limits on the statistical measures increase, especially for Group 4 (Thorney Island--instantaneous), shown in Figure 12b.

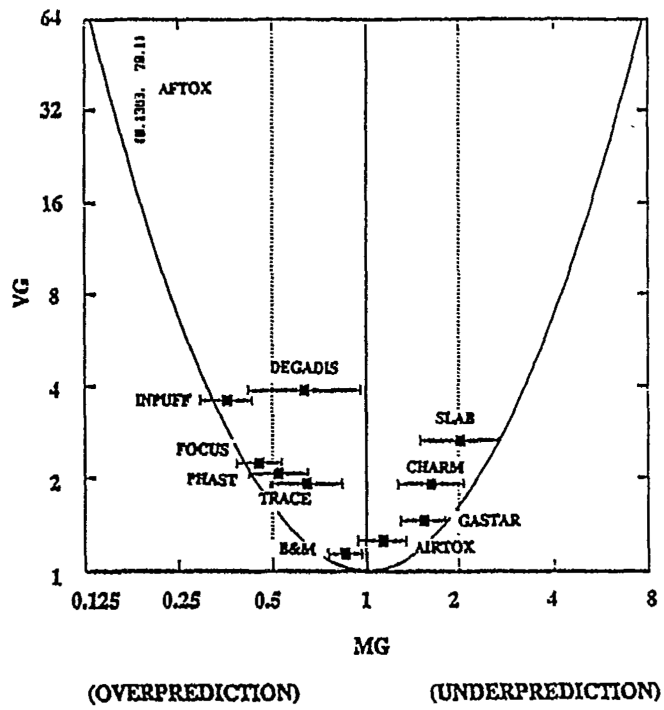
After removal of the data from the closest monitoring arcs, many of the models show a shift toward either less overpredictions or more underpredictions (that is, the mean ratio $\overline{C_p}/\overline{C_o}$ has decreased). This would be

CONCENTRATIONS
CONTINUOUS DENSE GAS DATA WITH
SHORT AVERAGING TIME (GROUP 1) AND X ≥ 200 M



a. Continuous dense groups of datasets (Burro, Coyote, Desert Tortoise, Goldfish, Maplin Sands, Thorney Island)

CONCENTRATIONS
INSTANTANEOUS DENSE GAS DATA
(GROUP 4) AND X ≥ 200 M



b. Instantaneous dense gas from Thorney Island

Figure 12. Model performance measures, Geometric Mean Bias MG = $\exp(\overline{\ell n C_o} - \overline{\ell n C_p})$ and Geometric Variance VG = $\exp[\overline{(\ell n C_o - \ell n C_p)^2}]$ for concentration predictions and observations at distances greater than or equal to 200 m. a: Continuous dense gas group of datasets (Burro, Coyote, Desert Tortoise, Goldfish, Maplin Sands, Thorney Island). b: Instantaneous dense gas data from Thorney Island. 95 percent confidence intervals on MG are indicated. The solid line is the "minimum VG" curve, from Equation (33). The dashed lines represent "factor of two" agreement between mean predictions and observations.

consistent with removing an overprediction tendency on the monitoring arcs in the near-field, where the measured concentrations may not represent peak concentrations. Analysis of the fractional bias in Figures 12a and 12b leads to the following conclusions for the dense gas data sets with the closest monitoring arc excluded:

Models that Overpredict by More Than a Factor of Two:

Continuous Release	Instantaneous Release
NONE	INPUFF, AFTOX

Models that Overpredict by about a Factor of Two:

Continuous Release	Instantaneous Release
NONE	FOCUS, DEGADIS, TRACE, PHAST

Models that Overpredict by Less Than a Factor of Two:

Continuous Release	Instantaneous Release
FOCUS, TRACE	BM

Models with Insignificant Overprediction or Underprediction:

Continuous Release	Instantaneous Release
DEGADIS, GASTAR	AIRTOX

Models that Underpredict by Less Than a Factor of Two:

Continuous Release	Instantaneous Release
PHAST, HEGADAS, BM, SLAB, AFTOX	GASTAR

Models that Underpredict by about a Factor of Two:

Continuous Release	Instantaneous Release
GPM, CHARM	SLAB, CHARM

Models that Underpredict by More Than a Factor of Two:

Continuous Release	Instantaneous Release
OB/DG, AIRTOX, INPUFF	NONE

The results for the geometric variance in Figures 12a and 12b are similar to those in Figures 10a and 11, since the only difference is the removal of the monitoring arcs with x < 200 m. With this change, most variances were reduced slightly. The largest variance in Group 1 is still given by the AIRTOX model, and the largest variance in Group 4 is still given by the AFTOX model. The GASTAR and EM models still show good performance for Group 4 (Thorney Island), although the AIRTOX model has "moved up" into one of the top three positions.

e. Groups 1 and 4 (Dense Gas Releases), Distances < 200 m

In order to assess the differences between model performance at far and near monitoring arcs, the data for x < 200 m are presented in Figure 13. Any dense gas effects will be amplified at these close distances. However, the observations may not indicate the true maximum concentration, because of inadequate horizontal and vertical resolution of the monitoring network.

Comparing Figures 12 and 13, it is seen that there indeed are more cases of model overprediction at close distances. Because of the shifts in the points, some of the models (for example, SLAB, GPM, TRACE, CHARM, AIRTOX) demonstrate improved performance at close distances for the continuous sources (parts a of the figures). Shifts also occur for the instantaneous sources (parts b of the figures), with the performance of some models (for, example, DEGADIS) deteriorating at the close distances, while the performance of other models (for example, PHAST) improves.

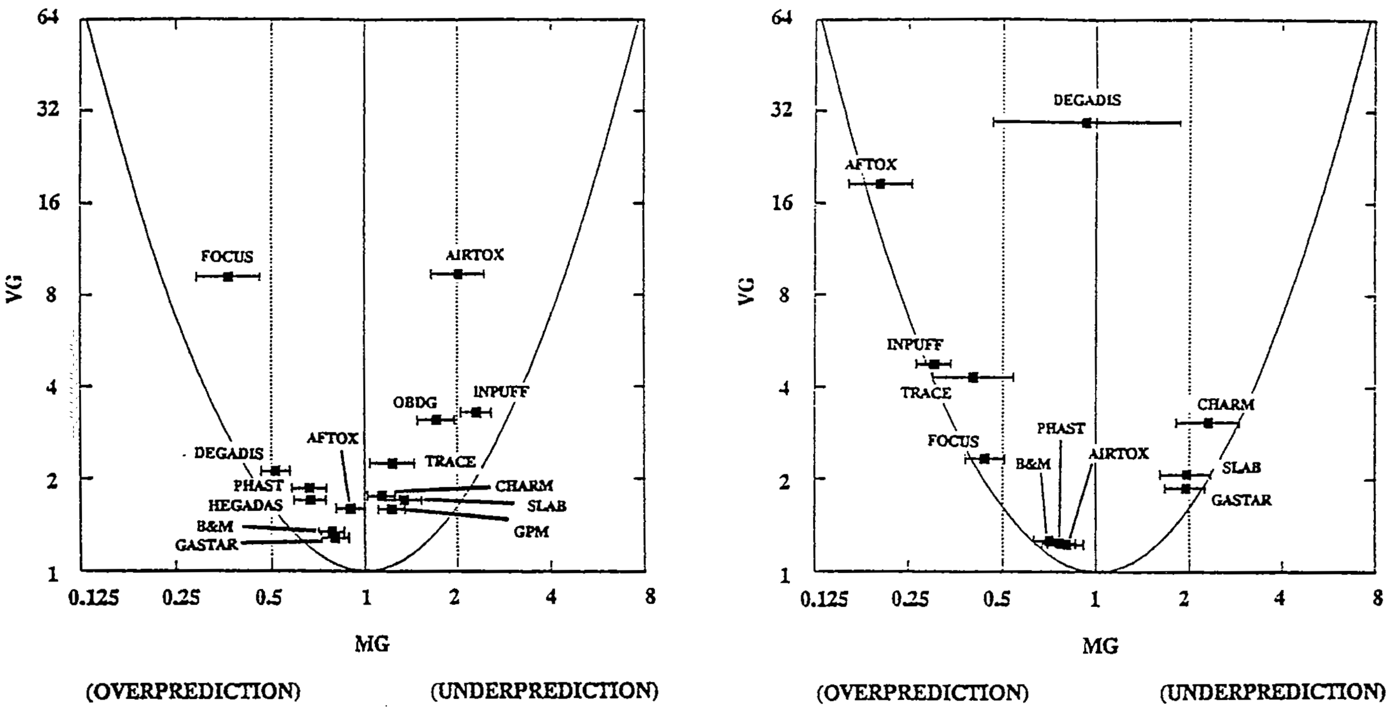
f. Groups 3 and 5: Passive Gas Releases

The statistics for the passive gas releases in Group 3 (continuous passive-gas releases) and Group 5 (instantaneous passive-gas releases) are tabulated in Appendices D-6 and D-7, and the plots of geometric mean bias MG versus geometric variance VG are shown in Figures 14a and 14b, respectively. Note that statistics for the continuous releases are dominated by the Prairie Grass dataset, while those for instantaneous releases are derived solely from the Hanford dataset.

The confidence limits on the geometric mean bias, MG, for the continuous releases of passive gases shown in Figure 14a are small, because

CONCENTRATIONS
CONTINUOUS DENSE GAS DATA WITH
SHORT AVERAGING TIME (GROUP 1) AND X < 200 M

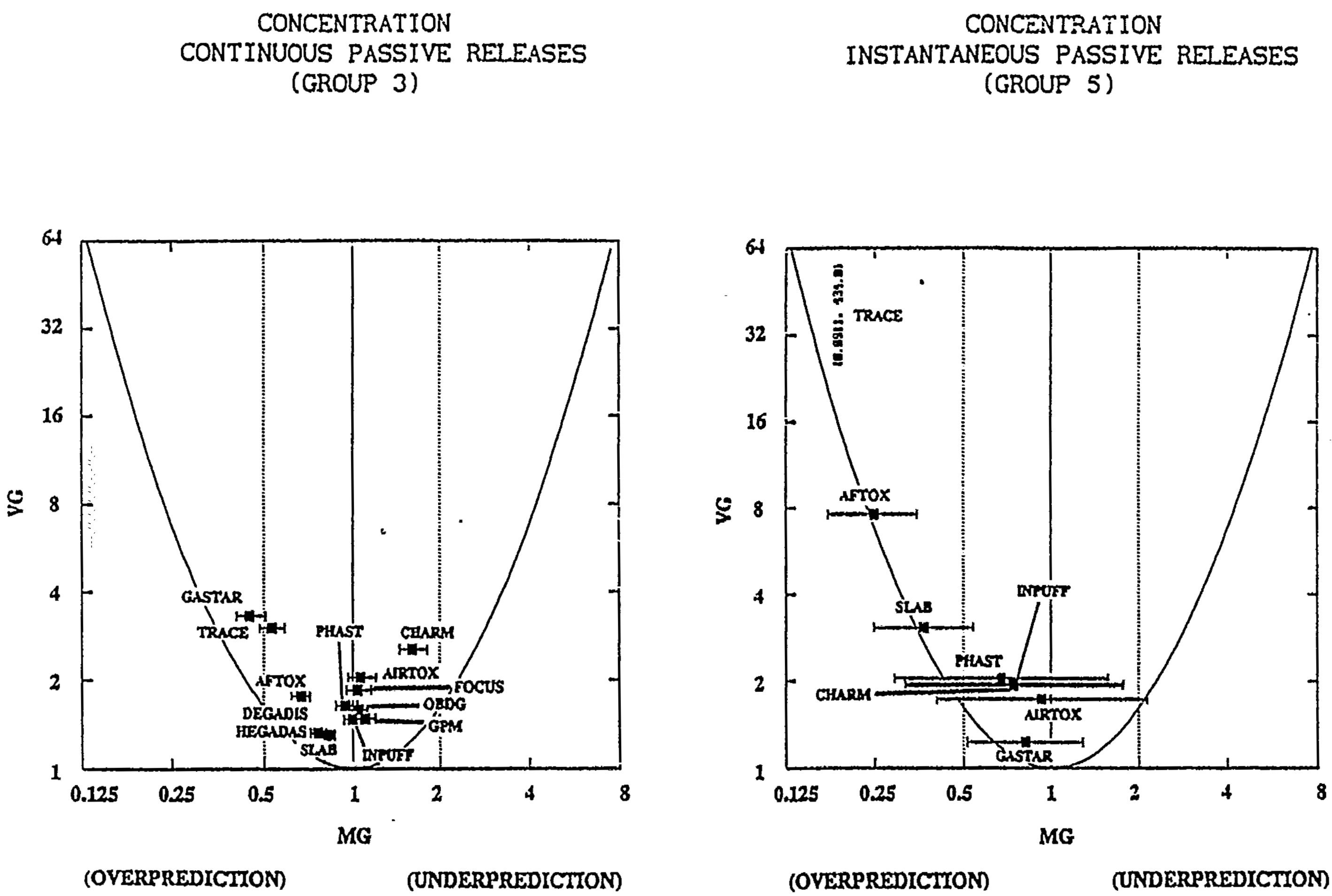
CONCENTRATIONS
INSTANTANEOUS DENSE GAS DATA
(GROUP 4) AND
X < 200 M



a. Continuous dense gas group datasets (Burro, Coyote, Desert Tortoise, Goldfish, Maplin Sands, Thorney Island)

b. Instantaneous dense gas dataset from Thorney Island

Figure 13. Model performance measures, Geometric Mean Bias MG = $\exp(\overline{\ell nC_o - \ell nC_p})$ and Geometric Variance VG = $\exp[\overline{(\ell nC_o - \ell nC_p)^2}]$ for concentration predictions and observations at distances less than 200 m. a: Continuous dense gas group of datasets (Burro, Coyote, Desert Tortoise, Goldfish, Maplin Sands, Thorney Island). b: Instantaneous dense gas data from Thorney Island. 95 percent confidence intervals on MG are indicated. The solid line is the "minimum VG" curve, from Equation (33). The dashed lines represent "factor of two" agreement between mean predictions and observations.



a. Continuous passive gas group of datasets (Prairie Grass and Hanford-continuous)

b. Instantaneous passive gas dataset from Hanford

Figure 14. Model performance measures, Geometric Mean Bias $MG = \exp(\overline{\ell nC_o - \ell nC_p})$ and Geometric Variance $VG = \exp[\overline{(\ell nC_o - \ell nC_p)^2}]$ for concentration predictions and observations. a: Continuous passive gas group of datasets (Prairie Grass and Hanford-continuous). b: Instantaneous passive gas dataset from Hanford. 95 percent confidence intervals on MG are indicated. The solid line is the "minimum VG" curve, from Equation (33). The dashed lines represent "factor of two" agreement between mean predictions and observations.

the Prairie Grass dataset provides many data-points. The GASTAR, TRACE, and CHARM models have relatively large variances. The geometric mean biases for Group 3 can be summarized as follows:

Models that Overpredict by about a Factor of Two:
TRACE, GASTAR

Models that Overpredict by Less Than a Factor of Two:
AFTOX, DEGADIS, HEGADAS, SLAB

Models with No Significant Overprediction or Underprediction:
INPUFF, GPM, OBDG, PHAST, FOCUS, AIRTOX

The models with the lowest variance (VG ~ 1.5) for Group 3 are the HEGADAS and SLAB models. The magnitude of the scatter for these models is slightly less than the mean value. The good performance of the HEGADAS model is surprising and probably fortuitous since that model is being initialized assuming a small area source, whereas the actual release was a small point source. A group of other models (AIRTOX, DEGADIS, OBDG, FOCUS, GPM, INPUFF, PHAST, and AFTOX) have relatively low VG values in the range from about 1.6 to 2.2, indicating that their scatter is approximately equal to the mean.

The Hanford dataset (Group 5) in Figure 14b has few numbers, leading to a large span in 95 percent confidence limits for the geometric mean bias, MG. Even so, all of the models tend to overpredict the peak concentrations on average. The GASTAR, AIRTOX, PHAST, INPUFF, and CHARM models have the best performance, with mean overpredictions of about 10 to 50 percent and scatters approximately equal to the mean. The TRACE model is unique in its very large degree of overprediction.

g. Analysis of Differences among Models

Up to this point we have characterized the tendency of each model to either overpredict or underpredict peak concentrations, based on the statistical measure, but we have not selected a "best" model. One way to characterize a "best" <u>group</u> of models is to identify the models with the smallest mean bias and the smallest scatter, and then ask the question: which other models have a bias or a scatter which is not significantly different from that of the "best" model? The answer provides one basis for defining the "best" group of models.

Appendix D-8 contains tabulations showing whether or not the difference in the geometric variance between pairs of models is significantly different from zero, at the 95 percent confidence level. Consider first the results for the continuous releases of dense gas shown in Figure 12a (Group 1, for distances greater than 200 m). GASTAR appears to have the best overall performance, but we see that its variance is not significantly different from the variance for HEGADAS. However, we see that the geometric mean bias MG found for GASTAR is significantly different from and closer to zero than the bias for the HEGADAS model, although there is no difference between the biases of the GASTAR and DEGADIS models. We conclude that, in general, this group of three models does a better job than the others of matching the peak observed concentrations at distances of 200 m or greater for continuous releases of dense gases.

A summary of model performance for the better performing models at distances greater than 200 m is given in Table 13 for Data Groups 1, 3, 4, and 5. There are no models that appear on the list of better models for all four data groups.

h. Analysis of Model Performance for Stable Ambient Conditions

Another facet of model performance that can be evaluated with these data is the question of how the models perform for the subset of the dense-gas data for which the atmospheric stability class is either E or F (that is, stable ambient conditions). Because "worst-case" dispersion conditions are usually found for these stabilities, many model applications focus on these stable ambient conditions. Figures 15a and 15b show the geometric mean bias (MG) and geometric variance (VG) results, and the statistics themselves are tabulated in Appendices D-9 and D-10 for the continuous and passive dense-gas releases, respectively.

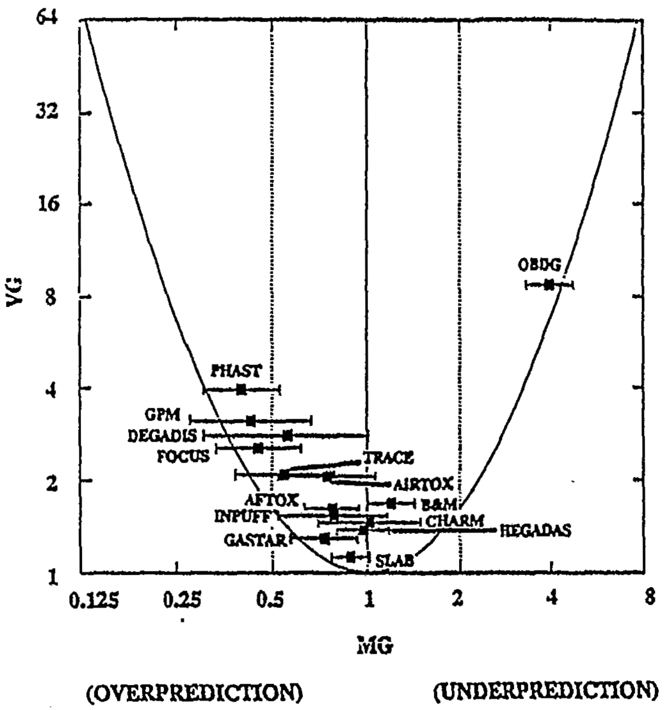
TABLE 13. SUMMARY OF BIAS AND VARIANCE RESULTS FOR PREDICTING PEAK CONCENTRATIONS, AT DISTANCES > 200 M.

	Minimum* Geometric Mean Bias MG $= \exp(\overline{\ln C_o/C_p})$	Minimum* Geometric Variance VG $= \exp(\overline{(\ln C_o/C_p)^2})$	Group of Better Models		
			Overpredicts	Even	Underpredicts
Continuous Dense Gas (x ≥ 200 m) Fig. 12a	0.95 (i.e., 5% bias)	1.4+		GASTAR DEGADIS	HEGADAS SLAB BM AFTOX
Instantaneous Dense Gas (Thorney Island) (x ≥ 200 m) Fig. 12b	0.90 (i.e., 10% bias)	1.2	BM	AIRTOX	GASTAR
Continuous Passive Gas Fig. 14a	1.00 (i.e., no bias)	1.4	HEGADAS SLAB	GPM INPUFF OBDG PHAST FOCUS AIRTOX	
Instantaneous Passive Gas (Hanford) (x = 800 m) Fig. 14b	0.95 (i.e., 5% bias)	1.3	CHARM INPUFF PHAST	AIRTOX	

* Minimum among the "better" performing group of models

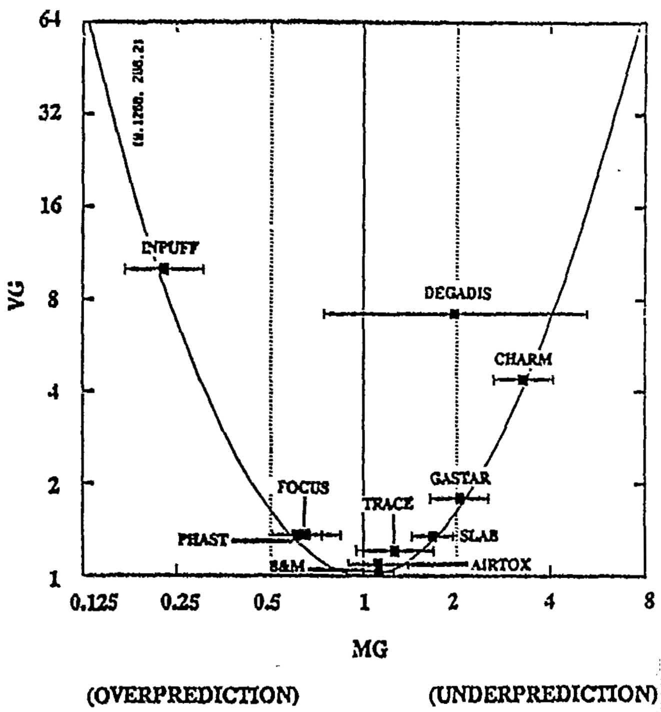
+ A value of VG ~ 1.6 indicates scatter equal to the mean

CONCENTRATIONS
CONTINUOUS DENSE GAS DATA WITH SHORT AVERAGING TIME (GROUP 1) X ≥ 200 M, AND STABLE AMBIENT CONDITIONS



a. Continuous dense gas group of datasets (Burro, Coyote, Desert Tortoise, Goldfish, Maplin Sands, Thorney Island)

CONCENTRATIONS
INSTANTANEOUS DENSE GAS DATA (GROUP 4) X ≥ 200 M, AND STABLE AMBIENT CONDITIONS



b. Instantaneous dense gas data from Thorney Island

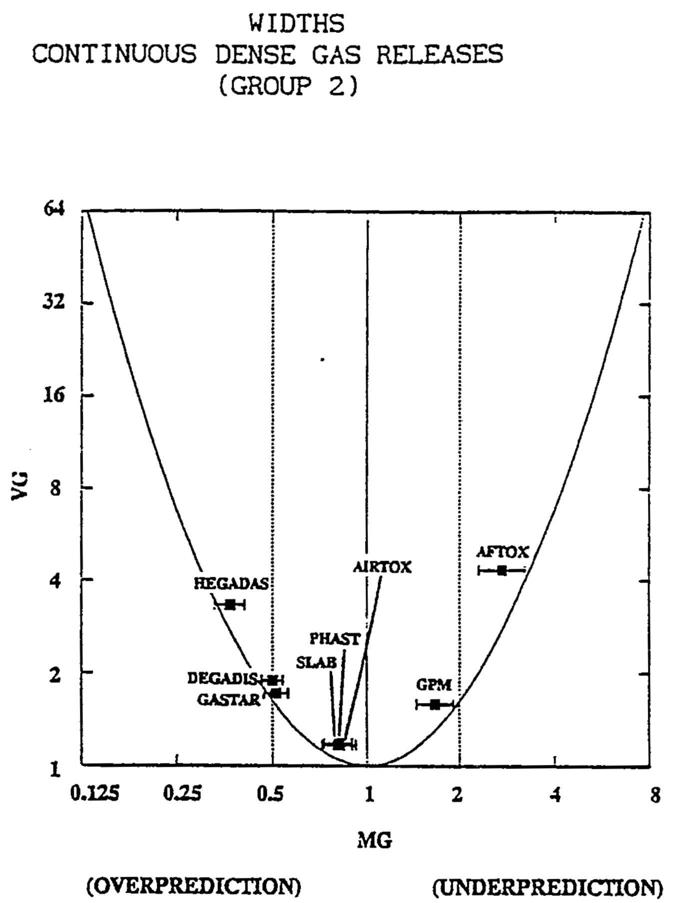
Figure 15. Model performance measures, Geometric Mean Bias $MG = \exp(\overline{\ln C_o - \ln C_p})$ and Geometric Variance $VG = \exp[\overline{(\ln C_o - \ln C_p)^2}]$ for concentration predictions and observations at distances greater than or equal to 200 m for STABLE (class E, F) conditions. a: Continuous dense gas group of datasets (Burro, Coyote, Desert Tortoise, Goldfish, Maplin Sands, Thorney Island). b: Instantaneous dense gas data from Thorney Island. 95 percent confidence intervals on MG are indicated. The solid line is the "minimum VG" curve, from Equation (33). The dashed lines represent "factor of two" agreement between mean predictions and observations.

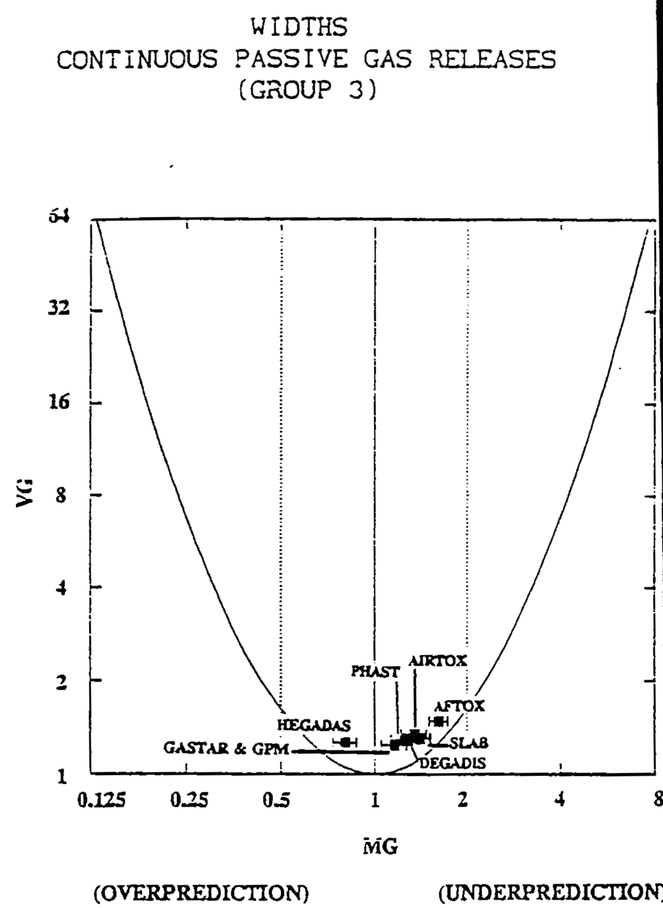
Comparing Figure 15a with Figure 12a, which includes all ambient stabilities, the models tend more towards overpredictions of peak concentrations during stable ambient conditions. In fact, only the OB/DG model shows a significant underprediction in Figure 15a. Although confidence limits are large due to the smaller number of points, one group of models appears to provide better performance. This group includes BM, HEGADAS, SLAB, CHARM, GASTAR, AFTOX, and INPUFF. Note that when the unstable and neutral ambient conditions are eliminated, the FOCUS model performance greatly improves.

Comparing Figures 15b and 12b, which both apply to instantaneous releases of dense gases, it is seen that the models show a greater tendency towards underpredictions during stable conditions. As before, the variance is dominated by the mean bias for most models. However, all the 95 percent confidence limits on the mean bias are fairly broad, since this sample of the dataset contains few points. The performance of the AIRTOX, B&M, and TRACE models is fairly good, while the performance of the AFTOX, CHARM, DEGADIS, and INPUFF models is relatively poor.

2. Cloud Widths (σ_y)

Another measure of model performance is the ability of the model to simulate cloud widths, which are very important for defining regions of toxic impacts. Figures 16a and 16b show the geometric mean bias MG and geometric variance VG results for predicting the width of the clouds for continuous dense-gas releases and continuous passive-gas releases, respectively. The corresponding statistics are tabulated in Appendices D-11 and D-12. These figures correspond to the performance measures for concentration predictions in Figures 10b and 14a. Comparing the figures, it is immediately evident that predictions of the widths are generally more successful, overall, than are the predictions of concentration. The largest values of variance are smaller, probably due to the smaller range of observed values of cloud widths. Furthermore, the variations in variance are largely due to variations in mean bias, as expressed by Equation (33).





a. Continuous dense gas group of datasets (Burro, Coyote, Desert Tortoise, Goldfish)

B. Continuous passive gas group of datasets (Hanford, Prairie Grass)

Figure 16. Model performance measures, Geometric Mean Bias MG = $\exp(\overline{\ell nC_o - \ell nC_p})$ and Geometric Variance VG = $\exp[\overline{(\ell nC_o - \ell nC_p)^2}]$ for plume width predictions and observations. a: Continuous dense gas group of datasets (Burro, Coyote, Desert Tortoise, Goldfish). b: Continuous passive gas group of datasets (Hanford, Prairie Grass). 95 percent confidence intervals on MG are indicated. There is no significant difference in part a among the MG and VG values for the three better models (GPM, AIRTOX, and SLAB). The solid line is the "minimum VG" curve, from Equation (3e). The dashed lines represent "factor of two" agreement between mean predictions and observations.

For the dense-gas releases, models such as GPM and AFTOX that do not treat dense gases (and hence dense gas slumping) underpredict the width, as might be anticipated. The other models that do simulate dense gases tend to overpredict. AIRTOX, PHAST, and SLAB overpredict the width by less than about 30 percent, on the average. DEGADIS, GASTAR, and HEGADAS overpredict the width by a factor of two or more.

For the passive releases, only HEGADAS tends to overpredict the widths. The rest underpredict by a small amount. There is no distinction between the performance of the simple passive dispersion model, GPM, and the dense-gas models. Overall, it is interesting to note that the models tend to slightly underpredict the width, and overpredict the peak concentrations resulting from continuous releases of passive gases.

SECTION V

SCIENTIFIC EVALUATION BY MEANS OF RESIDUAL PLOTS

A. PROCEDURES

One way of evaluating the scientific credibility of a model is through the use of residual plots, where "residual" is defined in this application as the ratio of the predicted to the observed concentration (note that the logarithm of this ratio equals the difference between the logarithm of the two concentrations). In other applications, the residual could be defined as the arithmetic difference between the observed and predicted concentrations. Values of the residual can be plotted versus variables such as wind speed or stability. The residual of a good model (1) should not exhibit any trend with variables such as wind speed and stability class, and (2) should not exhibit large deviations from unity (implying a perfect match between the model and the observed). The SIGPLOT plotting package described in Volume I was used to generate the residual plots for this evaluation.

The residuals are grouped for plotting by means of "box plots." Grouping is usually necessary because of the large number of data points. The cumulative distribution function (cdf) of the residuals within each group is represented by the 2nd, 16th, 50th, 84th, and 98th percentiles. These five significant points in the cdf are then plotted in a "box" pattern. As mentioned above, the residual boxes should not exhibit any systematic dependence on primary variables. It is also desirable that the residual boxes should be compact and should not deviate too much from unity.

B. RESULTS

Residuals for the continuous dense-gas releases are shown in Figure 17, where four "variables" are used: downwind distance (X), ambient wind speed (U), ambient Pasquill-Gifford stability class (PG CLASS), and the number of the experiment (EXPERIMENT). The PG CLASS numbers follow the normal convention in which 1 = very unstable (A), 2 = unstable (B), 3 = slightly unstable (C), 4 = neutral (D), 5 = slightly stable (E), and 6 = stable (F). The number of the experiment is based on the following alphabetical ordering of the datasets:

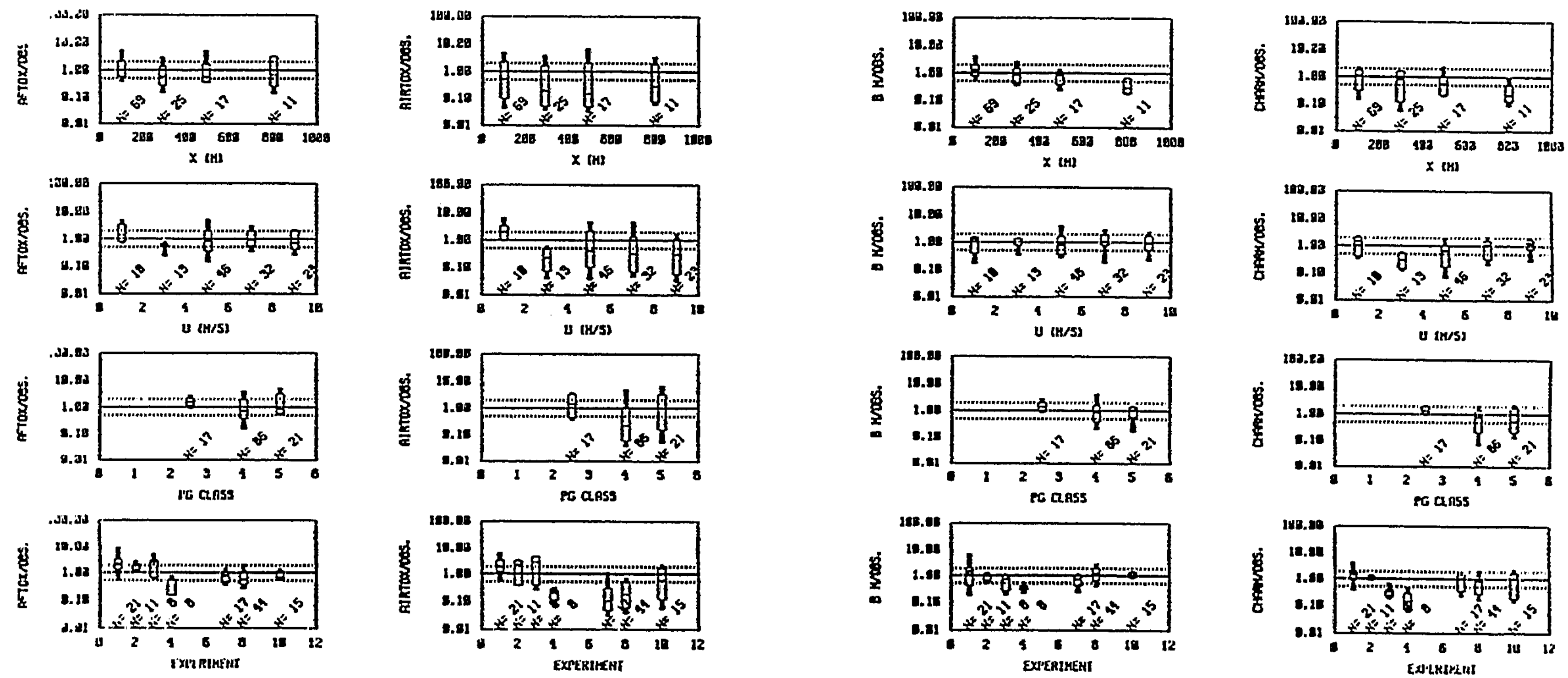


Figure 17. Distributions of C_p/C_o for the datasets containing continuous releases of dense-gas clouds (Burro[1], Coyote[2], Desert Tortoise[3], Goldfish[4], Maplin Sands LNG[7], Maplin Sands LPG[8], Thorney Island[10]. The "box plots" indicate the 2nd, 16th, 50th, 84th, and 98th percentiles of the cumulative distribution function of the N points in the class.

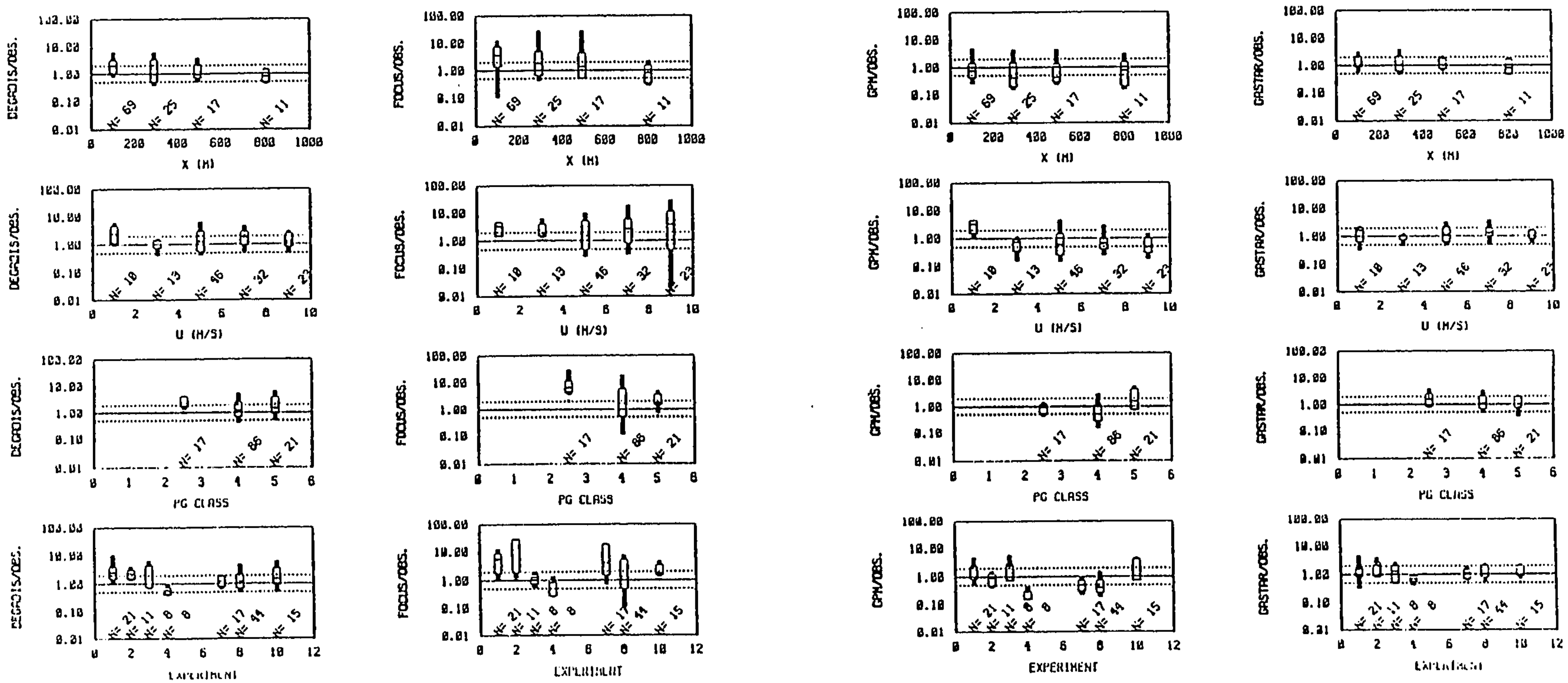


Figure 17. Distributions of C_p/C_o for the datasets containing continuous releases of dense-gas clouds (Burro[1], Coyote[2], Desert Tortoise[3], Goldfish[4], Maplin Sands LNG[7], Maplin Sands LPG[8], Thorney Island[10]. The "box plots" indicate the 2nd, 16th, 50th, 84th, and 98th percentiles of the cumulative distribution function of the N points in the class.

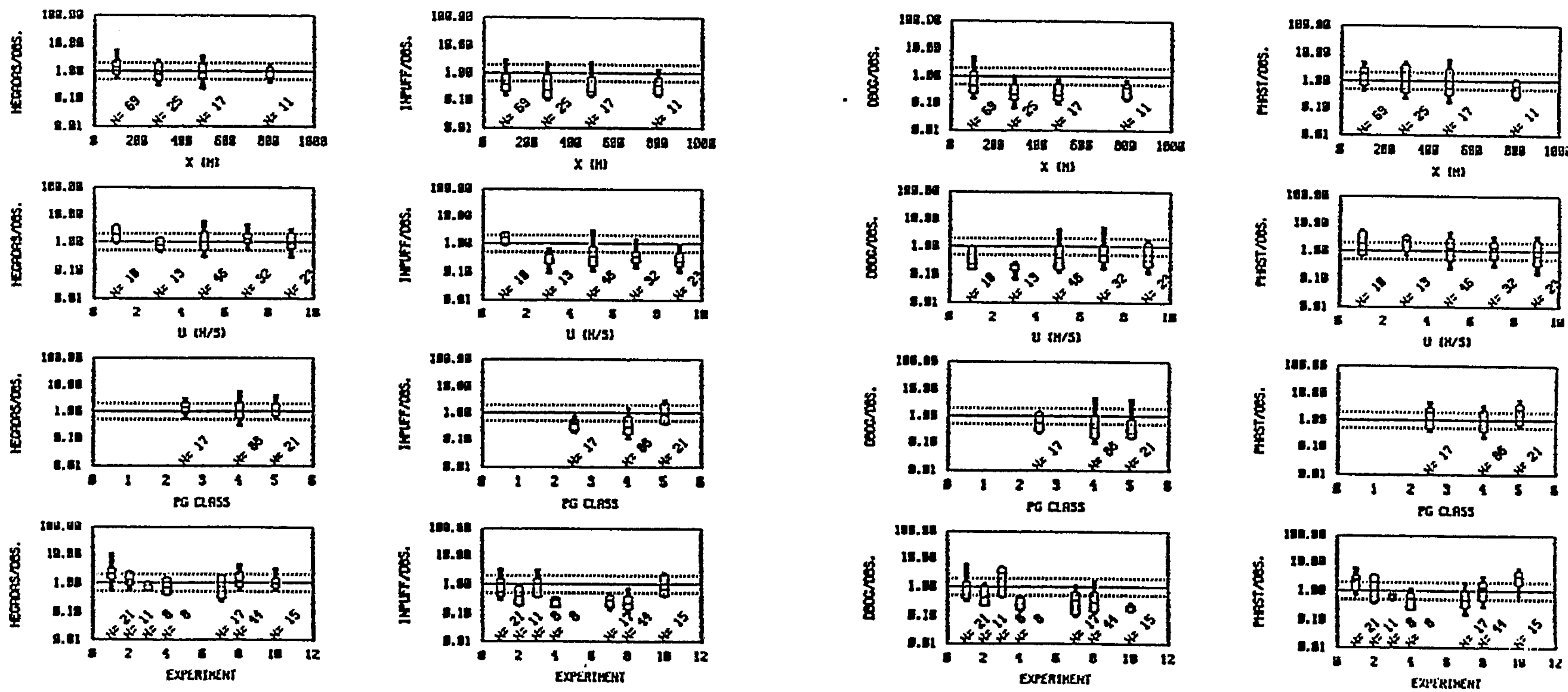


Figure 17. Distributions of C_p/C_o for the datasets containing continuous releases of dense-gas clouds (Burro[1], Coyote[2], Desert Tortoise[3], Goldfish[4], Maplin Sands LNG[7], Maplin Sands LPG[8], Thorney Island[10]. The "box plots" indicate the 2nd, 16th, 50th, 84th, and 98th percentiles of the cumulative distribution function of the N points in the class.

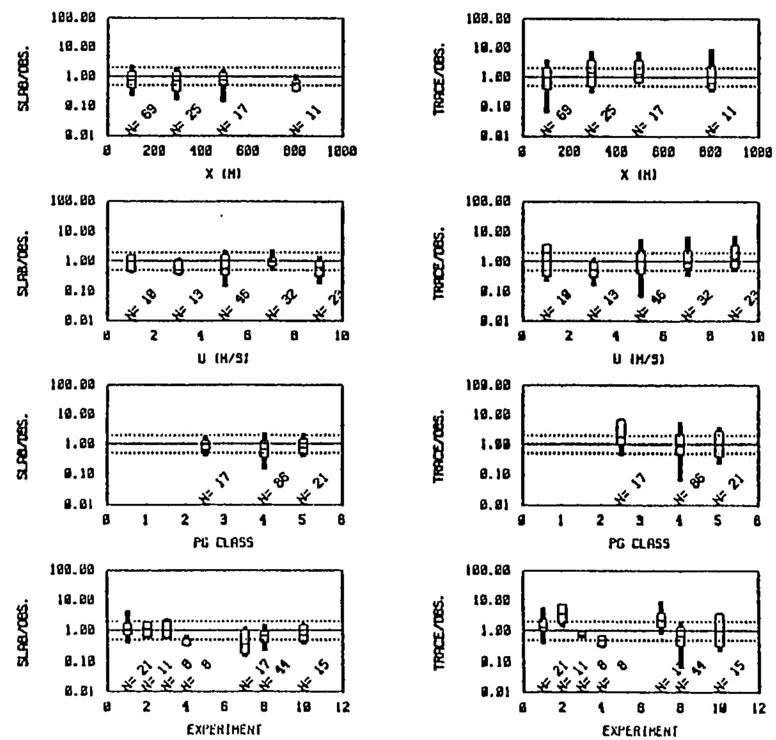


Figure 17. Distributions of C_p/C_o for the datasets containing continuous releases of dense-gas clouds (Burro[1], Coyote[2], Desert Tortoise[3], Goldfish[4], Maplin Sands LNG[7], Maplin Sands LPG[8], Thorney Island[10]. The "box plots" indicate the 2nd, 16th, 50th, 84th, and 98th percentiles of the cumulative distribution function of the N points in the class (Concluded).

1. Burro
2. Coyote
3. Desert Tortoise
4. Goldfish
5. Hanford (continuous)
6. Hanford (instantaneous)
7. Maplin Sands (LNG)
8. Maplin Sands (LPG)
9. Prairie Grass
10. Thorney Island (continuous)
11. Thorney Island (instantaneous)

Plotting the distribution of residuals against the experiment identifies potential "problems" with individual experiments. A good example of this is the Goldfish experiment. All of the models tend to underpredict concentrations observed during Goldfish. Table 14 summarizes characteristics of the performance of each of the models that are revealed by the plots of residuals. The main "problem" for many of the models is not a problem for certain dispersion regimes or a problem with near-field or far-field receptors. It is a problem of uneven performance among the datasets. A model will tend to overestimate concentrations for one dataset, and underestimate those for another. This can lead to a low overall mean bias but a large variance. However, some models such as GASTAR and HEGADAS display less variability in performance across the datasets, which indicates that there is reason to believe the other models can be improved in this regard.

Figure 18 contains the residual plots for the instantaneous-release dense-gas dataset (Group 4). Because only the Thorney Island trials are included in this group, there is no reason to plot residuals as a function of dataset. Table 15 summarizes the characteristics revealed in Figure 18. The most common problem identified is the tendency of some dense-gas models to underpredict peak concentrations and of other models to overpredict these concentrations during low wind speed, stable conditions. Also, we see that the simple passive gas models tend to overpredict concentrations in general. The AIRTOX, BM, GASTAR, and SLAB models show the desirable trait of relatively small variability in their residual plots.

TABLE 14. PROBLEMS REVEALED BY RESIDUAL PLOTS FOR CONTINUOUS RELEASES OF DENSE-GAS CLOUDS. (SEE FIGURE 17).

AFTOX:	Much of variability arises from uneven performance among individual datasets.
AIRTOX:	There is a large range in performance overall, with particularly large underpredictions for Goldfish and Maplin Sands. Underpredicts for all wind speeds except very low wind speed.
BM:	Tendency to underpredict at greater distances.
CHARM:	Much of variability is due to Desert Tortoise and Goldfish trials (2-phase jets). Tendency to underpredict at greater distances.
DEGADIS:	Tendency to overpredict at shorter distances.
FOCUS:	Large overpredictions during unstable conditions at shorter distances.
GPM:	Overpredictions for light wind speeds and stable conditions.
GASTAR:	Few problems, since there is little variability of residuals.
HEGADAS:	Few problems, since there is little variability of residuals.
INPUFF:	Much of variability is due to underpredictions for the Goldfish and Maplin Sands trials.
OB/DG:	Tends to underpredict in general, with poorest performance found for Goldfish, Maplin Sands, and Thorney Island trials.
PHAST:	Overpredicts at short distances, underpredicts at greater distances.
SLAB:	Few problems, since there is little variability of residuals.
TRACE:	Most variability arises from uneven performance among individual datasets.

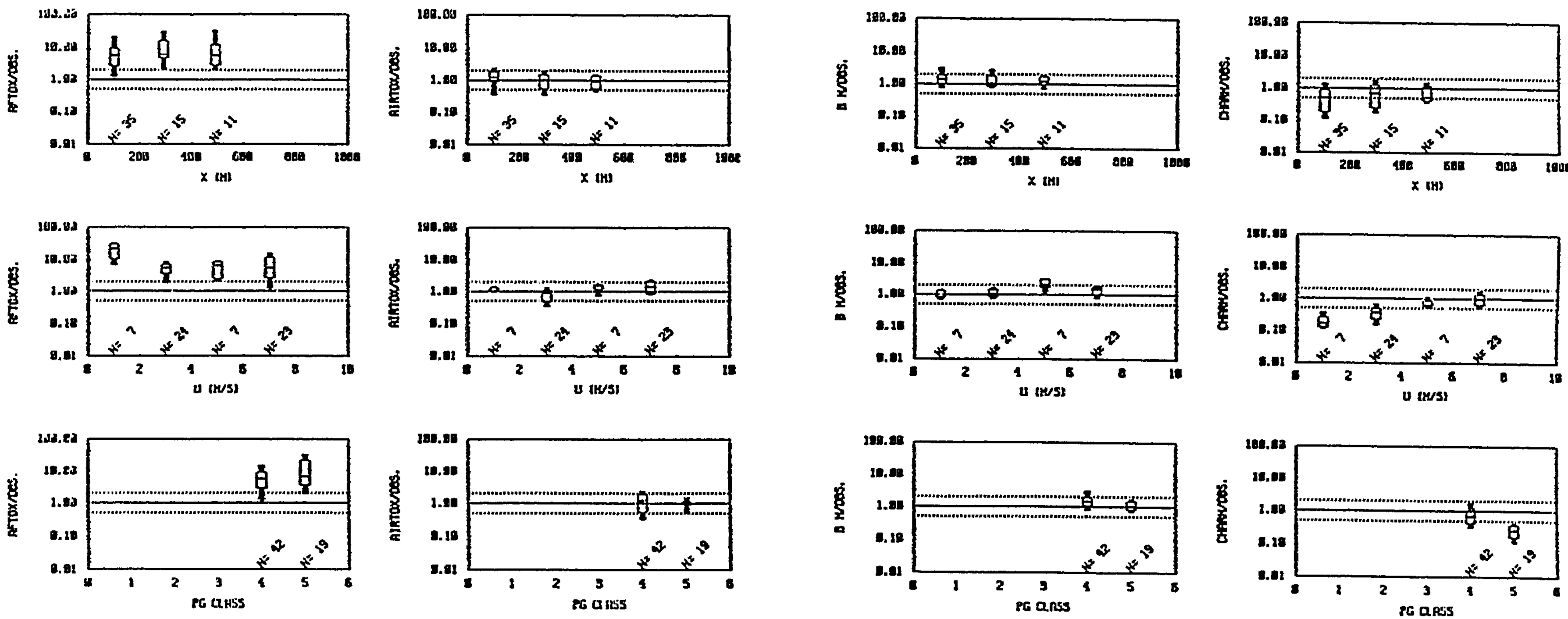


Figure 18. Distributions of C_p/C_o for Thorney Island instantaneous releases of dense-gas clouds. The "box plots" indicate the 2nd, 16th, 50th, 84th, and 98th percentiles of the cumulative distribution function of the N points in the class.

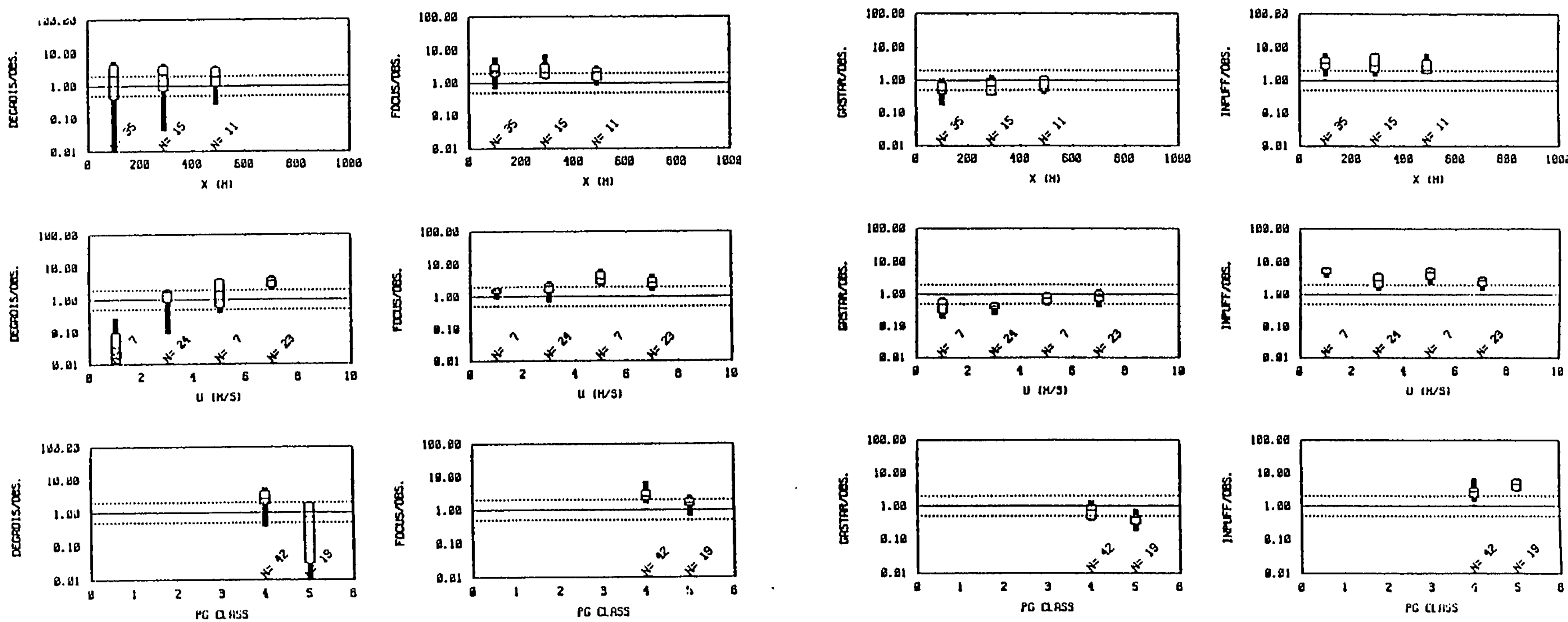


Figure 18. Distributions of C_p/C_o for Thorney Island instantaneous releases of dense-gas clouds. The "box plots" indicate the 2nd, 16th, 50th, 84th, and 98th percentiles of the cumulative distribution function of the N points in the class.

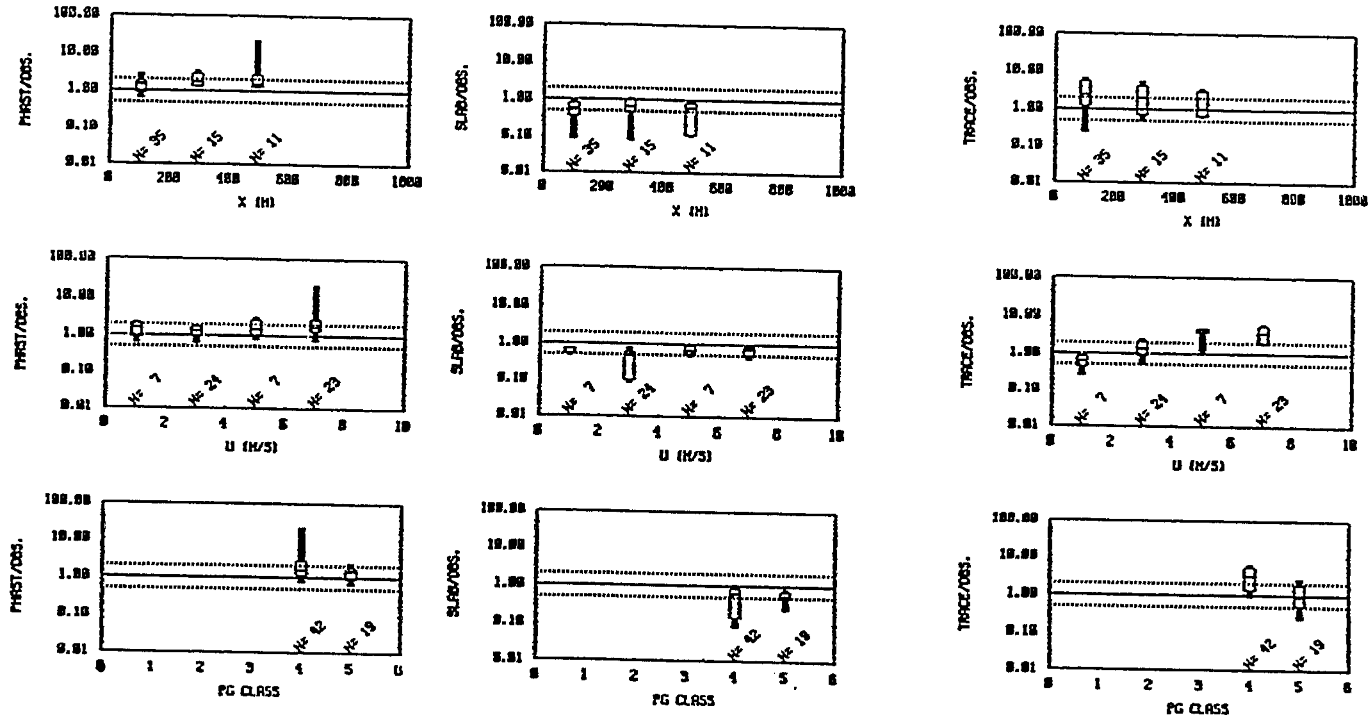


Figure 18. Distributions of C_p/C_o for Thorney Island instantaneous releases of dense-gas clouds. The "box plots" indicate the 2nd, 16th, 50th, 84th, and 98th percentiles of the cumulative distribution function of the N points in the class (Concluded).

TABLE 15. PROBLEMS REVEALED BY RESIDUAL PLOTS FOR INSTANTANEOUS DENSE-GAS CLOUDS (THORNEY ISLAND). (SEE FIGURE 18).

AFTOX:	Large overpredictions; worse for light wind speed, stable conditions
AIRTOX:	Few problems, since there is little variability in residual plots.
BM:	Few problems, since there is little variability in residual plots.
CHARM:	Underpredicts during low wind speed, stable conditions, at short distances.
DEGADIS:	Underpredicts during low winds and overpredicts during high winds.
FOCUS:	Moderate overpredictions throughout, with little variability.
GASTAR:	Few problems, since there is little variability in residual plots.
INPUFF:	General overpredictions throughout, with little variability.
PHAST:	A few large overpredictions during high wind speed conditions.
SLAB:	Few problems, since there is little variability in residual plots.
TRACE:	Underpredicts during low wind speed conditions and overpredicts during high wind speed conditions.

Because there are few data-points in the dataset for instantaneous releases of passive-gas clouds (Hanford), we have not produced residual plots for this dataset (Group 5). The plots for continuous releases of passive-gas clouds (Prairie Grass - Group 3) are shown in Figure 19, and the results are summarized in Table 16. Among the models designed for dense-gas clouds, several tend to increasingly overpredict concentrations during increasingly unstable conditions or higher wind conditions. The CHARM, GPM, HEGADAS, INPUFF, and SLAB models have the desirable trait that there is relatively little variability in their residual plots for this group of data.

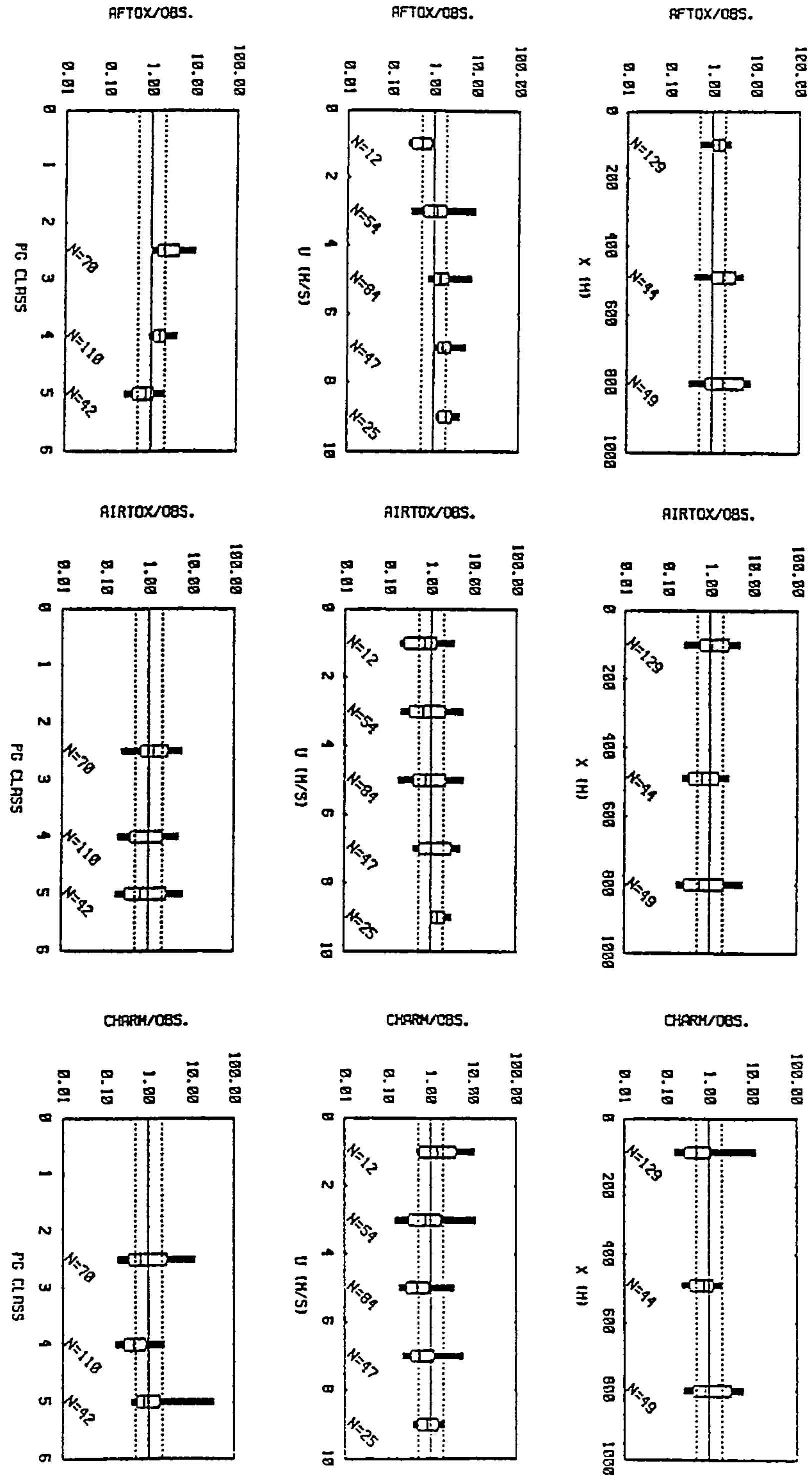


Figure 19. Distributions of C_p/C_o for Prairie Grass continuous releases of passive-gas clouds.

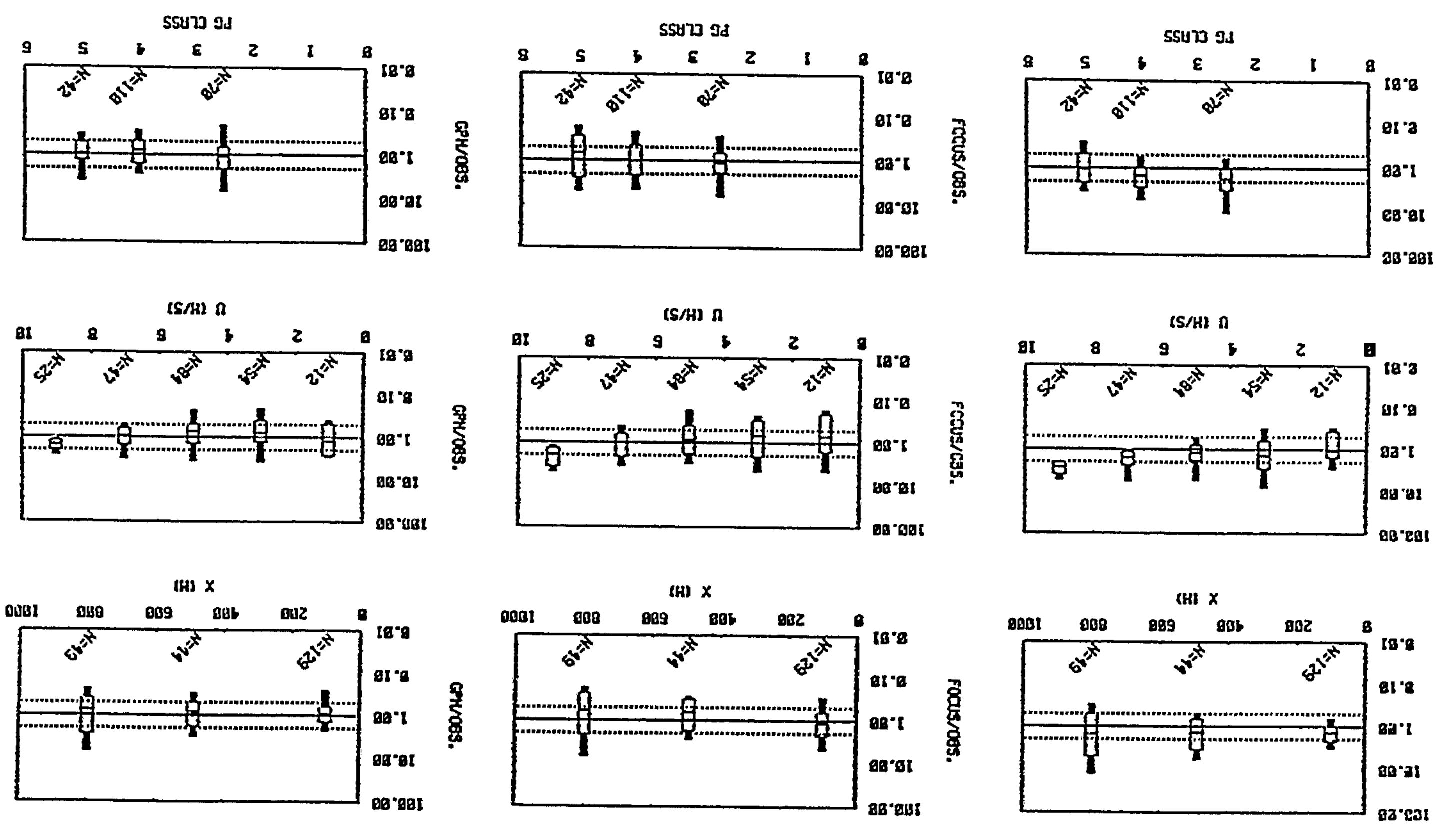


Figure 19. Distributions of C_p/C_o for Prairie Grass continuous releases of passive-gas clouds.

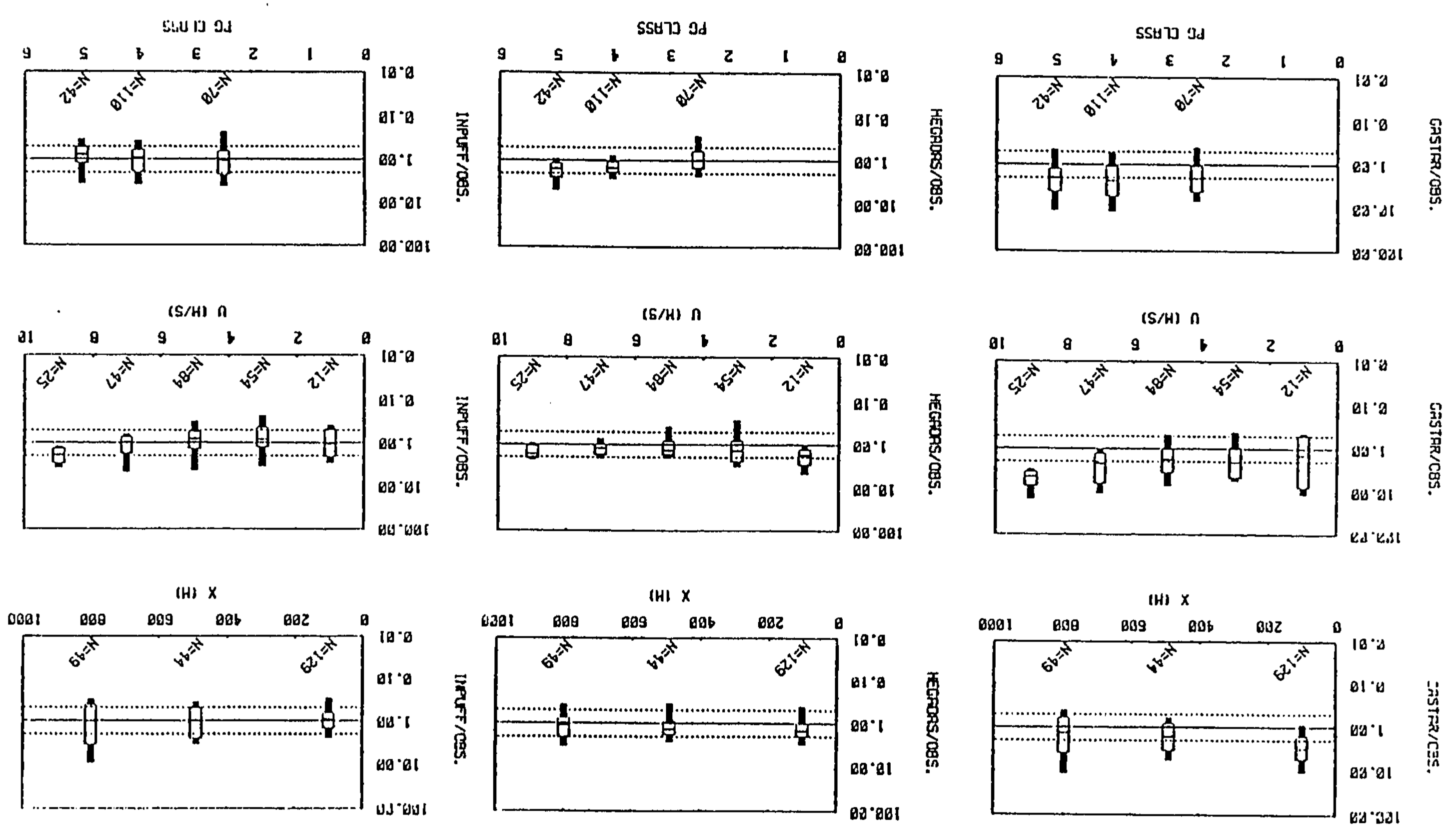


Figure 19. Distributions of C_p/C_o for Prairie Grass continuous releases of passive-gas clouds.

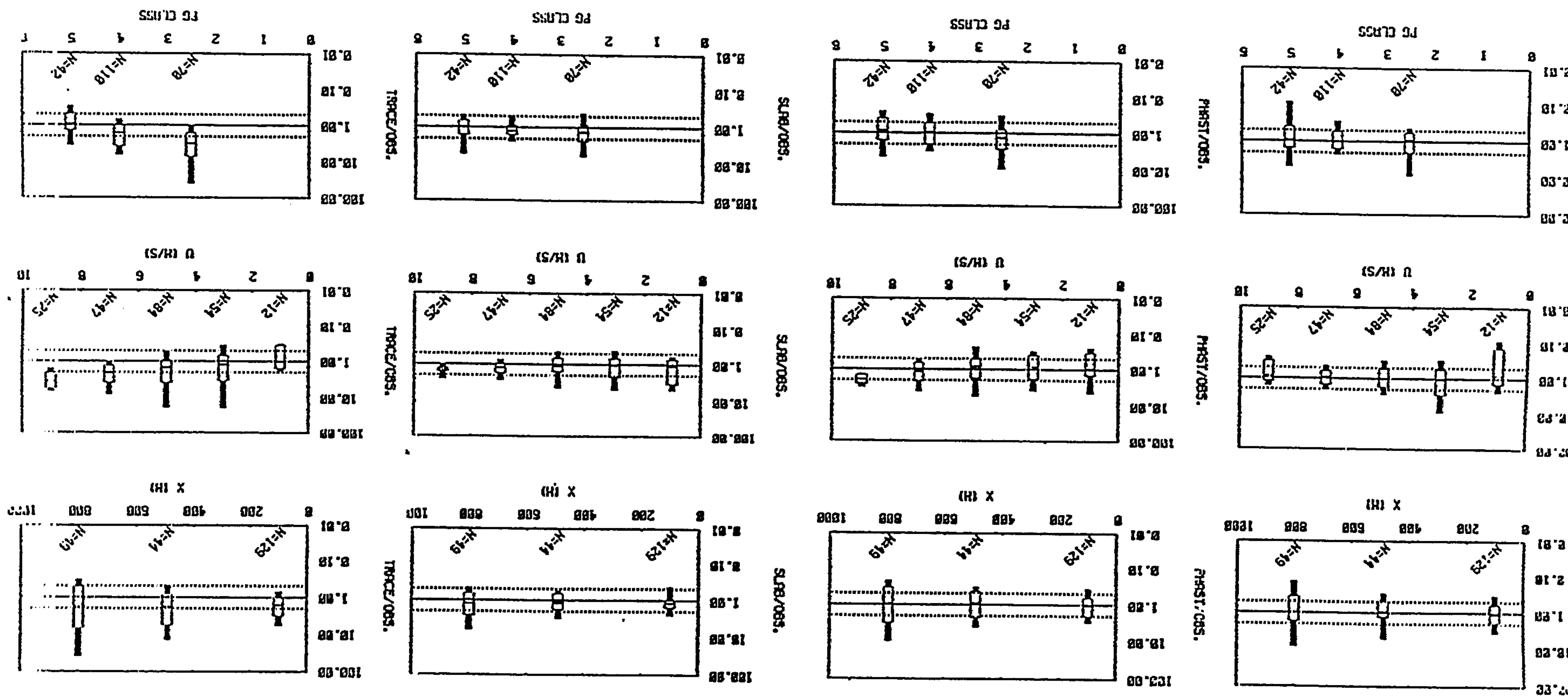


Figure 19. Distributions of C_p/C_o for Prairie Grass continuous releases of passive-gas clouds (Concluded).

TABLE 16. PROBLEMS REVEALED BY RESIDUAL PLOTS FOR CONTINUOUS PASSIVE-GAS CLOUDS (PRAIRIE GRASS). (SEE FIGURE 19).

AFTOX:	Slightly underpredicts during light wind speed, stable conditions.
AIRTOX:	Trend towards underpredictions at greater distances, light winds, and stable conditions.
CHARM:	Few problems, since there is little variability in residual plots.
DEGADIS:	Overpredicts slightly in general, but with little variability in residual plots.
FOCUS:	Relative underpredictions at low wind speeds and overpredictions at high wind speeds.
GPM:	Few problems, since there is little variability in residual plots.
GASTAR:	Overpredicts at shorter distances and higher wind speeds.
HEGADAS:	Few problems, since there is little variability in residual plots.
INPUFF:	Few problems, since there is little variability in residual plots.
OB/DG:	Underprediction tendency during light wind speeds.
PHAST:	Overpredicts during high wind speed conditions.
SLAB:	Few problems, since there is little variability in residual plots.
TRACE:	Overpredicts with increasingly higher winds and unstable dispersion conditions

SECTION VI

SENSITIVITY ANALYSIS USING MONTE CARLO PROCEDURES

A. OVERVIEW

The Monte Carlo method is one way of estimating the magnitude of model uncertainties due to input data errors. The method involves running the model multiple times, with the input parameters slightly perturbed each time (see Volume I, Section IX). It is necessary to implement the Monte Carlo sensitivity analyses on a platform where the user can easily run the model repeatedly, efficiently extract the information of interest, and not be overwhelmed by the amount of the output generated. The MDA (Modeler Data Archive) software package previously described in this volume serves as an ideal choice for this platform in that the execution of most of the dispersion models has been automated, and in that the extraction of useful information from the outputs can be achieved by the post-processors that have already been developed. In the following, we shall call the software package that implements the Monte Carlo method MDAMC.

B. CHOICE OF MODELS AND INPUT PARAMETERS

There are some important criteria that should be heeded in choosing specific dispersion models for application of the Monte Carlo sensitivity analyses. First, it is desirable that the input, the execution and the post-processing of the model be fully automated. Second, it is desirable that the model can execute reasonably fast (say, less than 10 seconds for each run), since it is necessary to run the model hundreds to thousands of times. Last, as a somewhat less stringent requirement, the model should have a simple I/O structure, such as a small number of compact input and output files are involved. Based on these criteria, the SLAB model was chosen for testing of MDAMC. The AFTOX, DEGADIS, GASTAR and GPM models also satisfy these criteria, but were not used in the sensitivity study reported in this section.

The input parameters accepted by the models can be classified as primary and secondary. Secondary input parameters are derived from the primary input parameters. Wind and temperature measurements, and surface roughness are the examples of primary input parameters. Monin-Obukhov length and stability class are the examples of secondary input parameters. In the Monte Carlo study, only variations in the primary input parameters are considered. The following seven primary input parameters are perturbed at each Monte Carlo simulation in our example:

- domain averaged wind speed (u),
- difference in wind speed between the domain-average and a tower (du),
- difference in temperature between two levels on a tower (dT),
- relative humidity (RH),
- surface roughness (z_0),
- source emission rate (Q), and
- source diameter (D).

The first four parameters are related to the meteorology, the fifth parameter is related to the site condition, and the last two parameters are related to the source condition. In this application, it is assumed that there is no correlation among the primary input parameters. Other secondary variables such as Monin-Obukhov length, friction velocity, and stability parameter are calculated from the above seven primary parameters.

Currently, the MDAMC package uses concentrations and cloud widths at certain downwind distances as indicators of model uncertainty due to input data errors.

Perhaps the most difficult problem encountered in Monte-Carlo sensitivity analyses is the specification of the distributions of the primary input parameters. The Gaussian distribution (for example, Reference 71) and the log-normal distribution (for example, Reference 72) are common choices for many ambient measurements. However, there is a lack of knowledge about the distributions for some parameters. Moreover, in the case of the surface roughness and the source emission rate, the need for a detailed description of their distributions becomes less clear. O'Neill et al. (Reference 73) found out the results of a Monte Carlo analysis of their stream ecosystem model were not sensitive to the choice of parameter distributions. Therefore, it was decided that a simple uniform distribution would be used for all parameters in this example. For a uniform distribution the probability of occurrence of the parameter is the same at all points within an upper and lower bound. Outside of these bounds, the probability of occurrence is zero.

The range of a parameter is the only information needed to fully define a uniform distribution. The ranges of uncertainties associated with meteorological observations depend on the kind of the instrument used, the averaging time, the orientation with the wind direction, and the atmospheric stability (see Volume III of this report). For simplicity, the MDAMC package assumes the following default values for the ranges of uncertainties for the input parameters; however, the user always has the option of specifying his own ranges.

wind speed (u and du):	the mean ± larger of 0.5 m/s and σ_u
temperature difference (dT):	the mean ± 0.2°C
relative humidity (RH):	the mean ± 10 percent
surface roughness (z_0):	the mean ± 1/2 order of magnitude
source emission rate (Q):	the mean ± 1/2 order of magnitude
source diameter (D):	the mean ± 1/2 order of magnitude

For example, if the observed domain-averaged wind speed, u, is 5.6 m/s and the standard deviation, σ_u, is 0.9 m/s, is the wind speed for each Monte Carlo simulation will be drawn randomly from the range between 4.7 and 6.5 m/s. If the reported surface roughness is 0.0316 m, the surface roughness for each Monte Carlo simulation will be drawn randomly from the range between 0.01 and 0.1 m.

C. IMPLEMENTATION

During the execution of MDAMC, the user has to specify: 1) a dispersion model whose uncertainty due to data input errors is to be investigated, 2) a trial from which perturbations on the primary input parameters will be created, 3) the number of Monte Carlo simulations to be made, and 4) the ranges for the primary input parameters, if the default values provided by the program were not desired.

The output file created by MDAMC echoes most of the user inputs just described previously. As an option, the file lists the values of the input and output parameters for each Monte Carlo simulation. Finally, the file includes the minimums, maximums, means and standard deviations for all the parameters based on all the simulations, so that the user can analyze the relationship of input data errors to model uncertainty. An example of this output file is shown in Table 17.

D. RESULTS

In the following, the Desert Tortoise 3 experiment and the SLAB model are chosen to demonstrate the use of the MDAMC package. It takes roughly two hours to complete 500 simulations using the SLAB model on a PC with 80386 CPU and 80387 math co-processor, both running at 25MHz. The default uncertainties for the primary input parameters that were previously described were used. For the Desert Tortoise 3 experiment the following observed values were listed in the MDA: u = 7.4 m/s, du = 0.2 m/s, dT = -0.02°C, RH = 14.8 percent, z_0 = 0.003 m, Q = 130.7 kg/s, D=0.0945 m, and u= 1.0 m/s. For a uniform distribution with the default ranges of uncertainties, the ratios of standard deviation to mean for u, du, dT, RH, z_0, Q, and D are 0.078, 2.89, 5.77, 0.39, 0.47, 0.47, and 0.47, respectively. The MDAMC package was first run with all seven primary input parameters perturbed simultaneously. In order to isolate the influence of each parameter, MDAMC was run seven more times, each time varying only one of the primary input parameters. Table 18 summarizes the results when all seven parameters were perturbed, and the corresponding probability density functions (pdf) of the concentrations and widths are shown in Figure 20. Tables 19 through 25 summarize the results when only one of the parameters was perturbed. Model results using the original input data without any perturbation were also included in the tables and referred to as the "reference value."

Table 26 summarizes the ratio of the relative model uncertainties, $\bar{\sigma}_c/\bar{C}$ and $\sigma_w/\bar{w}$, to the relative input data uncertainties, $\sigma_i/\bar{I}$ (C = concentration, w = width, i = input parameter) for this particular example of Monte Carlo sensitivity analysis. Note that the relative sensitivities are less than unity for all variables and that the predictions are the most sensitive to variations in wind speed and source strength.

From Figure 20 it is clear that even though all the primary input parameters were given a uniform distribution, the distribution of the subsequent model results is far from being uniform. It is evident from Table

TABLE 17. AN EXAMPLE OF THE OUTPUT FILE GENERATED BY THE MDAMC PACKAGE, WHERE 20 MONTE CARLO SIMULATIONS OF THE SLAB MODEL FOR THE DESERT TORTOISE 3 EXPERIMENT WERE PERFORMED.

Trial name: dt3
No. of simulation: 20
Orig. value, l.b., u.b., mean, sigma, and sigma/mean for each variable:
Note that the means and sigmas here are based on the THEORETICAL UNIFORM distribution

u	7.40	6.40	8.40	7.40	0.577	0.780E-01
du	0.200	-0.800	1.20	0.200	0.577	2.89
dT	-0.200E-01	-0.220	0.180	-0.200E-01	0.115	-5.77
RH	14.8	4.80	24.8	14.8	5.77	0.390
z0	0.300E-02	0.948E-03	0.948E-02	0.521E-02	0.246E-02	0.472
Q	131.	41.3	413.	227.	107.	0.472
Rdiam	0.945E-01	0.299E-01	0.299	0.164	0.776E-01	0.472

AFTOX = n
DEGADIS = n
GASTAR = n
GPM = n
SLAB = y
NDIST = 2
And the downwind distances (m) are:
100. 800.

Following are the values of the parameters for each simulation:

u	du	dT	RH	z0	Q	Rdiam	L	PG	conc(ppm)...		sigy(m)...	
7.180E+00	-4.577E-01	3.693E-02	2.218E+01	2.403E-03	2.990E+02	9.451E-02	4.433E+02	4	3.050E+05	2.010E+01	1.389E+01	1.067E+02
6.864E+00	1.131E+00	4.853E-02	1.107E+01	7.112E-03	4.092E+02	1.123E-01	7.997E+02	4	3.439E+05	2.133E+04	1.485E+01	1.165E+02
7.804E+00	3.245E-01	1.086E-01	2.081E+01	6.710E-03	3.527E+02	2.610E-01	6.275E+02	4	3.233E+05	1.773E+04	2.917E+01	9.763E+01
7.811E+00	-3.991E-01	1.369E-01	1.971E+01	4.210E-03	2.209E+02	2.541E-01	4.139E+02	4	2.351E+05	1.258E+04	2.892E+01	8.658E+01
7.385E+00	-4.086E-01	3.886E-02	7.263E+00	3.628E-03	2.472E+02	2.454E-01	5.273E+02	4	2.631E+05	1.484E+04	2.990E+01	9.366E+01
7.260E+00	-5.513E-02	3.835E-02	2.471E+01	9.208E-03	2.439E+02	2.611E-01	7.467E+02	4	2.427E+05	1.225E+04	3.068E+01	9.046E+01
6.756E+00	-6.007E-01	-1.978E-01	1.236E+01	8.630E-03	2.214E+02	1.248E-01	-2.045E+03	4	2.703E+05	1.156E+04	2.007E+01	9.643E+01
7.371E+00	5.474E-01	1.230E-01	1.302E+01	1.997E-03	1.735E+02	1.133E-01	4.028E+02	4	2.554E+05	1.246E+04	1.743E+01	8.820E+01
7.080E+00	6.179E-01	-3.019E-02	2.278E+01	1.084E-03	9.177E+01	1.131E-01	7.224E+02	4	1.722E+05	7.799E+03	1.942E+01	7.770E+01
8.364E+00	-6.513E-01	5.882E-02	8.073E+00	1.572E-03	1.757E+02	2.180E-01	4.656E+02	4	2.105E+05	1.152E+04	2.507E+01	7.962E+01
6.662E+00	1.603E-01	8.617E-02	1.420E+01	7.377E-03	2.309E+02	5.549E-02	5.028E+02	4	1.814E+05	1.219E+04	1.363E+01	1.041E+02
7.168E+00	4.973E-01	-3.636E-02	1.331E+01	4.051E-03	2.577E+02	2.089E-01	1.069E+03	4	2.910E+05	1.557E+04	2.703E+01	9.725E+01
7.159E+00	-3.657E-01	1.005E-01	1.489E+01	6.732E-03	3.555E+02	2.741E-01	4.581E+02	4	3.266E+05	1.886E+04	3.254E+01	1.052E+02
7.559E+00	1.063E+00	-1.039E-01	6.340E+00	7.373E-03	1.567E+02	2.055E-01	3.937E+03	4	1.874E+05	7.885E+03	2.534E+01	7.902E+01
6.433E+00	-5.475E-01	1.349E-01	2.175E+01	4.992E-03	3.645E+02	1.112E-01	2.826E+02	4	3.416E+05	2.292E+04	1.553E+01	1.204E+02
7.844E+00	6.039E-01	-2.172E-01	2.071E+01	4.236E-03	4.359E+01	7.307E-02	-2.181E+03	4	8.527E+04	2.506E+03	1.482E+01	6.115E+01
8.110E+00	-2.902E-01	-4.297E-02	1.021E+01	9.127E-03	3.012E+02	2.712E-01	1.520E+03	4	2.693E+05	1.323E+04	2.882E+01	8.913E+01
8.133E+00	1.044E+00	3.487E-02	1.403E+01	4.773E-03	1.018E+02	4.743E-02	9.934E+02	4	1.321E+05	5.430E+03	1.346E+01	7.261E+01
7.879E+00	5.178E-01	-4.231E-03	2.049E+01	8.542E-03	2.229E+02	2.872E-01	1.263E+03	4	2.124E+05	1.050E+04	2.930E+01	8.343E+01
8.045E+00	7.909E-02	1.600E-01	1.108E+01	4.285E-03	2.455E+02	3.045E-02	4.606E+02	4	9.948E+04	1.062E+04	9.998E+00	9.029E+01

Following are the min., max., means and standard deviations of the parameters for all simulations:

u	du	dT	RH	z0	Q	Rdiam	L	PG	conc(ppm)...		sigy(m)...	
6.433E+00	-6.513E-01	-2.172E-01	6.340E+00	1.084E-03	4.359E+01	3.045E-02	-2.181E+03		8.527E+04	2.506E+03	9.998E+00	6.115E+01
8.364E+00	1.131E+00	1.600E-01	2.471E+01	9.209E-03	4.092E+02	2.872E-01	3.937E+03		3.439E+05	2.292E+04	3.254E+01	1.204E+02
7.443E+00	1.405E-01	2.369E-02	1.545E+01	5.402E-03	2.358E+02	1.681E-01	5.705E+02		2.374E+05	1.309E+04	2.199E+01	9.180E+01
5.291E-01	5.764E-01	1.021E-01	5.561E+00	2.513E-03	9.319E+01	8.577E-02	1.180E+03		7.503E+04	5.115E+03	7.150E+00	1.416E+01

TABLE 18. MODEL UNCERTAINTIES FOR THE SLAB MODEL WHEN ALL SEVEN PRIMARY INPUT PARAMETERS (SEE TEXT) WERE PERTURBED SIMULTANEOUSLY IN 500 MONTE CARLO SIMULATIONS FOR THE DESERT TORTOISE3 EXPERIMENT. (S.D.: STANDARD DEVIATION)

	conc (ppm) @ 100m	conc (ppm) @ 800m	width (m) @ 100m	width (m) @ 800m
Reference value	210000	8545	16.8	81.3
minimum	66709	2074	9.4	57.6
maximum	424204	31130	38.5	127.7
mean	236500	13230	21.0	92.2
s.d.	87390	6032	6.7	15.1
s.d./mean	0.37	0.46	0.32	0.16

TABLE 19. MODEL UNCERTAINTIES FOR THE SLAB MODEL WHEN ONLY THE DOMAIN AVERAGED WIND SPEED WAS PERTURBED IN 500 MONTE CARLO SIMULATIONS FOR THE DESERT TORTOISE 3 EXPERIMENT. (S.D.: STANDARD DEVIATION)

	conc (ppm) @ 100m	conc (ppm) @ 800m	width (m) @ 100m	width (m) @ 800m
Reference value	210000	8545	16.8	81.3
minimum	203398	7593	15.4	74.0
maximum	215402	9595	18.6	90.4
mean	209600	8540	17.0	81.7
s.d.	3431	582	0.9	4.8
s.d./mean	0.016	0.068	0.053	0.059

TABLE 20. MODEL UNCERTAINTIES FOR THE SLAB MODEL WHEN ONLY THE DIFFERENCE IN WIND SPEED BETWEEN DOMAIN-AVERAGE AND A TOWER WAS PERTURBED IN 500 MONTE CARLO SIMULATIONS FOR THE DESERT TORTOISE 3 EXPERIMENT. (S.D.: STANDARD DEVIATION)

	conc (ppm) @ 100m	conc (ppm) @ 800m	width (m) @ 100m	width (m) @ 800m
Reference value	210000	8545	16.8	81.3
minimum	209700	8459	16.8	81.0
maximum	209700	8541	16.8	81.2
mean	209700	8488	16.8	81.1
s.d.	0	21	0	0.06
s.d./mean	0	0.0025	0	0.0007

TABLE 21. MODEL UNCERTAINTIES FOR THE SLAB MODEL WHEN ONLY THE DIFFERENCE IN TEMPERATURE BETWEEN TWO LEVELS ON A TOWER WAS PERTURBED IN 500 MONTE CARLO SIMULATIONS FOR THE DESERT TORTOISE 3 EXPERIMENT. (S.D.: STANDARD DEVIATION)

	conc (ppm) @ 100m	conc (ppm) @ 800m	width (m) @ 100m	width (m) @ 800m
Reference value	210000	8545	16.8	81.3
minimum	208698	8249	16.8	80.9
maximum	209702	8713	16.9	81.2
mean	209500	8494	16.9	81.1
s.d.	311	132	0.02	0.06
s.d./mean	0.0015	0.016	0.0012	0.0007

TABLE 22. MODEL UNCERTAINTIES FOR THE SLAB MODEL WHEN ONLY THE RELATIVE HUMIDITY WAS PERTURBED IN 500 MONTE CARLO SIMULATIONS FOR THE DESERT TORTOISE 3 EXPERIMENT. (S.D.: STANDARD DEVIATION)

	conc (ppm) @ 100m	conc (ppm) @ 800m	width (m) @ 100m	width (m) @ 800m
Reference value	210000	8545	16.8	81.3
minimum	207398	8368	16.8	81.0
maximum	211102	8641	17.0	81.2
mean	209400	8492	16.9	81.1
s.d.	1018	75	0.06	0.06
s.d./mean	0.0049	0.0088	0.0036	0.0007

TABLE 23. MODEL UNCERTAINTIES FOR THE SLAB MODEL WHEN ONLY THE SURFACE ROUGHNESS WAS PERTURBED IN 500 MONTE CARLO SIMULATIONS FOR THE DESERT TORTOISE 3 EXPERIMENT. (S.D.: STANDARD DEVIATION)

	conc (ppm) @ 100m	conc (ppm) @ 800m	width (m) @ 100m	width (m) @ 800m
Reference value	210000	8545	16.8	81.3
minimum	184698	6599	16.1	77.5
maximum	219102	10810	17.9	84.3
mean	200300	7827	17.2	79.8
s.d.	10240	1062	0.5	1.7
s.d./mean	0.05	0.14	0.029	0.021

TABLE 24. MODEL UNCERTAINTIES FOR THE SLAB MODEL WHEN ONLY THE SOURCE EMISSION RATE WAS PERTURBED IN 500 MONTE CARLO SIMULATIONS FOR THE DESERT TORTOISE 3 EXPERIMENT. (S.D.: STANDARD DEVIATION)

	conc (ppm) @ 100m	conc (ppm) @ 800m	width (m) @ 100m	width (m) @ 800m
Reference value	210000	8545	16.8	81.3
minimum	84789	2749	12.5	61.8
maximum	321303	23880	17.7	114.5
mean	257500	14450	15.0	94.5
s.d.	61460	6049	1.6	14.4
s.d./mean	0.24	0.42	0.11	0.15

TABLE 25. MODEL UNCERTAINTIES FOR THE SLAB MODEL WHEN ONLY THE SOURCE DIAMETER WAS PERTURBED IN 500 MONTE CARLO SIMULATIONS FOR THE DESERT TORTOISE 3 EXPERIMENT. (S.D.: STANDARD DEVIATION)

	conc (ppm) @ 100m	conc (ppm) @ 800m	width (m) @ 100m	width (m) @ 800m
Reference value	210000	8545	16.8	81.3
minimum	99209	7475	11.6	79.0
maximum	210402	8504	28.4	86.2
mean	180200	8305	21.7	80.7
s.d.	23450	1955	5.3	2.1
s.d./mean	0.13	0.24	0.24	0.026

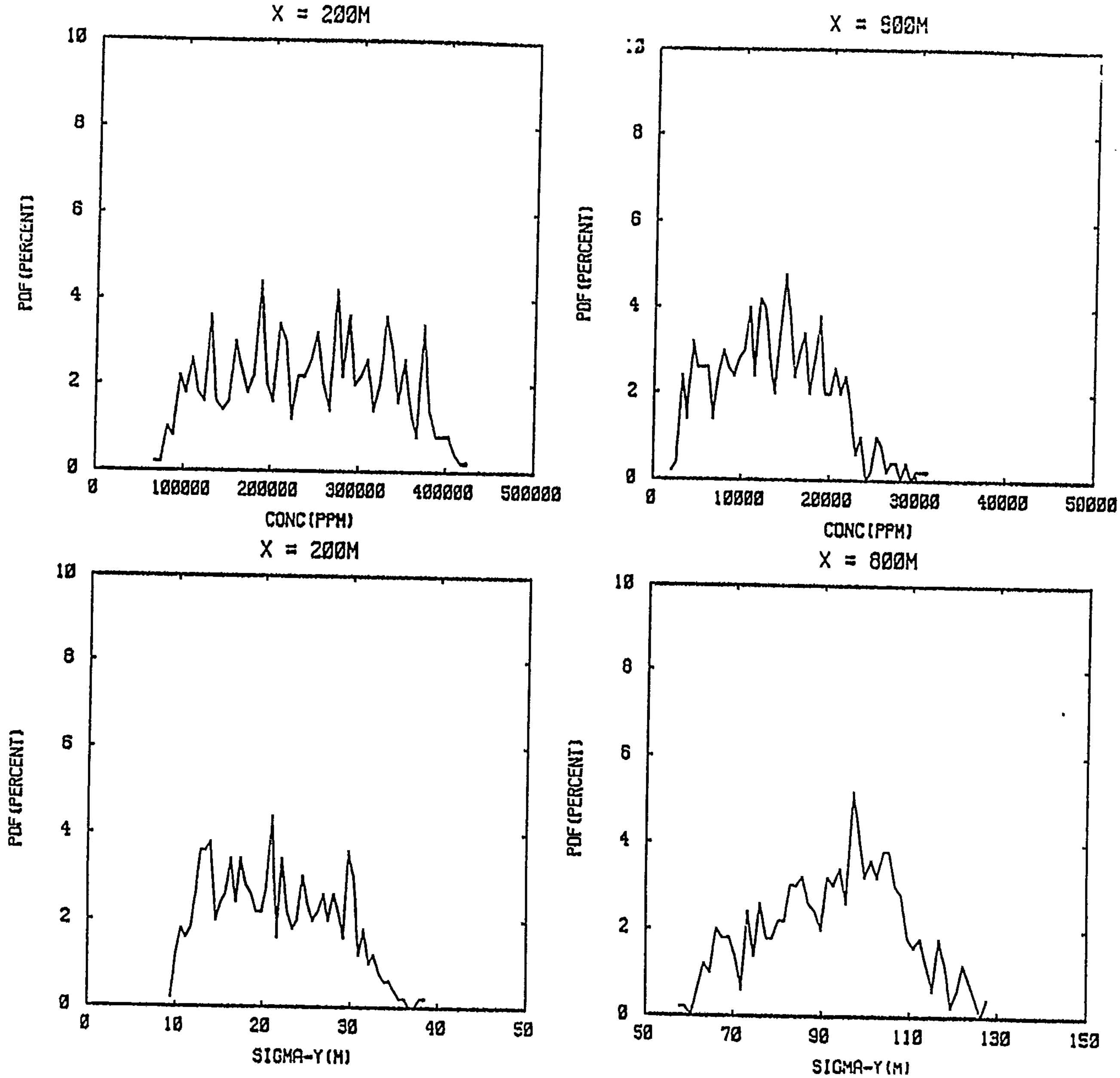


Figure 20. The probability density functions (pdf) of the concentrations and widths (sigma-y) at 200 and 800m downwind based on 500 Monte Carlo simulations of the SLAB model for the Desert Tortoise3 experiment.

TABLE 26. RATIOS OF RELATIVE MODEL UNCERTAINTIES, $\sigma_c/\overline{C}$ AND $\sigma_w/\overline{w}$, TO THE RELATIVE INPUT DATA UNCERTAINTIES, $\sigma_i/\overline{i}$, FOR THE SLAB MODEL WHEN THE SEVEN PRIMARY INPUT PARAMETERS (SEE TEXT) WERE PERTURBED ONE AT A TIME IN 500 MONTE CARLO SIMULATIONS FOR THE DESERT TORTOISE 3 EXPERIMENT. (σ = STANDARD DEVIATION, OVERBAR = MEAN, C = CONCENTRATION, w = CLOUD-WIDTH, AND i = INPUT PARAMETER).

	Downwind Distance	u	du	dT	RH	z_0	Q	D
$\sigma_i/\lvert i\rvert$		0.078	2.89	5.77	0.30	0.472	0.472	0.472
$\frac{\sigma_c/\overline{C}}{\sigma_i/\lvert\overline{i}\rvert}$	200 m	0.21	0	0.0026	0.012	0.11	0.51	0.28
	800 m	0.87	0.00087	0.0027	0.023	0.29	0.89	0.050
$\frac{\sigma_w/\overline{w}}{\sigma_i/\lvert\overline{i}\rvert}$	200 m	0.71	0	0.00024	0.0085	0.058	0.23	0.52
	800 m	0.75	0.00025	0.00012	0.0017	0.045	0.32	0.055

18 that large ranges of the model results due to input data uncertainties are observed. However, for the SLAB model and a horizontal aerosol jet release like Desert Tortoise 3, Table 26 shows that the large ranges in predictions are mainly attributed to uncertainties in the wind speed (u), the source emission rate (Q), and the source diameter (D). Uncertainties in the surface roughness (z_0) have a moderate influence. Uncertainties in the wind speed difference, (du), the temperature, (dT), and the relative humidity, (RH), are found to be relatively inconsequential. The results of this example point out the importance for a dispersion model to simulate the source term correctly for a horizontal aerosol jet release.

The calculated sensitivities could depend strongly on the model formulation and on the value of the original (reference) data. For example, if the uncertainty range of ΔT crosses a threshold where the PG class jumps from C to D, D to E, etc., then a large change in concentration or cloud width may result.

SECTION VII

SUMMARY OF EVALUATION

The tables and figures in the previous sections provide quantitative estimates of the model performance measures for individual groups of experiments (for example, dense-gas continuous releases or neutrally-buoyant gas instantaneous releases). Emphasis was on the geometric mean bias, MG, and the geometric variance, VG, for each group. It is difficult to combine these results, since the problem often reduces to comparing "apples" to "oranges." For example, how can the BM model, which applies only to dense gas releases, be compared with the Gaussian plume model, which applies only to continuous releases of neutrally-buoyant gases?

In this section, the model evaluation exercise is generalized by combining the information from the different datasets in a qualitative manner. For this purpose, we use the following three groups of datasets:

Group 1: Continuous dense gas releases, with short averaging times (several of the models state that they are most applicable to short rather than long averaging times)

Group 3: Instantaneous dense gas releases (Thorney Island)

Group 4: Continuous passive gas releases (mostly Prairie Grass)

The experiments with instantaneous passive gas releases are not included in this final summary since there were relatively few runs and all the models tended to overpredict.

A. CONCENTRATION PREDICTIONS

The evaluations discussed in Section IV emphasized use of the logarithm of concentration, which lessens the influence of outliers and which gives equal weight to over- or under-predictions. The FAC2 statistic is also a logarithmic measure, since it is the fraction of the predictions that are within a factor of two of observations. Ranking of models according to the FAC2 results is given in Table 27, where the ranges of FAC2 are arbitrarily

TABLE 27. RANKING OF MODELS ACCORDING TO FAC2 (FACTOR OF TWO) STATISTIC, WHICH EQUALS THE FRACTION OF TIME THAT THE PREDICTIONS ARE WITHIN A FACTOR OF TWO OF THE OBSERVATIONS.

Continuous Dense Gas Releases (Short Averaging Time)		Instantaneous Dense Gas Releases		Continuous Passive Gas Releases	
FAC2 > 0.7	(GPM) BM HEGADAS SLAB	FAC2 > 0.8	BM AIRTOX™	FAC2 > 0.8	(SLAB) (HEGADAS)
0.6 < FAC2 < 0.7	(AFTOX) DEGADIS CHARM™	0.6 < FAC2 < 0.8	PHAST™ SLAB	0.7 < FAC2 < 0.8	GPM OBDG INPUFF AFTOX
		0.5 < FAC2 < 0.6	GASTAR™ CHARM™		
0.4 < FAC2 < 0.6	TRACE™ GASTAR™ PHAST™ FOCUS™	0.2 < FAC2 < 0.5	TRACE™ FOCUS™ DEGADIS	0.5 < FAC2 < 0.7	PHAST™ DEGADIS FOCUS™ TRACE™ AIRTOX™ CHARM™
FAC2 < 0.4	(OBDG) (INPUFF) AIRTOX™	FAC2 < 0.2	(INPUFF) (AFTOX)	FAC2 < 0.5	GASTAR™

Notes: Parentheses indicate scenarios for which the model was <u>not</u> originally developed.
The superscript TM indicates a proprietary model.
The ranges in FAC2 were arbitrarily chosen so that the models were more or less equally divided into four or five distinct clusters.

chosen in each group such that the models are divided into four or five distinct clusters. Several conclusions can be made from this table:

- The FAC2 performance of any model is not related to its cost or complexity.

- In two of the three groups, the "best" model is one which was not originally developed for that scenario (that is, GPM for continuous dense gas releases and SLAB for continuous passive gas releases).

- The better models can have their predictions within a factor of two of the observations about 70 or 80 percent of the time.

- The BM, GPM, SLAB, and HEGADAS models demonstrate the most consistent performance for the FAC2 statistic.

Qualitative assessments based on the geometric mean bias, MG, and the geometric variance, VG, are given in Table 28. These results are sometimes slightly different from those from the "Factor of Two" analysis in Table 27. However, the four models (BM, GPM, SLAB, and HEGADAS) that produced the best "Factor of Two" agreement are on the list of six models (BM, GPM, SLAB, HEGADAS, CHARM, and PHAST) that produce the most consistent performance for the statistics MG and VG.

For safety purposes it may be better if a model overpredicts than underpredicts concentration. From this viewpoint, of the "top six" models, the SLAB and CHARM models may be less desirable because of their tendency to underpredict by a slight amount in Table 28.

B. WIDTHS

Figures 16a and 16b presented the geometric mean bias, MG, and the geometric variance, VG, for each model for the predicted and observed widths at the continuous release datasets. The better models for the dense gas releases were the AIRTOX, PHAST, and SLAB models. The AFTOX width predictions were about a factor of three low and the HEGADAS predictions were about a

TABLE 28. SUMMARY OF PERFORMANCE EVALUATION BASED ON GEOMETRIC MEAN BIAS MG AND GEOMETRIC VARIANCE VG FOR CONCENTRATIONS, NEGLECTING INSTANTANEOUS PASSIVE DATASET. THE TERMS "OVER" AND "UNDER" REFER TO THE BIAS IN THE MEAN PREDICTIONS.

	Continuous Dense Gas Releases (Short Averaging Time)	Instantaneous Dense Gas Releases	Continuous Passive Gas Releases
AFTOX	(Good)	(Poor-Way Over)	Fair-Over
AIRTOX™	Poor-Under	+Good	+Fair
*BM	Good	+Good	--
*CHARM™	Fair-Under	Fair-Under	+Fair-Under
DEGADIS	Good-Over	Poor	(Fair-Over)
FOCUS™	Poor-Over	Poor-Over	Good
GASTAR™	+Good	+Fair-Under	Poor-Over
*GPM	(Good-Under)	--	+Good
*HEGADAS	+Good	--	+(Good)
INPUFF	(Poor-Under)	(Poor-Over)	+Good
OB/DG	(Poor-Under)	--	Good
*PHAST™	Fair	Fair-Over	Good
*SLAB	+Good-Under	+Fair-Under	+(Good)
TRACE™	Fair	Poor-Over	Poor-Over

Notes: Parentheses indicate scenarios for which the model was <u>not</u> originally developed.
The superscript ™ indicates a proprietary model.
The symbol * marks a "better" model.
The symbol + marks a model with minimal trend in its residual plots.

factor of three high, while the GPM width predictions were about 40 percent low and the GASTAR and DEGADIS predictions were about a factor of two high. For the passive gas releases, all models performed reasonably well, with little difference among the results. It is difficult to choose a "better" model from these data because of this lack of variation. As before, it is concluded that the ability of a model to accurately simulate plume widths is not a function of its cost or complexity.

C. SCREENING MODEL RECOMMENDATIONS

The results of the analyses in this section lead to the recommendation that the following simple, analytical formulas can be confidently used for screening purposes for sources over flat, open terrain:

BM (Britter and McQuaid) for continuous and instantaneous dense gas releases.

GPM (Gaussian Plume Model) for continuous passive gas releases.

There are insufficient field data to justify recommendations for instantaneous passive gas releases. However, the EPA's INPUFF model appears to perform reasonably well for the Hanford dataset in Figure 14b.

These screening models would not be appropriate for source scenarios and terrain types outside of those used in the model derivations. For example, because the screening models neglect variations in roughness length, they would be inappropriate for urban areas or heavily industrialized areas.

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APPENDIX A

MODELERS DATA ARCHIVES FILES

Included in this Appendix are the listing of the Modelers Data Archives (MDA) files for the following experiments:

Burro
Coyote
Desert Tortoise
Goldfish
Hanford (continuous)
Hanford (instantaneous)
Maplin Sands (LNG)
Maplin Sands (LPG)
Prairie Grass
Thorney Island (continuous)
Thorney Island (instantaneous)

Burro								.
Liquefied natural gas								. Methane is at least 91% in composition
LNG								. 3-char. abbreviation of chemical
8								: number of trials included in MDA
8								: time zone designation
BU2	BU3	BU4	BU5	BU6	BU7	BU8	BU9	: trial ID
6	7	7	7	8	8	9	9	: month
18	2	9	16	5	27	3	17	: day
80	80	80	80	80	80	80	80	: year
15	15	14	16	16	18	19	18	: hour
59	08	07	20	05	12	09	37	: minute
17.46	17.26	17.05	17.08	17.24	18.22	18.12	18.82	: mol. weight (g/mole)
111.6	111.6	111.6	111.6	111.6	111.6	111.6	111.6	: normal boiling point (K)
511900.	511900.	511900.	511900.	511900.	511900.	511900.	511900.	: latent heat of evaporation (J/kg)
2238.	2238.	2238.	2238.	2238.	2238.	2238.	2238.	: specific heat - vapor (J/kg-K)
3348.5	3348.5	3348.5	3348.5	3348.5	3348.5	3348.5	3348.5	: specific heat - liquid (J/kg-K)
434.1	432.7	431.2	431.4	432.3	438.8	438.5	443.4	: density of liquid (kg/m**3)
8.8083	8.8083	8.8083	8.8083	8.8083	8.8083	8.8083	8.8083	: coefficient A for vapor pressure equation
983.89	983.89	983.89	983.89	983.89	983.89	983.89	983.89	: coefficient B for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: exit pressure (atm)
111.6	111.6	111.6	111.6	111.6	111.6	111.6	111.6	: source temperature (K)
35.91	36.30	36.09	34.89	37.17	38.60	41.85	45.13	: source diameter (m)
0	0	0	0	0	0	0	0	: source elevation (m)
EP	EP	EP	EP	EP	EP	EP	EP	: source type (IR,HJ,AS,EP)
L	L	L	L	L	L	L	L	: source phase (L,C,G)
58	58	58	58	58	58	58	58	: source containment diameter (m)
86.10	87.98	86.96	81.25	92.22	99.46	116.93	135.98	: spill/evaporation rate (kg/s)
173.	167.	175.	190.	129.	174.	107.	79.	: spill duration (s)
14960.	14712.	15221.	15444	11888.	17289	12453	10730.	: total released (kg)
1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	: initial concentration (ppm)
.927	.936	.933	.929	.923	.928	.929	.928	: ambient pressure (atm)
7.1	5.2	2.7	5.9	5.1	7.4	4.5	14.4	: relative humidity (%)
311.27	307.75	309.05	314.27	312.67	306.96	306.02	308.52	: ambient temperature #1-lower (K)
1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	: measurement height for temperature #1 (m)
310.22	306.03	307.97	313.28	311.64	306.53	306.28	308.42	: ambient temperature #2-upper (K)
10.	10.	10.	10.	10.	10.	10.	10.	: measurement height for temperature #2 (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: soil temperature (K)
3	3	3	3	3	3	3	3	: soil moisture (1:dry,2:moist,3:water)
5.59	5.58	9.35	7.79	9.35	8.75	1.94	5.94	: wind speed (m/s)
3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	: measurement height for wind speed (m)
5.4	5.4	9.0	7.4	9.1	8.4	1.8	5.7	: domain-avg wind speed (m/s)
1.8	1.19	1.19	1.13	1.08	1.16	0.27	0.74	: domain-avg sigma-u (m/s)
13.5	13.3	7.3	11.1	6.72	5.21	5.57	4.4	: domain-avg sigma-theta (deg)
2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	: measurement ht for domain-avg wind data (m)
360	360	360	360	360	360	360	360	: averaging time for domain-avg data (s)
.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	: roughness length z0 (m)
0.248	0.250	0.404	0.332	0.406	0.375	0.074	0.250	: friction velocity u-star (m/s)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: bowen ratio estimate
-.0885	-.1104	-.0270	-.0392	-.0218	-.0088	-.0606	-.0071	: inverse Monin-Obukhov length (1/m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	15.	: cloud cover (%)
3	3	3	3	3	4	5	4	: Pasquill-Gifford stability class (A-1;D-4;F-6)
35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	: latitude (deg)
117.7	117.7	117.7	117.7	117.7	117.7	117.7	117.7	: longitude (deg)
1.	1.	1.	1.	1.	1.	1.	1.	: averaging time for peak concentration (s)
40.	100.	80.	130.	70.	140.	80	50.	: averaging time for averaged concentration (s)
100.	100.	100.	100.	100.	100.	100.	100.	: concentration of interest for modeling (ppm)
1.	1.	1.	1.	1.	1.	1.	1.	: suggested receptor height for modeling (m)
2	2	2	2	2	3	4	4	: number of distances downwind
57.	57.	57.	57.	57.	57.	57.	57.	: distance downwind (m)
140.	140.	140.	140.	140.	140.	140.	140.	: distance downwind (m)
-99.9	-99.9	-99.9	-99.9	-99.9	400.	400.	400.	: distance downwind (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	800.	800.	: distance downwind (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: distance downwind (terminal record: -99.9)

Coyote			.
Liquefied natural gas			. Methane is at least 86% in composition
LNG			. 3-char. abbreviation of chemical
3			: number of trials included in MDA
8			: time zone designation
C03	C05	C06	: trial ID
9	10	10	: month
3	7	27	: day
81	81	81	: year
15	12	16	: hour
38	09	43	: minute
19.51	20.19	19.09	: mol. weight (g/mole)
111.6	111.6	111.6	: normal boiling point (K)
511900.	511900.	511900.	: latent heat of evaporation (J/kg)
2238.	2238.	2238.	: specific heat - vapor (J/kg-K)
3348.5	3348.5	3348.5	: specific heat - liquid (J/kg-K)
447.4	452.7	444.7	: density of liquid (kg/m**3)
8.8083	8.8083	8.8083	: coefficient A for vapor pressure equation
983.89	983.89	983.89	: coefficient B for vapor pressure equation
-99.9	-99.9	-99.9	: exit pressure (atm)
111.6	111.6	111.6	: source temperature (K)
38.63	43.96	42.93	: source diameter (m)
0.	0.	0.	: source elevation (m)
EP	EP	EP	: source type (IR,HJ,AS,EP)
L	L	L	: source phase (L,C,G)
58.	58.	58.	: source containment diameter (m)
100.67	129.02	123.03	: spill/evaporation rate (kg/s)
65	98	82	: spill duration (s)
6532.	12676.	10139.	: total released (kg)
1000000.	1000000.	1000000.	: initial concentration (ppm)
.924	.927	.930	: ambient pressure (atm)
11.3	22.1	22.8	: relative humidity (%)
311.45	301.49	297.26	: ambient temperature #1-lower (K)
1.	1.	1.	: measurement height for temperature #1 (m)
310.38	300.29	297.46	: ambient temperature #2-upper (K)
4.	4.	4.	: measurement height for temperature #2 (m)
-99.9	-99.9	-99.9	: soil temperature (K)
3	3	3	: soil moisture (1:dry,2:moist,3:water)
6.77	10.47	5.04	: wind speed (m/s)
3.	3.	3.	: measurement height for wind speed (m)
6.0	9.7	4.6	: domain-avg wind speed (m/s)
0.9	1.3	0.6	: domain-avg sigma-u (m/s)
6.0	5.1	5.1	: domain-avg sigma-theta (deg)
2.	2.	2.	: measurement ht for domain-avg wind data (m)
180.	180.	180.	: averaging time for domain-avg data (s)
.0002	.0002	.0002	: roughness length z0 (m)
.200	.442	.200	: friction velocity u-star (m/s)
-99.9	-99.9	-99.9	: bowen ratio estimate
-.1582	-.0377	.0136	: inverse Monin-Obukhov length (1/m)
15.	44.	60.	: cloud cover (%)
3	3	4	: Pasquill-Gifford stability class (A-1;D-4;F-6)
35.9	35.9	35.9	: latitude (deg)
117.7	117.7	117.7	: longitude (deg)
1.	1.	1.	: averaging time for peak concentration (s)
50.	90.	70.	: averaging time for averaged concentration (s)
100.	100.	100.	: concentration of interest for modeling (ppm)
1.	1.	1.	: suggested receptor height for modeling (m)
3	4	4	: number of distances downwind
140.	140.	140.	: distance downwind (m)
200.	200.	200.	: distance downwind (m)
300.	300.	300.	: distance downwind (m)
-99.9	400.	400.	: distance downwind (m)
-99.9	-99.9	-99.9	: distance downwind (terminal record: -99.9)

Desert Tortoise				.
Anhydrous Ammonia				.
NH3				. 3-char. abbreviation of chemical
4				: number of trials included in MDA
8				: time zone designation
DT1	DT2	DT3	DT4	: trial ID
8	8	9	9	: month
24	29	1	6	: day
83	83	83	83	: year
16	11	15	18	: hour
37	20	37	15	: minute
17.03	17.03	17.03	17.03	: mol. weight (g/mole)
239.7	239.7	239.7	239.7	: normal boiling point (K)
1.37e+06	1.37e+06	1.37e+06	1.37e+06	: latent heat of evaporation (J/kg)
2190.0	2190.0	2190.0	2190.0	: heat capacity - vapor (J/kg-K)
4490.0	4490.0	4490.0	4490.0	: heat capacity - liquid (J/kg-K)
682.8	682.8	682.8	682.8	: density of liquid (kg/m**3)
10.31499	10.31499	10.31499	10.31499	: coefficient A for vapor pressure equation
2132.52	2132.52	2132.52	2132.52	: coefficient B for vapor pressure equation
10.0	11.02	11.23	11.64	: exit pressure (atm)
294.7	293.3	295.3	297.3	: source temperature (K)
0.061	0.0945	0.0945	0.0945	: source diameter (m)
0.79	0.79	0.79	0.79	: source elevation (m)
HJ	HJ	HJ	HJ	: source type (IR,HJ,AS,EP)
C	C	C	C	: source phase (L,C,G)
-99.9	-99.9	-99.9	-99.9	: source containment diameter (m)
79.7	111.5	130.7	96.7	: spill/evaporation rate (kg/s)
126	255	166	381	: spill duration (s)
-99.9	-99.9	-99.9	-99.9	: total released (kg)
1.0e+06	1.0e+06	1.0e+06	1.0e+06	: initial concentration (ppm)
0.897	0.898	0.895	0.891	: ambient pressure (atm)
13.2	17.5	14.8	21.3	: relative humidity (%)
302.03	303.63	307.07	305.63	: ambient temperature #1-lower (K)
0.82	0.82	0.82	0.82	: measurement height for temperature #1 (m)
303.31	304.31	307.05	306.90	: ambient temperature #2-upper (K)
16.19	16.19	16.19	16.19	: measurement height for temperature #2 (m)
304.8	303.8	304.8	304.0	: soil temperature (K)
3	3	2	1	: soil moisture (1:dry,2:moist,3:water)
7.73	5.54	7.60	4.64	: wind speed (m/s)
3.36	3.36	3.36	3.36	: measurement height for wind speed (m)
7.4	5.8	7.4	4.5	: domain-avg wind speed (m/s)
1.2	0.7	1.0	-99.9	: domain-avg sigma-u (m/s)
5.7	7.5	8.3	5.0	: domain-avg sigma-theta (deg)
2.0	2.0	2.0	2.0	: measurement height for domain-avg wind data (m)
180.	180.	180.	180.	: averaging time for domain-avg data (s)
0.003	0.003	0.003	0.003	: roughness length z0 (m)
-99.9	-99.9	-99.9	-99.9	: friction velocity u-star (m/s)
-99.9	-99.9	-99.9	-99.9	: bowen ratio estimate
-99.9	-99.9	-99.9	-99.9	: inverse Monin-Obukhov length (1/m)
1.0	4.0	70.0	1.0	: cloud cover (%)
4	4	4	5	: Pasquill-Gifford stability class (A-1;D-4;F-6)
36.7	36.7	36.7	36.7	: latitude (deg)
116.0	116.0	116.0	116.0	: longitude (deg)
1.	1.	1.	1.	: averaging time for peak concentration (s)
80.	160.	120.	300.	: averaging time for averaged concentration (s)
100.	100.	100.	100.	: concentration of interest for modeling (ppm)
1.	1.	1.	1.	: suggested receptor height for modeling (m)
2	2	2	2	: number of distances downwind
100.	100.	100.	100.	: distance downwind
800.	800.	800.	800.	: distance downwind
-99.9	-99.9	-99.9	-99.9	: distance downwind (terminal record: -99.9)

Goldfish			.
Hydrogen fluoride			.
HF			. 3-char. abbreviation of chemical
3			: number of trials included in MDA
8			: time zone designation
GF1	GF2	GF3	: trial ID
8	8	8	: month
1	14	20	: day
90	90	90	: year
18	18	18	: hour
15	15	15	: minute
20.01	20.01	20.01	: mol. weight (g/mole)
292.7	292.7	292.7	: normal boiling point (K)
373000.	373000.	373000.	: latent heat of evaporation (J/kg)
1450.	1450.	1450.	: specific heat - vapor (J/kg-K)
2528.	2528.	2528.	: specific heat - liquid (J/kg-K)
987.	987.	987.	: density of liquid (kg/m**3)
11.06	11.06	11.06	: coefficient A for vapor pressure equation
3404.51	3404.51	3404.51	: coefficient B for vapor pressure equation
6.8	7.35	7.48	: exit pressure (atm)
313.2	311.2	312.2	: source temperature (K)
.0419	.0242	.0242	: source diameter (m)
1.	1.	1.	: source elevation (m)
HJ	HJ	HJ	: source type (IR,HJ,AS,EP)
C	C	C	: source phase (L,C,G)
-99.9	-99.9	-99.9	: source containment diameter (m)
27.67	10.46	10.27	: spill/evaporation rate (kg/s)
125	360.	360.	: spill duration (s)
3459.	3766.	3697.	: total released (kg)
1000000.	1000000.	1000000.	: initial concentration (ppm)
.893	.889	.894	: ambient pressure (atm)
4.9	10.7	17.7	: relative humidity (%)
310.40	309.38	307.61	: ambient temperature #1-lower (K)
2.	2.	2.	: measurement height for temperature #1 (m)
310.93	309.41	308.96	: ambient temperature #2-upper (K)
16.6	16.6	16.6	: measurement height for temperature #2 (m)
-99.9	-99.9	-99.9	: soil temperature (K)
1	1	1	: soil moisture (1:dry,2:moist,3:water)
5.79	4.04	4.80	: wind speed (m/s)
2.	2.	2.	: measurement height for wind speed (m)
5.6	4.2	5.4	: domain-avg wind speed (m/s)
-99.9	-99.9	-99.9	: domain-avg sigma-u (m/s)
10.7	14.9	10.7	: domain-avg sigma-theta (deg)
2.	2.	2.	: measurement ht for domain-avg wind data (m)
900.	900.	900.	: averaging time for domain-avg data (s)
.003	.003	.003	: roughness length z0 (m)
.34	.26	.33	: friction velocity u-star (m/s)
-99.9	-99.9	-99.9	: bowen ratio estimate
-99.9	-99.9	-99.9	: inverse Monin-Obukhov length (1/m)
-99.9	-99.9	-99.9	: cloud cover (%)
4	4	4	: Pasquill-Gifford stability class (A-1;D-4;F-6)
36.7	36.7	36.7	: latitude (deg)
116.	116.	116.	: longitude (deg)
66.6	66.6	66.6	: averaging time for peak concentration (s)
88.3	88.3	88.3	: averaging time for averaged concentration (s)
30.	30.	30.	: concentration of interest for modeling (ppm)
1.	1.	1.	: suggested receptor height for modeling (m)
3	2	3	: number of distances downwind
300.	300.	300.	: distance downwind (m)
1000.	1000.	1000.	: distance downwind (m)
3000.	-99.9	3000.	: distance downwind (m)
-99.9	-99.9	-99.9	: distance downwind (terminal record: -99.9)

Hanford (continuous)					.
Krypton-85					.
K85					: 3-char. abbreviation of chemical
5					: number of trials included in MDA
8					: time zone designation
HC1	HC2	HC3	HC4	HC5	: trial ID
9	10	10	10	11	: month
15	17	23	24	8	: day
67	67	67	67	67	: year
00	08	11	11	05	: hour
00	02	01	04	12	: minute
29.0	29.0	29.0	29.0	29.0	: mol. weight (g/mole) (of air)
120.3	120.3	120.3	120.3	120.3	: normal boiling point (K)
115800.	115800.	115800.	115800.	115800.	: latent heat of evaporation (J/kg)
249.	249.	249.	249.	249.	: specific heat - vapor (J/kg-K)
-99.9	-99.9	-99.9	-99.9	-99.9	: specific heat - liquid (J/kg-K)
-99.9	-99.9	-99.9	-99.9	-99.9	: density of liquid (kg/m**3)
-99.9	-99.9	-99.9	-99.9	-99.9	: coefficient A for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	-99.9	: coefficient B for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	-99.9	: exit pressure (atm)
290.87	285.43	288.93	286.65	278.82	: source temperature (K)
-99.9	-99.9	-99.9	-99.9	-99.9	: source diameter (m)
1.	1.	1.	1.	1.	: source elevation (m)
AS	AS	AS	AS	AS	: source type (IR,HJ,AS,EP)
G	G	G	G	G	: source phase (L,C,G)
-99.9	-99.9	-99.9	-99.9	-99.9	: source containment diameter (m)
.0117	.0120	.0278	.0388	.0171	: spill/evaporation rate (Ci/s)
928.	905.	855.	598.	1191.	: spill duration (s)
10.9	10.9	23.8	22.8	20.4	: total released (kg)
1000000.	1000000.	1000000.	1000000.	1000000.	: initial concentration (ppm)
-99.9	-99.9	-99.9	-99.9	-99.9	: ambient pressure (atm)
-99.9	-99.9	-99.9	-99.9	-99.9	: relative humidity (%)
290.87	285.43	288.93	286.65	278.82	: ambient temperature #1-lower (K)
1.5	.9	.9	.9	.9	: measurement height for temperature #1 (m)
292.19	284.71	287.54	284.65	279.32	: ambient temperature #2-upper (K)
6.1	15.	15.	15.	15.	: measurement height for temperature #2 (m)
-99.9	-99.9	-99.9	-99.9	-99.9	: soil temperature (K)
1	1	1	1	1	: soil moisture (1:dry,2:moist,3:water)
1.3	3.9	7.1	3.9	2.6	: wind speed (m/s)
1.5	1.5	1.5	1.5	1.5	: measurement height for wind speed (m)
1.3	3.9	7.1	3.9	2.6	: domain-avg wind speed (m/s)
.23	.90	1.44	1.02	.58	: domain-avg sigma-u (m/s)
11.8	6.1	9.8	13.	7.4	: domain-avg sigma-theta (deg)
1.5	1.5	1.5	1.5	1.5	: measurement ht for domain-avg wind data (m)
2340.	850.	840.	660.	1480.	: averaging time for domain-avg data (s)
0.03	0.03	0.03	0.03	0.03	: roughness length z0 (m)
-99.9	-99.9	-99.9	-99.9	-99.9	: friction velocity u-star (m/s)
-99.9	-99.9	-99.9	-99.9	-99.9	: bowen ratio estimate
-99.9	-99.9	-99.9	-99.9	-99.9	: inverse Monin-Obukhov length (1/m)
-99.9	-99.9	-99.9	-99.9	-99.9	: cloud cover (%)
6	3	3	3	5	: Pasquill-Gifford stability class (A-1;D-4;F-6)
46.5	46.5	46.5	46.5	46.5	: latitude (deg)
119.5	119.5	119.5	119.5	119.5	: longitude (deg)
38.4	38.4	38.4	38.4	38.4	: averaging time for peak concentration (s)
460.8	844.8	268.8	268.8	537.6	: averaging time for averaged concentration (s)
0.1	0.1	0.1	0.1	0.1	: concentration of interest for modeling (ppm)
1.5	1.5	1.5	1.5	1.5	: suggested receptor height for modeling (m)
2	2	2	2	2	: number of distances downwind
200.	200.	200.	200.	200.	: distance downwind (m)
800.	800.	800.	800.	800.	: distance downwind (m)
-99.9	-99.9	-99.9	-99.9	-99.9	: distance downwind (terminal record: -99.9)

Hanford (Instantaneous)						.
Krypton-85						.
K85						. 3-char. abbreviation of chemical
6						: number of trials included in MDA
8						: time zone designation
H12	H13	H15	H16	H17	H18	: trial ID
9	10	10	10	10	11	: month
14	17	23	23	24	08	: day
67	67	67	67	67	67	: year
23	07	10	11	10	06	: hour
00	38	53	30	53	02	: minute
29.0	29.0	29.0	29.0	29.0	29.0	: mol. weight (g/mole) (of air)
120.3	120.3	120.3	120.3	120.3	120.3	: normal boiling point (K)
115800.	115800.	115800.	115800.	115800.	115800.	: latent heat of evaporation (J/kg)
249.	249.	249.	249.	249.	249.	: specific heat - vapor (J/kg-K)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: specific heat - liquid (J/kg-K)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: density of liquid (kg/m**3)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: coefficient A for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: coefficient B for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: exit pressure (atm)
291.54	285.09	288.71	288.26	285.59	277.76	: source temperature (K)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: source diameter (m)
0.	0.	0.	0.	0.	0.	: source elevation (m)
IR	IR	IR	IR	IR	IR	: source type (IR,HJ,AS,EP)
G	G	G	G	G	G	: source phase (L,C,G)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: source containment diameter (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: spill/evaporation rate (Ci/s)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: spill duration (s)
10.0	10.0	10.0	10.0	10.0	10.0	: total released (Ci)
1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	: initial concentration (ppm)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: ambient pressure (atm)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: relative humidity (%)
291.54	285.09	288.71	288.26	285.59	277.76	: ambient temperature #1-lower (K)
1.5	.9	.9	1.5	.9	.9	: measurement height for temperature #1 (m)
293.21	284.65	287.32	287.43	284.21	278.43	: ambient temperature #2-upper (K)
6.1	15.	15.	6.1	15.	15.	: measurement height for temperature #2 (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: soil temperature (K)
1	1	1	1	1	1	: soil moisture (1:dry,2:moist,3:water)
1.3	4.1	7.6	7.2	4.5	1.6	: wind speed (m/s)
1.5	1.5	1.5	1.5	1.5	1.5	: measurement height for wind speed (m)
1.3	4.1	7.6	7.2	4.5	1.6	: domain-avg wind speed (m/s)
.15	.76	1.58	1.19	.87	.29	: domain-avg sigma-u (m/s)
4.4	5.1	6.4	5.4	9.1	8.7	: domain-avg sigma-theta (deg)
1.5	1.5	1.5	1.5	1.5	1.5	: measurement ht for domain-avg wind data (m)
1200.	600.	200.	240.	210.	540.	: averaging time for domain-avg data (s)
0.03	0.03	0.03	0.03	0.03	0.03	: roughness length z0 (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: friction velocity u-star (m/s)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: bowen ratio estimate
-99.9	99.9	-99.9	-99.9	-99.9	-99.9	: inverse Monin-Obukhov length (1/m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: cloud cover (%)
6	4	3	3	3	5	: Pasquill-Gifford stability class (A-1;D-4;F-6)
46.5	46.5	46.5	46.5	46.5	46.5	: latitude (deg)
119.5	119.5	119.5	119.5	119.5	119.5	: longitude (deg)
4.8	4.8	4.8	4.8	4.8	4.8	: averaging time for peak concentration (s)
4.8	4.8	4.8	4.8	4.8	4.8	: averaging time for averaged concentration (s)
0.1	0.1	0.1	0.1	0.1	0.1	: concentration of interest for modeling (ppm)
1.5	1.5	1.5	1.5	1.5	1.5	: suggested receptor height for modeling (m)
2	2	2	2	2	2	: number of distances downwind
200.	200.	200.	200.	200.	200.	: distance downwind (m)
800.	800.	800.	800.	800.	800.	: distance downwind (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: distance downwind (terminal record: -99.9)

Maplin Sands .
Liquified Natural Gas .
LNG . 3-char. abbreviation of chemical
4 : number of trials included in MDA
0 : time zone designation

MS27	MS29	MS34	MS35	: trial ID
9	9	9	9	: month
9	9	17	17	: day
80	80	80	80	: year
10	14	10	11	: hour
41	12	9	8	: minute
17.11	16.26	16.66	16.39	: mol. weight (g/mole)
111.7	111.7	111.7	111.7	: normal boiling point (K)
509880	509880	509880	509880	: latent heat of evaporation (J/kg)
2238.0	2238.0	2238.0	2238.0	: heat capacity - vapor (J/kg-K)
3348.5	3348.5	3348.5	3348.5	: heat capacity - liquid (J/kg-K)
435.3	426.8	430.2	427.8	: density of liquid (kg/m**3)
5.72096	5.72096	5.72096	5.72096	: coefficient A for vapor pressure equation
597.84	597.84	597.84	597.84	: coefficient B for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	: exit pressure (atm)
111.7	111.7	111.7	111.7	: source temperature (K)
18.6	20.9	18.0	20.1	: source diameter (m)
0	0	0	0	: source elevation (m)
EP	EP	EP	EP	: source type (IR,HJ,AS,EP)
L	L	L	L	: storage phase (L-liq,C-cryo,G-gas)
-99.9	-99.9	-99.9	-99.9	: source containment diameter (m)
23.21	29.16	21.51	27.09	: spill/evaporation rate (kg/s)
160	225	95	135	: spill duration (s)
3714.4	6561.3	2043.6	3657.7	: total released (kg)
1000000	1000000	1000000	1000000	: initial concentration (ppm)
-99.9	-99.9	-99.9	-99.9	: ambient pressure (atm)
53	71	90	77	: relative humidity (%)
288.10	289.30	288.40	289.30	: ambient temperature #1-lower (K)
1.9	1.9	1.9	1.9	: measurement height for temperature #1 (m)
287.78	289.24	288.06	288.81	: ambient temperature #2-upper (K)
10.1	10.1	10.1	10.1	: measurement height for temperature #2 (m)
288.8	290	289	289.8	: soil temperature (K)
3	3	3	3	: soil moisture (1:dry,2:moist,3:water)
5.5	7.4	8.6	9.8	: wind speed (m/s)
10	10	10	10	: measurement height for wind speed (m)
5.6	7.4	8.5	9.6	: domain-avg wind speed (m/s)
0.7	1	0.6	1.1	: domain-avg sigma-u (m/s)
-99.9	-99.9	-99.9	-99.9	: domain-avg sigma-theta (deg)
10	10	10	10	: measurement ht for domain-avg wind data (m)
160	225	90	135	: averaging time for domain-avg data (s)
0.0003	0.0003	0.0003	0.0003	: roughness length z0 (m)
-99.9	-99.9	-99.9	-99.9	: friction velocity u-star (m/s)
-99.9	-99.9	-99.9	-99.9	: bowen ratio estimate
-99.9	-99.9	-99.9	-99.9	: inverse Monin-Obukhov length (1/m)
10	90	20	20	: cloud cover (%)
-99	-99	-99	-99	: Pasquill-Gifford stability class (A-1;D-4;F-6)
51.0	51.0	51.0	51.0	: latitude (deg)
1.0	1.0	1.0	1.0	: longitude (deg)
3	3	3	3	: averaging time for peak concentration (s)
3	3	3	3	: averaging time for averaged concentration (s)
100.	100.	100.	100.	: concentration of interest for modeling (ppm)
0.9	0.9	0.9	0.9	: suggested receptor height for modeling (m)
5	7	2	3	: number of distances downwind
89	58	87	129	: distance downwind
131	90	179	250	: distance downwind
324	130	-99.9	406	: distance downwind
400	182	-99.9	-99.9	: distance downwind
650	252	-99.9	-99.9	: distance downwind
-99.9	324	-99.9	-99.9	: distance downwind
-99.9	403	-99.9	-99.9	: distance downwind
-99.9	-99.9	-99.9	-99.9	: distance downwind (terminal record: -99.9)

Maplin Sands .
Liquified Propane Gas .
LPG . 3-char. abbreviation of chemical
6 : number of trials included in MDA
0 : time zone designation

MS42	MS43	MS46	MS47	MS49	MS50	MS52	MS54	: trial ID
9	9	10	10	10	10	10	10	: month
28	28	1	1	6	8	9	15	: day
80	80	80	80	80	80	80	80	: year
15	17	15	16	10	10	14	8	: hour
53	18	12	16	37	38	34	25	: minute
43.93	43.93	43.95	43.84	43.76	43.93	43.87	43.94	: mol. weight (g/mole)
231.1	231.1	231.1	231.1	231.1	231.1	231.1	231.1	: normal boiling point (K)
425740	425740	425740	425740	425740	425740	425740	425740	: latent heat of evaporation (J/kg)
1678.0	1678.0	1678.0	1678.0	1678.0	1678.0	1678.0	1678.0	: heat capacity - vapor (J/kg-K)
2520.0	2520.0	2520.0	2520.0	2520.0	2520.0	2520.0	2520.0	: heat capacity - liquid (J/kg-K)
500.9	500.9	500.8	501.0	501.2	500.9	501.0	500.8	: density of liquid (kg/m**3)
9.0927	9.0927	9.0927	9.0927	9.0927	9.0927	9.0927	9.0927	: coefficient A for vapor pressure equation
1872.46	1872.46	1872.46	1872.46	1872.46	1872.46	1872.46	1872.46	: coefficient B for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: exit pressure (atm)
231.1	231.1	231.1	231.1	231.1	231.1	231.1	231.1	: source temperature (K)
14.9	14.3	15.7	18.6	13.3	19.5	21.7	14.3	: source diameter (m)
0	0	0	0	0	0	0	0	: source elevation (m)
EP	EP	EP	EP	EP	EP	EP	EP	: source type (IR,HJ,AS,EP)
L	L	L	L	L	L	L	L	: storage phase (L-liq,C-cryo,G-gas)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: source containment diameter (m)
20.87	19.20	23.37	32.57	16.71	35.89	44.25	19.20	: spill/evaporation rate (kg/s)
180	330	360	210	90	160	140	180	: spill duration (s)
3756.6	6336.0	8413.2	6839.7	1503.9	5742.4	6195.0	3456.0	: total released (kg)
1000000	1000000	1000000	1000000	1000000	1000000	1000000	1000000	: initial concentration (ppm)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: ambient pressure (atm)
-99.9	-99.9	71	78	88	79	63	85	: relative humidity (%)
291.50	290.20	291.90	290.60	286.50	283.60	285.00	281.60	: ambient temperature #1-lower (K)
1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	: measurement height for temperature #1 (m)
291.49	290.12	291.86	290.57	286.71	283.66	285.05	281.63	: ambient temperature #2-upper (K)
10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	: measurement height for temperature #2 (m)
291.7	292.1	290.5	290.3	286.2	283.1	285.1	282.6	: soil temperature (K)
3	3	3	3	3	3	3	3	: soil moisture (1:dry,2:moist,3:water)
3.7	5.5	8.1	5.6	6.2	7.9	7.9	3.8	: wind speed (m/s)
10	10	10	10	10	10	10	10	: measurement height for wind speed (m)
4	5.8	8.1	6.2	5.5	7.9	7.4	3.7	: domain-avg wind speed (m/s)
0.7	0.6	0.9	0.6	0.3	0.8	0.8	0.4	: domain-avg sigma-u (m/s)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: domain-avg sigma-theta (deg)
10	10	10	10	10	10	10	10	: measurement ht for domain-avg wind data (m)
160	340	480	300	90	250	180	180	: averaging time for domain-avg data (s)
0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	: roughness length z0 (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: friction velocity u-star (m/s)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: bowen ratio estimate
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: inverse Monin-Obukhov length (1/m)
30	50	20	50	40	75	20	10	: cloud cover (%)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: Pasquill-Gifford stability class (A-1;D-4;F-6)
51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	: latitude (deg)
1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	: longitude (deg)
3	3	3	3	3	3	3	3	: averaging time for peak concentration (s)
3	3	3	3	3	3	3	3	: averaging time for averaged concentration (s)
100.	100.	100.	100.	100.	100.	100.	100.	: concentration of interest for modeling (ppm)
0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.5	: suggested receptor height for modeling (m)
7	4	7	6	6	4	6	4	: number of distances downwind
30	80	34	90	90	59	61	56	: distance downwind
53	129	91	128	129	93	95	85	: distance downwind
83	249	130	182	180	182	178	178	: distance downwind
123	400	182	250	250	400	249	247	: distance downwind
179	-99.9	250	321	322	-99.9	398	-99.9	: distance downwind
247	-99.9	322	400	400	-99.9	650	-99.9	: distance downwind
398	-99.9	401	-99.9	-99.9	-99.9	-99.9	-99.9	: distance downwind
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: distance downwind (terminal record: -99.9)

Prairie Grass, set 1 .
Sulfur dioxide .
SO2 : 3-char. abbreviation of chemical
8 : number of trials included in MDA
6 : time zone designation

PG7	PG8	PG9	PG10	PG13	PG15	PG16	PG17	: trial ID
7	7	7	7	7	7	7	7	: month
10	10	11	11	22	23	23	23	: day
56	56	56	56	56	56	56	56	: year
14	17	16	12	20	8	10	20	: hour
15	00	00	00	00	00	00	00	: minute
64.	64.	64.	64.	64.	64.	64.	64.	: mol. weight (g/mole)
263.13	263.13	263.13	263.13	263.13	263.13	263.13	263.13	: normal boiling point (K)
386500.	386500.	386500.	386500.	386500.	386500.	386500.	386500.	: latent heat of evaporation (J/kg)
622.6	622.6	622.6	622.6	622.6	622.6	622.6	622.6	: specific heat - vapor (J/kg-K)
1331.	1331.	1331.	1331.	1331.	1331.	1331.	1331.	: specific heat - liquid (J/kg-K)
1462.	1462.	1462.	1462.	1462.	1462.	1462.	1462.	: density of liquid (kg/m**3)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: coefficient A for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: coefficient B for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: exit pressure (atm)
305.15	305.15	301.15	304.15	293.15	295.15	301.15	300.15	: source temperature (K)
0.0508	0.0508	0.0508	0.0508	0.0508	0.0508	0.0508	0.0508	: source diameter (m)
.45	.45	.45	.45	.45	.45	.45	.45	: source elevation (m)
HJ	HJ	HJ	HJ	HJ	HJ	HJ	HJ	: source type (IR,HJ,AS,EP)
G	G	G	G	G	G	G	G	: source phase (L,C,G)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: source containment diameter (m)
0.0899	0.0911	0.092	0.0921	0.0611	0.0955	0.093	0.0565	: spill/evaporation rate (kg/s)
600.	600.	600.	600.	600.	600.	600.	600.	: spill duration (s)
53.9	54.7	55.2	55.3	36.7	57.3	55.8	33.9	: total released (kg)
1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	: initial concentration (ppm)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: ambient pressure (atm)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: relative humidity (%)
305.15	305.15	301.15	304.15	293.15	295.15	301.15	300.15	: ambient temperature #1-lower (K)
2.	2.	2.	2.	2.	2.	2.	2.	: measurement height for temperature #1 (m)
303.55	303.95	299.55	302.15	295.05	294.05	300.15	300.65	: ambient temperature #2-upper (K)
16.	16.	16.	16.	16.	16.	16.	16.	: measurement height for temperature #2 (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: soil temperature (K)
1	1	1	1	1	1	1	1	: soil moisture (1:dry,2:moist,3:water)
4.2	4.9	6.9	4.6	1.3	3.4	3.2	3.3	: wind speed (m/s)
2.	2.	2.	2.	2.	2.	2.	2.	: measurement height for wind speed (m)
4.2	4.9	6.9	4.6	1.3	3.4	3.2	3.3	: domain-avg wind speed (m/s)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: domain-avg sigma-u (m/s)
25.6	10.2	10.2	16.8	3.2	12.8	18.5	5.6	: domain-avg sigma-theta (deg)
2.	2.	2.	2.	2.	2.	2.	2.	: measurement ht for domain-avg wind data (m)
600.	600.	600.	600.	600.	600.	600.	600.	: averaging time for domain-avg data (s)
.006	.006	.006	.006	.006	.006	.006	.006	: roughness length z0 (m)
0.31	0.31	0.46	0.32	0.09	0.23	0.24	0.21	: friction velocity u-star (m/s)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: bowen ratio estimate
-0.1020	-0.0556	-0.0323	-0.0909	0.2941	-0.1316	-0.1923	0.0208	: inverse Monin-Obukhov length (1/m)
0	0	30	30	20	0	0	70	: cloud cover (%)
2	3	3	2	6	1	1	4	: Pasquill-Gifford stability class (A-1;D-4;F-6)
42.3	42.3	42.3	42.3	42.3	42.3	42.3	42.3	: latitude (deg)
98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	: longitude (deg)
600.	600.	600.	600.	600.	600.	600.	600.	: averaging time for peak concentration (s)
600.	600.	600.	600.	600.	600.	600.	600.	: averaging time for averaged concentration (s)
1.	1.	1.	1.	1.	1.	1.	1.	: concentration of interest for modeling (ppm)
1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	: suggested receptor height for modeling (m)
5	5	5	5	2	5	5	5	: number of distances downwind
50.	50.	50.	50.	400.	50.	50.	50.	: distance downwind (m)
100.	100.	100.	100.	800.	100.	100.	100.	: distance downwind (m)
200.	200.	200.	200.	-99.9	200.	200.	200.	: distance downwind (m)
400.	400.	400.	400.	-99.9	400.	400.	400.	: distance downwind (m)
800.	800.	800.	800.	-99.9	800.	800.	800.	: distance downwind (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: distance downwind (terminal record: -99.9)

Prairie Grass, set 2								.
Sulfur dioxide								.
SO2								. 3-char. abbreviation of chemical
8								: number of trials included in MDA
6								: time zone designation
PG18	PG19	PG20	PG21	PG22	PG23	PG24	PG25	: trial ID
7	7	7	7	7	7	7	8	: month
23	25	25	25	25	29	29	1	: day
56	56	56	56	56	56	56	56	: year
22	11	14	22	24	21	23	13	: hour
00	00	00	00	00	00	00	00	: minute
64.	64.	64.	64.	64.	64.	64.	64.	: mol. weight (g/mole)
263.13	263.13	263.13	263.13	263.13	263.13	263.13	263.13	: normal boiling point (K)
386500.	386500.	386500.	386500.	386500.	386500.	386500.	386500.	: latent heat of evaporation (J/kg)
622.6	622.6	622.6	622.6	622.6	622.6	622.6	622.6	: specific heat - vapor (J/kg-K)
1331.	1331.	1331.	1331.	1331.	1331.	1331.	1331.	: specific heat - liquid (J/kg-K)
1462.	1462.	1462.	1462.	1462.	1462.	1462.	1462.	: density of liquid (kg/m**3)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: coefficient A for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: coefficient B for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: exit pressure (atm)
297.15	302.15	307.15	302.15	300.15	296.15	295.15	298.15	: source temperature (K)
0.0508	0.0508	0.0508	0.0508	0.0508	0.0508	0.0508	0.0508	: source diameter (m)
.45	.45	.45	.45	.45	.45	.45	.45	: source elevation (m)
HJ	HJ	HJ	HJ	HJ	HJ	HJ	HJ	: source type (IR,HJ,AS,EP)
G	G	G	G	G	G	G	G	: source phase (L,C,G)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: source containment diameter (m)
0.0576	0.1018	0.1012	0.0509	0.0484	0.0409	0.0412	0.1014	: spill/evaporation rate (kg/s)
600.	600.	600.	600.	600.	600.	600.	600.	: spill duration (s)
34.6	61.1	60.7	30.5	29.0	24.5	24.7	60.8	: total released (kg)
1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	: initial concentration (ppm)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: ambient pressure (atm)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: relative humidity (%)
297.15	302.15	307.15	302.15	300.15	296.15	295.15	298.15	: ambient temperature #1-lower (K)
2.	2.	2.	2.	2.	2.	2.	2.	: measurement height for temperature #1 (m)
298.75	300.85	304.85	302.45	300.45	296.35	295.35	297.45	: ambient temperature #2-upper (K)
16.	16.	16.	16.	16.	16.	16.	16.	: measurement height for temperature #2 (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: soil temperature (K)
1	1	1	1	1	1	1	1	: soil moisture (1:dry,2:moist,3:water)
3.5	5.8	8.6	6.1	6.4	5.9	6.2	2.8	: wind speed (m/s)
2.	2.	2.	2.	2.	2.	2.	2.	: measurement height for wind speed (m)
3.5	5.8	8.6	6.1	6.4	5.9	6.2	2.8	: domain-avg wind speed (m/s)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: domain-avg sigma-u (m/s)
5.3	11.6	8.3	6.6	5.8	7.3	7.1	24.8	: domain-avg sigma-theta (deg)
2.	2.	2.	2.	2.	2.	2.	2.	: measurement ht for domain-avg wind data (m)
600.	600.	600.	600.	600.	600.	600.	600.	: averaging time for domain-avg data (s)
.006	.006	.006	.006	.006	.006	.006	.006	: roughness length z0 (m)
0.20	0.39	0.60	0.38	0.46	0.39	0.38	0.20	: friction velocity u-star (m/s)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: bowen ratio estimate
0.0400	-0.0357	-0.0161	0.0058	0.0049	0.0052	0.0040	-0.1613	: inverse Monin-Obukhov length (1/m)
10	30	20	100	60	0	0	100	: cloud cover (%)
5	3	4	4	4	4	4	1	: Pasquill-Gifford stability class (A-1;D-4;F-6)
42.3	42.3	42.3	42.3	42.3	42.3	42.3	42.3	: latitude (deg)
98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	: longitude (deg)
600.	600.	600.	600.	600.	600.	600.	600.	: averaging time for peak concentration (s)
600.	600.	600.	600.	600.	600.	600.	600.	: averaging time for averaged concentration (s)
1.	1.	1.	1.	1.	1.	1.	1.	: concentration of interest for modeling (ppm)
1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	: suggested receptor height for modeling (m)
5	5	5	5	5	5	5	5	: number of distances downwind
50.	50.	50.	50.	50.	50.	50.	50.	: distance downwind (m)
100.	100.	100.	100.	100.	100.	100.	100.	: distance downwind (m)
200.	200.	200.	200.	200.	200.	200.	200.	: distance downwind (m)
400.	400.	400.	400.	400.	400.	400.	400.	: distance downwind (m)
800.	800.	800.	800.	800.	800.	800.	800.	: distance downwind (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: distance downwind (terminal record: -99.9)

Prairie Grass, set 3

									.
									.
Sulfur dioxide									
SO2									. 3-char. abbreviation of chemical
8									: number of trials included in MDA
6									: time zone designation
PG28	PG29	PG32	PG33	PG34	PG36	PG37	PG38		: trial ID
8	8	8	8	8	8	8	8		: month
2	3	6	7	7	11	12	12		: day
56	56	56	56	56	56	56	56		: year
24	2	20	13	15	23	3	5		: hour
00	00	00	00	00	30	00	00		: minute
64.	64.	64.	64.	64.	64.	64.	64.		: mol. weight (g/mole)
263.13	263.13	263.13	263.13	263.13	263.13	263.13	263.13		: normal boiling point (K)
386500.	386500.	386500.	386500.	386500.	386500.	386500.	386500.		: latent heat of evaporation (J/kg)
622.6	622.6	622.6	622.6	622.6	622.6	622.6	622.6		: specific heat - vapor (J/kg-K)
1331.	1331.	1331.	1331.	1331.	1331.	1331.	1331.		: specific heat - liquid (J/kg-K)
1462.	1462.	1462.	1462.	1462.	1462.	1462.	1462.		: density of liquid (kg/m**3)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9		: coefficient A for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9		: coefficient B for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9		: exit pressure (atm)
297.15	298.15	295.15	302.15	304.15	293.15	294.15	294.15		: source temperature (K)
0.0508	0.0508	0.0508	0.0508	0.0508	0.0508	0.0508	0.0508		: source diameter (m)
.45	.45	.45	.45	.45	.45	.45	.45		: source elevation (m)
HJ	HJ	HJ	HJ	HJ	HJ	HJ	HJ		: source type (IR,HJ,AS,EP)
G	G	G	G	G	G	G	G		: source phase (L,C,G)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9		: source containment diameter (m)
0.0417	0.0415	0.0414	0.0947	0.0974	0.04	0.0403	0.0454		: spill/evaporation rate (kg/s)
600.	600.	600.	600.	600.	600.	600.	600.		: spill duration (s)
25.0	24.9	24.8	56.8	58.4	24.0	24.2	27.2		: total released (kg)
1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	1000000.		: initial concentration (ppm)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9		: ambient pressure (atm)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9		: relative humidity (%)
297.15	298.15	295.15	302.15	304.15	293.15	294.15	294.15		: ambient temperature #1-lower (K)
2.	2.	2.	2.	2.	2.	2.	2.		: measurement height for temperature #1 (m)
298.15	299.05	299.45	301.15	303.05	294.95	294.55	294.35		: ambient temperature #2-upper (K)
16.	16.	16.	16.	16.	16.	16.	16.		: measurement height for temperature #2 (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9		: soil temperature (K)
1	1	1	1	1	1	1	1		: soil moisture (1:dry,2:moist,3:water)
2.6	3.5	2.2	8.5	9.0	1.9	4.6	4.1		: wind speed (m/s)
2.	2.	2.	2.	2.	2.	2.	2.		: measurement height for wind speed (m)
2.6	3.5	2.2	8.5	9.0	1.9	4.6	4.1		: domain-avg wind speed (m/s)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9		: domain-avg sigma-u (m/s)
6.4	8.0	3.6	10.5	7.3	3.8	7.0	5.0		: domain-avg sigma-theta (deg)
2.	2.	2.	2.	2.	2.	2.	2.		: measurement ht for domain-avg wind data (m)
600.	600.	600.	600.	600.	600.	600.	600.		: averaging time for domain-avg data (s)
.006	.006	.006	.006	.006	.006	.006	.006		: roughness length z0 (m)
0.16	0.23	0.13	0.50	0.60	0.10	0.29	0.28		: friction velocity u-star (m/s)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9		: bowen ratio estimate
0.0417	0.0278	0.1205	-0.0196	-0.0132	0.1282	0.0105	0.0101		: inverse Monin-Obukhov length (1/m)
0	-99.9	10	-99.9	20	0	30	80		: cloud cover (%)
5	4	6	4	4	6	4	4		: Pasquill-Gifford stability class (A-1;D-4;F-6)
42.3	42.3	42.3	42.3	42.3	42.3	42.3	42.3		: latitude (deg)
98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3		: longitude (deg)
600.	600.	600.	600.	600.	600.	600.	600.		: averaging time for peak concentration (s)
600.	600.	600.	600.	600.	600.	600.	600.		: averaging time for averaged concentration (s)
1.	1.	1.	1.	1.	1.	1.	1.		: concentration of interest for modeling (ppm)
1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5		: suggested receptor height for modeling (m)
5	5	3	5	5	5	5	5		: number of distances downwind
50.	50.	200.	50.	50.	50.	50.	50.		: distance downwind (m)
100.	100.	400.	100.	100.	100.	100.	100.		: distance downwind (m)
200.	200.	800.	200.	200.	200.	200.	200.		: distance downwind (m)
400.	400.	-99.9	400.	400.	400.	400.	400.		: distance downwind (m)
800.	800.	-99.9	800.	800.	800.	800.	800.		: distance downwind (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9		: distance downwind (terminal record: -99.9)

Prairie Grass, set 4 .
Sulfur dioxide .
SO2 . 3-char. abbreviation of chemical
8 : number of trials included in MDA
6 : time zone designation

PG41	PG42	PG43	PG44	PG45	PG46	PG48	PG49	: trial ID
8	8	8	8	8	8	8	8	: month
14	14	15	15	15	15	21	21	: day
56	56	56	56	56	56	56	56	: year
3	5	12	14	17	18	9	10	: hour
5	5	00	00	5	45	00	59	: minute
64.	64.	64.	64.	64.	64.	64.	64.	: mol. weight (g/mole)
263.13	263.13	263.13	263.13	263.13	263.13	263.13	263.13	: normal boiling point (K)
386500.	386500.	386500.	386500.	386500.	386500.	386500.	386500.	: latent heat of evaporation (J/kg)
622.6	622.6	622.6	622.6	622.6	622.6	622.6	622.6	: specific heat - vapor (J/kg-K)
1331.	1331.	1331.	1331.	1331.	1331.	1331.	1331.	: specific heat - liquid (J/kg-K)
1462.	1462.	1462.	1462.	1462.	1462.	1462.	1462.	: density of liquid (kg/m**3)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: coefficient A for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: coefficient B for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: exit pressure (atm)
294.15	296.15	308.15	310.15	309.15	306.15	293.15	297.15	: source temperature (K)
0.0508	0.0508	0.0508	0.0508	0.0508	0.0508	0.0508	0.0508	: source diameter (m)
.45	.45	.45	.45	.45	.45	.45	.45	: source elevation (m)
HJ	HJ	HJ	HJ	HJ	HJ	HJ	HJ	: source type (IR,HJ,AS,EP)
G	G	G	G	G	G	G	G	: source phase (L,C,G)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: source containment diameter (m)
0.0399	0.0564	0.0986	0.1007	0.1008	0.0997	0.1041	0.102	: spill/evaporation rate (kg/s)
600.	600.	600.	600.	600.	600.	600.	600.	: spill duration (s)
23.9	33.8	59.2	60.4	60.5	59.8	62.5	61.2	: total released (kg)
1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	: initial concentration (ppm)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: ambient pressure (atm)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: relative humidity (%)
294.15	296.15	308.15	310.15	309.15	306.15	293.15	297.15	: ambient temperature #1-lower (K)
2.	2.	2.	2.	2.	2.	2.	2.	: measurement height for temperature #1 (m)
295.55	296.55	306.75	308.65	308.75	306.55	291.95	295.35	: ambient temperature #2-upper (K)
16.	16.	16.	16.	16.	16.	16.	16.	: measurement height for temperature #2 (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: soil temperature (K)
1	1	1	1	1	1	1	1	: soil moisture (1:dry,2:moist,3:water)
4.0	5.8	5.0	5.7	6.1	5.2	8.0	6.3	: wind speed (m/s)
2.	2.	2.	2.	2.	2.	2.	2.	: measurement height for wind speed (m)
4.0	5.8	5.0	5.7	6.1	5.2	8.0	6.3	: domain-avg wind speed (m/s)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: domain-avg sigma-u (m/s)
5.0	6.6	12.2	12.7	6.9	7.7	8.1	11.9	: domain-avg sigma-theta (deg)
2.	2.	2.	2.	2.	2.	2.	2.	: measurement ht for domain-avg wind data (m)
600.	600.	600.	600.	600.	600.	600.	600.	: averaging time for domain-avg data (s)
.006	.006	.006	.006	.006	.006	.006	.006	: roughness length z0 (m)
0.23	0.37	0.35	0.40	0.39	0.34	0.51	0.45	: friction velocity u-star (m/s)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: bowen ratio estimate
0.0286	0.0083	-0.0625	-0.0400	-0.0115	0.0088	-0.0159	-0.0357	: inverse Monin-Obukhov length (1/m)
-99.9	-99.9	100	80	90	90	10	10	: cloud cover (%)
5	4	3	3	4	4	4	3	: Pasquill-Gifford stability class (A-1;D-4;F-6)
42.3	42.3	42.3	42.3	42.3	42.3	42.3	42.3	: latitude (deg)
98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	: longitude (deg)
600.	600.	600.	600.	600.	600.	600.	600.	: averaging time for peak concentration (s)
600.	600.	600.	600.	600.	600.	600.	600.	: averaging time for averaged concentration (s)
1.	1.	1.	1.	1.	1.	1.	1.	: concentration of interest for modeling (ppm)
1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	: suggested receptor height for modeling (m)
5	5	5	5	5	5	5	5	: number of distances downwind
50.	50.	50.	50.	50.	50.	50.	50.	: distance downwind (m)
100.	100.	100.	100.	100.	100.	100.	100.	: distance downwind (m)
200.	200.	200.	200.	200.	200.	200.	200.	: distance downwind (m)
400.	400.	400.	400.	400.	400.	400.	400.	: distance downwind (m)
800.	800.	800.	800.	800.	800.	800.	800.	: distance downwind (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: distance downwind (terminal record: -99.9)

Prairie Grass, set 5
Sulfur dioxide

SO2								. 3-char. abbreviation of chemical
8								: number of trials included in MDA
6								: time zone designation
PG50	PG51	PG53	PG54	PG55	PG56	PG57	PG58	: trial ID
8	8	8	8	8	8	8	8	: month
21	21	24	24	25	25	25	25	: day
56	56	56	56	56	56	56	56	: year
14	15	20	22	0	2	17	19	: hour
6	29	00	2	58	1	28	27	: minute
64.	64.	64.	64.	64.	64.	64.	64.	: mol. weight (g/mole)
263.13	263.13	263.13	263.13	263.13	263.13	263.13	263.13	: normal boiling point (K)
386500.	386500.	386500.	386500.	386500.	386500.	386500.	386500.	: latent heat of evaporation (J/kg)
622.6	622.6	622.6	622.6	622.6	622.6	622.6	622.6	: specific heat - vapor (J/kg-K)
1331.	1331.	1331.	1331.	1331.	1331.	1331.	1331.	: specific heat - liquid (J/kg-K)
1462.	1462.	1462.	1462.	1462.	1462.	1462.	1462.	: density of liquid (kg/m**3)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: coefficient A for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: coefficient B for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: exit pressure (atm)
304.15	305.15	290.15	292.15	290.15	289.15	309.15	299.15	: source temperature (K)
0.0508	0.0508	0.0508	0.0508	0.0508	0.0508	0.0508	0.0508	: source diameter (m)
.45	.45	.45	.45	.45	.45	.45	.45	: source elevation (m)
HJ	HJ	HJ	HJ	HJ	HJ	HJ	HJ	: source type (IR,HJ,AS,EP)
G	G	G	G	G	G	G	G	: source phase (L,C,G)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: source containment diameter (m)
0.1028	0.1024	0.0452	0.0434	0.0453	0.0459	0.1015	0.0405	: spill/evaporation rate (kg/s)
600.	600.	600.	600.	600.	600.	600.	600.	: spill duration (s)
61.7	61.4	27.1	26.0	27.2	27.5	60.9	24.3	: total released (kg)
1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	: initial concentration (ppm)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: ambient pressure (atm)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: relative humidity (%)
304.15	305.15	290.15	292.15	290.15	289.15	309.15	299.15	: ambient temperature #1-lower (K)
2.	2.	2.	2.	2.	2.	2.	2.	: measurement height for temperature #1 (m)
302.65	303.75	294.05	293.05	290.55	289.75	308.55	305.05	: ambient temperature #2-upper (K)
16.	16.	16.	16.	16.	16.	16.	16.	: measurement height for temperature #2 (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: soil temperature (K)
1	1	1	1	1	1	1	1	: soil moisture (1:dry,2:moist,3:water)
6.6	6.1	2.5	4.0	5.4	4.3	6.7	1.9	: wind speed (m/s)
2.	2.	2.	2.	2.	2.	2.	2.	: measurement height for wind speed (m)
6.6	6.1	2.5	4.0	5.4	4.3	6.7	1.9	: domain-avg wind speed (m/s)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: domain-avg sigma-u (m/s)
10.9	10.8	3.9	5.9	5.8	6.1	8.0	4.1	: domain-avg sigma-theta (deg)
2.	2.	2.	2.	2.	2.	2.	2.	: measurement ht for domain-avg wind data (m)
600.	600.	600.	600.	600.	600.	600.	600.	: averaging time for domain-avg data (s)
.006	.006	.006	.006	.006	.006	.006	.006	: roughness length z0 (m)
0.44	0.45	0.17	0.24	0.37	0.29	0.46	0.11	: friction velocity u-star (m/s)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: bowen ratio estimate
-0.0385	-0.0250	0.1000	0.0250	0.0081	0.0132	-0.0052	0.1563	: inverse Monin-Obukhov length (1/m)
10	10	0	0	0	0	0	30	: cloud cover (%)
3	4	6	4	4	4	4	6	: Pasquill-Gifford stability class (A-1;D-4;F-6)
42.3	42.3	42.3	42.3	42.3	42.3	42.3	42.3	: latitude (deg)
98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	: longitude (deg)
600.	600.	600.	600.	600.	600.	600.	600.	: averaging time for peak concentration (s)
600.	600.	600.	600.	600.	600.	600.	600.	: averaging time for averaged concentration (s)
1.	1.	1.	1.	1.	1.	1.	1.	: concentration of interest for modeling (ppm)
1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	: suggested receptor height for modeling (m)
5	5	5	5	5	5	5	3	: number of distances downwind
50.	50.	50.	50.	50.	50.	50.	200.	: distance downwind (m)
100.	100.	100.	100.	100.	100.	100.	400.	: distance downwind (m)
200.	200.	200.	200.	200.	200.	200.	800.	: distance downwind (m)
400.	400.	400.	400.	400.	400.	400.	-99.9	: distance downwind (m)
800.	800.	800.	800.	800.	800.	800.	-99.9	: distance downwind (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: distance downwind (terminal record: -99.9)

Prairie Grass, set 6 .
Sulfur dioxide .

SO2				: 3-char. abbreviation of chemical
4				: number of trials included in MDA
6				: time zone designation
PG59	PG60	PG61	PG62	: trial ID
8	8	8	8	: month
25	26	26	26	: day
56	56	56	56	: year
22	0	11	14	: hour
26	27	1	00	: minute
64.	64.	64.	64.	: mol. weight (g/mole)
263.13	263.13	263.13	263.13	: normal boiling point (K)
386500.	386500.	386500.	386500.	: latent heat of evaporation (J/kg)
622.6	622.6	622.6	622.6	: specific heat - vapor (J/kg-K)
1331.	1331.	1331.	1331.	: specific heat - liquid (J/kg-K)
1462.	1462.	1462.	1462.	: density of liquid (kg/m**3)
-99.9	-99.9	-99.9	-99.9	: coefficient A for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	: coefficient B for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	: exit pressure (atm)
297.15	299.15	307.15	305.15	: source temperature (K)
0.0508	0.0508	0.0508	0.0508	: source diameter (m)
.45	.45	.45	.45	: source elevation (m)
HJ	HJ	HJ	HJ	: source type (IR,HJ,AS,EP)
G	G	G	G	: source phase (L,C,G)
-99.9	-99.9	-99.9	-99.9	: source containment diameter (m)
0.0402	0.0385	0.1021	0.1021	: spill/evaporation rate (kg/s)
600.	600.	600.	600.	: spill duration (s)
24.1	23.1	61.3	61.3	: total released (kg)
1000000.	1000000.	1000000.	1000000.	: initial concentration (ppm)
-99.9	-99.9	-99.9	-99.9	: ambient pressure (atm)
-99.9	-99.9	-99.9	-99.9	: relative humidity (%)
297.15	299.15	307.15	305.15	: ambient temperature #1-lower (K)
2.	2.	2.	2.	: measurement height for temperature #1 (m)
300.15	299.85	305.35	304.15	: ambient temperature #2-upper (K)
16.	16.	16.	16.	: measurement height for temperature #2 (m)
-99.9	-99.9	-99.9	-99.9	: soil temperature (K)
1	1	1	1	: soil moisture (1:dry,2:moist,3:water)
2.6	4.9	8.0	5.2	: wind speed (m/s)
2.	2.	2.	2.	: measurement height for wind speed (m)
2.6	4.9	8.0	5.2	: domain-avg wind speed (m/s)
-99.9	-99.9	-99.9	-99.9	: domain-avg sigma-u (m/s)
5.2	5.9	11.0	8.8	: domain-avg sigma-theta (deg)
2.	2.	2.	2.	: measurement ht for domain-avg wind data (m)
600.	600.	600.	600.	: averaging time for domain-avg data (s)
.006	.006	.006	.006	: roughness length z0 (m)
0.14	0.28	0.51	0.34	: friction velocity u-star (m/s)
-99.9	-99.9	-99.9	-99.9	: bowen ratio estimate
0.0909	0.0172	-0.0263	-0.0333	: inverse Monin-Obukhov length (1/m)
50	70	30	80	: cloud cover (%)
6	4	4	3	: Pasquill-Gifford stability class (A-1;D-4;F-6)
42.3	42.3	42.3	42.3	: latitude (deg)
98.3	98.3	98.3	98.3	: longitude (deg)
600.	600.	600.	600.	: averaging time for peak concentration (s)
600.	600.	600.	600.	: averaging time for averaged concentration (s)
1.	1.	1.	1.	: concentration of interest for modeling (ppm)
1.5	1.5	1.5	1.5	: suggested receptor height for modeling (m)
5	5	5	4	: number of distances downwind
50.	50.	50.	100.	: distance downwind (m)
100.	100.	100.	200.	: distance downwind (m)
200.	200.	200.	400.	: distance downwind (m)
400.	400.	400.	800.	: distance downwind (m)
800.	800.	800.	-99.9	: distance downwind (m)
-99.9	-99.9	-99.9	-99.9	: distance downwind (terminal record: -99.9)

Thorney Island (continuous)		.
Mixture of Freon-12 and Nitrogen		.
F12		. 3-char. abbreviation of chemical
2		: number of trials included in MDA
0		: time zone designation
TC45	TC47	: trial ID
6	6	: month
09	15	: day
84	84	: year
19	20	: hour
59	08	: minute
57.8	57.8	: mol. weight (g/mole)
243.4	243.4	: normal boiling point (K)
165000.	165000.	: latent heat of evaporation (J/kg)
610.	610.	: specific heat - vapor (J/kg-K)
970.	970.	: specific heat - liquid (J/kg-K)
1520.	1520.	: density of liquid (kg/m**3)
-99.9	-99.9	: coefficient A for vapor pressure equation
-99.9	-99.9	: coefficient B for vapor pressure equation
-99.9	-99.9	: exit pressure (atm)
286.25	287.45	: source temperature (K)
2.	2.	: source diameter (m)
0.	0.	: source elevation (m)
AS	AS	: source type (IR,HJ,AS,EP)
G	G	: source phase (L,C,G)
-99.9	-99.9	: source containment diameter (m)
10.67	10.22	: spill/evaporation rate (kg/s)
455.	465.	: spill duration (s)
4855.	4752.	: total released (kg)
1000000.	1000000.	: initial concentration (ppm)
1.0	1.0	: ambient pressure (atm)
100.	97.4	: relative humidity (%)
286.25	287.45	: ambient temperature #1-lower (K)
2.	2.	: measurement height for temperature #1 (m)
-99.9	-99.9	: ambient temperature #2-upper (K)
-99.9	-99.9	: measurement height for temperature #2 (m)
285.95	287.65	: soil (grass) temperature (K)
1	1	: soil moisture (1:dry,2:moist,3:water)
2.3	1.5	: wind speed (m/s)
10.	10.	: measurement height for wind speed (m)
2.3	1.5	: domain-avg wind speed (m/s)
-99.9	-99.9	: domain-avg sigma-u (m/s)
-99.9	-99.9	: domain-avg sigma-theta (deg)
10.	10.	: measurement ht for domain-avg wind data (m)
600.	600.	: averaging time for domain-avg data (s)
0.01	0.01	: roughness length z0 (m)
-99.9	-99.9	: friction velocity u-star (m/s)
-99.9	-99.9	: bowen ratio estimate
-99.9	-99.9	: inverse Monin-Obukhov length (1/m)
13.	0.	: cloud cover (%)
5	6	: Pasquill-Gifford stability class (A-1;D-4;F-6)
51.	51.	: latitude (deg)
1.	1.	: longitude (deg)
30.	30.	: averaging time for peak concentration (s)
30.	30.	: averaging time for averaged concentration (s)
100.	100.	: concentration of interest for modeling (ppm)
0.4	0.4	: suggested receptor height for modeling (m)
9	6	: number of distances downwind
40.	50.	: distance downwind (m)
53.	90.	: distance downwind (m)
72.	212.	: distance downwind (m)
90.	250.	: distance downwind (m)
112.	335.	: distance downwind (m)
158.	472.	: distance downwind (m)
250.	-99.9	: distance downwind (m)
335.	-99.9	: distance downwind (m)
472.	-99.9	: distance downwind (m)
-99.9	-99.9	: distance downwind (terminal record: -99.9)

Thorney Island (Instantaneous)
Mixture of Freon-12 and Nitrogen

F12									: 3-char. abbreviation of chemical
9									: number of trials included in MDA
0									: time zone designation
TI6	TI7	TI8	TI9	TI12	TI13	TI17	TI18	TI19	: trial ID
8	9	9	9	10	10	6	6	6	: month
4	8	9	15	15	19	9	10	10	: day
82	82	82	82	82	82	83	83	83	: year
19	19	17	18	17	11	19	15	20	: hour
11	33	49	46	21	41	52	56	41	: minute
47.69	50.58	47.11	46.24	68.49	57.80	121.38	54.04	61.27	: mol. weight (g/mole)
243.4	243.4	243.4	243.4	243.4	243.4	243.4	243.4	243.4	: normal boiling point (K)
165000.	165000.	165000.	165000.	165000.	165000.	165000.	165000.	165000.	: latent heat of evaporation (J/kg)
610.	610.	610.	610.	610.	610.	610.	610.	610.	: specific heat - vapor (J/kg-K)
970.	970.	970.	970.	970.	970.	970.	970.	970.	: specific heat - liquid (J/kg-K)
1520.	1520.	1520.	1520.	1520.	1520.	1520.	1520.	1520.	: density of liquid (kg/m**3)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: coefficient A for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: coefficient B for vapor pressure equation
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: exit pressure (atm)
291.83	290.46	290.68	291.45	283.29	286.88	289.21	289.66	286.47	: source temperature (K)
14.	14.	14.	14.	14.	14.	14.	14.	14.	: source diameter (m)
0.	0.	0.	0.	0.	0.	0.	0.	0.	: source elevation (m)
IR	IR	IR	IR	IR	IR	IR	IR	IR	: source type (IR,HJ,AS,EP)
G	G	G	G	G	G	G	G	G	: source phase (L,C,G)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: source containment diameter (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: spill/evaporation rate (kg/s)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: spill duration (s)
3147.	4249.	3958.	3866.	5736.	4800.	8711.	3881.	5477.	: total released (kg)
1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	1000000.	: initial concentration (ppm)
1.000	1.008	1.009	1.006	1.000	1.006	.995	.994	.993	: ambient pressure (atm)
74.8	80.7	87.6	87.3	66.2	74.1	94.0	81.3	94.8	: relative humidity (%)
291.83	290.46	290.68	291.45	283.29	286.88	289.21	289.66	286.47	: ambient temperature #1-lower (K)
2.	2.	2.	2.	2.	2.	2.	2.	2.	: measurement height for temperature #1 (m)
291.64	290.47	290.56	292.11	284.31	286.44	288.92	288.52	286.51	: ambient temperature #2-upper (K)
16.	16.	16.	16.	16.	16.	16.	16.	16.	: measurement height for temperature #2 (m)
-99.9	290.85	291.55	-99.9	285.15	287.85	291.05	297.45	286.15	: soil (grass) temperature (K)
1	1	1	1	1	1	1	1	1	: soil moisture (1:dry,2:moist,3:water)
2.8	3.4	2.4	1.7	2.5	7.3	5.0	7.4	6.4	: wind speed (m/s)
10.	10.	10.	10.	10.	10.	10.	10.	10.	: measurement height for wind speed (m)
2.8	3.4	2.4	1.7	2.5	7.3	5.0	7.4	6.4	: domain-avg wind speed (m/s)
.38	.47	.34	.10	.24	.81	.67	.98	.85	: domain-avg sigma-u (m/s)
6.49	8.12	3.88	-99.9	5.97	5.30	8.02	7.68	5.27	: domain-avg sigma-theta (deg)
10.	10.	10.	10.	10.	10.	10.	10.	10.	: measurement ht for domain-avg wind data (m)
600.	600.	600.	600.	600.	384.	600.	600.	600.	: averaging time for domain-avg data (s)
0.018	0.018	0.012	0.008	0.018	0.01	0.018	0.005	0.01	: roughness length z0 (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: friction velocity u-star (m/s)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: bowen ratio estimate
0.000	0.011	-.110	0.650	0.100	-.011	-.005	-.023	0.003	: inverse Monin-Obukhov length (1/m)
50.	25.	25.	0.	88.	38.	75.	63.	38.	: cloud cover (%)
4	5	4	6	5	4	4	4	4	: Pasquill-Gifford stability class (A-1;D-4;F-6)
51.	51.	51.	51.	51.	51.	51.	51.	51.	: latitude (deg)
1.	1.	1.	1.	1.	1.	1.	1.	1.	: longitude (deg)
.6	.6	.6	.6	.6	.6	.6	.6	.6	: averaging time for peak concentration (s)
.6	.6	.6	.6	.6	.6	.6	.6	.6	: averaging time for averaged concentration (s)
100.	100.	100.	100.	100.	100.	100.	100.	100.	: concentration of interest for modeling (ppm)
0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	: suggested receptor height for modeling (m)
5	7	7	7	5	6	7	10	7	: number of distances downwind
71.	71.	71.	71.	71.	71.	40.	40.	40.	: distance downwind (m)
141.	100.	100.	100.	150.	100.	50.	60.	60.	: distance downwind (m)
180.	150.	150.	141.	200.	224.	71.	70.	71.	: distance downwind (m)
283.	180.	200.	180.	361.	316.	100.	80.	100.	: distance downwind (m)
424.	224.	364.	224.	500.	361.	141.	100.	224.	: distance downwind (m)
-99.9	361.	412.	316.	-99.9	412.	224.	200.	361.	: distance downwind (m)
-99.9	500.	510.	503.	-99.9	-99.9	500.	224.	583.	: distance downwind (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	300.	-99.9	: distance downwind (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	400.	-99.9	: distance downwind (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	510.	-99.9	: distance downwind (m)
-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	: distance downwind (terminal record: -99.9)

APPENDIX B

MODEL APPLICATION INFORMATION

Included in this Appendix are the tables containing the input parameters to each of the following models:

AFTOX
AIRTOX
Britter and McQuaid
CHARM
DEGADIS
FOCUS
GASTAR
GPM
HEGADAS
INPUFF
OBDG
PHAST
SLAB
TRACE

for each of the following experiments:

Burro
Coyote
Desert Tortoise
Goldfish
Hanford (continuous)
Hanford (instantaneous)
Maplin Sands (LNG)
Maplin Sands (LPG)
Prairie Grass
Thorney Island (continuous)
Thorney Island (instantaneous)

AFTOX INPUT DATA FOR: Burro
CHEMICAL RELEASED : Liquefied natural gas

IS PRINTER ON? : N
STATION NO.? : 3
CHANGE DATE/TIME? : Y
UNIT SYSTEM? : METRIC
TIME ZONE : 8

TRIAL :	3U2	3U3	3U4	3U5	3U6	3U7	3U8	3U9
MONTH :	6	7	7	7	8	8	8	9
DAY :	18	2	9	16	5	27	3	17
YEAR :	80	80	80	80	80	80	80	80
HOUR :	15	15	14	16	16	18	19	18
MINUTE :	59	8	7	20	5	12	9	37
TYPE OF SPILL :	1	1	1	1	1	1	1	1
STATION NO. :	15	15	15	15	15	15	15	15
CHEMICAL NO. :	56	56	56	56	56	56	56	56
MOLECULAR WEIGHT :	17.460	17.260	17.050	17.080	17.240	18.220	18.120	18.820
CONC. OF INTEREST :	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
MEAS. HEIGHT (m) :	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
AMB. TEMP. (C) :	38.1	34.5	35.8	41.1	39.5	33.8	32.8	35.3
WIND DIR. (deg) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WIND SPEED (m/s) :	5.4	5.4	9.0	7.4	9.1	8.4	1.8	5.7
HAVE STDV. OF DIR? :	Y	Y	Y	Y	Y	Y	Y	Y
STD. DEV. DIR. (deg) :	13.5	13.3	7.3	11.1	6.7	5.1	5.6	4.4
AVERAGING TIME (min) :	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
CLOUD COV. (8ths) :	0	0	0	0	0	[illegible]	0	1
SOIL MOISTURE :	2	2	2	2	2	2	2	2
INVERSION? :	n	n	n	n	n	n	n	n
SITE ROUGHNESS (cm) :	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
RELEASE HT (m) :	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CONTINUOUS GAS RELEASE								
EMIS. RATE (kg/min) :	5166.0	5278.8	5217.6	4875.0	5533.2	5967.6	7015.8	8158.8
STILL LEAKING? :	n	n	n	n	n	n	n	n
ELAPSED TIME (min) :	2.88	2.78	2.92	3.17	2.15	2.90	1.78	1.32
CONC. AVG TIME (min) :	1.00	1.67	1.33	2.17	1.17	2.33	1.33	1.00
SPECIFIED CONC (ppm) :	100.	100.	100.	100.	100.	100.	100.	100.
DOWNWIND DIST. (m) :	57.0	57.0	57.0	57.0	57.0	57.0	57.0	57.0
TRAVEL TIME (min) :	0.2	0.2	0.1	0.1	0.1	0.1	0.4	0.1
DOWNWIND DIST. (m) :	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0
TRAVEL TIME (min) :	0.4	0.4	0.2	0.3	0.2	0.2	0.9	0.3
DOWNWIND DIST. (m) :	-99.9	-99.9	-99.9	-99.9	-99.9	400.0	400.0	400.0
TRAVEL TIME (min) :	0.0	0.0	0.0	0.0	0.0	0.7	2.6	1.0
DOWNWIND DIST. (m) :	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	800.0	800.0
TRAVEL TIME (min) :	0.0	0.0	0.0	0.0	0.0	0.0	5.2	2.0
SOLAR ANGLE (deg) :	35.76	46.49	58.54	31.53	32.29	1.90	-11.25	-9.22

AFTOX INPUT DATA FOR: Coyote
CHEMICAL RELEASED : Liquefied natural gas . Methane is at least 86% in c

IS PRINTER ON?	: N		
STATION NO.?	: 3		
CHANGE DATE/TIME?	: Y		
UNIT SYSTEM?	: METRIC		
TIME ZONE	: 8		
TRIAL	: C03	C05	C06
MONTH	9	10	10
DAY	3	7	27
YEAR	91	91	91
HOUR	15	12	16
MINUTE	38	9	43
TYPE OF SPILL	1	1	1
STATION NO.	15	15	15
CHEMICAL NO.	56	56	56
MOLECULAR WEIGHT	19.510	20.190	19.090
CONC. OF INTEREST	100.00	100.00	100.00
MEAS. HEIGHT (m)	2.0	2.0	2.0
AMB. TEMP. (C)	38.3	28.3	24.1
WIND DIR. (deg)	0.0	0.0	0.0
WIND SPEED (m/s)	6.0	9.7	4.6
HAVE STDV. OF DIR?	Y	Y	Y
STD. DEV. DIR. (deg)	6.0	5.1	5.1
AVERAGING TIME (min)	3.00	3.00	3.00
CLOUD COV. (8ths)	1	3	4
SOIL MOISTURE	2	2	2
INVERSION?	n	n	n
SITE ROUGHNESS (cm)	0.020	0.020	0.020
RELEASE HT (m)	0.00	0.00	0.00
CONTINUOUS GAS RELEASE			
EMIS. RATE (kg/min)	6040.2	7741.2	7381.8
STILL LEAKING?	n	n	n
ELAPSED TIME (min)	1.08	1.63	1.37
CONC. AVG TIME (min)	1.00	1.50	1.17
SPECIFIED CONC (ppm)	100.	100.	100.
DOWNWIND DIST. (m)	140.0	140.0	140.0
TRAVEL TIME (min)	0.3	0.2	0.4
DOWNWIND DIST. (m)	200.0	200.0	200.0
TRAVEL TIME (min)	0.5	0.3	0.6
DOWNWIND DIST. (m)	300.0	300.0	300.0
TRAVEL TIME (min)	0.7	0.5	0.9
DOWNWIND DIST. (m)	-99.9	400.0	400.0
TRAVEL TIME (min)	0.0	0.6	1.2
SOLAR ANGLE (deg)	31.20	48.33	2.86

AFTOX INPUT DATA FOR: Desert Tortoise
CHEMICAL RELEASED : Anhydrous Ammonia

IS PRINTER ON?	:	N			
STATION NO.?	:	3			
CHANGE DATE/TIME?	:	Y			
UNIT SYSTEM?	:	METRIC			
TIME ZONE	:	8			
TRIAL	:	DT1	DT2	DT3	DT4
MONTH	:	8	8	9	9
DAY	:	24	29	1	6
YEAR	:	83	83	83	83
HOUR	:	16	11	15	18
MINUTE	:	37	20	37	15
TYPE OF SPILL	:	1	1	1	1
STATION NO.	:	12	12	12	12
CHEMICAL NO.	:	13	13	13	13
MOLECULAR WEIGHT	:	17.030	17.030	17.030	17.030
CONC. OF INTEREST	:	100.00	100.00	100.00	100.00
MEAS. HEIGHT (m)	:	2.0	2.0	2.0	2.0
AMB. TEMP. (C)	:	28.8	30.4	33.9	32.4
WIND DIR. (deg)	:	0.0	0.0	0.0	0.0
WIND SPEED (m/s)	:	7.4	5.8	7.4	4.5
HAVE STDV. OF DIR?	:	Y	Y	Y	Y
STD. DEV. DIR. (deg)	:	5.7	7.5	8.3	5.0
AVERAGING TIME (min)	:	3.00	3.00	3.00	3.00
CLOUD COV. (8ths)	:	0	0	5	0
SOIL MOISTURE	:	2	2	2	1
INVERSION?	:	n	n	n	n
SITE ROUGHNESS (cm)	:	0.300	0.300	0.300	0.300
RELEASE HT (m)	:	0.79	0.79	0.79	0.79
CONTINUOUS GAS RELEASE					
EMIS. RATE (kg/min)	:	4782.0	6690.0	7842.0	5802.0
STILL LEAKING?	:	n	n	n	n
ELAPSED TIME (min)	:	2.10	4.25	2.77	6.35
CONC. AVG TIME (min)	:	1.33	2.67	2.00	5.00
SPECIFIED CONC (ppm)	:	100.	100.	100.	100.
DOWNWIND DIST. (m)	:	100.0	100.0	100.0	100.0
TRAVEL TIME (min)	:	0.2	0.2	0.2	0.3
DOWNWIND DIST. (m)	:	800.0	800.0	800.0	800.0
TRAVEL TIME (min)	:	1.4	1.7	1.4	2.1
SOLAR ANGLE (deg)	:	20.68	62.41	30.46	-2.43

AFTOX INPUT DATA FOR: Goldfish
CHEMICAL RELEASED : Hydrogen fluoride

IS PRINTER ON?	: N			
STATION NO.?	: 3			
CHANGE DATE/TIME?	: Y			
UNIT SYSTEM?	: METRIC			
TIME ZONE	: 8			
TRIAL	:	GF1	GF2	GF3
MONTH	:	8	8	8
DAY	:	1	14	20
YEAR	:	90	90	90
HOUR	:	18	18	18
MINUTE	:	15	15	15
TYPE OF SPILL	:	1	1	1
STATION NO.	:	12	12	12
CHEMICAL NO.	:	48	48	48
MOLECULAR WEIGHT	:	20.010	20.010	20.010
CONC. OF INTEREST	:	30.00	30.00	30.00
MEAS. HEIGHT (m)	:	2.0	2.0	2.0
AMB. TEMP. (C)	:	37.2	36.2	34.4
WIND DIR. (deg)	:	0.0	0.0	0.0
WIND SPEED (m/s)	:	5.6	4.2	5.4
HAVE STDV. OF DIR?	:	Y	Y	Y
STD. DEV. DIR. (deg)	:	10.7	14.9	10.7
AVERAGING TIME (min)	:	15.00	15.00	15.00
CLOUD COV. (8ths)	:	0	0	0
SOIL MOISTURE	:	1	1	1
INVERSION?	:	n	n	n
SITE ROUGHNESS (cm)	:	0.300	0.300	0.300
RELEASE HT (m)	:	1.00	1.00	1.00
CONTINUOUS GAS RELEASE				
EMIS. RATE (kg/min)	:	1660.2	627.6	616.2
STILL LEAKING?	:	n	n	n
ELAPSED TIME (min)	:	2.08	6.00	6.00
CONC. AVG TIME (min)	:	1.47	1.47	1.47
SPECIFIED CONC (ppm)	:	30.	30.	30.
DOWNWIND DIST. (m)	:	300.0	300.0	300.0
TRAVEL TIME (min)	:	0.7	0.9	0.7
DOWNWIND DIST. (m)	:	1000.0	1000.0	1000.0
TRAVEL TIME (min)	:	2.3	3.1	2.2
DOWNWIND DIST. (m)	:	3000.0	-99.9	3000.0
TRAVEL TIME (min)	:	6.8	0.5	6.7
SOLAR ANGLE (deg)	:	6.06	3.60	2.21

AFTOX INPUT DATA FOR: Hanford (continuous)
CHEMICAL RELEASED : Krypton-85

IS PRINTER ON? : N
STATION NO.? : 3
CHANGE DATE/TIME? : Y
UNIT SYSTEM? : METRIC
TIME ZONE : 8

TRIAL :	HC1	HC2	HC3	HC4	HC5
MONTH :	9	10	10	10	11
DAY :	15	17	23	24	3
YEAR :	67	67	67	67	67
HOUR :	0	9	11	11	5
MINUTE :	0	2	1	4	12
TYPE OF SPILL :	1	1	1	1	1
STATION NO. :	16	16	16	16	16
CHEMICAL NO. :	78	78	78	78	78
MOLECULAR WEIGHT :	29.000	29.000	29.000	29.000	29.000
CONC. OF INTEREST :	0.10	0.10	0.10	0.10	0.10
MEAS. HEIGHT (m) :	1.5	1.5	1.5	1.5	1.5
AMB. TEMP. (C) :	17.7	12.2	15.7	13.4	5.6
WIND DIR. (deg) :	0.0	0.0	0.0	0.0	0.0
WIND SPEED (m/s) :	1.3	3.9	7.1	3.9	2.5
HAVE STDV. OF DIR? :	Y	Y	Y	Y	Y
STD. DEV. DIR. (deg) :	11.3	6.1	9.3	13.0	7.4
AVERAGING TIME (min) :	39.00	14.17	14.00	11.00	24.67
CLOUD COV. (8ths) :	0	0	0	0	0
SOIL MOISTURE :	1	1	1	1	1
INVERSION? :	n	n	n	n	n
SITE ROUGHNESS (cm) :	3.000	3.000	3.000	3.000	3.000
RELEASE HT (m) :	1.00	1.00	1.00	1.00	1.00
CONTINUOUS GAS RELEASE					
EMIS. RATE (kg/min) :	0.7	0.7	1.7	2.3	1.0
STILL LEAKING? :	n	n	n	n	n
ELAPSED TIME (min) :	15.47	15.08	14.25	9.97	19.85
CONC. AVG TIME (min) :	7.68	14.08	4.48	4.48	8.96
SPECIFIED CONC (ppm) :	0.	0.	0.	0.	0.
DOWNWIND DIST. (m) :	200.0	200.0	200.0	200.0	200.0
TRAVEL TIME (min) :	1.0	0.6	0.3	0.6	0.8
DOWNWIND DIST. (m) :	800.0	800.0	800.0	800.0	800.0
TRAVEL TIME (min) :	3.9	2.4	1.3	2.5	3.2
SOLAR ANGLE (deg) :	-40.08	15.98	31.69	31.45	-16.85

AFTOX INPUT DATA FOR: Hanford (Instantaneous)
CHEMICAL RELEASED : Krypton-85

IS PRINTER ON? : N
STATION NO.? : 3
CHANGE DATE/TIME? : Y
UNIT SYSTEM? : METRIC
TIME ZONE : 8

TRIAL :	HI2	HI3	HI5	HI6	HI7	HI8
MONTH :	9	10	10	10	10	11
DAY :	14	17	23	23	24	8
YEAR :	67	67	67	67	67	67
HOUR :	23	7	10	11	10	6
MINUTE :	0	38	53	30	53	2
TYPE OF SPILL :	2	2	2	2	2	2
STATION NO. :	16	16	16	16	16	16
CHEMICAL NO. :	78	78	78	78	78	78
MOLECULAR WEIGHT :	29.000	29.000	29.000	29.000	29.000	29.000
CONC. OF INTEREST :	0.10	0.10	0.10	0.10	0.10	0.10
MEAS. HEIGHT (m) :	1.5	1.5	1.5	1.5	1.5	1.5
AMB. TEMP. (C) :	18.3	11.9	15.5	15.1	12.4	4.6
WIND DIR. (deg) :	0.0	0.0	0.0	0.0	0.0	0.0
WIND SPEED (m/s) :	1.3	4.1	7.6	7.2	4.5	1.6
HAVE STDV. OF DIR? :	Y	Y	Y	Y	Y	Y
STD. DEV. DIR. (deg) :	4.4	5.1	6.4	5.4	9.1	8.7
AVERAGING TIME (min) :	20.00	10.00	3.33	4.00	3.50	9.00
CLOUD COV. (8ths) :	0	0	0	0	0	0
SOIL MOISTURE :	1	1	1	1	1	1
INVERSION? :	n	n	n	n	n	n
SITE ROUGHNESS (cm) :	3.000	3.000	3.000	3.000	3.000	3.000
RELEASE HT (m) :	0.00	0.00	0.00	0.00	0.00	0.00
INSTANTANEOUS GAS RELEASE						
TOTAL MASS (kg) :	10.00	10.00	10.00	10.00	10.00	10.00
CONC. AVG TIME (min) :	1.00	1.00	1.00	1.00	1.00	1.00
SPECIFIED CONC (ppm) :	0.	0.	0.	0.	0.	0.
DOWNWIND DIST. (m) :	200.0	200.0	200.0	200.0	200.0	200.0
TRAVEL TIME (min) :	0.9	0.6	0.3	0.3	0.5	1.1
DOWNWIND DIST. (m) :	800.0	800.0	800.0	800.0	800.0	800.0
TRAVEL TIME (min) :	3.7	2.2	1.2	1.3	2.1	4.6
SOLAR ANGLE (deg) :	-38.36	12.40	31.38	32.36	31.04	-8.40

AFTOX INPUT DATA FOR: Maplin Sands
CHEMICAL RELEASED : Liquified Natural Gas

IS PRINTER ON? : N
STATION NO.? : 3
CHANGE DATE/TIME? : Y
UNIT SYSTEM? : METRIC
TIME ZONE : 0

TRIAL		MS27	MS29	MS34	MS35
MONTH	:	9	9	9	9
DAY	:	9	9	17	17
YEAR	:	80	80	80	80
HOUR	:	10	14	10	11
MINUTE	:	41	12	9	8
TYPE OF SPILL	:	1	1	1	1
STATION NO.	:	17	17	17	17
CHEMICAL NO.	:	56	56	56	56
MOLECULAR WEIGHT	:	17.110	16.260	16.660	16.390
CONC. OF INTEREST	:	100.00	100.00	100.00	100.00
MEAS. HEIGHT (m)	:	10.0	10.0	10.0	10.0
AMB. TEMP. (C)	:	14.9	16.1	15.2	16.1
WIND DIR. (deg)	:	0.0	0.0	0.0	0.0
WIND SPEED (m/s)	:	5.6	7.4	8.5	9.6
HAVE STDV. OF DIR?	:	Y	Y	Y	Y
STD. DEV. DIR. (deg)	:	5.4	5.7	4.8	5.2
AVERAGING TIME (min)	:	2.67	3.75	1.80	2.25
CLOUD COV. (8ths)	:	0	7	1	1
SOIL MOISTURE	:	2	2	2	2
INVERSION?	:	n	n	n	n
SITE ROUGHNESS (cm)	:	0.030	0.030	0.030	0.030
RELEASE HT (m)	:	0.00	0.00	0.00	0.00
CONTINUOUS GAS RELEASE					
EMIS. RATE (kg/min)	:	1392.6	1749.6	1290.6	1625.4
STILL LEAKING?	:	n	n	n	n
ELAPSED TIME (min)	:	2.67	3.75	1.58	2.25
CONC. AVG TIME (min)	:	1.00	1.00	1.00	1.00
SPECIFIED CONC (ppm)	:	100.	100.	100.	100.
DOWNWIND DIST. (m)	:	89.0	58.0	87.0	129.0
TRAVEL TIME (min)	:	0.3	0.1	0.2	0.2
DOWNWIND DIST. (m)	:	131.0	90.0	179.0	250.0
TRAVEL TIME (min)	:	0.4	0.2	0.4	0.4
DOWNWIND DIST. (m)	:	324.0	130.0	-99.9	406.0
TRAVEL TIME (min)	:	1.0	0.3	6.7	0.7
DOWNWIND DIST. (m)	:	400.0	182.0	-99.9	-99.9
TRAVEL TIME (min)	:	1.2	0.4	1.2	0.0
DOWNWIND DIST. (m)	:	650.0	252.0	-99.9	-99.9
TRAVEL TIME (min)	:	1.9	0.6	0.0	0.0
DOWNWIND DIST. (m)	:	-99.9	324.0	-99.9	-99.9
TRAVEL TIME (min)	:	0.0	0.7	0.0	0.0
DOWNWIND DIST. (m)	:	-99.9	403.0	-99.9	-99.9
TRAVEL TIME (min)	:	0.0	0.9	0.0	0.0
SOLAR ANGLE (deg)	:	41.35	36.77	36.12	40.12

AFTOX INPUT DATA FOR: Maplin Sands
CHEMICAL RELEASED : Liquified Propane Gas

IS PRINTER ON? : N
STATION NO.? : 3
CHANGE DATE/TIME? : Y
UNIT SYSTEM? : METRIC
TIME ZONE : 0

TRIAL	:	MS42	MS43	MS46	MS47	MS49	MS50	MS52	MS54
MONTH	:	9	9	10	10	10	10	10	10
DAY	:	28	28	1	1	5	8	9	15
YEAR	:	90	90	90	90	90	90	90	90
HOUR	:	15	17	15	16	10	10	14	8
MINUTE	:	53	18	12	16	37	38	34	25
TYPE OF SPILL	:	1	1	1	1	1	1	1	1
STATION NO.	:	17	17	17	17	17	17	17	17
CHEMICAL NO.	:	68	68	68	68	68	68	68	68
MOLECULAR WEIGHT	:	43.930	43.930	43.950	43.340	43.760	43.930	43.870	43.940
CONC. OF INTEREST	:	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
MEAS. HEIGHT (m)	:	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
AMB. TEMP. (C)	:	18.3	17.0	18.7	17.4	13.3	10.4	11.3	8.4
WIND DIR. (deg)	:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WIND SPEED (m/s)	:	4.0	5.3	8.1	6.2	5.5	7.9	7.4	3.7
HAVE STDV. OF DIR?	:	Y	Y	Y	Y	Y	Y	Y	Y
STD. DEV. DIR. (deg)	:	5.5	6.2	6.7	6.1	4.8	5.9	5.5	5.5
AVERAGING TIME (min)	:	3.00	5.67	8.00	5.00	1.50	4.17	3.00	3.00
CLOUD COV. (8ths)	:	2	4	1	4	3	6	1	0
SOIL MOISTURE	:	2	2	2	2	2	2	2	2
INVERSION?	:	n	n	n	n	n	n	n	n
SITE ROUGHNESS (cm)	:	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
RELEASE HT (m)	:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CONTINUOUS GAS RELEASE									
EMIS. RATE (kg/min)	:	1252.2	1152.0	1402.2	1954.2	1002.6	2153.4	2655.0	1152.0
STILL LEAKING?	:	n	n	n	n	n	n	n	n
ELAPSED TIME (min)	:	3.00	5.50	6.00	3.50	1.50	2.67	2.33	3.00
CONC. AVG TIME (min)	:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SPECIFIED CONC (ppm)	:	100.	100.	100.	100.	100.	100.	100.	100.
DOWNWIND DIST. (m)	:	28.0	88.0	34.0	90.0	90.0	59.0	61.0	56.0
TRAVEL TIME (min)	:	0.1	0.3	0.1	0.2	0.3	0.1	0.1	0.3
DOWNWIND DIST. (m)	:	53.0	129.0	91.0	128.0	129.0	93.0	95.0	85.0
TRAVEL TIME (min)	:	0.2	0.4	0.2	0.3	0.4	0.2	0.2	0.4
DOWNWIND DIST. (m)	:	83.0	249.0	130.0	182.0	180.0	182.0	178.0	178.0
TRAVEL TIME (min)	:	0.3	0.7	0.3	0.5	0.5	0.4	0.4	0.8
DOWNWIND DIST. (m)	:	123.0	400.0	182.0	250.0	250.0	400.0	249.0	247.0
TRAVEL TIME (min)	:	0.5	1.1	0.4	0.7	0.8	0.8	0.6	1.1
DOWNWIND DIST. (m)	:	179.0	-99.9	250.0	321.0	322.0	-99.9	398.0	-99.9
TRAVEL TIME (min)	:	0.7	0.6	0.5	0.9	1.0	0.0	0.9	0.0
DOWNWIND DIST. (m)	:	247.0	-99.9	322.0	400.0	400.0	-99.9	650.0	-99.9
TRAVEL TIME (min)	:	1.0	0.7	0.7	1.1	1.2	0.0	1.5	0.0
DOWNWIND DIST. (m)	:	398.0	-99.9	401.0	-99.9	-99.9	-99.9	-99.9	-99.9
TRAVEL TIME (min)	:	1.7	0.9	0.8	0.0	0.0	0.0	0.0	0.0
SOLAR ANGLE (deg)	:	16.79	4.04	21.24	12.38	31.63	30.97	22.83	16.01

AFTOX INPUT DATA FOR: Prairie Grass, Sec 1
CHEMICAL RELEASED : Sulfur dioxide

IS PRINTER ON? : N
STATION NO.? : 3
CHANGE DATE/TIME? : Y
UNIT SYSTEM? : METRIC
TIME ZONE : 6

TRIAL :	PG7	PG8	PG9	PG10	PG13	PG15	PG16	PG17
MONTH :	7	7	7	7	7	7	7	7
DAY :	10	10	11	11	22	23	23	23
YEAR :	56	56	56	56	56	56	56	56
HOUR :	14	17	16	12	20	9	10	20
MINUTE :	15	0	0	0	0	0	0	0
TYPE OF SPILL :	1	1	1	1	1	1	1	1
STATION NO. :	19	19	19	19	19	19	19	19
CHEMICAL NO. :	71	71	71	71	71	71	71	71
MOLECULAR WEIGHT :	64.000	64.000	64.000	64.000	64.000	64.000	64.000	64.000
CONC. OF INTEREST :	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MEAS. HEIGHT (m) :	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
AMB. TEMP. (C) :	31.9	31.9	27.9	30.9	19.9	21.9	27.9	26.9
WIND DIR. (deg) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WIND SPEED (m/s) :	4.2	4.9	6.9	4.5	1.3	3.4	3.2	3.3
HAVE STDV. OF DIR? :	Y	Y	Y	Y	Y	Y	Y	Y
STD. DEV. DIR. (deg):	25.6	10.2	10.2	16.3	3.2	12.3	13.5	5.6
AVERAGING TIME (min):	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
CLOUD COV. (8ths) :	0	0	2	2	1	0	0	5
SOIL MOISTURE :	1	1	1	1	1	1	1	1
INVERSION? :	n	n	n	n	n	n	n	n
SITE ROUGHNESS (cm) :	0.600	0.600	0.600	0.600	0.600	0.600	0.600	0.600
RELEASE HT (m) :	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
CONTINUOUS GAS RELEASE								
EMIS. RATE (kg/min) :	5.4	5.5	5.5	5.5	3.7	5.7	5.6	3.4
STILL LEAKING? :	n	n	n	n	n	n	n	n
ELAPSED TIME (min) :	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
CONC. AVG TIME (min):	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
SPECIFIED CONC (ppm):	1.	1.	1.	1.	1.	1.	1.	1.
DOWNWIND DIST. (m) :	50.0	50.0	50.0	50.0	400.0	50.0	50.0	50.0
TRAVEL TIME (min) :	0.2	0.1	0.1	0.2	2.4	0.2	0.2	0.2
DOWNWIND DIST. (m) :	100.0	100.0	100.0	100.0	800.0	100.0	100.0	100.0
TRAVEL TIME (min) :	0.3	0.3	0.2	0.3	4.9	0.4	0.4	0.4
DOWNWIND DIST. (m) :	200.0	200.0	200.0	200.0	-99.9	200.0	200.0	200.0
TRAVEL TIME (min) :	0.7	0.6	0.4	0.6	0.5	0.8	0.9	0.7
DOWNWIND DIST. (m) :	400.0	400.0	400.0	400.0	-99.9	400.0	400.0	400.0
TRAVEL TIME (min) :	1.4	1.1	0.8	1.2	0.8	1.7	1.3	1.4
DOWNWIND DIST. (m) :	800.0	800.0	800.0	800.0	-99.9	800.0	800.0	800.0
TRAVEL TIME (min) :	2.7	2.3	1.6	2.5	1.0	3.3	3.6	2.9
SOLAR ANGLE (deg) :	61.58	32.68	43.68	68.25	-0.30	28.00	49.80	-0.44

AFTOX INPUT DATA FOR: Thorney Island (continuous)
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen

IS PRINTER ON?	:	N	
STATION NO.?	:	3	
CHANGE DATE/TIME?	:	Y	
UNIT SYSTEM?	:	METRIC	
TIME ZONE	:	0	
TRIAL	:	TC45	TC47
MONTH	:	6	6
DAY	:	9	15
YEAR	:	84	84
HOUR	:	19	20
MINUTE	:	59	8
TYPE OF SPILL	:	1	1
STATION NO.	:	11	11
CHEMICAL NO.	:	46	46
MOLECULAR WEIGHT	:	57.300	57.300
CONC. OF INTEREST	:	100.00	100.00
MEAS. HEIGHT (m)	:	10.0	10.0
AMB. TEMP. (C)	:	13.0	14.3
WIND DIR. (deg)	:	0.0	0.0
WIND SPEED (m/s)	:	2.3	1.5
HAVE STDV. OF DIR?	:	Y	Y
STD. DEV. DIR. (deg)	:	4.4	2.0
AVERAGING TIME (min)	:	10.00	10.00
CLOUD COV. (8ths)	:	1	0
SOIL MOISTURE	:	1	1
INVERSION?	:	n	n
SITE ROUGHNESS (cm)	:	1.000	1.000
RELEASE HT (m)	:	0.00	0.00
CONTINUOUS GAS RELEASE			
EMIS. RATE (kg/min)	:	640.2	613.2
STILL LEAKING?	:	n	n
ELAPSED TIME (min)	:	7.58	7.75
CONC. AVG TIME (min)	:	1.00	1.00
SPECIFIED CONC (ppm)	:	100.	100.
DOWNWIND DIST. (m)	:	40.0	50.0
TRAVEL TIME (min)	:	0.3	0.6
DOWNWIND DIST. (m)	:	53.0	90.0
TRAVEL TIME (min)	:	0.4	1.0
DOWNWIND DIST. (m)	:	72.0	212.0
TRAVEL TIME (min)	:	0.5	2.4
DOWNWIND DIST. (m)	:	90.0	250.0
TRAVEL TIME (min)	:	0.7	2.8
DOWNWIND DIST. (m)	:	112.0	335.0
TRAVEL TIME (min)	:	0.8	3.7
DOWNWIND DIST. (m)	:	158.0	472.0
TRAVEL TIME (min)	:	1.1	5.2
DOWNWIND DIST. (m)	:	250.0	-99.9
TRAVEL TIME (min)	:	1.8	0.9
DOWNWIND DIST. (m)	:	335.0	-99.9
TRAVEL TIME (min)	:	2.4	0.0
DOWNWIND DIST. (m)	:	472.0	-99.9
TRAVEL TIME (min)	:	3.4	0.0
SOLAR ANGLE (deg)	:	1.28	0.62

AFTOX INPUT DATA FOR: Thorney Island (Instantaneous)
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen

IS PRINTER ON? : N
STATION NO.? : 3
CHANGE DATE/TIME? : Y
UNIT SYSTEM? : METRIC
TIME ZONE : 0

TRIAL :	TI6	TI7	TI8	TI9	TI12	TI13	TI17	TI18	TI19
MONTH :	8	9	9	9	10	10	6	6	6
DAY :	4	8	9	15	15	19	9	10	10
YEAR :	82	82	82	82	82	82	83	83	83
HOUR :	19	19	17	18	17	11	19	13	20
MINUTE :	11	33	49	46	21	41	52	56	41
TYPE OF SPILL :	2	2	2	2	2	2	2	2	2
STATION NO. :	11	11	11	11	11	11	11	11	11
CHEMICAL NO. :	46	46	46	46	46	46	46	46	46
MOLECULAR WEIGHT :	47.690	50.580	47.110	46.240	68.490	57.800	121.380	54.040	61.270
CONC. OF INTEREST :	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
MEAS. HEIGHT (m) :	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
AMB. TEMP. (C) :	18.6	17.3	17.5	18.3	10.1	13.7	16.0	16.5	13.3
WIND DIR. (deg) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WIND SPEED (m/s) :	2.8	3.4	2.4	1.7	2.5	7.3	5.0	7.4	5.4
HAVE STDV. OF DIR? :	Y	Y	Y	Y	Y	Y	Y	Y	Y
STD. DEV. DIR. (deg) :	6.5	3.1	3.9	2.0	6.0	5.3	8.0	7.7	5.3
AVERAGING TIME (min) :	10.00	10.00	10.00	10.00	10.00	6.40	10.00	10.00	10.00
CLOUD COV. (8ths) :	4	2	2	0	7	3	6	5	3
SOIL MOISTURE :	1	1	1	1	1	1	1	1	1
INVERSION? :	n	n	n	n	n	n	n	n	n
SITE ROUGHNESS (cm) :	1.800	1.800	1.200	0.800	1.800	1.000	1.800	0.500	1.000
RELEASE HT (m) :	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INSTANTANEOUS GAS RELEASE									
TOTAL MASS (kg) :	3147.00	4249.00	3958.00	3866.00	5736.00	4800.00	8711.00	3881.00	5477.00
CONC. AVG TIME (min) :	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SPECIFIED CONC (ppm) :	100.	100.	100.	100.	100.	100.	100.	100.	100.
DOWNWIND DIST. (m) :	71.0	71.0	71.0	71.0	71.0	71.0	40.0	40.0	40.0
TRAVEL TIME (min) :	0.4	0.3	0.5	0.7	0.5	0.2	0.1	0.1	0.1
DOWNWIND DIST. (m) :	141.0	100.0	100.0	100.0	150.0	100.0	50.0	60.0	60.0
TRAVEL TIME (min) :	0.8	0.5	0.7	1.0	1.0	0.2	0.2	0.1	0.2
DOWNWIND DIST. (m) :	180.0	150.0	150.0	141.0	200.0	224.0	71.0	70.0	71.0
TRAVEL TIME (min) :	1.1	0.7	1.0	1.4	1.3	0.5	0.2	0.2	0.2
DOWNWIND DIST. (m) :	283.0	180.0	200.0	180.0	361.0	316.0	100.0	80.0	100.0
TRAVEL TIME (min) :	1.7	0.9	1.4	1.8	2.4	0.7	0.3	0.2	0.3
DOWNWIND DIST. (m) :	424.0	224.0	364.0	224.0	500.0	361.0	141.0	100.0	224.0
TRAVEL TIME (min) :	2.5	1.1	2.5	2.2	3.3	0.8	0.5	0.2	0.6
DOWNWIND DIST. (m) :	-99.9	361.0	412.0	316.0	-99.9	412.0	224.0	200.0	361.0
TRAVEL TIME (min) :	1.1	1.8	2.9	3.1	1.2	0.9	0.7	0.5	0.9
DOWNWIND DIST. (m) :	-99.9	500.0	510.0	503.0	-99.9	-99.9	500.0	224.0	583.0
TRAVEL TIME (min) :	1.8	2.5	3.5	4.9	0.0	0.0	1.7	0.5	1.5
DOWNWIND DIST. (m) :	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	300.0	-99.9
TRAVEL TIME (min) :	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0
DOWNWIND DIST. (m) :	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	400.0	-99.9
TRAVEL TIME (min) :	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0
DOWNWIND DIST. (m) :	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	510.0	-99.9
TRAVEL TIME (min) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0
SOLAR ANGLE (deg) :	4.37	-9.27	6.33	-4.70	-1.31	29.34	2.08	37.46	-3.75

AIRTOX DATA FOR : Burro
CHEMICAL RELEASED : Liquefied natural gas

*** SCENARIO DATA ***								
SCENARIO :	BU2	BU3	BU4	BU5	BU6	BU7	BU8	BU9
DOT NUMBER :	1971	1971	1971	1971	1971	1971	1971	1971
RELEASE(JET=1,OTHER=0) :	0	0	0	0	0	0	0	0
EMISSION RATE (kg/s) :	86.100	87.980	86.960	81.250	92.220	99.460	116.930	135.980
DURATION (s) :	173.	167.	175.	190.	129.	174.	107.	79.
% LIQUID :	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
% AEROSOL :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RELATIVE HUMIDITY (%) :	7.1	5.2	2.7	5.3	5.1	7.4	4.5	14.4
SURFACE ROUGHNESS (m) :	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020
BUILDING WIDTH (m) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BUILDING HEIGHT (m) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FOR NON-JET RELEASES --								
DILUTION FACTOR :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STORAGE TEMP. (K) :	111.6	111.6	111.6	111.6	111.6	111.6	111.6	111.6
DIKE AREA (m^2) :	2642.1	2642.1	2642.1	2642.1	2642.1	2642.1	2642.1	2642.1
POOL DEPTH (m) :	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
SOIL COND. (kcal/msK) :	0.141E-02	0.141E-02	0.141E-02	0.141E-02	0.141E-02	0.141E-02	0.141E-02	0.141E-02
SOIL THERM DIFF(m^2/s) :	0.141E-05	0.141E-05	0.141E-05	0.141E-05	0.141E-05	0.141E-05	0.141E-05	0.141E-05
FOR JET RELEASES ONLY --								
RELEASE TEMP. (K) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RELEASE HT. (m) :	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ORIFICE AREA (m^2) :	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
EXIT VEL. (m/s) :	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANGLE (deg from hor.) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
*** USER DATA ***								
MODE (0=SNAP, 1=FOOT) :	1	1	1	1	1	1	1	1
REPORTING TIMES (s) :	80	80	80	90	60	80	50	30
MODEL TIME STEP (s) :	10	10	10	10	10	10	10	10
FOOTPRT START TIME (s) :	0	0	0	0	0	0	0	0
FOOTPRT STOP TIME (s) :	160	160	160	180	120	160	400	150
*** PRINT OPTIONS ***								
ECHO INPUTS (1=yes) :	1	1	1	1	1	1	1	1
SNAPSHOT CONCS (1=yes) :	1	1	1	1	1	1	1	1
MAX CONCS (1=yes) :	1	1	1	1	1	1	1	1
RECEPTOR CONCS (1=yes) :	1	1	1	1	1	1	1	1
HEIGHT & SIGMA (1=yes) :	1	1	1	1	1	1	1	1
*** CONCENTRATION LEVELS (PLOT) ***								
USER=0, DATABASE=1 :	0	0	0	0	0	0	0	0
USER - HIGH LEV (ppm) :	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
USER - MID LEV (ppm) :	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
USER - LOW LEV (ppm) :	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
*** METEOROLOGICAL DATA (5 min.) ***								
WIND SPEED (m/s) :	6.0	5.9	10.3	8.4	10.4	9.7	2.6	6.7
WIND DIR (deg) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STAB CLASS (A=1,F=6) :	3.	3.	3.	3.	3.	4.	5.	4.
TEMPERATURE (K) :	311.3	307.8	309.0	314.3	312.7	307.0	306.0	308.5
*** RECEPTOR DATA ***								
X-COORDINATE (m) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y-COORDINATES (m) :	-57.0	-57.0	-57.0	-57.0	-57.0	-57.0	-57.0	-57.0
Y-COORDINATES (m) :	-140.0	-140.0	-140.0	-140.0	-140.0	-140.0	-140.0	-140.0
Y-COORDINATES (m) :	99.9	99.9	99.9	99.9	99.9	-400.0	-400.0	-400.0
Y-COORDINATES (m) :	99.9	99.9	99.9	99.9	99.9	99.9	-800.0	-800.0

AIRTOX DATA FOR : Coyote
CHEMICAL RELEASED : Liquefied natural gas . Methane is at least 86% in c

*** SCENARIO DATA ***			
SCENARIO :	C03	C05	C06
DOT NUMBER :	1971	1971	1971
RELEASE(JET=1,OTHER=0) :	0	0	0
EMISSION RATE (kg/s) :	100.670	129.020	123.030
DURATION (s) :	65.	38.	82.
% LIQUID :	100.0	100.0	100.0
% AEROSOL :	0.0	0.0	0.0
RELATIVE HUMIDITY (%) :	11.3	22.1	32.3
SURFACE ROUGHNESS (m) :	0.00020	0.00020	0.00020
BUILDING WIDTH (m) :	0.0	0.0	0.0
BUILDING HEIGHT (m) :	0.0	0.0	0.0
FOR NON-JET RELEASES --			
DILUTION FACTOR :	0.0	0.0	0.0
STORAGE TEMP. (K) :	111.6	111.6	111.6
DIKE AREA (m^2) :	2642.1	2642.1	2642.1
POOL DEPTH (m) :	0.01	0.01	0.01
SOIL COND. (kcal/msK) :	0.141E-02	0.141E-02	0.141E-02
SOIL THERM DIFF(m^2/s) :	0.141E-05	0.141E-05	0.141E-05
FOR JET RELEASES ONLY --			
RELEASE TEMP. (K) :	0.0	0.0	0.0
RELEASE HT. (m) :	0.00	0.00	0.00
ORIFICE AREA (m^2) :	0.0000	0.0000	0.0000
EXIT VEL. (m/s) :	0.00	0.00	0.00
ANGLE (deg from hor.) :	0.0	0.0	0.0
*** USER DATA ***			
MODE (0=SNAP, 1=FOOT) :	1	1	1
REPORTING TIMES (s) :	30	40	40
MODEL TIME STEP (s) :	10	10	10
FOOTPRT START TIME (s) :	0	0	0
FOOTPRT STOP TIME (s) :	90	80	120
*** PRINT OPTIONS ***			
ECHO INPUTS (1=yes) :	1	1	1
SNAPSHOT CONCS (1=yes) :	1	1	1
MAX CONCS (1=yes) :	1	1	1
RECEPTOR CONCS (1=yes) :	1	1	1
HEIGHT & SIGMA (1=yes) :	1	1	1
*** CONCENTRATION LEVELS (PLOT) ***			
USER=0, DATABASE=1 :	0	0	0
USER - HIGH LEV (ppm) :	100.00	100.00	100.00
USER - MID LEV (ppm) :	100.00	100.00	100.00
USER - LOW LEV (ppm) :	100.00	100.00	100.00
*** METEOROLOGICAL DATA (5 min.) ***			
WIND SPEED (m/s) :	6.7	11.0	5.7
WIND DIR (deg) :	0.0	0.0	0.0
STAB CLASS (A=1,F=6) :	3.	3.	4.
TEMPERATURE (K) :	311.5	301.5	297.3
*** RECEPTOR DATA ***			
X-COORDINATES (m) :	0.0	0.0	0.0
Y-COORDINATES (m) :	-140.0	-140.0	-140.0
Y-COORDINATES (m) :	-200.0	-200.0	-200.0
Y-COORDINATES (m) :	-300.0	-300.0	-300.0
Y-COORDINATES (m) :	99.9	-400.0	-400.0

AIRTOX DATA FOR : Desert Tortoise
CHEMICAL RELEASED : Anhydrous Ammonia

*** SCENARIO DATA ***				
SCENARIO :	DT1	DT2	DT3	DT4
DOT NUMBER :	1005	1005	1005	1005
RELEASE(JET-1,OTHER-0) :	1	1	1	1
EMISSION RATE (kg/s) :	79.700	111.500	130.700	96.700
DURATION (s) :	126.	255.	166.	381.
% LIQUID :	81.3	81.7	91.1	80.4
% AEROSOL :	100.0	100.0	100.0	100.0
RELATIVE HUMIDITY (%) :	13.2	17.5	14.3	21.3
SURFACE ROUGHNESS (m) :	0.00300	0.00300	0.00300	0.00300
BUILDING WIDTH (m) :	0.0	0.0	0.0	0.0
BUILDING HEIGHT (m) :	0.0	0.0	0.0	0.0
FOR NON-JET RELEASES --				
DILUTION FACTOR :	0.0	0.0	0.0	0.0
STORAGE TEMP. (K) :	0.0	0.0	0.0	0.0
DIKE AREA (m^2) :	0.0	0.0	0.0	0.0
POOL DEPTH (m) :	0.00	0.00	0.00	0.00
SOIL COND. (kcal/msK) :	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SOIL THERM DIFF(m^2/s) :	0.000E+00	0.000E+00	0.000E+00	0.000E+00
FOR JET RELEASES ONLY --				
RELEASE TEMP. (K) :	237.5	237.6	237.5	237.4
RELEASE HT. (m) :	0.79	0.79	0.79	0.79
ORIFICE AREA (m^2) :	0.8445	1.1199	1.1647	1.2115
EXIT VEL. (m/s) :	22.65	23.28	27.29	20.19
ANGLE (deg from hor.) :	0.0	0.0	0.0	0.0
*** USER DATA ***				
MODE (0=SNAP, 1=FOOT) :	1	1	1	1
REPORTING TIMES (s) :	60	120	80	190
MODEL TIME STEP (s) :	10	10	10	10
FOOTPRT START TIME (s) :	0	0	0	0
FOOTPRT STOP TIME (s) :	180	240	240	380
*** PRINT OPTIONS ***				
ECHO INPUTS (1=yes) :	1	1	1	1
SNAPSHOT CONCS (1=yes) :	1	1	1	1
MAX CONCS (1=yes) :	1	1	1	1
RECEPTOR CONCS (1=yes) :	1	1	1	1
HEIGHT & SIGMA (1=yes) :	1	1	1	1
*** CONCENTRATION LEVELS (PLOT) ***				
USER=0, DATABASE=1 :	0	0	0	0
USER - HIGH LEV (ppm) :	100.00	100.00	100.00	100.00
USER - MID LEV (ppm) :	100.00	100.00	100.00	100.00
USER - LOW LEV (ppm) :	100.00	100.00	100.00	100.00
*** METEOROLOGICAL DATA (5 min.) ***				
WIND SPEED (m/s) :	9.7	7.6	9.3	6.2
WIND DIR (deg) :	0.0	0.0	0.0	0.0
STAB CLASS (A=1,F=6) :	4.	4.	4.	5.
TEMPERATURE (K) :	302.0	303.6	307.1	305.6
*** RECEPTOR DATA ***				
X-COORDINATE (m) :	0.0	0.0	0.0	0.0
Y-COORDINATES (m) :	-100.0	-100.0	-100.0	-100.0
Y-COORDINATES (m) :	-800.0	-800.0	-800.0	-800.0

AIRTOX DATA FOR : Goldfish
CHEMICAL RELEASED : Hydrogen fluoride

*** SCENARIO DATA ***			
SCENARIO :	GF1	GF2	GF3
DOT NUMBER :	1052	1052	1052
RELEASE(JET=1,OTHER=0) :	1	1	1
EMISSION RATE (kg/s) :	27.570	10.460	10.270
DURATION (s) :	125.	360.	360.
% LIQUID :	84.0	85.0	84.7
% AEROSOL :	100.0	100.0	100.0
RELATIVE HUMIDITY (%) :	4.9	10.7	17.7
SURFACE ROUGHNESS (m) :	0.00300	0.00300	0.00300
BUILDING WIDTH (m) :	0.0	0.0	0.0
BUILDING HEIGHT (m) :	0.0	0.0	0.0
FOR NON-JET RELEASES --			
DILUTION FACTOR :	0.0	0.0	0.0
STORAGE TEMP. (K) :	0.0	0.0	0.0
DIKE AREA (m^2) :	0.0	0.0	0.0
POOL DEPTH (m) :	0.00	0.00	0.00
SOIL COND. (kcal/msK) :	0.000E+00	0.000E+00	0.000E+00
SOIL THERM DIFF(m^2/s) :	0.000E+00	0.000E+00	0.000E+00
FOR JET RELEASES ONLY --			
RELEASE TEMP. (K) :	289.6	289.5	289.5
RELEASE HT. (m) :	1.00	1.00	1.00
ORIFICE AREA (m^2) :	0.2906	0.0896	0.0926
EXIT VEL. (m/s) :	20.33	23.04	22.62
ANGLE (deg from hor.) :	0.0	0.0	0.0
*** USER DATA ***			
MODE (0=SNAP, 1=FOOT) :	1	1	1
REPORTING TIMES (s) :	60	180	180
MODEL TIME STEP (s) :	10	10	10
FOOTPRT START TIME (s) :	0	0	0
FOOTPRT STOP TIME (s) :	480	540	720
*** PRINT OPTIONS ***			
ECHO INPUTS (1=yes) :	1	1	1
SNAPSHOT CONCS (1=yes) :	1	1	1
MAX CONCS (1=yes) :	1	1	1
RECEPTOR CONCS (1=yes) :	1	1	1
HEIGHT & SIGMA (1=yes) :	1	1	1
*** CONCENTRATION LEVELS (PLOT) ***			
USER=0, DATABASE=1 :	0	0	0
USER - HIGH LEV (ppm) :	30.00	30.00	30.00
USER - MID LEV (ppm) :	30.00	30.00	30.00
USER - LOW LEV (ppm) :	30.00	30.00	30.00
*** METEOROLOGICAL DATA (5 min.) ***			
WIND SPEED (m/s) :	7.3	5.4	7.5
WIND DIR (deg) :	0.0	0.0	0.0
STAB CLASS (A=1,F=6) :	4.	4.	4.
TEMPERATURE (K) :	310.4	309.4	307.6
*** RECEPTOR DATA ***			
X-COORDINATE (m) :	0.0	0.0	0.0
Y-COORDINATES (m) :	-300.0	-300.0	-300.0
Y-COORDINATES (m) :	-1000.0	-1000.0	-1000.0
Y-COORDINATES (m) :	-3000.0	99.9	-3000.0

AIRTOX DATA FOR : Hanford (continuous)
CHEMICAL RELEASED : Krypton-85

*** SCENARIO DATA ***					
SCENARIO :	HC1	HC2	HC3	HC4	HC5
DOT NUMBER :	9999	9999	9999	9999	9999
(9999=N2 with m.w.=29.0)					
RELEASE(JET=1,OTHER=0) :	0	0	0	0	0
EMISSION RATE (kg/s) :	0.012	0.012	0.028	0.039	0.017
DURATION (s) :	928.	905.	855.	598.	1191.
% LIQUID :	0.0	0.0	0.0	0.0	0.0
% AEROSOL :	0.0	0.0	0.0	0.0	0.0
RELATIVE HUMIDITY (%) :	20.0	20.0	20.0	20.0	20.0
SURFACE ROUGHNESS (m) :	0.03000	0.03000	0.03000	0.03000	0.03000
BUILDING WIDTH (m) :	0.0	0.0	0.0	0.0	0.0
BUILDING HEIGHT (m) :	0.0	0.0	0.0	0.0	0.0
FOR NON-JET RELEASES --					
DILUTION FACTOR :	0.0	0.0	0.0	0.0	0.0
STORAGE TEMP. (K) :	290.9	285.4	288.9	286.6	278.3
DIKE AREA (m^2) :	0.0	0.0	0.0	0.0	0.0
POOL DEPTH (m) :	0.01	0.01	0.01	0.01	0.01
SOIL COND. (kcal/msK) :	0.564E-04	0.564E-04	0.564E-04	0.564E-04	0.564E-04
SOIL THERM DIFF(m^2/s) :	0.244E-06	0.244E-06	0.244E-06	0.244E-06	0.244E-06
FOR JET RELEASES ONLY --					
RELEASE TEMP. (K) :	0.0	0.0	0.0	0.0	0.0
RELEASE HT. (m) :	0.00	0.00	0.00	0.00	0.00
ORIFICE AREA (m^2) :	0.0000	0.0000	0.0000	0.0000	0.0000
EXIT VEL. (m/s) :	0.00	0.00	0.00	0.00	0.00
ANGLE (deg from hor.) :	0.0	0.0	0.0	0.0	0.0
*** USER DATA ***					
MODE (0=SNAP, 1=FOOT) :	1	1	1	1	1
REPORTING TIMES (s) :	460	450	420	290	590
MODEL TIME STEP (s) :	10	10	10	10	10
FOOTPRT START TIME (s) :	0	0	0	0	0
FOOTPRT STOP TIME (s) :	920	900	840	580	1180
*** PRINT OPTIONS ***					
ECHO INPUTS (1=yes) :	1	1	1	1	1
SNAPSHOT CONCS (1=yes) :	1	1	1	1	1
MAX CONCS (1=yes) :	1	1	1	1	1
RECEPTOR CONCS (1=yes) :	1	1	1	1	1
HEIGHT & SIGMA (1=yes) :	1	1	1	1	1
*** CONCENTRATION LEVELS (PLOT) ***					
USER=0, DATABASE=1 :	0	0	0	0	0
USER - HIGH LEV (ppm) :	0.10	0.10	0.10	0.10	0.10
USER - MID LEV (ppm) :	0.10	0.10	0.10	0.10	0.10
USER - LOW LEV (ppm) :	0.10	0.10	0.10	0.10	0.10
*** METEOROLOGICAL DATA (5 min.) ***					
WIND SPEED (m/s) :	3.4	5.6	10.3	5.4	4.2
WIND DIR (deg) :	0.0	0.0	0.0	0.0	0.0
STAB CLASS (A=1,F=6) :	6.	3.	3.	3.	5.
TEMPERATURE (K) :	290.9	285.4	288.9	286.6	278.3
*** RECEPTOR DATA ***					
X-COORDINATE (m) :	0.0	0.0	0.0	0.0	0.0
Y-COORDINATES (m) :	-200.0	-200.0	-200.0	-200.0	-200.0
Y-COORDINATES (m) :	-800.0	-800.0	-800.0	-800.0	-800.0

AIRTOX DATA FOR : Hanford (Instantaneous)
CHEMICAL RELEASED : Krypton-85

*** SCENARIO DATA ***						
SCENARIO :	HI2	HI3	HI5	HI6	HI7	HI8
DOT NUMBER :	9999	9999	9999	9999	9999	9999
9999=N2 with m.w.=29.0)						
RELEASE(JET=1,OTHER=0) :	0	0	0	0	0	0
EMISSION RATE (kg/s) :	1.000	1.000	1.000	1.000	1.000	1.000
DURATION (s) :	10.	10.	10.	10.	10.	10.
% LIQUID :	0.0	0.0	0.0	0.0	0.0	0.0
% AEROSOL :	0.0	0.0	0.0	0.0	0.0	0.0
RELATIVE HUMIDITY (%) :	20.0	20.0	20.0	20.0	20.0	20.0
SURFACE ROUGHNESS (m) :	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000
BUILDING WIDTH (m) :	0.0	0.0	0.0	0.0	0.0	0.0
BUILDING HEIGHT (m) :	0.0	0.0	0.0	0.0	0.0	0.0
FOR NON-JET RELEASES --						
DILUTION FACTOR :	0.0	0.0	0.0	0.0	0.0	0.0
STORAGE TEMP. (K) :	291.5	285.1	288.7	288.3	285.6	277.3
DIKE AREA (m^2) :	0.0	0.0	0.0	0.0	0.0	0.0
POOL DEPTH (m) :	0.01	0.01	0.01	0.01	0.01	0.01
SOIL COND. (kcal/msK) :	0.564E-04	0.564E-04	0.564E-04	0.564E-04	0.564E-04	0.564E-04
SOIL THERM DIFF(m^2/s) :	0.244E-06	0.244E-06	0.244E-06	0.244E-06	0.244E-06	0.244E-06
FOR JET RELEASES ONLY --						
RELEASE TEMP. (K) :	0.0	0.0	0.0	0.0	0.0	0.0
RELEASE HT. (m) :	0.00	0.00	0.00	0.00	0.00	0.00
ORIFICE AREA (m^2) :	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
EXIT VEL. (m/s) :	0.00	0.00	0.00	0.00	0.00	0.00
ANGLE (deg from hor.) :	0.0	0.0	0.0	0.0	0.0	0.0
*** USER DATA ***						
MODE (0=SNAP, 1=FOOT) :	1	1	1	1	1	1
REPORTING TIMES (s) :	20	10	10	10	10	30
MODEL TIME STEP (s) :	10	10	10	10	10	10
FOOTPRT START TIME (s) :	0	0	0	0	0	0
FOOTPRT STOP TIME (s) :	520	300	180	180	280	560
*** PRINT OPTIONS ***						
ECHO INPUTS (1=yes) :	1	1	1	1	1	1
SNAPSHOT CONCS (1=yes) :	1	1	1	1	1	1
MAX CONCS (1=yes) :	1	1	1	1	1	1
RECEPTOR CONCS (1=yes) :	1	1	1	1	1	1
HEIGHT & SIGMA (1=yes) :	1	1	1	1	1	1
*** CONCENTRATION LEVELS (PLOT) ***						
USER=0, DATABASE=1 :	0	0	0	0	0	0
USER - HIGH LEV (ppm) :	0.10	0.10	0.10	0.10	0.10	0.10
USER - MID LEV (ppm) :	0.10	0.10	0.10	0.10	0.10	0.10
USER - LOW LEV (ppm) :	0.10	0.10	0.10	0.10	0.10	0.10
*** METEOROLOGICAL DATA (5 min.) ***						
WIND SPEED (m/s) :	3.6	6.0	11.1	10.4	6.4	2.9
WIND DIR (deg) :	0.0	0.0	0.0	0.0	0.0	0.0
STAB CLASS (A=1,F=6) :	6.	4.	3.	3.	3.	5.
TEMPERATURE (K) :	291.5	285.1	288.7	288.3	285.6	277.3
*** RECEPTOR DATA ***						
X-COORDINATE (m) :	0.0	0.0	0.0	0.0	0.0	0.0
Y-COORDINATES (m) :	-200.0	-200.0	-200.0	-200.0	-200.0	-200.0
Y-COORDINATES (m) :	-800.0	-800.0	-800.0	-800.0	-800.0	-800.0

AIRTOX DATA FOR : Maplin Sands
CHEMICAL RELEASED : Liquified Natural Gas

*** SCENARIO DATA ***					
SCENARIO	:	MS27	MS29	MS34	MS35
DOT NUMBER	:	1971	1971	1971	1971
RELEASE(JET=1,OTHER=0)	:	0	0	0	0
EMISSION RATE (kg/s)	:	23.210	29.160	21.510	27.090
DURATION (s)	:	160.	225.	95.	135.
% LIQUID	:	100.0	100.0	100.0	100.0
% AEROSOL	:	0.0	0.0	0.0	0.0
RELATIVE HUMIDITY (%)	:	53.0	71.0	90.0	77.0
SURFACE ROUGHNESS (m)	:	0.00030	0.00030	0.00030	0.00030
BUILDING WIDTH (m)	:	0.0	0.0	0.0	0.0
BUILDING HEIGHT (m)	:	0.0	0.0	0.0	0.0
FOR NON-JET RELEASES --					
DILUTION FACTOR	:	0.0	0.0	0.0	0.0
STORAGE TEMP. (K)	:	111.7	111.7	111.7	111.7
DIKE AREA (m^2)	:	0.0	0.0	0.0	0.0
POOL DEPTH (m)	:	0.01	0.01	0.01	0.01
SOIL COND. (kcal/msK)	:	0.141E-02	0.141E-02	0.141E-02	0.141E-02
SOIL THERM DIFF(m^2/s)	:	0.141E-05	0.141E-05	0.141E-05	0.141E-05
FOR JET RELEASES ONLY --					
RELEASE TEMP. (K)	:	0.0	0.0	0.0	0.0
RELEASE HT. (m)	:	0.00	0.00	0.00	0.00
ORIFICE AREA (m^2)	:	0.0000	0.0000	0.0000	0.0000
EXIT VEL. (m/s)	:	0.00	0.00	0.00	0.00
ANGLE (deg from hor.)	:	0.0	0.0	0.0	0.0
*** USER DATA ***					
MODE (0=SNAP, 1=FOOT)	:	1	1	1	1
REPORTING TIMES (s)	:	80	110	40	60
MODEL TIME STEP (s)	:	10	10	10	10
FOOTPRT START TIME (s)	:	0	0	0	0
FOOTPRT STOP TIME (s)	:	240	220	80	120
*** PRINT OPTIONS ***					
ECHO INPUTS (1=yes)	:	1	1	1	1
SNAPSHOT CONCS (1=yes)	:	1	1	1	1
MAX CONCS (1=yes)	:	1	1	1	1
RECEPTOR CONCS (1=yes)	:	1	1	1	1
HEIGHT & SIGMA (1=yes)	:	1	1	1	1
*** CONCENTRATION LEVELS (PLOT) ***					
USER=0, DATABASE=1	:	0	0	0	0
USER - HIGH LEV (ppm)	:	100.00	100.00	100.00	100.00
USER - MID LEV (ppm)	:	100.00	100.00	100.00	100.00
USER - LOW LEV (ppm)	:	100.00	100.00	100.00	100.00
*** METEOROLOGICAL DATA (5 min.) ***					
WIND SPEED (m/s)	:	5.6	7.4	8.5	9.6
WIND DIR (deg)	:	0.0	0.0	0.0	0.0
STAB CLASS (A=1,F=6)	:	4.	4.	4.	4.
TEMPERATURE (K)	:	288.1	289.3	288.4	289.3
*** RECEPTOR DATA ***					
X-COORDINATE (m)	:	0.0	0.0	0.0	0.0
Y-COORDINATES (m)	:	-89.0	-58.0	-87.0	-129.0
Y-COORDINATES (m)	:	-131.0	-90.0	-179.0	-250.0
Y-COORDINATES (m)	:	-324.0	-130.0	99.9	-406.0
Y-COORDINATES (m)	:	-400.0	-182.0	99.9	99.9
Y-COORDINATES (m)	:	-650.0	-252.0	99.9	99.9
Y-COORDINATES (m)	:	99.9	-324.0	99.9	99.9
Y-COORDINATES (m)	:	99.9	-403.0	99.9	99.9

AIRTOX DATA FOR : Maplin Sands
CHEMICAL RELEASED : Liquified Propane Gas

*** SCENARIO DATA ***

SCENARIO	:	MS42	MS43	MS46	MS47	MS49	MS50	MS52	MS54
DOT NUMBER	:	1978	1978	1978	1978	1978	1978	1978	1978
RELEASE(JET=1,OTHER=0)	:	0	0	0	0	0	0	0	0
EMISSION RATE (kg/s)	:	20.370	19.200	23.370	32.570	16.710	35.590	44.250	10.200
DURATION (s)	:	180.	330.	360.	210.	90.	150.	140.	180.
% LIQUID	:	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
% AEROSOL	:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RELATIVE HUMIDITY (%)	:	90.0	80.0	71.0	78.0	38.0	79.0	63.0	35.0
SURFACE ROUGHNESS (m)	:	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
BUILDING WIDTH (m)	:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BUILDING HEIGHT (m)	:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FOR NON-JET RELEASES --									
DILUTION FACTOR	:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STORAGE TEMP. (K)	:	231.1	231.1	231.1	231.1	231.1	231.1	231.1	231.1
DIKE AREA (m^2)	:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POOL DEPTH (m)	:	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
SOIL COND. (kcal/msK)	:	0.141E-02	0.141E-02	0.141E-02	0.141E-02	0.141E-02	0.141E-02	0.141E-02	0.141E-02
SOIL THERM DIFF(m^2/s)	:	0.141E-05	0.141E-05	0.141E-05	0.141E-05	0.141E-05	0.141E-05	0.141E-05	0.141E-05
FOR JET RELEASES ONLY --									
RELEASE TEMP. (K)	:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RELEASE HT. (m)	:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ORIFICE AREA (m^2)	:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
EXIT VEL. (m/s)	:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANGLE (deg from hor.)	:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*** USER DATA ***

MODE (0=SNAP, 1=FOOT)	:	1	1	1	1	1	1	1	1
REPORTING TIMES (s)	:	90	160	180	100	40	80	70	90
MODEL TIME STEP (s)	:	10	10	10	10	10	10	10	10
FOOTPRT START TIME (s)	:	0	0	0	0	0	0	0	0
FOOTPRT STOP TIME (s)	:	270	320	360	200	120	160	210	180

*** PRINT OPTIONS ***

ECHO INPUTS (1=yes)	:	1	1	1	1	1	1	1	1
SNAPSHOT CONCS (1=yes)	:	1	1	1	1	1	1	1	1
MAX CONCS (1=yes)	:	1	1	1	1	1	1	1	1
RECEPTOR CONCS (1=yes)	:	1	1	1	1	1	1	1	1
HEIGHT & SIGMA (1=yes)	:	1	1	1	1	1	1	1	1

*** CONCENTRATION LEVELS (PLOT) ***

USER=0, DATABASE=1	:	0	0	0	0	0	0	0	0
USER - HIGH LEV (ppm)	:	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
USER - MID LEV (ppm)	:	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
USER - LOW LEV (ppm)	:	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

*** METEOROLOGICAL DATA (5 min.) ***

WIND SPEED (m/s)	:	4.0	5.8	8.1	6.2	5.5	7.9	7.4	3.7
WIND DIR (deg)	:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STAB CLASS (A=1,F=6)	:	4.	4.	4.	4.	4.	4.	4.	4.
TEMPERATURE (K)	:	291.5	290.2	291.9	290.6	286.5	283.6	285.0	281.6

*** RECEPTOR DATA ***

X-COORDINATE (m)	:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y-COORDINATES (m)	:	-28.0	-88.0	-34.0	-90.0	-90.0	-59.0	-61.0	-56.0
Y-COORDINATES (m)	:	-53.0	-129.0	-91.0	-128.0	-129.0	-93.0	-95.0	-65.0
Y-COORDINATES (m)	:	-83.0	-249.0	-130.0	-182.0	-150.0	-182.0	-178.0	-178.0
Y-COORDINATES (m)	:	-123.0	-400.0	-182.0	-250.0	-250.0	-400.0	-249.0	-247.0
Y-COORDINATES (m)	:	-179.0	99.9	-250.0	-321.0	-322.0	99.9	-398.0	99.9
Y-COORDINATES (m)	:	-247.0	99.9	-322.0	-400.0	-400.0	99.9	-650.0	99.9
Y-COORDINATES (m)	:	-398.0	99.9	-401.0	99.9	99.9	99.9	99.9	99.9

AIRTOX DATA FOR : Prairie Grass, sec .
CHEMICAL RELEASED : Sulfur dioxide

SCENARIO	PG7	PG8	PG9	PG10	PG13	PG15	PG16	PG17
*** SCENARIO DATA ***								
DOT NUMBER	1079	1079	1079	1079	1079	1079	1079	1079
RELEASE(JET=1,OTHER=0)	1	1	1	1	1	1	1	1
EMISSION RATE (kg/s)	0.090	0.091	0.092	0.092	0.061	0.095	0.093	0.056
DURATION (s)	600.	600.	600.	600.	600.	600.	600.	600.
% LIQUID	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% AEROSOL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RELATIVE HUMIDITY (%)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
SURFACE ROUGHNESS (m)	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600
BUILDING WIDTH (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BUILDING HEIGHT (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FOR NON-JET RELEASES --								
DILUTION FACTOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STORAGE TEMP. (K)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DIKE AREA (m^2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POOL DEPTH (m)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOIL COND. (kcal/msK)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SOIL THERM DIFF(m^2/s)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
FOR JET RELEASES ONLY --								
RELEASE TEMP. (K)	305.1	305.1	301.1	304.1	293.1	295.1	301.1	300.1
RELEASE HT. (m)	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
ORIFICE AREA (m^2)	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020
EXIT VEL. (m/s)	17.34	17.57	17.51	17.71	11.32	17.32	17.70	10.72
ANGLE (deg from hor.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
*** USER DATA ***								
MODE (0=SNAP, 1=FOOT)	1	1	1	1	1	1	1	1
REPORTING TIMES (s)	300	300	300	300	300	300	300	300
MODEL TIME STEP (s)	10	10	10	10	10	10	10	10
FOOTPRT START TIME (s)	0	0	0	0	0	0	0	0
FOOTPRT STOP TIME (s)	600	600	600	600	600	600	600	600
*** PRINT OPTIONS ***								
ECHO INPUTS (1=yes)	1	1	1	1	1	1	1	1
SNAPSHOT CONCS (1=yes)	1	1	1	1	1	1	1	1
MAX CONCS (1=yes)	1	1	1	1	1	1	1	1
RECEPTOR CONCS (1=yes)	1	1	1	1	1	1	1	1
HEIGHT & SIGMA (1=yes)	1	1	1	1	1	1	1	1
*** CONCENTRATION LEVELS (PLOT) ***								
USER=0, DATABASE=1	0	0	0	0	0	0	0	0
USER - HIGH LEV (ppm)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USER - MID LEV (ppm)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USER - LOW LEV (ppm)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
*** METEOROLOGICAL DATA (5 min.) ***								
WIND SPEED (m/s)	4.9	5.9	8.4	5.4	2.7	4.0	3.7	4.6
WIND DIR (deg)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STAB CLASS (A=1,F=6)	2.	3.	3.	2.	6.	1.	1.	4.
TEMPERATURE (K)	305.1	305.1	301.1	304.1	293.1	295.1	301.1	300.1
*** RECEPTOR DATA ***								
X-COORDINATE (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y-COORDINATES (m)	-50.0	-50.0	-50.0	-50.0	-400.0	-50.0	-50.0	-50.0
Y-COORDINATES (m)	-100.0	-100.0	-100.0	-100.0	-800.0	-100.0	-100.0	-100.0
Y-COORDINATES (m)	-200.0	-200.0	-200.0	-200.0	99.9	-200.0	-200.0	-200.0
Y-COORDINATES (m)	-400.0	-400.0	-400.0	-400.0	99.9	-400.0	-400.0	-400.0
Y-COORDINATES (m)	-800.0	-800.0	-800.0	-800.0	99.9	-800.0	-800.0	-800.0

AIRTOX DATA FOR : Thorney Island (continuous)
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen

*** SCENARIO DATA ***			
SCENARIO	:	TC45	TC47
DOT NUMBER	:	9913	9913
RELEASE(JET=1,OTHER=0)	:	0	0
EMISSION RATE (kg/s)	:	10.570	10.220
DURATION (s)	:	455.	465.
% LIQUID	:	0.0	0.0
% AEROSOL	:	0.0	0.0
RELATIVE HUMIDITY (%)	:	100.0	97.4
SURFACE ROUGHNESS (m)	:	0.01000	0.01000
BUILDING WIDTH (m)	:	0.0	0.0
BUILDING HEIGHT (m)	:	0.0	0.0
FOR NON-JET RELEASES --			
DILUTION FACTOR	:	0.0	0.0
STORAGE TEMP. (K)	:	286.3	287.5
DIKE AREA (m^2)	:	0.0	0.0
POOL DEPTH (m)	:	0.01	0.01
SOIL COND. (kcal/msK)	:	0.564E-04	0.564E-04
SOIL THERM DIFF(m^2/s)	:	0.244E-06	0.244E-06
FOR JET RELEASES ONLY --			
RELEASE TEMP. (K)	:	0.0	0.0
RELEASE HT. (m)	:	0.00	0.00
ORIFICE AREA (m^2)	:	0.0000	0.0000
EXIT VEL. (m/s)	:	0.00	0.00
ANGLE (deg from hor.)	:	0.0	0.0
*** USER DATA ***			
MODE (0=SNAP, 1=FOOT)	:	1	1
REPORTING TIMES (s)	:	220	230
MODEL TIME STEP (s)	:	10	10
FOOTPRT START TIME (s)	:	0	0
FOOTPRT STOP TIME (s)	:	440	690
*** PRINT OPTIONS ***			
ECHO INPUTS (1=yes)	:	1	1
SNAPSHOT CONCS (1=yes)	:	1	1
MAX CONCS (1=yes)	:	1	1
RECEPTOR CONCS (1=yes)	:	1	1
HEIGHT & SIGMA (1=yes)	:	1	1
*** CONCENTRATION LEVELS (PLOT) ***			
USER=0, DATABASE=1	:	0	0
USER - HIGH LEV (ppm)	:	100.00	100.00
USER - MID LEV (ppm)	:	100.00	100.00
USER - LOW LEV (ppm)	:	100.00	100.00
*** METEOROLOGICAL DATA (5 min.) ***			
WIND SPEED (m/s)	:	2.3	1.5
WIND DIR (deg)	:	0.0	0.0
STAB CLASS (A=1,F=6)	:	5.	6.
TEMPERATURE (K)	:	286.3	287.5
*** RECEPTOR DATA ***			
X-COORDINATE (m)	:	0.0	0.0
Y-COORDINATES (m)	:	-40.0	-50.0
Y-COORDINATES (m)	:	-53.0	-90.0
Y-COORDINATES (m)	:	-72.0	-212.0
Y-COORDINATES (m)	:	-90.0	-250.0
Y-COORDINATES (m)	:	-112.0	-335.0
Y-COORDINATES (m)	:	-158.0	-472.0
Y-COORDINATES (m)	:	-250.0	99.9
Y-COORDINATES (m)	:	-335.0	99.9
Y-COORDINATES (m)	:	-472.0	99.9

AIRTOX DATA FOR : Thorney Island (Instantaneous)
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen

*** SCENARIO DATA ***

SCENARIO :	TI6	TI7	TI8	TI9	TI12	TI13	TI17	TI18	TI19
DOT NUMBER :	9906	9907	9908	9909	3912	3913	3917	3918	3919
RELEASE(JET=1,OTHER=0) :	0	0	0	0	0	0	0	0	0
EMISSION RATE (kg/s) :	314.700	424.900	395.300	386.600	573.600	480.000	371.100	338.100	547.700
DURATION (s) :	10.	10.	10.	10.	10.	10.	10.	10.	10.
% LIQUID :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% AEROSOL :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RELATIVE HUMIDITY (%) :	74.3	30.7	37.5	37.3	56.2	74.1	34.0	31.3	94.8
SURFACE ROUGHNESS (m) :	0.01800	0.01800	0.01200	0.00800	0.01800	0.01000	0.01800	0.00500	0.01000
BUILDING WIDTH (m) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BUILDING HEIGHT (m) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FOR NON-JET RELEASES --									
DILUTION FACTOR :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STORAGE TEMP. (K) :	291.8	290.5	290.7	291.5	283.3	286.9	289.2	289.7	286.5
DIKE AREA (m^2) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POOL DEPTH (m) :	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
SOIL COND. (kcal/msK) :	0.564E-04	0.564E-04	0.564E-04	0.564E-04	0.564E-04	0.564E-04	0.564E-04	0.564E-04	0.564E-04
SOIL THERM DIFF(m^2/s) :	0.244E-06	0.244E-06	0.244E-06	0.244E-06	0.244E-06	0.244E-06	0.244E-06	0.244E-06	0.244E-06
FOR JET RELEASES ONLY --									
RELEASE TEMP. (K) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RELEASE HT. (m) :	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ORIFICE AREA (m^2) :	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
EXIT VEL. (m/s) :	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANGLE (deg from hor.) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*** USER DATA ***

MODE (0=SNAP, 1=FOOT) :	1	1	1	1	1	1	1	1	1
REPORTING TIMES (s) :	10	10	10	20	10	10	10	10	10
MODEL TIME STEP (s) :	10	10	10	10	10	10	10	10	10
FOOTPRT START TIME (s) :	0	0	0	0	0	0	0	0	0
FOOTPRT STOP TIME (s) :	340	320	460	640	440	140	240	160	220

*** PRINT OPTIONS ***

ECHO INPUTS (1=yes) :	1	1	1	1	1	1	1	1	1
SNAPSHOT CONCS (1=yes) :	1	1	1	1	1	1	1	1	1
MAX CONCS (1=yes) :	1	1	1	1	1	1	1	1	1
RECEPTOR CONCS (1=yes) :	1	1	1	1	1	1	1	1	1
HEIGHT & SIGMA (1=yes) :	1	1	1	1	1	1	1	1	1

*** CONCENTRATION LEVELS (PLOT) ***

USER=0, DATABASE=1 :	0	0	0	0	0	0	0	0	0
USER - HIGH LEV (ppm) :	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
USER - MID LEV (ppm) :	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
USER - LOW LEV (ppm) :	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

*** METEOROLOGICAL DATA (5 min.) ***

WIND SPEED (m/s) :	2.8	3.4	2.4	1.7	2.5	7.3	5.0	7.4	6.4
WIND DIR (deg) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STAB CLASS (A=1,F=6) :	4.	5.	4.	6.	5.	4.	4.	4.	4.
TEMPERATURE (K) :	291.3	290.5	290.7	291.5	283.3	286.3	289.2	289.7	286.5

*** RECEPTOR DATA ***

X-COORDINATE (m) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y-COORDINATES (m) :	-71.0	-71.0	-71.0	-71.0	-71.0	-71.0	-40.0	-40.0	-40.0
Y-COORDINATES (m) :	-141.0	-100.0	-100.0	-100.0	-150.0	-100.0	-50.0	-60.0	-60.0
Y-COORDINATES (m) :	-180.0	-150.0	-150.0	-141.0	-200.0	-224.0	-71.0	-70.0	-71.0
Y-COORDINATES (m) :	-283.0	-180.0	-200.0	-180.0	-361.0	-316.0	-100.0	-80.0	-100.0
Y-COORDINATES (m) :	-424.0	-224.0	-364.0	-224.0	-500.0	-361.0	-141.0	-100.0	-224.0
Y-COORDINATES (m) :	99.9	-361.0	-412.0	-316.0	99.9	-412.0	-224.0	-200.0	-361.0
Y-COORDINATES (m) :	99.9	-500.0	-510.0	-503.0	99.9	99.9	-500.0	-224.0	-583.0
Y-COORDINATES (m) :	99.9	99.9	99.9	99.9	99.9	99.9	99.9	-300.0	99.9
Y-COORDINATES (m) :	99.9	99.9	99.9	99.9	99.9	99.9	99.9	-400.0	99.9
Y-COORDINATES (m) :	99.9	99.9	99.9	99.9	99.9	99.9	99.9	-510.0	99.9

B&M INPUT DATA FOR : Burro
CHEMICAL RELEASED : Liquefied natural gas

TRIAL	BU2	BU3	BU4	BU5	BU6	BU7	BU8	BU9
INITIAL CONC(ppp)	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
DENSE ENOUGH? (inst)	Y	Y	Y	Y	Y	Y	Y	Y
DENSE ENOUGH? (cnst)	Y	Y	Y	Y	Y	Y	Y	Y
MIN DIST INST (m)	1735.	1651.	2996.	2660.	2236.	2822.	458.	381.
COR. PARAM. (inst)	1.34	1.31	1.10	1.38	1.07	1.26	4.49	1.77
1/Di (1/m)	0.491E-01	0.493E-01	0.485E-01	0.482E-01	0.527E-01	0.475E-01	0.529E-01	0.562E-01
MAX DIST CNST (m)	416.	396.	719.	538.	537.	677.	110.	211.
COR. PARAM. (cnst)	0.77	0.77	0.44	0.54	0.45	0.50	1.35	0.30
1/Dc (1/m)	0.352	0.345	0.453	0.423	0.443	0.425	0.201	0.306

B&M INPUT DATA FOR : Coyote .
CHEMICAL RELEASED : Liquefied natural gas . Methane is at least 86% in c

TRIAL	CO3	CO5	CO6
INITIAL CONC(ppp)	1.000000	1.000000	1.000000
DENSE ENOUGH? (inst)	Y	Y	Y
DENSE ENOUGH? (cnst)	Y	Y	Y
MIN DIST INST (m)	723.	1794.	784.
COR. PARAM. (inst)	1.70	1.15	1.38
1/Di (1/m)	0.671E-01	0.544E-01	0.576E-01
MAX DIST CNST (m)	174.	431.	198.
COR. PARAM. (cnst)	0.78	0.50	0.89
1/Dc (1/m)	0.362	0.417	0.301

B&M INPUT DATA FOR : Desert Tortoise
CHEMICAL RELEASED : Anhydrous Ammonia

TRIAL	DT1	DT2	DT3	DT4
INITIAL CONC(ppp)	0.089979	0.091419	0.096518	0.095455
DENSE ENOUGH? (inst)	Y	Y	Y	Y
DENSE ENOUGH? (cnst)	Y	Y	Y	Y
MIN DIST INST (m)	2033.	3241.	2568.	3952.
COR. PARAM. (inst)	1.11	1.69	1.35	2.18
1/Di (1/m)	0.192E-01	0.136E-01	0.152E-01	0.126E-01
MAX DIST CNST (m)	488.	778.	616.	949.
COR. PARAM. (cnst)	0.58	0.79	0.68	0.94
1/Dc (1/m)	0.926E-01	0.701E-01	0.732E-01	0.692E-01

B&M INPUT DATA FOR : Goldfish .
CHEMICAL RELEASED : Hydrogen fluoride .

TRIAL	GF1	GF2	GF3
INITIAL CONC(ppp)	0.088112	0.083367	0.076311
DENSE ENOUGH? (inst)	Y	Y	Y
DENSE ENOUGH? (cnst)	Y	Y	Y
MIN DIST INST (m)	1521.	3227.	4482.
COR. PARAM. (inst)	0.54	0.74	0.51
1/Di (1/m)	0.268E-01	0.255E-01	0.250E-01
MAX DIST CNST (m)	365.	774.	1076.
COR. PARAM. (cnst)	0.32	0.36	0.25
1/Dc (1/m)	0.132	0.179	0.204

B&M INPUT DATA FOR : Hanford (continuous)
CHEMICAL RELEASED : Krypton-85

TRIAL	HC1	HC2	HC3	HC4	HC5
INITIAL CONC(ppp)	1.000000	1.000000	1.000000	1.000000	1.000000
DENSE ENOUGH? (inst)	N	N	N	N	N
DENSE ENOUGH? (cnst)	N	N	N	N	N
MIN DIST INST (m)	5259.	3452.	14691.	5346.	3374.
COR. PARAM. (inst)	0.07	0.04	0.02	0.05	0.05
1/Di (1/m)	0.481	0.484	0.372	0.378	0.396
MAX DIST CNST (m)	1262.	2029.	3526.	1283.	2010.
COR. PARAM. (cnst)	0.03	0.02	0.01	0.02	0.02
1/Dc (1/m)	18.8	24.1	21.3	13.1	17.7

B&M INPUT DATA FOR : Hanford (instantaneous)
CHEMICAL RELEASED : Krypton-85

TRIAL	HI2	HI3	HI5	HI6	HI7	HI8
INITIAL CONC(ppp)	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
DENSE ENOUGH? (inst)	N	N	N	N	N	N
DENSE ENOUGH? (cnst)	N	N	N	N	N	N
MIN DIST INST (m)	0.	0.	0.	0.	0.	0.
COR. PARAM. (inst)	0.06	0.03	0.02	0.02	0.03	0.06
1/Di (1/m)	0.495	0.499	0.497	0.497	0.498	0.503
MAX DIST CNST (m)	0.	0.	0.	0.	0.	0.
COR. PARAM. (cnst)	0.00	0.00	0.00	0.00	0.00	0.00
1/Dc (1/m)	0.100E+05	0.100E+05	0.100E+05	0.100E+05	0.100E+05	0.100E+05

B&M INPUT DATA FOR : Maplin Sands
CHEMICAL RELEASED : Liquified Natural Gas

TRIAL	MS27	MS29	MS34	MS35
INITIAL CONC(ppp)	1.000000	1.000000	1.000000	1.000000
DENSE ENOUGH? (inst)	Y	Y	Y	Y
DENSE ENOUGH? (cnst)	Y	Y	Y	Y
MIN DIST INST (m)	1493.	2775.	1346.	2160.
COR. PARAM. (inst)	1.44	1.13	0.83	0.80
1/Di (1/m)	0.795E-01	0.647E-01	0.962E-01	0.788E-01
MAX DIST CNST (m)	358.	666.	323.	518.
COR. PARAM. (cnst)	0.57	0.43	0.36	0.33
1/Dc (1/m)	0.671	0.671	0.848	0.796

B&M INPUT DATA FOR : Maplin Sands
CHEMICAL RELEASED : Liquified Propane Gas

TRIAL	MS42	MS43	MS46	MS47	MS49	MS50	MS52	MS54
INITIAL CONC(ppp)	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
DENSE ENOUGH? (inst)	Y	Y	Y	Y	Y	Y	Y	Y
DENSE ENOUGH? (cnst)	Y	Y	Y	Y	Y	Y	Y	Y
MIN DIST INST (m)	1200.	3190.	4860.	2170.	825.	2107.	1727.	1110.
COR. PARAM. (inst)	2.58	1.93	1.46	1.33	1.57	1.36	1.47	2.64
1/Di (1/m)	0.851E-01	0.715E-01	0.651E-01	0.697E-01	0.115	0.739E-01	0.720E-01	0.875E-01
MAX DIST CNST (m)	288.	766.	1166.	521.	198.	506.	414.	266.
COR. PARAM. (cnst)	0.94	0.63	0.47	0.66	0.64	0.52	0.58	0.97
1/Dc (1/m)	0.667	0.837	0.897	0.664	0.872	0.714	0.622	0.668

B&M INPUT DATA FOR : Prairie Grass, set 1
CHEMICAL RELEASED : Sulfur dioxide

TRIAL	PG7	PG8	PG9	PG10	PG13	PG15	PG16	PG17
INITIAL CONC(ppp)	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
DENSE ENOUGH? (inst)	Y	Y	Y	Y	Y	Y	Y	Y
DENSE ENOUGH? (cnst)	Y	Y	Y	Y	Y	Y	Y	Y
MIN DIST INST (m)	4926.	5880.	8385.	5383.	2737.	3982.	3749.	4625.
COR. PARAM. (inst)	1.17	0.98	0.69	1.07	1.35	1.45	1.84	1.14
1/Di (1/m)	0.362	0.360	0.361	0.359	0.417	0.359	0.359	0.425
MAX DIST CNST (m)	1182.	1411.	2012.	1292.	657.	956.	900.	1110.
COR. PARAM. (cnst)	0.28	0.24	0.16	0.26	0.46	0.35	0.37	0.27
1/Dc (1/m)	11.8	12.8	15.4	12.2	10.9	10.5	10.2	14.6

B&M INPUT DATA FOR : Thorney Island (continuous)
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen

TRIAL	TC45	TC47
INITIAL CONC(ppp)	1.000000	1.000000
DENSE ENOUGH? (inst)	Y	Y
DENSE ENOUGH? (cnst)	Y	Y
MIN DIST INST (m)	1744.	1163.
COR. PARAM. (inst)	4.34	7.40
1/Di (1/m)	0.798E-01	0.802E-01
MAX DIST CNST (m)	419.	279.
COR. PARAM. (cnst)	1.46	2.22
1/Dc (1/m)	0.729	0.600

B&M INPUT DATA FOR : Thorney Island (instantaneous)
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen

TRIAL	TI6	TI7	TI8	TI9	TI12	TI13	TI17	TI18	TI19
INITIAL CONC(ppp)	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
DENSE ENOUGH? (inst)	Y	Y	Y	Y	Y	Y	Y	Y	Y
DENSE ENOUGH? (cnst)	N	N	N	N	N	N	N	N	N
MIN DIST INST (m)	0.	0.	0.	0.	0.	0.	0.	0.	0.
COR. PARAM. (inst)	3.09	2.84	3.69	5.09	5.18	1.52	3.38	1.37	1.86
1/Di (1/m)	0.859E-01	0.796E-01	0.796E-01	0.796E-01	0.801E-01	0.802E-01	0.836E-01	0.835E-01	0.779E-01
MAX DIST CNST (m)	0.	0.	0.	0.	0.	0.	0.	0.	0.
COR. PARAM. (cnst)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/Dc (1/m)	0.100E+05	0.100E+05	0.100E+05	0.100E+05	0.100E+05	0.100E+05	0.100E+05	0.100E+05	0.100E+05

CHARM INPUT DATA FOR: Burro
CHEMICAL RELEASED : Methane
MODE : PLANNING - USER SPECIFIED RELEASE PARAMETERS, NO BUILDINGS

TRIAL :	B02	B03	B04	B05	B06	B07	B08	B09
CONC. SPEC. (ppm) :	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
REL HUMID. (%) :	7.1	5.2	2.7	5.9	5.1	7.4	4.5	14.4
AIR TEMP. (C) :	38.1	34.5	35.8	41.1	39.5	33.8	32.8	35.3
AIR PRESSURE (atm) :	0.927	0.936	0.933	0.929	0.923	0.928	0.929	0.928
WIND SPEED (m/s) :	5.4	5.4	9.0	7.4	9.1	8.4	1.8	5.7
ROUGHNESS LENGTH (m) :	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
MEASUREMENT HT (m) :	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STAB. CLASS :	C	C	C	C	C	D	E	D
RELEASE HEIGHT (m) :	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RELEASE LOC - (0,0) :								
GAS TEMP (C) :	-162.6	-162.6	-162.6	-162.6	-162.6	-162.6	-162.6	-162.6
DIAMETER (m) :	35.91	36.30	36.09	34.39	37.17	38.60	41.35	45.13
HOR. SPEED (m/s) :	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FRACTION DROPLETS :	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MOLAR WATER FRACT. :	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MOLAR AIR FRACT. :	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
IF CONTINUOUS, USE CONSTANT EMISSION RATE:								
EMIS. RATE (g/s) :	86100.	87980.	86960.	81250.	92220.	99460.	116930.	135980.
RELEASE DUR. (min) :	2.88	2.78	2.32	3.17	2.15	2.30	1.78	1.32
IF INSTANTANEOUS, USE TOTAL MASS RELEASED:								
MASS RELEASED (kg) :	0.	0.	0.	0.	0.	0.	0.	0.
RECEPTOR DIST. (m) :	57.0	57.0	57.0	57.0	57.0	57.0	57.0	57.0
RECEPTOR DIST. (m) :	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0
RECEPTOR DIST. (m) :	-99.9	-99.9	-99.9	-99.9	-99.9	400.0	400.0	400.0
RECEPTOR DIST. (m) :	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	800.0	800.0

CHARM INPUT DATA FOR: Coyote
CHEMICAL RELEASED : Methane . Methane is at least 86% in c
MODE : PLANNING - USER SPECIFIED RELEASE PARAMETERS, NO BUILDINGS

TRIAL :	C03	C05	C06
CONC. SPEC. (ppm) :	100.0	100.0	100.0
REL HUMID. (%) :	11.3	22.1	22.8
AIR TEMP. (C) :	38.3	28.3	24.1
AIR PRESSURE (atm) :	0.924	0.927	0.930
WIND SPEED (m/s) :	6.0	9.7	4.6
ROUGHNESS LENGTH (m) :	0.0002	0.0002	0.0002
MEASUREMENT HT (m) :	2.0	2.0	2.0
STAB. CLASS :	C	C	D
RELEASE HEIGHT (m) :	0.00	0.00	0.00
RELEASE LOC - (0,0) :			
GAS TEMP (C) :	-162.6	-162.6	-162.6
DIAMETER (m) :	38.83	43.96	42.93
HOR. SPEED (m/s) :	0.00	0.00	0.00
FRACTION DROPLETS :	0.000	0.000	0.000
MOLAR WATER FRACT. :	0.000	0.000	0.000
MOLAR AIR FRACT. :	0.000	0.000	0.000
IF CONTINUOUS, USE CONSTANT EMISSION RATE:			
EMIS. RATE (g/s) :	100670.	129020.	123030.
RELEASE DUR. (min) :	1.08	1.63	1.37
IF INSTANTANEOUS, USE TOTAL MASS RELEASED:			
MASS RELEASED (kg) :	0.	0.	0.
RECEPTOR DIST. (m) :	140.0	140.0	140.0
RECEPTOR DIST. (m) :	200.0	200.0	200.0
RECEPTOR DIST. (m) :	300.0	300.0	300.0
RECEPTOR DIST. (m) :	-99.9	400.0	400.0

CHARM INPUT DATA FOR: Desert Tortoise
CHEMICAL RELEASED : Anhydrous Ammonia
MODE : PLANNING - USER SPECIFIED RELEASE PARAMETERS, NO BUILDINGS

TRIAL	DT1	DT2	DT3	DT4
CONC. SPEC. (ppm)	100.0	100.0	100.0	100.0
REL HUMID. (%)	13.2	17.5	14.3	21.3
AIR TEMP. (C)	28.8	30.4	33.9	32.4
AIR PRESSURE (atm)	0.897	0.898	0.895	0.891
WIND SPEED (m/s)	7.4	5.8	7.4	4.5
ROUGHNESS LENGTH (m)	0.0030	0.0030	0.0030	0.0030
MEASUREMENT HT (m)	2.0	2.0	2.0	2.0
STAB. CLASS	D	D	D	E
RELEASE HEIGHT (m)	0.79	0.79	0.79	0.79
RELEASE LOC = (0,0)				
GAS TEMP (C)	-35.7	-35.7	-35.7	-35.7
DIAMETER (m)	1.04	1.19	1.22	1.24
HOR. SPEED (m/s)	22.65	23.28	27.29	20.19
FRACTION DROPLETS	0.813	0.817	0.811	0.804
MOLAR WATER FRACT.	0.000	0.000	0.000	0.000
MOLAR AIR FRACT.	0.000	0.000	0.000	0.000
IF CONTINUOUS, USE CONSTANT EMISSION RATE:				
EMIS. RATE (g/s)	79700.	111500.	130700.	96700.
RELEASE DUR. (min)	2.10	4.25	2.77	6.35
IF INSTANTANEOUS, USE TOTAL MASS RELEASED:				
MASS RELEASED (kg)	0.	0.	0.	0.
RECEPTOR DIST. (m)	100.0	100.0	100.0	100.0
RECEPTOR DIST. (m)	900.0	800.0	800.0	800.0

CHARM INPUT DATA FOR: Goldfish
CHEMICAL RELEASED : Hydrogen fluoride
MODE : PLANNING - USER SPECIFIED RELEASE PARAMETERS, NO BUILDINGS

TRIAL	GF1	GF2	GF3
CONC. SPEC. (ppm)	30.0	30.0	30.0
REL HUMID. (%)	4.9	10.7	17.7
AIR TEMP. (C)	37.2	36.2	34.4
AIR PRESSURE (atm)	0.893	0.889	0.894
WIND SPEED (m/s)	5.6	4.2	5.4
ROUGHNESS LENGTH (m)	0.0030	0.0030	0.0030
MEASUREMENT HT (m)	2.0	2.0	2.0
STAB. CLASS	D	D	D
RELEASE HEIGHT (m)	1.00	1.00	1.00
RELEASE LOC = (0,0)			
GAS TEMP (C)	16.4	16.4	16.4
DIAMETER (m)	0.61	0.34	0.34
HOR. SPEED (m/s)	20.33	23.04	22.62
FRACTION DROPLETS	0.840	0.853	0.847
MOLAR WATER FRACT.	0.000	0.000	0.000
MOLAR AIR FRACT.	0.000	0.000	0.000
IF CONTINUOUS, USE CONSTANT EMISSION RATE:			
EMIS. RATE (g/s)	27670.	10460.	10270.
RELEASE DUR. (min)	2.08	6.00	6.00
IF INSTANTANEOUS, USE TOTAL MASS RELEASED:			
MASS RELEASED (kg)	0.	0.	0.
RECEPTOR DIST. (m)	300.0	300.0	300.0
RECEPTOR DIST. (m)	1000.0	1000.0	1000.0
RECEPTOR DIST. (m)	3000.0	-99.9	3000.0

CHARM INPUT DATA FOR: Hanford (continuous)
CHEMICAL RELEASED : ("Air"-oxygen with m.w.=29.0)
MODE : PLANNING - USER SPECIFIED RELEASE PARAMETERS, NO BUILDINGS

TRIAL	HC1	HC2	HC3	HC4	HC5
CONC. SPEC. (ppm) :	0.1	0.1	0.1	0.1	0.1
REL HUMID. (%) :	20.0	20.0	20.0	20.0	20.0
AIR TEMP. (C) :	17.7	12.2	15.7	13.4	5.6
AIR PRESSURE (atm) :	1.000	1.000	1.000	1.000	1.000
WIND SPEED (m/s) :	1.3	3.9	7.1	3.9	2.5
ROUGHNESS LENGTH (m) :	0.0300	0.0300	0.0300	0.0300	0.0300
MEASUREMENT HT (m) :	1.5	1.5	1.5	1.5	1.5
STAB. CLASS :	F	C	C	C	E
RELEASE HEIGHT (m) :	1.00	1.00	1.00	1.00	1.00
RELEASE LOC - (0,0) :					
GAS TEMP (C) :	17.7	12.2	15.7	13.4	5.6
DIAMETER (m) :	0.12	0.06	0.07	0.11	0.09
HOR. SPEED (m/s) :	0.00	0.00	0.00	0.00	0.00
FRACTION DROPLETS :	0.000	0.000	0.000	0.000	0.000
MOLAR WATER FRACT. :	0.000	0.000	0.000	0.000	0.000
MOLAR AIR FRACT. :	0.000	0.000	0.000	0.000	0.000
IF CONTINUOUS, USE CONSTANT EMISSION RATE:					
EMIS. RATE (g/s) :	12.	12.	28.	39.	17.
RELEASE DUR. (min) :	15.47	15.08	14.25	9.97	19.85
IF INSTANTANEOUS, USE TOTAL MASS RELEASED:					
MASS RELEASED (kg) :	0.	0.	0.	0.	0.
RECEPTOR DIST. (m) :	200.0	200.0	200.0	200.0	200.0
RECEPTOR DIST. (m) :	800.0	800.0	800.0	800.0	800.0

CHARM INPUT DATA FOR: Hanford (instantaneous)
CHEMICAL RELEASED : ("Air"-oxygen with m.w.=29.0)
MODE : PLANNING - USER SPECIFIED RELEASE PARAMETERS, NO BUILDINGS

TRIAL	HI2	HI3	HI5	HI6	HI7	HI8
CONC. SPEC. (ppm) :	0.1	0.1	0.1	0.1	0.1	0.1
REL HUMID. (%) :	20.0	20.0	20.0	20.0	20.0	20.0
AIR TEMP. (C) :	18.3	11.9	15.5	15.1	12.4	4.6
AIR PRESSURE (atm) :	1.000	1.000	1.000	1.000	1.000	1.000
WIND SPEED (m/s) :	1.3	4.1	7.6	7.2	4.5	1.6
ROUGHNESS LENGTH (m) :	0.0300	0.0300	0.0300	0.0300	0.0300	0.0300
MEASUREMENT HT (m) :	1.5	1.5	1.5	1.5	1.5	1.5
STAB. CLASS :	F	D	C	C	C	E
RELEASE HEIGHT (m) :	0.00	0.00	0.00	0.00	0.00	0.00
RELEASE LOC - (0,0) :						
GAS TEMP (C) :	18.3	11.9	15.5	15.1	12.4	4.6
DIAMETER (m) :	2.76	2.74	2.75	2.75	2.74	2.71
HOR. SPEED (m/s) :	0.00	0.00	0.00	0.00	0.00	0.00
FRACTION DROPLETS :	0.000	0.000	0.000	0.000	0.000	0.000
MOLAR WATER FRACT. :	0.000	0.000	0.000	0.000	0.000	0.000
MOLAR AIR FRACT. :	0.000	0.000	0.000	0.000	0.000	0.000
IF CONTINUOUS, USE CONSTANT EMISSION RATE:						
EMIS. RATE (g/s) :	0.	0.	0.	0.	0.	0.
RELEASE DUR. (min) :	0.00	0.00	0.00	0.00	0.00	0.00
IF INSTANTANEOUS, USE TOTAL MASS RELEASED:						
MASS RELEASED (kg) :	10.	10.	10.	10.	10.	10.
RECEPTOR DIST. (m) :	200.0	200.0	200.0	200.0	200.0	200.0
RECEPTOR DIST. (m) :	800.0	800.0	800.0	800.0	800.0	800.0

CHARM INPUT DATA FOR: Maplin Sands
CHEMICAL RELEASED : Methane
MODE : PLANNING - USER SPECIFIED RELEASE PARAMETERS, NO BUILDINGS

TRIAL	MS27	MS29	MS34	MS35
CONC. SPEC. (ppm)	100.0	100.0	100.0	100.0
REL HUMID. (%)	53.0	71.0	90.0	77.0
AIR TEMP. (C)	14.3	15.1	15.2	16.1
AIR PRESSURE (atm)	1.000	1.000	1.000	1.000
WIND SPEED (m/s)	5.6	7.4	8.5	9.6
ROUGHNESS LENGTH (m)	0.0003	0.0003	0.0003	0.0003
MEASUREMENT HT (m)	10.0	10.0	10.0	10.0
STAB. CLASS	D	D	D	D
RELEASE HEIGHT (m)	0.00	0.00	0.00	0.00
RELEASE LOC = (0,0)				
GAS TEMP (C)	-161.5	-161.5	-161.5	-161.5
DIAMETER (m)	18.60	20.90	18.00	20.10
HOR. SPEED (m/s)	0.00	0.00	0.00	0.00
FRACTION DROPLETS	0.000	0.000	0.000	0.000
MOLAR WATER FRACT.	0.000	0.000	0.000	0.000
MOLAR AIR FRACT.	0.000	0.000	0.000	0.000
IF CONTINUOUS, USE CONSTANT EMISSION RATE:				
EMIS. RATE (g/s)	23210.	29160.	21510.	27090.
RELEASE DUR. (min)	2.67	3.75	1.58	2.25
IF INSTANTANEOUS, USE TOTAL MASS RELEASED:				
MASS RELEASED (kg)	0.	0.	0.	0.
RECEPTOR DIST. (m)	39.0	58.0	37.0	129.0
RECEPTOR DIST. (m)	131.0	90.0	179.0	250.0
RECEPTOR DIST. (m)	324.0	130.0	-99.9	406.0
RECEPTOR DIST. (m)	400.0	182.0	-99.9	-99.9
RECEPTOR DIST. (m)	650.0	252.0	-99.9	-99.9
RECEPTOR DIST. (m)	-99.9	324.0	-99.9	-99.9
RECEPTOR DIST. (m)	-99.9	403.0	-99.9	-99.9

CHARM INPUT DATA FOR: Maplin Sands
CHEMICAL RELEASED : Propane
MODE : PLANNING - USER SPECIFIED RELEASE PARAMETERS, NO BUILDINGS

TRIAL	MS42	MS43	MS46	MS47	MS49	MS50	MS52	MS54
CONC. SPEC. (ppm)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
REL HUMID. (%)	80.0	90.0	71.0	78.0	88.0	79.0	63.0	85.0
AIR TEMP. (C)	18.3	17.0	18.7	17.4	13.3	10.4	11.3	8.4
AIR PRESSURE (atm)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
WIND SPEED (m/s)	4.0	5.3	8.1	6.2	5.5	7.9	7.4	3.7
ROUGHNESS LENGTH (m)	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
MEASUREMENT HT (m)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
STAB. CLASS	D	D	D	D	D	D	D	D
RELEASE HEIGHT (m)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RELEASE LOC = (0,0)								
GAS TEMP (C)	-42.1	-42.1	-42.1	-42.1	-42.1	-42.1	-42.1	-42.1
DIAMETER (m)	14.90	14.30	15.70	18.60	13.30	19.50	21.70	14.30
HOR. SPEED (m/s)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FRACTION DROPLETS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MOLAR WATER FRACT.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MOLAR AIR FRACT.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
IF CONTINUOUS, USE CONSTANT EMISSION RATE:								
EMIS. RATE (g/s)	20870.	19200.	23370.	32570.	16710.	35890.	44250.	19200.
RELEASE DUR. (min)	3.00	5.30	6.00	3.50	1.30	2.67	2.33	3.00
IF INSTANTANEOUS, USE TOTAL MASS RELEASED:								
MASS RELEASED (kg)	0.	0.	0.	0.	0.	0.	0.	0.
RECEPTOR DIST. (m)	28.0	88.0	34.0	90.0	90.0	59.0	61.0	56.0
RECEPTOR DIST. (m)	53.0	129.0	91.0	128.0	129.0	93.0	95.0	85.0
RECEPTOR DIST. (m)	83.0	249.0	130.0	182.0	180.0	182.0	178.0	178.0
RECEPTOR DIST. (m)	123.0	400.0	182.0	250.0	250.0	400.0	249.0	247.0
RECEPTOR DIST. (m)	179.0	-99.9	250.0	321.0	322.0	-99.9	398.0	-99.9
RECEPTOR DIST. (m)	247.0	-99.9	322.0	400.0	400.0	-99.9	650.0	-99.9
RECEPTOR DIST. (m)	398.0	-99.9	401.0	-99.9	-99.9	-99.9	-99.9	-99.9

CHARM INPUT DATA FOR: Prairie Grass, sec
CHEMICAL RELEASED : Sulfur dioxide
MODE : PLANNING - USER SPECIFIED RELEASE PARAMETERS, NO BUILDINGS

TRIAL	PG7	PG8	PG9	PG10	PG13	PG15	PG16	PG17
CONC. SPEC. (ppm) :	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
REL HUMID. (%) :	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
AIR TEMP. (C) :	31.9	31.9	27.9	30.9	19.9	21.9	27.9	26.9
AIR PRESSURE (atm) :	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
WIND SPEED (m/s) :	4.2	4.9	5.9	4.6	1.3	3.4	3.2	3.3
ROUGHNESS LENGTH (m) :	0.0060	0.0060	0.0060	0.0060	0.0060	0.0060	0.0060	0.0060
MEASUREMENT HT (m) :	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
STAB. CLASS :	B	C	C	B	F	A	A	D
RELEASE HEIGHT (m) :	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
RELEASE LOC - (0,0) :								
GAS TEMP (C) :	31.9	31.9	27.9	30.9	19.9	21.9	27.9	26.9
DIAMETER (m) :	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
HOR. SPEED (m/s) :	17.34	17.57	17.51	17.71	11.32	17.82	17.70	10.72
FRACTION DROPLETS :	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MOLAR WATER FRACT. :	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MOLAR AIR FRACT. :	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
IF CONTINUOUS, USE CONSTANT EMISSION RATE:								
EMIS. RATE (g/s) :	90.	91.	92.	92.	61.	96.	93.	57.
RELEASE DUR. (min) :	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
IF INSTANTANEOUS, USE TOTAL MASS RELEASED:								
MASS RELEASED (kg) :	0.	0.	0.	0.	0.	0.	0.	0.
RECEPTOR DIST. (m) :	50.0	50.0	50.0	50.0	400.0	50.0	50.0	50.0
RECEPTOR DIST. (m) :	100.0	100.0	100.0	100.0	800.0	100.0	100.0	100.0
RECEPTOR DIST. (m) :	200.0	200.0	200.0	200.0	-99.9	200.0	200.0	200.0
RECEPTOR DIST. (m) :	400.0	400.0	400.0	400.0	-99.9	400.0	400.0	400.0
RECEPTOR DIST. (m) :	800.0	800.0	800.0	800.0	-99.9	800.0	800.0	800.0

CHARM INPUT DATA FOR: Thorney Island (continuous) .
CHEMICAL RELEASED : Use TRIAL-SPECIFIC name for Thorney Is. .
MODE : PLANNING - USER SPECIFIED RELEASE PARAMETERS, NO BUILDINGS

TRIAL	TC45	TC47
CONC. SPEC. (ppm) :	100.0	100.0
REL HUMID. (%) :	100.0	97.4
AIR TEMP. (C) :	13.0	14.3
AIR PRESSURE (atm) :	1.000	1.000
WIND SPEED (m/s) :	2.3	1.5
ROUGHNESS LENGTH (m) :	0.0100	0.0100
MEASUREMENT HT (m) :	10.0	10.0
STAB. CLASS :	E	F
RELEASE HEIGHT (m) :	0.00	0.00
RELEASE LOC - (0,0) :		
GAS TEMP (C) :	13.0	14.3
DIAMETER (m) :	2.00	2.00
HOR. SPEED (m/s) :	0.00	0.00
FRACTION DROPLETS :	0.000	0.000
MOLAR WATER FRACT. :	0.000	0.000
MOLAR AIR FRACT. :	0.000	0.000
IF CONTINUOUS, USE CONSTANT EMISSION RATE:		
EMIS. RATE (g/s) :	10670.	10220.
RELEASE DUR. (min) :	7.58	7.75
IF INSTANTANEOUS, USE TOTAL MASS RELEASED:		
MASS RELEASED (kg) :	0.	0.
RECEPTOR DIST. (m) :	40.0	50.0
RECEPTOR DIST. (m) :	53.0	90.0
RECEPTOR DIST. (m) :	72.0	212.0
RECEPTOR DIST. (m) :	90.0	250.0
RECEPTOR DIST. (m) :	112.0	335.0
RECEPTOR DIST. (m) :	158.0	472.0
RECEPTOR DIST. (m) :	250.0	-99.9
RECEPTOR DIST. (m) :	335.0	-99.9
RECEPTOR DIST. (m) :	472.0	-99.9

CHARM INPUT DATA FOR: Thorney Island (instantaneous)
CHEMICAL RELEASED : Use TRIAL-SPECIFIC name for Thorney Is.
MODE : PLANNING - USER SPECIFIED RELEASE PARAMETERS, NO BUILDINGS

TRIAL :	TI6	TI7	TI8	TI9	TI12	TI13	TI17	TI18	TI19
CONC. SPEC. (ppm) :	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
REL HUMID. (%) :	74.3	80.7	87.6	87.3	56.2	74.1	94.0	81.1	94.8
AIR TEMP. (C) :	18.6	17.3	17.5	18.3	10.1	13.7	16.0	16.5	13.3
AIR PRESSURE (atm) :	1.000	1.008	1.009	1.006	1.000	1.006	0.995	0.994	0.993
WIND SPEED (m/s) :	3.8	3.4	2.4	1.7	2.5	7.3	5.0	7.4	6.4
ROUGHNESS LENGTH (m) :	0.0180	0.0180	0.0120	0.0080	0.0180	0.0100	0.0180	0.0050	0.0100
MEASUREMENT HT (m) :	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
STAB. CLASS :	D	E	D	F	E	D	D	D	D
RELEASE HEIGHT (m) :	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RELEASE LOC = (0,0) :									
GAS TEMP (C) :	18.6	17.3	17.5	18.3	10.1	13.7	16.0	16.5	13.3
DIAMETER (m) :	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
HOR. SPEED (m/s) :	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FRACTION DROPLETS :	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MOLAR WATER FRACT. :	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MOLAR AIR FRACT. :	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
IF CONTINUOUS, USE CONSTANT EMISSION RATE:									
EMIS. RATE (g/s) :	0.	0.	0.	0.	0.	0.	0.	0.	0.
RELEASE DUR. (min) :	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IF INSTANTANEOUS, USE TOTAL MASS RELEASED:									
MASS RELEASED (kg) :	3147.	4249.	3958.	3866.	5736.	4800.	8711.	3881.	5477.
RECEPTOR DIST. (m) :	71.0	71.0	71.0	71.0	71.0	71.0	40.0	40.0	40.0
RECEPTOR DIST. (m) :	141.0	100.0	100.0	100.0	150.0	100.0	50.0	60.0	60.0
RECEPTOR DIST. (m) :	180.0	150.0	150.0	141.0	200.0	224.0	71.0	70.0	71.0
RECEPTOR DIST. (m) :	283.0	180.0	200.0	180.0	361.0	316.0	100.0	80.0	100.0
RECEPTOR DIST. (m) :	424.0	224.0	364.0	224.0	500.0	361.0	141.0	100.0	224.0
RECEPTOR DIST. (m) :	-99.9	361.0	412.0	316.0	-99.9	412.0	224.0	200.0	361.0
RECEPTOR DIST. (m) :	-99.9	500.0	510.0	503.0	-99.9	-99.9	500.0	224.0	583.0
RECEPTOR DIST. (m) :	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	300.0	-99.9
RECEPTOR DIST. (m) :	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	400.0	-99.9
RECEPTOR DIST. (m) :	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	510.0	-99.9

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DEG. INPUT DATA FOR : Burro
CHEMICAL RELEASED : Liquefied natural gas

TRIAL	:	BU2	BU3	BU4	BU5	BU6	BU7	BU8	BU9
U0 (m/s)	:	5.4	5.4	9.0	7.4	9.1	8.4	1.8	5.7
MEAS. HEIGHT (m)	:	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ROUGHNESS LENGTH (m)	:	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020
PG STAB CLASS	:	3	3	3	3	3	4	5	4
AVERAGING TIME (s)	:	40.0	100.0	80.0	130.0	70.0	140.0	80.0	50.0
MONIN-OBUHKOV LEN (m)	:	-12.9	-5.8	-49.3	-35.6	-53.4	-148.6	15.5	-2288.3
AMB. TEMP. (K)	:	311.3	307.8	309.0	314.3	312.7	307.0	306.0	308.5
AMB. PRESS. (atm)	:	0.927	0.936	0.933	0.929	0.923	0.928	0.929	0.928
REL. HUMID. (%)	:	7.1	5.2	2.7	5.9	5.1	7.4	4.5	14.4
AIR DENSITY (kg/m^3)	:	1.050	1.073	1.066	1.042	1.041	1.066	1.071	1.059
ISOTHERMAL? 1-YES	:	0	0	0	0	0	0	0	0
SURFACE TEMP (K)	:	311.3	307.8	309.0	314.3	312.7	307.0	306.0	308.5
HEAT TRNS 0-no ;1-std	:	1	1	1	1	1	1	1	1
H2O TRNS 0-no ;1-std	:	1	1	1	1	1	1	1	1
MOL. WT. (kg/kg-mol)	:	17.46	17.26	17.05	17.08	17.24	18.22	18.12	18.82
GAS TEMP. (K)	:	111.6	111.6	111.5	111.5	111.6	111.6	111.6	111.5
GAS DENSITY (kg/m^3)	:	1.769	1.766	1.738	1.734	1.739	1.848	1.340	1.909
HEAT CAP CONST	:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HEAT CAP POWER	:	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000
UPPER CONC. (mol frac)	:	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100
LOWER CONC. (mol frac)	:	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100
RECEPTOR HT. (m)	:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHEMICAL MASS FRACTION	:	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
STEADY-STATE? T-TRUE	:	T	T	T	T	T	T	T	T
EVOLUTION RATE (kg/s)	:	86.10	37.98	86.36	81.25	92.22	99.46	116.93	135.98
SOURCE RADIUS (m)	:	17.955	18.150	18.045	17.445	18.585	19.300	20.925	22.565
TOTAL MASS (kg)	:	14980.00	14712.00	15221.00	15444.00	11888.00	17289.00	12453.00	10730.00

DEG. INPUT DATA FOR : Coyote
CHEMICAL RELEASED : Liquefied natural gas

. Methane is at least 86% in c

TRIAL	:	CO3	CO5	CO6
U0 (m/s)	:	6.0	9.7	4.6
MEAS. HEIGHT (m)	:	2.0	2.0	2.0
ROUGHNESS LENGTH (m)	:	0.00020	0.00020	0.00020
PG STAB CLASS	:	3	3	4
AVERAGING TIME (s)	:	50.0	90.0	70.0
MONIN-OBUHKOV LEN (m)	:	-12.2	-31.7	56.1
AMB. TEMP. (K)	:	311.5	301.5	297.3
AMB. PRESS. (atm)	:	0.924	0.927	0.930
REL. HUMID. (%)	:	11.3	22.1	22.8
AIR DENSITY (kg/m^3)	:	1.045	1.082	1.102
ISOTHERMAL? 1-YES	:	0	0	0
SURFACE TEMP (K)	:	311.5	301.5	297.3
HEAT TRNS 0-no ;1-std	:	1	1	1
H2O TRNS 0-no ;1-std	:	1	1	1
MOL. WT. (kg/kg-mol)	:	19.51	20.19	19.09
GAS TEMP. (K)	:	111.6	111.6	111.6
GAS DENSITY (kg/m^3)	:	1.970	2.045	1.940
HEAT CAP CONST	:	0.0	0.0	0.0
HEAT CAP POWER	:	5.000	5.000	5.000
UPPER CONC. (mol frac)	:	0.000100	0.000100	0.000100
LOWER CONC. (mol frac)	:	0.000100	0.000100	0.000100
RECEPTOR HT. (m)	:	0.0	0.0	0.0
CHEMICAL MASS FRACTION	:	1.00000	1.00000	1.00000
STEADY-STATE? T-TRUE	:	T	T	T
EVOLUTION RATE (kg/s)	:	100.67	129.02	123.03
SOURCE RADIUS (m)	:	19.415	21.980	21.465
TOTAL MASS (kg)	:	6532.00	12676.00	10139.00

DEG. INPUT DATA FOR : Desert Tortoise
CHEMICAL RELEASED : Anhydrous Ammonia
AEROSOL MODELED WITH MIXTURE FILE

TRIAL	:	DT1	DT2	DT3	DT4
U0 (m/s)	:	7.4	5.3	7.4	4.5
MEAS. HEIGHT (m)	:	2.0	2.0	2.0	2.0
ROUGHNESS LENGTH (m)	:	0.00300	0.00300	0.00300	0.00300
PG STAB CLASS	:	4	4	4	5
AVERAGING TIME (s)	:	80.0	160.0	120.0	300.0
MONIN-OBUHKOV LEN (m)	:	93.2	34.3	847.3	41.0
AMB. TEMP. (K)	:	302.0	303.5	307.1	305.6
AMB. PRESS. (atm)	:	0.897	0.898	0.895	0.891
REL. HUMID. (%)	:	13.2	17.5	14.8	21.3
AIR DENSITY (kg/m^3)	:	1.047	1.041	1.026	1.025
ISOTHERMAL? 1=YES	:	1	1	1	1
SURFACE TEMP (K)	:	302.0	303.6	307.1	305.6
HEAT TRNS 0=no ;1=std	:	0	0	0	0
H2O TRNS 0=no ;1=std	:	0	0	0	0
MOL. WT. (kg/kg-mol)	:	17.03	17.03	17.03	17.03
GAS TEMP. (K)	:	302.0	303.6	307.1	305.5
GAS DENSITY (kg/m^3)	:	4.156	4.276	4.112	3.953
HEAT CAP CONST	:	0.0	0.0	0.0	0.0
HEAT CAP POWER	:	0.000	0.000	0.000	0.000
UPPER CONC. (mol frac)	:	0.000100	0.000100	0.000100	0.000100
LOWER CONC. (mol frac)	:	0.000100	0.000100	0.000100	0.000100
RECEPTOR HT. (m)	:	0.0	0.0	0.0	0.0
CHEMICAL MASS FRACTION	:	1.00000	1.00000	1.00000	1.00000
STEADY-STATE? T=TRUE	:	T	T	T	T
EVOLUTION RATE (kg/s)	:	79.70	111.50	130.70	96.70
SOURCE RADIUS (m)	:	0.963	1.271	1.238	1.403
TOTAL MASS (kg)	:	10042.20	28432.50	21696.20	36842.70

DEG. INPUT DATA FOR : Goldfish
CHEMICAL RELEASED : Hydrogen fluoride
AEROSOL MODELED WITH MIXTURE FILE

TRIAL	:	GF1	GF2	GF3
U0 (m/s)	:	5.6	4.2	5.4
MEAS. HEIGHT (m)	:	2.0	2.0	2.0
ROUGHNESS LENGTH (m)	:	0.00300	0.00300	0.00300
PG STAB CLASS	:	4	4	4
AVERAGING TIME (s)	:	88.3	88.3	88.3
MONIN-OBUHKOV LEN (m)	:	101.3	173.1	40.9
AMB. TEMP. (K)	:	310.4	309.4	307.6
AMB. PRESS. (atm)	:	0.893	0.889	0.894
REL. HUMID. (%)	:	4.9	10.7	17.7
AIR DENSITY (kg/m^3)	:	1.015	1.012	1.023
ISOTHERMAL? 1=YES	:	1	1	1
SURFACE TEMP (K)	:	310.4	309.4	307.6
HEAT TRNS 0=no ;1=std	:	0	0	0
H2O TRNS 0=no ;1=std	:	0	0	0
MOL. WT. (kg/kg-mol)	:	20.01	20.01	20.01
GAS TEMP. (K)	:	310.4	309.4	307.5
GAS DENSITY (kg/m^3)	:	4.683	5.065	4.900
HEAT CAP CONST	:	0.0	0.0	0.0
HEAT CAP POWER	:	0.000	0.000	0.000
UPPER CONC. (mol frac)	:	0.000030	0.000030	0.000030
LOWER CONC. (mol frac)	:	0.000030	0.000030	0.000030
RECEPTOR HT. (m)	:	0.0	0.0	0.0
CHEMICAL MASS FRACTION	:	1.00000	1.00000	1.00000
STEADY-STATE? T=TRUE	:	T	T	T
EVOLUTION RATE (kg/s)	:	27.67	10.46	10.27
SOURCE RADIUS (m)	:	0.615	0.419	0.375
TOTAL MASS (kg)	:	3459.00	3766.00	3697.00

FILE OF ORDERED TRIPLES: dggf.mix

DEG. INPUT DATA FOR : Hanford (continuous)
CHEMICAL RELEASED : Krypton-85

TRIAL	HC1	HC2	HC3	HC4	HC5
U0 (m/s)	1.3	3.9	7.1	3.9	2.5
MEAS. HEIGHT (m)	1.5	1.5	1.5	1.5	1.5
ROUGHNESS LENGTH (m)	0.03000	0.03000	0.03000	0.03000	0.03000
PG STAB CLASS	6	3	3	3	5
AVERAGING TIME (s)	460.8	844.8	268.3	268.3	537.6
MONIN-OBUHKOV LEN (m)	6.9	-111.3	-136.1	-26.7	70.2
AMB. TEMP. (K)	290.9	285.4	288.9	286.6	278.3
AMB. PRESS. (atm)	1.000	1.000	1.000	1.000	1.000
REL. HUMID. (%)	20.0	20.0	20.0	20.0	20.0
AIR DENSITY (kg/m^3)	1.213	1.236	1.221	1.231	1.266
ISOTHERMAL? 1=YES	1	1	1	1	1
SURFACE TEMP (K)	290.9	285.4	288.9	286.6	278.3
HEAT TRNS 0=no ;1=std	0	0	0	0	0
H2O TRNS 0=no ;1=std	0	0	0	0	0
MOL. WT. (kg/kg-mol)	29.00	29.00	29.00	29.00	29.00
GAS TEMP. (K)	290.9	285.4	288.9	286.6	278.8
GAS DENSITY (kg/m^3)	1.216	1.239	1.224	1.234	1.269
HEAT CAP CONST	-26079.0	-26079.0	-26079.0	-26079.0	-26079.0
HEAT CAP POWER	1.000	1.000	1.000	1.000	1.000
UPPER CONC. (mol frac)	0.000000	0.000000	0.000000	0.000000	0.000000
LOWER CONC. (mol frac)	0.000000	0.000000	0.000000	0.000000	0.000000
RECEPTOR HT. (m)	0.0	0.0	0.0	0.0	0.0
CHEMICAL MASS FRACTION	1.00000	1.00000	1.00000	1.00000	1.00000
STEADY-STATE? T=TRUE	T	T	T	T	T
EVOLUTION RATE (kg/s)	0.01	0.01	0.03	0.04	0.02
SOURCE RADIUS (m)	0.053	0.030	0.034	0.053	0.043
TOTAL MASS (kg)	10.90	10.90	23.80	22.30	20.40

DEG. INPUT DATA FOR : Hanford (instantaneous)
CHEMICAL RELEASED : Krypton-85

TRIAL	HI2	HI3	HI5	HI6	HI7	HI8
U0 (m/s)	1.3	4.1	7.6	7.2	4.5	1.6
MEAS. HEIGHT (m)	1.5	1.5	1.5	1.5	1.5	1.5
ROUGHNESS LENGTH (m)	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000
PG STAB CLASS	6	4	3	3	3	5
AVERAGING TIME (s)	4.8	4.8	4.8	4.8	4.8	4.8
MONIN-OBUHKOV LEN (m)	5.7	-262.9	-216.5	-155.3	-63.6	27.3
AMB. TEMP. (K)	291.5	285.1	288.7	288.3	285.6	277.8
AMB. PRESS. (atm)	1.000	1.000	1.000	1.000	1.000	1.000
REL. HUMID. (%)	20.0	20.0	20.0	20.0	20.0	20.0
AIR DENSITY (kg/m^3)	1.210	1.238	1.222	1.224	1.236	1.271
ISOTHERMAL? 1=YES	1	1	1	1	1	1
SURFACE TEMP (K)	291.5	285.1	288.7	288.3	285.6	277.8
HEAT TRNS 0=no ;1=std	0	0	0	0	0	0
H2O TRNS 0=no ;1=std	0	0	0	0	0	0
MOL. WT. (kg/kg-mol)	29.00	29.00	29.00	29.00	29.00	29.00
GAS TEMP. (K)	291.5	285.1	288.7	288.3	285.6	277.8
GAS DENSITY (kg/m^3)	1.213	1.241	1.225	1.227	1.238	1.273
HEAT CAP CONST	-26079.0	-26079.0	-26079.0	-26079.0	-26079.0	-26079.0
HEAT CAP POWER	1.000	1.000	1.000	1.000	1.000	1.000
UPPER CONC. (mol frac)	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
LOWER CONC. (mol frac)	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
RECEPTOR HT. (m)	0.0	0.0	0.0	0.0	0.0	0.0
CHEMICAL MASS FRACTION	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
STEADY-STATE? T=TRUE	F	F	F	F	F	F
EVOLUTION RATE (kg/s)	0.00	0.00	0.00	0.00	0.00	0.00
SOURCE RADIUS (m)	1.379	1.369	1.375	1.374	1.370	1.357
TOTAL MASS (kg)	10.00	10.00	10.00	10.00	10.00	10.00

DEG. INPUT DATA FOR : Maplin Sands
CHEMICAL RELEASED : Liquified Natural Gas

TRIAL	MS27	MS29	MS34	MS35
U0 (m/s)	5.6	7.4	9.5	9.6
MEAS. HEIGHT (m)	10.0	10.0	10.0	10.0
ROUGHNESS LENGTH (m)	0.00030	0.00030	0.00030	0.00030
PG STAB CLASS	4	4	4	4
AVERAGING TIME (s)	3.0	3.0	3.0	3.0
MONIN-OBUKHOV LEN (m)	-37.0	1220.6	-102.7	-81.6
AMB. TEMP. (K)	288.1	289.3	288.4	289.3
AMB. PRESS. (atm)	1.000	1.000	1.000	1.000
REL. HUMID. (%)	53.0	71.0	90.0	77.0
AIR DENSITY (kg/m^3)	1.222	1.215	1.218	1.215
ISOTHERMAL? 1=YES	0	0	0	0
SURFACE TEMP (K)	288.8	290.0	289.0	289.8
HEAT TRNS 0=no ;1=std	1	1	1	1
H2O TRNS 0=no ;1=std	1	1	1	1
MOL. WT. (kg/kg-mol)	17.11	16.26	16.66	16.39
GAS TEMP. (K)	111.7	111.7	111.7	111.7
GAS DENSITY (kg/m^3)	1.868	1.775	1.819	1.790
HEAT CAP CONST	0.0	0.0	0.0	0.0
HEAT CAP POWER	5.000	5.000	5.000	5.000
UPPER CONC. (mol frac)	0.000100	0.000100	0.000100	0.000100
LOWER CONC. (mol frac)	0.000100	0.000100	0.000100	0.000100
RECEPTOR HT. (m)	0.0	0.0	0.0	0.0
CHEMICAL MASS FRACTION	1.00000	1.00000	1.00000	1.00000
STEADY-STATE? T=TRUE	T	T	T	T
EVOLUTION RATE (kg/s)	23.21	29.16	21.51	27.09
SOURCE RADIUS (m)	9.300	10.450	9.000	10.050
TOTAL MASS (kg)	3714.40	6561.30	2043.60	3657.70

DEG. INPUT DATA FOR : Maplin Sands
CHEMICAL RELEASED : Liquified Propane Gas

TRIAL	MS42	MS43	MS46	MS47	MS49	MS50	MS52	MS54
U0 (m/s)	4.0	5.8	8.1	6.2	5.5	7.9	7.4	3.7
MEAS. HEIGHT (m)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
ROUGHNESS LENGTH (m)	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
PG STAB CLASS	4	4	4	4	4	4	4	4
AVERAGING TIME (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
MONIN-OBUKHOV LEN (m)	99.7	9999.0	750.2	294.2	69.6	208.7	224.9	57.8
AMB. TEMP. (K)	291.5	290.2	291.9	290.6	286.5	283.6	285.0	281.6
AMB. PRESS. (atm)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
REL. HUMID. (%)	80.0	80.0	71.0	78.0	88.0	79.0	63.0	85.0
AIR DENSITY (kg/m^3)	1.204	1.210	1.203	1.209	1.227	1.241	1.236	1.250
ISOTHERMAL? 1=YES	0	0	0	0	0	0	0	0
SURFACE TEMP (K)	291.7	292.1	290.5	290.3	286.2	283.1	285.1	282.6
HEAT TRNS 0=no ;1=std	1	1	1	1	1	1	1	1
H2O TRNS 0=no ;1=std	1	1	1	1	1	1	1	1
MOL. WT. (kg/kg-mol)	43.93	43.93	43.35	43.84	43.76	43.93	43.87	43.94
GAS TEMP. (K)	231.1	231.1	231.1	231.1	231.1	231.1	231.1	231.1
GAS DENSITY (kg/m^3)	2.318	2.318	2.319	2.314	2.309	2.318	2.315	2.319
HEAT CAP CONST	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4
HEAT CAP POWER	2.250	2.250	2.250	2.250	2.250	2.250	2.250	2.250
UPPER CONC. (mol frac)	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100
LOWER CONC. (mol frac)	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100
RECEPTOR HT. (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHEMICAL MASS FRACTION	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
STEADY-STATE? T=TRUE	T	T	T	T	T	T	T	T
EVOLUTION RATE (kg/s)	20.87	19.20	23.37	32.57	16.71	35.89	44.25	19.20
SOURCE RADIUS (m)	7.450	7.150	7.850	9.300	6.650	9.750	10.850	7.150
TOTAL MASS (kg)	3756.60	6336.00	8413.20	6839.70	1503.90	5742.40	6195.00	3456.00

DEG. INPUT DATA FOR : Prairie Grass, set 1
CHEMICAL RELEASED : Sulfur dioxide

TRIAL	PG7	PG8	PG9	PG10	PG13	PG15	PG16	PG17
UO (m/s) :	4.2	4.9	6.9	4.6	1.3	3.4	3.2	3.3
MEAS. HEIGHT (m) :	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ROUGHNESS LENGTH (m) :	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600
PG STAB CLASS :	2	3	3	2	6	1	1	4
AVERAGING TIME (s) :	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0
MONIN-OBUHKOV LEN (m) :	-8.2	-20.6	-34.1	-7.5	6.0	-7.7	-7.3	49.3
AMB. TEMP. (K) :	305.1	305.1	301.1	304.1	293.1	295.1	301.1	300.1
AMB. PRESS. (atm) :	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
REL. HUMID. (%) :	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
AIR DENSITY (kg/m^3) :	1.154	1.154	1.170	1.158	1.203	1.195	1.170	1.174
ISOTHERMAL? 1-YES :	1	1	1	1	1	1	1	1
SURFACE TEMP (K) :	305.1	305.1	301.1	304.1	293.1	295.1	301.1	300.1
HEAT TRNS 0=no ;1=std :	0	0	0	0	0	0	0	0
H2O TRNS 0=no ;1=std :	0	0	0	0	0	0	0	0
MOL. WT. (kg/kg-mol) :	64.00	64.00	64.00	64.00	64.00	64.00	64.00	64.00
GAS TEMP. (K) :	305.1	305.1	301.1	304.1	293.1	295.1	301.1	300.1
GAS DENSITY (kg/m^3) :	2.558	2.558	2.592	2.566	2.663	2.645	2.592	2.601
HEAT CAP CONST :	6546.4	6546.4	6546.4	6546.4	6546.4	6546.4	6546.4	6546.4
HEAT CAP POWER :	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
UPPER CONC. (mol frac) :	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001
LOWER CONC. (mol frac) :	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001
RECEPTOR HT. (m) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHEMICAL MASS FRACTION :	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
STEADY-STATE? T=TRUE :	T	T	T	T	T	T	T	T
EVOLUTION RATE (kg/s) :	0.09	0.09	0.09	0.09	0.06	0.10	0.09	0.06
SOURCE RADIUS (m) :	0.054	0.051	0.043	0.052	0.084	0.061	0.063	0.049
TOTAL MASS (kg) :	53.90	54.70	55.20	55.30	36.70	57.30	55.80	33.90

DEG. INPUT DATA FOR : Thorney Island (continuous) .
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen .

TRIAL	TC45	TC47
UO (m/s) :	2.3	1.5
MEAS. HEIGHT (m) :	10.0	10.0
ROUGHNESS LENGTH (m) :	0.01000	0.01000
PG STAB CLASS :	5	6
AVERAGING TIME (s) :	30.0	30.0
MONIN-OBUHKOV LEN (m) :	21.7	10.8
AMB. TEMP. (K) :	286.3	287.5
AMB. PRESS. (atm) :	1.000	1.000
REL. HUMID. (%) :	100.0	97.4
AIR DENSITY (kg/m^3) :	1.227	1.222
ISOTHERMAL? 1=YES :	1	1
SURFACE TEMP (K) :	286.3	287.5
HEAT TRNS 0=no ;1=std :	0	0
H2O TRNS 0=no ;1=std :	0	0
MOL. WT. (kg/kg-mol) :	57.80	57.80
GAS TEMP. (K) :	286.3	287.5
GAS DENSITY (kg/m^3) :	2.463	2.452
HEAT CAP CONST :	1958.0	1958.0
HEAT CAP POWER :	1.000	1.000
UPPER CONC. (mol frac) :	0.000100	0.000100
LOWER CONC. (mol frac) :	0.000100	0.000100
RECEPTOR HT. (m) :	0.0	0.0
CHEMICAL MASS FRACTION :	1.00000	1.00000
STEADY-STATE? T=TRUE :	T	T
EVOLUTION RATE (kg/s) :	10.67	10.22
SOURCE RADIUS (m) :	1.000	1.000
TOTAL MASS (kg) :	4855.00	4752.00

DEG. INPUT DATA FOR : Thorney Island (Instantaneous)
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen

TRIAL	:	TI6	TI7	TI8	TI9	TI12	TI13	TI17	TI18	TI19
U0 m/s)	:	2.8	3.4	2.4	1.7	2.5	7.3	5.0	7.4	6.4
MEAS. HEIGHT (m)	:	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
ROUGHNESS LENGTH (m)	:	0.01800	0.01800	0.01200	0.00800	0.01800	0.01000	0.01800	0.00500	0.01000
PG STAB CLASS	:	4	5	4	6	5	4	4	4	4
AVERAGING TIME (s)	:	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
MONIN-OBUHKOV LEN (m)	:	9999.0	90.0	-9.1	1.5	10.0	-90.9	-200.0	-43.5	333.3
AMB. TEMP. (K)	:	291.8	290.5	290.7	291.5	283.3	286.9	289.2	289.7	286.5
AMB. PRESS. (atm)	:	1.000	1.008	1.009	1.006	1.000	1.006	0.995	0.994	0.993
REL. HUMID. (%)	:	74.8	80.7	87.6	87.3	66.2	74.1	94.0	81.3	94.8
AIR DENSITY (kg/m^3)	:	1.203	1.219	1.218	1.211	1.243	1.234	1.208	1.205	1.218
ISOTHERMAL? 1=YES	:	1	1	1	1	0	1	0	0	1
SURFACE TEMP (K)	:	291.8	290.5	290.7	291.5	285.1	286.9	291.0	297.5	286.5
HEAT TRNS 0=no ;1=std	:	0	0	0	0	1	0	1	1	0
H2O TRNS 0=no ;1=std	:	0	0	0	0	0	0	0	0	0
MOL. WT. (kg/kg-mol)	:	47.69	50.58	47.11	46.24	68.49	57.80	121.38	54.04	61.27
GAS TEMP. (K)	:	291.8	290.5	290.7	291.5	283.3	286.9	289.2	289.7	286.5
GAS DENSITY (kg/m^3)	:	1.993	2.141	1.994	1.947	2.949	2.472	5.093	2.262	2.590
HEAT CAP CONST	:	-4209.1	-2446.2	-4562.9	-5093.6	8478.9	1958.0	40741.8	-335.6	4074.7
HEAT CAP POWER	:	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
UPPER CONC. (mol frac)	:	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100
LOWER CONC. (mol frac)	:	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100	0.000100
RECEPTOR HT. (m)	:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHEMICAL MASS FRACTION	:	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
STEADY-STATE? T=TRUE	:	F	F	F	F	F	F	F	F	F
EVOLUTION RATE (kg/s)	:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOURCE RADIUS (m)	:	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000
TOTAL MASS (kg)	:	3147.00	4249.00	3958.00	3866.00	5736.00	4800.00	8711.00	3881.00	5477.00

FOCUS INPUT DATA FOR : Burro
CHEMICAL RELEASED : Liquefied natural gas
TITLE SCREEN:
TRIAL NAME : bu2 bu3 bu4 bu5 bu6 bu7 bu8 bu9
TYPE OF UNITS : Metric units

		bu2	bu3	bu4	bu5	bu6	bu7	bu8	bu9
MATERIAL SCREEN:									
PRIMARY CHEMICAL NO.	:	1	1	1	1	1	1	1	1
MOLE FRACTION	:	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
MATERIAL TEMPERATURE (C)	:	-162.55	-162.55	-162.55	-162.55	-162.55	-162.55	-162.55	-162.55
MATERIAL PRESSURE (kPa)	:	93.9	94.3	94.5	94.1	93.5	94.0	94.1	94.0
WEATHER SCREEN:									
WIND SPEED @ 10M (m/s)	:	6.02	5.93	10.27	8.40	10.40	9.73	2.57	6.69
REL. HUMIDITY (%)	:	7.10	5.20	2.70	5.90	5.10	7.40	4.50	14.40
AMBIENT TEMP. (C)	:	38.12	34.60	35.90	41.12	39.52	33.31	32.87	35.37
P-G CLASS	:	C	C	C	C	C	D	E	D
RELEASE SCREEN:									
CONTINUOUS RELEASE									
RELEASE DURATION (min)	:	2.883	2.783	2.917	3.167	2.150	2.900	1.783	1.317
PIPE DIAMETER (m)	:	0.15000	0.15000	0.15000	0.15000	0.15000	0.15000	0.15000	0.15000
EXIT AREA (m2)	:	0.01767	0.01767	0.01767	0.01767	0.01767	0.01767	0.01767	0.01767
FLOW RATE (kg/s)	:	86.1000	87.9800	86.3600	81.2500	92.2200	99.4600	116.9300	135.9800
RELEASE HEIGHT (m)	:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ANGLE FROM HORIZON TO EXIT	:	270.0	270.0	270.0	270.0	270.0	270.0	270.0	270.0
REGULATED RELEASE									
TERRAIN SCREEN:									
SURFACE ROUGHNESS (m)	:	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020
CALM OPEN SEA									
SURFACE TEMP. (C)	:	38.12	34.60	35.90	41.12	39.52	33.81	32.87	35.37
DIKING SCREEN:									
UNCONFINED									
VD/VE SCREEN:									
TRACK ONE COMPONENT									
EXPRESS CONCENTRATION IN PPM									
LOWEST CONC. LIMIT, PPM	:	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000
MIDDLE CONC. LIMIT, PPM	:	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000
HIGHEST CONC. LIMIT, PPM	:	400.000	400.000	400.000	400.000	400.000	400.000	400.000	400.000
DISP. COEFF. AVG. TIME (min)	:	0.667	1.667	1.333	2.167	1.167	2.333	1.333	0.833
USE DEFAULT TIME STEP POSITIONS									

FOCUS INPUT DATA FOR : Coyote
CHEMICAL RELEASED : Liquefied natural gas . Methane is at least 86% in c
TITLE SCREEN:
TRIAL NAME : co3 co5 co6
TYPE OF UNITS : Metric units

		co3	co5	co6
MATERIAL SCREEN:				
PRIMARY CHEMICAL NO.	:	1	1	1
MOLE FRACTION	:	1.00000	1.00000	1.00000
MATERIAL TEMPERATURE (C)	:	-162.55	-162.55	-162.55
MATERIAL PRESSURE (kPa)	:	93.6	93.9	94.2
WEATHER SCREEN:				
WIND SPEED @ 10M (m/s)	:	6.68	10.99	5.74
REL. HUMIDITY (%)	:	11.30	22.10	22.80
AMBIENT TEMP. (C)	:	38.30	28.34	24.11
P-G CLASS	:	C	C	D
RELEASE SCREEN:				
CONTINUOUS RELEASE				
RELEASE DURATION (min)	:	1.083	1.633	1.367
PIPE DIAMETER (m)	:	0.15000	0.15000	0.15000
EXIT AREA (m2)	:	0.01767	0.01767	0.01767
FLOW RATE (kg/s)	:	100.6700	129.0200	123.0300
RELEASE HEIGHT (m)	:	0.000	0.000	0.000
ANGLE FROM HORIZON TO EXIT	:	270.0	270.0	270.0
REGULATED RELEASE				
TERRAIN SCREEN:				
SURFACE ROUGHNESS (m)	:	0.00020	0.00020	0.00020
CALM OPEN SEA				
SURFACE TEMP. (C)	:	38.30	28.34	24.11
DIKING SCREEN:				
UNCONFINED				
VD/VE SCREEN:				
TRACK ONE COMPONENT				
EXPRESS CONCENTRATION IN PPM				
LOWEST CONC. LIMIT, PPM	:	100.000	100.000	100.000
MIDDLE CONC. LIMIT, PPM	:	200.000	300.000	200.000
HIGHEST CONC. LIMIT, PPM	:	400.000	400.000	400.000
DISP. COEFF. AVG. TIME (min)	:	0.333	1.500	1.167
USE DEFAULT TIME STEP POSITIONS				

FOCUS INPUT DATA FOR	:	Desert Tortoise			
CHEMICAL RELEASED	:	Anhydrous Ammonia			
TITLE SCREEN:					
TRIAL NAME	:	dt1	dt2	dt3	dt4
TYPE OF UNITS	:	Metric units			
MATERIAL SCREEN:					
PRIMARY CHEMICAL NO.	:	53	53	53	53
MOLE FRACTION	:	1.00000	1.00000	1.00000	1.00000
MATERIAL TEMPERATURE (C)	:	21.55	20.15	22.15	24.15
MATERIAL PRESSURE (kPa)	:	1013.3	1116.6	1137.9	1179.4
WEATHER SCREEN:					
WIND SPEED @ 10M (m/s)	:	9.68	7.63	9.28	6.22
REL. HUMIDITY (%)	:	13.20	17.50	14.80	21.30
AMBIENT TEMP. (C)	:	28.88	30.48	33.92	32.48
P-G CLASS	:	D	D	D	E
RELEASE SCREEN:					
CONTINUOUS RELEASE					
RELEASE DURATION (min)	:	2.100	4.250	2.767	6.350
PIPE DIAMETER (m)	:	0.08100	0.09450	0.09450	0.09450
EXIT AREA (m2)	:	0.00515	0.00701	0.00701	0.00701
FLOW RATE (kg/s)	:	79.7000	111.5000	130.7000	96.7000
RELEASE HEIGHT (m)	:	0.790	0.790	0.790	0.790
ANGLE FROM HORIZON TO EXIT	:	0.0	0.0	0.0	0.0
REGULATED RELEASE					
TERRAIN SCREEN:					
SURFACE ROUGHNESS (m)	:	0.00300	0.00300	0.00300	0.00300
MUD FLATS					
SURFACE TEMP. (C)	:	31.65	30.65	31.65	30.85
DIKING SCREEN:					
UNCONFINED					
VD/VE SCREEN:					
TRACK ONE COMPONENT					
EXPRESS CONCENTRATION IN PPM					
LOWEST CONC. LIMIT, PPM	:	100.000	100.000	100.000	100.000
MIDDLE CONC. LIMIT, PPM	:	200.000	200.000	200.000	200.000
HIGHEST CONC. LIMIT, PPM	:	400.000	400.000	400.000	400.000
DISP. COEFF. AVG. TIME (min)	:	1.333	2.667	2.000	5.000
USE DEFAULT TIME STEP POSITIONS					

FOCUS INPUT DATA FOR	:	Goldfish		
CHEMICAL RELEASED	:	Hydrogen fluoride		
TITLE SCREEN:				
TRIAL NAME	:	gf1	gf2	gf3
TYPE OF UNITS	:	Metric units		
MATERIAL SCREEN:				
PRIMARY CHEMICAL NO.	:	50	50	50
MOLE FRACTION	:	1.00000	1.00000	1.00000
MATERIAL TEMPERATURE (C)	:	40.05	38.05	39.05
MATERIAL PRESSURE (kPa)	:	689.0	744.7	757.9
WEATHER SCREEN:				
WIND SPEED @ 10M (m/s)	:	7.30	5.38	7.47
REL. HUMIDITY (%)	:	4.90	10.70	17.70
AMBIENT TEMP. (C)	:	37.25	36.23	34.46
P-G CLASS	:	D	D	D
RELEASE SCREEN:				
CONTINUOUS RELEASE				
RELEASE DURATION (min)	:	2.083	6.000	6.000
PIPE DIAMETER (m)	:	0.04190	0.02420	0.02420
EXIT AREA (m2)	:	0.00138	0.00046	0.00046
FLOW RATE (kg/s)	:	27.5700	10.4600	10.2700
RELEASE HEIGHT (m)	:	1.000	1.000	1.000
ANGLE FROM HORIZON TO EXIT	:	0.0	0.0	0.0
REGULATED RELEASE				
TERRAIN SCREEN:				
SURFACE ROUGHNESS (m)	:	0.00300	0.00300	0.00300
MUD FLATS				
SURFACE TEMP. (C)	:	37.25	36.23	34.46
DIKING SCREEN:				
UNCONFINED				
VD/VE SCREEN:				
TRACK ONE COMPONENT				
EXPRESS CONCENTRATION IN PPM				
LOWEST CONC. LIMIT, PPM	:	30.000	30.000	30.000
MIDDLE CONC. LIMIT, PPM	:	60.000	60.000	60.000
HIGHEST CONC. LIMIT, PPM	:	120.000	120.000	120.000
DISP. COEFF. AVG. TIME (min)	:	1.472	1.472	1.472
USE DEFAULT TIME STEP POSITIONS				

FOCUS INPUT DATA FOR : Hanford (continuous)
CHEMICAL RELEASED : Krypton-85
TITLE SCREEN:
TRIAL NAME : hc1 hc2 hc3 hc4 hc5
TYPE OF UNITS : Metric units

		hc1	hc2	hc3	hc4	hc5
MATERIAL SCREEN:						
PRIMARY CHEMICAL NO.	:	62	62	62	62	62
MOLE FRACTION	:	1.00000	1.00000	1.00000	1.00000	1.00000
MATERIAL TEMPERATURE (C)	:	17.72	12.28	15.78	13.50	5.67
MATERIAL PRESSURE (kPa)	:	101.3	101.3	101.3	101.3	101.3
WEATHER SCREEN:						
WIND SPEED @ 10M (m/s)	:	3.40	5.60	10.31	5.36	4.22
REL. HUMIDITY (%)	:	20.00	20.00	20.00	20.00	20.00
AMBIENT TEMP. (C)	:	17.72	12.28	15.78	13.50	5.67
P-G CLASS	:	F	C	C	C	E
RELEASE SCREEN:						
CONTINUOUS RELEASE						
RELEASE DURATION (min)	:	15.467	15.083	14.250	9.967	19.850
PIPE DIAMETER (m)	:	0.10553	0.05930	0.06734	0.10649	0.08611
EXIT AREA (m2)	:	0.00875	0.00276	0.00356	0.00891	0.00582
FLOW RATE (kg/s)	:	0.0117	0.0120	0.0278	0.0388	0.0171
RELEASE HEIGHT (m)	:	1.000	1.000	1.000	1.000	1.000
ANGLE FROM HORIZON TO EXIT	:	0.0	0.0	0.0	0.0	0.0
REGULATED RELEASE						
TERRAIN SCREEN:						
SURFACE ROUGHNESS (m)	:	0.03000	0.03000	0.03000	0.03000	0.03000
TALL GRASS						
SURFACE TEMP. (C)	:	17.72	12.28	15.78	13.50	5.67
DIKING SCREEN:						
UNCONFINED						
VD/VE SCREEN:						
TRACK ONE COMPONENT						
EXPRESS CONCENTRATION IN PPM						
LOWEST CONC. LIMIT, PPM	:	0.100	0.100	0.100	0.100	0.100
MIDDLE CONC. LIMIT, PPM	:	0.200	0.200	0.200	0.200	0.200
HIGHEST CONC. LIMIT, PPM	:	0.400	0.400	0.400	0.400	0.400
DISP. COEFF. AVG. TIME (min)	:	7.680	14.080	4.480	4.480	8.960
USE DEFAULT TIME STEP POSITIONS						

FOCUS INPUT DATA FOR : Hanford (instantaneous)
CHEMICAL RELEASED : Krypton-85
TITLE SCREEN:
TRIAL NAME : hi2 hi3 hi5 hi6 hi7 hi8
TYPE OF UNITS : Metric units

		hi2	hi3	hi5	hi6	hi7	hi8
MATERIAL SCREEN:							
PRIMARY CHEMICAL NO.	:	62	62	62	62	62	62
MOLE FRACTION	:	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
MATERIAL TEMPERATURE (C)	:	18.39	11.94	15.56	15.11	12.44	4.61
MATERIAL PRESSURE (kPa)	:	101.3	101.3	101.3	101.3	101.3	101.3
WEATHER SCREEN:							
WIND SPEED @ 10M (m/s)	:	3.62	5.99	11.06	10.42	6.37	2.92
REL. HUMIDITY (%)	:	20.00	20.00	20.00	20.00	20.00	20.00
AMBIENT TEMP. (C)	:	18.39	11.94	15.56	15.11	12.44	4.61
P-G CLASS	:	F	D	C	C	C	E
RELEASE SCREEN:							
INSTANTANEOUS RELEASE							
MASS SPILLED (kg)	:	10.00	10.00	10.00	10.00	10.00	10.00
TERRAIN SCREEN:							
SURFACE ROUGHNESS (m)	:	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000
TALL GRASS							
SURFACE TEMP. (C)	:	18.39	11.94	15.56	15.11	12.44	4.61
DIKING SCREEN:							
UNCONFINED							
VD/VE SCREEN:							
TRACK ONE COMPONENT							
EXPRESS CONCENTRATION IN PPM							
LOWEST CONC. LIMIT, PPM	:	0.100	0.100	0.100	0.100	0.100	0.100
MIDDLE CONC. LIMIT, PPM	:	0.200	0.200	0.200	0.200	0.200	0.200
HIGHEST CONC. LIMIT, PPM	:	0.400	0.400	0.400	0.400	0.400	0.400
DISP. COEFF. AVG. TIME (min)	:	0.080	0.080	0.080	0.080	0.080	0.080
USE DEFAULT TIME STEP POSITIONS							

FOCUS INPUT DATA FOR : Maplin Sands
CHEMICAL RELEASED : Liquified Natural Gas
TITLE SCREEN:

TRIAL NAME	:	ms27	ms29	ms34	ms35
TYPE OF UNITS	:	Metric units			
MATERIAL SCREEN:					
PRIMARY CHEMICAL NO.	:	1	1	1	1
MOLE FRACTION	:	1.00000	1.00000	1.00000	1.00000
MATERIAL TEMPERATURE (C)	:	-162.45	-162.45	-162.45	-162.45
MATERIAL PRESSURE (kPa)	:	101.3	101.3	101.3	101.3
WEATHER SCREEN:					
WIND SPEED @ 10M (m/s)	:	5.60	7.40	8.50	9.60
REL. HUMIDITY (%)	:	53.00	71.00	90.00	77.00
AMBIENT TEMP. (C)	:	14.95	16.15	15.25	16.15
P-G CLASS	:	D	D	D	D
RELEASE SCREEN:					
CONTINUOUS RELEASE					
RELEASE DURATION (min)	:	2.667	3.750	1.583	2.250
PIPE DIAMETER (m)	:	0.15000	0.15000	0.15000	0.15000
EXIT AREA (m2)	:	0.01767	0.01767	0.01767	0.01767
FLOW RATE (kg/s)	:	23.2100	29.1600	21.5100	27.0900
RELEASE HEIGHT (m)	:	0.000	0.000	0.000	0.000
ANGLE FROM HORIZON TO EXIT	:	270.0	270.0	270.0	270.0
REGULATED RELEASE					
TERRAIN SCREEN:					
SURFACE ROUGHNESS (m)	:	0.00030	0.00030	0.00030	0.00030
CALM OPEN SEA					
SURFACE TEMP. (C)	:	15.65	16.35	15.35	16.65
DIKING SCREEN:					
UNCONFINED					
VD/VE SCREEN:					
TRACK ONE COMPONENT					
EXPRESS CONCENTRATION IN PPM					
LOWEST CONC. LIMIT, PPM	:	100.000	100.000	100.000	100.000
MIDDLE CONC. LIMIT, PPM	:	200.000	200.000	200.000	200.000
HIGHEST CONC. LIMIT, PPM	:	400.000	400.000	400.000	400.000
DISP. COEFF. AVG. TIME (min)	:	0.050	0.050	0.050	0.050
USE DEFAULT TIME STEP POSITIONS					

FOCUS INPUT DATA FOR : Maplin Sands
CHEMICAL RELEASED : Liquified Propane Gas
TITLE SCREEN:

TRIAL NAME	:	ms42	ms43	ms46	ms47	ms49	ms50	ms52	ms54
TYPE OF UNITS	:	Metric units							
MATERIAL SCREEN:									
PRIMARY CHEMICAL NO.	:	3	3	3	3	3	3	3	3
MOLE FRACTION	:	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
MATERIAL TEMPERATURE (C)	:	-43.05	-43.05	-43.05	-43.05	-43.05	-43.05	-43.05	-43.05
MATERIAL PRESSURE (kPa)	:	101.3	101.3	101.3	101.3	101.3	101.3	101.3	101.3
WEATHER SCREEN:									
WIND SPEED @ 10M (m/s)	:	4.00	5.80	8.10	6.20	5.50	7.90	7.40	3.70
REL. HUMIDITY (%)	:	80.00	80.00	71.00	78.00	88.00	79.00	53.00	85.00
AMBIENT TEMP. (C)	:	18.35	17.05	18.75	17.45	13.35	10.45	11.85	8.45
P-G CLASS	:	D	D	D	D	D	D	D	D
RELEASE SCREEN:									
CONTINUOUS RELEASE									
RELEASE DURATION (min)	:	3.000	5.500	6.000	3.500	1.500	2.667	2.333	3.000
PIPE DIAMETER (m)	:	0.15000	0.15000	0.15000	0.15000	0.15000	0.15000	0.15000	0.15000
EXIT AREA (m2)	:	0.01767	0.01767	0.01767	0.01767	0.01767	0.01767	0.01767	0.01767
FLOW RATE (kg/s)	:	20.8700	19.2000	23.3700	32.5700	16.7100	35.8900	44.2500	19.2000
RELEASE HEIGHT (m)	:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ANGLE FROM HORIZON TO EXIT	:	270.0	270.0	270.0	270.0	270.0	270.0	270.0	270.0
REGULATED RELEASE									
TERRAIN SCREEN:									
SURFACE ROUGHNESS (m)	:	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
CALM OPEN SEA									
SURFACE TEMP. (C)	:	18.55	18.95	17.35	17.15	13.05	9.95	11.95	9.45
DIKING SCREEN:									
UNCONFINED									
VD/VE SCREEN:									
TRACK ONE COMPONENT									
EXPRESS CONCENTRATION IN PPM									
LOWEST CONC. LIMIT, PPM	:	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000
MIDDLE CONC. LIMIT, PPM	:	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000
HIGHEST CONC. LIMIT, PPM	:	400.000	400.000	400.000	400.000	400.000	400.000	400.000	400.000
DISP. COEFF. AVG. TIME (min)	:	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
USE DEFAULT TIME STEP POSITIONS									

FOCUS INPUT DATA FOR	:	Prairie Grass, sec							
CHEMICAL RELEASED	:	Sulfur dioxide							
TITLE SCREEN:									
TRIAL NAME	:	pg7	pg8	pg9	pg10	pg13	pg15	pg16	pg17
TYPE OF UNITS	:	Metric units							
MATERIAL SCREEN:									
PRIMARY CHEMICAL NO.	:	44	44	44	44	44	44	44	44
MOLE FRACTION	:	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
MATERIAL TEMPERATURE (C)	:	32.00	32.00	28.00	31.00	20.00	22.00	28.00	27.00
MATERIAL PRESSURE (kPa)	:	101.3	101.3	101.3	101.3	101.3	101.3	101.3	101.3
WEATHER SCREEN:									
WIND SPEED @ 10M (m/s)	:	4.93	5.88	3.38	5.38	2.74	3.98	3.75	4.52
REL. HUMIDITY (%)	:	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
AMBIENT TEMP. (C)	:	32.00	32.00	28.00	31.00	20.00	22.00	28.00	27.00
P-G CLASS	:	B	C	C	B	F	A	A	D
RELEASE SCREEN:									
CONTINUOUS RELEASE									
RELEASE DURATION (min)	:	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000
PIPE DIAMETER (m)	:	0.05080	0.05080	0.05080	0.05080	0.05080	0.05080	0.05080	0.05080
EXIT AREA (m2)	:	0.00203	0.00203	0.00203	0.00203	0.00203	0.00203	0.00203	0.00203
FLOW RATE (kg/s)	:	0.0899	0.0911	0.0920	0.0921	0.0611	0.0955	0.0930	0.0565
RELEASE HEIGHT (m)	:	0.450	0.450	0.450	0.450	0.450	0.450	0.450	0.450
ANGLE FROM HORIZON TO EXIT	:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
REGULATED RELEASE									
TERRAIN SCREEN:									
SURFACE ROUGHNESS (m)	:	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600
CUT GRASS									
SURFACE TEMP. (C)	:	32.00	32.00	28.00	31.00	20.00	22.00	28.00	27.00
DIKING SCREEN:									
UNCONFINED									
VD/VE SCREEN:									
TRACK ONE COMPONENT									
EXPRESS CONCENTRATION IN PPM									
LOWEST CONC. LIMIT, PPM	:	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
MIDDLE CONC. LIMIT, PPM	:	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
HIGHEST CONC. LIMIT, PPM	:	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000
DISP. COEFF. AVG. TIME (min)	:	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000
USE DEFAULT TIME STEP POSITIONS									

FOCUS INPUT DATA FOR	:	Thorney Island (continuous)	
CHEMICAL RELEASED	:	Mixture of Freon-12 and Nitrogen	
TITLE SCREEN:			
TRIAL NAME	:	tc45	tc47
TYPE OF UNITS	:	Metric units	
MATERIAL SCREEN:			
PRIMARY CHEMICAL NO.	:	56	56
MOLE FRACTION	:	0.32043	0.32043
SECONDARY CHEMICAL NO.	:	16	16
MOLE FRACTION	:	0.67957	0.67957
MATERIAL TEMPERATURE (C)	:	13.10	14.30
MATERIAL PRESSURE (kPa)	:	101.3	101.3
WEATHER SCREEN:			
WIND SPEED @ 10M (m/s)	:	2.30	1.50
REL. HUMIDITY (%)	:	100.00	97.40
AMBIENT TEMP. (C)	:	13.10	14.30
P-G CLASS	:	E	F
RELEASE SCREEN:			
CONTINUOUS RELEASE			
RELEASE DURATION (min)	:	7.583	7.750
PIPE DIAMETER (m)	:	2.00000	2.00000
EXIT AREA (m2)	:	3.14159	3.14159
FLOW RATE (kg/s)	:	10.6700	10.2200
RELEASE HEIGHT (m)	:	0.000	0.000
ANGLE FROM HORIZON TO EXIT	:	0.0	0.0
REGULATED RELEASE			
TERRAIN SCREEN:			
SURFACE ROUGHNESS (m)	:	0.01000	0.01000
CUT GRASS			
SURFACE TEMP. (C)	:	12.80	14.50
DIKING SCREEN:			
UNCONFINED			
VD/VE SCREEN:			
TRACK ONE COMPONENT			
EXPRESS CONCENTRATION IN PPM			
LOWEST CONC. LIMIT, PPM	:	100.000	100.000
MIDDLE CONC. LIMIT, PPM	:	200.000	200.000
HIGHEST CONC. LIMIT, PPM	:	400.000	400.000
DISP. COEFF. AVG. TIME (min)	:	0.500	0.500
USE DEFAULT TIME STEP POSITIONS			

FOCUS INPUT DATA FOR : Thorney Island (instantaneous)
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen

TITLE SCREEN:										
TRIAL NAME	:	ti6	ti7	ti8	ti9	ti12	ti13	ti17	ti18	ti19
TYPE OF UNITS	:	Metric units								
MATERIAL SCREEN:										
PRIMARY CHEMICAL NO.	:	56	56	56	56	56	56	56	56	56
MOLE FRACTION	:	0.21172	0.24280	0.20548	0.19613	0.43538	0.32043	1.00000	0.28000	0.35774
SECONDARY CHEMICAL NO.	:	16	16	16	16	16	16	16	16	16
MOLE FRACTION	:	0.78828	0.75720	0.79452	0.80387	0.56462	0.67957	0.00000	0.72000	0.64225
MATERIAL TEMPERATURE (C)	:	18.68	17.31	17.53	18.30	10.14	13.73	16.06	16.51	13.32
MATERIAL PRESSURE (kPa)	:	101.3	102.1	102.2	101.9	101.3	101.9	100.8	100.7	100.6
WEATHER SCREEN:										
WIND SPEED @ 10M (m/s)	:	2.80	3.40	2.40	1.70	2.50	7.30	5.00	7.40	6.40
REL. HUMIDITY (%)	:	74.80	80.70	87.60	87.30	66.20	74.10	94.00	81.30	94.80
AMBIENT TEMP. (C)	:	18.68	17.31	17.53	18.30	10.14	13.73	16.06	16.51	13.32
P-G CLASS	:	D	E	D	F	E	D	D	D	D
RELEASE SCREEN:										
INSTANTANEOUS RELEASE										
MASS SPILLED (kg)	:	3147.00	4249.00	3958.00	3866.00	5736.00	4800.00	8711.00	3881.00	5477.00
TERRAIN SCREEN:										
SURFACE ROUGHNESS (m)	:	0.01800	0.01800	0.01200	0.00800	0.01800	0.01000	0.01800	0.00500	0.01000
CUT GRASS										
SURFACE TEMP. (C)	:	18.68	17.70	18.40	18.30	12.00	14.70	17.90	24.30	13.00
DIKING SCREEN:										
UNCONFINED										
VD/VE SCREEN:										
TRACK MIXTURE										
EXPRESS CONCENTRATION IN PPM										
LOWEST CONC. LIMIT, PPM	:	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000
MIDDLE CONC. LIMIT, PPM	:	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000
HIGHEST CONC. LIMIT, PPM	:	400.000	400.000	400.000	400.000	400.000	400.000	400.000	400.000	400.000
DISP. COEFF. AVG. TIME (min)	:	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
USE DEFAULT TIME STEP POSITIONS										

GASTAR INPUT DATA FOR : Burro
CHEMICAL RELEASED : Liquefied natural gas

TRIAL NAME	:	BU2	BU3	BU4	BU5	BU6	BU7	BU8	BU9
CHEMICAL NO.	:	9	9	9	9	9	9	9	9
WIND SPEED @ 10M (m/s)	:	6.02	5.93	10.27	8.40	10.40	9.73	2.57	6.69
SURFACE ROUGHNESS (m)	:	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020
P-G CLASS	:	C	C	C	C	C	D	E	D
M-O LENGTH (m)	:	-12.947	-5.814	-49.310	-35.634	-53.393	-148.633	15.478	-2288.323
AIR TEMP. (K)	:	311.27	307.75	309.05	314.27	312.57	306.96	306.02	308.52
ATM. PRESSURE (mb)	:	939.28	948.40	945.36	941.31	935.23	940.30	941.31	940.30
SFC. TEMP. (K)	:	311.27	307.75	309.05	314.27	312.67	306.96	306.02	308.52
REL. HUMIDITY (%)	:	7.10	5.20	2.70	5.90	5.10	7.40	4.50	14.40
REL. TYPE: I-INSTANTANEOUS, C and A-CONTINUOUS, T-TIME-VARYING	:	C	C	C	C	C	C	C	C
REL. TYPE: I-ISOTHERMAL, T-THERMAL, A-AEROSOL	:	T	T	T	T	T	T	T	T
INIT. CLOUD DENS. (kg/m^3)	:	1.769	1.766	1.738	1.734	1.739	1.848	1.840	1.909
PHYSICAL SOURCE WIDHT (m)	:	35.910	36.300	36.090	34.890	37.170	38.600	41.850	45.130
INIT. FLOW RATE (m^3/s)	:	48.6755	49.8309	50.0201	46.8545	53.0295	53.3249	63.5599	71.2425
INIT. CONCENTRATION (mol)	:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
INIT. TEMPERATURE (K)	:	111.60	111.60	111.60	111.60	111.60	111.60	111.60	111.60
SIMULATION DURATION (s)	:	125.93	125.93	115.56	118.92	115.38	147.62	544.44	240.35
AVERAGING TIME (s)	:	40.00	100.00	80.00	130.00	70.00	140.00	80.00	50.00

GASTAR INPUT DATA FOR : Coyote .
CHEMICAL RELEASED : Liquefied natural gas . Methane is at least 86% in c

TRIAL NAME	:	CO3	CO5	CO6
CHEMICAL NO.	:	9	9	9
WIND SPEED @ 10M (m/s)	:	6.68	10.99	5.74
SURFACE ROUGHNESS (m)	:	0.00020	0.00020	0.00020
P-G CLASS	:	C	C	D
M-O LENGTH (m)	:	-12.197	-31.665	56.085
AIR TEMP. (K)	:	311.45	301.49	297.26
ATM. PRESSURE (mb)	:	936.24	939.28	942.32
SFC. TEMP. (K)	:	311.45	301.49	297.26
REL. HUMIDITY (%)	:	11.30	22.10	22.80
REL. TYPE: I-INSTANTANEOUS, C and A-CONTINUOUS, T-TIME-VARYING	:	C	C	C
REL. TYPE: I-ISOTHERMAL, T-THERMAL, A-AEROSOL	:	T	T	T
INIT. CLOUD DENS. (kg/m^3)	:	1.970	2.045	1.940
PHYSICAL SOURCE WIDHT (m)	:	38.830	43.960	42.930
INIT. FLOW RATE (m^3/s)	:	51.0978	63.0772	63.4094
INIT. CONCENTRATION (mol)	:	1.0000	1.0000	1.0000
INIT. TEMPERATURE (K)	:	111.60	111.60	111.60
SIMULATION DURATION (s)	:	150.00	141.24	186.96
AVERAGING TIME (s)	:	50.00	90.00	70.00

GASTAR INPUT DATA FOR : Desert Tortoise
CHEMICAL RELEASED : Anhydrous Ammonia

TRIAL NAME	:	DT1	DT2	DT3	DT4
CHEMICAL NO.	:	1	1	1	1
WIND SPEED @ 10M (m/s)	:	9.68	7.63	9.28	6.22
SURFACE ROUGHNESS (m)	:	0.00300	0.00300	0.00300	0.00300
P-G CLASS	:	D	D	D	E
M-O LENGTH (m)	:	93.201	84.333	847.250	41.002
AIR TEMP. (K)	:	302.03	303.63	307.07	305.63
ATM. PRESSURE (mb)	:	908.89	909.90	906.86	902.31
SFC. TEMP. (K)	:	304.80	303.80	304.80	304.00
REL. HUMIDITY (%)	:	13.20	17.50	14.30	21.30
REL. TYPE: I-INSTANTANEOUS, C and A-CONTINUOUS, T-TIME-VARYING	:	C	C	C	C
REL. TYPE: I-ISOTHERMAL, T-THERMAL, A-AEROSOL	:	A	A	A	A
INIT. MASS FLUX (kg/s)	:	79.7	111.5	130.7	96.7
INIT. DIAMETER (m)	:	1.037	1.194	1.213	1.242
INIT. CLOUD DENS. (kg/m^3)	:	4.166	4.276	4.112	3.953
INIT. CONCENTRATION (mol)	:	1.0000	1.0000	1.0000	1.0000
INIT. TEMPERATURE (K)	:	237.54	237.57	237.50	237.41
INIT. AEROSOL FRACTION	:	0.813	0.817	0.811	0.804
INIT. HEIGHT (m)	:	0.79	0.79	0.79	0.79
INIT. THETA (deg)	:	0	0	0	0
INIT. PHI (deg)	:	0	0	0	0
SIMU. DIST. FOR OBJET (m)	:	500	500	500	500
SIMULATION DURATION (s)	:	208.11	237.93	208.11	277.78
AVERAGING TIME (s)	:	30.00	160.00	120.00	300.00

GASTAR INPUT DATA FOR : Maplin Sands
CHEMICAL RELEASED : Liquified Natural Gas

TRIAL NAME	MS27	MS29	MS34	MS35
CHEMICAL NO.	9	9	9	9
WIND SPEED @ 10M (m/s)	5.60	7.40	8.50	9.60
SURFACE ROUGHNESS (m)	0.00030	0.00030	0.00030	0.00030
P-G CLASS	D	D	D	D
M-O LENGTH (m)	-36.953	1220.632	-102.720	-81.578
AIR TEMP. (K)	288.10	289.30	288.40	289.30
ATM. PRESSURE (mb)	1013.25	1013.25	1013.25	1013.25
SFC. TEMP. (K)	288.80	290.00	289.00	289.80
REL. HUMIDITY (%)	53.00	71.00	90.00	77.00
REL. TYPE: I=INSTANTANEOUS, C and A=CONTINUOUS, T=TIME-VARYING	C	C	C	C
REL. TYPE: I=ISOTHERMAL, T=THERMAL, A=AEROSOL	T	T	T	T
INIT. CLOUD DENS. (kg/m^3)	1.868	1.775	1.819	1.790
PHYSICAL SOURCE WIDHT (m)	18.600	20.900	18.000	20.100
INIT. FLOW RATE (m^3/s)	12.4235	16.4243	11.8246	15.1374
INIT. CONCENTRATION (mol)	1.0000	1.0000	1.0000	1.0000
INIT. TEMPERATURE (K)	111.70	111.70	111.70	111.70
SIMULATION DURATION (s)	216.07	154.46	121.06	142.29
AVERAGING TIME (s)	3.00	3.00	3.00	3.00

GASTAR INPUT DATA FOR : Maplin Sands
CHEMICAL RELEASED : Liquified Propane Gas

TRIAL NAME	MS42	MS43	MS46	MS47	MS49	MS50	MS52	MS54
CHEMICAL NO.	12	12	12	12	12	12	12	12
WIND SPEED @ 10M (m/s)	4.00	5.80	8.10	6.20	5.50	7.90	7.40	3.70
SURFACE ROUGHNESS (m)	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
P-G CLASS	D	D	D	D	D	D	D	D
M-O LENGTH (m)	99.735	9999.000	750.151	294.223	69.596	208.744	224.903	67.837
AIR TEMP. (K)	291.50	290.20	291.90	290.60	286.50	283.60	285.00	281.60
ATM. PRESSURE (mb)	1013.25	1013.25	1013.25	1013.25	1013.25	1013.25	1013.25	1013.25
SFC. TEMP. (K)	291.70	292.10	290.50	290.30	286.20	283.10	285.10	282.60
REL. HUMIDITY (%)	80.00	80.00	71.00	78.00	88.00	79.00	63.00	85.00
REL. TYPE: I=INSTANTANEOUS, C and A=CONTINUOUS, T=TIME-VARYING	C	C	C	C	C	C	C	C
REL. TYPE: I=ISOTHERMAL, T=THERMAL, A=AEROSOL	T	T	T	T	T	T	T	T
INIT. CLOUD DENS. (kg/m^3)	2.318	2.318	2.319	2.314	2.309	2.318	2.315	2.319
PHYSICAL SOURCE WIDHT (m)	14.900	14.300	15.700	18.600	13.300	19.500	21.700	14.300
INIT. FLOW RATE (m^3/s)	9.0018	8.2815	10.0755	14.0771	7.2355	15.4803	19.1123	8.2796
INIT. CONCENTRATION (mol)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
INIT. TEMPERATURE (K)	231.10	231.10	231.10	231.10	231.10	231.10	231.10	231.10
SIMULATION DURATION (s)	199.50	168.97	149.51	164.52	172.73	150.63	187.84	166.76
AVERAGING TIME (s)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00

GASTAR INPUT DATA FOR : Prairie Grass, set 1
CHEMICAL RELEASED : Sulfur dioxide

TRIAL NAME	PG7	PG8	PG9	PG10	PG13	PG15	PG16	PG17
CHEMICAL NO.	13	13	13	13	13	13	13	13
WIND SPEED @ 10M (m/s)	4.93	5.88	8.38	5.38	2.74	3.98	3.75	4.62
SURFACE ROUGHNESS (m)	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600
P-G CLASS	B	C	C	B	F	A	A	D
M-O LENGTH (m)	-8.178	-20.611	-34.123	-7.452	6.014	-7.736	-7.834	49.806
AIR TEMP. (K)	305.15	305.15	301.15	304.15	293.15	295.15	301.15	300.15
ATM. PRESSURE (mb)	1013.25	1013.25	1013.25	1013.25	1013.25	1013.25	1013.25	1013.25
SFC. TEMP. (K)	305.15	305.15	301.15	304.15	293.15	295.15	301.15	300.15
REL. HUMIDITY (%)	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
REL. TYPE: I=INSTANTANEOUS, C and A=CONTINUOUS, T=TIME-VARYING	C	C	C	C	C	C	C	C
REL. TYPE: I=ISOTHERMAL, T=THERMAL, A=AEROSOL	I	I	I	I	I	I	I	I
INIT. CLOUD DENS. (kg/m^3)	2.558	2.558	2.592	2.566	2.563	2.645	2.592	2.601
PHYSICAL SOURCE WIDHT (m)	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
INIT. FLOW RATE (m^3/s)	0.0351	0.0356	0.0355	0.0359	0.0229	0.0361	0.0359	0.0217
INIT. CONCENTRATION (mol)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
SIMULATION DURATION (s)	290.48	263.27	215.34	273.91	715.28	335.29	350.00	342.42
AVERAGING TIME (s)	600.00	600.00	600.00	600.00	600.00	600.00	600.00	600.00

GASTAR INPUT DATA FOR : Goldfish
CHEMICAL RELEASED : Hydrogen fluoride

TRIAL NAME	GF1	GF2	GF3
CHEMICAL NO.	14	14	14
WIND SPEED @ 10M (m/s)	7.30	5.38	7.47
SURFACE ROUGHNESS (m)	0.00300	0.00300	0.00300
P-G CLASS	D	D	D
M-O LENGTH (m)	101.293	173.142	40.927
AIR TEMP. (K)	310.40	309.38	307.61
ATM. PRESSURE (mb)	904.83	900.78	905.35
SFC. TEMP. (K)	310.40	309.38	307.61
REL. HUMIDITY (%)	4.90	10.70	17.70
REL. TYPE: I-INSTANTANEOUS, C and A-CONTINUOUS, T-TIME-VARYING	C	C	C
REL. TYPE: I-ISOTHERMAL, T-THERMAL, A-AEROSOL	A	A	A
INIT. CLOUD DENS. (kg/m^3)	4.683	5.065	4.900
PHYSICAL SOURCE WIDHT (m)	0.608	0.338	0.343
INIT. FLOW RATE (m^3/s)	5.9087	2.0653	2.0957
INIT. CONCENTRATION (mol)	1.0000	1.0000	1.0000
INIT. TEMPERATURE (K)	289.58	289.46	289.61
INIT. AEROSOL FRACTION	0.840	0.853	0.847
SIMULATION DURATION (s)	635.71	338.10	655.56
AVERAGING TIME (s)	88.30	88.30	88.30

GASTAR INPUT DATA FOR : Hanford (continuous)
CHEMICAL RELEASED : Krypton-85

TRIAL NAME	HC1	HC2	HC3	HC4	HC5
CHEMICAL NO.	5	5	5	5	5
WIND SPEED @ 10M (m/s)	3.40	5.60	10.31	5.36	4.22
SURFACE ROUGHNESS (m)	0.03000	0.03000	0.03000	0.03000	0.03000
P-G CLASS	F	C	C	C	E
M-O LENGTH (m)	6.875	-111.826	-186.121	-26.653	70.243
AIR TEMP. (K)	290.87	285.43	288.93	286.65	278.82
ATM. PRESSURE (mb)	1013.25	1013.25	1013.25	1013.25	1013.25
SFC. TEMP. (K)	290.87	285.43	288.93	286.65	278.82
REL. HUMIDITY (%)	20.00	20.00	20.00	20.00	20.00
REL. TYPE: I-INSTANTANEOUS, C and A-CONTINUOUS, T-TIME-VARYING	C	C	C	C	C
REL. TYPE: I-ISOTHERMAL, T-THERMAL, A-AEROSOL	I	I	I	I	I
INIT. CLOUD DENS. (kg/m^3)	1.216	1.239	1.224	1.234	1.269
PHYSICAL SOURCE WIDHT (m)	0.106	0.059	0.067	0.106	0.086
INIT. FLOW RATE (m^3/s)	0.0096	0.0097	0.0227	0.0314	0.0135
INIT. CONCENTRATION (mol)	1.0000	1.0000	1.0000	1.0000	1.0000
SIMULATION DURATION (s)	715.38	305.13	212.68	305.13	407.69
AVERAGING TIME (s)	460.80	844.80	268.80	268.80	537.60

GASTAR INPUT DATA FOR : Hanford (instantaneous)
CHEMICAL RELEASED : Krypton-85

TRIAL NAME	HI2	HI3	HI5	HI6	HI7	HI8
CHEMICAL NO.	5	5	5	5	5	5
WIND SPEED @ 10M (m/s)	3.62	5.99	11.06	10.42	6.37	2.92
SURFACE ROUGHNESS (m)	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000
P-G CLASS	F	D	C	C	C	E
M-O LENGTH (m)	5.742	-262.928	-216.547	-155.306	-63.594	27.267
AIR TEMP. (K)	291.54	285.09	288.71	288.26	285.59	277.76
ATM. PRESSURE (mb)	1013.25	1013.25	1013.25	1013.25	1013.25	1013.25
SFC. TEMP. (K)	291.54	285.09	288.71	288.26	285.59	277.76
REL. HUMIDITY (%)	20.00	20.00	20.00	20.00	20.00	20.00
REL. TYPE: I-INSTANTANEOUS, C and A-CONTINUOUS, T-TIME-VARYING	I	I	I	I	I	I
REL. TYPE: I-ISOTHERMAL, T-THERMAL, A-AEROSOL	I	I	I	I	I	I
INIT. CLOUD DENS. (kg/m^3)	1.213	1.241	1.225	1.227	1.238	1.273
INIT. CLOUD RAD. (m)	1.3792	1.3690	1.3748	1.3740	1.3698	1.3572
INIT. CLOUD VOL. (m^3)	8.243	8.060	8.163	8.150	8.074	7.853
INIT. CONCENTRATION (mol)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
INIT. MOMENTUM MIXING: A: WELL MIXED, B: OTHERWISE	B	B	B	B	B	B
SIMULATION DURATION (s)	715.38	295.12	205.26	211.11	277.78	600.00

GASTAR INPUT DATA FOR : Thorney Island (continuous)
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen

TRIAL NAME	TC45	TC47
CHEMICAL NO.	25	26
WIND SPEED @ 10M (m/s)	2.30	1.50
SURFACE ROUGHNESS (m)	0.01000	0.01000
P-G CLASS	E	F
M-O LENGTH (m)	21.670	10.835
AIR TEMP. (K)	286.25	287.45
ATM. PRESSURE (mb)	1013.25	1013.25
SFC. TEMP. (K)	285.35	287.65
REL. HUMIDITY (%)	100.00	97.40
REL. TYPE: I=INSTANTANEOUS, C and A=CONTINUOUS, T=TIME-VARYING	C	C
REL. TYPE: I=ISOTHERMAL, T=THERMAL, A=AEROSOL	I	I
INIT. CLOUD DENS. (kg/m^3)	2.463	2.452
PHYSICAL SOURCE WIDHT (m)	2.000	2.000
INIT. FLOW RATE (m^3/s)	4.3326	4.1673
INIT. CONCENTRATION (mol)	1.0000	1.0000
SIMULATION DURATION (s)	305.22	414.67
AVERAGING TIME (s)	30.00	30.00

GASTAR INPUT DATA FOR : Thorney Island (instantaneous)
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen

TRIAL NAME	TI6	TI7	TI8	TI9	TI12	TI13	TI17	TI18	TI19
CHEMICAL NO.	16	17	18	19	20	21	22	23	24
WIND SPEED @ 10M (m/s)	2.80	3.40	2.40	1.70	2.50	7.30	5.30	7.40	6.40
SURFACE ROUGHNESS (m)	0.01800	0.01800	0.01200	0.00800	0.01800	0.01000	0.01800	0.00500	0.01000
P-G CLASS	D	E	D	F	E	D	D	D	D
M-O LENGTH (m)	9999.000	90.909	-9.091	1.538	10.000	-90.909	-200.000	-43.478	333.333
AIR TEMP. (K)	291.33	290.46	290.68	291.45	283.29	286.88	289.21	289.66	286.47
ATM. PRESSURE (mb)	1013.25	1021.36	1022.37	1019.33	1013.25	1019.33	1008.18	1007.17	1006.16
SFC. TEMP. (K)	291.83	290.85	291.55	291.45	285.15	287.85	291.05	297.45	286.15
REL. HUMIDITY (%)	74.80	80.70	87.60	87.30	66.20	74.10	94.00	81.30	94.80
REL. TYPE: I=INSTANTANEOUS, C and A=CONTINUOUS, T=TIME-VARYING	I	I	I	I	I	I	I	I	I
REL. TYPE: I=ISOTHERMAL, T=THERMAL, A=AEROSOL	I	I	I	I	I	I	I	I	I
INIT. CLOUD DENS. (kg/m^3)	1.993	2.141	1.994	1.947	2.949	2.472	5.093	2.262	2.590
INIT. CLOUD RAD. (m)	7.0000	7.0000	7.0000	7.0000	7.0000	7.0000	7.0000	7.0000	7.0000
INIT. CLOUD VOL. (m^3)	1578.944	1984.728	1984.513	1985.991	1945.273	1941.704	1710.324	1715.923	2114.424
INIT. CONCENTRATION (mol)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
INIT. MOMENTUM MIXING: A: WELL MIXED, B: OTHERWISE	B	B	B	B	B	B	B	B	B
SIMULATION DURATION (s)	251.43	247.06	312.50	395.88	300.00	156.44	200.00	168.92	191.09

GPM INPUT DATA FOR : Burro
CHEMICAL RELEASED : Liquefied natural gas

TRIAL	:	BU2	BU3	BU4	BU5	BU6	BU7	BU8	BU9
EMIS. RATE (g/s)	:	86100.	87980.	86960.	31250.	92220.	99460.	116930.	135980.
WIND SPEED (m/s)	:	5.4	5.4	9.0	7.4	9.1	3.4	1.8	5.7
STAB. CLASS	:	C	C	C	C	C	D	E	D
AVG. TIME (min)	:	0.67	1.67	1.33	2.17	1.27	2.33	1.33	0.33
INITIAL SIGMA-Y (m)	:	2.82892	2.84606	2.21339	2.38234	2.27968	2.36857	5.55167	3.31640
INITIAL SIGMA-Z (m)	:	2.82892	2.84606	2.21339	2.38234	2.27968	2.36857	5.55167	3.31640
PLUME HEIGHT (m)	:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
REC. HT. (m)	:	1.	1.	1.	1.	1.	1.	1.	1.
1:RURAL 2:URBAN	:	1	1	1	1	1	1	1	1
CONC. SPEC. (ppm)	:	100.	100.	100.	100.	100.	100.	100.	100.
MOLEC. WT. (g/mol)	:	17.46	17.26	17.05	17.38	17.24	18.22	18.12	18.82
AIR TEMP. (K)	:	311.3	307.8	309.0	314.3	312.7	307.0	306.0	308.5

NOTE: initial sigmas are used to be consistent with
the initial concentration at the source

GPM INPUT DATA FOR : Coyote .
CHEMICAL RELEASED : Liquefied natural gas . Methane is at least 86% in c

TRIAL	:	CO3	CO5	CO6
EMIS. RATE (g/s)	:	100670.	129020.	123030.
WIND SPEED (m/s)	:	6.0	9.7	4.6
STAB. CLASS	:	C	C	D
AVG. TIME (min)	:	0.83	1.50	1.17
INITIAL SIGMA-Y (m)	:	2.75051	2.36472	3.41869
INITIAL SIGMA-Z (m)	:	2.75051	2.36472	3.41869
PLUME HEIGHT (m)	:	0.0	0.0	0.0
REC. HT. (m)	:	1.	1.	1.
1:RURAL 2:URBAN	:	1	1	1
CONC. SPEC. (ppm)	:	100.	100.	100.
MOLEC. WT. (g/mol)	:	19.51	20.19	19.09
AIR TEMP. (K)	:	311.5	301.5	297.3

NOTE: initial sigmas are used to be consistent with
the initial concentration at the source

GPM INPUT DATA FOR : Desert Tortoise
CHEMICAL RELEASED : Anhydrous Ammonia

TRIAL	:	DT1	DT2	DT3	DT4
EMIS. RATE (g/s)	:	79700.	111500.	130700.	96700.
WIND SPEED (m/s)	:	7.4	5.8	7.4	4.5
STAB. CLASS	:	D	D	D	E
AVG. TIME (min)	:	1.33	2.67	2.00	5.00
INITIAL SIGMA-Y (m)	:	1.63536	2.18545	2.10040	2.32223
INITIAL SIGMA-Z (m)	:	1.63536	2.18545	2.10040	2.32223
PLUME HEIGHT (m)	:	0.8	0.8	0.8	0.8
REC. HT. (m)	:	1.	1.	1.	1.
1:RURAL 2:URBAN	:	1	1	1	1
CONC. SPEC. (ppm)	:	100.	100.	100.	100.
MOLEC. WT. (g/mol)	:	17.03	17.03	17.03	17.03
AIR TEMP. (K)	:	302.0	303.6	307.1	305.6

NOTE: initial sigmas are used to be consistent with
the initial concentration at the source

GPM INPUT DATA FOR : Goldfish
CHEMICAL RELEASED : Hydrogen fluoride

TRIAL	:	GF1	GF2	GF3
EMIS. RATE (g/s)	:	27670.	10460.	10270.
WIND SPEED (m/s)	:	5.6	4.2	5.4
STAB. CLASS	:	D	D	D
AVG. TIME (min)	:	1.47	1.47	1.47
INITIAL SIGMA-Y (m)	:	1.21901	0.36714	0.75548
INITIAL SIGMA-Z (m)	:	1.21901	0.36714	0.75548
PLUME HEIGHT (m)	:	1.0	1.0	1.0
REC. HT. (m)	:	1.	1.	1.
1:RURAL 2:URBAN	:	1	1	1
CONC. SPEC. (ppm)	:	30.	30.	30.
MOLEC. WT. (g/mol)	:	20.01	20.01	20.01
AIR TEMP. (K)	:	310.4	309.4	307.5

NOTE: initial sigmas are used to be consistent with
the initial concentration at the source

GPM INPUT DATA FOR : Hanford (continuous)
CHEMICAL RELEASED : Krypton-85

TRIAL	:	HC1	HC2	HC3	HC4	HC5
EMIS. RATE (g/s)	:	12.	12.	29.	39.	17.
WIND SPEED (m/s)	:	1.3	3.9	7.1	3.9	2.6
STAB. CLASS	:	F	C	C	C	E
AVG. TIME (min)	:	7.68	14.08	4.48	4.48	8.96
INITIAL SIGMA-Y (m)	:	0.04854	0.02811	0.03191	0.05066	0.04062
INITIAL SIGMA-Z (m)	:	0.04854	0.02811	0.03191	0.05066	0.04062
PLUME HEIGHT (m)	:	1.0	1.0	1.0	1.0	1.0
REC. HT. (m)	:	2.	2.	2.	2.	2.
1:RURAL 2:URBAN	:	1	1	1	1	1
CONC. SPEC. (ppm)	:	0.	0.	0.	0.	0.
MOLEC. WT. (g/mol)	:	29.00	29.00	29.00	29.00	29.00
AIR TEMP. (K)	:	290.9	285.4	288.9	286.6	278.8

NOTE: initial sigmas are used to be consistent with
the initial concentration at the source

GPM INPUT DATA FOR : Maplin Sands
CHEMICAL RELEASED : Liquified Natural Gas

TRIAL	:	MS27	MS29	MS34	MS35
EMIS. RATE (g/s)	:	23210.	29160.	21510.	27090.
WIND SPEED (m/s)	:	5.6	7.4	8.5	9.6
STAB. CLASS	:	D	D	D	D
AVG. TIME (min)	:	0.05	0.05	0.05	0.05
INITIAL SIGMA-Y (m)	:	1.34958	1.35270	1.06925	1.14015
INITIAL SIGMA-Z (m)	:	1.34958	1.35270	1.06925	1.14015
PLUME HEIGHT (m)	:	0.0	0.0	0.0	0.0
REC. HT. (m)	:	1.	1.	1.	1.
1:RURAL 2:URBAN	:	1	1	1	1
CONC. SPEC. (ppm)	:	100.	100.	100.	100.
MOLEC. WT. (g/mol)	:	17.11	16.26	16.66	16.39
AIR TEMP. (K)	:	288.1	289.3	288.4	289.3

NOTE: initial sigmas are used to be consistent with
the initial concentration at the source

GPM INPUT DATA FOR : Maplin Sands
CHEMICAL RELEASED : Liquified Propane Gas

TRIAL	MS42	MS43	MS46	MS47	MS49	MS50	MS52	MS54
EMIS. RATE (g/s)	20870.	19200.	23370.	32570.	16710.	35890.	44250.	19200.
WIND SPEED (m/s)	4.0	5.3	8.1	6.2	5.5	7.9	7.4	3.7
STAB. CLASS	D	D	D	D	D	D	D	D
AVG. TIME (min)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
INITIAL SIGMA-Y (m)	0.95056	0.75546	0.70719	0.95331	0.72051	0.37489	1.00690	0.93163
INITIAL SIGMA-Z (m)	0.95056	0.75546	0.70719	0.95331	0.72051	0.37489	1.00690	0.93163
PLUME HEIGHT (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
REC. HT. (m)	1.	1.	1.	1.	1.	1.	1.	1.
1:RURAL 2:URBAN	1	1	1	1	1	1	1	1
CONC. SPEC. (ppm)	100.	100.	100.	100.	100.	100.	100.	100.
MOLEC. WT. (g/mol)	43.93	43.93	43.95	43.84	43.76	43.93	43.87	43.94
AIR TEMP. (K)	291.5	290.2	291.9	290.6	286.5	283.6	285.0	281.6

NOTE: initial sigmas are used to be consistent with
the initial concentration at the source

GPM INPUT DATA FOR : Prairie Grass, set 1
CHEMICAL RELEASED : Sulfur dioxide

TRIAL	PG7	PG8	PG9	PG10	PG13	PG15	PG16	PG17
EMIS. RATE (g/s)	90.	91.	92.	92.	61.	96.	93.	57.
WIND SPEED (m/s)	4.2	4.9	6.9	4.5	1.3	3.4	3.2	3.3
STAB. CLASS	B	C	C	B	F	A	A	D
AVG. TIME (min)	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
INITIAL SIGMA-Y (m)	0.05161	0.04810	0.04046	0.04983	0.07496	0.05814	0.05974	0.04578
INITIAL SIGMA-Z (m)	0.05161	0.04810	0.04046	0.04983	0.07496	0.05814	0.05974	0.04578
PLUME HEIGHT (m)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
REC. HT. (m)	2.	2.	2.	2.	2.	2.	2.	2.
1:RURAL 2:URBAN	1	1	1	1	1	1	1	1
CONC. SPEC. (ppm)	1.	1.	1.	1.	1.	1.	1.	1.
MOLEC. WT. (g/mol)	64.00	64.00	64.00	64.00	64.00	64.00	64.00	64.00
AIR TEMP. (K)	305.1	305.1	301.1	304.1	293.1	295.1	301.1	300.1

NOTE: initial sigmas are used to be consistent with
the initial concentration at the source

GPM INPUT DATA FOR : Thorney Island (continuous)
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen

TRIAL	TC45	TC47
EMIS. RATE (g/s)	10670.	10220.
WIND SPEED (m/s)	2.3	1.5
STAB. CLASS	E	F
AVG. TIME (min)	0.50	0.50
INITIAL SIGMA-Y (m)	0.77435	0.94039
INITIAL SIGMA-Z (m)	0.77435	0.94039
PLUME HEIGHT (m)	0.0	0.0
REC. HT. (m)	0.	0.
1:RURAL 2:URBAN	1	1
CONC. SPEC. (ppm)	100.	100.
MOLEC. WT. (g/mol)	57.80	57.80
AIR TEMP. (K)	286.3	287.5

NOTE: initial sigmas are used to be consistent with
the initial concentration at the source

HEG. INPUT DATA FOR : Burro
CHEMICAL RELEASED : Liquefied natural gas

TRIAL	BU2	BU3	BU4	BU5	BU6	BU7	BU8	BU9
ICNT	0	0	0	0	0	0	0	0
ISURF	4	4	4	4	4	4	4	4
POOL DATA								
PLL (m)	35.910	36.300	36.090	34.890	37.170	38.600	41.850	45.130
PLHW (m)	17.955	18.150	18.045	17.445	18.585	19.300	20.925	22.565
AMBIENT CONDITIONS								
Z0 (m)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
U0 (m/s)	5.40	5.40	9.00	7.40	9.10	8.40	1.80	5.70
AIRTEMP (C)	38.07	34.55	35.85	41.07	39.47	33.76	32.82	35.32
RH	0.071	0.052	0.027	0.059	0.051	0.074	0.045	0.144
TGROUND (C)	38.07	34.55	35.85	41.07	39.47	33.76	32.82	35.32
DISP								
ROUGH (m)	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020
MONIN (m)	-12.95	-5.81	-49.31	-35.63	-53.39	-148.63	15.48	-500.00
CROSSW DELTA	0.122	0.146	0.140	0.134	0.136	0.096	0.065	0.078
CROSSW BETA	0.897	0.897	0.897	0.897	0.897	0.905	0.902	0.905
CE	1.150	1.150	1.150	1.150	1.150	1.150	1.150	1.150
CLOUD								
XSTEP	0.139	0.138	0.139	0.143	0.135	0.130	0.119	0.111
XMAX (m)	17.8	17.6	17.7	18.3	17.2	23.3	31.1	28.8
CAMIN (kg/m**3)	1.000E-07	1.000E-07	1.000E-07	1.000E-07	1.000E-07	1.000E-07	1.000E-07	1.000E-07
CU (kg/m**3)	1.769E-04	1.766E-04	1.738E-04	1.734E-04	1.739E-04	1.848E-04	1.840E-04	1.909E-04
CL (kg/m**3)	8.844E-05	8.828E-05	8.692E-05	8.670E-05	8.695E-05	9.239E-05	9.198E-05	9.543E-05
SOURCE								
FLUX (kg/m**2/s)	6.677E-02	6.677E-02	6.676E-02	6.675E-02	6.675E-02	6.675E-02	6.676E-02	6.676E-02
TEMPGAS (C)	-161.60	-161.60	-161.60	-161.60	-161.60	-161.60	-161.60	-161.60
CPGAS (J/mol/K)	39.08	38.63	38.16	38.23	38.58	40.78	40.55	42.12
MWGAS (kg/kmol)	17.46	17.26	17.05	17.08	17.24	18.22	18.12	18.82
WATGAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEATGR	24	24	24	24	24	24	24	24

HEG. INPUT DATA FOR : Coyote
CHEMICAL RELEASED : Liquefied natural gas . Methane is at least 86% in c

TRIAL	CO3	CO5	CO6
ICNT	0	0	0
ISURF	4	4	4
POOL DATA			
PLL (m)	38.830	43.960	42.930
PLHW (m)	19.415	21.980	21.465
AMBIENT CONDITIONS			
Z0 (m)	2.00	2.00	2.00
U0 (m/s)	6.00	9.70	4.60
AIRTEMP (C)	38.25	28.29	24.06
RH	0.113	0.221	0.228
TGROUND (C)	38.25	28.29	24.06
DISP			
ROUGH (m)	0.00020	0.00020	0.00020
MONIN (m)	-12.20	-31.66	56.08
CROSSW DELTA	0.127	0.143	0.083
CROSSW BETA	0.897	0.897	0.905
CE	1.150	1.150	1.150
CLOUD			
XSTEP	0.129	0.114	0.116
XMAX (m)	20.6	20.5	21.0
CAMIN (kg/m**3)	1.000E-07	1.000E-07	1.000E-07
CU (kg/m**3)	1.970E-04	2.045E-04	1.940E-04
CL (kg/m**3)	9.851E-05	1.022E-04	9.701E-05
SOURCE			
FLUX (kg/m**2/s)	6.677E-02	6.676E-02	6.676E-02
TEMPGAS (C)	-161.60	-161.60	-161.60
CPGAS (J/mol/K)	43.66	45.19	42.72
MWGAS (kg/kmol)	19.51	20.19	19.09
WATGAS	0.00	0.00	0.00
HEATGR	24	24	24

REG. INPUT DATA FOR : Desert Tortoise
CHEMICAL RELEASED : Anhydrous Ammonia
PSEUDO-GAS APPROACH SIMULATING AIR/VAPOR MIX

TRIAL	: DT1	DT2	DT3	DT4
ICNT	0	0	0	0
ISURF	2	2	2	2

*

POOL DATA

*

PLL (m)	14.301	19.615	18.261	20.451
PLHW (m)	7.400	9.807	9.130	10.225

*

AMBIENT CONDITIONS

*

ZO (m)	2.00	2.00	2.00	2.00
UO (m/s)	7.40	5.30	7.40	4.50
AIRTEMP (C)	28.83	30.43	33.87	32.43
RH	0.132	0.175	0.148	0.213
TGROUND (C)	31.60	30.60	31.60	30.80

*

DISP

*

ROUGH (m)	0.00300	0.00300	0.00300	0.00300
MONIN (m)	93.20	84.33	847.25	41.00
CROSSW DELTA	0.086	0.098	0.093	0.085
CROSSW BETA	0.905	0.905	0.905	0.902
CE	1.150	1.150	1.150	1.150

*

CLOUD

*

XSTEP	0.338	0.255	0.274	0.244
XMAX (m)	87.8	66.3	71.2	63.6
CAMIN (kg/m**3)	1.000E-07	1.000E-07	1.000E-07	1.000E-07
CU (kg/m**3)	1.425E-03	1.401E-03	1.320E-03	1.329E-03
CL (kg/m**3)	7.123E-04	7.007E-04	6.602E-04	6.644E-04

*

SOURCE

*

FLUX (kg/m**2/s)	6.608E+00	5.173E+00	6.612E+00	3.941E+00
TEMPGAS (C)	-35.66	-35.63	-35.70	-35.79
CPGAS (J/mol/K)	29.81	29.80	29.84	29.80
MWGAS (kg/kmol)	27.83	27.79	27.73	27.71
WATGAS	0.00	0.00	0.00	0.00
HEATGR	24	24	24	24

REG. INPUT DATA FOR : Goldfish
CHEMICAL RELEASED : Hydrogen fluoride
PSEUDO-GAS APPROACH SIMULATING AIR/VAPOR MIX

TRIAL	: GF1	GF2	GF3
ICNT	0	0	0
ISURF	2	2	2

*

POOL DATA

*

PLL (m)	10.339	8.000	8.000
PLHW (m)	5.170	4.000	4.000

*

AMBIENT CONDITIONS

*

ZO (m)	2.00	2.00	2.00
UO (m/s)	5.60	4.20	5.40
AIRTEMP (C)	37.20	36.18	34.41
RH	0.049	0.107	0.177
TGROUND (C)	37.20	36.18	34.41

*

DISP

*

ROUGH (m)	0.00300	0.00300	0.00300
MONIN (m)	101.29	173.14	40.93
CROSSW DELTA	0.087	0.087	0.087
CROSSW BETA	0.905	0.905	0.905
CE	1.150	1.150	1.150

*

CLOUD

*

XSTEP	0.484	0.625	0.625
XMAX (m)	338.5	187.5	437.5
CAMIN (kg/m**3)	1.000E-07	1.000E-07	1.000E-07
CU (kg/m**3)	3.604E-04	3.794E-04	4.170E-04
CL (kg/m**3)	1.302E-04	1.397E-04	2.085E-04

*

SOURCE

*

FLUX (kg/m**2/s)	4.132E+00	3.758E+00	2.961E+00
TEMPGAS (C)	16.38	16.26	16.41
CPGAS (J/mol/K)	29.09	29.05	29.02
MWGAS (kg/kmol)	28.14	28.15	28.17
WATGAS	0.00	0.00	0.00
HEATGR	24	24	24

HEG. INPUT DATA FOR : Hanford (continuous)
CHEMICAL RELEASED : Krypton-85

TRIAL	:	HC1	HC2	HC3	HC4	HC5
ICNT	:	0	0	0	0	0
ISURF	:	3	3	3	3	3
*						
POOL DATA						
*						
PLL (m)	:	8.000	8.000	8.000	8.000	8.000
PLHW (m)	:	4.000	4.000	4.000	4.000	4.000
*						
AMBIENT CONDITIONS						
*						
Z0 (m)	:	1.50	1.50	1.50	1.50	1.50
U0 (m/s)	:	1.50	3.90	7.10	3.90	2.60
AIRTEMP (C)	:	17.67	12.23	15.73	13.45	5.62
RH	:	0.200	0.200	0.200	0.200	0.200
TGROUND (C)	:	17.67	12.23	15.73	13.45	5.62
*						
DISP						
*						
ROUGH (m)	:	0.03000	0.03000	0.03000	0.03000	0.03000
MONIN (m)	:	6.87	-111.83	-186.12	-26.65	70.24
CROSSW DELTA	:	0.062	0.224	0.178	0.178	0.096
CROSSW BETA	:	0.902	0.897	0.897	0.897	0.902
CE	:	1.150	1.150	1.150	1.150	1.150
*						
CLOUD						
*						
XSTEP	:	0.625	0.625	0.625	0.625	0.625
XMAX (m)	:	162.5	162.5	162.5	162.5	162.5
CAMIN (kg/m**3)	:	1.000E-07	1.000E-07	1.000E-07	1.000E-07	1.000E-07
CU (kg/m**3)	:	1.216E-07	1.239E-07	1.224E-07	1.234E-07	1.269E-07
CL (kg/m**3)	:	1.000E-07	1.000E-07	1.000E-07	1.000E-07	1.000E-07
*						
SOURCE						
*						
FLUX (kg/m**2/s)	:	1.828E-04	1.875E-04	4.344E-04	6.063E-04	2.672E-04
TEMPGAS (C)	:	17.67	12.23	15.73	13.45	5.62
CPGAS (J/mol/K)	:	7.22	7.22	7.22	7.22	7.22
MWGAS (kg/kmol)	:	29.00	29.00	29.00	29.00	29.00
WATGAS	:	0.00	0.00	0.00	0.00	0.00
HEATGR	:	24	24	24	24	24

HEG. INPUT DATA FOR : Maplin Sands
CHEMICAL RELEASED : Liquified Natural Gas

TRIAL	:	MS27	MS29	MS34	MS35
ICNT	:	0	0	0	0
ISURF	:	4	4	4	4
*					
POOL DATA					
*					
PLL (m)	:	18.600	20.900	18.000	20.100
PLHW (m)	:	9.300	10.450	9.000	10.050
*					
AMBIENT CONDITIONS					
*					
Z0 (m)	:	10.00	10.00	10.00	10.00
U0 (m/s)	:	5.60	7.40	8.50	9.60
AIRTEMP (C)	:	14.90	16.10	15.20	16.10
RH	:	0.530	0.710	0.900	0.770
TGROUND (C)	:	15.60	16.80	15.80	16.60
*					
DISP					
*					
ROUGH (m)	:	0.00030	0.00030	0.00030	0.00030
MONIN (m)	:	-36.95	1220.63	-102.72	-81.58
CROSSW DELTA	:	0.064	0.064	0.064	0.064
CROSSW BETA	:	0.905	0.905	0.905	0.905
CE	:	1.150	1.150	1.150	1.150
*					
CLOUD					
*					
XSTEP	:	0.269	0.239	0.278	0.249
XMAX (m)	:	61.3	43.2	37.7	45.1
CAMIN (kg/m**3)	:	1.000E-07	1.000E-07	1.000E-07	1.000E-07
CU (kg/m**3)	:	1.368E-04	1.775E-04	1.819E-04	1.790E-04
CL (kg/m**3)	:	9.341E-05	8.377E-05	9.095E-05	8.948E-05
*					
SOURCE					
*					
FLUX (kg/m**2/s)	:	6.709E-02	6.676E-02	6.639E-02	6.705E-02
TEMPGAS (C)	:	-161.50	-161.50	-161.50	-161.50
CPGAS (J/mol/K)	:	38.29	36.39	37.29	36.68
MWGAS (kg/kmol)	:	17.11	16.26	16.66	16.39
WATGAS	:	0.00	0.00	0.00	0.00
HEATGR	:	24	24	24	24

HEG. INPUT DATA FOR : Maplin Sands
CHEMICAL RELEASED : Liquified Propane Gas

TRIAL	MS42	MS43	MS46	MS47	MS49	MS50	MS52	MS54
ICNT	0	0	0	0	0	0	0	0
ISURF	4	4	4	4	4	4	4	4
POOL DATA								
PLL (m)	14.900	14.300	15.700	19.600	13.300	19.500	21.700	14.300
PLHW (m)	7.450	7.150	7.850	9.800	6.650	9.750	10.850	7.150
AMBIENT CONDITIONS								
Z0 (m)	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
U0 (m/s)	4.00	5.30	3.10	6.20	5.50	7.90	7.40	3.70
AIRTEMP (C)	18.30	17.00	18.70	17.40	13.30	10.40	11.30	3.40
RH	0.800	0.800	0.710	0.780	0.880	0.790	0.630	0.350
TGROUND (C)	18.50	18.90	17.30	17.10	13.00	9.90	11.30	9.40
DISP								
ROUGH (m)	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
MONIN (m)	99.73	9999.00	750.15	294.22	69.60	208.74	224.30	67.34
CROSSW DELTA	0.064	0.064	0.064	0.064	0.064	0.064	0.064	0.064
CROSSW BETA	0.905	0.905	0.905	0.905	0.905	0.905	0.905	0.905
CE	1.150	1.150	1.150	1.150	1.150	1.150	1.150	1.150
CLOUD								
XSTEP	0.336	0.350	0.318	0.269	0.376	0.256	0.230	0.350
XMAX (m)	60.3	62.9	57.4	48.4	67.7	46.2	53.0	52.2
CAMIN (kg/m**3)	1.000E-07	1.000E-07	1.000E-07	1.000E-07	1.000E-07	1.000E-07	1.000E-07	1.000E-07
CU (kg/m**3)	2.318E-04	2.318E-04	2.319E-04	2.314E-04	2.309E-04	2.318E-04	2.315E-04	2.319E-04
CL (kg/m**3)	1.159E-04	1.159E-04	1.160E-04	1.157E-04	1.155E-04	1.159E-04	1.158E-04	1.159E-04
SOURCE								
FLUX (kg/m**2/s)	9.400E-02	9.389E-02	9.481E-02	9.414E-02	9.447E-02	9.439E-02	9.397E-02	9.389E-02
TEMPGAS (C)	-42.10	-42.10	-42.10	-42.10	-42.10	-42.10	-42.10	-42.10
CPGAS (J/mol/K)	73.71	73.71	73.75	73.56	73.43	73.71	73.61	73.73
MWGAS (kg/kmol)	43.93	43.93	43.95	43.84	43.76	43.93	43.87	43.94
WATGAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEATGR	24	24	24	24	24	24	24	24

HEG. INPUT DATA FOR : Prairie Grass, set 1
CHEMICAL RELEASED : Sulfur dioxide

TRIAL	PG7	PG8	PG9	PG10	PG13	PG15	PG16	PG17
ICNT	0	0	0	0	0	0	0	0
ISURF	3	3	3	3	3	3	3	3
POOL DATA								
PLL (m)	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000
PLHW (m)	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000
AMBIENT CONDITIONS								
Z0 (m)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
U0 (m/s)	4.20	4.90	6.90	4.60	1.50	3.40	3.20	3.30
AIRTEMP (C)	31.95	31.95	27.95	30.95	19.95	21.95	27.95	26.95
RH	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
TGROUND (C)	31.95	31.95	27.95	30.95	19.95	21.95	27.95	26.95
DISP								
ROUGH (m)	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600
MONIN (m)	-8.18	-20.61	-34.12	-7.45	6.01	-7.74	-7.83	49.81
CROSSW DELTA	0.371	0.209	0.209	0.371	0.065	0.527	0.527	0.128
CROSSW BETA	0.866	0.897	0.897	0.866	0.902	0.865	0.865	0.905
CE	1.150	1.150	1.150	1.150	1.150	1.150	1.150	1.150
CLOUD								
XSTEP	0.625	0.625	0.625	0.625	0.625	0.625	0.625	0.625
XMAX (m)	162.5	162.5	162.5	162.5	162.5	162.5	162.5	162.5
CAMIN (kg/m**3)	1.000E-07	1.000E-07	1.000E-07	1.000E-07	1.000E-07	1.000E-07	1.000E-07	1.000E-07
CU (kg/m**3)	2.558E-06	2.558E-06	2.592E-06	2.566E-06	2.663E-06	2.645E-06	2.592E-06	2.601E-06
CL (kg/m**3)	1.279E-06	1.279E-06	1.296E-06	1.283E-06	1.331E-06	1.322E-06	1.296E-06	1.300E-06
SOURCE								
FLUX (kg/m**2/s)	1.405E-03	1.423E-03	1.438E-03	1.439E-03	9.547E-04	1.492E-03	1.453E-03	8.828E-04
TEMPGAS (C)	31.95	31.95	27.95	30.95	19.95	21.95	27.95	26.95
CPGAS (J/mol/K)	39.35	39.35	39.35	39.35	39.35	39.35	39.35	39.35
MWGAS (kg/kmol)	64.00	64.00	64.00	64.00	64.00	64.00	64.00	64.00
WATGAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEATGR	24	24	24	24	24	24	24	24

HEG. INPUT DATA FOR : Thorney Island (continuous)
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen

TRIAL	:	TC45	TC47
ICNT	:	0	0
ISURF	:	3	3
*			
POOL DATA			
*			
PLL (m)	:	8.000	8.000
PLHW (m)	:	4.000	4.000
*			
AMBIENT CONDITIONS			
*			
Z0 (m)	:	10.00	10.00
U0 (m/s)	:	2.30	1.50
AIRTEMP (C)	:	13.05	14.25
RH	:	1.000	0.974
TGROUND (C)	:	12.75	14.45
*			
DISP			
*			
ROUGH (m)	:	0.01000	0.01000
MONIN (m)	:	21.57	10.34
CROSSW DELTA	:	0.054	0.036
CROSSW BETA	:	0.902	0.902
CE	:	1.150	1.150
*			
CLOUD			
*			
XSTEP	:	0.625	0.625
XMAX (m)	:	121.5	121.5
CAMIN (kg/m**3)	:	1.000E-07	1.000E-07
CU (kg/m**3)	:	2.463E-04	2.452E-04
CL (kg/m**3)	:	1.231E-04	1.226E-04
*			
SOURCE			
*			
FLUX (kg/m**2/s)	:	1.667E-01	1.597E-01
TEMPGAS (C)	:	13.05	14.25
CPGAS (J/mol/K)	:	35.26	35.26
MWGAS (kg/kmol)	:	57.80	57.80
WATGAS	:	0.00	0.00
HEATGR	:	24	24

0732290 0505708 787

INPUFF INPUT DATA FOR: Burro
CHEMICAL RELEASED : Liquefied natural gas

TRIAL NAME	BU2	BU3	BU4	BU5	BU6	BU7	BU8	BU9
IW	6							
LADT	F							
LP22	F							
KEYDSP	1							
SYMAX (m)	1000.0							
LPCC	F							
LPIC	T							
XGRDSW (km)	0.00							
YGRDSW (km)	-4.00							
XSIZE (km)	8.00							
YSIZE (km)	8.00							
NTIME	1							
ITIME (s)	680	680	720	760	650	680	1100	800
NSOURC	1							
NREC	2	2	2	2	2	3	4	4
XREC (km)	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057
YREC (km)	0.000							
ZREC (m)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
XREC (km)	0.140	0.140	0.140	0.140	0.140	0.140	0.140	0.140
YREC (km)	0.000							
ZREC (m)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
XREC (km)	-0.100	-0.100	-0.100	-0.100	-0.100	0.400	0.400	0.400
YREC (km)	0.000							
ZREC (m)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
XREC (km)	-0.100	-0.100	-0.100	-0.100	-0.100	-0.100	0.300	0.800
YREC (km)	0.000							
ZREC (m)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
LDWSH	F							
LBID	F							
LDEPS	F							
LUPLRS	F							
LCMBPF	T							
ISTEP (s)	-1							
ISAMPL (s)	5	10	10	10	10	10	10	5
ISTRTC (s)	0							
SDCMBN	1.00							
ANHGT (m)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WDIR (deg)	270.0							
WSPD (m/s)	5.40	5.40	9.00	7.40	9.10	8.40	1.80	5.70
HL (m)	9999.							
KST	3	3	3	3	3	4	6	5
SGPH (rad)	-9.900							
SGTH (rad)	-9.900							
TEMP (K)	311.27	307.75	309.05	314.27	312.67	306.96	306.02	308.52
CDIS (km)	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057
XSORC (km)	0.000							
YSORC (km)	0.000							
NSRCDS	4	4	4	4	5	4	10	10
ISUPDT (s)	170	170	180	190	130	170	110	80
DV (cm/s)	0.00							
SVV (cm/s)	0.00							
QP (g/s)	0.861E+05	0.880E+05	0.870E+05	0.812E+05	0.922E+05	0.995E+05	0.117E+06	0.136E+06
HPP (m)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TSP (K)	300.00							
DP (m)	1.00							
VSP (m/s)	0.00							
VFP (m**3/s)	0.00							
SYOP (m)	2.83	2.85	2.21	2.38	2.28	2.37	5.55	3.32
SZOP (m)	2.33	2.55	2.21	2.38	2.28	2.37	5.55	3.32
SDIR (deg)	270.							
SSPD (m/s)	0.00							

ALL FOLLOWING SOURCE EMISSION RECORDS HAVE ZERO EMISSION RATE

INPUFF INPUT DATA FOR: Toyota
CHEMICAL RELEASED : Liquefied natural gas

0732290 0505709 613

. Methane is at least 96% in c

TRIAL NAME	:	003	005	006
IN	:	6		
LADT	:	F		
L222	:	F		
KEYDSP	:	1		
SYMAX (m)	:	1000.0		
LPCC	:	F		
LPIC	:	T		
XGRDSW (km)	:	0.00		
YGRDSW (km)	:	-4.00		
XSIZE (km)	:	8.00		
YSIZE (km)	:	8.00		
NTIME	:	1		
ITIME (s)	:	700	700	720
NSOURC	:	1		
NREC	:	3	4	4
XREC (km)	:	0.140	0.140	0.140
YREC (km)	:	0.000		
ZREC (m)	:	1.000	1.000	1.000
XREC (km)	:	0.200	0.200	0.200
YREC (km)	:	0.000		
ZREC (m)	:	1.000	1.000	1.000
XREC (km)	:	0.300	0.300	0.300
YREC (km)	:	0.000		
ZREC (m)	:	1.000	1.000	1.000
XREC (km)	:	-0.100	0.400	0.400
YREC (km)	:	0.000		
ZREC (m)	:	1.000	1.000	1.000
LDWSH	:	F		
LBID	:	F		
LDEPS	:	F		
LUPLRS	:	F		
LCMBPF	:	T		
ISTEP (s)	:	-1		
ISAMPL (s)	:	5	10	10
ISTRTC (s)	:	0		
SDCMBN	:	1.00		
ANHGT (m)	:	2.00	2.00	2.00
WDIR (deg)	:	270.0		
WSPD (m/s)	:	6.00	9.70	4.60
HL (m)	:	9999.		
KST	:	3	3	4
SGPH (rad)	:	-9.900		
SGTH (rad)	:	-9.900		
TEMP (K)	:	311.45	301.49	297.26
CDIS (km)	:	0.140	0.140	0.140
XSORC (km)	:	0.000		
YSORC (km)	:	0.000		
NSRCDS	:	10	7	9
ISUPDT (s)	:	70	100	80
DV (cm/s)	:	0.00		
SVV (cm/s)	:	0.00		
QP (g/s)	:	0.101E+06	0.129E+06	0.123E+06
HPP (m)	:	0.00	0.00	0.00
TSP (K)	:	300.00		
DP (m)	:	1.00		
VSP (m/s)	:	0.00		
VFP (m**3/s)	:	0.00		
SYOP (m)	:	2.75	2.36	3.42
SZOP (m)	:	2.75	2.36	3.42
SDIR (deg)	:	270.		
SSPD (m/s)	:	0.00		

ALL FOLLOWING SOURCE EMISSION RECORDS HAVE ZERO EMISSION RATE

INPUFF INPUT DATA FOR: Desert Tortoise
CHEMICAL RELEASED : Anhydrous Ammonia

TRIAL NAME	:	DT1	DT2	DT3	DT4
IW	:	5			
LADT	:	F			
LPRT	:	F			
KEYDSP	:	1			
SYMAX (m)	:	1000.0			
LPCC	:	F			
LPIC	:	T			
XORDSW (km)	:	0.00			
YORDSW (km)	:	-4.00			
XSIZE (km)	:	8.00			
YSIZE (km)	:	8.00			
NTIME	:	1			
ITIME (s)	:	780	780	850	1140
NSOURC	:	1			
NREC	:	2	2	2	2
XREC (km)	:	0.100	0.100	0.100	0.100
YREC (km)	:	0.000			
ZREC (m)	:	1.000	1.000	1.000	1.000
XREC (km)	:	0.300	0.800	0.800	0.800
YREC (km)	:	0.000			
ZREC (m)	:	1.000	1.000	1.000	1.000
LDWSH	:	F			
LBID	:	F			
LDEPS	:	F			
LUPLRS	:	F			
LCMBPF	:	T			
ISTEP (s)	:	-1			
ISAMPL (s)	:	10	10	10	10
ISTRTC (s)	:	0			
SDCMBN	:	1.00			
ANHGT (m)	:	2.00	2.00	2.00	2.00
WDIR (deg)	:	270.0			
WSPD (m/s)	:	7.40	5.80	7.40	4.50
HL (m)	:	9999.			
KST	:	4	4	4	6
SGPH (rad)	:	-9.900			
SGTH (rad)	:	-9.900			
TEMP (K)	:	302.03	303.63	307.07	305.63
CDIS (km)	:	0.100	0.100	0.100	0.100
XSORC (km)	:	0.000			
YSORC (km)	:	0.000			
NSRCDS	:	6	3	5	3
ISUPDT (s)	:	130	260	170	380
DV (cm/s)	:	0.00			
SVV (cm/s)	:	0.00			
QP (g/s)	:	0.797E+05	0.111E+06	0.131E+06	0.967E+05
HPP (m)	:	0.79	0.79	0.79	0.79
TSP (K)	:	300.00			
DP (m)	:	1.00			
VSP (m/s)	:	0.00			
VFP (m**3/s)	:	0.00			
SYOP (m)	:	1.64	2.19	2.10	2.32
SZOP (m)	:	1.64	2.19	2.10	2.32
SDIR (deg)	:	270.			
SSPD (m/s)	:	0.00			

ALL FOLLOWING SOURCE EMISSION RECORDS HAVE ZERO EMISSION RATE

INPUFF INPUT DATA FOR: Goldfish
CHEMICAL RELEASED : Hydrogen fluoride

TRIAL NAME	: GF1	GF2	GF3
IX	5		
LADT	F		
LPRT	F		
KEYDSP	1		
SYMAX (m)	1000.0		
LPCC	F		
LPIC	F		
XGRDSW (km)	0.00		
YGRDSW (km)	-4.00		
XSIZE (km)	8.00		
YSIZE (km)	8.00		
NTIME	1		
ITIME (s)	1170	1080	1440
NSOURC	1		
NREC	3	2	3
XREC (km)	0.300	0.300	0.300
YREC (km)	0.000		
ZREC (m)	1.000	1.000	1.000
XREC (km)	1.000	1.000	1.000
YREC (km)	0.000		
ZREC (m)	1.000	1.000	1.000
XREC (km)	3.000	-0.100	3.000
YREC (km)	0.000		
ZREC (m)	1.000	1.000	1.000
LDWSH	F		
LBID	F		
LDEPS	F		
LDPLRS	F		
LCMBPF	T		
ISTEP (s)	-1		
ISAMPL (s)	10	10	10
ISTRTC (s)	0		
SDCMBN	1.00		
ANHGT (m)	2.00	2.00	2.00
WDIR (deg)	270.0		
WSPD (m/s)	5.60	4.20	5.40
HL (m)	9999.		
KST	4	4	4
SGPH (rad)	-9.900		
SGTH (rad)	-9.900		
TEMP (K)	310.40	309.38	307.61
CDIS (km)	0.300	0.300	0.300
XSORC (km)	0.000		
YSORC (km)	0.000		
NSRCDS	9	3	4
ISUPDT (s)	130	360	360
DV (cm/s)	0.00		
SVV (cm/s)	0.00		
QP (g/s)	0.277E+05	0.105E+05	0.103E+05
HPP (m)	1.00	1.00	1.00
TSP (K)	300.00		
DP (m)	1.00		
VSP (m/s)	0.00		
VFP (m**3/s)	0.00		
SYOP (m)	1.22	0.87	0.76
SZOP (m)	1.22	0.87	0.76
SDIR (deg)	270.		
SSPD (m/s)	0.00		

ALL FOLLOWING SOURCE EMISSION RECORDS HAVE ZERO EMISSION RATE

INPUFF INPUT DATA FOR: Hanford (continuous)
CHEMICAL RELEASED : Krypton-85

TRIAL NAME		HC1	HC2	HC3	HC4	HC5
IW	:	6				
LADT	:	F				
LP22	:	F				
KEYDSP	:	1				
GYMAX (m)	:	1000.0				
LPCC	:	F				
LPIC	:	T				
XGRDSW (km)	:	0.00				
YGRDSW (km)	:	-4.00				
XSIZE (km)	:	8.00				
YSIZE (km)	:	8.00				
NTIME	:	1				
ITIME (s)	:	1860	2730	2580	1200	3570
NSOURC	:	1				
NREC	:	2	2	2	2	2
XREC (km)	:	0.200	0.200	0.200	0.200	0.200
YREC (km)	:	0.000				
ZREC (m)	:	1.500	1.500	1.500	1.500	1.500
XREC (km)	:	0.800	0.800	0.800	0.800	0.800
YREC (km)	:	0.000				
ZREC (m)	:	1.500	1.500	1.500	1.500	1.500
LDWSH	:	F				
LBID	:	F				
LDEPS	:	F				
LUPLRS	:	F				
LCMBPF	:	T				
ISTEP (s)	:	-1				
ISAMPL (s)	:	10	10	10	10	10
ISTRTC (s)	:	0				
SDCMBN	:	1.00				
ANHGT (m)	:	1.50	1.50	1.50	1.50	1.50
WDIR (deg)	:	270.0				
WSPD (m/s)	:	1.30	3.90	7.10	3.90	2.60
HL (m)	:	9999.				
KST	:	7	3	3	3	6
SGPH (rad)	:	-9.900				
SGTH (rad)	:	-9.900				
TEMP (K)	:	290.87	285.43	288.93	286.65	278.32
CDIS (km)	:	0.200	0.200	0.200	0.200	0.200
XSORC (km)	:	0.000				
YSORC (km)	:	0.000				
NSRCDS	:	2	3	3	2	3
ISUPDT (s)	:	930	910	860	600	1190
DV (cm/s)	:	0.00				
SVV (cm/s)	:	0.00				
QP (g/s)	:	11.7	12.0	27.8	38.8	17.1
HPP (m)	:	1.00	1.00	1.00	1.00	1.00
TSP (K)	:	300.00				
DP (m)	:	1.00				
VSP (m/s)	:	0.00				
VFP (m**3/s)	:	0.00				
SYOP (m)	:	0.05	0.03	0.03	0.05	0.04
SZOP (m)	:	0.05	0.03	0.03	0.05	0.04
SDIR (deg)	:	270.				
SSPD (m/s)	:	0.00				

ALL FOLLOWING SOURCE EMISSION RECORDS HAVE ZERO EMISSION RATE

INPUFF INPUT DATA FOR: Hanford (instantaneous)
CHEMICAL RELEASED : Krypton-85

TRIAL NAME	: HI2	HI3	HI5	HI6	HI7	HI8
IW	: 5					
LADT	: F					
LP22	: F					
KEYDSP	: 1					
SYMAX (m)	: 1000.0					
LPCC	: F					
LPIC	: T					
XGRDSW (km)	: 0.00					
YGRDSW (km)	: -4.00					
XSIZE (km)	: 8.00					
YSIZE (km)	: 8.00					
NTIME	: 1					
ITIME (s)	: 1200	800	700	700	800	1100
NSOURC	: 1					
NREC	: 2	2	2	2	2	2
XREC (km)	: 0.200	0.200	0.200	0.200	0.200	0.200
YREC (km)	: 0.000					
ZREC (m)	: 1.500	1.500	1.500	1.500	1.500	1.500
XREC (km)	: 0.800	0.800	0.800	0.800	0.800	0.800
YREC (km)	: 0.000					
ZREC (m)	: 1.500	1.500	1.500	1.500	1.500	1.500
LDWSH	: F					
LBID	: F					
LDEPS	: F					
LUPLRS	: F					
LCMBPF	: T					
ISTEP (s)	: -1					
ISAMPL (s)	: 1	1	1	1	1	1
ISTRTC (s)	: 0					
SDCMBN	: 1.00					
ANHGT (m)	: 1.50	1.50	1.50	1.50	1.50	1.50
WDIR (deg)	: 270.0					
WSPD (m/s)	: 1.30	4.10	7.60	7.20	4.50	1.60
HL (m)	: 9999.					
KST	: 7	4	3	3	3	6
SGPH (rad)	: -9.900					
SGTH (rad)	: -9.900					
TEMP (K)	: 291.54	285.09	288.71	288.26	285.59	277.76
CDIS (km)	: 0.200	0.200	0.200	0.200	0.200	0.200
XSORC (km)	: 0.000					
YSORC (km)	: 0.000					
NSRCDS	: 100	100	100	100	100	100
ISUPDT (s)	: 12	8	7	7	8	11
DV (cm/s)	: 0.00					
SVV (cm/s)	: 0.00					
QP (g/s)	: 833.	0.125E+04	0.143E+04	0.143E+04	0.125E+04	909.
HPP (m)	: 0.00	0.00	0.00	0.00	0.00	0.00
TSP (K)	: 300.00					
DP (m)	: 1.00					
VSP (m/s)	: 0.00					
VFP (m**3/s)	: 0.00					
SYOP (m)	: 0.41	0.28	0.22	0.23	0.27	0.38
SZOP (m)	: 0.41	0.28	0.22	0.23	0.27	0.38
SDIR (deg)	: 270.					
SSPD (m/s)	: 0.00					

ALL FOLLOWING SOURCE EMISSION RECORDS HAVE ZERO EMISSION RATE

INPUFF INPUT DATA FOR: Maplin Sands
CHEMICAL RELEASED : Liquified Natural Gas

TRIAL NAME	MS27	MS29	MS34	MS35
IW	5			
LADT	F			
LP22	F			
KEYDSP	1			
SYMAX (m)	1000.0			
LPCC	F			
LPIC	T			
XGRDSW (km)	0.00			
YGRDSW (km)	-4.00			
XSIZE (km)	8.00			
YSIZE (km)	8.00			
NTIME	1			
ITIME (s)	800	690	700	700
NSOURC	1			
NREC	5	7	2	3
XREC (km)	0.089	0.058	0.087	0.129
YREC (km)	0.000			
ZREC (m)	0.900	0.900	0.900	0.900
XREC (km)	0.131	0.090	0.179	0.250
YREC (km)	0.000			
ZREC (m)	0.900	0.900	0.900	0.900
XREC (km)	0.324	0.130	-0.100	0.406
YREC (km)	0.000			
ZREC (m)	0.900	0.900	0.900	0.900
XREC (km)	0.400	0.182	-0.100	-0.100
YREC (km)	0.000			
ZREC (m)	0.900	0.900	0.900	0.900
XREC (km)	0.650	0.252	-0.100	-0.100
YREC (km)	0.000			
ZREC (m)	0.900	0.900	0.900	0.900
XREC (km)	-0.100	0.324	-0.100	-0.100
YREC (km)	0.000			
ZREC (m)	0.900	0.900	0.900	0.900
XREC (km)	-0.100	0.403	-0.100	-0.100
YREC (km)	0.000			
ZREC (m)	0.900	0.900	0.900	0.900
LDWSH	F			
LBID	F			
LDEPS	F			
LUPLRS	F			
LCMBPF	T			
ISTEP (s)	-1			
ISAMPL (s)	1	1	1	1
ISTRTC (s)	0			
SDCMBN	1.00			
ANHGT (m)	10.00	10.00	10.00	10.00
WDIR (deg)	270.0			
WSPD (m/s)	5.60	7.40	8.50	9.60
HL (m)	9999.			
KST	4	4	4	4
SGPH (rad)	-9.900			
SGTH (rad)	-9.900			
TEMP (K)	288.10	289.30	288.40	289.30
CDIS (km)	0.089	0.058	0.087	0.129
XSORC (km)	0.000			
YSORC (km)	0.000			
NSRCDS	5	3	7	5
ISUPDT (s)	160	230	100	140
DV (cm/s)	0.00			
SVV (cm/s)	0.00			
QP (g/s)	0.232E+05	0.292E+05	0.215E+05	0.271E+05
HPP (m)	0.00	0.00	0.00	0.00
TSP (K)	300.00			
DP (m)	1.00			
VSP (m/s)	0.00			
VFP (m**3/s)	0.00			
SYOP (m)	1.35	1.35	1.07	1.14
SZOP (m)	1.35	1.35	1.07	1.14
SDIR (deg)	270.			
SSPD (m/s)	0.00			

ALL FOLLOWING SOURCE EMISSION RECORDS HAVE ZERO EMISSION RATE

INPUFF INPUT DATA FOR: Maplin Sands
CHEMICAL RELEASED : Liquified Propane Gas

TRIAL NAME	:	MS42	MS43	MS46	MS47	MS49	MS50	MS52	MS54
IW	:	6							
LAST	:	F							
LPLT	:	F							
KEYDSP	:	1							
SYMAX (m)	:	1000.0							
LPCC	:	F							
LPIC	:	T							
XGRDSW (km)	:	0.00							
YGRDSW (km)	:	-4.00							
XSIZE (km)	:	8.00							
YSIZE (km)	:	8.00							
NTIME	:	1							
ITIME (s)	:	720	990	720	840	720	800	700	720
NSOURC	:	1							
NREC	:	7	4	7	6	6	4	6	4
XREC (km)	:	0.028	0.088	0.034	0.090	0.090	0.059	0.061	0.056
YREC (km)	:	0.000							
ZREC (m)	:	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.500
XREC (km)	:	0.053	0.129	0.091	0.128	0.129	0.093	0.095	0.085
YREC (km)	:	0.000							
ZREC (m)	:	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.500
XREC (km)	:	0.083	0.249	0.130	0.182	0.180	0.182	0.178	0.178
YREC (km)	:	0.000							
ZREC (m)	:	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.500
XREC (km)	:	0.123	0.400	0.182	0.250	0.250	0.400	0.249	0.247
YREC (km)	:	0.000							
ZREC (m)	:	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.500
XREC (km)	:	0.179	-0.100	0.250	0.321	0.322	-0.100	0.398	-0.100
YREC (km)	:	0.000							
ZREC (m)	:	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.500
XREC (km)	:	0.247	-0.100	0.322	0.400	0.400	-0.100	0.650	-0.100
YREC (km)	:	0.000							
ZREC (m)	:	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.500
XREC (km)	:	0.398	-0.100	0.401	-0.100	-0.100	-0.100	-0.100	-0.100
YREC (km)	:	0.000							
ZREC (m)	:	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.500
LDWSH	:	F							
LBID	:	F							
LDEPS	:	F							
LUPLRS	:	F							
LCMBPF	:	T							
ISTEP (s)	:	-1							
ISAMPL (s)	:	1	1	1	1	1	1	1	1
ISTRTC (s)	:	0							
SDCMBN	:	1.00							
ANHGT (m)	:	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
WDIR (deg)	:	270.0							
WSPD (m/s)	:	4.00	5.80	8.10	6.20	5.50	7.90	7.40	3.70
HL (m)	:	9999.							
KST	:	4	4	4	4	4	4	4	4
SGPH (rad)	:	-9.900							
SGTH (rad)	:	-9.900							
TEMP (K)	:	291.50	290.20	291.90	290.60	286.50	283.60	285.00	281.60
CDIS (km)	:	0.028	0.088	0.034	0.090	0.090	0.059	0.061	0.056
XSORC (km)	:	0.000							
YSORC (km)	:	0.000							
NSRCDS	:	4	3	2	4	8	5	5	4
ISUPDT (s)	:	180	330	360	210	90	160	140	180
DV (cm/s)	:	0.00							
SVV (cm/s)	:	0.00							
QP (g/s)	:	0.209E+05	0.192E+05	0.234E+05	0.326E+05	0.167E+05	0.359E+05	0.442E+05	0.192E+05
HPP (m)	:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TSP (K)	:	300.00							
DP (m)	:	1.00							
VSP (m/s)	:	0.00							
VFP (m**3/s)	:	0.00							
SYOP (m)	:	0.95	0.76	0.71	0.95	0.72	0.87	1.01	0.93
SZOP (m)	:	0.95	0.76	0.71	0.95	0.72	0.87	1.01	0.93
SDIR (deg)	:	270.							
SSPD (m/s)	:	0.00							

ALL FOLLOWING SOURCE EMISSION RECORDS HAVE ZERO EMISSION RATE

INPUFF INPUT DATA FOR: Prairie Grass, Set 1
CHEMICAL RELEASED : Sulfur dioxide

TRIAL NAME	PG7	PG8	PG9	PG10	PG13	PG15	PG16	PG17
IW	6							
LADT	F							
LPPP	F							
KEYDSP	1							
SYMAX (m)	1000.0							
LPCC	F							
LPTC	T							
XGRDSW (km)	0.00							
YGRDSW (km)	-4.00							
XSIZE (km)	8.00							
YSIZE (km)	8.00							
NTIME	1							
ITIME (s)	1200	1200	1200	1200	1800	1200	1200	1200
NSOURC	1							
NREC	5	5	5	5	2	5	5	5
XREC (km)	0.050	0.050	0.050	0.050	0.400	0.050	0.050	0.050
YREC (km)	0.000							
ZREC (m)	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500
XREC (km)	0.100	0.100	0.100	0.100	0.800	0.100	0.100	0.100
YREC (km)	0.000							
ZREC (m)	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500
XREC (km)	0.200	0.200	0.200	0.200	-0.100	0.200	0.200	0.200
YREC (km)	0.000							
ZREC (m)	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500
XREC (km)	0.400	0.400	0.400	0.400	-0.100	0.400	0.400	0.400
YREC (km)	0.000							
ZREC (m)	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500
XREC (km)	0.800	0.800	0.800	0.800	-0.100	0.800	0.800	0.800
YREC (km)	0.000							
ZREC (m)	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500
LDWSH	F							
LBID	F							
LDEPS	F							
LUPLRS	F							
LCMBPF	T							
ISTEP (s)	-1							
ISAMPL (s)	10	10	10	10	10	10	10	10
ISTRTC (s)	0							
SDCMBN	1.00							
ANHGT (m)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
WDIR (deg)	270.0							
WSPD (m/s)	4.20	4.90	6.90	4.60	1.30	3.40	3.20	3.30
HL (m)	9999.							
KST	2	3	3	2	7	1	1	5
SGPH (rad)	-9.900							
SGTH (rad)	-9.900							
TEMP (K)	305.15	305.15	301.15	304.15	293.15	295.15	301.15	300.15
CDIS (km)	0.050	0.050	0.050	0.050	0.400	0.050	0.050	0.050
XSORC (km)	0.000							
YSORC (km)	0.000							
NSRCDS	2	2	2	2	3	2	2	2
ISUPDT (s)	600	600	600	600	600	600	600	600
DV (cm/s)	0.00							
SVV (cm/s)	0.00							
QP (g/s)	89.9	91.1	92.0	92.1	61.1	95.5	93.0	56.5
HPP (m)	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
TSP (K)	300.00							
DP (m)	1.00							
VSP (m/s)	0.00							
VFP (m**3/s)	0.00							
SYOP (m)	0.05	0.05	0.04	0.05	0.07	0.06	0.06	0.05
SZOP (m)	0.05	0.05	0.04	0.05	0.07	0.06	0.06	0.05
SDIR (deg)	270.							
SSPD (m/s)	0.00							

ALL FOLLOWING SOURCE EMISSION RECORDS HAVE ZERO EMISSION RATE

INPUFF INPUT DATA FOR: Thorney Island (continuous)
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen

TRIAL NAME	:	TC45	TC47
IN	:	6	
LADT	:	F	
LPLC	:	F	
KEYDSP	:	1	
SYMAX (m)	:	1000.0	
LPCC	:	F	
LPIC	:	T	
XGRDSW (km)	:	0.00	
YGRDSW (km)	:	-4.00	
XSIZE (km)	:	8.00	
YSIZE (km)	:	8.00	
NTIME	:	1	
ITIME (s)	:	920	940
NSOURC	:	1	
NREC	:	9	6
XREC (km)	:	0.040	0.050
YREC (km)	:	0.000	
ZREC (m)	:	0.400	0.400
XREC (km)	:	0.053	0.090
YREC (km)	:	0.000	
ZREC (m)	:	0.400	0.400
XREC (km)	:	0.072	0.212
YREC (km)	:	0.000	
ZREC (m)	:	0.400	0.400
XREC (km)	:	0.090	0.250
YREC (km)	:	0.000	
ZREC (m)	:	0.400	0.400
XREC (km)	:	0.112	0.335
YREC (km)	:	0.000	
ZREC (m)	:	0.400	0.400
XREC (km)	:	0.158	0.472
YREC (km)	:	0.000	
ZREC (m)	:	0.400	0.400
XREC (km)	:	0.250	-0.100
YREC (km)	:	0.000	
ZREC (m)	:	0.400	0.400
XREC (km)	:	0.335	-0.100
YREC (km)	:	0.000	
ZREC (m)	:	0.400	0.400
XREC (km)	:	0.472	-0.100
YREC (km)	:	0.000	
ZREC (m)	:	0.400	0.400
LDWSH	:	F	
LBID	:	F	
LDEPS	:	F	
LUPLRS	:	F	
LCMBPF	:	T	
ISTEP (s)	:	-1	
ISAMPL (s)	:	5	5
ISTRTC (s)	:	0	
SDCMBN	:	1.00	
ANHGT (m)	:	10.00	10.00
WDIR (deg)	:	270.0	
WSPD (m/s)	:	2.30	1.50
HL (m)	:	9999.	
KST	:	6	7
SGPH (rad)	:	-9.900	
SGTH (rad)	:	-9.900	
TEMP (K)	:	286.25	287.45
CDIS (km)	:	0.040	0.050
XSORC (km)	:	0.000	
YSORC (km)	:	0.000	
NSRCDS	:	2	2
ISUPDT (s)	:	460	470
DV (cm/s)	:	0.00	
SVV (cm/s)	:	0.00	
QP (g/s)	:	0.107E+05	0.102E+05
HPP (m)	:	0.00	0.00
TSP (K)	:	300.00	
DP (m)	:	1.00	
VSP (m/s)	:	0.00	
VFP (m**3/s)	:	0.00	
SYOP (m)	:	0.77	0.34
SZOP (m)	:	0.77	0.34
SDIR (deg)	:	270.	
SSPD (m/s)	:	0.00	

ALL FOLLOWING SOURCE EMISSION RECORDS HAVE ZERO EMISSION RATE

INPUFF INPUT DATA FOR: Thorney Island (Instantaneous)
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen

TRIAL NAME	: TI6	TI7	TI8	TI9	TI12	TI13	TI17	TI18	TI19
IW	: 6								
LADT	: F								
LPRT	: F								
KEYDSP	: 1								
SYMAX (m)	: 1000.0								
LPCC	: F								
LPIC	: T								
XGRDSW (km)	: 0.00								
YGRDSW (km)	: -4.00								
XSIZE (km)	: 8.00								
YSIZE (km)	: 8.00								
NTIME	: 1								
ITIME (s)	: 800	700	800	900	800	700	700	700	700
NSOURC	: 1								
NREC	: 5	7	7	7	5	6	7	10	7
XREC (km)	: 0.071	0.071	0.071	0.071	0.071	0.071	0.040	0.040	0.040
YREC (km)	: 0.000								
ZREC (m)	: 0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400
XREC (km)	: 0.141	0.100	0.100	0.100	0.150	0.100	0.050	0.060	0.060
YREC (km)	: 0.000								
ZREC (m)	: 0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400
XREC (km)	: 0.180	0.150	0.150	0.141	0.200	0.224	0.071	0.070	0.071
YREC (km)	: 0.000								
ZREC (m)	: 0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400
XREC (km)	: 0.283	0.180	0.200	0.180	0.361	0.316	0.100	0.080	0.100
YREC (km)	: 0.000								
ZREC (m)	: 0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400
XREC (km)	: 0.424	0.224	0.364	0.224	0.500	0.361	0.141	0.100	0.224
YREC (km)	: 0.000								
ZREC (m)	: 0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400
XREC (km)	: -0.100	0.361	0.412	0.316	-0.100	0.412	0.224	0.200	0.361
YREC (km)	: 0.000								
ZREC (m)	: 0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400
XREC (km)	: -0.100	0.500	0.510	0.503	-0.100	-0.100	0.500	0.224	0.583
YREC (km)	: 0.000								
ZREC (m)	: 0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400
XREC (km)	: -0.100	-0.100	-0.100	-0.100	-0.100	-0.100	-0.100	0.300	-0.100
YREC (km)	: 0.000								
ZREC (m)	: 0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400
XREC (km)	: -0.100	-0.100	-0.100	-0.100	-0.100	-0.100	-0.100	0.400	-0.100
YREC (km)	: 0.000								
ZREC (m)	: 0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400
XREC (km)	: -0.100	-0.100	-0.100	-0.100	-0.100	-0.100	-0.100	0.510	-0.100
YREC (km)	: 0.000								
ZREC (m)	: 0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400
LDWSH	: F								
LBID	: F								
LDEPS	: F								
LUPLRS	: F								
LCMBPF	: T								
ISTEP (s)	: -1								
ISAMPL (s)	: 1	1	1	1	1	1	1	1	1
ISTRTC (s)	: 0								
SDCMBN	: 1.00								
ANHGT (m)	: 10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
WDIR (deg)	: 270.0								
WSPD (m/s)	: 2.80	3.40	2.40	1.70	2.50	7.30	5.00	7.40	6.40
HL (m)	: 9999.								
KST	: 4	6	4	7	6	4	4	4	5
SGPH (rad)	: -9.900								
SGTH (rad)	: -9.900								
TEMP (K)	: 291.83	290.46	290.68	291.45	283.29	286.88	289.21	289.66	286.47
CDIS (km)	: 0.071	0.071	0.071	0.071	0.071	0.071	0.040	0.040	0.040
XSORC (km)	: 0.000								
YSORC (km)	: 0.000								
NSRCDS	: 100	100	100	100	100	100	100	100	100
ISUPDT (s)	: 8	7	8	9	8	7	7	7	7
DV (cm/s)	: 0.00								
SVV (cm/s)	: 0.00								
QP (g/s)	: 0.393E+06	0.607E+06	0.495E+06	0.430E+06	0.717E+06	0.686E+06	0.124E+07	0.554E+06	0.782E+06
HPP (m)	: 0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TSP (K)	: 300.00								
DP (m)	: 1.00								
VSP (m/s)	: 0.00								
VFP (m**3/s)	: 0.00								
SYOP (m)	: 4.74	5.15	5.74	6.43	5.56	3.48	3.94	3.25	3.38
SZOP (m)	: 4.74	5.15	5.74	6.43	5.56	3.48	3.94	3.25	3.38
SDIR (deg)	: 270.								
SSPD (m/s)	: 0.00								

ALL FOLLOWING SOURCE EMISSION RECORDS HAVE ZERO EMISSION RATE

OB/DG INPUT DATA FOR	:	Burro							
CHEMICAL RELEASED	:	Liquefied natural gas							
MEASURED TEMPERATURE (K)	:	311.27	307.75	309.35	314.27	312.57	306.96	306.02	308.52
MEASUREMENT HEIGHT (m)	:	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
MEASURED TEMPERATURE (K)	:	310.22	306.03	307.07	313.28	311.64	306.53	306.28	308.42
MEASUREMENT HEIGHT (m)	:	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
10-2m TEMP DIFFERENCE (F)	:	-1.48	-2.29	-1.62	-1.47	-1.86	-0.76	0.35	-0.27
EMISSION RATE (KG/S)	:	86.1000	97.3800	86.9600	81.2500	92.2200	99.4600	116.3300	135.9800

OB/DG INPUT DATA FOR	:	Coyote			
CHEMICAL RELEASED	:	Liquefied natural gas			. Methane is at least 86% in c
MEASURED TEMPERATURE (K)	:	311.45	301.49	297.26	
MEASUREMENT HEIGHT (m)	:	1.0	1.0	1.0	
MEASURED TEMPERATURE (K)	:	310.38	300.29	297.46	
MEASUREMENT HEIGHT (m)	:	4.0	4.0	4.0	
16-2m TEMP DIFFERENCE (F)	:	-2.13	-2.55	0.59	
EMISSION RATE (KG/S)	:	100.6700	129.0200	123.0300	

OB/DG INPUT DATA FOR	:	Desert Tortoise			
CHEMICAL RELEASED	:	Anhydrous Ammonia			
MEASURED TEMPERATURE (K)	:	302.03	303.63	307.07	305.63
MEASUREMENT HEIGHT (m)	:	0.8	0.8	0.8	0.8
MEASURED TEMPERATURE (K)	:	303.31	304.31	307.05	306.90
MEASUREMENT HEIGHT (m)	:	16.2	16.2	16.2	16.2
16-2m TEMP DIFFERENCE (F)	:	1.67	0.87	-0.38	1.75
EMISSION RATE (KG/S)	:	79.7000	111.5000	130.7000	96.7000

OB/DG INPUT DATA FOR	:	Goldfish		
CHEMICAL RELEASED	:	Hydrogen fluoride		
MEASURED TEMPERATURE (K)	:	310.40	309.38	307.61
MEASUREMENT HEIGHT (m)	:	2.0	2.0	2.0
MEASURED TEMPERATURE (K)	:	310.93	309.41	308.96
MEASUREMENT HEIGHT (m)	:	16.6	16.6	16.6
16-2m TEMP DIFFERENCE (F)	:	0.94	0.06	2.36
EMISSION RATE (KG/S)	:	27.6700	10.4600	10.2700

OB/DG INPUT DATA FOR	:	Hanford (continuous)				
CHEMICAL RELEASED	:	Krypton-85				
MEASURED TEMPERATURE (K)	:	290.87	285.43	288.93	286.65	278.82
MEASUREMENT HEIGHT (m)	:	1.5	0.9	0.9	0.9	0.9
MEASURED TEMPERATURE (K)	:	292.19	284.71	287.54	284.65	279.32
MEASUREMENT HEIGHT (m)	:	6.1	15.0	15.0	15.0	15.0
16-2m TEMP DIFFERENCE (F)	:	6.10	-0.97	-1.33	-2.38	0.68
EMISSION RATE (KG/S)	:	0.0117	0.0120	0.0278	0.0388	0.0171

OB/DG INPUT DATA FOR : Maolin Sands
CHEMICAL RELEASED : Liquified Natural Gas

MEASURED TEMPERATURE (K)	:	288.10	289.30	288.40	289.30
MEASUREMENT HEIGHT (m)	:	1.9	1.9	1.9	1.9
MEASURED TEMPERATURE (K)	:	287.78	289.24	288.36	288.31
MEASUREMENT HEIGHT (m)	:	10.1	10.1	10.1	10.1
16-2m TEMP DIFFERENCE (F)	:	-0.74	-0.20	-0.30	-1.11
EMISSION RATE (KG/S)	:	23.2100	29.1600	21.5100	27.0900

OB/DG INPUT DATA FOR : Maplin Sands
CHEMICAL RELEASED : Liquified Propane Gas

MEASURED TEMPERATURE (K)	:	291.50	290.20	291.90	290.60	286.50	283.60	285.00	281.60
MEASUREMENT HEIGHT (m)	:	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
MEASURED TEMPERATURE (K)	:	291.49	290.12	291.36	290.57	286.71	283.56	285.05	281.63
MEASUREMENT HEIGHT (m)	:	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1
16-2m TEMP DIFFERENCE (F)	:	-0.08	-0.25	-0.16	-0.13	0.47	0.08	0.06	0.02
EMISSION RATE (KG/S)	:	20.3700	19.2000	23.3700	32.5700	16.7100	35.3900	44.2500	19.2000

OB/DG INPUT DATA FOR : Prairie Grass, set 1
CHEMICAL RELEASED : Sulfur dioxide

MEASURED TEMPERATURE (K)	:	305.15	305.15	301.15	304.15	293.15	295.15	301.15	300.15
MEASUREMENT HEIGHT (m)	:	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
MEASURED TEMPERATURE (K)	:	303.55	303.95	299.55	302.15	295.05	294.05	300.15	300.65
MEASUREMENT HEIGHT (m)	:	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
16-2m TEMP DIFFERENCE (F)	:	-2.88	-2.16	-2.88	-3.60	3.42	-1.98	-1.80	0.90
EMISSION RATE (KG/S)	:	0.0899	0.0911	0.0920	0.0921	0.0611	0.0955	0.0930	0.0565

OB/DG INPUT DATA FOR : Thorney Island (continuous)
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen

MEASURED TEMPERATURE (K)	:	286.25	287.45
MEASUREMENT HEIGHT (m)	:	2.0	2.0
MEASURED TEMPERATURE (K)	:	-99.90	-99.90
MEASUREMENT HEIGHT (m)	:	-99.9	-99.9
16-2m TEMP DIFFERENCE (F)	:	0.54	0.45
EMISSION RATE (KG/S)	:	10.6700	10.2200

PHAST DATA FOR : Burro
CHEMICAL RELEASED : Liquefied natural gas

*** STUDY DATA (METRIC UNITS) ***

WIND SPEED @ 10m (m/s) :	6.0	5.0	10.3	8.4	10.4	9.7	1.8	5.7
STAB CLASS (A=1,F=6) :	3.	3.	3.	3.	3.	4.	5.	4.
TEMPERATURE (K) :	311.3	307.3	309.0	314.3	312.7	307.0	306.0	308.5
PRESSURE (N/m^2) :	93923.	94840.	94536.	94131.	93523.	94030.	94131.	94030.
SURFACE TEMP (K) :	311.3	307.3	309.0	314.3	312.7	307.0	306.0	308.5
RELATIVE HUMIDITY :	0.071	0.052	0.027	0.059	0.051	0.074	0.045	0.144
SURFACE ROUGHNESS PAR :	0.03697	0.03697	0.03697	0.03697	0.03697	0.03697	0.03697	0.03697

*** CASE DATA ***

TRIAL DESCRIPTION :	BU2	BU3	BU4	BU5	BU6	BU7	BU8	BU9
REC. DISTANCE (m) :	57.0	57.0	57.0	57.0	57.0	57.0	57.0	57.0
REC. DISTANCE (m) :	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0
REC. DISTANCE (m) :	-99.9	-99.9	-99.9	-99.9	-99.9	400.0	400.0	400.0
REC. DISTANCE (m) :	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	800.0	800.0
CONC OF INTEREST (ppm) :	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
MATERIAL NUMBER :	32	32	32	32	32	32	32	32
INVENTORY (kg) :	14980.0	14712.0	15221.0	15444.0	11888.0	17289.0	12453.0	10730.0

*** RELEASE DATA ***
Use Reactive Liquid Method (specify evap rate)

STORAGE TEMP. (K) :	111.6	111.6	111.6	111.6	111.6	111.6	111.6	111.6
EMISSION RATE (kg/s) :	96.10	87.38	86.96	81.25	92.22	99.46	116.93	135.98
EMIS RATE (kg/s/m^2) :	0.0850	0.0850	0.0850	0.0850	0.0850	0.0850	0.0850	0.0850
DURATION (s) :	173.00	167.00	175.00	190.00	129.00	174.00	107.00	79.00
POOL AREA (m^2) :	1012.79	1034.91	1022.97	956.07	1085.11	1170.21	1375.56	1599.63

PHAST DATA FOR : Coyote .
CHEMICAL RELEASED : Liquefied natural gas . Methane is at least 36% in c

*** STUDY DATA (METRIC UNITS) ***

WIND SPEED @ 10m (m/s) :	6.7	11.0	5.7
STAB CLASS (A=1,F=6) :	3.	3.	4.
TEMPERATURE (K) :	311.5	301.5	297.3
PRESSURE (N/m^2) :	93624.	93928.	94232.
SURFACE TEMP (K) :	311.5	301.5	297.3
RELATIVE HUMIDITY :	0.113	0.221	0.228
SURFACE ROUGHNESS PAR :	0.03697	0.03697	0.03697

*** CASE DATA ***

TRIAL DESCRIPTION :	CO3	CO5	CO6
REC. DISTANCE (m) :	140.0	140.0	140.0
REC. DISTANCE (m) :	200.0	200.0	200.0
REC. DISTANCE (m) :	300.0	300.0	300.0
REC. DISTANCE (m) :	-99.9	400.0	400.0
CONC OF INTEREST (ppm) :	100.00	100.00	100.00
MATERIAL NUMBER :	32	32	32
INVENTORY (kg) :	6532.0	12676.0	10139.0

*** RELEASE DATA ***
Use Reactive Liquid Method (specify evap rate)

STORAGE TEMP. (K) :	111.6	111.6	111.6
EMISSION RATE (kg/s) :	100.67	129.02	123.33
EMIS RATE (kg/s/m^2) :	0.0850	0.0850	0.0850
DURATION (s) :	65.00	98.00	82.00
POOL AREA (m^2) :	1184.20	1517.77	1447.48

PHAST DATA FOR : Desert Tortoise
CHEMICAL RELEASED : Anhydrous Ammonia

*** STUDY DATA (METRIC UNITS) ***

WIND SPEED @ 10m (m/s) :	9.7	7.6	9.3	5.2
STAB CLASS (A=1,F=6) :	4.	4.	4.	5.
TEMPERATURE (K) :	302.0	303.5	307.1	305.5
PRESSURE (N/m^2) :	90889.	90990.	90686.	90281.
SURFACE TEMP (K) :	304.3	303.3	304.3	304.0
RELATIVE HUMIDITY :	0.132	0.175	0.148	0.213
SURFACE ROUGHNESS PAR :	0.04931	0.04931	0.04931	0.04931

*** CASE DATA ***

TRIAL DESCRIPTION :	DT1	DT2	DT3	DT4
REC. DISTANCE (m) :	100.0	100.0	100.0	100.0
REC. DISTANCE (m) :	800.0	900.0	800.0	800.0
CONC OF INTEREST (ppm) :	100.00	100.00	100.00	100.00
MATERIAL NUMBER :	5	5	5	5
INVENTORY (kg) :	10042.2	28432.5	21696.2	36842.7

*** RELEASE DATA ***
Use Padded Liquid Vessel
and Liquid Leak (nominal 3m head)

STORAGE TEMP. (K) :	294.7	293.3	295.3	297.3
STORAGE PRESS. (bar-g) :	10.00000	11.02000	11.23000	11.54000
DIKE AREA (m^2) :	0.0	0.0	0.0	0.0
1=wet,2=dry,4=water :	4	4	1	2
HOLE DIAMETER (mm) :	81.	95.	95.	95.
RELEASE HT. (m) :	0.79	0.79	0.79	0.79
DIRECTION (Up/Hor.) :	H	H	H	H

Vary the storage pressure or the hole diameter to obtain the actual emission rate:

EMISSION RATE (kg/s) :	79.70	111.50	130.70	96.70

PHAST DATA FOR : Goldfish
CHEMICAL RELEASED : Hydrogen fluoride

*** STUDY DATA (METRIC UNITS) ***

WIND SPEED @ 10m (m/s) :	7.3	5.4	7.5
STAB CLASS (A=1,F=6) :	4.	4.	4.
TEMPERATURE (K) :	310.4	309.4	307.6
PRESSURE (N/m^2) :	90483.	90078.	90585.
SURFACE TEMP (K) :	310.4	309.4	307.6
RELATIVE HUMIDITY :	0.049	0.107	0.177
SURFACE ROUGHNESS PAR :	0.04931	0.04931	0.04931

*** CASE DATA ***

TRIAL DESCRIPTION :	GF1	GF2	GF3
REC. DISTANCE (m) :	300.0	300.0	300.0
REC. DISTANCE (m) :	1000.0	1000.0	1000.0
REC. DISTANCE (m) :	3000.0	-99.9	3000.0
CONC OF INTEREST (ppm) :	30.00	30.00	30.00
MATERIAL NUMBER :	27	27	27
INVENTORY (kg) :	3459.0	3766.0	3697.0

*** RELEASE DATA ***
Use Padded Liquid Vessel
and Liquid Leak (nominal 3m head)

STORAGE TEMP. (K) :	313.2	311.2	312.2
STORAGE PRESS. (bar-g) :	6.80000	7.35000	7.48000
DIKE AREA (m^2) :	0.0	0.0	0.0
1=wet,2=dry,4=water :	2	2	2
HOLE DIAMETER (mm) :	42.	24.	24.
RELEASE HT. (m) :	1.00	1.00	1.00
DIRECTION (Up/Hor.) :	H	H	H

Vary the storage pressure or the hole diameter to obtain the actual emission rate:

EMISSION RATE (kg/s) :	27.67	10.46	10.27

PHAST DATA FOR : Hanford (continuous)
CHEMICAL RELEASED : Krypton-85

*** STUDY DATA (METRIC UNITS) ***

WIND SPEED @ 10m (m/s) :	3.4	5.6	10.2	5.4	4.2
STAB CLASS (A=1,F=6) :	6.	3.	3.	3.	5.
TEMPERATURE (K) :	290.9	285.4	288.9	286.6	278.3
PRESSURE (N/m^2) :	101325.	101325.	101325.	101325.	101325.
SURFACE TEMP (K) :	290.9	285.4	288.9	286.6	278.3
RELATIVE HUMIDITY :	0.200	0.200	0.200	0.200	0.200
SURFACE ROUGHNESS PAR :	0.06886	0.06886	0.06886	0.06886	0.06886

*** CASE DATA ***

TRIAL DESCRIPTION :	HC1	HC2	HC3	HC4	HC5
REC. DISTANCE (m) :	200.0	200.0	200.0	200.0	200.0
REC. DISTANCE (m) :	800.0	800.0	800.0	800.0	800.0
CONC OF INTEREST (ppm) :	0.10	0.10	0.10	0.10	0.10
MATERIAL NUMBER :	66	66	66	66	66
(66=NO with m.w.=29.0)					
INVENTORY (kg) :	10.9	10.9	23.3	22.8	20.4

*** RELEASE DATA ***
Use Pressurized Gas Vessel
and Vapor Leak (short line)

STORAGE TEMP. (K) :	290.9	285.4	288.9	286.6	278.3
STORAGE PRESS. (bar-g) :	-99.90000	-99.90000	-99.90000	-99.90000	-99.90000
DIKE AREA (m^2) :	0.0	0.0	0.0	0.0	0.0
1=wet,2=dry,4=water :	2	2	2	2	2
HOLE DIAMETER (mm) :	106.	59.	67.	106.	86.
RELEASE HT. (m) :	1.00	1.00	1.00	1.00	1.00
DIRECTION (Up/Hor.) :	H	H	H	H	H

Vary the storage pressure or the hole diameter to obtain the actual emission rate:

EMISSION RATE (kg/s) :	0.01	0.01	0.03	0.04	0.02

PHAST DATA FOR : Hanford (instantaneous)
CHEMICAL RELEASED : Krypton-85

*** STUDY DATA (METRIC UNITS) ***

WIND SPEED @ 10m (m/s) :	3.6	6.0	11.1	10.4	6.4	2.9
STAB CLASS (A=1,F=6) :	6.	4.	3.	3.	3.	5.
TEMPERATURE (K) :	291.5	285.1	288.7	288.3	285.6	277.8
PRESSURE (N/m^2) :	101325.	101325.	101325.	101325.	101325.	101325.
SURFACE TEMP (K) :	291.5	285.1	288.7	288.3	285.6	277.8
RELATIVE HUMIDITY :	0.200	0.200	0.200	0.200	0.200	0.200
SURFACE ROUGHNESS PAR :	0.06886	0.06886	0.06886	0.06886	0.06886	0.06886

*** CASE DATA ***

TRIAL DESCRIPTION :	HI2	HI3	HI5	HI6	HI7	HI8
REC. DISTANCE (m) :	200.0	200.0	200.0	200.0	200.0	200.0
REC. DISTANCE (m) :	800.0	800.0	800.0	800.0	800.0	800.0
CONC OF INTEREST (ppm) :	0.10	0.10	0.10	0.10	0.10	0.10
MATERIAL NUMBER :	66	66	66	66	66	66
(66=NO with m.w.=29.0)						
INVENTORY (kg) :	10.0	10.0	10.0	10.0	10.0	10.0

*** RELEASE DATA ***
Use Pressurized Gas Vessel
and Catastrophic Rupture

STORAGE TEMP. (K) :	291.5	285.1	288.7	288.3	285.6	277.8
STORAGE PRESS. (bar-g) :	-99.90000	-99.90000	-99.90000	-99.90000	-99.90000	-99.90000
DIKE AREA (m^2) :	0.0	0.0	0.0	0.0	0.0	0.0
1=wet,2=dry,4=water :	2	2	2	2	2	2
HOLE DIAMETER (mm) :	2758.	2738.	2750.	2748.	2740.	2714.
RELEASE HT. (m) :	0.00	0.00	0.00	0.00	0.00	0.00
DIRECTION (Up/Hor.) :	U	U	U	U	U	U

Vary the storage pressure or the hole diameter to obtain the actual emission rate:

EMISSION RATE (kg/s) :	0.00	0.00	0.00	0.00	0.00	0.00

PHAST DATA FOR : Maplin Sands
CHEMICAL RELEASED : Liquified Natural Gas

*** STUDY DATA (METRIC UNITS) ***

WIND SPEED @ 10m (m/s) :	5.6	7.4	8.3	9.6
STAB CLASS (A=1,F=6) :	4.	4.	4.	4.
TEMPERATURE (K) :	288.1	289.3	288.4	289.3
PRESSURE (N/m^2) :	101325.	101325.	101325.	101325.
SURFACE TEMP (K) :	288.3	290.0	289.0	289.3
RELATIVE HUMIDITY :	0.530	0.710	0.900	0.770
SURFACE ROUGHNESS PAR :	0.03841	0.03841	0.03841	0.03841

*** CASE DATA ***

TRIAL DESCRIPTION :	MS27	MS29	MS34	MS35
REC. DISTANCE (m) :	89.0	58.0	87.0	129.0
REC. DISTANCE (m) :	131.0	90.0	179.0	250.0
REC. DISTANCE (m) :	324.0	130.0	-99.9	406.0
REC. DISTANCE (m) :	400.0	182.0	-99.9	-99.9
REC. DISTANCE (m) :	650.0	252.0	-99.9	-99.9
REC. DISTANCE (m) :	-99.9	324.0	-99.9	-99.9
REC. DISTANCE (m) :	-99.9	403.0	-99.9	-99.9
CONC OF INTEREST (ppm) :	100.00	100.00	100.00	100.00
MATERIAL NUMBER :	32	32	32	32
INVENTORY (kg) :	3714.4	6561.3	2043.6	3657.7

*** RELEASE DATA ***
Use Reactive Liquid Method (specify evap rate)

STORAGE TEMP. (K) :	111.7	111.7	111.7	111.7
EMISSION RATE (kg/s) :	23.21	29.16	21.51	27.09
EMIS RATE (kg/s/m^2) :	0.0854	0.0850	0.0845	0.0854
DURATION (s) :	160.00	225.00	95.00	135.00
POOL AREA (m^2) :	271.72	343.07	254.47	317.31

PHAST DATA FOR : Maplin Sands
CHEMICAL RELEASED : Liquified Propane Gas

*** STUDY DATA (METRIC UNITS) ***

WIND SPEED @ 10m (m/s) :	4.0	5.8	8.1	6.2	5.5	7.9	7.4	3.7
STAB CLASS (A=1,F=6) :	4.	4.	4.	4.	4.	4.	4.	4.
TEMPERATURE (K) :	291.5	290.2	291.9	290.6	286.5	283.6	285.0	281.6
PRESSURE (N/m^2) :	101325.	101325.	101325.	101325.	101325.	101325.	101325.	101325.
SURFACE TEMP (K) :	291.7	292.1	290.5	290.3	286.2	283.1	285.1	282.6
RELATIVE HUMIDITY :	0.800	0.800	0.710	0.780	0.880	0.790	0.630	0.850
SURFACE ROUGHNESS PAR :	0.03841	0.03841	0.03841	0.03841	0.03841	0.03841	0.03841	0.03841

*** CASE DATA ***

TRIAL DESCRIPTION :	MS42	MS43	MS46	MS47	MS49	MS50	MS52	MS54
REC. DISTANCE (m) :	28.0	88.0	34.0	90.0	90.0	59.0	61.0	56.0
REC. DISTANCE (m) :	53.0	129.0	91.0	128.0	129.0	93.0	95.0	85.0
REC. DISTANCE (m) :	83.0	249.0	130.0	182.0	180.0	182.0	178.0	178.0
REC. DISTANCE (m) :	123.0	400.0	182.0	250.0	250.0	400.0	249.0	247.0
REC. DISTANCE (m) :	179.0	-99.9	250.0	321.0	322.0	-99.9	398.0	-99.9
REC. DISTANCE (m) :	247.0	-99.9	322.0	400.0	400.0	-99.9	650.0	-99.9
REC. DISTANCE (m) :	398.0	-99.9	401.0	-99.9	-99.9	-99.9	-99.9	-99.9
CONC OF INTEREST (ppm) :	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
MATERIAL NUMBER :	45	45	45	45	45	45	45	45
INVENTORY (kg) :	3756.6	6336.0	8413.2	6839.7	1503.9	5742.4	6195.0	3456.0

*** RELEASE DATA ***
Use Reactive Liquid Method (specify evap rate)

STORAGE TEMP. (K) :	231.1	231.1	231.1	231.1	231.1	231.1	231.1	231.1
EMISSION RATE (kg/s) :	20.87	19.20	23.37	32.57	16.71	35.89	44.25	19.20
EMIS RATE (kg/s/m^2) :	0.1197	0.1195	0.1207	0.1199	0.1203	0.1202	0.1196	0.1195
DURATION (s) :	180.00	330.00	360.00	210.00	90.00	160.00	140.00	180.00
POOL AREA (m^2) :	174.37	160.61	193.59	271.72	138.93	298.65	369.84	160.61

PHAST DATA FOR : Prairie Grass, sec 1
CHEMICAL RELEASED : Sulfur dioxide

*** STUDY DATA (METRIC UNITS) ***

WIND SPEED @ 10m (m/s) :	4.9	5.9	3.4	5.4	2.7	4.0	3.7	4.6
STAB CLASS (A=1,F=6) :	2.	3.	3.	2.	6.	1.	1.	4.
TEMPERATURE (K) :	305.1	305.1	301.1	304.1	293.1	295.1	301.1	300.1
PRESSURE (N/m^2) :	101325.	101325.	101325.	101325.	101325.	101325.	101325.	101325.
SURFACE TEMP (K) :	305.1	305.1	301.1	304.1	293.1	295.1	301.1	300.1
RELATIVE HUMIDITY :	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
SURFACE ROUGHNESS PAR :	0.05392	0.05392	0.05392	0.05392	0.05392	0.05392	0.05392	0.05392

*** CASE DATA ***

TRIAL DESCRIPTION :	PG7	PG8	PG9	PG10	PG13	PG15	PG16	PG17
REC. DISTANCE (m) :	50.0	50.0	50.0	50.0	400.0	50.0	50.0	50.0
REC. DISTANCE (m) :	100.0	100.0	100.0	100.0	800.0	100.0	100.0	100.0
REC. DISTANCE (m) :	200.0	200.0	200.0	200.0	-99.9	200.0	200.0	200.0
REC. DISTANCE (m) :	400.0	400.0	400.0	400.0	-99.9	400.0	400.0	400.0
REC. DISTANCE (m) :	800.0	800.0	800.0	800.0	-99.9	800.0	800.0	800.0
CONC OF INTEREST (ppm) :	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MATERIAL NUMBER :	49	49	49	49	49	49	49	49
INVENTORY (kg) :	53.9	54.7	55.2	55.3	36.7	57.3	55.8	33.9

*** RELEASE DATA ***
Use Pressurized Gas Vessel
and Vapor Leak (short line)

STORAGE TEMP. (K) :	305.1	305.1	301.1	304.1	293.1	295.1	301.1	300.1
STORAGE PRESS. (bar-g) :	-99.90000	-99.90000	-99.90000	-99.90000	-99.90000	-99.90000	-99.90000	-99.90000
DIKE AREA (m^2) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1=wet,2=dry,4=water :	2	2	2	2	2	2	2	2
HOLE DIAMETER (mm) :	51.	51.	51.	51.	51.	51.	51.	51.
RELEASE HT. (m) :	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
DIRECTION (Up/Hor.) :	H	H	H	H	H	H	H	H

Vary the storage pressure or the hole diameter to obtain the actual emission rate:

EMISSION RATE (kg/s) :	0.09	0.09	0.09	0.09	0.06	0.10	0.09	0.06

PHAST DATA FOR : Thorney Island (continuous)
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen

*** STUDY DATA (METRIC UNITS) ***

WIND SPEED @ 10m (m/s) :	2.3	1.5
STAB CLASS (A=1,F=6) :	5.	6.
TEMPERATURE (K) :	286.3	287.5
PRESSURE (N/m^2) :	101325.	101325.
SURFACE TEMP (K) :	286.0	287.6
RELATIVE HUMIDITY :	1.000	0.974
SURFACE ROUGHNESS PAR :	0.05791	0.05791

*** CASE DATA ***

TRIAL DESCRIPTION :	TC45	TC47
REC. DISTANCE (m) :	40.0	50.0
REC. DISTANCE (m) :	53.0	90.0
REC. DISTANCE (m) :	72.0	212.0
REC. DISTANCE (m) :	90.0	250.0
REC. DISTANCE (m) :	112.0	335.0
REC. DISTANCE (m) :	158.0	472.0
REC. DISTANCE (m) :	250.0	-99.9
REC. DISTANCE (m) :	335.0	-99.9
REC. DISTANCE (m) :	472.0	-99.9
CONC OF INTEREST (ppm) :	100.00	100.00
MATERIAL NUMBER :	62	62
INVENTORY (kg) :	4855.0	4752.0

*** RELEASE DATA ***
Use Pressurized Gas Vessel
and Vapor Leak (short line)

STORAGE TEMP. (K) :	286.3	287.5
STORAGE PRESS. (bar-g) :	-99.90000	-99.90000
DIKE AREA (m^2) :	0.0	0.0
1=wet,2=dry,4=water :	2	2
HOLE DIAMETER (mm) :	2000.	2000.
RELEASE HT. (m) :	0.00	0.00
DIRECTION (Up/Hor.) :	H	H

Vary the storage pressure or the hole diameter to obtain the actual emission rate:

EMISSION RATE (kg/s) :	10.67	10.22

PHAST DATA FOR : Thorney Island (Instantaneous)
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen

*** STUDY DATA (METRIC UNITS) ***									
WIND SPEED @ 10m (m/s) :	2.8	3.4	2.4	1.7	2.5	7.3	5.0	7.4	5.4
STAB CLASS (A=1,F=6) :	4.	5.	4.	6.	5.	4.	4.	4.	4.
TEMPERATURE (K) :	291.8	290.5	290.7	291.5	283.3	286.9	289.2	289.7	286.5
PRESSURE (N/m^2) :	101325.	102136.	102237.	101933.	101325.	101933.	100813.	100717.	100616.
SURFACE TEMP (K) :	291.8	290.9	291.5	291.5	285.1	287.9	291.0	297.5	286.1
RELATIVE HUMIDITY :	0.748	0.807	0.876	0.873	0.662	0.741	0.940	0.813	0.848
SURFACE ROUGHNESS PAR :	0.06329	0.06329	0.05948	0.05609	0.06329	0.05791	0.06329	0.05263	0.05791
*** CASE DATA ***									
TRIAL DESCRIPTION :	TI6	TI7	TI8	TI9	TI12	TI13	TI17	TI18	TI19
REC. DISTANCE (m) :	71.0	71.0	71.0	71.0	71.0	71.0	40.0	40.0	40.0
REC. DISTANCE (m) :	141.0	100.0	100.0	100.0	150.0	100.0	50.0	60.0	60.0
REC. DISTANCE (m) :	180.0	150.0	150.0	141.0	200.0	224.0	71.0	70.0	71.0
REC. DISTANCE (m) :	283.0	180.0	200.0	180.0	361.0	316.0	100.0	80.0	100.0
REC. DISTANCE (m) :	424.0	224.0	364.0	224.0	500.0	361.0	141.0	100.0	224.0
REC. DISTANCE (m) :	-99.9	361.0	412.0	316.0	-99.9	412.0	224.0	200.0	361.0
REC. DISTANCE (m) :	-99.9	500.0	510.0	503.0	-99.9	-99.9	500.0	224.0	583.0
REC. DISTANCE (m) :	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	300.0	-99.9
REC. DISTANCE (m) :	-99.9	-99.9	-99.9	-99.9	-99.9	-99.3	-99.9	400.0	-99.9
REC. DISTANCE (m) :	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9	510.0	-99.9
CONC OF INTEREST (ppm) :	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
MATERIAL NUMBER :	57	58	59	60	61	62	63	64	65
INVENTORY (kg) :	3147.0	4249.0	3958.0	3866.0	5736.0	4800.0	8711.0	3881.0	5477.0
*** RELEASE DATA ***									
Use Pressurized Gas Vessel and Catastrophic Rupture									
STORAGE TEMP. (K) :	291.8	290.5	290.7	291.5	283.3	286.9	289.2	289.7	286.5
STORAGE PRESS. (bar-g) :	-99.90000	-99.90000	-99.90000	-99.90000	-99.90000	-99.90000	-99.90000	-99.90000	-99.90000
DIKE AREA (m^2) :	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1=wet,2=dry,4=water :	2	2	2	2	2	2	2	2	2
HOLE DIAMETER (mm) :	14000.	14000.	14000.	14000.	14000.	14000.	14000.	14000.	14000.
RELEASE HT. (m) :	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIRECTION (Up/Hor.) :	U	U	U	U	U	U	U	U	U

Vary the storage pressure or the hole diameter to obtain the actual emission rate:

EMISSION RATE (kg/s) :	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SLAB INPUT DATA FOR : Burro
CHEMICAL RELEASED : Liquefied natural gas
THE SPILL ID CODE (IDSPL) HAS THE FOLLOWING KEY:
1: EVAPORATING POOL
2: HORIZONTAL JET
3: VERTICAL JET
4: INSTANTANEOUS OR SHORT DURATION

TRIAL	:	BU2	BU3	BU4	BU5	BU6	BU7	BU8	BU9
IDSPL	:	1	1	1	1	1	1	1	1
NCALC (sub-step mult.)	:	1	1	1	1	1	1	1	1
MOL. WT. (kg/mol)	:	0.01746	0.01726	0.01705	0.01708	0.01724	0.01822	0.01812	0.01892
Cp-gas (J/kg-K)	:	2238.0	2238.0	2238.0	2238.0	2238.0	2238.0	2238.0	2238.0
NORMAL BOILING PT (K)	:	111.6	111.6	111.6	111.6	111.6	111.6	111.6	111.6
LIQ MASS FRACTION	:	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
HEAT OF VAP. (J/kg)	:	511900.	511900.	511900.	511900.	511900.	511900.	511900.	511900.
LIQ HEAT CAP (J/kg-K)	:	3348.5	3348.5	3348.5	3348.5	3348.5	3348.5	3348.5	3348.5
LIQ DENSITY (kg/m^3)	:	434.1	432.7	431.2	431.4	432.3	438.3	438.5	443.4
B VAP PRESS CONST	:	983.89	983.89	983.89	983.89	983.89	983.89	983.89	983.89
C VAP PRESS CONST	:	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
GAS TEMPERATURE (K)	:	111.6	111.6	111.6	111.6	111.6	111.6	111.6	111.6
MASS EMIS RATE (kg/s)	:	86.10	87.98	86.96	81.25	92.22	99.46	116.93	135.38
SOURCE AREA (m^2)	:	1012.79	1034.91	1022.37	956.07	1085.11	1170.21	1375.56	1599.63
SOURCE DURATION (s)	:	173.	167.	175.	190.	129.	174.	107.	79.
TOTAL MASS (kg)	:	14980.0	14712.0	15221.0	15444.0	11888.0	17289.0	12453.0	10730.0
SOURCE HEIGHT (m)	:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CONC AVG TIME (s)	:	40.	100.	80.	130.	70.	140.	30.	50.
MAX DIST (m)	:	640.	640.	640.	640.	640.	900.	1300.	1300.
REC HEIGHT (m)	:	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
REC HEIGHT (m)	:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
REC HEIGHT (m)	:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
REC HEIGHT (m)	:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ROUGHNESS LENGTH (m)	:	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020
MET SENSOR HT (m)	:	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
WIND SPEED (m/s)	:	5.4	5.4	9.0	7.4	9.1	8.4	1.8	5.7
TEMPERATURE (K)	:	311.3	307.9	309.0	314.3	312.7	307.0	306.0	308.5
REL HUMID (%)	:	7.1	5.2	2.7	5.9	5.1	7.4	4.5	14.4
SPECIFIC CONC (ppm)	:	100.	100.	100.	100.	100.	100.	100.	100.
STAB CLASS (A=1,F=6)	:	0.	0.	0.	0.	0.	0.	0.	0.
1/MONIN-OBUKHOV (1/m)	:	-0.0772	-0.1720	-0.0203	-0.0281	-0.0187	-0.0067	0.0646	-0.0004
ENDING RECORD	:	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.

SLAB INPUT DATA FOR : Coyote
CHEMICAL RELEASED : Liquefied natural gas
THE SPILL ID CODE (IDSPL) HAS THE FOLLOWING KEY:
1: EVAPORATING POOL
2: HORIZONTAL JET
3: VERTICAL JET
4: INSTANTANEOUS OR SHORT DURATION

. Methane is at least 86% in c

TRIAL	:	CO3	CO5	CO6
IDSPL	:	1	1	1
NCALC (sub-step mult.)	:	1	1	1
MOL. WT. (kg/mol)	:	0.01951	0.02019	0.01909
Cp-gas (J/kg-K)	:	2238.0	2238.0	2238.0
NORMAL BOILING PT (K)	:	111.6	111.6	111.6
LIQ MASS FRACTION	:	1.000	1.000	1.000
HEAT OF VAP. (J/kg)	:	511900.	511900.	511900.
LIQ HEAT CAP (J/kg-K)	:	3348.5	3348.5	3348.5
LIQ DENSITY (kg/m^3)	:	447.4	452.7	444.7
B VAP PRESS CONST	:	983.89	983.89	983.89
C VAP PRESS CONST	:	0.10	0.10	0.10
GAS TEMPERATURE (K)	:	111.6	111.6	111.6
MASS EMIS RATE (kg/s)	:	100.67	129.02	123.03
SOURCE AREA (m^2)	:	1184.20	1517.77	1447.48
SOURCE DURATION (s)	:	65.	98.	82.
TOTAL MASS (kg)	:	6532.0	12676.0	10139.0
SOURCE HEIGHT (m)	:	0.00	0.00	0.00
CONC AVG TIME (s)	:	50.	90.	70.
MAX DIST (m)	:	800.	900.	900.
REC HEIGHT (m)	:	1.0	1.0	1.0
REC HEIGHT (m)	:	0.0	0.0	0.0
REC HEIGHT (m)	:	0.0	0.0	0.0
REC HEIGHT (m)	:	0.0	0.0	0.0
ROUGHNESS LENGTH (m)	:	0.00020	0.00020	0.00020
MET SENSOR HT (m)	:	2.0	2.0	2.0
WIND SPEED (m/s)	:	6.0	9.7	4.5
TEMPERATURE (K)	:	311.5	301.5	297.3
REL HUMID (%)	:	11.3	22.1	22.8
SPECIFIC CONC (ppm)	:	100.	100.	100.
STAB CLASS (A=1,F=6)	:	0.	0.	0.
1/MONIN-OBUKHOV (1/m)	:	-0.0820	-0.0316	0.0178
ENDING RECORD	:	-1.	-1.	-1.

SLAB INPUT DATA FOR : Desert Tortoise
CHEMICAL RELEASED : Anhydrous Ammonia
THE SPILL ID CODE (IDSPL) HAS THE FOLLOWING KEY:
1: EVAPORATING POOL
2: HORIZONTAL JET
3: VERTICAL JET
4: INSTANTANEOUS OR SHORT DURATION

TRIAL	: DT1	DT2	DT3	DT4
IDSPL	2	2	2	2
NCALC (sub-step mult.)	1	1	1	1
MOL. WT. (kg/mol)	0.01703	0.01703	0.01703	0.01703
Cp-gas (J/kg-K)	2190.0	2190.0	2190.0	2190.0
NORMAL BOILING PT (K)	239.7	239.7	239.7	239.7
LIQ MASS FRACTION	0.313	0.317	0.311	0.304
HEAT OF VAP. (J/kg)	1370000.	1370000.	1370000.	1370000.
LIQ HEAT CAP (J/kg-K)	4490.0	4490.0	4490.0	4490.0
LIQ DENSITY (kg/m^3)	682.8	682.8	682.8	682.8
B VAP PRESS CONST	2132.52	2132.52	2132.52	2132.52
C VAP PRESS CONST	-32.36	-32.96	-32.96	-32.96
GAS TEMPERATURE (K)	294.7	293.3	295.3	297.3
MASS EMIS RATE (kg/s)	79.70	111.50	130.70	96.70
SOURCE AREA (m^2)	0.84	1.12	1.16	1.21
SOURCE DURATION (s)	126.	255.	166.	381.
TOTAL MASS (kg)	10042.2	28432.5	21696.2	36842.7
SOURCE HEIGHT (m)	0.79	0.79	0.79	0.79
CONC AVG TIME (s)	80.	160.	120.	300.
MAX DIST (m)	1300.	1300.	1300.	1300.
REC HEIGHT (m)	1.0	1.0	1.0	1.0
REC HEIGHT (m)	0.0	0.0	0.0	0.0
REC HEIGHT (m)	0.0	0.0	0.0	0.0
REC HEIGHT (m)	0.0	0.0	0.0	0.0
ROUGHNESS LENGTH (m)	0.00300	0.00300	0.00300	0.00300
MET SENSOR HT (m)	2.0	2.0	2.0	2.0
WIND SPEED (m/s)	7.4	5.8	7.4	4.5
TEMPERATURE (K)	302.0	303.6	307.1	305.6
REL HUMID (%)	13.2	17.5	14.8	21.3
SPECIFIC CONC (ppm)	100.	100.	100.	100.
STAB CLASS (A=1,F=6)	0.	0.	0.	0.
1/MONIN-OBUKHOV (1/m)	0.0107	0.0119	0.0012	0.0244
ENDING RECORD	-1.	-1.	-1.	-1.

SLAB INPUT DATA FOR : Goldfish
CHEMICAL RELEASED : Hydrogen fluoride
THE SPILL ID CODE (IDSPL) HAS THE FOLLOWING KEY:
1: EVAPORATING POOL
2: HORIZONTAL JET
3: VERTICAL JET
4: INSTANTANEOUS OR SHORT DURATION

TRIAL	: GF1	GF2	GF3
IDSPL	2	2	2
NCALC (sub-step mult.)	1	1	1
MOL. WT. (kg/mol)	0.02001	0.02001	0.02001
Cp-gas (J/kg-K)	1450.0	1450.0	1450.0
NORMAL BOILING PT (K)	292.7	292.7	292.7
LIQ MASS FRACTION	0.840	0.853	0.847
HEAT OF VAP. (J/kg)	373000.	373000.	373000.
LIQ HEAT CAP (J/kg-K)	2528.0	2528.0	2528.0
LIQ DENSITY (kg/m^3)	987.0	987.0	987.0
B VAP PRESS CONST	3404.51	3404.51	3404.51
C VAP PRESS CONST	15.12	15.12	15.12
GAS TEMPERATURE (K)	313.2	311.2	312.2
MASS EMIS RATE (kg/s)	27.67	10.46	10.27
SOURCE AREA (m^2)	0.29	0.09	0.09
SOURCE DURATION (s)	125.	360.	360.
TOTAL MASS (kg)	3459.0	3766.0	3697.0
SOURCE HEIGHT (m)	1.00	1.00	1.00
CONC AVG TIME (s)	88.	88.	88.
MAX DIST (m)	3500.	1500.	3500.
REC HEIGHT (m)	1.0	1.0	1.0
REC HEIGHT (m)	0.0	0.0	0.0
REC HEIGHT (m)	0.0	0.0	0.0
REC HEIGHT (m)	0.0	0.0	0.0
ROUGHNESS LENGTH (m)	0.00300	0.00300	0.00300
MET SENSOR HT (m)	2.0	2.0	2.0
WIND SPEED (m/s)	5.5	4.2	5.4
TEMPERATURE (K)	310.4	309.4	307.5
REL HUMID (%)	4.9	10.7	17.7
SPECIFIC CONC (ppm)	30.	30.	30.
STAB CLASS (A=1,F=6)	0.	0.	0.
1/MONIN-OBUKHOV (1/m)	0.0099	0.0058	0.0244
ENDING RECORD	-1.	-1.	-1.

SLAB INPUT DATA FOR : Hanford (continuous)
CHEMICAL RELEASED : Krypton-85
THE SPILL ID CODE (IDSPL) HAS THE FOLLOWING KEY:
1: EVAPORATING POOL
2: HORIZONTAL JET
3: VERTICAL JET
4: INSTANTANEOUS OR SHORT DURATION

TRIAL	HC1	HC2	HC3	HC4	HC5
IDSPL	2	2	2	2	2
NCALC (sub-step mult.)	1	1	1	1	1
MOL. WT. (kg/mol)	0.02900	0.02900	0.02900	0.02900	0.02900
Cp-gas (J/kg-K)	249.0	249.0	249.0	249.0	249.0
NORMAL BOILING PT (K)	120.3	120.3	120.3	120.3	120.3
LIQ MASS FRACTION	0.000	0.000	0.000	0.000	0.000
HEAT OF VAP. (J/kg)	115800.	115800.	115800.	115800.	115800.
LIQ HEAT CAP (J/kg-K)	-99.9	-99.9	-99.9	-99.9	-99.9
LIQ DENSITY (kg/m^3)	-99.9	-99.9	-99.9	-99.9	-99.9
B VAP PRESS CONST	-1.00	-1.00	-1.00	-1.00	-1.00
C VAP PRESS CONST	0.00	0.00	0.00	0.00	0.00
GAS TEMPERATURE (K)	290.9	285.4	288.9	286.6	278.3
MASS EMIS RATE (kg/s)	0.01	0.01	0.03	0.04	0.02
SOURCE AREA (m^2)	0.01	0.00	0.00	0.01	0.01
SOURCE DURATION (s)	928.	905.	855.	598.	1191.
TOTAL MASS (kg)	10.9	10.9	23.8	22.8	20.4
SOURCE HEIGHT (m)	1.00	1.00	1.00	1.00	1.00
CONC AVG TIME (s)	461.	345.	269.	269.	538.
MAX DIST (m)	1300.	1300.	1300.	1300.	1300.
REC HEIGHT (m)	1.5	1.5	1.5	1.5	1.5
REC HEIGHT (m)	0.0	0.0	0.0	0.0	0.0
REC HEIGHT (m)	0.0	0.0	0.0	0.0	0.0
REC HEIGHT (m)	0.0	0.0	0.0	0.0	0.0
ROUGHNESS LENGTH (m)	0.03000	0.03000	0.03000	0.03000	0.03000
MET SENSOR HT (m)	1.5	1.5	1.5	1.5	1.5
WIND SPEED (m/s)	1.3	3.9	7.1	3.9	2.6
TEMPERATURE (K)	290.9	285.4	288.9	286.6	278.8
REL HUMID (%)	20.0	20.0	20.0	20.0	20.0
SPECIFIC CONC (ppm)	0.	0.	0.	0.	0.
STAB CLASS (A=1,F=6)	0.	0.	0.	0.	0.
1/MONIN-OBUKHOV (1/m)	0.1455	-0.0089	-0.0054	-0.0375	0.0142
ENDING RECORD	-1.	-1.	-1.	-1.	-1.

SLAB INPUT DATA FOR : Hanford (Instantaneous)
CHEMICAL RELEASED : Krypton-85
THE SPILL ID CODE (IDSPL) HAS THE FOLLOWING KEY:
1: EVAPORATING POOL
2: HORIZONTAL JET
3: VERTICAL JET
4: INSTANTANEOUS OR SHORT DURATION

TRIAL	HI2	HI3	HI5	HI6	HI7	HI8
IDSPL	4	4	4	4	4	4
NCALC (sub-step mult.)	1	1	1	1	1	1
MOL. WT. (kg/mol)	0.02900	0.02900	0.02900	0.02900	0.02900	0.02900
Cp-gas (J/kg-K)	249.0	249.0	249.0	249.0	249.0	249.0
NORMAL BOILING PT (K)	120.3	120.3	120.3	120.3	120.3	120.3
LIQ MASS FRACTION	0.000	0.000	0.000	0.000	0.000	0.000
HEAT OF VAP. (J/kg)	115800.	115800.	115800.	115800.	115800.	115800.
LIQ HEAT CAP (J/kg-K)	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9
LIQ DENSITY (kg/m^3)	-99.9	-99.9	-99.9	-99.9	-99.9	-99.9
B VAP PRESS CONST	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00
C VAP PRESS CONST	0.00	0.00	0.00	0.00	0.00	0.00
GAS TEMPERATURE (K)	291.5	285.1	288.7	288.3	285.6	277.8
MASS EMIS RATE (kg/s)	0.00	0.00	0.00	0.00	0.00	0.00
SOURCE AREA (m^2)	5.98	5.89	5.94	5.93	5.89	5.79
SOURCE DURATION (s)	0.	0.	0.	0.	0.	0.
TOTAL MASS (kg)	10.0	10.0	10.0	10.0	10.0	10.0
SOURCE HEIGHT (m)	0.00	0.00	0.00	0.00	0.00	0.00
CONC AVG TIME (s)	5.	5.	5.	5.	5.	5.
MAX DIST (m)	1300.	1300.	1300.	1300.	1300.	1300.
REC HEIGHT (m)	1.5	1.5	1.5	1.5	1.5	1.5
REC HEIGHT (m)	0.0	0.0	0.0	0.0	0.0	0.0
REC HEIGHT (m)	0.0	0.0	0.0	0.0	0.0	0.0
REC HEIGHT (m)	0.0	0.0	0.0	0.0	0.0	0.0
ROUGHNESS LENGTH (m)	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000
MET SENSOR HT (m)	1.5	1.5	1.5	1.5	1.5	1.5
WIND SPEED (m/s)	1.3	4.1	7.6	7.2	4.5	1.6
TEMPERATURE (K)	291.5	285.1	288.7	288.3	285.6	277.8
REL HUMID (%)	20.0	20.0	20.0	20.0	20.0	20.0
SPECIFIC CONC (ppm)	0.	0.	0.	0.	0.	0.
STAB CLASS (A=1,F=6)	0.	0.	0.	0.	0.	0.
1/MONIN-OBUKHOV (1/m)	0.1742	-0.0038	-0.0046	-0.0064	-0.0157	0.0367
ENDING RECORD	-1.	-1.	-1.	-1.	-1.	-1.

SLAB INPUT DATA FOR : Maplin Sands
CHEMICAL RELEASED : Liquified Natural Gas
THE SPILL ID CODE (IDSPL) HAS THE FOLLOWING KEY:

1: EVAPORATING POOL
2: HORIZONTAL JET
3: VERTICAL JET
4: INSTANTANEOUS OR SHORT DURATION

TRIAL	MS27	MS29	MS34	MS35
IDSPL	1	1	1	1
NCALC (sub-step mult.)	1	1	1	1
MOL. WT. (kg/mol)	0.01711	0.01626	0.01666	0.01639
Cp-gas (J/kg-K)	2238.0	2238.0	2238.0	2238.0
NORMAL BOILING PT (K)	111.7	111.7	111.7	111.7
LIQ MASS FRACTION	1.000	1.000	1.000	1.000
HEAT OF VAP. (J/kg)	509880.	509880.	509880.	509880.
LIQ HEAT CAP (J/kg-K)	3348.5	3348.5	3348.5	3348.5
LIQ DENSITY (kg/m^3)	435.3	426.3	430.2	427.8
B VAP PRESS CONST	597.34	597.34	597.34	597.34
C VAP PRESS CONST	-7.20	-7.20	-7.20	-7.20
GAS TEMPERATURE (K)	111.7	111.7	111.7	111.7
MASS EMIS RATE (kg/s)	23.21	29.16	21.51	27.09
SOURCE AREA (m^2)	271.72	343.07	254.47	317.31
SOURCE DURATION (s)	160.	225.	95.	135.
TOTAL MASS (kg)	3714.4	6561.3	2043.6	3657.7
SOURCE HEIGHT (m)	0.00	0.00	0.00	0.00
CONC AVG TIME (s)	3.	3.	3.	3.
MAX DIST (m)	1150.	903.	679.	906.
REC HEIGHT (m)	0.9	0.9	0.9	0.9
REC HEIGHT (m)	0.0	0.0	0.0	0.0
REC HEIGHT (m)	0.0	0.0	0.0	0.0
REC HEIGHT (m)	0.0	0.0	0.0	0.0
ROUGHNESS LENGTH (m)	0.00030	0.00030	0.00030	0.00030
MET SENSOR HT (m)	10.0	10.0	10.0	10.0
WIND SPEED (m/s)	5.6	7.4	8.5	9.6
TEMPERATURE (K)	288.1	289.3	288.4	289.3
REL HUMID (%)	53.0	71.0	90.0	77.0
SPECIFIC CONC (ppm)	100.	100.	100.	100.
STAB CLASS (A=1,F=6)	0.	0.	0.	0.
1/MONIN-OBUKHOV (1/m)	-0.0271	0.0008	-0.0097	-0.0123
ENDING RECORD	-1.	-1.	-1.	-1.

SLAB INPUT DATA FOR : Maplin Sands
CHEMICAL RELEASED : Liquified Propane Gas
THE SPILL ID CODE (IDSPL) HAS THE FOLLOWING KEY:

1: EVAPORATING POOL
2: HORIZONTAL JET
3: VERTICAL JET
4: INSTANTANEOUS OR SHORT DURATION

TRIAL	MS42	MS43	MS46	MS47	MS49	MS50	MS52	MS54
IDSPL	1	1	1	1	1	1	1	1
NCALC (sub-step mult.)	1	1	1	1	1	1	1	1
MOL. WT. (kg/mol)	0.04393	0.04393	0.04395	0.04384	0.04376	0.04393	0.04387	0.04394
Cp-gas (J/kg-K)	1678.0	1678.0	1678.0	1678.0	1678.0	1678.0	1678.0	1678.0
NORMAL BOILING PT (K)	231.1	231.1	231.1	231.1	231.1	231.1	231.1	231.1
LIQ MASS FRACTION	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
HEAT OF VAP. (J/kg)	425740.	425740.	425740.	425740.	425740.	425740.	425740.	425740.
LIQ HEAT CAP (J/kg-K)	2520.0	2520.0	2520.0	2520.0	2520.0	2520.0	2520.0	2520.0
LIQ DENSITY (kg/m^3)	500.9	500.9	500.8	501.0	501.2	500.9	501.0	500.8
B VAP PRESS CONST	1872.46	1872.46	1872.46	1872.46	1872.46	1872.46	1872.46	1872.46
C VAP PRESS CONST	-25.17	-25.17	-25.17	-25.17	-25.17	-25.17	-25.17	-25.17
GAS TEMPERATURE (K)	231.1	231.1	231.1	231.1	231.1	231.1	231.1	231.1
MASS EMIS RATE (kg/s)	20.87	19.20	23.37	32.57	16.71	35.89	44.25	19.20
SOURCE AREA (m^2)	174.37	160.61	193.59	271.72	138.93	298.65	369.84	160.61
SOURCE DURATION (s)	180.	330.	360.	210.	90.	160.	140.	180.
TOTAL MASS (kg)	3756.6	6336.0	8413.2	6839.7	1503.9	5742.4	6195.0	3456.0
SOURCE HEIGHT (m)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CONC AVG TIME (s)	3.	3.	3.	3.	3.	3.	3.	3.
MAX DIST (m)	898.	900.	901.	900.	900.	900.	1150.	747.
REC HEIGHT (m)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
REC HEIGHT (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
REC HEIGHT (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
REC HEIGHT (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ROUGHNESS LENGTH (m)	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
MET SENSOR HT (m)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
WIND SPEED (m/s)	4.0	5.3	8.1	6.2	5.5	7.9	7.4	3.7
TEMPERATURE (K)	291.5	290.2	291.9	290.5	286.5	283.5	285.0	281.5
REL HUMID (%)	80.0	80.0	71.0	78.0	88.0	79.0	63.0	85.0
SPECIFIC CONC (ppm)	100.	100.	100.	100.	100.	100.	100.	100.
STAB CLASS (A=1,F=6)	0.	0.	0.	0.	0.	0.	0.	0.
1/MONIN-OBUKHOV (1/m)	0.0100	0.0000	0.0013	0.0034	0.0144	0.0048	0.0044	0.0147
ENDING RECORD	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.

SLAB INPUT DATA FOR :   Prairie Grass, set 1
CHEMICAL RELEASED   :   Sulfur dioxide
THE SPILL ID CODE (IDSPL) HAS THE FOLLOWING KEY:
1: EVAPORATING POOL
2: HORIZONTAL JET
3: VERTICAL JET
4: INSTANTANEOUS OR SHORT DURATION

TRIAL	PG7	PG8	PG9	PG10	PG13	PG15	PG16	PG17
IDSPL	2	2	2	2	2	2	2	2
NCALC (sub-step mult.)	1	1	1	1	1	1	1	1
MOL. WT. (kg/mol)	0.06400	0.06400	0.06400	0.06400	0.06400	0.06400	0.06400	0.06400
Cp-gas (J/kg-K)	622.6	622.6	622.6	622.6	622.6	622.6	622.6	622.6
NORMAL BOILING PT (K)	263.1	263.1	263.1	263.1	263.1	263.1	263.1	263.1
LIQ MASS FRACTION	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
HEAT OF VAP. (J/kg)	386500.	386500.	386500.	386500.	386500.	386500.	386500.	386500.
LIQ HEAT CAP (J/kg-K)	1331.0	1331.0	1331.0	1331.0	1331.0	1331.0	1331.0	1331.0
LIQ DENSITY (kg/m^3)	1462.0	1462.0	1462.0	1462.0	1462.0	1462.0	1462.0	1462.0
B VAP PRESS CONST	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00
C VAP PRESS CONST	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GAS TEMPERATURE (K)	305.1	305.1	301.1	304.1	293.1	295.1	301.1	300.1
MASS EMIS RATE (kg/s)	0.09	0.09	0.09	0.09	0.06	0.10	0.09	0.06
SOURCE AREA (m^2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOURCE DURATION (s)	600.	600.	600.	600.	600.	600.	600.	600.
TOTAL MASS (kg)	53.9	54.7	55.2	55.3	36.7	57.3	55.8	33.9
SOURCE HEIGHT (m)	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
CONC AVG TIME (s)	600.	600.	600.	600.	600.	600.	600.	600.
MAX DIST (m)	1300.	1300.	1300.	1300.	1300.	1300.	1300.	1300.
REC HEIGHT (m)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
REC HEIGHT (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
REC HEIGHT (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
REC HEIGHT (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ROUGHNESS LENGTH (m)	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600
MET SENSOR HT (m)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
WIND SPEED (m/s)	4.2	4.9	6.9	4.6	1.3	3.4	3.2	3.3
TEMPERATURE (K)	305.1	305.1	301.1	304.1	293.1	295.1	301.1	300.1
REL HUMID (%)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
SPECIFIC CONC (ppm)	1.	1.	1.	1.	1.	1.	1.	1.
STAB CLASS (A=1,F=6)	0.	0.	0.	0.	0.	0.	0.	0.
1/MONIN-OBUKHOV (1/m)	-0.1223	-0.0485	-0.0293	-0.1342	0.1663	-0.1293	-0.1277	0.0201
ENDING RECORD	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.

SLAB INPUT DATA FOR :   Thorney Island (continuous)
CHEMICAL RELEASED   :   Mixture of Freon-12 and Nitrogen
THE SPILL ID CODE (IDSPL) HAS THE FOLLOWING KEY:
1: EVAPORATING POOL
2: HORIZONTAL JET
3: VERTICAL JET
4: INSTANTANEOUS OR SHORT DURATION

TRIAL	TC45	TC47
IDSPL	2	2
NCALC (sub-step mult.)	1	1
MOL. WT. (kg/mol)	0.05780	0.05780
Cp-gas (J/kg-K)	610.0	610.0
NORMAL BOILING PT (K)	243.4	243.4
LIQ MASS FRACTION	0.000	0.000
HEAT OF VAP. (J/kg)	165000.	165000.
LIQ HEAT CAP (J/kg-K)	970.0	970.0
LIQ DENSITY (kg/m^3)	1520.0	1520.0
B VAP PRESS CONST	-1.00	-1.00
C VAP PRESS CONST	0.00	0.00
GAS TEMPERATURE (K)	286.3	287.5
MASS EMIS RATE (kg/s)	10.67	10.22
SOURCE AREA (m^2)	3.14	3.14
SOURCE DURATION (s)	455.	465.
TOTAL MASS (kg)	4855.0	4752.0
SOURCE HEIGHT (m)	0.00	0.00
CONC AVG TIME (s)	30.	30.
MAX DIST (m)	972.	972.
REC HEIGHT (m)	0.4	0.4
REC HEIGHT (m)	0.0	0.0
REC HEIGHT (m)	0.0	0.0
REC HEIGHT (m)	0.0	0.0
ROUGHNESS LENGTH (m)	0.01000	0.01000
MET SENSOR HT (m)	10.0	10.0
WIND SPEED (m/s)	2.3	1.5
TEMPERATURE (K)	286.3	287.5
REL HUMID (%)	100.0	97.4
SPECIFIC CONC (ppm)	100.	100.
STAB CLASS (A=1,F=6)	0.	0.
1/MONIN-OBUKHOV (1/m)	0.0461	0.0923
ENDING RECORD	-1.	-1.

DEGADIS INPUT DATA FOR : Thorney Island (Instantaneous)
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen
THE SPILL ID CODE (IDSPL) HAS THE FOLLOWING KEY:
1: EVAPORATING POOL
2: HORIZONTAL JET
3: VERTICAL JET
4: INSTANTANEOUS OR SHORT DURATION

TRIAL	TI6	TI7	TI8	TI9	TI12	TI13	TI17	TI18	TI19
IDSPL	4	4	4	4	4	4	4	4	4
NCALC (sub-step mult.)	1	1	1	1	1	1	1	1	1
MOL. WT. (kg/mol)	0.04769	0.05058	0.04711	0.04624	0.06849	0.05780	0.12138	0.05404	0.06127
Cp-gas (J/kg-K)	610.0	610.0	610.0	610.0	610.0	610.0	610.0	610.0	610.0
NORMAL BOILING PT (K)	243.4	243.4	243.4	243.4	243.4	243.4	243.4	243.4	243.4
LIQ MASS FRACTION	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
HEAT OF VAP. (J/kg)	165000.	165000.	165000.	165000.	165000.	165000.	165000.	165000.	165000.
LIQ HEAT CAP (J/kg-K)	970.0	970.0	970.0	970.0	970.0	970.0	970.0	970.0	970.0
LIQ DENSITY (kg/m^3)	1520.0	1520.0	1520.0	1520.0	1520.0	1520.0	1520.0	1520.0	1520.0
B VAP PRESS CONST	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00
C VAP PRESS CONST	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GAS TEMPERATURE (K)	291.8	290.5	290.7	291.5	283.3	286.9	289.2	289.7	286.5
MASS EMIS RATE (kg/s)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOURCE AREA (m^2)	153.94	153.94	153.94	153.94	153.94	153.94	153.94	153.94	153.94
SOURCE DURATION (s)	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOTAL MASS (kg)	3147.0	4249.0	3958.0	3866.0	5736.0	4800.0	8711.0	3881.0	5477.0
SOURCE HEIGHT (m)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CONC AVG TIME (s)	1.	1.	1.	1.	1.	1.	1.	1.	1.
MAX DIST (m)	924.	1000.	1010.	1003.	1000.	912.	1000.	1010.	1083.
REC HEIGHT (m)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
REC HEIGHT (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
REC HEIGHT (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
REC HEIGHT (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ROUGHNESS LENGTH (m)	0.01800	0.01800	0.01200	0.00800	0.01800	0.01000	0.01800	0.00500	0.01000
MET SENSOR HT (m)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
WIND SPEED (m/s)	2.8	3.4	2.4	1.7	2.5	7.3	5.0	7.4	6.4
TEMPERATURE (K)	291.8	290.5	290.7	291.5	283.3	286.9	289.2	289.7	286.5
REL HUMID (%)	74.8	80.7	87.6	87.3	66.2	74.1	94.0	81.3	94.3
SPECIFIC CONC (ppm)	100.	100.	100.	100.	100.	100.	100.	100.	100.
STAB CLASS (A=1,F=6)	0.	0.	0.	0.	0.	0.	0.	0.	0.
1/MONIN-OBUKHOV (1/m)	0.0000	0.0110	-0.1100	0.6500	0.1000	-0.0110	-0.0050	-0.0230	0.0030
ENDING RECORD	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.

TRACE INPUT DATA FOR	:	Burro							
CHEMICAL RELEASED	:	Liquefied natural gas							
TRIAL NAME	:	BU2	BU3	BU4	BU5	BU6	BU7	BU8	BU9
CHEMICAL NO.	:	61	61	61	61	61	61	61	61
(999=N2 with m.w.=29.0)									
RELEASE TYPE: 1=CONT., 2=INST., 3=TRANS.									
	:	1	1	1	1	1	1	1	1
PHASE OF CHEMICAL: 1=LIQUID, 2=GAS									
	:	1	1	1	1	1	1	1	1
RELEASE RATE (kg/s)	:	86.1000	87.9800	86.9600	91.2500	92.2200	99.4600	116.9300	135.9800
RELEASE DURATION (s)	:	173.00	167.00	175.00	190.00	129.00	174.00	107.00	79.00
TEMP. OF CHEMICAL (K)	:	111.60	111.60	111.60	111.60	111.60	111.60	111.60	111.60
RELEASE ELEVATION (m)	:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VERTICAL VELO. (m/s)	:	0.00							
HORIZONAL VELO. (m/s)	:	0.00							
INIT. RADIUS (m)	:	17.9550	18.1500	18.0450	17.4450	18.5850	19.3000	20.9250	22.5650
AIR/CHEMICAL MOLE RATIO (INITIAL DILUTION)									
	:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MAX. POOL AREA (m^2)	:	2642.080	2642.080	2642.080	2642.080	2642.080	2642.080	2642.080	2642.080
MIN. POOL DEPTH (m)	:	0.010							
ALBEDO OF POOL	:	0.150							
AEROSOL FORMATION: 1=MANUAL, 2=DEFAULT									
	:	2	2	2	2	2	2	2	2
AEROSOL/FLASH MASS RATIO	:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AEROSOL AIR ENTRAINMENT: 1=MANUAL, 2=DEFAULT									
	:	2	2	2	2	2	2	2	2
AIR/CHEMICAL MASS RATIO	:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SUBSTRATE: 0=W, 1=C, 2=Asoil, 3=SDsoil, 4=SMsoil									
	:	0	0	0	0	0	0	0	0
SUBSTRATE TEMP. (K)	:	311.27	307.75	309.05	314.27	312.67	306.96	306.02	308.52
WIND SPEED (m/s)	:	5.40	5.40	9.00	7.40	9.10	8.40	1.80	5.70
HORZ. STAB.	:	3	3	3	3	3	4	5	4
VERT. STAB.	:	3	3	3	3	3	4	5	4
TEMP. (K)	:	311.27	307.75	309.05	314.27	312.67	306.96	306.02	308.52
HUMIDITY (FRACTION)	:	0.07	0.05	0.03	0.06	0.05	0.07	0.05	0.14
SOLAR RAD. (w/m^2)	:	300.00							
SURFACE ROUGHNESS (m)	:	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020
M-O LENGTH (m)	:	-12.947	-5.814	-49.310	-35.634	-53.393	-148.633	15.478	-2288.323
WIND MEAS. HT. (m)	:	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
CEILING HT. (m)	:	10000.							
UPPER LEVEL STAB.	:	3	3	3	3	3	4	5	4
SIMULATION TIME (s)	:	625.93	625.93	615.56	618.92	615.38	647.62	1044.44	740.35
TLV HT. (m)	:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MAX. DOSAGE DISTANCE (m)	:	140.	140.	140.	140.	140.	400.	800.	800.
CONC. AVG. TIME (s)	:	40.00	100.00	80.00	130.00	70.00	140.00	80.00	50.00

. Methane is at least 86% in c

TRACE INPUT DATA FOR	:	Coyote		
CHEMICAL RELEASED	:	Liquefied natural gas		
TRIAL NAME	:	CO3	CO5	CO6
CHEMICAL NO.	:	61	61	61
(999=N2 with m.w.=29.0)				
RELEASE TYPE: 1=CONT., 2=INST., 3=TRANS.				
	:	1	1	1
PHASE OF CHEMICAL: 1=LIQUID, 2=GAS				
	:	1	1	1
RELEASE RATE (kg/s)	:	100.6700	129.0200	123.0300
RELEASE DURATION (s)	:	65.00	98.00	82.00
TEMP. OF CHEMICAL (K)	:	111.60	111.60	111.60
RELEASE ELEVATION (m)	:	0.00	0.00	0.00
VERTICAL VELO. (m/s)	:	0.00		
HORIZONAL VELO. (m/s)	:	0.00		
INIT. RADIUS (m)	:	19.4150	21.9800	21.4650
AIR/CHEMICAL MOLE RATIO (INITIAL DILUTION)				
	:	0.000	0.000	0.000
MAX. POOL AREA (m^2)	:	2642.080	2642.080	2642.080
MIN. POOL DEPTH (m)	:	0.010		
ALBEDO OF POOL	:	0.150		
AEROSOL FORMATION: 1=MANUAL, 2=DEFAULT				
	:	2	2	2
AEROSOL/FLASH MASS RATIO	:	0.0000	0.0000	0.0000
AEROSOL AIR ENTRAINMENT: 1=MANUAL, 2=DEFAULT				
	:	2	2	2
AIR/CHEMICAL MASS RATIO	:	0.0000	0.0000	0.0000
SUBSTRATE: 0=W, 1=C, 2=Asoil, 3=SDsoil, 4=SMsoil				
	:	0	0	0
SUBSTRATE TEMP. (K)	:	311.45	301.49	297.26
WIND SPEED (m/s)	:	6.00	9.70	4.60
HORZ. STAB.	:	3	3	4
VERT. STAB.	:	3	3	4
TEMP. (K)	:	311.45	301.49	297.26
HUMIDITY (FRACTION)	:	0.11	0.22	0.23
SOLAR RAD. (w/m^2)	:	300.00		
SURFACE ROUGHNESS (m)	:	0.00020	0.00020	0.00020
M-O LENGTH (m)	:	-12.197	-31.665	56.385
WIND MEAS. HT. (m)	:	2.00	2.00	2.00
CEILING HT. (m)	:	10000.		
UPPER LEVEL STAB.	:	3	3	4
SIMULATION TIME (s)	:	650.00	641.24	686.35
TLV HT. (m)	:	1.00	1.00	1.00
MAX. DOSAGE DISTANCE (m)	:	300.	400.	400.
CONC. AVG. TIME (s)	:	50.00	30.00	70.00

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TRACE INPUT DATA FOR          : Desert Tortoise
CHEMICAL RELEASED             : Anhydrous Ammonia
TRIAL NAME                    : DT1        DT2        DT3        DT4
CHEMICAL NO.                  :         22         22         22         22
(999=N2 with m.w.=29.0)
RELEASE TYPE: 1=CONT., 2=INST., 3=TRANS.
                              :          1          1          1          1
PHASE OF CHEMICAL: 1=LIQUID, 2=GAS
                              :          1          1          1          1
RELEASE RATE (kg/s)           :    79.7000   111.5000   130.7000    96.7000
RELEASE DURATION (s)          :     126.00     255.00     166.00     381.00
TEMP. OF CHEMICAL (K)         :     294.70     293.30     295.30     297.00
RELEASE ELEVATION (m)         :       0.79       0.79       0.79       0.79
VERTICAL VELO. (m/s)          :       0.00
HORIZONAL VELO. (m/s)         :       0.00
INIT. RADIUS (m)              :     0.5185     0.5971     0.6089     0.6210
AIR/CHEMICAL MOLE RATIO (INITIAL DILUTION)
                              :      0.000      0.000      0.000      0.000
MAX. POOL AREA (m^2)          :  10000.000  10000.000  10000.000  10000.000
MIN. POOL DEPTH (m)           :      0.010
ALBEDO OF POOL                :      0.150
AEROSOL FORMATION: 1=MANUAL, 2=DEFAULT
                              :          1          1          1          1
AEROSOL/FLASH MASS RATIO      : 10000.000010000.000010000.000010000.0000
AEROSOL AIR ENTRAINMENT: 1=MANUAL, 2=DEFAULT
                              :          2          2          2          2
AIR/CHEMICAL MASS RATIO       :     0.0000     0.0000     0.0000     0.0000
SUBSTRATE: 0=W, 1=C, 2=Asoil, 3=SDsoil, 4=SMsoil
                              :          0          0          4          2
SUBSTRATE TEMP. (K)           :     304.80     303.80     304.80     304.00
WIND SPEED (m/s)              :       7.40       5.80       7.40       4.50
HORZ. STAB.                   :          4          4          4          5
VERT. STAB.                   :          4          4          4          5
TEMP. (K)                     :     302.03     303.63     307.07     305.63
HUMIDITY (FRACTION)           :       0.13       0.17       0.15       0.21
SOLAR RAD. (w/m^2)            :     300.00
SURFACE ROUGHNESS (m)         :    0.00300    0.00300    0.00300    0.00300
M-O LENGTH (m)                :     93.201     84.333    847.250     41.002
WIND MEAS. HT. (m)            :       2.00       2.00       2.00       2.00
CEILING HT. (m)               :     10000.
UPPER LEVEL STAB.             :          4          4          4          5
SIMULATION TIME (s)           :     708.11     737.93     708.11     777.78
TLV HT. (m)                   :       1.00       1.00       1.00       1.00
MAX. DOSAGE DISTANCE (m)      :       800.       800.       800.       800.
CONC. AVG. TIME (s)           :      80.00     160.00     120.00     300.00


TRACE INPUT DATA FOR          :     Goldfish
CHEMICAL RELEASED             :     Hydrogen fluoride
TRIAL NAME                    : GF1        GF2        GF3
CHEMICAL NO.                  :         17         17         17
(999=N2 with m.w.=29.0)
RELEASE TYPE: 1=CONT., 2=INST., 3=TRANS.
                              :          1          1          1
PHASE OF CHEMICAL: 1=LIQUID, 2=GAS
                              :          1          1          1
RELEASE RATE (kg/s)           :    27.6700    10.4600    10.2700
RELEASE DURATION (s)          :     125.00     360.00     360.00
TEMP. OF CHEMICAL (K)         :     313.20     311.20     312.20
RELEASE ELEVATION (m)         :       1.00       1.00       1.00
VERTICAL VELO. (m/s)          :       0.00
HORIZONAL VELO. (m/s)         :       0.00
INIT. RADIUS (m)              :     0.3041     0.1689     0.1717
AIR/CHEMICAL MOLE RATIO (INITIAL DILUTION)
                              :      0.000      0.000      0.000
MAX. POOL AREA (m^2)          :  10000.000  10000.000  10000.000
MIN. POOL DEPTH (m)           :      0.010
ALBEDO OF POOL                :      0.150
AEROSOL FORMATION: 1=MANUAL, 2=DEFAULT
                              :          1          1          1
AEROSOL/FLASH MASS RATIO      : 10000.000010000.000010000.0000
AEROSOL AIR ENTRAINMENT: 1=MANUAL, 2=DEFAULT
                              :          2          2          2
AIR/CHEMICAL MASS RATIO       :     0.0000     0.0000     0.0000
SUBSTRATE: 0=W, 1=C, 2=Asoil, 3=SDsoil, 4=SMsoil
                              :          2          2          2
SUBSTRATE TEMP. (K)           :     310.40     309.38     307.61
WIND SPEED (m/s)              :       5.60       4.20       5.40
HORZ. STAB.                   :          4          4          4
VERT. STAB.                   :          4          4          4
TEMP. (K)                     :     310.40     309.38     307.61
HUMIDITY (FRACTION)           :       0.05       0.11       0.13
SOLAR RAD. (w/m^2)            :     300.00
SURFACE ROUGHNESS (m)         :    0.00300    0.00300    0.00300
M-O LENGTH (m)                :    101.293    173.142     40.327
WIND MEAS. HT. (m)            :       2.00       2.00       2.00
CEILING HT. (m)               :     10000.
UPPER LEVEL STAB.             :          4          4          4
SIMULATION TIME (s)           :    1135.71     338.10    1155.56
TLV HT. (m)                   :       1.00       1.00       1.00
MAX. DOSAGE DISTANCE (m)      :      3000.      1000.      3000.
CONC. AVG. TIME (s)           :      38.30      38.30      38.30
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TRACE INPUT DATA FOR	Hanford (continuous)				
CHEMICAL RELEASED	Krypton-85				
TRIAL NAME	HC1	HC2	HC3	HC4	HC5
CHEMICAL NO. (999=N2 with m.w.=29.0)	999	999	999	999	999
RELEASE TYPE: 1=CONT., 2=INST., 3=TRANS.	1	1	1	1	1
PHASE OF CHEMICAL: 1=LIQUID, 2=GAS	2	2	2	2	2
RELEASE RATE (g/s)	0.0117	0.0160	0.0273	0.0388	0.0171
RELEASE DURATION (s)	328.00	905.00	955.00	398.00	1191.00
TEMP. OF CHEMICAL (K)	290.37	285.43	288.93	286.65	278.82
RELEASE ELEVATION (m)	1.00	1.00	1.00	1.00	1.00
VERTICAL VELO. (m/s)	0.00				
HORIZONAL VELO. (m/s)	0.00				
INIT. RADIUS (m)	0.0528	0.0296	0.0337	0.0532	0.0431
AIR/CHEMICAL MOLE RATIO (INITIAL DILUTION)	0.000	0.000	0.000	0.000	0.000
MAX. POOL AREA (m^2)	10000.000	10000.000	10000.000	10000.000	10000.000
MIN. POOL DEPTH (m)	0.010				
ALBEDO OF POOL	0.150				
AEROSOL FORMATION: 1=MANUAL, 2=DEFAULT	2	2	2	2	2
AEROSOL/FLASH MASS RATIO	0.0000	0.0000	0.0000	0.0000	0.0000
AEROSOL AIR ENTRAINMENT: 1=MANUAL, 2=DEFAULT	2	2	2	2	2
AIR/CHEMICAL MASS RATIO	0.0000	0.0000	0.0000	0.0000	0.0000
SUBSTRATE: 0=W, 1=C, 2=Asoil, 3=SDsoil, 4=SMsoil	2	2	2	2	2
SUBSTRATE TEMP. (K)	290.87	285.43	288.93	286.65	278.82
WIND SPEED (m/s)	1.30	3.90	7.10	3.90	2.60
HORZ. STAB.	6	3	3	3	5
VERT. STAB.	6	3	3	3	5
TEMP. (K)	290.87	285.43	288.93	286.65	278.82
HUMIDITY (FRACTION)	0.20	0.20	0.20	0.20	0.20
SOLAR RAD. (W/m^2)	300.00				
SURFACE ROUGHNESS (m)	0.03000	0.03000	0.03000	0.03000	0.03000
M-O LENGTH (m)	6.875	-111.826	-186.121	-26.653	70.243
WIND MEAS. HT. (m)	1.50	1.50	1.50	1.50	1.50
CEILING HT. (m)	10000.				
UPPER LEVEL STAB.	6	3	3	3	5
SIMULATION TIME (s)	1215.38	805.13	712.68	805.13	907.69
TLV HT. (m)	1.50	1.50	1.50	1.50	1.50
MAX. DOSAGE DISTANCE (m)	800.	800.	800.	800.	800.
CONC. AVG. TIME (s)	460.80	844.80	268.80	268.80	537.60

TRACE INPUT DATA FOR	Hanford (instantaneous)					
CHEMICAL RELEASED	Krypton-85					
TRIAL NAME	HI2	HI3	HI5	HI6	HI7	HI8
CHEMICAL NO. (999=N2 with m.w.=29.0)	999	999	999	999	999	999
RELEASE TYPE: 1=CONT., 2=INST., 3=TRANS.	2	2	2	2	2	2
PHASE OF CHEMICAL: 1=LIQUID, 2=GAS	2	2	2	2	2	2
TOTAL MASS RELEASED (kg)	10.00	10.00	10.00	10.00	10.00	10.00
RELEASE DURATION (s)	0.00	0.00	0.00	0.00	0.00	0.00
TEMP. OF CHEMICAL (K)	291.54	285.09	288.71	288.26	285.59	277.76
RELEASE ELEVATION (m)	0.00	0.00	0.00	0.00	0.00	0.00
VERTICAL VELO. (m/s)	0.00					
HORIZONAL VELO. (m/s)	0.00					
INIT. RADIUS (m)	1.3792	1.3690	1.3748	1.3740	1.3698	1.3572
AIR/CHEMICAL MOLE RATIO (INITIAL DILUTION)	0.000	0.000	0.000	0.000	0.000	0.000
MAX. POOL AREA (m^2)	10000.000	10000.000	10000.000	10000.000	10000.000	10000.000
MIN. POOL DEPTH (m)	0.010					
ALBEDO OF POOL	0.150					
AEROSOL FORMATION: 1=MANUAL, 2=DEFAULT	2	2	2	2	2	2
AEROSOL/FLASH MASS RATIO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AEROSOL AIR ENTRAINMENT: 1=MANUAL, 2=DEFAULT	2	2	2	2	2	2
AIR/CHEMICAL MASS RATIO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SUBSTRATE: 0=W, 1=C, 2=Asoil, 3=SDsoil, 4=SMsoil	2	2	2	2	2	2
SUBSTRATE TEMP. (K)	291.54	285.09	288.71	288.26	285.59	277.76
WIND SPEED (m/s)	1.30	4.10	7.50	7.20	4.50	1.60
HORZ. STAB.	6	4	3	3	3	5
VERT. STAB.	6	4	3	3	3	5
TEMP. (K)	291.54	285.09	288.71	288.26	285.59	277.76
HUMIDITY (FRACTION)	0.20	0.20	0.20	0.20	0.20	0.20
SOLAR RAD. (W/m^2)	300.00					
SURFACE ROUGHNESS (m)	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000
M-O LENGTH (m)	5.742	-262.328	-216.547	-155.306	-63.594	27.267
WIND MEAS. HT. (m)	1.50	1.50	1.50	1.50	1.50	1.50
CEILING HT. (m)	10000.					
UPPER LEVEL STAB.	6	4	3	3	3	5
SIMULATION TIME (s)	1215.38	795.12	705.26	711.11	777.78	1100.00
TLV HT. (m)	1.50	1.50	1.50	1.50	1.50	1.50
MAX. DOSAGE DISTANCE (m)	300.	300.	300.	300.	300.	300.
CONC. AVG. TIME (s)	4.30	4.50	4.50	4.30	4.50	4.50

TRACE INPUT DATA FOR	: Maplin Sands			
CHEMICAL RELEASED	: Liquified Natural Gas			
TRIAL NAME	: MS27	MS29	MS34	MS35
CHEMICAL NO.	: 61	61	61	61
(999=N2 with m.w.=29.0)				
RELEASE TYPE: 1-CONT., 2-INST., 3-TRANS.	: 1	1	1	1
PHASE OF CHEMICAL: 1-LIQUID, 2-GAS	: 1	1	1	1
RELEASE RATE (kg/s)	: 23.2100	29.1600	21.5100	27.0900
RELEASE DURATION (s)	: 160.00	225.00	95.00	135.00
TEMP. OF CHEMICAL (K)	: 111.70	111.70	111.70	111.70
RELEASE ELEVATION (m)	: 0.00	0.00	0.00	0.00
VERTICAL VELO. (m/s)	: 0.00			
HORIZONAL VELO. (m/s)	: 0.00			
INIT. RADIUS (m)	: 9.3000	10.4500	9.0000	10.0500
AIR/CHEMICAL MOLE RATIO (INITIAL DILUTION)	: 0.000	0.000	0.000	0.000
MAX. POOL AREA (m^2)	: 10000.000	10000.000	10000.000	10000.000
MIN. POOL DEPTH (m)	: 0.010			
ALBEDO OF POOL	: 0.150			
AEROSOL FORMATION: 1-MANUAL, 2-DEFAULT	: 2	2	2	2
AEROSOL/FLASH MASS RATIO	: 0.0000	0.0000	0.0000	0.0000
AEROSOL AIR ENTRAINMENT: 1-MANUAL, 2-DEFAULT	: 2	2	2	2
AIR/CHEMICAL MASS RATIO	: 0.0000	0.0000	0.0000	0.0000
SUBSTRATE: 0=W, 1=C, 2=Asoil, 3=SDsoil, 4=SMsoil	: 0	0	0	0
SUBSTRATE TEMP. (K)	: 288.80	290.00	289.00	289.80
WIND SPEED (m/s)	: 5.60	7.40	8.50	9.60
HORZ. STAB.	: 4	4	4	4
VERT. STAB.	: 4	4	4	4
TEMP. (K)	: 288.10	289.30	288.40	289.30
HUMIDITY (FRACTION)	: 0.53	0.71	0.90	0.77
SOLAR RAD. (w/m^2)	: 300.00			
SURFACE ROUGHNESS (m)	: 0.00030	0.00030	0.00030	0.00030
M-O LENGTH (m)	: -36.953	1220.632	-102.720	-81.578
WIND MEAS. HT. (m)	: 10.00	10.00	10.00	10.00
CEILING HT. (m)	: 10000.			
UPPER LEVEL STAB.	: 4	4	4	4
SIMULATION TIME (s)	: 716.07	654.46	621.06	642.29
TLV HT. (m)	: 0.90	0.90	0.90	0.90
MAX. DOSAGE DISTANCE (m)	: 650.	403.	179.	406.
CONC. AVG. TIME (s)	: 3.00	3.00	3.00	3.00

TRACE INPUT DATA FOR	: Maplin Sands							
CHEMICAL RELEASED	: Liquified Propane Gas							
TRIAL NAME	: MS42	MS43	MS46	MS47	MS49	MS50	MS52	MS54
CHEMICAL NO.	: 132	132	132	132	132	132	132	132
(999=N2 with m.w.=29.0)								
RELEASE TYPE: 1-CONT., 2-INST., 3-TRANS.	: 1	1	1	1	1	1	1	1
PHASE OF CHEMICAL: 1-LIQUID, 2-GAS	: 1	1	1	1	1	1	1	1
RELEASE RATE (kg/s)	: 20.8700	19.2000	23.3700	32.5700	16.7100	35.8900	44.2500	19.2000
RELEASE DURATION (s)	: 180.00	330.00	360.00	210.00	90.00	160.00	140.00	180.00
TEMP. OF CHEMICAL (K)	: 231.10	231.10	231.10	231.10	231.10	231.10	231.10	231.10
RELEASE ELEVATION (m)	: 0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VERTICAL VELO. (m/s)	: 0.00							
HORIZONAL VELO. (m/s)	: 0.00							
INIT. RADIUS (m)	: 7.4500	7.1500	7.8500	9.3000	6.6500	9.7500	10.3500	7.1500
AIR/CHEMICAL MOLE RATIO (INITIAL DILUTION)	: 0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MAX. POOL AREA (m^2)	: 10000.000	10000.000	10000.000	10000.000	10000.000	10000.000	10000.000	10000.000
MIN. POOL DEPTH (m)	: 0.010							
ALBEDO OF POOL	: 0.150							
AEROSOL FORMATION: 1-MANUAL, 2-DEFAULT	: 2	2	2	2	2	2	2	2
AEROSOL/FLASH MASS RATIO	: 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AEROSOL AIR ENTRAINMENT: 1-MANUAL, 2-DEFAULT	: 2	2	2	2	2	2	2	2
AIR/CHEMICAL MASS RATIO	: 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SUBSTRATE: 0=W, 1=C, 2=Asoil, 3=SDsoil, 4=SMsoil	: 0	0	0	0	0	0	0	0
SUBSTRATE TEMP. (K)	: 291.70	292.10	290.50	290.30	286.20	283.10	285.10	282.60
WIND SPEED (m/s)	: 4.00	5.80	8.10	6.20	5.50	7.30	7.40	3.70
HORZ. STAB.	: 4	4	4	4	4	4	4	4
VERT. STAB.	: 4	4	4	4	4	4	4	4
TEMP. (K)	: 291.50	290.20	291.90	290.60	286.50	283.60	285.00	281.60
HUMIDITY (FRACTION)	: 0.80	0.80	0.71	0.78	0.38	0.79	0.63	0.35
SOLAR RAD. (w/m^2)	: 300.00							
SURFACE ROUGHNESS (m)	: 0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
M-O LENGTH (m)	: 99.735	9999.000	750.151	294.223	69.596	208.744	224.303	67.837
WIND MEAS. HT. (m)	: 10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
CEILING HT. (m)	: 10000.							
UPPER LEVEL STAB.	: 4	4	4	4	4	4	4	4
SIMULATION TIME (s)	: 699.50	668.37	649.51	664.52	672.73	650.63	687.34	666.76
TLV HT. (m)	: 0.30	0.30	0.30	0.50	0.30	0.30	0.30	0.50
MAX. DOSAGE DISTANCE (m)	: 398.	400.	401.	400.	400.	400.	650.	247.
CONC. AVG. TIME (s)	: 3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00

TRACE INPUT DATA FOR : Prairie Grass, sec 1
CHEMICAL RELEASED : Sulfur dioxide

TRIAL NAME	PG7	PG8	PG9	PG10	PG13	PG15	PG16	PG17
CHEMICAL NO. (999=N2 with m.w.=29.0)	33	33	33	33	33	33	33	33
RELEASE TYPE: 1=CONT., 2=INST., 3=TRANS.	1	1	1	1	1	1	1	1
PHASE OF CHEMICAL: 1=LIQUID, 2=GAS	2	2	2	2	2	2	2	2
RELEASE RATE (kg/s)	0.0899	0.0911	0.0920	0.0921	0.0611	0.0955	0.0930	0.0565
RELEASE DURATION (s)	600.00	600.00	600.00	600.00	600.00	600.00	600.00	600.00
TEMP. OF CHEMICAL (K)	305.15	305.15	301.15	304.15	293.15	295.15	301.15	300.15
RELEASE ELEVATION (m)	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
VERTICAL VELO. (m/s)	0.00							
HORIZONAL VELO. (m/s)	0.00							
INIT. RADIUS (m)	0.0254	0.0254	0.0254	0.0254	0.0254	0.0254	0.0254	0.0254
AIR/CHEMICAL MOLE RATIO (INITIAL DILUTION)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MAX. POOL AREA (m^2)	10000.000	10000.000	10000.000	10000.000	10000.000	10000.000	10000.000	10000.000
MIN. POOL DEPTH (m)	0.010							
ALBEDO OF POOL	0.150							
AEROSOL FORMATION: 1=MANUAL, 2=DEFAULT	2	2	2	2	2	2	2	2
AEROSOL/FLASH MASS RATIO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AEROSOL AIR ENTRAINMENT: 1=MANUAL, 2=DEFAULT	2	2	2	2	2	2	2	2
AIR/CHEMICAL MASS RATIO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SUBSTRATE: 0=W, 1=C, 2=Asoil, 3=SDsoil, 4=SMsoil	2	2	2	2	2	2	2	2
SUBSTRATE TEMP. (K)	305.15	305.15	301.15	304.15	293.15	295.15	301.15	300.15
WIND SPEED (m/s)	4.20	4.90	6.90	4.60	1.30	3.40	3.20	3.30
HORZ. STAB.	2	3	3	2	6	1	1	4
VERT. STAB.	2	3	3	2	6	1	1	4
TEMP. (K)	305.15	305.15	301.15	304.15	293.15	295.15	301.15	300.15
HUMIDITY (FRACTION)	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
SOLAR RAD. (W/m^2)	300.00							
SURFACE ROUGHNESS (m)	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600	0.00600
M-O LENGTH (m)	-8.178	-20.611	-34.123	-7.452	6.014	-7.736	-7.834	49.806
WIND MEAS. HT. (m)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
CEILING HT. (m)	10000.							
UPPER LEVEL STAB.	2	3	3	2	6	1	1	4
SIMULATION TIME (s)	790.48	763.27	715.94	773.91	1215.38	835.29	850.00	842.42
TLV HT. (m)	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
MAX. DOSAGE DISTANCE (m)	800.	800.	800.	800.	800.	800.	800.	800.
CONC. AVG. TIME (s)	600.00	600.00	600.00	600.00	600.00	600.00	600.00	600.00

TRACE INPUT DATA FOR : Thorney Island (continuous)
CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen

TRIAL NAME	TC45	TC47
CHEMICAL NO. (999=N2 with m.w.=29.0)	945	947
RELEASE TYPE: 1=CONT., 2=INST., 3=TRANS.	1	1
PHASE OF CHEMICAL: 1=LIQUID, 2=GAS	2	2
RELEASE RATE (kg/s)	10.6700	10.2200
RELEASE DURATION (s)	455.00	465.00
TEMP. OF CHEMICAL (K)	286.25	287.45
RELEASE ELEVATION (m)	0.00	0.00
VERTICAL VELO. (m/s)	0.00	
HORIZONAL VELO. (m/s)	0.00	
INIT. RADIUS (m)	1.0000	1.0000
AIR/CHEMICAL MOLE RATIO (INITIAL DILUTION)	0.000	0.000
MAX. POOL AREA (m^2)	10000.000	10000.000
MIN. POOL DEPTH (m)	0.010	
ALBEDO OF POOL	0.150	
AEROSOL FORMATION: 1=MANUAL, 2=DEFAULT	2	2
AEROSOL/FLASH MASS RATIO	0.0000	0.0000
AEROSOL AIR ENTRAINMENT: 1=MANUAL, 2=DEFAULT	2	2
AIR/CHEMICAL MASS RATIO	0.0000	0.0000
SUBSTRATE: 0=W, 1=C, 2=Asoil, 3=SDsoil, 4=SMsoil	2	2
SUBSTRATE TEMP. (K)	285.95	287.65
WIND SPEED (m/s)	2.30	1.80
HORZ. STAB.	5	6
VERT. STAB.	5	6
TEMP. (K)	286.25	287.45
HUMIDITY (FRACTION)	1.00	0.97
SOLAR RAD. (W/m^2)	300.00	
SURFACE ROUGHNESS (m)	0.01000	0.01000
M-O LENGTH (m)	31.670	10.535
WIND MEAS. HT. (m)	10.00	10.00
CEILING HT. (m)	10000.	
UPPER LEVEL STAB.	5	6
SIMULATION TIME (s)	805.22	914.67
TLV HT. (m)	0.40	0.40
MAX. DOSAGE DISTANCE (m)	472.	472.
CONC. AVG. TIME (s)	30.00	30.00

TRACE INPUT DATA FOR : Thorney Island (Instantaneous)

CHEMICAL RELEASED : Mixture of Freon-12 and Nitrogen

0732290 0505738 414

TRIAL NAME	TI6	TI7	TI8	TI9	TI12	TI13	TI17	TI18	TI19
CHEMICAL NO. (999=N2 with m.w.=29.0)	906	907	908	909	912	913	917	918	919
RELEASE TYPE: 1=CONT., 2=INST., 3=TRANS.	2	2	2	2	2	2	2	2	2
PHASE OF CHEMICAL: 1=LIQUID, 2=GAS	2	2	2	2	2	2	2	2	2
TOTAL MASS RELEASED (kg)	3147.00	4249.00	3958.00	3866.00	3736.00	4800.00	3711.00	3881.00	5477.00
RELEASE DURATION (s)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TEMP. OF CHEMICAL (K)	291.33	290.46	290.68	291.45	283.29	286.88	289.21	289.66	286.47
RELEASE ELEVATION (m)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VERTICAL VELO. (m/s)	0.00								
HORIZONTAL VELO. (m/s)	0.00								
INIT. RADIUS (m)	7.0000	7.0000	7.0000	7.0000	7.0000	7.0000	7.0000	7.0000	7.0000
AIR/CHEMICAL MOLE RATIO (INITIAL DILUTION)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MAX. POOL AREA (m^2)	10000.000	10000.000	10000.000	10000.000	10000.000	10000.000	10000.000	10000.000	10000.000
MIN. POOL DEPTH (m)	0.010								
ALBEDO OF POOL	0.150								
AEROSOL FORMATION: 1=MANUAL, 2=DEFAULT	2	2	2	2	2	2	2	2	2
AEROSOL/FLASH MASS RATIO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AEROSOL AIR ENTRAINMENT: 1=MANUAL, 2=DEFAULT	2	2	2	2	2	2	2	2	2
AIR/CHEMICAL MASS RATIO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SUBSTRATE: 0=W, 1=C, 2=Asoil, 3=SDsoil, 4=SMsoil	2	2	2	2	2	2	2	2	2
SUBSTRATE TEMP. (K)	291.83	290.85	291.55	291.45	285.15	287.85	291.05	297.45	286.15
WIND SPEED (m/s)	2.80	3.40	2.40	1.70	2.50	7.30	5.00	7.40	6.40
HORZ. STAB.	4	5	4	6	5	4	4	4	4
VERT. STAB.	4	5	4	6	5	4	4	4	4
TEMP. (K)	291.83	290.46	290.68	291.45	283.29	286.88	289.21	289.66	286.47
HUMIDITY (FRACTION)	0.75	0.81	0.88	0.87	0.66	0.74	0.94	0.81	0.95
SOLAR RAD. (w/m^2)	300.00								
SURFACE ROUGHNESS (m)	0.01800	0.01800	0.01200	0.00800	0.01800	0.01000	0.01800	0.00500	0.01000
M-O LENGTH (m)	9999.000	90.909	-9.091	1.538	10.000	-90.909	-200.000	-43.478	333.333
WIND MEAS. HT. (m)	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
CEILING HT. (m)	10000.								
UPPER LEVEL STAB.	4	5	4	6	5	4	4	4	4
SIMULATION TIME (s)	751.43	747.06	812.50	895.88	800.00	656.44	700.00	668.92	691.09
TLV HT. (m)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
MAX. DOSAGE DISTANCE (m)	424.	500.	510.	503.	500.	412.	500.	510.	583.
CONC. AVG. TIME (s)	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60

APPENDIX C

TABULATION OF THE OBSERVED AND PREDICTED CLOUD-WIDTHS AND CONCENTRATIONS

APPENDIX C-1

THE OBSERVED AND PREDICTED MAXIMUM CONCENTRATION (PPM) FOR THE LONGEST AVAILABLE AVERAGING TIME

TRIAL	X	OBS.	AFTOX	AIRTOX	B&M	CHARM	DEGADIS	FOCUS	GPM	GASTAR	HEGADAS	INPUFF	OBDG	PHAST	SLAB	TRACE
BU2	57	86956	289300	310900	432400	299000	649800	972300	155400	274800	500200	114100	252700	441000	252400	155400
	140	30013	76090	181400	112100	112000	251000	554900	45880	179600	123300	33740	55390	286000	102300	112200
BU3	57	79053	279000	311300	441700	296000	625200	975500	142000	266500	406500	115200	174300	440000	180400	96360
	140	63731	72830	182600	115900	107000	242700	685400	40560	173400	45100	33560	35300	287000	32850	111600
BU4	57	85519	362800	193100	314500	291000	399900	979400	105400	165600	371500	83790	241000	428000	162800	134400
	140	40292	118900	103000	98400	125000	167800	789300	27840	107400	124000	21730	52180	56400	70190	104600
BU5	57	68925	266300	229600	344500	264000	486300	979600	108600	204600	372800	91400	248300	452000	198500	190200
	140	49913	72150	129500	100000	113000	195700	503900	28900	129700	131700	24780	54170	100000	84290	115900
BU6	57	127460	379100	212000	324500	303000	410800	976300	110300	167300	376000	85930	261100	525000	169500	225500
	140	36656	126500	111100	100000	134000	175800	707700	29560	110400	132000	22810	57720	65900	74920	120000
BU7	57	144140	367900	212700	342500	302000	449400	869800	162600	176900	472600	164900	355500	467000	196300	176800
	140	44183	120800	129500	100000	124000	189800	479700	50570	119600	160500	55310	87290	257000	94440	111200
	400	23467	22360	22590	22940	14200	41980	76040	9850	40430	32150	11480	12200	29800	20960	48150
BU8	57	294660	874000	581200	700000	504000	806900	959300	515300	258900	1000000	492300	554000	387000	230600	344200
	140	162250	540500	551000	100000	240000	374400	731900	281300	123200	734200	256500	177200	291000	117700	200800
	400	29160	176500	241100	14300	74000	138200	163100	89410	63510	136600	82440	27050	62000	42030	101000
	800	20896	63650	71520	3624	19100	25430	31730	34530	42300	40540	30300	7145	27100	14900	41620
BU9	57	34205	730200	401800	500800	317000	751900	949300	261700	341700	769400	239600	486100	469000	323300	413800
	140	65218	433600	299100	142600	113000	323000	361500	97200	234800	245200	88320	140900	320000	181600	214300
	400	22920	124700	81410	16260	28400	67380	71040	21640	69390	67500	20210	20730	109000	48010	125900
	800	11006	42830	26060	5561	7100	21500	17930	7395	21780	18550	6962	5450	16000	14470	33770
CO3	140	54229	204000	239600	106700	99100	248200	391000	42280	171100	134700	31790	40030	292000	96880	188700
	200	23253	106800	160000	40520	56100	149200	200700	23870	122600	59970	18150	20380	98100	52230	170200
	300	6959	57180	74100	18450	27200	77310	104200	12010	75800	16690	9786	9347	35600	21670	131200
CO5	140	32808	145700	86730	100000	150000	176200	927000	30260	97650	129200	24540	36560	78600	68040	386300
	200	24713	105800	36240	76450	85800	113300	927000	16730	75360	68700	13760	18580	35000	42830	312900
	300	7201	39400	11830	42890	42600	64230	927000	8262	50950	26500	7046	8512	15000	22690	234800
	400	6341	24970	8700	24120	22200	41620	600200	4940	35830	12940	4382	4875	8360	13560	171800
CO6	140	82544	247300	251300	147100	124000	325700	351700	97130	270500	296200	96210	175100	309000	179100	171800
	200	45342	152500	240300	54100	82600	197200	170900	60070	188800	182300	60340	95760	242000	126600	160400
	300	21935	82500	98810	28080	46100	110600	27880	33370	108200	112000	34060	45830	160000	75140	151900
	400	17277	51940	76960	16610	29100	69290	67730	21590	68660	77880	22420	26680	111000	48960	103100
DT1	100	49943	190400	308900	70290	20900	285300	133400	100600	170300	71590	101300	335800	48100	151100	59020
	800	8843	6889	2725	2084	2340	7421	9047	3519	9958	6235	3771	8690	8480	6134	6816
DT2	100	83203	270700	312500	78780	27300	449000	139700	141900	138500	88890	157300	334000	51100	198700	77200
	800	10804	10790	8873	5099	3260	14240	9559	5420	8847	9930	6676	8618	12100	10100	11080

TRIAL	X	OBS.	AFTOX	AIRTOX	B&M	CHARM	DEGADIS	FOCUS	GPM	GASTAR	HEGADAS	INPUFF	OBDG	PHAST	SLAB	TRACE
DT3	100	76881	227000	331000	82120	30100	408800	151900	140400	136600	87870	152100	275400	56300	210000	80730
	800	7087	7989	6103	4111	3330	12520	12440	5337	8357	8631	6261	6545	12700	8545	10630
DT4	100	57300	379500	401000	82540	55900	540000	238400	255100	167000	95000	256600	392500	44500	192500	84800
	800	16678	20980	21570	9546	8110	17900	15540	11360	16140	11770	14170	11080	10900	11890	12800
GF1	300	25473	13750	7683	14340	3210	16270	35330	7284	25190	12860	7855	13000	31700	13020	12520
	1000	3098	1728	623	657	812	2222	2474	978	2830	2685	1063	1257	1950	1678	2009
	3000	411.0	319.4	99.8	149.4	188.0	396.5	174.0	179.7	372.2	670.3	150.4	147.7	92.0	207.9	276.0
GF2	300	19396	2951	3766	8337	1380	8126	17350	3792	12500	7065	4141	3290	16000	6208	6716
	1000	2392	338	319	728	322	1132	844	496	1363	1285	541	315	949	811	988
GF3	300	18596	5251	1994	6891	1060	7260	18860	2913	12760	7319	3106	8773	9800	6808	5708
	1000	2492	655	202	729	224	1077	714	378	1096	1707	411	845	541	942	835
	3000	224.0	120.8	34.7	76.2	62.0	130.2	59.3	68.8	129.2	322.2	61.0	99.3	54.0	152.2	118.3
HC1	200	33.04	7.90	38.42	********	351.00	51.00	52.37	86.66	252.10	97.96	69.21	47.49	32.40	110.30	51.83
	800	2.630	0.750	2.833	********	10.400	3.564	3.017	7.662	29.280	12.320	7.530	3.181	3.230	13.210	4.072
HC2	200	2.33	3.10	1.63	********	26.60	3.97	1.49	2.14	3.62	2.34	2.37	2.79	1.83	3.38	3.53
	800	0.1900	0.2800	0.1122	********	0.6190	0.2847	0.0941	0.1465	0.1117	0.1122	0.1933	0.1865	0.1430	0.2550	0.2680
HC3	200	4.54	5.00	2.46	********	56.20	6.45	3.13	3.46	7.04	4.19	3.05	3.99	4.10	6.12	6.33
	800	0.260	0.460	0.142	********	1.380	0.463	0.191	0.237	0.263	0.227	0.253	0.267	0.320	0.467	0.472
HC4	200	6.68	7.30	5.64	********	56.20	15.85	8.11	8.71	7.75	5.30	7.68	3.92	7.55	6.78	15.45
	800	0.430	0.620	0.373	********	1.330	1.135	0.506	0.598	0.165	0.194	0.625	0.262	0.592	0.486	1.176
HC5	200	6.33	12.50	15.45	********	197.00	19.19	17.47	23.65	41.85	21.78	21.69	8.83	22.60	15.44	21.44
	800	0.970	1.200	1.139	********	5.780	1.375	1.123	1.875	3.712	2.306	2.281	0.592	1.940	1.274	1.678
HI2	200	363	5100	2622	********	3100	********	********	********	866	********	3408	********	3900	1583	7095
	800	38.4	166.7	90.8	********	105.0	********	********	********	41.9	********	110.2	********	136.0	87.8	290.8
HI3	200	90.5	798.2	440.8	********	428.0	********	********	********	198.8	********	452.0	********	429.0	430.5	2793.0
	800	7.39	22.10	8.75	********	12.00	********	********	********	8.06	********	12.94	********	11.20	14.61	114.00
HI5	200	172	800	493	********	118	********	********	********	130	********	111	********	141	388	1354
	800	6.81	22.30	3.11	********	2.97	********	********	********	5.12	********	3.03	********	3.39	14.31	61.03
HI6	200	189	789	405	********	122	********	********	********	128	********	114	********	142	376	1302
	800	5.54	22.30	2.91	********	2.97	********	********	********	5.05	********	3.03	********	3.42	13.58	61.05
HI7	200	173	575	269	********	122	********	********	********	129	********	132	********	141	329	1723
	800	2.00	15.00	2.89	********	2.90	********	********	********	5.17	********	3.00	********	3.39	10.88	64.57
HI8	200	153	1094	723	********	968	********	********	********	352	********	1059	********	1100	786	2704
	800	9.47	31.20	22.03	********	30.20	********	********	********	15.41	********	31.11	********	31.60	29.99	97.17

TRIAL	X	OBS.	AFTOX	AIRTOX	B&M	CHARM	DEGADIS	FOCUS	GPM	GASTAR	HEGADAS	INPUFF	OBDG	PHAST	SLAB	TRACE
MS27	89	123100	123200	140900	100000	118000	161600	552600	76470	144500	94160	42780	48030	168000	61550	141000
	131	94900	68990	89840	74270	73000	96580	244100	44040	92470	56800	24460	23190	71600	33250	133100
	324	35600	15570	6963	15620	12500	25480	27280	10620	25060	10290	5881	4045	9640	6348	130800
	400	29100	10870	5059	8652	6580	18510	21670	7531	18510	6486	4106	2686	6240	4350	112800
	650	5700	4720	1608	4073	2180	7669	12750	3412	8437	2200	1858	1044	2360	1808	51880
MS29	58	141500	219300	28700	168000	214000	278000	773900	132800	169300	188200	73930	169500	301000	135400	196300
	90	114300	122800	14830	100000	145000	164300	447300	75570	124600	104200	42740	79720	128000	92640	152300
	130	61900	70800	4873	68640	96800	103400	454100	44710	88210	69730	24710	40570	58000	62530	139100
	182	54300	41380	2520	41170	59900	66900	415200	26790	60420	51830	14870	21470	27000	40470	129200
	252	20400	24170	1448	19880	32100	42290	363000	16000	39600	39870	8871	11500	13500	25470	89520
	324	16500	15820	941	14000	23400	29120	309200	10660	27100	31900	5914	7076	8050	17230	58630
	403	13500	10920	645	9406	12600	21010	170400	7472	19660	24780	4162	4635	5270	12020	40070
MS34	87	118100	83920	11770	79370	163000	121500	370000	55710	98160	83140	29340	46550	66600	44070	217900
	179	45500	29260	2513	21630	35600	52470	876500	18370	45480	28800	9796	11820	15200	16990	158400
MS35	129	77400	51990	8155	46080	123000	84340	288100	34310	68750	56060	18600	23960	32500	25330	120700
	250	30700	17520	1688	13090	22100	36350	81650	11950	31640	18100	6494	6710	8690	9575	45540
	406	22800	7681	723	5226	6690	18130	35810	5369	14370	6524	2926	2618	3450	4318	18000
MS42	28	113200	270400	82210	467600	161000	613800	1000000	192600	376800	691000	101900	193300	242000	4952	3209
	53	110900	136800	60750	196900	85000	355400	843600	92600	252200	336100	48380	64590	180000	26060	7497
	83	66700	72870	41560	100000	52700	193300	337900	49730	148400	167200	25950	27990	130000	36800	12330
	123	41500	39510	20720	67080	32200	89900	91230	27320	86290	83910	14400	13200	90900	31690	17440
	179	21700	21380	5638	34820	18200	42700	40580	14940	44610	42100	7785	6393	58000	22500	16580
	247	21800	12450	2644	17820	7410	22220	13270	8769	25020	22840	4735	3422	33400	15160	12870
	398	10500	5516	1149	8588	2220	8717	5315	3942	10150	9479	2144	1353	13700	8024	7043
MS43	88	56500	43330	22580	92350	61400	93060	69550	31480	75080	92220	15990	21170	101000	36940	19520
	129	35100	23510	13990	55870	39100	48280	205100	17070	44750	47800	8796	10160	59300	23670	20240
	249	18900	7822	2481	16610	15000	13360	88210	5663	15280	14270	2968	2838	17800	8772	12360
	400	7500	3475	866	7979	4090	5618	6939	2525	7199	5935	1354	1128	3790	4015	6585
MS46	34	97600	139900	29480	247700	175000	287900	2461	107800	112900	302000	49800	150400	241000	71090	115000
	91	57200	36010	13600	77290	71400	71850	6586	26760	55710	75100	13070	25290	88000	34740	27750
	130	37600	20270	4795	46510	50500	40570	9408	15020	36700	41780	7488	12780	50000	22130	21910
	182	26100	11580	2895	24680	33100	22450	13170	8543	22120	23500	4391	6671	17300	13490	16570
	250	18500	6767	1576	14300	20900	13180	13340	4973	15020	13560	2623	3603	7160	8172	11600
	322	16700	4390	966	9171	14500	8490	11040	3224	9992	8760	1724	2203	3690	5430	8217
	401	7200	3010	633	6488	7560	5805	9562	2216	6895	6006	1184	1437	2220	3749	6139
MS47	90	80900	64620	28550	100000	71000	144900	207800	44320	91120	135100	23100	35990	128000	52590	28300
	128	40200	37140	20830	79260	47000	78920	230400	25780	60000	75060	13620	18440	87000	37150	27380
	182	31300	20840	13010	46520	29800	39400	192200	14610	38520	40730	7892	9368	51200	23420	21630
	250	15500	12220	6404	24760	17700	21760	25550	8639	23740	23030	4653	5066	28700	14730	15400
	321	14400	7987	2618	15970	8720	13610	12190	5685	15310	14700	3119	3118	17000	9940	11130
	400	9500	5478	1446	11060	4400	9112	7968	3930	11060	9893	2136	2032	11000	6937	8128

TRIAL	X	OBS.	AFTOX	AIRTOX	B&M	CHARM	DEGADIS	FOCUS	GPM	GASTAR	HEGADAS	INPUFF	OBDG	PHAST	SLAB	TRACE
MS49	90	72100	58360	6416	86490	46300	87900	106200	28100	69180	85680	14040	24640	91800	33970	151000
	129	46700	21230	3326	51980	31100	44650	68520	15720	42970	45890	7993	12370	54600	24990	98900
	180	43500	12410	1943	28570	11700	23920	24830	9005	25620	25360	4683	6496	32000	17220	63250
	250	25000	6997	945	9929	4350	12740	10690	5149	14930	14300	2708	3434	16100	11270	38590
	322	14800	4539	557	7363	2290	8108	7338	3340	9215	9200	1785	2099	7040	8081	25290
	400	7600	3126	386	5165	1430	5500	3914	2306	6869	6410	1215	1376	3450	5838	16980
MS50	59	103300	101900	27420	146900	127000	205100	73280	71250	94080	215200	36090	91970	178000	72020	58190
	93	57100	52090	16120	97700	80500	111700	53530	36750	67540	108400	18700	40030	110000	49560	40240
	182	30800	17540	3796	41470	32900	32880	28950	12550	31140	35320	6564	11140	40000	21620	20040
	400	11900	4596	717	9834	3760	8302	6337	3340	10090	9120	1817	2419	4320	6342	7357
MS52	61	56300	125600	34910	175200	123000	272400	243700	83470	107200	258200	43040	104200	192000	81700	26620
	95	33800	66110	24740	100000	76700	138200	91990	44590	78220	134000	23790	46760	121000	58640	29700
	178	26000	24150	8323	53290	31700	45250	57260	16690	37780	47120	8975	14210	55900	27800	21810
	249	11200	13760	3525	29450	18900	24220	27800	9609	25150	26100	5181	7438	29900	16800	15290
	398	11800	6229	1120	12810	8050	10420	7155	4394	12040	11450	2400	2994	6560	8115	7992
	650	7500	2674	471	4880	1530	4360	2555	1945	5346	4980	1043	1152	2050	3675	4217
MS54	56	226900	130500	50410	179200	73000	326700	514400	85150	245700	312000	44960	54790	166000	80460	37750
	85	120000	69900	31830	100000	47400	179500	473000	46930	149300	158900	24750	25050	121000	60500	41100
	178	53400	20950	3939	33940	16400	42410	340100	14590	42150	40970	7766	6042	55100	26100	23720
	247	49500	12030	1978	17390	5980	21330	241500	8465	23050	21990	4628	3199	32900	16900	15090
PG7	50	36.3	60.0	203.9	********	40.4	76.1	68.5	53.0	251.2	65.1	43.1	46.8	71.2	52.3	113.5
	100	8.50	13.10	17.37	********	7.38	18.66	13.94	13.72	39.09	12.82	12.69	12.11	18.07	11.86	44.47
	200	1.60	2.50	3.39	********	2.01	4.61	3.18	3.48	5.08	2.34	3.66	3.13	4.68	2.76	24.24
	400	0.300	0.500	0.790	********	0.788	1.210	0.773	0.882	0.710	0.408	1.002	0.811	1.240	0.688	4.165
	800	0.0300	0.0960	0.1952	********	0.2520	0.3139	0.1962	0.2250	0.0973	0.0691	0.2595	0.2099	0.3400	0.1761	1.1680
PG8	50	154.9	160.1	346.9	********	46.1	122.7	141.5	96.3	319.0	129.0	77.9	76.2	123.4	106.1	162.0
	100	41.8	58.3	30.7	********	10.7	34.4	27.3	25.9	71.4	28.8	23.9	19.7	31.5	26.9	63.1
	200	9.30	18.50	6.43	********	3.24	9.12	6.09	6.70	12.36	5.71	7.05	5.10	8.30	6.66	19.76
	400	1.50	5.60	1.54	********	1.45	2.58	1.46	1.74	1.93	1.05	2.04	1.32	2.30	1.74	5.71
	800	0.260	1.600	0.395	********	0.466	0.730	0.368	0.459	0.278	0.182	0.575	0.342	0.620	0.458	1.585
PG9	50	71.7	112.4	79.8	********	44.7	90.0	108.7	68.4	385.3	105.4	55.9	47.3	88.3	97.8	106.1
	100	20.30	40.90	33.65	********	8.32	24.38	19.96	18.37	81.81	25.08	17.02	12.23	22.27	25.96	44.18
	200	5.00	12.90	4.31	********	2.10	6.88	4.36	4.75	10.72	5.34	4.98	3.16	5.85	6.64	13.54
	400	1.000	3.900	1.040	********	0.883	1.935	1.036	1.228	1.869	1.028	1.402	0.819	1.580	1.761	3.865
	800	0.190	1.100	0.268	********	0.342	0.546	0.260	0.325	0.295	0.186	0.414	0.212	0.440	0.471	1.068
PG10	50	66.2	74.8	187.7	********	40.3	66.8	65.7	49.4	204.1	57.3	40.0	28.3	66.9	43.0	109.7
	100	15.80	22.20	16.08	********	7.23	17.47	13.18	12.80	29.72	11.18	11.85	7.32	16.96	9.64	43.56
	200	4.10	6.20	3.14	********	1.75	4.42	2.99	3.25	4.22	2.03	3.41	1.89	4.39	2.22	13.80
	400	1.000	1.700	0.737	********	0.771	1.143	0.725	0.822	0.609	0.352	0.931	0.490	1.170	0.551	4.011
	800	0.0600	0.4600	0.1828	********	0.2130	0.2953	0.1836	0.2098	0.0817	0.0596	0.2389	0.1269	0.3200	0.1401	1.1180
PG13	400	46.7	43.5	30.2	********	54.3	39.7	29.7	59.5	60.1	92.9	54.9	12.0	44.8	78.2	42.5
	800	37.07	14.00	8.45	********	20.20	13.72	7.58	17.36	18.49	41.96	17.90	3.10	12.68	27.85	12.93

TRIAL	X	OBS.	AFTOX	AIRTOX	B&M	CHARM	DEGADIS	FOCUS	GPM	GASTAR	HEGADAS	INPUFF	OBDG	PHAST	SLAB	TRACE
PG15	50	147.0	160.3	96.4	********	28.6	80.9	41.5	30.1	312.5	58.7	31.2	86.3	47.1	63.6	100.7
	100	38.80	52.20	7.46	********	5.15	22.75	8.85	7.66	33.25	11.28	8.81	22.35	12.16	14.12	39.00
	200	7.80	15.50	1.81	********	1.48	5.77	2.06	1.93	4.84	2.04	2.30	5.78	2.98	3.23	12.52
	400	1.700	4.500	0.431	********	0.325	1.504	0.504	0.489	0.679	0.351	0.529	1.497	0.750	0.802	3.643
	800	0.2000	1.3000	0.1041	********	0.0514	0.3892	0.1287	0.1247	0.0892	0.0595	0.0782	0.3874	0.1900	0.2039	1.0080
PG16	50	67.4	94.1	85.6	********	28.7	96.3	44.3	31.8	308.0	62.7	32.2	95.7	46.6	68.8	107.7
	100	12.70	27.20	8.16	********	5.24	23.45	9.39	8.08	43.83	12.10	9.35	24.77	12.00	15.25	40.81
	200	2.30	7.40	1.88	********	1.74	6.15	2.18	2.04	5.66	2.17	2.45	6.41	2.94	3.49	13.05
	400	0.200	2.000	0.456	********	0.347	1.591	0.535	0.516	0.772	0.375	0.567	1.659	0.750	0.864	3.789
	800	0.0200	0.5400	0.1116	********	0.0502	0.4094	0.1363	0.1316	0.1034	0.0634	0.0818	0.4294	0.1900	0.2204	1.0470
PG17	50	235.4	244.7	517.9	********	62.5	235.0	264.0	153.9	571.8	370.2	149.0	235.0	203.3	272.0	241.3
	100	98.2	110.3	47.6	********	14.1	73.9	54.2	44.7	137.7	117.0	50.3	60.8	50.8	98.6	93.6
	200	30.80	39.80	9.91	********	8.07	21.60	12.34	12.35	28.72	37.00	15.69	15.74	13.61	29.62	29.85
	400	9.50	13.10	2.61	********	3.30	6.59	2.99	3.50	7.24	11.84	4.80	4.07	3.75	8.59	8.67
	800	3.480	4.200	0.766	********	1.030	2.070	0.757	1.049	2.088	3.848	1.436	1.055	1.060	2.426	2.412
PG18	50	231	233	1018	********	128	335	571	265	1076	485	217	539	366	296	213
	100	94.8	107.5	109.4	********	50.6	120.2	107.7	97.8	250.9	169.8	81.1	139.6	94.2	119.4	89.8
	200	35.1	39.1	22.2	********	21.1	37.7	23.4	28.3	71.8	55.8	26.6	36.1	25.7	38.3	31.5
	400	11.70	12.90	5.48	********	8.93	11.65	5.55	7.78	23.41	18.48	8.53	9.35	7.18	11.57	9.78
	800	5.17	4.10	1.51	********	2.79	3.86	1.39	2.22	8.27	6.16	2.75	2.42	2.07	3.40	2.83
PG19	50	78.4	120.7	278.1	********	49.3	114.6	139.0	90.1	326.3	133.8	75.6	75.2	114.7	121.2	141.9
	100	19.7	40.9	47.7	********	10.3	32.1	26.1	24.2	71.4	31.3	22.2	19.5	29.3	31.5	56.5
	200	4.70	12.40	6.36	********	2.59	8.61	5.73	6.27	13.51	6.50	6.53	5.03	7.73	7.97	17.31
	400	0.700	3.600	1.443	********	1.300	2.438	1.366	1.622	2.318	1.228	1.882	1.303	2.090	2.105	4.949
	800	0.130	1.000	0.367	********	0.400	0.690	0.344	0.429	0.363	0.219	0.540	0.337	0.580	0.559	1.368
PG20	50	61.9	110.0	97.2	********	76.0	151.1	298.3	108.6	880.3	139.6	100.3	20.3	160.4	90.9	130.1
	100	19.10	41.70	57.14	********	14.60	53.23	50.59	31.50	104.10	34.96	35.80	5.26	40.60	24.40	68.37
	200	5.60	13.50	8.55	********	2.78	15.53	10.66	8.70	23.58	7.69	11.40	1.36	10.93	6.28	22.64
	400	1.200	4.100	2.106	********	1.220	4.744	2.491	2.461	6.671	1.510	3.524	0.352	3.020	1.676	6.568
	800	0.2800	1.2000	0.6135	********	0.6050	1.4890	0.6196	0.7378	1.5020	0.2748	1.0570	0.0912	0.8600	0.4496	1.8290
PG21	50	104.2	108.6	93.1	********	49.0	133.5	180.1	76.0	470.8	141.0	73.4	180.7	108.1	117.7	110.2
	100	36.20	46.20	35.45	********	9.69	39.84	31.94	22.01	60.51	44.28	24.69	46.77	26.80	36.87	47.13
	200	10.80	16.20	4.70	********	2.31	12.17	6.84	6.07	17.11	13.52	7.64	12.10	7.14	10.29	14.93
	400	3.30	5.20	1.35	********	1.13	3.68	1.61	1.72	3.73	4.14	2.33	3.13	1.96	2.88	4.34
	800	1.170	1.600	0.395	********	0.483	1.153	0.402	0.515	1.072	1.284	0.725	0.811	0.560	0.798	1.208
PG22	50	85.2	107.1	78.9	********	46.4	126.0	161.4	68.5	523.2	126.4	67.0	170.7	69.0	104.5	98.7
	100	30.80	47.60	33.51	********	9.16	37.29	28.75	19.83	59.08	39.50	22.25	44.17	20.40	32.78	42.77
	200	10.10	17.10	4.60	********	2.02	11.34	6.16	5.47	15.01	12.02	6.91	11.43	6.14	9.14	13.55
	400	3.20	5.60	1.21	********	1.12	3.44	1.45	1.55	3.58	3.67	2.09	2.96	1.69	2.56	3.93
	800	0.910	1.800	0.357	********	0.414	1.079	0.362	0.463	0.997	1.134	0.645	0.766	0.490	0.709	1.097
PG23	50	63.4	80.7	79.9	********	42.0	110.3	139.3	62.0	437.0	114.0	59.0	130.7	83.7	94.2	90.3
	100	22.00	33.30	27.31	********	8.36	35.68	25.49	17.94	54.94	35.44	20.21	33.84	21.32	29.39	38.17
	200	6.90	11.40	3.94	********	2.11	10.57	5.53	4.95	12.67	10.80	6.20	8.76	5.76	8.20	12.08
	400	2.200	3.600	1.101	********	0.868	3.249	1.310	1.399	3.538	3.274	1.889	2.267	1.590	2.295	3.508
	800	0.740	1.100	0.326	********	0.430	1.022	0.328	0.419	0.771	1.012	0.584	0.587	0.450	0.635	0.977

TRIAL	X	OBS.	AFTOX	AIRTOX	B&M	CHARM	DEGADIS	FOCUS	GPM	GASTAR	HEGADAS	INPUFF	OBDG	PHAST	SLAB	TRACE
PG24	50	56.1	79.0	71.8	********	41.5	112.4	134.0	59.2	378.8	107.8	57.5	131.2	82.8	89.3	85.8
	100	18.20	32.90	28.09	********	8.24	36.64	24.45	17.14	47.10	33.60	19.20	33.97	20.75	27.83	36.78
	200	6.00	11.30	3.76	********	1.92	10.58	5.29	4.73	13.39	10.18	5.94	8.79	5.56	7.74	11.64
	400	2.000	3.600	1.055	********	0.959	3.202	1.249	1.336	2.978	3.082	1.796	2.276	1.530	2.165	3.381
	800	0.680	1.100	0.310	********	0.377	1.004	0.313	0.400	0.835	0.946	0.560	0.589	0.430	0.599	0.942
PG25	50	109.4	99.9	41.7	********	32.9	112.2	53.1	39.2	555.1	90.2	39.1	141.3	56.3	112.9	132.9
	100	14.70	22.40	10.27	********	6.04	27.48	11.39	9.96	79.60	17.54	11.58	36.59	14.61	25.72	52.40
	200	2.30	4.50	2.29	********	2.74	7.25	2.67	2.52	9.56	3.19	3.06	9.47	3.59	5.97	17.00
	400	0.500	0.890	0.557	********	0.583	1.898	0.655	0.637	1.287	0.556	0.684	2.451	0.900	1.496	4.965
	800	0.0800	0.1700	0.1424	********	0.0618	0.4918	0.1671	0.1624	0.1702	0.0944	0.1009	0.6343	0.2400	0.3832	1.3740
PG28	50	184	186	789	********	147	539	508	258	883	465	206	254	371	274	222
	100	73.0	79.8	82.3	********	56.9	192.8	99.8	95.3	257.1	182.2	78.4	65.7	92.6	117.8	92.2
	200	22.0	28.1	20.6	********	24.8	46.8	22.1	27.5	75.0	58.0	26.2	17.0	24.9	39.5	32.0
	400	7.90	9.10	5.22	********	8.79	11.01	5.27	7.59	23.50	18.98	8.36	4.40	6.91	12.27	9.82
	800	3.19	2.90	1.44	********	2.53	2.77	1.33	2.16	7.86	6.33	2.68	1.14	1.99	3.64	2.82
PG29	50	86.6	122.9	186.2	********	48.9	170.4	184.9	106.3	395.3	257.0	98.6	234.9	136.2	201.3	167.3
	100	32.8	49.3	26.9	********	10.0	55.8	37.1	30.8	88.3	83.9	34.7	60.8	34.0	74.4	64.7
	200	10.20	16.50	6.26	********	5.78	16.02	8.36	8.51	21.34	27.22	10.82	15.74	9.10	22.73	20.70
	400	3.40	5.20	1.70	********	2.55	4.85	2.01	2.41	4.80	8.86	3.31	4.07	2.51	6.70	6.03
	800	0.960	1.600	0.501	********	0.796	1.523	0.508	0.722	1.403	2.914	0.999	1.054	0.210	1.921	1.682
PG32	200	100.1	54.9	51.1	********	100.0	85.5	55.7	81.7	130.7	146.8	64.8	124.6	56.5	94.4	69.7
	400	42.1	18.6	13.2	********	30.3	21.0	13.2	24.1	56.9	62.8	21.5	32.3	16.6	37.1	21.2
	800	20.59	5.90	3.65	********	8.00	5.20	3.31	7.01	21.63	19.64	6.93	8.35	5.02	12.06	6.01
PG33	50	75.3	89.7	86.7	********	71.8	162.1	274.8	101.2	530.5	156.0	94.1	97.8	147.3	119.0	122.7
	100	23.1	32.0	51.6	********	13.8	50.8	46.4	29.4	81.2	43.6	33.3	25.3	37.1	34.1	63.8
	200	6.90	10.00	7.74	********	2.64	14.57	9.75	8.10	23.64	10.92	10.61	6.55	9.97	9.10	21.05
	400	1.40	3.00	1.90	********	1.17	4.50	2.28	2.29	5.71	2.48	3.29	1.70	2.75	2.48	6.11
	800	0.270	0.890	0.555	********	0.581	1.416	0.566	0.687	1.453	0.515	0.993	0.439	0.780	0.674	1.700
PG34	50	72.8	99.9	77.5	********	72.4	144.2	274.9	99.0	527.0	152.8	94.4	90.7	144.1	116.2	113.4
	100	24.9	37.9	48.5	********	13.8	49.9	45.8	28.7	90.3	42.6	32.9	23.5	36.3	33.4	62.0
	200	6.90	12.20	7.36	********	2.65	14.64	9.54	7.92	22.60	10.72	10.38	6.08	9.74	8.91	20.76
	400	1.80	3.70	1.82	********	1.07	4.44	2.22	2.24	5.50	2.44	3.19	1.57	2.69	2.43	6.02
	800	0.460	1.100	0.543	********	0.526	1.393	0.551	0.672	1.516	0.506	0.972	0.407	0.770	0.660	1.676
PG36	50	299	253	1043	********	730	850	1374	383	1124	671	480	423	1300	317	537
	100	195	135	259	********	298	253	295	250	393	295	201	110	280	190	230
	200	72.4	52.1	61.9	********	114.0	82.9	66.7	90.7	105.4	129.8	72.7	28.3	73.4	80.8	77.9
	400	22.80	17.50	15.98	********	33.60	24.25	16.00	26.79	45.54	57.86	24.56	7.34	20.94	29.59	23.12
	800	13.91	5.60	4.44	********	9.19	5.86	4.03	7.79	18.61	18.54	8.05	1.90	6.26	8.73	6.45
PG37	50	83.5	104.5	125.8	********	43.3	125.5	150.1	77.7	418.6	156.4	74.8	151.4	108.2	129.4	118.4
	100	29.10	43.60	18.80	********	8.73	41.02	29.43	22.50	81.61	49.86	25.57	39.18	26.83	42.10	49.06
	200	8.40	15.00	5.00	********	3.27	12.18	6.57	6.21	15.33	15.64	7.87	10.14	7.15	11.94	15.91
	400	2.70	4.80	1.31	********	1.40	3.74	1.58	1.75	4.33	4.94	2.38	2.62	1.97	3.39	4.67
	800	0.770	1.500	0.398	********	0.624	1.177	0.396	0.526	0.968	1.574	0.730	0.679	0.560	0.945	1.307

TRIAL	X	OBS.	AFTOX	AIRTOX	B&M	CHARM	DEGADIS	FOCUS	GPM	GASTAR	HEGADAS	INPUFF	OBDG	PHAST	SLAB	TRACE
PG38	50	132.8	167.4	177.5	********	48.3	159.9	182.7	98.0	317.9	197.0	95.0	144.1	139.8	158.0	133.7
	100	57.00	78.89	26.06	********	9.78	48.48	36.77	28.41	79.41	61.80	31.90	37.31	34.36	51.47	54.88
	200	19.00	28.90	6.11	********	4.39	14.76	8.30	7.84	20.66	19.16	9.89	9.66	9.12	14.55	18.44
	400	6.90	9.60	1.68	********	1.94	4.47	2.00	2.22	5.51	5.97	3.01	2.50	2.50	4.10	5.56
	800	2.380	3.000	0.501	********	0.676	1.403	0.504	0.665	1.219	1.884	0.907	0.647	0.690	1.141	1.580
PG41	50	164.4	146.9	710.0	********	82.8	215.3	383.1	159.6	655.5	269.0	130.1	321.5	232.9	174.5	193.3
	100	69.0	69.3	67.5	********	32.7	81.3	69.3	58.9	143.5	90.7	49.0	83.2	59.1	64.5	73.3
	200	24.5	25.4	13.9	********	15.8	24.5	14.8	17.0	40.5	30.1	16.2	21.5	16.0	19.7	23.0
	400	8.90	8.40	3.48	********	5.90	7.61	3.48	4.68	13.75	10.00	5.16	5.58	4.47	5.85	6.62
	800	3.580	2.700	0.944	********	1.670	2.468	0.863	1.332	4.609	3.318	1.648	1.443	1.290	1.685	1.837
PG42	50	100.4	122.9	111.5	********	52.0	147.4	185.4	86.7	634.7	165.8	82.7	213.2	84.6	138.7	126.5
	100	36.8	52.3	37.5	********	10.3	44.1	34.8	25.1	67.5	52.4	28.4	55.2	28.0	43.9	53.4
	200	11.50	18.30	5.47	********	2.66	13.36	7.61	6.93	19.36	16.24	8.70	14.29	7.62	12.32	16.90
	400	2.90	5.90	1.53	********	1.16	4.06	1.81	1.96	4.37	5.02	2.66	3.70	2.15	3.46	4.91
	800	0.780	1.800	0.446	********	0.584	1.272	0.453	0.588	1.203	1.574	0.810	0.957	0.620	0.959	1.367
PG43	50	89.4	125.2	365.9	********	49.7	124.9	153.7	103.1	328.3	129.0	81.7	66.1	132.1	100.2	164.5
	100	20.7	41.5	32.7	********	11.4	35.9	29.5	27.7	73.7	28.1	25.6	17.1	33.9	24.8	62.9
	200	5.80	12.50	7.03	********	3.36	9.74	6.57	7.18	11.72	5.47	7.54	4.42	8.98	6.10	19.27
	400	0.900	3.600	1.655	********	1.530	2.738	1.573	1.858	1.878	0.985	2.189	1.145	2.430	1.586	5.508
	800	0.190	1.000	0.426	********	0.493	0.773	0.396	0.492	0.270	0.169	0.615	0.296	0.670	0.416	1.522
PG44	50	69.0	105.7	294.4	********	50.1	109.9	150.4	93.1	317.2	128.6	78.2	60.2	118.8	108.8	146.8
	100	18.2	34.5	39.8	********	10.5	32.8	27.5	25.0	65.8	29.1	22.9	15.6	30.3	27.8	58.2
	200	5.20	10.30	6.63	********	2.68	9.06	6.01	6.47	12.35	5.85	6.74	4.03	8.02	6.94	17.83
	400	1.10	3.00	1.50	********	1.33	2.52	1.43	1.68	1.99	1.08	1.93	1.04	2.17	1.82	5.10
	800	0.210	0.860	0.380	********	0.417	0.710	0.357	0.443	0.311	0.189	0.561	0.270	0.600	0.481	1.409
PG45	50	131.8	155.1	426.4	********	82.0	221.3	366.4	153.0	539.7	255.6	146.9	195.7	213.1	201.5	221.4
	100	41.5	58.8	126.5	********	16.1	68.1	66.2	44.4	136.4	72.6	50.5	50.7	54.8	59.1	95.4
	200	14.40	19.00	11.54	********	3.81	20.64	14.28	12.28	33.73	19.08	16.09	13.11	14.85	15.81	30.26
	400	3.10	5.80	3.01	********	2.02	6.38	3.38	3.48	8.76	4.63	4.96	3.39	4.12	4.32	8.79
	800	1.020	1.700	0.854	********	0.913	2.012	0.845	1.043	2.301	1.042	1.530	0.878	1.170	1.173	2.449
PG46	50	203.3	177.3	511.7	********	84.4	238.9	363.6	175.5	702.3	355.6	168.4	389.6	229.7	290.2	222.5
	100	72.2	67.2	79.1	********	16.7	80.3	69.3	51.0	143.3	111.0	58.8	100.9	59.3	93.6	93.9
	200	21.90	21.80	13.00	********	5.18	23.68	15.29	14.11	34.85	34.30	18.79	26.11	16.11	26.30	31.32
	400	7.50	6.70	3.23	********	2.46	7.27	3.65	3.99	9.93	10.64	5.75	6.76	4.47	7.37	9.41
	800	2.280	2.000	0.922	********	1.200	2.287	0.915	1.198	2.290	3.358	1.750	1.749	1.270	2.037	2.673
PG48	50	80.7	115.8	110.0	********	76.1	167.7	275.8	114.6	848.1	168.6	111.4	83.6	166.3	122.7	147.0
	100	23.6	43.9	60.9	********	14.6	53.8	50.3	33.2	108.1	45.3	37.7	21.6	42.2	34.4	72.6
	200	6.10	14.20	8.98	********	2.81	16.39	10.88	9.18	24.69	10.82	12.01	5.60	11.36	9.06	23.63
	400	1.70	4.30	2.20	********	1.39	4.99	2.56	2.60	6.70	2.33	3.69	1.45	3.14	2.45	6.86
	800	0.470	1.300	0.638	********	0.694	1.567	0.641	0.779	1.736	0.455	1.122	0.375	0.940	0.663	1.910
PG49	50	77.1	104.2	236.8	********	48.3	106.2	124.4	81.8	624.3	109.8	64.3	40.0	105.4	90.6	127.9
	100	24.10	34.90	64.87	********	9.52	28.12	23.62	21.99	81.21	24.68	20.20	10.36	26.78	23.14	52.08
	200	6.70	10.50	5.65	********	2.40	7.91	5.22	5.68	10.38	4.94	5.92	2.68	7.06	5.78	15.95
	400	1.200	3.100	1.339	********	1.160	2.238	1.248	1.471	1.588	0.910	1.720	0.694	1.910	1.516	4.558
	800	0.210	0.900	0.336	********	0.423	0.633	0.314	0.389	0.245	0.158	0.486	0.180	0.530	0.401	1.260

TRIAL	X	OBS.	AFTOX	AIRTOX	B&M	CHARM	DEGADIS	FOCUS	GPM	GASTAR	HEGADAS	INPUFF	OBDG	PHAST	SLAB	TRACE
PG50	50	87.0	119.3	215.7	********	49.4	100.6	130.5	80.6	600.4	124.2	61.2	60.3	102.8	115.7	125.4
	100	27.90	41.70	73.59	********	9.44	28.12	23.69	21.65	98.39	29.56	19.92	15.60	26.10	30.58	51.70
	200	6.60	12.90	5.36	********	2.38	7.95	5.14	5.60	12.58	6.27	5.79	4.04	6.88	7.79	15.84
	400	1.40	3.80	1.32	********	1.08	2.22	1.22	1.45	2.27	1.21	1.66	1.04	1.86	2.07	4.53
	800	0.210	1.100	0.331	********	0.417	0.628	0.305	0.383	0.348	0.218	0.480	0.271	0.520	0.553	1.251
PG51	50	100.1	131.0	461.1	********	81.6	200.7	355.2	153.4	542.1	190.0	147.3	67.9	220.7	118.5	222.0
	100	26.3	46.1	114.6	********	16.0	70.7	66.7	44.6	134.1	46.2	50.6	17.6	56.8	31.1	95.7
	200	6.70	14.30	12.24	********	3.79	20.87	14.66	12.32	37.65	9.81	16.14	4.55	15.42	7.89	30.34
	400	1.10	4.20	3.09	********	2.01	6.36	3.49	3.49	8.64	1.88	4.98	1.18	4.28	2.09	8.81
	800	0.160	1.200	0.895	********	0.910	1.995	0.876	1.045	2.430	0.334	1.534	0.305	1.220	0.556	2.455
PG53	50	339	256	1668	********	582	964	1250	325	1545	648	406	1626	850	317	412
	100	192	135	250	********	264	283	255	213	411	304	172	421	203	187	177
	200	83.1	51.9	53.0	********	103.0	86.8	56.0	77.2	157.6	139.8	62.2	109.1	56.8	79.2	61.5
	400	30.4	17.4	13.3	********	30.9	19.6	13.3	22.8	55.5	49.4	20.6	28.2	16.7	28.9	18.8
	800	12.19	5.60	3.68	********	7.59	4.89	3.33	6.63	19.88	16.14	6.71	7.31	5.06	9.59	5.36
PG54	50	154.7	143.8	159.0	********	46.9	164.1	173.0	95.4	298.2	217.6	93.5	240.7	125.5	177.8	130.3
	100	61.40	63.50	23.45	********	9.51	48.35	34.21	27.65	86.59	71.30	31.01	62.30	37.25	62.99	53.30
	200	22.30	22.70	5.51	********	4.42	14.38	7.67	7.63	19.09	23.08	9.61	16.13	8.35	18.75	17.88
	400	8.10	7.50	1.55	********	1.95	4.41	1.84	2.16	5.01	7.47	2.93	4.17	2.30	5.46	5.38
	800	3.450	2.400	0.461	********	0.668	1.388	0.463	0.647	1.142	2.446	0.905	1.080	0.650	1.552	1.530
PG55	50	77.3	113.9	101.9	********	44.9	127.2	152.6	73.4	324.1	142.0	70.9	167.8	71.9	118.8	108.0
	100	30.30	50.60	26.14	********	8.96	41.42	28.94	21.25	100.80	45.10	24.08	43.44	23.65	37.84	44.55
	200	9.70	18.10	4.76	********	2.61	11.84	6.37	5.86	15.95	14.02	7.49	11.24	6.43	10.67	14.09
	400	2.80	6.00	1.26	********	1.06	3.60	1.51	1.66	3.76	4.38	2.23	2.91	1.81	3.00	4.09
	800	1.010	1.900	0.378	********	0.521	1.129	0.380	0.497	1.051	1.384	0.687	0.753	0.520	0.836	1.140
PG56	50	112.9	137.6	153.7	********	48.0	160.6	173.6	92.9	329.9	198.0	86.5	199.4	124.8	163.0	126.6
	100	39.90	60.10	22.83	********	9.69	47.00	34.31	26.92	95.75	64.00	30.26	51.60	31.07	55.17	52.22
	200	13.20	21.40	5.69	********	4.04	13.91	7.69	7.43	20.21	20.38	9.38	13.36	8.30	16.02	17.60
	400	4.60	7.00	1.56	********	1.77	4.28	1.85	2.10	4.34	6.53	2.88	3.46	2.28	4.57	5.32
	800	1.700	2.200	0.458	********	0.630	1.349	0.465	0.630	1.259	2.114	0.886	0.895	0.650	1.285	1.513
PG57	50	101.6	142.1	358.6	********	80.7	202.3	355.9	140.4	1077.0	225.4	132.8	162.2	198.1	174.9	200.6
	100	29.2	53.8	140.2	********	15.7	63.5	62.4	40.8	185.8	63.1	46.4	42.0	50.7	50.3	88.7
	200	10.40	17.40	11.59	********	3.31	19.30	13.30	11.26	33.41	16.06	14.80	10.87	13.72	13.39	28.17
	400	3.10	5.30	2.79	********	1.98	5.93	3.13	3.19	7.18	3.74	4.55	2.81	3.80	3.64	8.19
	800	0.790	1.600	0.785	********	0.925	1.866	0.781	0.956	2.114	0.792	1.383	0.728	1.080	0.989	2.281
PG58	200	110.8	56.4	51.9	********	118.0	84.7	56.5	93.7	131.4	171.0	74.3	258.9	58.2	125.8	80.7
	400	49.9	18.9	13.3	********	34.9	25.0	13.4	27.7	34.5	77.1	24.6	67.0	17.0	57.5	23.9
	800	20.70	6.00	3.68	********	9.52	6.05	3.33	8.05	9.01	30.26	8.08	17.35	5.13	19.47	6.68
PG59	50	267	222	1557	********	524	882	1249	284	1086	536	357	906	776	290	357
	100	193	103	231	********	235	261	245	187	407	256	152	235	187	152	153
	200	84.5	37.5	48.7	********	90.8	72.9	53.0	67.7	134.0	118.8	54.6	60.7	52.7	59.5	53.7
	400	35.7	12.4	12.4	********	27.6	16.9	12.4	20.0	44.2	37.5	18.0	15.7	15.5	20.5	16.5
	800	13.79	3.90	3.42	********	6.69	4.25	3.10	5.80	15.65	12.42	5.91	4.07	4.71	6.54	4.72

TRIAL	X	OBS.	AFTOX	AIRTOX	B&M	CHARM	DEGADIS	FOCUS	GPM	GASTAR	HEGADAS	INPUFF	OBDG	PHAST	SLAB	TRACE
PG60	50	109.9	109.4	104.6	********	42.7	130.4	144.0	70.9	409.8	146.0	68.0	187.3	91.9	122.1	107.9
	100	42.50	48.30	15.92	********	8.59	38.54	27.28	20.53	89.55	47.12	23.35	48.48	23.46	40.47	45.72
	200	15.50	17.30	4.56	********	2.91	11.56	6.00	5.66	14.66	15.02	7.23	12.55	6.35	11.65	14.68
	400	5.30	5.70	1.20	********	1.21	3.53	1.43	1.60	3.67	4.78	2.18	3.25	1.76	3.32	4.31
	800	2.160	1.800	0.356	********	0.557	1.109	0.359	0.480	0.992	1.542	0.672	0.840	0.500	0.930	1.208
PG61	50	70.3	96.7	116.4	********	77.7	170.3	312.3	117.7	840.1	157.4	114.5	41.4	172.5	106.4	151.0
	100	20.1	33.6	63.5	********	14.9	54.8	54.0	34.2	108.1	40.3	38.8	10.7	43.8	28.8	74.6
	200	6.00	10.40	9.34	********	2.87	16.75	11.45	9.43	28.04	9.02	12.34	2.78	11.82	7.44	24.78
	400	1.500	3.100	2.286	********	1.420	5.083	2.681	2.669	6.556	1.810	3.790	0.718	3.270	1.995	7.047
	800	0.340	0.910	0.658	********	0.710	1.595	0.667	0.800	1.842	0.333	1.153	0.186	0.980	0.535	1.963
PG62	100	40.9	69.9	30.4	********	11.2	35.8	28.7	27.4	80.9	37.4	25.2	27.5	32.8	38.9	62.5
	200	11.50	22.60	7.09	********	3.16	9.67	6.38	7.08	16.36	7.88	7.42	7.13	8.69	9.79	19.15
	400	2.80	6.90	1.61	********	1.47	2.72	1.53	1.83	2.94	1.51	2.14	1.85	2.35	2.59	5.47
	800	0.720	2.100	0.410	********	0.474	0.769	0.384	0.485	0.452	0.271	0.606	0.478	0.650	0.691	1.513
TC45	40	200000	123300	11040	264800	26500	272400	302700	144900	233000	311000	74020	57960	371000	77400	56680
	53	129000	81280	10880	170300	19600	219200	219200	101500	144500	174200	52380	34320	320000	59590	50880
	72	89000	50300	10540	93700	16200	140600	144400	66340	84230	81720	34550	19180	246000	43580	47650
	90	62000	35030	10150	65230	13500	92310	102000	47580	55050	48100	25050	12500	211000	33870	42760
	112	37900	24400	9617	43630	11000	52460	70190	33820	37620	29220	18570	8195	153000	26140	35710
	158	26200	13680	8290	21580	8280	23350	36570	19280	18990	14150	11090	4206	86700	16910	22650
	250	7600	6249	4544	10240	4260	7321	15020	8804	8510	5865	5226	1723	30700	9297	10100
	335	5000	3776	2886	7152	3010	3770	9007	5281	4989	3498	3304	975	15000	6456	5675
	472	3600	2088	1689	3859	1960	1858	4868	2892	2701	1992	1928	500	5840	4144	3409
TC47	50	159000	125700	377400	253800	52800	145000	240300	248900	141700	553500	129900	35320	101000	73340	37490
	90	74000	50840	102300	60700	30200	145000	121600	130900	69360	106100	68180	11500	70000	44290	24380
	212	14700	12180	14230	13340	13200	67210	32640	39570	18610	12060	21120	2184	39800	14160	24380
	250	6700	9192	11210	9869	11200	41660	24150	30620	14910	8479	16580	1585	34500	10960	23650
	335	4800	5561	7539	6882	8170	16290	16020	19160	9182	4719	10550	896	23000	6924	17980
	472	2400	3077	4799	3253	5820	5747	10520	10910	5167	2504	6243	460	15200	3958	9487
TI6	71	90400	495700	85740	100000	34400	161000	163300	********	35730	********	226200	********	89500	43060	191000
	141	36700	214800	24530	46570	17200	70650	87590	********	15150	********	89210	********	48700	17800	61210
	180	26200	141800	13180	29940	13100	46820	65460	********	10420	********	56540	********	38700	12530	36050
	283	9760	57740	5410	13900	6520	21230	28950	********	5102	********	22570	********	16753	6306	13330
	424	5290	23420	2903	6615	2850	9604	11280	********	2430	********	9217	********	6880	3255	5509
TI7	71	132000	441400	136800	100000	25000	164000	90130	********	38760	********	361300	********	100000	47670	241000
	100	59200	295600	79590	100000	17600	123000	86030	********	26450	********	250400	********	78900	32160	154800
	150	33800	156400	36880	48290	11500	68380	73050	********	15900	********	157600	********	55600	19430	75620
	180	25400	111600	28560	36200	9380	50830	62180	********	12150	********	117900	********	44576	15310	50800
	224	19800	71960	20490	21700	7300	36360	42680	********	8692	********	81180	********	33000	11320	31270
	361	11900	25020	8048	11310	3910	15440	15520	********	4045	********	32750	********	14800	5657	10690
	500	6020	11530	4769	5567	2570	8102	7268	********	2283	********	16630	********	7290	3394	5317
TI8	71	92500	573400	100700	100000	29300	147000	178800	********	36960	********	246300	********	89100	14050	211600
	100	61100	428200	54270	100000	20900	121000	119800	********	26070	********	156100	********	69900	7765	135700
	150	40300	259000	19610	45860	13700	72870	92850	********	16080	********	82380	********	49365	4008	70580
	200	28100	163200	9829	25110	9990	44000	61970	********	10710	********	49340	********	35274	2496	38120
	364	10800	49850	3689	9359	3620	15780	18020	********	3871	********	14770	********	13200	898	9915
	412	6920	37940	3091	7372	2950	12400	14700	********	3195	********	11270	********	10200	716	7448
	510	4260	23330	2277	4462	2070	8089	6890	********	2168	********	7000	********	6230	481	4826

TRIAL	X	OBS.	AFTOX	AIRTOX	B&M	CHARM	DEGADIS	FOCUS	GPM	GASTAR	HEGADAS	INPUFF	OBDG	PHAST	SLAB	TRACE
T19	71	123000	833600	159400	100000	14000	805	194000	********	22350	********	418700	********	78800	58480	31110
	100	70600	766800	71780	100000	8890	770	93490	********	18650	********	321400	********	63600	39020	31110
	141	35800	671500	38010	47270	5820	808	66280	********	15250	********	230600	********	51900	25300	30760
	180	26500	585100	26490	27520	4340	852	50960	********	12890	********	174500	********	43200	18200	22200
	224	20700	496900	20030	17200	3710	893	36620	********	10860	********	131600	********	35900	13490	15080
	316	11400	350300	13270	9699	2900	1085	15470	********	7779	********	79420	********	25000	8155	5950
	503	5450	179700	7889	3765	1960	1516	4693	********	4279	********	36620	********	12500	3899	3407
T112	71	116000	545000	111400	100000	17000	10830	159500	********	27600	********	344600	********	73200	28760	104500
	150	31700	252400	32180	41470	7180	14200	80650	********	13560	********	140700	********	42300	13510	38520
	200	18500	162400	16520	19460	5160	16130	50250	********	9422	********	89230	********	31700	9723	23150
	361	9990	53050	5351	7531	2360	7156	14310	********	3646	********	30380	********	13100	4627	4996
	500	3680	26160	3330	3709	1550	3782	7342	********	2043	********	15620	********	6760	3002	2490
T113	71	73300	196400	130300	100000	62200	325000	170200	********	56620	********	221100	********	122000	56910	391800
	100	64600	218100	85370	87680	42300	191000	126300	********	39290	********	146000	********	90000	35500	233400
	224	25400	136400	20740	20150	17300	51470	48170	********	13600	********	46110	********	33500	10540	49860
	316	12500	70020	10160	12440	11000	28810	24900	********	8219	********	22720	********	18000	5985	24740
	361	9260	52960	8179	9772	8240	22640	19160	********	6573	********	18510	********	14000	4747	18640
	412	7290	39760	6437	8440	6170	17970	15960	********	5419	********	13540	********	10400	3783	14050
T117	40	127000	264800	152600	224600	71200	50690	284500	********	58870	********	394100	********	103000	60200	493800
	50	85100	218100	123200	156400	51600	51870	212300	********	49420	********	322800	********	90700	47750	391600
	71	47600	310700	75580	100000	30600	59130	170000	********	35580	********	230100	********	72500	32170	241500
	100	31900	229300	44790	100000	18600	93270	108400	********	24270	********	153200	********	54900	21190	144600
	141	14900	135000	24710	46240	12900	63550	87870	********	15600	********	96970	********	39079	13470	73010
	224	6520	56920	11630	17810	7810	29960	46410	********	7490	********	44880	********	20900	6974	27240
	500	3330	9597	2415	4089	2230	6058	9046	********	1803	********	7249	********	4330	1932	4092
T118	40	242000	301200	284800	225000	124000	618000	391400	********	100200	********	332200	********	181000	121900	560400
	60	86100	213700	190900	114300	82000	433000	188900	********	74230	********	231100	********	144000	66690	477000
	70	62700	184100	144000	100000	69400	346000	168600	********	62650	********	204000	********	128000	52820	398300
	80	52500	160400	125100	100000	60200	289000	152800	********	55780	********	178500	********	118000	43020	338500
	100	40800	188400	92810	79930	47400	195000	108600	********	44240	********	133400	********	97600	30450	258200
	200	16100	157800	28200	22410	21900	62140	57880	********	18160	********	49560	********	44400	10440	74350
	224	11000	128700	21480	18340	19300	52050	44400	********	15610	********	40600	********	37100	8662	58620
	300	8060	72480	11120	11900	13900	31960	29650	********	10050	********	22730	********	22400	5353	31490
	400	4870	39020	6414	8005	7290	19120	15790	********	6406	********	13160	********	12600	3279	17210
	510	3490	22420	4136	5597	4130	12360	9066	********	4385	********	7335	********	76800	2111	10360
T119	40	184000	397400	267300	250100	105000	477000	688800	********	81510	********	379100	********	163000	108400	575000
	60	82400	305400	156500	129100	65300	361000	404500	********	60660	********	270800	********	129000	70480	461800
	71	72200	268700	132800	100000	53400	313000	316500	********	51750	********	232300	********	115000	58480	373600
	100	53900	526800	77810	96970	35300	187000	105100	********	36580	********	158800	********	89000	39020	230100
	224	13600	215200	19370	26250	14700	50740	46380	********	12580	********	47640	********	34200	13490	49980
	361	6770	94790	7100	11670	8350	22280	19490	********	6169	********	18350	********	14000	6665	17500
	583	2990	35380	3114	5317	3050	9176	4613	********	2768	********	5965	********	5060	3061	6240

APPENDIX C-2

THE OBSERVED AND PREDICTED MAXIMUM CONCENTRATION (PPM) FOR THE SHORTEST AVERAGING TIME AVAILABLE FOR BURRO, COYOTE, DESERT TORTOISE, AND HANFORD (CONTINUOUS)

TRIAL	X	OBS.	AFTOX	AIRTOX	B&M	CHARM	DEGADIS	FOCUS	GPM	GASTAR	HEGADAS	INPUFF	OBDG	PHAST	SLAB	TRACE
BU2	57	152540	289300	310900	432400	299000	649400	972300	220200	269000	500200	120400	252700	441000	256400	155400
	140	55000	76090	181400	112100	112000	245800	554900	76110	175900	123300	35070	55390	286000	105800	112200
BU3	57	224380	299200	311300	441700	296000	624000	975500	223700	270500	406500	121500	174300	440000	192400	96360
	140	89850	79920	182600	115900	107000	239800	685400	77510	177300	45100	35440	35300	287000	37230	111600
BU4	57	177030	375400	193100	314500	291000	397900	979400	170700	156200	371500	83230	241000	428000	166800	134400
	140	71620	124900	103000	98400	125000	166000	789300	53630	101000	124000	23050	52180	56400	74590	104600
BU5	57	190410	296100	229600	344500	264000	484100	979600	184300	195500	372800	93050	248300	452000	204500	190200
	140	96000	82990	129500	100000	113000	192000	507400	59570	124300	131700	26030	54170	100000	90890	115900
BU6	57	178690	385900	212000	324500	303000	410200	976300	174500	158000	376000	86450	261100	525000	172500	225500
	140	60970	129900	111100	100000	134000	173600	477600	55450	103500	132000	23460	57720	65900	78970	120000
BU7	57	179390	405800	212700	342500	302000	448400	958000	258400	176900	472600	166700	355500	467000	200300	170800
	140	71320	139500	129500	100000	124000	189800	622500	99170	119700	160500	57060	87290	257000	100300	111200
	400	38560	26340	22590	22940	14200	41770	76140	23030	41520	32150	11970	12200	29800	24160	48150
BU8	57	558740	883700	581200	700000	504000	806700	959300	621200	195900	1000000	521400	554000	387000	230600	344200
	140	164110	556100	551000	100000	240000	369800	731900	398700	108500	734200	269600	177200	291000	118900	200800
	400	35810	184900	241100	14300	74000	137600	163100	158400	58820	136600	85290	27050	62000	43420	101000
	800	21160	67140	71520	3624	19100	24930	31730	69070	40950	40540	31600	7145	27100	15410	41620
BU9	57	72800	730200	401800	500800	317000	750300	949300	347800	341700	769400	249100	486100	469000	325300	413800
	140	105560	433600	299100	142600	113000	322000	397200	153300	234800	245200	94330	140900	320000	183600	214300
	400	39640	124700	81410	16260	28400	67140	71080	40450	69390	67500	20860	20730	109000	51170	125900
	800	13950	42830	26060	5561	7100	21540	15460	14840	21930	18550	6926	5450	16000	16760	33770·
CO1	140	106820	204000	239600	106700	99100	249200	391000	72920	167000	134700	33090	40030	292000	100800	188700
	200	48620	106800	160000	40520	56100	146800	200700	43470	120300	59970	18400	20380	98100	55100	170200
	300	19050	57180	74100	18450	27200	77130	98180	23010	74570	16690	9665	9347	35600	24020	131200
CO5	140	115330	139600	86730	100000	150000	174800	920900	58800	92690	129200	25420	36560	78600	72160	386300
	200	80920	125900	36240	76450	85800	112200	914800	34390	71950	68700	14300	18580	35000	46510	312900
	300	31740	42540	11830	42890	42600	63860	904700	17880	49580	26500	7329	8512	15000	25390	234800
	400	23040	27050	8700	24120	22200	41510	650300	11000	35730	12940	4484	4875	8360	15610	171800
CO6	140	126980	252900	251300	147100	124000	322000	369000	159400	270700	296200	101500	175100	309000	180100	171800
	200	85000	156400	240300	54100	82600	196400	171000	105700	189000	182300	62450	95760	242000	132800	160400
	300	41830	84830	98810	28080	46100	109600	52130	63050	108000	112000	36310	45830	160000	84640	151900
	400	32910	53470	76960	16610	29100	69100	67730	42590	68650	77880	23130	26680	111000	57800	103100
DT1	100	63260	199000	308900	70290	20900	285300	133400	182100	170300	71590	103200	335800	48100	152500	59020
	800	10950	7292	2725	2084	2340	7420	10370	8052	9958	6235	3868	8690	8480	6624	6616
DT2	100	109580	309800	312500	78780	27300	449300	139700	268200	138500	88890	165700	334000	51100	199700	77200
	800	18590	13090	8873	5099	3260	14240	10960	13950	8847	9930	6876	8618	12100	10600	11080

TRIAL	X	OBS.	AFTOX	AIRTOX	B&M	CHARM	DEGADIS	FOCUS	GPM	GASTAR	HEGADAS	INPUFF	OBDG	PHAST	SLAB	TRACE
DT3	100	97250	251400	331000	82120	30100	407900	151900	256600	136600	87870	154700	275400	56300	211000	80730
	800	15630	9161	6103	4111	3330	12500	12440	13030	8357	8631	6389	6545	12700	9181	10630
DT4	100	84260	454100	401000	82540	55900	539000	138400	482900	167000	95000	269900	392500	44500	192500	84800
	800	20910	28660	21570	9546	8110	17890	15540	32080	16140	11770	14330	11080	10900	12390	12800
HC1	200	49.7	11.9	38.4	********	351.0	81.4	136.2	141.9	225.4	147.0	70.6	47.5	32.4	171.9	51.8
	800	3.39	1.10	2.83	********	10.40	5.89	8.10	12.58	25.29	19.64	7.48	3.18	3.23	21.39	4.07
HC2	200	4.90	5.20	1.63	********	26.60	7.35	5.10	3.97	4.09	4.18	2.46	2.79	1.83	6.16	3.53
	800	0.4200	0.4800	0.1122	********	0.6190	0.5325	0.3234	0.2718	0.0903	0.2066	0.1969	0.1865	0.1430	0.4700	0.2680
HC3	200	7.24	6.70	2.46	********	56.20	9.51	6.78	5.12	5.99	6.03	3.10	3.99	4.10	8.89	6.33
	800	0.440	0.620	0.142	********	1.380	0.688	0.416	0.350	0.121	0.332	0.256	0.267	0.320	0.686	0.472
HC4	200	14.03	9.80	5.64	********	56.20	23.29	17.53	12.84	15.36	7.63	7.99	3.92	7.55	9.89	15.45
	800	1.170	0.830	0.373	********	1.330	1.688	1.100	0.882	0.382	0.285	0.638	0.262	0.592	0.724	1.176
HC5	200	13.81	19.30	15.45	********	197.00	32.33	49.47	40.00	86.10	34.48	22.63	8.83	22.60	25.65	21.44
	800	1.950	2.000	1.139	********	5.780	2.348	3.232	3.176	9.139	3.838	2.281	0.592	1.940	2.148	1.678

APPENDIX C-3

THE OBSERVED AND PREDICTED CLOUD-WIDTHS (σ_y) (M)

TRIAL	X	OBS.	AFTOX	AIRTOX	DEGADIS	GASTAR	GPM	HEGADAS	PHAST	SLAB
BU3	57	20.0	4.7	20.3	23.7	30.2	7.2	34.1	17.5	19.5
BU4	57	14.9	3.0	15.9	18.5	23.0	6.4	23.6	7.2	14.5
BU5	57	13.2	4.1	17.0	19.7	24.6	7.0	26.5	12.1	15.0
	140	10.1	9.0	24.0	28.6	31.9	13.6	36.2	14.9	21.4
BU6	140	20.3	6.3	20.4	26.6	29.1	12.2	32.3	15.0	19.5
BU7	140	20.9	7.2	23.1	30.2	33.8	10.6	35.2	21.0	21.2
BU8	57	27.1	2.1	35.7	41.7	33.1	7.8	112.6	44.0	81.2
	400	84.2	11.4	120.4	139.9	190.5	21.1	185.6	112.0	134.2
BU9	57	22.1	1.8	19.1	28.3	33.7	6.1	42.5	17.7	21.8
	140	26.7	3.7	29.4	42.3	52.6	10.0	53.6	33.4	31.3
	400	44.6	9.3	52.8	67.9	77.8	22.3	89.0	62.3	51.7
	800	57.1	17.1	76.7	87.1	84.5	40.5	118.7	66.3	73.5
CO3	140	23.5	6.1	24.8	38.3	45.0	12.0	48.1	30.4	28.0
CO6	140	15.4	6.3	30.6	46.1	55.7	10.6	64.0	37.0	39.0
	200	17.1	8.6	36.4	53.7	64.8	13.7	71.7	43.9	45.1
DT1	100	11.8	4.8	14.4	41.3	27.5	6.9	74.2	12.0	16.6
	800	61.8	30.5	52.7	169.9	167.5	42.7	202.2	89.2	69.1
DT2	100	14.7	5.5	22.1	57.3	26.5	8.3	97.2	13.9	20.7
	800	88.2	35.0	76.3	255.4	213.5	49.3	288.8	116.8	93.6
DT3	100	15.2	5.7	18.9	46.8	23.5	7.8	86.8	12.7	16.8
	800	73.4	36.1	57.4	202.4	175.2	46.6	236.4	103.3	81.3
DT4	100	15.7	4.4	26.3	70.8	32.5	7.5	110.9	14.8	25.5
	800	86.0	28.0	103.8	335.9	327.5	42.4	353.1	132.4	112.0
GF1	300	25.1	13.2	20.1	57.6	55.5	17.3	69.8	41.0	25.0
	1000	63.0	38.8	70.1	96.5	96.6	53.1	124.0	88.3	57.0
	3000	113.9	104.1	204.6	153.6	174.0	144.4	219.7	160.4	128.2
GF2	300	29.9	18.4	20.0	55.9	59.2	17.0	65.0	42.5	24.6
	1000	54.7	54.2	70.0	93.6	98.4	52.8	117.8	81.3	57.6
GF3	300	25.1	13.2	21.5	41.0	35.1	16.9	52.6	32.2	20.5
	1000	49.8	38.8	74.0	68.2	66.1	52.7	95.0	54.2	48.9
	3000	75.2	104.1	208.5	138.8	150.6	144.1	195.1	170.2	112.8
HC1	200	15.6	15.9	7.9	7.6	7.5	7.6	11.9	6.1	6.3
	800	70.7	54.9	30.8	26.2	29.1	29.3	37.6	19.0	23.4

TRIAL	X	OBS.	AFTOX	AIRTOX	DEGADIS	GASTAR	GPM	HEGADAS	PHAST	SLAB
HC2	200	15.1	20.1	21.8	26.5	23.3	23.4	37.4	20.0	17.4
	800	36.2	69.7	84.7	92.1	90.7	90.7	127.8	70.0	65.4
HC3	200	13.7	16.0	21.8	21.0	18.5	18.6	30.1	20.0	13.3
	800	38.7	55.5	84.7	73.6	72.1	72.1	102.0	70.0	50.3
HC4	200	19.6	19.9	21.8	21.1	18.6	18.6	30.1	20.0	17.8
	800	55.2	69.1	84.7	73.1	72.1	72.2	102.0	70.0	67.2
HC5	200	15.5	12.2	11.9	11.8	11.6	11.7	17.4	9.4	12.7
	800	37.8	42.3	46.2	40.9	45.2	45.2	57.5	32.4	47.7
PG7	50	6.2	10.2	6.8	10.6	8.0	8.0	15.9	9.3	7.9
	100	12.0	18.9	14.7	19.7	15.9	16.0	28.6	18.3	15.9
	200	22.0	35.2	30.5	37.0	31.7	31.7	51.9	35.5	31.8
	400	39.0	65.5	61.6	68.8	62.8	62.8	94.3	67.9	62.7
	800	71.0	122.2	122.0	128.7	123.2	123.2	171.6	128.2	120.6
PG8	50	6.6	4.3	4.5	7.1	5.5	5.5	10.9	6.0	5.3
	100	12.0	7.8	9.9	13.2	11.0	11.0	19.4	11.9	10.7
	200	21.0	14.4	20.8	24.7	21.8	21.8	35.2	23.2	21.4
	400	41.0	26.8	42.2	46.1	43.2	43.2	64.6	44.7	42.2
	800	86.0	49.8	83.7	86.1	84.7	84.7	119.6	85.1	81.2
PG9	50	9.0	4.3	5.5	7.1	5.5	5.5	10.9	6.0	4.6
	100	18.0	7.8	10.9	13.3	10.9	11.0	19.3	11.9	9.3
	200	33.0	14.4	21.8	24.8	21.8	21.8	35.1	23.2	18.6
	400	63.0	26.8	43.1	46.1	43.1	43.2	64.6	44.6	36.8
	800	116.0	49.8	84.7	86.1	84.6	84.7	119.5	85.1	70.8
PG10	50	12.3	7.0	6.6	10.6	8.0	8.0	15.9	9.3	8.3
	100	20.0	12.9	14.6	19.7	15.9	16.0	28.6	18.3	16.8
	200	35.0	23.9	30.4	36.8	31.7	31.7	51.9	35.5	33.4
	400	61.0	44.5	61.5	68.8	62.8	62.8	94.3	67.9	66.0
	800	97.0	83.0	121.9	128.5	123.2	123.2	171.6	128.2	127.4
PG15	50	8.6	5.3	9.7	10.6	11.0	11.0	21.8	13.4	8.1
	100	16.0	9.8	20.6	19.7	21.9	22.0	39.9	26.1	16.5
	200	26.0	18.1	42.3	36.9	43.6	43.6	72.8	49.7	32.9
	400	45.0	33.6	85.1	68.8	86.3	86.3	132.6	93.3	64.6
	800	92.0	62.6	168.2	128.1	169.4	169.4	241.7	173.6	124.6
PG16	50	13.7	7.7	9.8	10.6	11.0	11.0	21.8	13.5	8.1
	100	26.0	14.2	20.7	19.7	21.9	22.0	39.9	26.1	16.4
	200	49.0	26.4	42.4	36.8	43.6	43.6	72.8	49.7	32.7
	400	72.0	49.1	85.1	68.7	86.3	86.3	132.7	93.4	64.4
	800	116.0	91.5	168.2	128.2	169.3	169.4	241.7	173.6	124.0
PG19	50	8.7	4.8	4.2	7.1	5.5	5.5	10.9	6.0	4.8
	100	16.0	8.8	9.7	13.3	11.0	11.0	19.4	11.9	9.7
	200	32.0	16.4	20.5	24.7	21.8	21.8	35.2	23.2	19.4
	400	55.0	30.4	41.9	46.2	43.2	43.2	64.6	44.6	38.1
	800	85.0	56.6	83.5	86.1	84.6	84.7	119.5	85.1	73.8

TRIAL	X	OBS.	AFTOX	AIRTOX	DEGADIS	GASTAR	GPM	HEGADAS	PHAST	SLAB
PG20	50	7.9	4.0	4.0	4.6	4.0	4.0	7.6	3.9	4.5
	100	14.0	7.4	7.9	8.6	8.0	8.0	13.0	7.7	9.2
	200	27.0	13.7	15.8	16.0	15.9	15.9	23.1	15.1	18.3
	400	49.0	25.4	31.4	29.8	31.4	31.4	42.1	29.2	36.0
	800	90.0	47.2	61.6	55.7	61.6	61.6	77.3	55.8	69.5
PG25	50	16.2	10.0	10.0	10.6	11.1	11.0	21.8	13.5	7.2
	100	36.0	18.5	20.9	19.7	22.0	22.0	39.9	26.1	14.6
	200	72.0	34.3	42.6	36.9	43.6	43.6	72.8	49.7	29.1
	400	134.0	64.0	85.3	68.9	86.3	86.3	132.7	93.4	57.3
	800	214.0	119.3	168.4	128.7	169.3	169.4	241.7	173.7	110.3
PG43	50	10.5	5.1	4.5	7.1	5.5	5.5	10.9	6.0	5.6
	100	21.0	9.3	9.9	13.3	11.0	11.0	19.4	11.9	11.4
	200	40.0	17.2	20.8	24.7	21.8	21.8	35.2	23.2	22.7
	400	89.0	32.0	42.1	46.1	43.1	43.2	64.6	44.7	44.6
	800	200.0	59.6	83.7	86.1	84.7	84.7	119.6	85.1	86.4
PG44	50	11.4	5.3	4.3	7.1	5.5	5.5	10.9	6.0	5.1
	100	22.0	9.7	9.7	13.2	11.0	11.0	19.4	11.9	10.4
	200	43.0	17.9	20.6	24.7	21.8	21.8	35.2	23.2	20.7
	400	73.0	33.3	42.0	46.1	43.2	43.2	64.6	44.7	40.6
	800	126.0	62.1	83.6	86.0	84.7	84.7	119.5	85.1	78.8
PG49	50	8.9	4.9	4.1	7.1	5.5	5.5	10.9	6.0	5.2
	100	17.0	9.1	9.6	13.2	10.9	11.0	19.3	11.9	10.5
	200	35.0	16.8	20.4	24.7	21.8	21.8	35.1	23.2	21.0
	400	72.0	31.2	41.8	46.1	43.2	43.2	64.6	44.7	41.4
	800	118.0	58.1	83.4	86.1	84.7	84.7	119.5	85.1	80.0
PG50	50	8.2	4.5	4.0	7.1	5.5	5.5	10.9	6.0	4.6
	100	15.0	8.3	9.5	13.3	10.9	11.0	19.3	11.9	9.4
	200	28.0	15.4	20.4	24.8	21.8	21.8	35.1	23.2	18.7
	400	55.0	28.6	41.7	46.1	43.1	43.2	64.6	44.7	36.9
	800	115.0	53.2	83.3	86.2	84.7	84.7	119.5	85.1	71.3
PG51	50	9.6	4.5	3.0	4.6	4.0	4.0	7.7	3.9	4.8
	100	18.0	8.2	7.0	8.6	8.0	8.0	13.1	7.7	9.6
	200	32.0	15.2	14.9	16.0	15.9	15.9	23.2	15.1	19.2
	400	60.0	28.3	30.5	29.8	31.4	31.4	42.2	29.2	37.7
	800	77.0	52.7	60.7	55.8	61.5	61.6	77.9	55.8	73.0
PG61	50	10.4	4.6	4.0	4.6	4.0	4.0	7.6	3.9	4.4
	100	19.0	8.4	8.0	8.6	8.0	8.0	13.0	7.7	8.9
	200	35.0	15.5	15.8	16.0	15.9	15.9	23.1	15.1	17.8
	400	65.0	28.3	31.4	29.9	31.4	31.4	42.2	29.2	34.9
	800	109.0	53.7	61.6	55.8	61.5	61.6	77.8	55.8	67.3

APPENDIX D

TABULATION OF THE PERFORMANCE MEASURES AND THE RESULTS OF CONFIDENCE LIMITS ANALYSIS

APPENDIX D-1

THE PERFORMANCE MEASURES FOR THE PREDICTED CONCENTRATIONS FOR THE CONTINUOUS DENSE GAS RELEASES (BURRO, COYOTE, DESERT TORTOISE, GOLDFISH, MAPLIN SANDS, AND THORNEY ISLAND), INCLUDING ALL DOWNWIND DISTANCES. THE SHORTEST AVAILABLE AVERAGING TIME WAS USED.

PERFORMANCE MEASURES FOR CONCENTRATIONS FOR CONTINUOUS DENSE GAS RELEASES (BURRO, COYOTE, DESERT TORTOISE, GOLDFISH, MAPLIN SANDS, THORNEY ISLAND), SHORT AVERAGING TIME, ALL X'S.

All observations, (N= 124)

model	mean	sigma	bias	vg	fa2	mg
OBS.	10.44	1.25	0.00	1.00	1.000	1.000
AFTOX	10.35	1.70	0.10	1.78	0.661	1.100
AIRTOX	9.48	2.13	0.96	17.68	0.242	2.623
B&M	10.36	1.62	0.08	1.53	0.742	1.087
CHARM	10.05	1.71	0.40	2.49	0.613	1.485
DEGADIS	10.83	1.66	-0.39	1.84	0.629	0.677
FOCUS	11.19	1.99	-0.75	6.51	0.419	0.474
GPM	10.07	1.64	0.37	2.14	0.524	1.450
GASTAR	10.60	1.41	-0.16	1.28	0.815	0.856
HEGADAS	10.59	1.60	-0.15	1.58	0.742	0.862
INPUFF	9.47	1.58	0.97	4.63	0.242	2.628
OBDG	9.54	1.82	0.90	4.98	0.290	2.468
PHAST	10.58	1.72	-0.13	2.14	0.492	0.874
SLAB	10.10	1.41	0.34	1.68	0.702	1.408
TRACE	10.47	1.47	-0.03	2.35	0.581	0.973

Block 1: BURRO (N= 21)

model	mean	sigma	bias	vg	fa2	mg
OBS.	11.38	0.85	0.00	1.00	1.000	1.000
AFTOX	12.13	0.93	-0.75	2.56	0.476	0.471
AIRTOX	12.02	0.83	-0.64	2.08	0.571	0.530
B&M	11.53	1.47	-0.15	1.95	0.667	0.857
CHARM	11.68	1.12	-0.30	1.44	0.762	0.744
DEGADIS	12.29	1.03	-0.91	2.91	0.238	0.401
FOCUS	12.90	1.22	-1.52	15.81	0.238	0.219
GPM	11.64	0.92	-0.26	1.47	0.810	0.771
GASTAR	11.72	0.69	-0.34	1.49	0.810	0.712
HEGADAS	12.11	1.09	-0.73	2.41	0.476	0.481
INPUFF	11.01	1.06	0.37	1.77	0.476	1.451
OBDG	11.30	1.32	0.08	1.61	0.762	1.081
PHAST	12.06	1.08	-0.68	2.31	0.476	0.505
SLAB	11.45	0.88	-0.07	1.31	0.857	0.931
TRACE	11.75	0.60	-0.37	1.59	0.667	0.689

Block 2: COYOTE (N= 11)

model	mean	sigma	bias	vg	fa2	mg
OBS.	10.89	0.64	0.00	1.00	1.000	1.000
AFTOX	11.44	0.66	-0.56	1.46	0.727	0.574
AIRTOX	11.23	1.10	-0.34	2.39	0.182	0.712
B&M	10.75	0.71	0.13	1.10	1.000	1.141
CHARM	10.97	0.62	-0.08	1.03	1.000	0.919
DEGADIS	11.69	0.60	-0.80	2.08	0.273	0.447
FOCUS	12.54	1.02	-1.66	42.16	0.091	0.190
GPM	10.70	0.75	0.18	1.27	0.818	1.203
GASTAR	11.48	0.57	-0.59	1.72	0.455	0.554
HEGADAS	11.15	0.95	-0.27	1.38	0.636	0.764
INPUFF	9.96	0.88	0.93	3.32	0.455	2.527
OBDG	10.18	1.01	0.70	2.49	0.364	2.019
PHAST	11.23	1.15	-0.35	2.37	0.182	0.705
SLAB	10.95	0.72	-0.07	1.19	0.909	0.936
TRACE	12.13	0.36	-1.24	6.40	0.273	0.288

Block 3: DESERT TORTOISE (N= 8)

model	mean	sigma	bias	vg	fa2	mg
OBS.	10.53	0.87	0.00	1.00	1.000	1.000
AFTOX	11.01	1.62	-0.48	2.34	0.500	0.619
AIRTOX	10.83	1.97	-0.30	3.91	0.125	0.743
B&M	9.84	1.48	0.69	2.39	0.500	1.985
CHARM	9.30	1.13	1.23	5.34	0.125	3.429
DEGADIS	11.17	1.77	-0.65	3.51	0.500	0.524
FOCUS	10.63	1.23	-0.10	1.20	0.875	0.902
GPM	11.07	1.53	-0.54	2.20	0.500	0.583
GASTAR	10.59	1.35	-0.07	1.39	0.750	0.936
HEGADAS	10.22	1.14	0.30	1.20	1.000	1.354
INPUFF	10.43	1.63	0.10	1.37	0.500	1.102
OBDG	10.89	1.83	-0.36	3.19	0.250	0.700
PHAST	10.06	0.77	0.47	1.30	0.375	1.601
SLAB	10.65	1.51	-0.12	1.56	0.625	0.887
TRACE	10.22	1.02	0.31	1.14	1.000	1.361

PERFORMANCE MEASURES FOR CONCENTRATIONS FOR CONTINUOUS DENSE GAS RELEASES (BURRO, COYOTE, DESERT TORTOISE, GOLDFISH, MAPLIN SANDS, THORNEY ISLAND), SHORT AVERAGING TIME, ALL X'S.

Block 4: GOLDFISH			(N= 8)			
model	mean	sigma	bias	vg	fa2	mg
OBS.	8.11	1.66	0.00	1.00	1.000	1.000
AFTOX	7.05	1.50	1.06	4.44	0.500	2.897
AIRTOX	6.30	1.74	1.81	31.25	0.000	6.112
B&M	7.06	1.79	1.06	3.30	0.125	2.884
CHARM	6.19	1.20	1.92	64.75	0.000	6.855
DEGADIS	7.52	1.53	0.59	1.55	0.500	1.812
FOCUS	7.56	2.18	0.56	1.95	0.500	1.750
GPM	6.70	1.50	1.42	8.48	0.000	4.135
GASTAR	7.75	1.73	0.37	1.23	0.875	1.447
HEGADAS	7.75	1.19	0.36	1.51	0.750	1.440
INPUFF	6.72	1.58	1.40	7.65	0.000	4.044
OBDG	6.98	1.70	1.13	4.46	0.125	3.097
PHAST	7.31	2.20	0.81	2.77	0.500	2.239
SLAB	7.30	1.53	0.82	2.08	0.500	2.268
TRACE	7.31	1.52	0.80	2.05	0.375	2.226

Block 5: MAPLIN SANDS, LNG			(N= 17)			
model	mean	sigma	bias	vg	fa2	mg
OBS.	10.66	0.88	0.00	1.00	1.000	1.000
AFTOX	10.37	1.06	0.29	1.27	0.824	1.331
AIRTOX	8.53	1.54	2.13	244.60	0.118	8.396
B&M	10.22	1.09	0.44	1.47	0.706	1.554
CHARM	10.49	1.29	0.17	1.51	0.765	1.185
DEGADIS	10.86	0.94	-0.21	1.16	0.941	0.814
FOCUS	12.13	1.29	-1.47	22.67	0.176	0.230
GPM	9.96	1.02	0.70	1.89	0.471	2.021
GASTAR	10.73	0.85	-0.07	1.11	1.000	0.929
HEGADAS	10.35	1.14	0.30	1.67	0.765	1.357
INPUFF	9.36	1.02	1.30	6.30	0.059	3.677
OBDG	9.50	1.33	1.16	6.05	0.235	3.198
PHAST	9.99	1.39	0.67	2.43	0.353	1.950
SLAB	9.90	1.16	0.75	2.72	0.412	2.126
TRACE	11.48	0.64	-0.82	2.79	0.471	0.441

Block 6: MAPLIN SANDS, LPG			(N= 44)			
model	mean	sigma	bias	vg	fa2	mg
OBS.	10.34	0.87	0.00	1.00	1.000	1.000
AFTOX	9.89	1.21	0.45	1.66	0.614	1.575
AIRTOX	8.58	1.49	1.76	48.56	0.136	5.825
B&M	10.49	1.15	-0.15	1.36	0.795	0.857
CHARM	9.96	1.28	0.38	2.02	0.659	1.460
DEGADIS	10.56	1.31	-0.22	1.54	0.795	0.806
FOCUS	10.59	1.65	-0.25	4.34	0.477	0.780
GPM	9.54	1.19	0.80	2.54	0.364	2.233
GASTAR	10.45	1.06	-0.11	1.21	0.818	0.892
HEGADAS	10.58	1.27	-0.24	1.50	0.773	0.785
INPUFF	8.89	1.17	1.45	10.72	0.091	4.254
OBDG	9.15	1.38	1.19	7.30	0.205	3.297
PHAST	10.46	1.35	-0.12	1.64	0.636	0.888
SLAB	9.82	0.88	0.52	1.80	0.727	1.688
TRACE	9.84	0.83	0.50	2.47	0.636	1.651

Block 7: THORNEY ISLAND			(N= 15)			
model	mean	sigma	bias	vg	fa2	mg
OBS.	10.04	1.46	0.00	1.00	1.000	1.000
AFTOX	9.76	1.31	0.29	1.18	1.000	1.331
AIRTOX	9.32	1.28	0.72	6.68	0.467	2.060
B&M	10.21	1.44	-0.17	1.07	1.000	0.843
CHARM	9.28	0.85	0.76	3.80	0.400	2.137
DEGADIS	10.50	1.53	-0.46	1.92	0.733	0.629
FOCUS	10.72	1.28	-0.67	1.78	0.733	0.509
GPM	10.37	1.24	-0.32	1.76	0.733	0.723
GASTAR	10.16	1.34	-0.12	1.14	0.867	0.884
HEGADAS	10.04	1.75	0.00	1.23	0.933	1.001
INPUFF	9.77	1.17	0.27	1.70	0.400	1.306
OBDG	8.43	1.57	1.61	14.07	0.000	5.019
PHAST	11.03	1.21	-0.99	3.36	0.267	0.371
SLAB	9.83	0.99	0.21	1.33	0.733	1.239
TRACE	9.97	0.31	0.08	2.21	0.533	1.078

APPENDIX D-2

THE PERFORMANCE MEASURES FOR THE PREDICTED CONCENTRATIONS FOR THE CONTINUOUS DENSE GAS RELEASES (BURRO, COYOTE, DESERT TORTOISE, GOLDFISH, MAPLIN SANDS, AND THORNEY ISLAND), INCLUDING ALL DOWNWIND DISTANCES. THE LONGEST AVAILABLE AVERAGING TIME WAS USED.

PERFORMANCE MEASURES FOR CONCENTRATIONS FOR CONTINUOUS DENSE GAS RELEASES (BURRO, COYOTE, DESERT TORTOISE, GOLDFISH, MAPLIN SANDS, THORNEY ISLAND), LONG AVERAGING TIME, ALL X'S.

All observations, (N= 124)

model	mean	sigma	bias	vg	fa2	mg
OBS.	10.25	1.20	0.00	1.00	1.000	1.000
AFTOX	10.32	1.69	-0.07	2.44	0.540	0.931
AIRTOX	9.48	2.13	0.78	22.77	0.202	2.172
B&M	10.36	1.62	-0.10	1.81	0.645	0.900
CHARM	10.05	1.71	0.21	2.93	0.492	1.230
DEGADIS	10.83	1.66	-0.58	2.92	0.589	0.560
FOCUS	11.18	1.99	-0.93	13.60	0.387	0.396
GPM	9.87	1.55	0.38	2.11	0.556	1.464
GASTAR	10.61	1.41	-0.35	1.72	0.694	0.703
HEGADAS	10.59	1.60	-0.34	2.07	0.637	0.714
INPUFF	9.46	1.57	0.79	4.08	0.355	2.201
OBDG	9.54	1.82	0.71	5.04	0.298	2.044
PHAST	10.58	1.72	-0.32	2.78	0.476	0.724
SLAB	10.08	1.41	0.17	1.93	0.581	1.187
TRACE	10.47	1.47	-0.22	3.53	0.516	0.806

Block 1: BURRO (N= 21)

model	mean	sigma	bias	vg	fa2	mg
OBS.	10.88	0.77	0.00	1.00	1.000	1.000
AFTOX	12.08	0.95	-1.20	6.27	0.143	0.301
AIRTOX	12.02	0.83	-1.13	4.86	0.190	0.322
B&M	11.53	1.47	-0.65	4.06	0.238	0.521
CHARM	11.68	1.12	-0.79	2.80	0.381	0.452
DEGADIS	12.30	1.03	-1.42	10.92	0.143	0.242
FOCUS	12.90	1.20	-2.02	111.47	0.095	0.133
GPM	11.10	1.07	-0.22	1.55	0.857	0.802
GASTAR	11.76	0.70	-0.88	2.98	0.333	0.416
HEGADAS	12.11	1.09	-1.23	6.89	0.190	0.292
INPUFF	10.97	1.06	-0.09	1.49	0.810	0.914
OBDG	11.30	1.32	-0.42	2.29	0.524	0.657
PHAST	12.06	1.08	-1.18	6.58	0.333	0.307
SLAB	11.40	0.91	-0.52	1.97	0.571	0.594
TRACE	11.75	0.60	-0.87	2.89	0.429	0.418

Block 2: COYOTE (N= 11)

model	mean	sigma	bias	vg	fa2	mg
OBS.	9.98	0.82	0.00	1.00	1.000	1.000
AFTOX	11.41	0.68	-1.43	8.29	0.000	0.240
AIRTOX	11.23	1.10	-1.25	7.05	0.273	0.287
B&M	10.75	0.71	-0.78	2.40	0.545	0.460
CHARM	10.97	0.62	-0.99	3.24	0.364	0.371
DEGADIS	11.70	0.60	-1.72	21.27	0.000	0.179
FOCUS	12.49	1.12	-2.51	3661.70	0.091	0.081
GPM	10.05	0.83	-0.08	1.09	1.000	0.928
GASTAR	11.49	0.57	-1.52	11.58	0.000	0.219
HEGADAS	11.15	0.95	-1.18	4.33	0.000	0.308
INPUFF	9.93	0.87	0.05	1.14	1.000	1.053
OBDG	10.18	1.01	-0.21	1.23	0.727	0.814
PHAST	11.23	1.15	-1.26	6.76	0.182	0.284
SLAB	10.87	0.75	-0.89	2.32	0.182	0.411
TRACE	12.13	0.36	-2.15	208.97	0.000	0.116

Block 3: DESERT TORTOISE (N= 8)

model	mean	sigma	bias	vg	fa2	mg
OBS.	10.16	0.96	0.00	1.00	1.000	1.000
AFTOX	10.86	1.64	-0.70	2.74	0.500	0.497
AIRTOX	10.83	1.97	-0.66	4.77	0.375	0.517
B&M	9.84	1.48	0.32	1.55	0.750	1.381
CHARM	9.30	1.13	0.87	2.45	0.125	2.384
DEGADIS	11.17	1.77	-1.01	5.36	0.500	0.364
FOCUS	10.60	1.27	-0.43	1.42	0.750	0.649
GPM	10.30	1.67	-0.13	1.35	0.625	0.377
GASTAR	10.59	1.35	-0.43	1.51	0.750	0.651
HEGADAS	10.22	1.14	-0.06	1.09	1.000	0.942
INPUFF	10.40	1.62	-0.24	1.78	0.625	0.788
OBDG	10.39	1.83	-0.72	4.01	0.500	0.487
PHAST	10.06	0.77	0.11	1.12	1.000	1.113
SLAB	10.62	1.53	-0.45	1.31	0.500	0.637
TRACE	10.22	1.02	-0.05	1.06	1.000	0.947

PERFORMANCE MEASURES FOR CONCENTRATIONS FOR CONTINUOUS DENSE GAS RELEASES (BURRO, COYOTE, DESERT TORTOISE, GOLDFISH, MAPLIN SANDS, THORNEY ISLAND), LONG AVERAGING TIME, ALL X'S.

Block 4: GOLDFISH (N= 8)

model	mean	sigma	bias	vg	fa2	mg
OBS.	8.11	1.66	0.00	1.00	1.000	1.000
AFTOX	7.05	1.50	1.06	4.44	0.500	2.897
AIRTOX	6.30	1.74	1.81	31.25	0.000	6.112
B&M	7.06	1.79	1.06	3.30	0.125	2.884
CHARM	6.19	1.20	1.92	64.75	0.000	6.855
DEGADIS	7.52	1.53	0.59	1.55	0.500	1.812
FOCUS	7.56	2.18	0.56	1.95	0.500	1.750
GPM	6.70	1.50	1.42	8.48	0.000	4.135
GASTAR	7.75	1.73	0.37	1.23	0.875	1.447
HEGADAS	7.75	1.19	0.36	1.51	0.750	1.440
INPUFF	6.72	1.58	1.40	7.65	0.000	4.044
OBDG	6.98	1.70	1.13	4.46	0.125	3.097
PHAST	7.31	2.20	0.81	2.77	0.500	2.239
SLAB	7.30	1.53	0.82	2.08	0.500	2.268
TRACE	7.31	1.52	0.80	2.05	0.375	2.226

Block 5: MAPLIN SANDS, LNG (N= 17)

model	mean	sigma	bias	vg	fa2	mg
OBS.	10.66	0.88	0.00	1.00	1.000	1.000
AFTOX	10.37	1.06	0.29	1.27	0.824	1.331
AIRTOX	8.53	1.54	2.13	244.60	0.118	8.396
B&M	10.22	1.09	0.44	1.47	0.706	1.554
CHARM	10.49	1.29	0.17	1.51	0.765	1.185
DEGADIS	10.86	0.94	-0.21	1.16	0.941	0.814
FOCUS	12.13	1.29	-1.47	22.67	0.176	0.230
GPM	9.96	1.02	0.70	1.89	0.471	2.021
GASTAR	10.73	0.85	-0.07	1.11	1.000	0.929
HEGADAS	10.35	1.14	0.30	1.67	0.765	1.357
INPUFF	9.36	1.02	1.30	6.30	0.059	3.677
OBDG	9.50	1.33	1.16	6.05	0.235	3.198
PHAST	9.99	1.39	0.67	2.43	0.353	1.950
SLAB	9.90	1.16	0.75	2.72	0.412	2.126
TRACE	11.48	0.64	-0.82	2.79	0.471	0.441

Block 6: MAPLIN SANDS, LPG (N= 44)

model	mean	sigma	bias	vg	fa2	mg
OBS.	10.34	0.87	0.00	1.00	1.000	1.000
AFTOX	9.89	1.21	0.45	1.66	0.614	1.575
AIRTOX	8.58	1.49	1.76	48.56	0.136	5.825
B&M	10.49	1.15	-0.15	1.36	0.795	0.857
CHARM	9.96	1.28	0.38	2.02	0.659	1.460
DEGADIS	10.56	1.31	-0.22	1.54	0.795	0.806
FOCUS	10.59	1.65	-0.25	4.34	0.477	0.780
GPM	9.54	1.19	0.80	2.54	0.364	2.233
GASTAR	10.45	1.06	-0.11	1.21	0.818	0.892
HEGADAS	10.58	1.27	-0.24	1.50	0.773	0.785
INPUFF	8.89	1.17	1.45	10.72	0.091	4.254
OBDG	9.15	1.38	1.19	7.30	0.205	3.297
PHAST	10.46	1.35	-0.12	1.64	0.636	0.888
SLAB	9.82	0.88	0.52	1.80	0.727	1.688
TRACE	9.84	0.83	0.50	2.47	0.636	1.651

Block 7: THORNEY ISLAND (N= 15)

model	mean	sigma	bias	vg	fa2	mg
OBS.	10.04	1.46	0.00	1.00	1.000	1.000
AFTOX	9.76	1.31	0.29	1.18	1.000	1.331
AIRTOX	9.32	1.28	0.72	6.68	0.467	2.060
B&M	10.21	1.44	-0.17	1.07	1.000	0.843
CHARM	9.28	0.85	0.76	3.80	0.400	2.137
DEGADIS	10.50	1.53	-0.46	1.92	0.733	0.629
FOCUS	10.72	1.28	-0.67	1.78	0.733	0.509
GPM	10.37	1.24	-0.32	1.76	0.733	0.723
GASTAR	10.16	1.34	-0.12	1.14	0.867	0.884
HEGADAS	10.04	1.75	0.00	1.23	0.933	1.001
INPUFF	9.77	1.17	0.27	1.70	0.400	1.306
OBDG	8.43	1.57	1.61	14.07	0.000	5.019
PHAST	11.03	1.21	-0.99	3.86	0.267	0.371
SLAB	9.83	0.99	0.21	1.33	0.733	1.239
TRACE	9.97	0.31	0.08	2.21	0.533	1.078

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APPENDIX D-3

THE PERFORMANCE MEASURES FOR THE PREDICTED CONCENTRATIONS FOR THE INSTANTANEOUS DENSE GAS RELEASE (THORNEY ISLAND), INCLUDING ALL DOWNWIND DISTANCES.

PERFORMANCE MEASURES FOR CONCENTRATIONS FOR INSTANTANEOUS DENSE GAS RELEASE (THORNEY ISLAND), ALL X'S.

THORNEY ISLAND (N= 61)

model	mean	sigma	bias	vg	fa2	mg
OBS.	10.08	1.14	0.00	1.00	1.000	1.000
AFTOX	11.86	1.08	-1.78	36.83	0.033	0.169
AIRTOX	10.14	1.37	-0.06	1.23	0.869	0.944
B&M	10.34	1.20	-0.26	1.20	0.934	0.772
CHARM	9.42	1.13	0.67	2.45	0.541	1.948
DEGADIS	10.34	1.75	-0.26	11.22	0.344	0.771
FOCUS	10.89	1.19	-0.81	2.29	0.410	0.445
GASTAR	9.53	1.06	0.55	1.66	0.557	1.736
INPUFF	11.20	1.24	-1.12	4.16	0.180	0.327
PHAST	10.53	0.97	-0.45	1.58	0.770	0.637
SLAB	9.40	1.26	0.68	2.33	0.689	1.979
TRACE	10.77	1.53	-0.69	2.92	0.459	0.502

APPENDIX D-4

THE PERFORMANCE MEASURES FOR THE PREDICTED CONCENTRATIONS FOR THE CONTINUOUS DENSE GAS RELEASES (BURRO, COYOTE, DESERT TORTOISE, GOLDFISH, MAPLIN SANDS, AND THORNEY ISLAND), FOR DOWNWIND DISTANCES $\geq$ 200M ONLY. THE SHORTEST AVAILABLE AVERAGING TIME WAS USED.

PERFORMANCE MEASURES FOR CONCENTRATIONS FOR CONTINUOUS DENSE GAS RELEASES (BURRO, COYOTE, DESERT TORTOISE, GOLDFISH, MAPLIN SANDS, THORNEY ISLAND), SHORT AVERAGING TIME, X >= 200M.

All observations, (N= 58)

model	mean	sigma	bias	vg	fa2	mg
OBS.	9.48	1.08	0.00	1.00	1.000	1.000
AFTOX	9.16	1.48	0.33	2.03	0.569	1.389
AIRTOX	8.22	1.92	1.26	36.35	0.155	3.543
B&M	9.02	1.24	0.46	1.79	0.603	1.591
CHARM	8.78	1.50	0.70	3.70	0.517	2.013
DEGADIS	9.56	1.39	-0.08	1.57	0.690	0.924
FOCUS	9.93	1.85	-0.45	4.38	0.534	0.640
GPM	8.92	1.44	0.56	3.01	0.379	1.752
GASTAR	9.56	1.29	-0.07	1.29	0.810	0.929
HEGADAS	9.33	1.22	0.15	1.45	0.793	1.162
INPUFF	8.37	1.30	1.11	6.85	0.190	3.047
OBDG	8.16	1.31	1.32	8.52	0.172	3.744
PHAST	9.30	1.53	0.19	2.52	0.431	1.208
SLAB	9.09	1.23	0.39	1.65	0.724	1.483
TRACE	9.78	1.60	-0.30	2.49	0.534	0.743

Block 1: BURRO (N= 5)

model	mean	sigma	bias	vg	fa2	mg
OBS.	10.23	0.41	0.00	1.00	1.000	1.000
AFTOX	11.16	0.70	-0.94	3.85	0.200	0.392
AIRTOX	11.01	0.86	-0.79	3.54	0.400	0.455
B&M	9.22	0.70	1.00	3.23	0.200	2.725
CHARM	9.95	0.78	0.28	1.52	0.600	1.319
DEGADIS	10.74	0.68	-0.51	1.59	0.800	0.600
FOCUS	10.89	0.81	-0.66	1.93	0.800	0.518
GPM	10.67	0.83	-0.45	2.17	0.600	0.639
GASTAR	10.68	0.40	-0.45	1.27	1.000	0.639
HEGADAS	10.75	0.68	-0.52	1.69	0.800	0.592
INPUFF	9.98	0.86	0.25	1.89	0.400	1.282
OBDG	9.41	0.61	0.82	2.18	0.400	2.273
PHAST	10.56	0.67	-0.34	1.34	0.800	0.714
SLAB	10.20	0.49	0.03	1.10	1.000	1.031
TRACE	11.02	0.52	-0.80	2.10	0.400	0.452

Block 2: COYOTE (N= 8)

model	mean	sigma	bias	vg	fa2	mg
OBS.	10.59	0.51	0.00	1.00	1.000	1.000
AFTOX	11.17	0.56	-0.57	1.50	0.625	0.564
AIRTOX	10.91	1.11	-0.32	2.85	0.000	0.729
B&M	10.41	0.50	0.18	1.13	1.000	1.200
CHARM	10.69	0.47	-0.10	1.03	1.000	0.909
DEGADIS	11.43	0.47	-0.83	2.20	0.250	0.435
FOCUS	12.32	1.08	-1.73	70.27	0.125	0.178
GPM	10.44	0.67	0.15	1.27	0.750	1.163
GASTAR	11.28	0.49	-0.69	1.91	0.375	0.502
HEGADAS	10.81	0.87	-0.22	1.41	0.625	0.802
INPUFF	9.68	0.80	0.91	3.27	0.500	2.487
OBDG	9.85	0.90	0.74	2.60	0.375	2.096
PHAST	10.89	1.11	-0.29	2.57	0.125	0.747
SLAB	10.71	0.66	-0.11	1.22	0.875	0.893
TRACE	12.05	0.32	-1.45	10.14	0.125	0.234

Block 3: DESERT TORTOISE (N= 4)

model	mean	sigma	bias	vg	fa2	mg
OBS.	9.68	0.24	0.00	1.00	1.000	1.000
AFTOX	9.44	0.52	0.24	1.18	1.000	1.276
AIRTOX	8.92	0.74	0.76	2.32	0.250	2.138
B&M	8.42	0.54	1.27	5.51	0.000	3.554
CHARM	8.24	0.46	1.44	8.80	0.000	4.239
DEGADIS	9.43	0.32	0.26	1.08	1.000	1.295
FOCUS	9.41	0.16	0.28	1.11	1.000	1.319
GPM	9.60	0.50	0.09	1.10	1.000	1.091
GASTAR	9.25	0.26	0.43	1.29	0.750	1.538
HEGADAS	9.09	0.23	0.59	1.42	1.000	1.803
INPUFF	8.86	0.47	0.83	2.13	0.250	2.286
OBDG	9.06	0.19	0.63	1.57	0.500	1.871
PHAST	9.30	0.16	0.39	1.20	1.000	1.471
SLAB	9.15	0.23	0.53	1.32	1.000	1.699
TRACE	9.22	0.24	0.47	1.25	1.000	1.595

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