

**SPRAYTRAN User's Guide:
A GIS-Based Atmospheric Spray Droplet Dispersion
Modeling System**

by

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NOTICE

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Foreword

The offsite drift of pesticides from agricultural spray applications is a source of risk to non-target crops, sensitive ecological areas, and nearby human communities. The potential exposures from spray operations to sensitive crops, ecological resources, and human settlements are increasing as land use change intensifies in many areas of the country. The SPRAY TRANsport (SPRAYTRAN) system, documented in this report provides a tool for evaluating exposure from offsite drift from multiple agricultural fields in an adjacent community or small watershed-scale area. Current tools in use by the U.S. Environmental Protection Agency, Office of Pesticide Programs only address near-field (<300 m), primary drift from a single, pesticide application to a single, row-crop field during neutral atmospheric conditions over level terrain with uniform surface characteristics under the assumption of uniform and constant meteorology. SPRAYTRAN provides a tool to address meso-scale drift from multiple applications in variable terrain driven by spatially and temporally variable meteorology.

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Abstract

The offsite drift of pesticide from spray operations is an ongoing source of concern. The SPRAY TRANsport (SPRAYTRAN) system, documented in this report, incorporates the near-field spray application model, AGDISP, into a meso-scale atmospheric transport model. The AGDISP model is a near-field modeling technology (<1000 m) used to evaluate primary drift from a single pesticide application to a single row crop field during neutral atmospheric conditions over level terrain with uniform surface characteristics under the assumption of uniform and constant meteorology. The SPRAYTRAN system incorporates the on-field deposition and near-field spray drift results from AGDISP into a meso-scale transport model through a geographic information system-based user interface. SPRAYTRAN also extends and uses the DUST TRANsport (DUSTRAN) modeling system to enhance the assessment of offsite drift of pesticides. DUSTRAN is being developed for the U.S. Department of Defense to assess training/testing range dust-oriented pollutant contributions to local and regional air quality, to help manage dust-generating activities, and to help develop dust-mitigation strategies. SPRAYTRAN allows the assessment of potential pesticide exposures from multiple applications to multiple fields in variable terrain with time-varying, non-uniform meteorology.

Acronyms

AGDISP	Agricultural Dispersal
DoD	U.S. Department of Defense
DUSTRAN	DUST TRANsport
EPA	U.S. Environmental Protection Agency
ESRI	Environmental System Research Institute
GIS	Geographic Information System
NERL	National Exposure Research Laboratory
NRMRL	National Risk Management Research Laboratory
OPP	Office of Pesticide Programs
PNNL	Pacific Northwest National Laboratory
SERDP	Strategic Environmental Research and Development Program
SPRAYTRAN	SPRAY TRANsport
USDA-FS	U.S. Department of Agriculture-Forest Service
USFS	U.S. Forest Service
UTM	Universal Transverse Mercator

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1.0 Introduction

The drift of air-borne pesticides beyond the target site during spray applications is a source of environmental concern because of the potential for human health impacts, downwind contamination and damage to crops and livestock, and endangerment of ecological resources. The amount and ultimate destination of these airborne pesticides is a function of application techniques, environmental conditions, and the physical properties of the spray solution. The sensitivity of drift to numerous factors, including atmospheric conditions, terrain features, and application equipment, makes the use of models necessary for evaluating the potential risks of spray operations and the potential effectiveness of mitigation options.

Several models have been developed to predict the drift and deposition from aerial spray applications. Both empirical and mechanistic models have been used to evaluate near-field spray operations. However, the empirical models do not take into account any physical basis for spray drift and are generally applicable only to situations very similar to those upon which they were developed. Simple, mechanistic models for evaluating near-field spray dynamics have generally fallen into two categories based on the mathematical approach to turbulent mixing, i.e., Gaussian dispersion equations and particle tracking models. Gaussian modeling is a classical approach used in evaluating releases from tall stacks and other sources for moderately long range drift, but does not provide much resolution in the representation of equipment and near-field dynamics in flow-fields near an aircraft. Resolution and representation of the effects of equipment and near-field dynamics in the flow fields in the vicinity of the spray aircraft have been addressed using LaGrangian modeling approaches. LaGrangian models track a cohort of droplets in a given drop size category, and overlay a random component to account for atmospheric turbulence. The LaGrangian approach lends itself to detailed modeling of the effects of application equipment on spray dispersal, and can be used to evaluate the mitigating effects of alternative equipment uses and near-field buffer zones.

AGricultural DISpersal (AGDISP) is based on a LaGrangian approach to the solution of the spray material equations of motion, and includes simplified sub-models for the effects of the aircraft wake, and the air-generated and ambient turbulence. AGDISP evaluates many particle-size classes and includes evaporation algorithms for volatile carriers. AGDISP is used by the U.S. Forest Service to evaluate and manage spray applications, and forms the basis of a regulatory tool used by the U.S. Environmental Protection Agency (EPA), Office of Pesticide Programs, to evaluate potential impacts from pesticide drift in the pesticide registration process. AGDISP is recommended for use within 300 m of the application area, and simulates a single application to a field-scale area. AGDISP does not incorporate the impacts of variable terrain or time-varying, non-uniform meteorology.

A comprehensive assessment of the potential impacts of multiple pesticide applications in a containing watershed or nearby community requires the ability to evaluate multiple applications to multiple fields in an area with variable terrain. The SPRAY TRANsport (SPRAYTRAN) modeling system, described in this document, links output from the AGDISP near-field simulation to the CALMET/CALPUFF atmospheric modeling system through DUST TRANsport (DUSTTRAN), a geographic information system (GIS) interface developed for the U.S. Department of Defense (DoD) to use the CALMET/CALPUFF system to evaluate the environmental impacts of dust-generating activities, such as troop maneuvers and convoy movement.

This document is designed to give the user sufficient information to develop a series of area sources using AGDISP and to run the SPRAYTRAN simulation using AGDISP output to define the area sources. This is a companion document to the DUSTRAN User Guide (Allwine et al. 2005), that contains additional details on the DUSTRAN/SPRAYTRAN interface, alternative source input options, and the operation and parameterization of CALMET/CALPUFF simulations for the DUSTRAN/SPRAYTRAN applications.

1.1 Status and Future Efforts

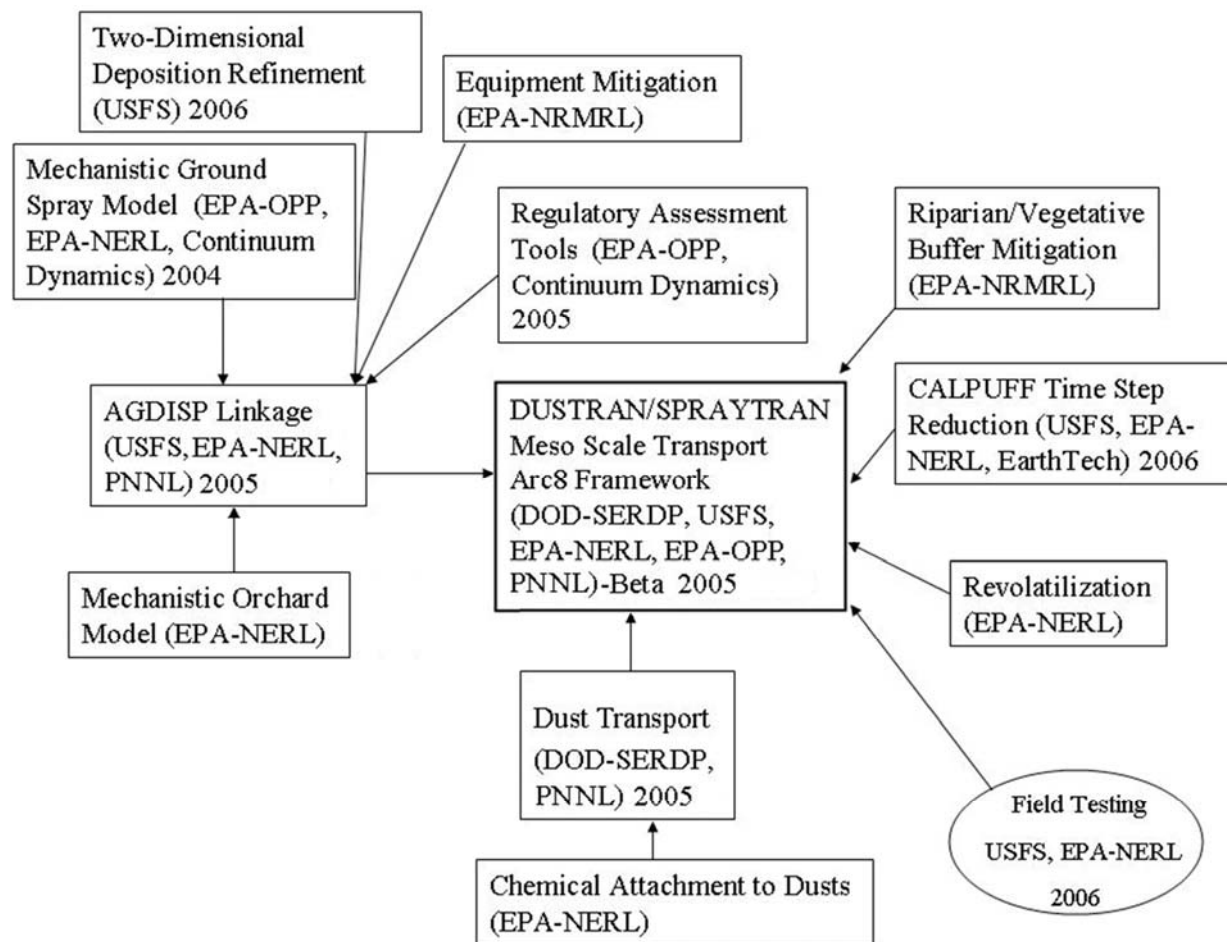
The current SPRAYTRAN system is part of an ongoing collaborative effort among the U.S. Department of Agriculture-Forest Service (USDA-FS), the EPA, and Pacific Northwest National Laboratory (PNNL) to develop a comprehensive drift evaluation tool. Figure 1.1 illustrates the components of this effort with organizational involvement. The tasks shown with their dates, have either been completed or are actively in progress, and have been at least partially funded. During the remainder of 2005 and 2006, three major efforts, in addition to the SPRAYTRAN Meso-Scale Transport Framework described in this document, are in progress or will be initiated, including 1) reduction in CALPUFF averaging time, 2) AGDISP deposition refinement, and 3) SPRAYTRAN field validation.

A reduction in CALPUFF averaging time is necessary because the basic time step in CALPUFF is 1 hour. The source can be specified with a shorter release time, but the time step that drives the puff downwind is 1 hour. Given the time scales involved in pesticide spray application and the relatively small modeling domain (10 to 100 km) of SPRAYTRAN, the hourly time step only allows a few steps within the domain in most cases, and also inappropriately averages near-field processes that account for deposition of most of the mass. A contract is being put into place with the CALPUFF developers to alter the basic code. It is anticipated that this alteration will be in place by October 2005, and then the modified CALPUFF will be incorporated into SPRAYTRAN.

The USDA-FS has a related model development program to bring detailed, near-field deposition modeling into an accelerated rate calorimetry (ARC) GIS environment known as SprayAdvisor. This effort requires fundamental modifications to AGDISP to change the model from a two-dimensional, infinite line source model to a three dimensional, finite line source treatment. In addition, modern application systems can provide time-varying data that cannot be used by the current, steady-state version of AGDISP. These refinements are being addressed collaboratively by the USDA-FS, its contractors in the United States, and cooperators in New Zealand. A modified AGDISP code currently being tested in New Zealand correctly handles finite line geometry and allows input variables to change during a run. This new version of AGDISP, expected to be available in September 2005, will subsequently be interfaced with SPRAYTRAN.

A collaborative effort between the USDA-FS, EPA, Forest Research New Zealand, and the Canadian Forest Service (other cooperators are also being approached) is being planned to validate the SPRAYTRAN modeling system. Validating this type of long range deposition model is challenging. Two sites that provide the necessary space are being considered. One is in central Utah, and the other is in New Brunswick. A generic experimental design is being developed that will be used to finalize site selection. Detailed discussions have commenced as to tracer, sampling methods, and sampling grid. This work is tentatively scheduled for September 2006.

Longer range research proposed is the addition of secondary drift processes—pesticide revolatilization and attachment to wind-blown dusts—into SPRAYTRAN. Incorporating these processes will require the ability to run simulations for a longer time period (month to a season) and to incorporate detailed soil information as well as the ability to simulate soil moisture content.



DOD	U.S. Department of Defense
EPA	U.S. Environmental Protection Agency
NERL	National Exposure Research Laboratory
NRMRL	National Risk Management Research Laboratory
OPP	Office of Pesticide Programs
PNNL	Pacific Northwest National Laboratory
SERDP	Strategic Environmental Research Development Program
USFS	U.S. Forest Service

Figure 1.1. Components in the Development of a Comprehensive Pesticide Drift Assessment Tool

2.0 SPRAYTRAN System Components

SPRAYTRAN is a modeling system that consists of three distinct components: 1) AGDISP, a model for evaluating near-field (< 300 m) pesticide spray application drift and deposition, 2) DUSTAN, a GIS-based interface and source model for evaluating meso-scale (up to several hundred kilometers) environmental impacts of dust-generating activities, such as troop maneuvers and convoy movement, and 3) the CALMET/CALPUFF system, a set of meteorological and transport models for evaluating atmospheric transport and dispersion of particles at a relative large scale (up to 300 km). AGDISP and CALMET/CALPUFF operate on different time and spatial scales, and focus on different processes that dominate the particle transport dynamics within these two models. Careful consideration must be given to properly linking AGDISP output as the source term for the longer range modeling framework. This section describes the individual components of the SPRAYTRAN system, and then discusses in detail the theory and practice of linking the three components together.

2.1 AGDISP

AGDISP is used to generate on-field and near-field deposition and associated air concentrations resulting from the aerial application of sprayed material. AGDISP is based on a LaGrangian approach to the solution of the spray material equations of motion. LaGrangian models track cohorts of droplets in given drop-size categories and overlay a random component on the movement of the droplets to account for atmospheric turbulence. AGDISP 8.03 tracks the movement of up to 100 different drop-size categories from up to 60 different nozzle locations on the aircraft. AGDISP includes simplified models for the effects of the aircraft wake and aircraft-generated ambient turbulence. AGDISP calculates evaporation for each drop-size class as a function of droplet size, ambient temperature, and relative humidity, as well as the properties of the droplet solution. AGDISP assumes constant meteorological conditions and no variability in terrain or ground cover type.

Sprayed areas are divided into spray blocks based on the logistics of conducting spray applications. For analysis in AGDISP, these spray block areas need to be approximated as rectangles with specified lengths and widths. The area of each rectangle should equal the area of the spray block that it represents. The effective swath width and the number of swaths define the effective width of the sprayed area. AGDISP is fundamentally a two dimensional model—calculating downwind deposition across the spray block and vertical air concentration. Add-on calculations are performed to estimate deposition at the edges of the spray block in the secondary horizontal dimension.

The strength of AGDISP is in its capability to calculate the dynamics of particle movement near the aircraft, and to account for evaporation of the carrier (typically water) out of the sprayed droplets, leaving behind the relatively nonvolatile active ingredient. More details of AGDISP formulations algorithms can be found in Teske and Curbishly (2002) and Teske et al. (2002). Details of AGDISP performance evaluation can be found in Bird et al. (2002).

2.2 CALMET/CALPUFF Modeling System

CALMET is a meteorological model that develops hourly wind and temperature fields on a three-dimensional gridded modeling domain. CALMET includes a diagnostic wind-field generator containing

objective analysis and parameterized treatments of slope flows, kinetic terrain effects, terrain blocking effects, a divergence minimization procedure, and a micrometeorological model for overland and over-water boundary layers.

CALPUFF is an atmospheric transport and dispersion model that advects “puffs” of material emitted from modeled sources, simulating dispersion and transformation processes along the way. CALPUFF is a non-steady-state, LaGrangian Gaussian puff model containing modules for complex terrain effects, overwater transport, costal interaction effects, building downwash, wet and dry removal, and simple chemical transformation. CALPUFF uses the wind and temperature fields generated by CALMET to transport material.

The CALMET/CALPUFF system is capable of assessing time-varying point and area sources, suitable for modeling domains from tens of meters to hundreds of kilometers, and is applicable to rough and complex terrain conditions. The CALMET/CALPUFF system is one of EPA’s preferred/recommended air quality models.

2.3 DUSTRAN

Activities at DoD training/testing ranges can be significant sources of dust and other particulate contaminants into local and regional air sheds governed by air-quality regulations. Dust-generating activities include vehicle and troop maneuvers, convoy movement, helicopter activities, munitions impacts, roadway preparations, and wind erosion whenever the preceding activities disturb the soil surface. Other sources of particulates include the use of smokes and obscurants, controlled burns, and engine operations.

Beginning January 2001, the U.S. Department of Energy’s PNNL began a 4-year research project, funded primarily by DoD’s Strategic Environmental Research and Development Program (SERDP), to develop an atmospheric dispersion modeling system to assist the DoD in addressing particulate air quality issues at military training/testing ranges.

The basic approach in formulating DUSTRAN was to construct the system from available, widely-used components, and to focus the research on coupling the components, advancing the state-of-science in dust-emission formulations, making the system user friendly, and documenting the modeling system.

The primary components of DUSTRAN are:

- the GIS for specifying geographical inputs (e.g., modeling domain, surface characteristics, activity locations) and viewing model outputs (e.g., dust concentration and deposition fields)
- the dust-emissions module for determining dust-emission rates as a function of time and location given the dust-generating activities schedule and locations
- the atmospheric dispersion models for determining ground-level dust concentrations and deposition patterns.

2.3.1 Geographic Information System

DUSTRAN is based on the Environmental System Research Institute's (ESRI's) ArcMap 8.1 GIS, the EPA-approved CALPUFF (Scire et al. 2000a) dispersion model, and the widely used CALGRID dispersion model (Scire et al. 1989). The CALMET meteorological model (Scire et al. 2000b) provides the meteorological fields (e.g., winds, mixing height) for the CALPUFF and CALGRID dispersion models. DUSTRAN currently includes dust-emission factors for wheeled military vehicles developed in the SERDP project CP-1191 (Gillies et al. 2003) and incorporates the widely used AP-42 emission factors for paved and unpaved roads. The primary features of DUSTRAN are as follows:

- The modeling domain is graphically specified and is size selectable (20 k to 400 km).
- It operates at any U.S. geographic location (provided the proper data files are present for each desired location).
- Single-station or multiple-station meteorology can be used and easily specified.
- Multiple point, area, and line releases can be accommodated and specified graphically.
- Simulation and release times are easily specified in the user interface.
- The output concentrations and deposition contours can be viewed graphically—the output can be animated to view the progression of the dust plume across the modeling domain.
- Multiple particle sizes can be simulated at one time.
- Simulation periods are typically a few hours to one day.
- The atmospheric models treat both wet and dry deposition.
- The atmospheric models treat complex terrain effects.
- A help file with operating instructions is available from the user interface.
- The modeling system operates on both Windows 2000 and XP platforms.

The DUSTRAN graphical interface allows the user to graphically identify the locations of the training activities on a map and allows for specifying the types, speeds, and number of vehicles active during an exercise. Through the interface, the user specifies the time of the training exercise, duration of the exercise, size of modeling domain (depends on whether the user is interested in near-field or far-field impacts), duration of the simulation, and source of meteorological data. After execution of the dispersion model, the ground-level dust air concentrations and deposition fields are displayed graphically within the GIS.

3.0 AGDISP-SPRAYTRAN Linkage

The SPRAYTRAN system combines detailed source-term and air-dispersion models. The source-term parameters for spray-block applications are defined using the AGDISP model outputs. These source-term parameters are used in the SPRAYTRAN interface as input to a spray-application version of the DUSTAN GIS-based air modeling system. This section supplements the user's guide section of this document by providing the technical basis for using AGDISP data.

AGDISP was designed to optimize agricultural spraying operations, and has detailed algorithms for characterizing the release, dispersion, and deposition over and downwind of the application area. AGDISP thus provides detailed results on and nearby the spray block.

The SPRAYTRAN interface combines a state-of-the-art graphic interface and air-dispersion model into a system for evaluating the transport and dispersion of spray drift on a regional scale. The definition of the characteristics of the source term is a key step in applying SPRAYTRAN. Predicting downwind air concentrations and surface deposition requires a good definition of the spray source term.

AGDISP incorporates details of the spray application that are required to model the deposition on, and nearby, the application area. Detailed spray characteristics, equipment characterization, application information, local meteorology, and surface characteristics are needed. Large droplets will fall at a rate determined by their size—and as a result, the droplet size distribution must be characterized by many droplet size ranges. A single wind speed and direction are adequate to address local scale transport, dispersion, and deposition of spray droplets for the short downwind distances and spray durations.

SPRAYTRAN requires similar input information to AGDISP, but with a change in importance and detail of those parameters related to the different distances that are being modeled. On the spray block, a single wind direction and speed defines the local flow for an AGDISP analysis. To define the potential longer downwind trajectory of the drift material, the spatial and temporal patterns of the winds are needed. In a SPRAYTRAN analysis, the importance of such details as the number of spray passes and their length, width, and height becomes progressively less as the downwind distance increases—and the amount of applied material over the area becomes the dominant parameter.

The spray release droplet size distribution is important in both models. The deposition of the sprayed material on and in the immediate vicinity of the target area is the primary output of AGDISP. Because larger droplets comprise the largest mass fraction of the released material, and these droplets fall rapidly, the near-application deposition rates are normally dominated by the larger droplets. The coupling of the AGDISP computations with SPRAYTRAN extends the analysis to a more detailed air-dispersion analysis of the residual material that has the potential to be carried farther downwind. The linkage of the models requires that appropriate information on the droplet size of the material available to be carried downwind be obtained from AGDISP.

As illustrated in Figure 3.1, AGDISP and SPRAYTRAN operate on different but adjoining spatial and temporal scales. The scales dictate different requirements for their input parameters. The SPRAYTRAN system provides results downwind of the spray block that depend on the selected computation grid. A grid of points in the vicinity of the spray block is needed to define

transport/deposition patterns in the immediate vicinity of the spray block. Otherwise, plots based on a regional Cartesian receptor grid will have near-source patterns defined by the sparse set of computation points rather than the shape and configuration of the spray block.

The AGDISP and SPRAYTRAN results are complementary data that combine to define the fate of sprayed material over and downwind of the spray block. Currently, the AGDISP and SPRAYTRAN results can both be plotted in the STRAYTRAN system, but are not merged into a single plot.

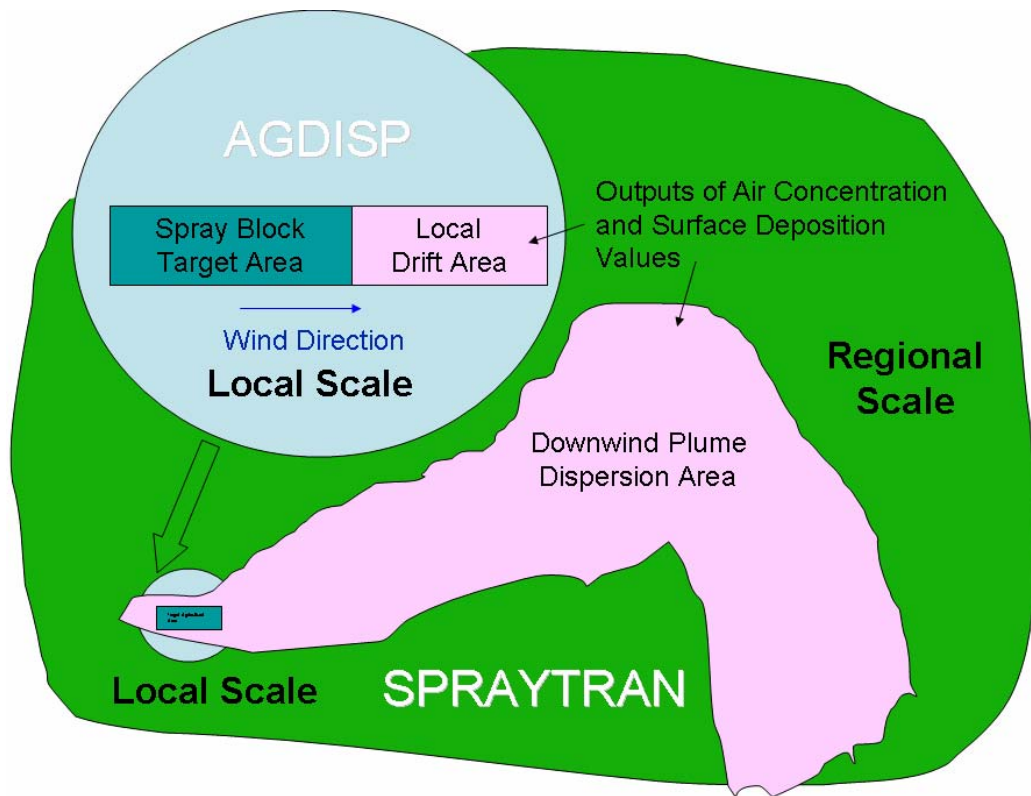


Figure 3.1 Local and Regional Scale Plumes Addressed by AGDISP and SPRAYTRAN

The linkage of AGDISP to SPRAYTRAN provides a means of modeling the downwind concentrations based on a source-term defined using AGDISP. The source term in SPRAYTRAN is defined by 1) SPRAYTRAN parameters being populated based on data from AGDISP files, and 2) user setup of an equivalent run in AGDISP and SPRAYTRAN. Advanced users, conducting special studies, may want to use the option of modifying the populated inputs, or even by-passing the direct AGDISP file read option.

3.1 AGDISP Interface:

Once the application methodology details are defined, the AGDISP user starts the analysis of a specific application by specifying the area and location of the spray block. In the AGDISP main screen analysis, the application direction across the spray block, the effective spray width, and the number of swaths are key input parameters in defining a specific application. An application direction is selected

that is at right angles to, or nearly right angles to, the ambient winds. The number of swaths required for a specific application is computed by dividing the length of the spray block area at right angles to the application direction by the effective swath width. The current version of AGDISP is an infinite line source model along the direction the aircraft travels, and thus does not require the length of the block (i.e., lengths of application swaths) for its primary calculations.

The AGDISP main screen analysis is based on a 2-dimensional (height and distance) model that defines properties along a centerline across, and downwind, of the application block. As described in the following, the inputs and results of the AGDISP main screen analysis are saved to files for the source definition module in the SPRAYTRAN interface. An AGDISP toolbox feature extends the 2-dimensional application to provide 3-dimensional representations of spray applications over specified areas. The number of spray swaths is defined by the number of flight lines required to cover the width, x . The length of the flight lines, y , defines the initial lateral dimension of the plume from the spray block. To have equivalent deposition patterns output to the SPRAYTRAN system, the width used in the toolbox must be the same as in the main AGDISP interface, and the area used in the toolbox must be the same as that used in the SPRAYTRAN interface.

3.2 SPRAYTRAN Source-Term Interface

The major components of the SPRAYTRAN system are illustrated in Figure 3.2. The arrows indicate the information and data transfers between the major components, AGDISP, SPRAYTRAN, GIS, and CALPUFF Drift Dispersion Models, that are, or may be, required to set-up an analysis in the SPRAYTRAN system. The arrows also indicate the potential for feedback for defining equivalent values for input parameters in the SPRAYTRAN and AGDISP interfaces.

To do an analysis using the SPRAYTRAN-AGDISP linkages, the first piece of required information is the application area. If the user has the dimensions of the spray block, it will make sense to start with the AGDISP interface. It may, however, be necessary to start by defining the application area in the SPRAYTRAN interface.

If the application area is too large for a single application, or the slopes of the underlying terrain dictate, multiple source inputs from AGDISP will be required. The following discussion applies to each section of area input to the SPRAYTRAN interface as a spray block or a section of a spray block.

Three AGDISP files need to be created from the AGDISP user-interface: 1) Input Summary, 2) Numerical Values, and 3) Deposition Results. The AGDISP parameters for the first two files that are used in the SPRAYTRAN emission rate computation are noted in Tables 3.1 and 3.2. Entries that are read from the AGDISP output files into SPRAYTRAN are marked in **bold**. Other parameters considered as potentially important in the linkage are given in *italics*.

The values imported from AGDISP for the mean droplet size and active mass aloft must be defined at the same distance downwind of the spray block. To meet this requirement, AGDISP is run for the same value of the “Flux Plane”^(a) distance and the “Maximum Downwind Distance.”^(b) The imported

(a) Defined in the main AGDISP screen.

(b) Defined “Advanced” tab on the main AGDISP screen.

volumetric mean mass droplet diameter, “Dv0.5,” and “Airborne Drift” are both listed in the “Numerical Values” file.

Data in the third file from AGDISP, “Deposition Results,” are input to the SPRAYTRAN GIS component. Table 3.3 lists the constants of the file for the example case (i.e. 200m column) as well as for other runs with different values for the flux plume distance. The table shows how the size and drift parameters vary across the selected distances. The data in the third file allows the combination of the detailed AGDISP results with the SPRAYTRAN results.

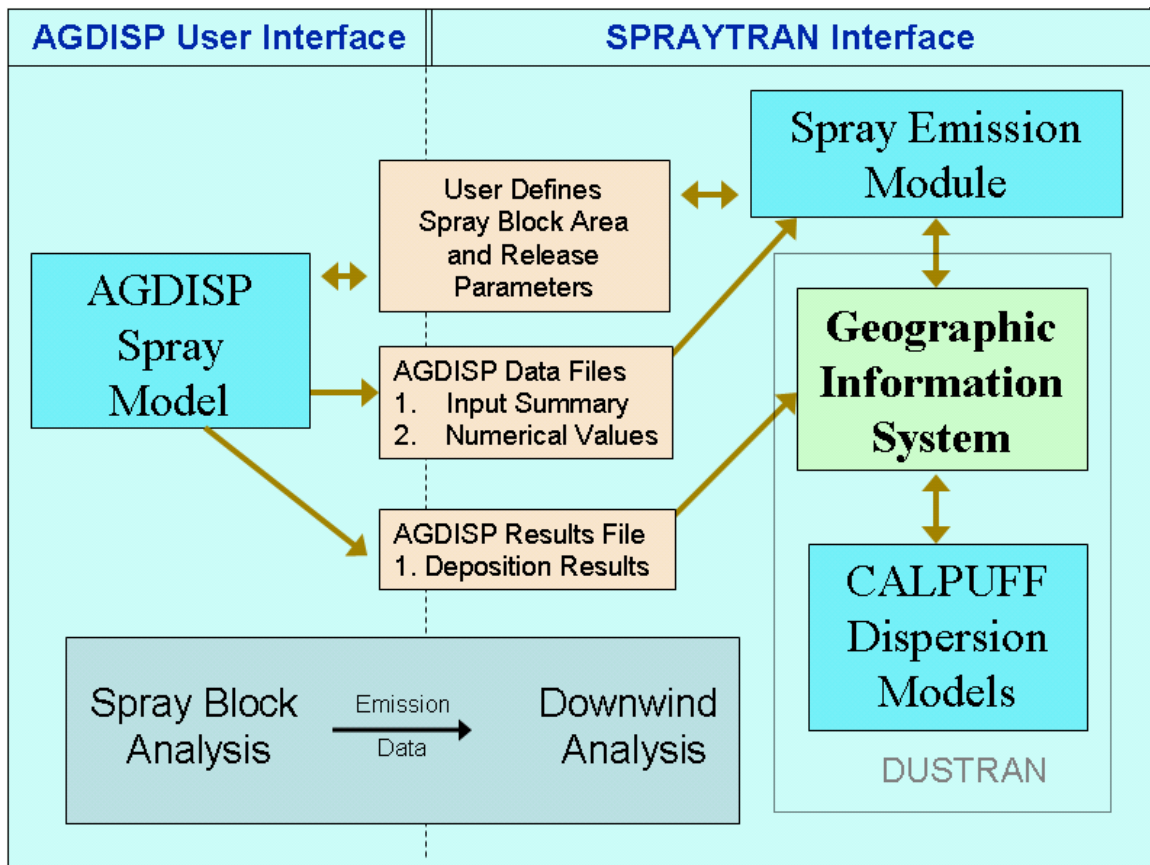


Figure 3.2 Major Components of the SPRAYTRAN Modeling System

**Table 3.1. Contents of “INPUT DATA SUMMARY FILE”
(Bold values are read by SPRAYTRAN)**

AGDISP Input Data Summary

--General--

Title: SPRAYTRAN Example Case

Notes:

Calculations Done: Yes

Run ID: AGDISP ExCase.ag 8.08 07-04-2005 12:37:21

--Aircraft--

Name	Air Tractor AT-401	
Type	Library	
Boom Height (m)	30.48	
Flight Lines	44	
Optimize Flight Lines	No	
Flight Line Reps	#	Reps
	1	1
	2	1
	3	1
	4	1
	5	1
	6	1
	7	1
	8	1
	9	1
	10	1
	11	1
	12	1
	13	1
	14	1
	15	1
	16	1
	17	1
	18	1
	19	1
	20	1
	21	1
	22	1
	23	1
	24	1
	25	1
	26	1
	27	1
	28	1
	29	1
	30	1
	31	1
	32	1
	33	1
	34	1
	35	1
	36	1
	37	1
	38	1
	39	1
	40	1
	41	1
	42	1
	43	1
	44	1
Wing Type	Fixed-Wing	
Semispan (m)	7.47	
Typical Speed (m/s)	53.64	
Biplane Separation (m)	0	
Weight (kg)	2720.47	
Planform Area (m ²)	27.31	
Propeller RPM	2000	

Propeller Radius (m)	1.37
Engine Vert Distance (m)	-0.3658
Engine Fwd Distance (m)	3.63

--Aerial Application Type--	-----
Aerial Application Type	Liquid

--Drop Size Distribution--	-----
Name	ASAE Fine to Medium
Type	Reference
Drop Categories	
	# Diam (um) Frac
	1 10.77 0.0010
	2 16.73 0.0003
	3 19.39 0.0007
	4 22.49 0.0003
	5 26.05 0.0007
	6 30.21 0.0010
	7 35.01 0.0010
	8 40.57 0.0020
	9 47.03 0.0033
	10 54.50 0.0053
	11 63.16 0.0067
	12 73.23 0.0090
	13 84.85 0.0133
	14 98.12 0.0223
	15 113.71 0.0330
	16 131.73 0.0393
	17 152.79 0.0480
	18 177.84 0.0647
	19 205.84 0.0830
	20 238.45 0.1147
	21 276.48 0.1283
	22 320.60 0.1380
	23 372.18 0.1127
	24 430.74 0.0640
	25 498.91 0.0440
	26 578.54 0.0317
	27 670.72 0.0203
	28 777.39 0.0093
	29 900.61 0.0010
	30 1044.42 0.0007
	31 1210.66 0.0003

--Nozzle Distribution--	-----
Boom Length (%)	65.06
Nozzle Locations	
	# Hor(m) Ver(m) Fwd(m)
	1 -4.86 0 0
	2 -4.62 0 0
	3 -4.38 0 0
	4 -4.15 0 0
	5 -3.91 0 0
	6 -3.67 0 0
	7 -3.44 0 0
	8 -3.2 0 0
	9 -2.96 0 0
	10 -2.73 0 0
	11 -2.49 0 0

12	-2.25	0	0
13	-2.01	0	0
14	-1.78	0	0
15	-1.54	0	0
16	-1.3	0	0
17	-1.07	0	0
18	-0.8295	0	0
19	-0.5925	0	0
20	-0.3555	0	0
21	-0.1185	0	0
22	0.1185	0	0
23	0.3555	0	0
24	0.5925	0	0
25	0.8295	0	0
26	1.07	0	0
27	1.3	0	0
28	1.54	0	0
29	1.78	0	0
30	2.01	0	0
31	2.25	0	0
32	2.49	0	0
33	2.73	0	0
34	2.96	0	0
35	3.2	0	0
36	3.44	0	0
37	3.67	0	0
38	3.91	0	0
39	4.15	0	0
40	4.38	0	0
41	4.62	0	0
42	4.86	0	0

```

--Swath--
Swath Width                                18.29 m
Swath Displacement                          0 m

--Spray Material--
Name                                         Water
Type                                         Reference
Nonvolatile Fraction                        0.03
Active Fraction                            0.015
Spray Volume Rate (L/ha)                   18.71
Specific Gravity                            1
Evaporation Rate (µm²/deg C/sec)           84.76

--Meteorology--
Wind Speed (m/s)                           2.24
Wind Direction (deg)                       -90
Temperature (deg C)                        18.33
Relative Humidity (%)                      50

--Atmospheric Stability--
Atmospheric Stability                      Overcast

--Transport--
Flux Plane Distance (m)                    200

--Canopy--

```

```

Name
Type
Height (m)
Canopy Roughness (m)
Canopy Displacement (m)

--Terrain--
Upslope Angle (deg)
Sideslope Angle (deg)

--Advanced--
Wind Speed Height (m)
Max Compute Time (sec)
Max Downwind Dist (m)
Vortex Decay Rate (IGE) (m/s)
Vortex Decay Rate (OGE) (m/s)
Aircraft Drag Coeff
Propeller Efficiency
Ambient Pressure (mb)
Save Trajectory Files
Half Boom

```

Table 3.2. DEPOSITION VALUES FILE

Line Number(s)	File Contents	Data Parameters
1	108 79	Number of x and y points
2 to x*y	-13.8249 1739.5 0 -13.8249 1721.212 0 -13.8249 1702.924 0 -13.8249 1684.635 0 -13.8249 1666.347 0 -13.8249 1648.059 0 -13.8249 1629.771 0 -13.8249 1611.483 0 -13.8249 1593.194 2.006747E-15 -13.8249 1574.906 1.24907E-12 -13.8249 1556.618 2.062673E-10 -13.8249 1538.33 6.120038E-07 -13.8249 1520.042 2.41917E-06 -13.8249 1501.753 2.425395E-06 -13.8249 1483.465 2.425472E-06 1412.655 -162.4729 8.350052E-08 1412.655 -180.7611 4.204104E-08 1412.655 -199.0493 2.015772E-08 1412.655 -217.3374 9.161351E-09	Each line has x coordinate, y coordinate, and deposition value

(a) This example case file has ADISP deposition and coordinate parameters in metric units. The AGDISP metric option must be selected for data transfer to SPRAYTRAN.

Interface Distances: There are two key distance parameters that must be defined in AGDISP as part of the source-term linkage.

The “Flux Plane Distance” in the AGDISP main screen is a special computation distance defined from the downwind edge of the spray block for which the vertical profile and the drop-size distribution of the spray plume will be available in the AGDISP output files.

The “Maximum Downwind Distance”, as defined under the Advanced tab in the AGDISP main screen, should be set to the same distance as the Flux Plane Distance. This downwind distance represents the distance to which AGDISP will compute dispersion and deposition. The fraction remaining airborne at that distance is used to define the mass of airborne material at that distance.

Selecting an appropriate distance for these two parameters involves several considerations. The AGDISP constraint is that the distance should be great enough that effects of the application equipment and evaporation are no longer important processes. This distance downwind needs to be selected where the mean droplet size is no longer decreasing rapidly with distance. The distance should also be consistent with near-source grid spacing being used in SPRAYTRAN. Based on these considerations, a flux plane distance of 200 m is recommended for most applications.

Table 3.3. "Numerical Data / Vertical Profiles" File Contents Listing for Different Selections of the AGDISP Flux Plane Distance Parameter. The file listing for the example case is shown as bolded text. The example case parameters used in SPRAYTRAN are shown in italic text.

AGDISP Numerical Data File Contents Listings for Selected Flux Plane Distances				
25m	100m	200m	300m	399m
AGDISP Numerical Values	AGDISP Numerical Values	AGDISP Numerical Values	AGDISP Numerical Values	AGDISP Numerical Values
Drop Size Distribution: Vertical Profile Dv0.1 14.64 μm Dv0.5 33.52 μm Dv0.9 123.38 μm Relative Span: 3.24 < 141 μm : 92.68 %	Drop Size Distribution: Vertical Profile Dv0.1 12.12 μm Dv0.5 25.66 μm Dv0.9 44.27 μm Relative Span: 1.25 < 141 μm : 100 %	Drop Size Distribution: Vertical Profile Dv0.1 10.53 μm Dv0.5 22.1 μm Dv0.9 37.92 μm Relative Span: 1.24 < 141 μm: 100 %	Drop Size Distribution: Vertical Profile Dv0.1 9.6 μm Dv0.5 19.81 μm Dv0.9 32.39 μm Relative Span: 1.15 < 141 μm : 100 %	Drop Size Distribution: Vertical Profile Dv0.1 8.98 μm Dv0.5 18.63 μm Dv0.9 29.24 μm Relative Span: 1.09 < 141 μm : 100 %
Accountancy of Active: Application Efficiency: 95.91 % Downwind Deposition: 1.85 % Airborne Drift: 2.24 % Carrier Evaporated: 27.53 %	Accountancy of Active: Application Efficiency: 95.33 % Downwind Deposition: 3.36 % Airborne Drift: 1.31 % Carrier Evaporated: 27.53 %	Accountancy of Active: Application Efficiency: 94.99 % Downwind Deposition: 4.02 % Airborne Drift: 0.9891 % Carrier Evaporated: 27.53 %	Accountancy of Active: Application Efficiency: 94.84 % Downwind Deposition: 4.37 % Airborne Drift: 0.7914 % Carrier Evaporated: 27.53 %	Accountancy of Active: Application Efficiency: 94.72 % Downwind Deposition: 4.61 % Airborne Drift: 0.6728 % Carrier Evaporated: 27.53 %
RunID: AGDISP ExCasenew.ag 8.08 09-01-2005 13:14:44	RunID: AGDISP ExCasenew.ag 8.08 09-01-2005 13:19:39	RunID: AGDISP 8.08 06-23-2005 09:30:31	RunID: AGDISP ExCasenew.ag 8.08 09-01-2005 13:20:46	RunID: AGDISP ExCasenew.ag 8.08 09-01-2005 13:22:41

For special cases, the user may wish to study the variation of important parameters with distance. The AGDISP plot of "fraction aloft" from the "Views" menu provides the active airborne fraction as a function of distance. The variation of the volumetric median diameter can be obtained from a series of runs with different flux plane distances. The results of such a series of runs are shown in Table 3.3 and plotted in Figure 3.3.^(a) These two plots can be used to select an appropriate distance for a spray drift source term.

(a) This plot is not an AGDISP plot but rather an externally plotted product.

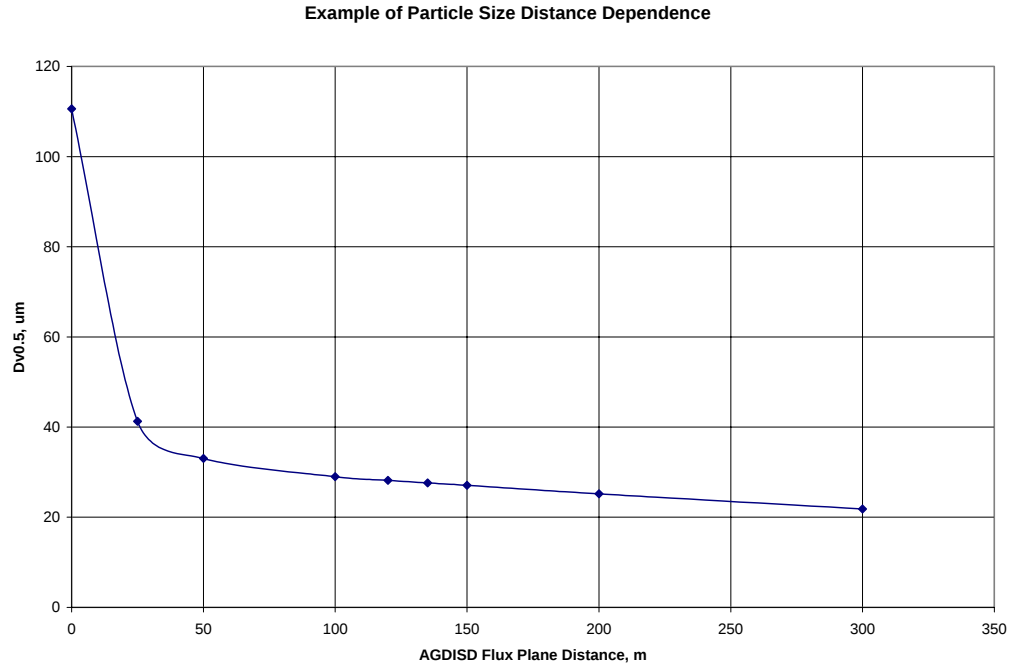


Figure 3.3 AGDISP Dv0.5 Parameter Values from Example Runs in Table 3.3

Emission Rate: Equivalent but different emission rate formulations are used in the two models. AGDISP requires as input the volumetric application rate, and SPRAYTRAN requires the amount of drift being carried downwind of the application area as an emission rate over a period of time. As a result, the SPRAYTRAN emission rate is some fraction of the AGDISP emission rate.

The total active chemical agent mass applied in a spray application is computed by:

$$T = s \rho_w V A F \quad (3.1)$$

where

- T = Total applied mass, kg
- s = Specific gravity of spray, dimensionless
- ρ_w = Density of water, (1.0) kg/L
- V = Spray volume rate, L/ha
- A = Spray block area (ha)
- F = Active chemical agent mass fraction, dimensionless

A large fraction of the active chemical mass, residing mainly in the larger droplet sizes, by design is deposited on the spray block and on an area immediately downwind. The release duration and computed information from AGDISP on the residual airborne drift provide a means of defining an equivalent SPRAYTRAN emission rate:

$$E(x) = c T f(x) / 100 / t \quad (3.2)$$

where $E(x)$ = Equivalent emission rate at a downwind location, g/s
 c = Conversion factor (=1000), g/kg
 $f(x)$ = Residual active chemical agent airborne drift, percent
 t = Duration of release, s
 x = Distance downwind, m.

Combining Equations 3.1 and 3.2, the equation for the equivalent emission rate used in SPRAYTRAN is:

$$E(x) = s p_w V F A c f(x)/100 / t \quad (3.3)$$

This emission rate represents the material applied over the spray block that is still airborne at the specified flux plane distance. Values for defining the parameters s , V , and F are read directly from the AGDISP input summary files (see Table 3.1). The spray block area (A) is calculated by the SPRAYTRAN GIS interface from the user delineation of the spray block. The parameter $f(x)$, the percent of residual airborne active chemical agent at the maximum downwind distance in AGDISP, is read from the AGDISP Number Values/Vertical Profile file (Table 3.3). The volumetric median diameter of the particles at this distance is also transferred to SPRAYTRAN from the AGDISP Numerical Values/Vertical Profile file (Table 3.3) and applied to the computed emission rate. The parameter t is the release period for the source that the user specifies in SPRAYTRAN.

3.3 Spray Block Application Area

Both AGDISP and the SPRAYTRAN drift dispersion models assume chemical application over some area. Both systems assume a computational spray block area that may require an approximate fit of the actual area.

Because the application area is not passed directly from AGDISP to SPRAYTRAN, an equivalent application area to that used by AGDISP must be specified in the SPRAYTRAN interface. In AGDISP, the area of application is defined as x-y input parameters. The AGDISP spray block width (number of swaths times the width of a swath, assuming a zero swath displacement) should be consistent with the width of the area defined in the SPRAYTRAN interface.

The length dimension of the area (also the length of application swaths) is not as critical in the linkage. The AGDISP toolbox provides the capability of using the initial AGDISP setup to consider spray blocks with different lengths and widths. In the SPRAYTRAN interface, the user can use the initial AGDISP setup to consider spray blocks with different spray application lengths. However, because the data transferred from AGDISP applies to a specific block width, the data should be applied only to blocks with equivalent widths.

AGDISP uses a local coordinate system defined relative to the orientation of the flight lines. AGDISP runs are made by making a best-fit of a rectangular box to the area irregardless of the N-S /E-W orientation of the area. Wind direction in AGDISP is defined in a relative fashion as either being parallel, perpendicular, or somewhere between the sides of the application area. Optimal consistency in source-term linkages within the current SPRAYTRAN system occurs with application swaths that are perpendicular to the wind (i.e., -90 degrees).

The AGDISP source definition parameters that are input into the SPRAYTRAN interface are based on N-S application swaths and an east wind irregardless of what application parameters are set in the AGDISP toolbox. The SPRAYTRAN emission module uses those inputs to define a source term for other spray block configurations in much the same manner as the AGDISP toolbox.

The SPRAYTRAN interface uses a universal transverse mercator (UTM) coordinate system. The application area, as a quadrilateral, is defined by the user selection of four points representing the spray block on a map. Although still limited to four points, the area does not have to be rectangular, and the area is defined in terms of its actual N-S/E-W orientation.

The deposition pattern imported for viewing in the SPRAYTRAN interface from the AGDISP toolbox must be configured to be equivalent to the application case evaluated in the main AGDISP screen. The deposition patterns generated by AGDISP and SPRAYTRAN can be compared by running special equivalent cases. The spray block "length" dimension needs to be equivalent to the corresponding cross-application path length used in STRAYTRAN. For an overlapping comparison, the area in SPRAYTRAN must have the same orientation as the AGDISP run. Otherwise, the deposition plots will be plotted as occurring in different directions. The AGDISP "application angle" should be set to zero to correspond with the AGDISP main-menu computations for the "flux plane distance" and "maximum computation distance." Then in SPRAYTRAN, Meteorology should be entered as a single observation with a wind speed and stability that match the AGDISP inputs. The wind direction should be defined such that winds will travel over the spray block in the same way as in the AGDISP runs.^(a) The selection of this wind direction will depend on the actual orientation of the spray block.^(b)

The local coordinate system in AGDISP and the UTM coordinate system in the SPRAYTRAN interface are combined by assuming in the SPRAYTRAN GIS that the lower left corner of the deposition pattern from AGDISP is the lower left corner of the spray block. This plotting procedure matches the assumptions for the source data imported from AGDISP and allows deposition pattern comparisons with plots on the same map. Note that it is necessary to select parameters in the AGDISP toolbox to emulate the assumption of N-S spray paths and east winds. Other cases run with the AGDISP toolbox will not display properly in the SPRAYTRAN GIS, and the plotting function of AGDISP should be used to view these cases.

3.4 Meteorological Parameters

In addition to the emission-rate parameters, equivalent meteorological parameters will need to be used in the AGDISP and SPRAYTRAN runs (Figure 3.4). Typical values are run in the AGDISP system and applied to a wider range of values in the SPRAYTRAN analyses. After importing AGDISP data, the user should always check to be sure appropriate values of meteorological parameters for a SPRAYTRAN run are being used.

-
- (a) Note that wind direction has different meanings in the components and cannot simply be imported: In AGDISP, "wind direction" means angle of air flow relative to the spray block axis, and in the SPRAYTRAN interface "wind direction" is the direction from which the air flow is coming.
 - (b) For an overlapping comparison, the area in the SPRAYTRAN interface must have the same orientation as the AGDISP run. Otherwise, the different definition wind directions in the AGDISP inputs can result in the deposition patterns occurring in different directions.

The SPRAYTRAN source parameters window is populated with values based on AGDISP input. These values appear after the Load AGDISP option is selected, and input files are identified. The “Effective height above ground” parameter is assigned a value of 1/2 the release (or boom) height. The “Initial vertical spread” is also assigned a value of 1/2 the release (or boom) height. These are provided as typical values which may be changed as needed.

The “Air temperature” is assigned the air temperature value from AGDISP. Two other parameters in the SPRAYTRAN source parameter window, are assigned nominal values. The “Effective rise velocity” should be given a nominally small value of 1. The “Effective radius” is a dispersion model setup parameter that will normally have a value of 1.

The AGDISP data files are for a single set of wind conditions. That is, the wind speed and direction at the release area are constant over the application time period. Values for these parameters are selected in AGDISP as typical application conditions. The SPRAYTRAN interface allows the user to make single observation runs to check that AGDISP and the CALPUFF models have equivalent near-source results.

Specify Meteorological Data	
Wind Speed	22 m/s
Wind Direction	32
Mixing Height	500 m
Ambient Temperature	25 C
Relative Humidity	50 %
Ambient Pressure	1000 mb
Atmospheric Stability	G - Strongly Stable
Wind Speed >= 0.0	
Defaults OK Cancel	

Figure 3.4 Example Single Observation Meteorological Data Input Window

An application using the linkage of AGDISP to SPRAYTRAN needs to consider the potential importance of other meteorological parameters, including their potential temporal variations, in the definition of the source term by AGDISP. For example, the droplet-size distribution at the “flux-plane” will vary with relative humidity—with major differences at very high relative humidities. Also, changes in wind speeds during the period of application can significantly change the source definition for SPRAYTRAN. The extent of importance of variations in such parameters during the application should be defined by sensitivity studies and accounted for in the definition of the SPRAYTRAN source term.

Advanced Users: Although the AGDISP-SPRAYTRAN linkage described herein will define the downwind patterns for many applications, advanced users may want to make stand-alone SPRAYTRAN

runs to treat special situations, conduct sensitivity studies, etc. For example, the advanced user may want to study the effect of using additional droplet-size categories in the computation.

4.0 SPRAYTRAN Operation (UG/example)

SPRAYTRAN combines detailed source-term and air-dispersion models. The source-term parameters for spray-block applications are defined using the AGDISP model. These source-term parameters are used in a spray-application version of the DUSTAN GIS-based air modeling system named SPRAYTRAN. This section provides step-by-step guidance for conducting an analysis in this SPRAYTRAN system. An example run of the SPRAYTRAN system, based on spray application to a single spray block, is used in this guidance. This example also provides a test case for the user to verify that the software and linkages are working correctly.

4.1 AGDISP Interface—Single Application Block Case Example

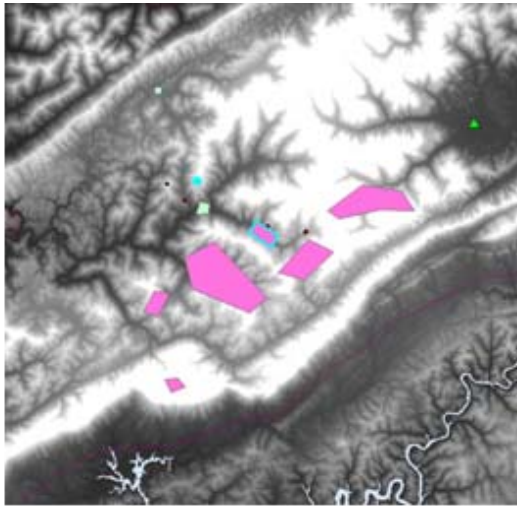
To illustrate the operation of the STRAYTRAN modeling system, an example case is presented that is based on an application to an actual forest spray block located in north-east Tennessee. Figure 4.1 displays this example case, and Table 4.1 defines the major parameters relative to conducting the SPRAYTRAN analysis.

The case example detailed in Figure 4.1 assumes the application path will be along the longer dimension of the block (1540 m) and that the application is assumed to be performed when the wind direction is at right angles to that application direction. The number of required swaths to cover the 800-m length is computed as 44 (length of area divided by the effective width of swaths), assuming no overlap of swaths.

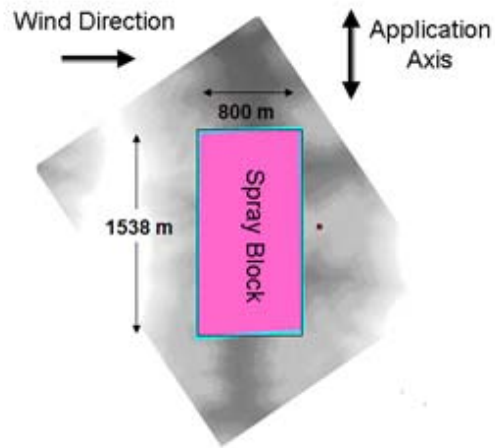
Application Notes: The size of the example case area is small enough that it can be modeled as one AGDISP assessment. Other, larger application areas, also shown in Figure 4.1, will need to be considered as several spray blocks.

The details of spray direction, wind direction, etc. are not expected to greatly affect the magnitude of the net residual airborne active chemical agent emission rate used in the SPRAYTRAN interface. There are many possible combinations involving rotation of the area, approximation of the block shape with a rectangle, and the use of relatively arbitrary application setup directions as well as ambient conditions that will produce equivalent spray applications. Users can confirm this for their specific applications by testing several configurations. Section 3.0 contains additional information relative to specific parameters.

This setup of an AGDISP analysis is an expedient simplification to define an illustrative example case. This example application does not account for actual local features of the selected site that could be included in an AGDISP analysis. For example, the flat terrain assumption does not account for the actual area's location in relatively complex terrain centered in a valley.



SPRAYTRAN Modeling System
Example Case. Spray block areas are shown on a regional map as pink areas with the example case outlined in blue.



Example Case Spray Block Area. Area is shown rotated with dimensions, wind direction, and axis direction labeled.

Figure 4.1 Details of Example Case

A forested area is to be sprayed. The spray block is 123 hectares ($1.23 \times 10^6 \text{ m}^2$ or 304 acres). The map (above left) shows the example case spray block along with and relative to a number of other spray blocks. The example spray block is rotated (above right) to a vertical orientation and fit to a rectangular shape with sides of about 800 and 1540 m (2630 and 5040 ft).

Table 4.1. Tabular Summary of SPRAYTRAN Modeling System Example Case Parameters

Parameter	Value	Units	Information Source
Application area	123	hectares	User defined.
Rectangular area length	800	m	Values are based on a “best fit” of the actual area shape to a rectangular area.
Rectangular area width	1540	m	Values are based on a “best fit” of the actual area shape to a rectangular area.
Effective swath width	18.29	m	Characterization of the spray technology and application details defines the effective width of swath.
AGDISP Application Axis Direction	0	degrees	User selected. Example case assumes the application is along (i.e. parallel to) the 1540-m spray block length.
AGDISP Wind Direction	-90	degrees	Defined relative to application direction.
Number of swaths	44	(none)	Number of swaths required to cover length of example area.

4.2 AGDISP Interface

To link to the SPRAYTRAN interface, there are key AGDISP parameters related to the specific site characteristics, as well as computation options that must be defined properly. Those key parameters are identified in the steps defined in the following.

The following guidance assumes that users begin with an understanding of how to use AGDISP to conduct an analysis of their spray application. Other AGDISP parameters, not explicitly discussed here, defining the application method, materials, and field operations, must also be set properly. For the example case, these parameters are assumed to be already defined by the AGDISP setup efforts that preceded the steps shown in the following. Users are referred to the AGDISP documentation of these parameters and guidance on conducting AGDISP runs.

Step 1. Start AGDISP main screen and load application case.

- a) For the example case, or to start a new analysis, Start the AGDISP software and select “ok” on the AGDISP title screen.

The example case is based on modification of the set of parameters distributed with AGDISP. The AGDISP main screens should now be displayed and populated with the inputs as shown in Figure 4.2, and the second part of Step 1 will not be needed.

If the entries have different values, they could be correct, but are in English units. Step 2 shows how to change the display between English and metric units. Note that Step 2 should not be skipped, even if the display is showing metric units—to ensure that all unit conversion changes have been set.

- b) For a previously defined and saved case,

Old case: AGDISP Screen/File menu/Open...: Find, select, and load the desired application case (file with an “ag” extension) of interest.

For the example case, the file “AdispDr.ag” can be loaded.

Step 2. Set default units to metric.

AGDISP Screen/File menu/Preferences:

In the “Preferences” screen (Figure 4.3),

- “System”—select the Metric units.
- “Deposition”—mass units set to g.
- “Deposition”—area set to m².

This unit selection action is essential before any data are exported from AGDISP. That is, the AGDISP case can be set up in either English or Metric units as long as the option for metric units is set before data are exported. However, to minimize the chance of incorrect units in the output files, it is recommended that AGDISP be set-up and run in metric units.

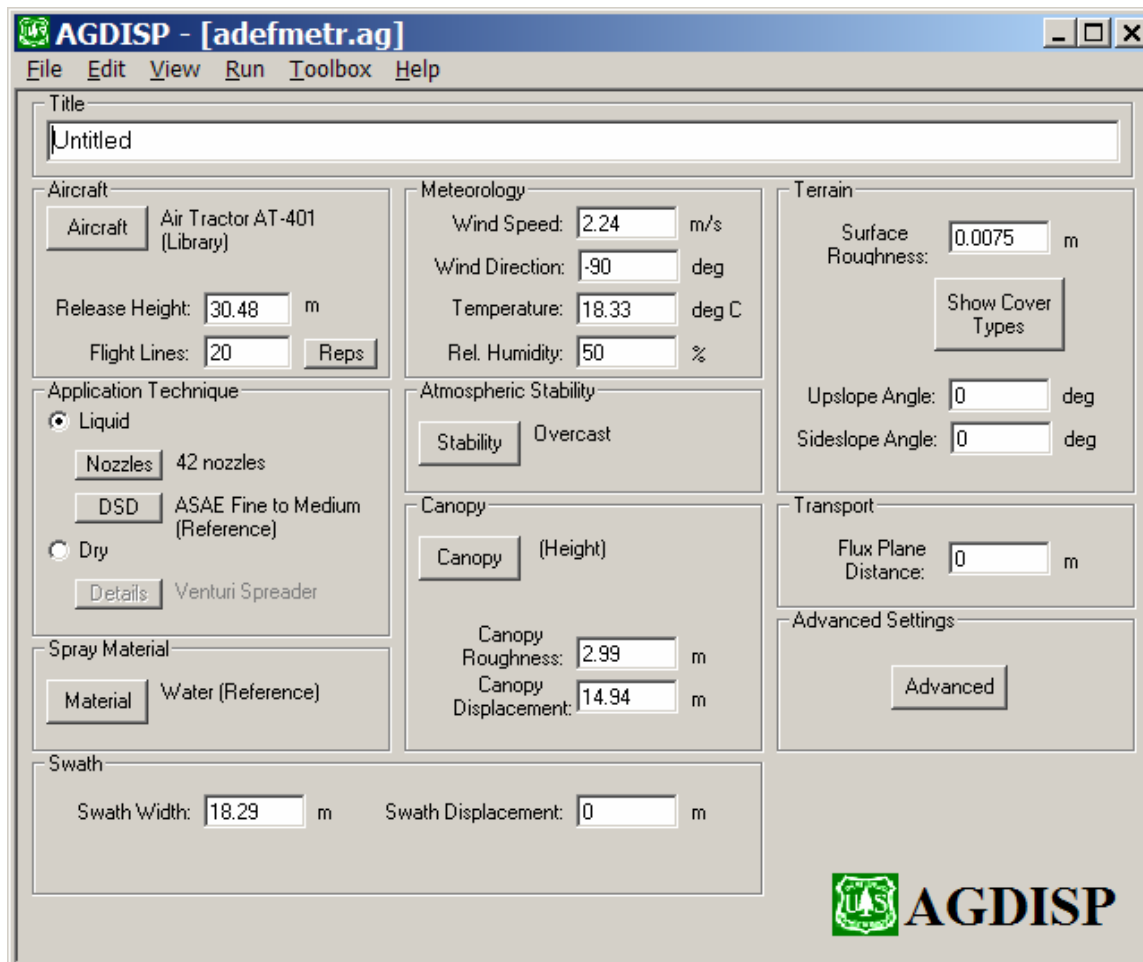


Figure 4.2 Initial Main AGDISP Screen with Distribution Parameters (metric units)

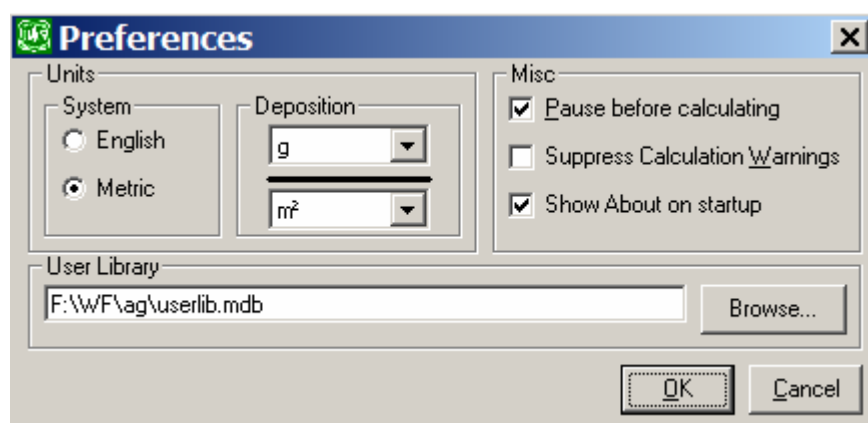


Figure 4.3 AGDISP Preferences Screen Set to Metric Units

Step 3. Enter values of parameters for example case.

Starting with the main AGDISP screen (Figure 4.2), the default parameters distributed with AGDISP will be displayed. The next step is to modify the parameters to represent the characteristics of the selected example case.

Title: Enter descriptive title for the analysis case.

For the example case, enter "SPRAYTRAN Example Case."

Flight lines: Enter the number of swaths required to cover the area.

For our example case, enter the value, 44. computed previously in the description of the spray block area (see Table 4.3).

Wind speed: Enter a wind speed that will be typical during the application.

For the example case, the value of 2.24 m/s is used.

Wind direction: Enter the angle of application relative to the ambient winds.

This parameter is set to -90 deg in the example case.

Application Note: the value of this parameter is not expected to greatly change the net "residual" active chemical agent airborne emission rate defined for use in the SPRAYTRAN interface.

Temperature: Enter an air temperature that will be typical during the application.

A value of 18.33 deg C is used in the example case.

Application Note: Although this parameter will not be directly important in the SPRAYTRAN dispersion computations, the value of this parameter can have an influence on other data imported from AGDISP in terms of evaporation rate computations.

Relative Humidity: Enter typical relative humidity for the application period.

A value of 50% is used in the example case.

Application Note: Although this parameter will not be directly important in the SPRAYTRAN dispersion computations, the value will have an influence of the droplet-size distributions output from AGDISP in terms of evaporation rate computations.

Atmospheric Stability: select either day or night conditions along with expected surface heating/cooling situations.

"Nighttime" with "overcast" conditions is selected for the example case.

Application note: Stability is used in air modeling to represent the ambient atmospheric turbulence intensities. AGDISP and the SPRAYTRAN air dispersion modules use equivalent definitions of stability. AGDISP defines stability in terms the time of day and meteorological conditions. The air dispersion modules in SPRAYTRAN define stability in terms of stability categories where A-C are unstable

(rapid mixing), D neutral, and E-F stable (slow mixing). The AGDISP stability designation combined with the wind speed is mapped to the conditions for the lettered stability categories in the table below. For the example case, the nocturnal overcast designation indicates D category conditions for all ambient wind conditions.

Table 4.2. Relationship Between Turbulence and Weather Conditions^(a)

AGDISP Weather Conditions Selection		SPRAYTRAN Inputs				
		Pasquill-Gifford Stability Category				
		Ambient Wind Speed (m/s)				
		<2	2	4	6	>6
Day (1 hour after sunrise to sunset)	Isolation (sunshine)	A	A/B	B	C	C
	Strong	B	B	B/C	C/D	D
	Moderate	C	C	C	D	D
	Slight	D	D	D	D	D
	Weak	D	D	D	D	D
Night (sunset to one hour after sunrise)	Cloud cover	D	D	D	D	D
	Overcast	D	D	D	D	D
	Thinly overcast	E	D	D	D	D
	Less than 3/8 overcast	F	E	D	D	D
Stability Categories:						
A: Extremely unstable conditions		D: Neutral conditions				
B: Moderately unstable conditions		E: Slightly stable conditions				
C: Slightly unstable conditions		F: Moderately stable conditions				

(a) based on tables in [Randerson, 1984]

Transport: Enter the “Flux Plane Distance.”

A value of 200 m should be entered for the example case.

Application Note: 200 m is the recommended value for this parameter for generating input files for the SPRAYTRAN interface. The drift droplet size distribution is defined at this distance.

The main AGDISP screen now contains the parameters needed for the example case (Figure 4.4).

Advanced Settings/Advanced button

Maximum Downwind Distance: A value of 200 m should be entered for the example case as shown in Figure 4.5.

Application Note: The 200-m distance is the recommended value for this parameter for generating input files for the SPRAYTRAN interface. The fraction of “residual” active chemical remaining aloft as drift is defined at this distance.

Step 4. Perform AGDISP calculations.

From the main screen, select the “Run” pull down menu and the “Run Calculations” option. Informational messages about ranges of parameters may appear. If such windows appear, select “Yes” to continue with the calculations. The linkage calculations may be conducted at

distances outside the normal range of AGDISP usage. When a computation window appears, select “Start”. Then use the “Close” button to return to the main AGDISP screen.

Application Note: The AGDISP interface provides a number of tables and plots related to various aspects of the spray application. In the following steps, several of these outputs are saved in files that can be read by the SPRAYTRAN interface.

The screenshot shows the AGDISP - [ExCase.ag] window with the following parameters:

- Title:** SPRAYTRAN Example Case
- Aircraft:**
 - Aircraft: Air Tractor AT-401 (Library)
 - Release Height: 30.48 m
 - Flight Lines: 44 Reps
- Application Technique:**
 - ☒ Liquid
 - Nozzles: 42 nozzles
 - DSD: ASAE Fine to Medium (Reference)
 - ☐ Dry
 - Details: Venturi Spreader
- Spray Material:**
 - Material: Water (Reference)
- Meteorology:**
 - Wind Speed: 2.24 m/s
 - Wind Direction: -90 deg
 - Temperature: 18.33 deg C
 - Rel. Humidity: 50 %
- Atmospheric Stability:**
 - Stability: Overcast
- Canopy:**
 - Canopy (Height):
 - Canopy Roughness: 2.99 m
 - Canopy Displacement: 14.94 m
- Terrain:**
 - Surface Roughness: 0.0075 m
 - Show Cover Types
 - Upslope Angle: 0 deg
 - Sideslope Angle: 0 deg
- Transport:**
 - Flux Plane Distance: 200 m
- Advanced Settings:**
 - Advanced
- Swath:**
 - Swath Width: 18.29 m
 - Swath Displacement: 0 m

The AGDISP logo is visible in the bottom right corner of the window.

Figure 4.4 Main AGDISP Screen with Example Case Parameters (metric units)

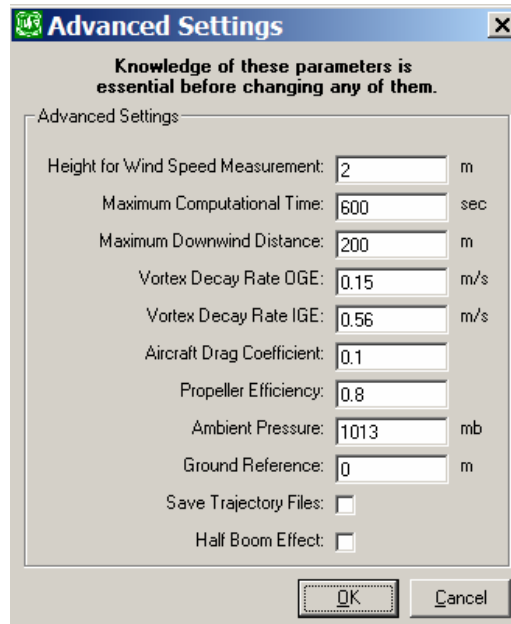


Figure 4.5 AGDISP Advanced Setting Screen with Example Case Parameters

Step 5. Save AGDISP application case data and results.

- a) **AGDISP Save File:** In the main AGDISP window, select the File pull down menu. Use “Save” or “Save as” to save the options selected and parameters entered in the current application case. For the example case, enter “ExCase” as the file name (Figure 4.6). This file allows the user to reload current application data that have been entered into AGDISP at a later time.
- b) **Save Files for SPRAYTRAN Source Term Module:** For the interface with SPRAYTRAN, two AGDISP data files need to be saved. These files should be saved in a directory where they can be easily found and loaded later in the SPRAYTRAN interface. When making many runs, it is recommended that a special sub-directory be made for the files saved from AGDISP.

Summary File: From the main screen, select the “View” pull down menu and then “Input Summary” option. The “Input Summary” screen is shown in Figure 4.7.

Select the “Save” button at the bottom of the screen. A “Save As” window will open (Figure 4.8). An appropriate file name and directory should be selected for the summary file. For our example case, enter “ExCaseSummaryFile” and select “Save.” Then select the “Ok” button to return to the main AGDISP menu.

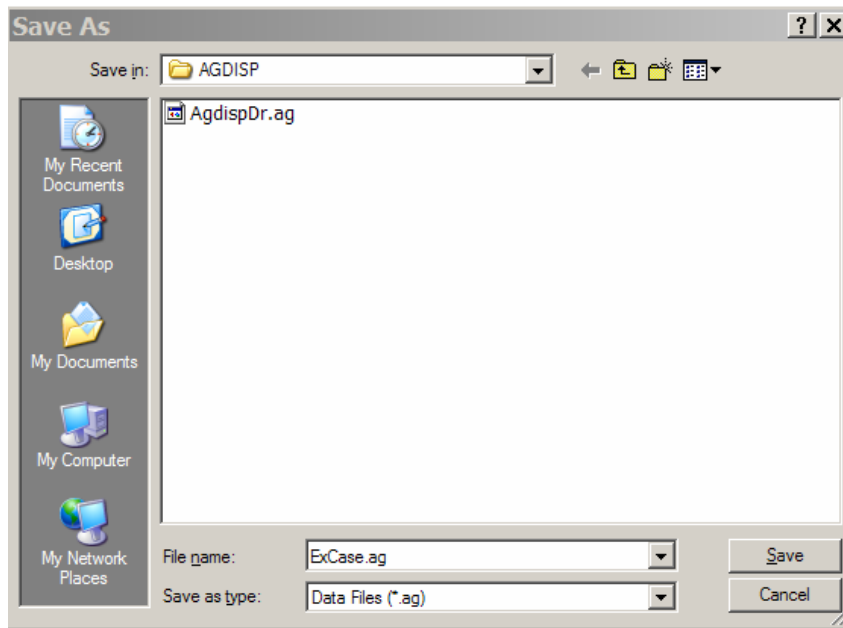


Figure 4.6 AGDISP Case Save Operation

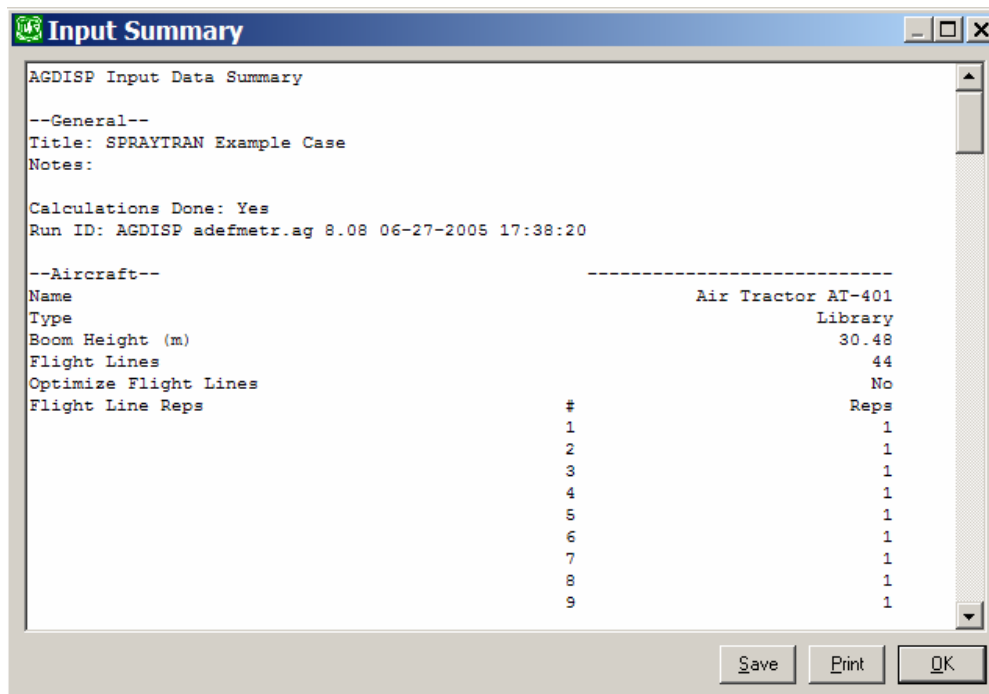


Figure 4.7 Input Summary Screen

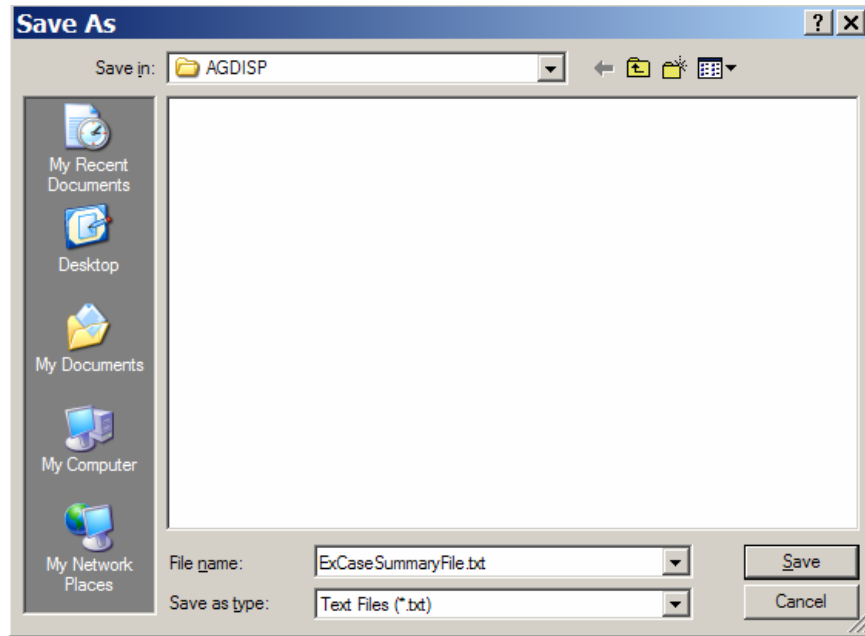


Figure 4.8 Summary File Save Screen

Profile File: From the main screen, select the “View” pull down menu again and then the “Numerical Values” option. The “Numerical Values” screen shown in Figure 4.9 should appear. Select “Vertical Profile” from the pull-down menu. This window (Figure 4.9) will then display the profile results for the “Flux Plane Distance.”

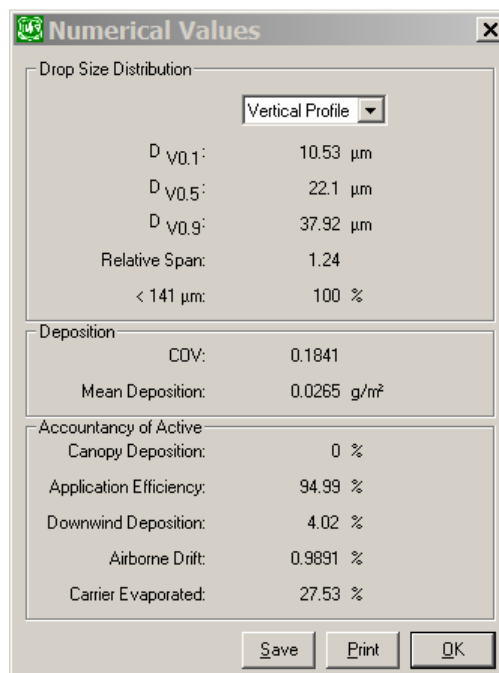


Figure 4.9 Numerical Values Screen

Select the “Save” button at the bottom of the screen. A “Save As” window will open (Figure 4.10). An appropriate file name and directory should be selected for the profile data file. For the example case, enter “ExCaseProfileFile” and select “Save.” Then select “Ok” to return to the main AGDISP window.

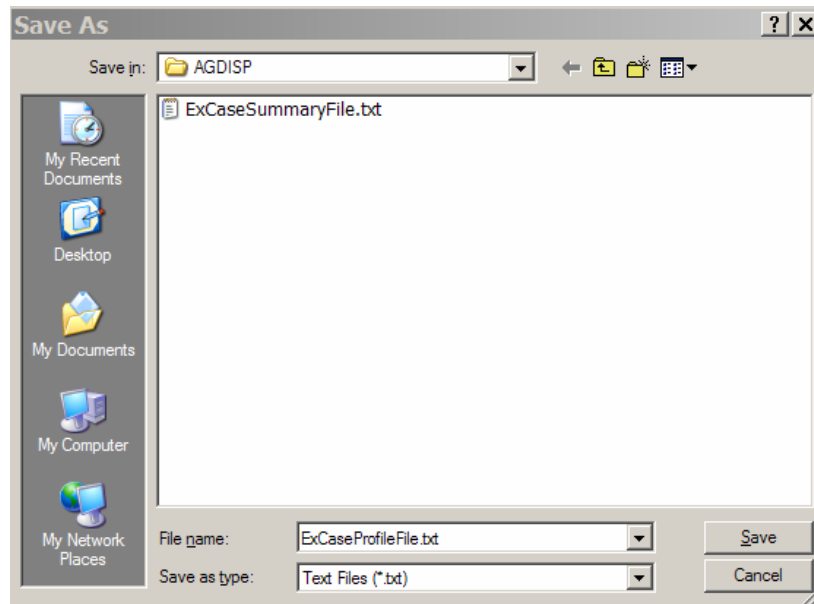


Figure 4.10 Numerical Values Save Screen

Step 6. Define and export equivalent deposition case in the AGDISP toolbox.

In this step, a deposition plot for a specific spray block area is prepared in the AGDISP toolbox by entering equivalent values to those used in the main AGDISP screen. This step must be completed for each case that the AGDISP and CALPUFF deposition patterns are going to be compared.

The loading of these deposition data into the SPRAYTRAN interface is to enable combination of the AGDISP and CALPUFF deposition results. Currently, only a limited graphic representation of the AGDISP deposition plots is implemented in the SPRAYTRAN GIS, and the user is directed to the AGDISP plots for definition of the AGDISP deposition patterns.

Application Note: Although the deposition data are not used in the definition of the source term, the SPRAYTRAN interface requires that a deposition file exist when data are imported. A base case deposition file (i.e., file from the initial case) can be used for all runs—with the understanding that the imported AGDISP plot applies only to the base case. This practice is particularly useful when analyzing an application involving multiple spray blocks using the same application method and approach.

From the main screen, select the “Toolbox” pull down menu and then select the “Spray Block Details” as shown in Figure 4.11.

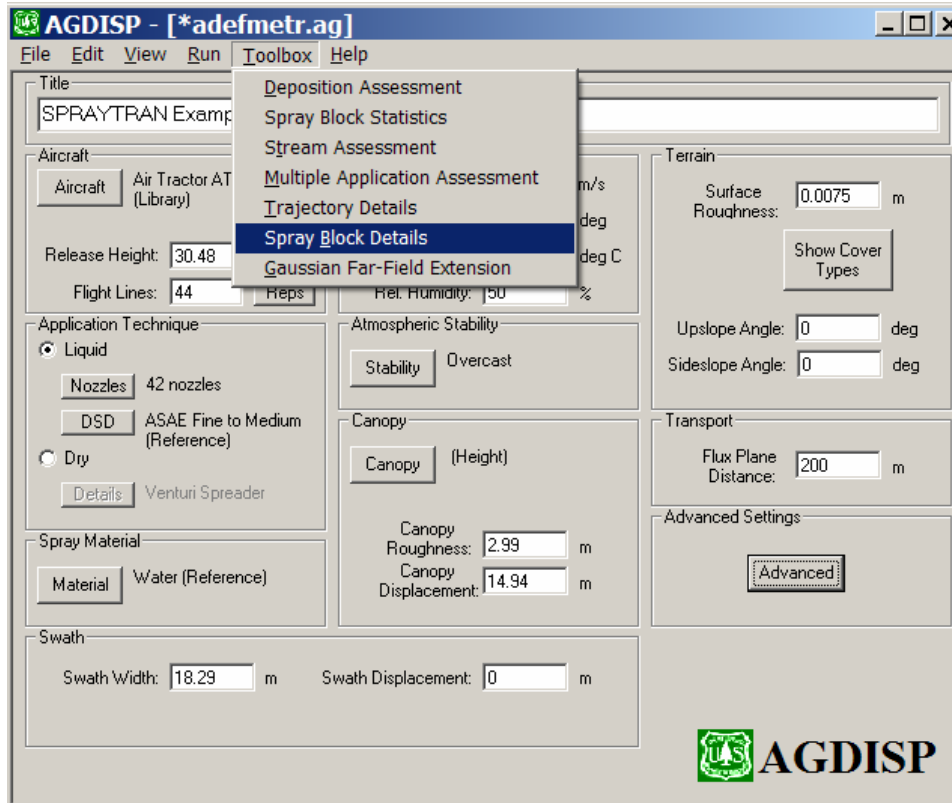


Figure 4.11 Selecting Spray Block Details

The “Spray Block Details” window will appear (Figure 4.12). This screen provides the capability of applying the application base case defined in the main AGDISP window to other application configurations.

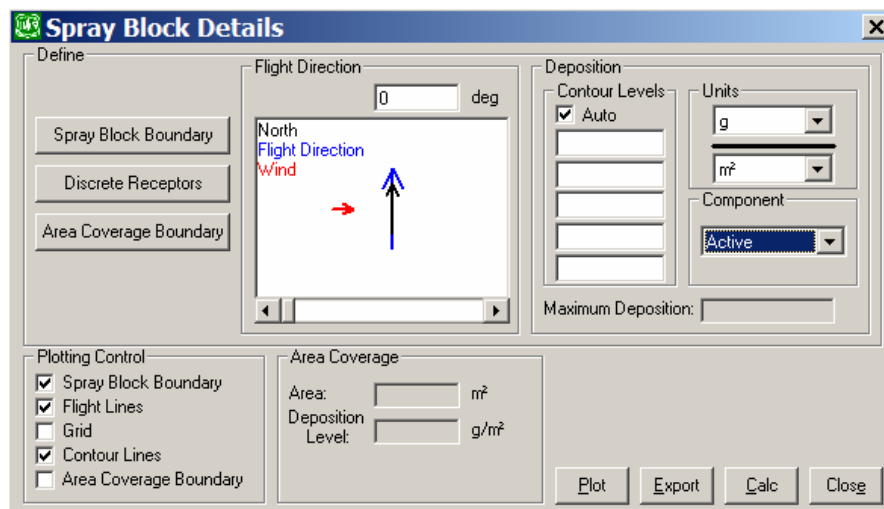


Figure 4.12 Spray Block Details Option

For all applications linking to the SYRAYTRAN interface, the following parameters will need to be set in the main “Spray Block Details” window:

Units: Select “g” and “m².”

Component: Select “Active.”

Flight Direction: Set to “0” deg.

Select the “Spray Block Boundary” Button, and the “Spray Block Boundary” window will appear (Figure 4.13).

The coordinates of the corners of a rectangular representation of the area are entered as a series of (x, y) values. For linkage to the SPRAYTRAN interface, a local coordinate system is used with the spray block lower left corner at the origin (0,0). For the example case, enter the x length value of 800 m and the y length value of 1540 m as shown to define the other corners of the rectangular area. Then select the “Ok” button to return to the “Spray Block Details” window.

In the “Spray Block Details” window (shown previously), the “Calc” button will start a re-computation for the area configuration that has been selected.

Then, the “Plot” button will display the computation results graphically as shown in Figure 4.14.

	Corner X (m)	Corner Y (m)
1	0	0
2	800	0
3	800	1540
4	0	1540
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		

Buttons: Insert, Delete, Clear, Import, Export, OK, Cancel

Figure 4.13 Spray Block Boundary

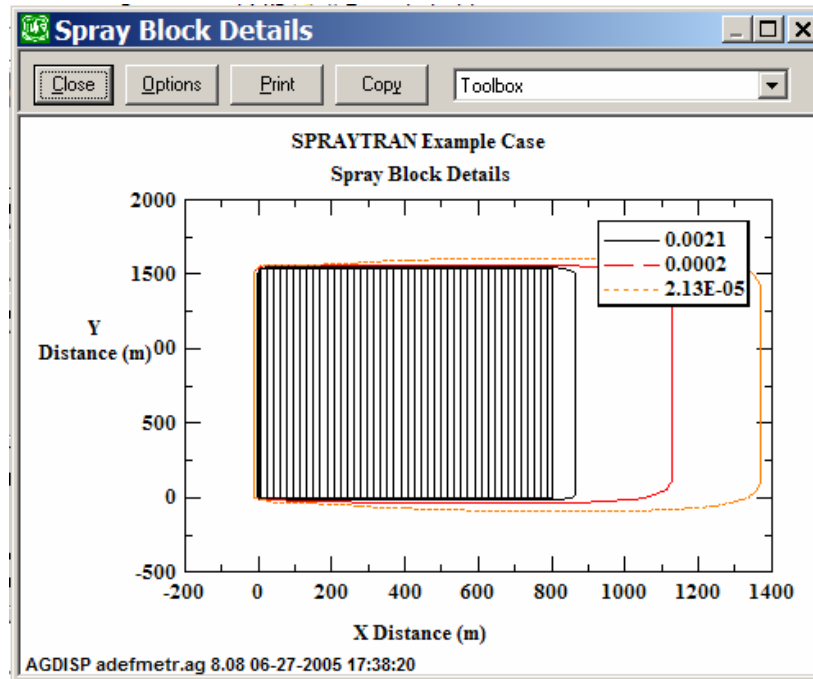


Figure 4.14 Spray Block Boundary

Select the “Close” button to return to the “Spray Block Details” window.

Save AGDISP Deposition File: From the main “Spray Block Details” screen, select the “Export” button. A “Save As” window will open (Figure 4.15). An appropriate file name and directory should be selected for the deposition file. This file should be saved in the same directory as used to save the two AGDISP files above.

For the example case, enter “ExCaseDeposition” and select “Save.”

Then select the “Close” button on the “**Spray Block Details**” screen to return to the main AGDISP menu. This completes the steps required for entering and exporting data to be used in the SPRAYTRAN interface.

The options selected and data entered in the “Spray Block Details” screens are not stored by AGDISP—so the run options and input data must be reentered each time this set of screens is accessed.

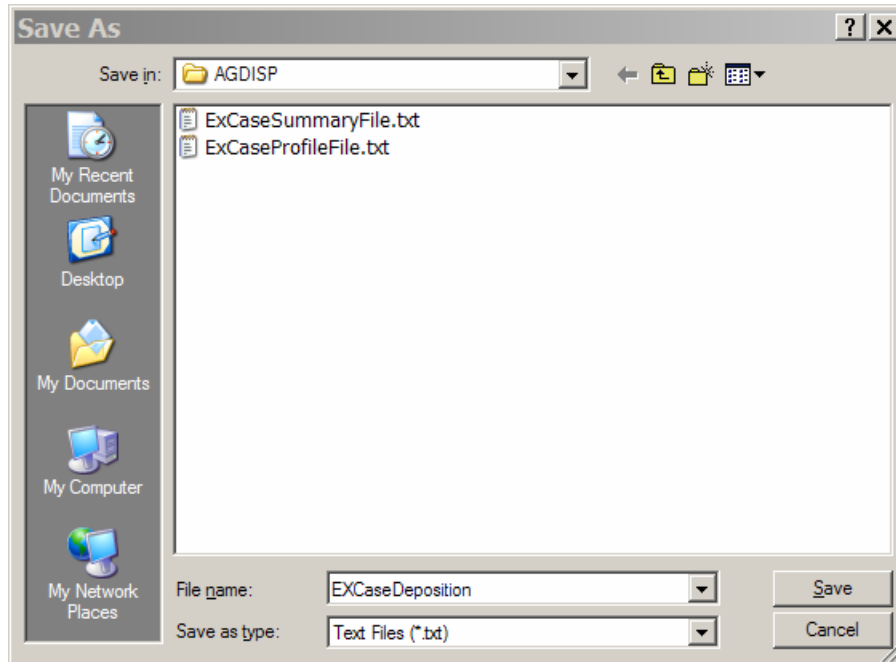


Figure 4.15 Deposition File Save Screen

4.3 AGDISP Interface—Multiple Application Cases

The preceding section provides step-by-step guidance for conducting a single spray-block analysis. Multiple application cases can also be considered by the SPRAYTRAN system.

Multiple application cases are needed for studies of the cumulative effect of drift from many application areas. Also, even for studies of a local area, the variations in the local terrain, surface cover, meteorology, application area size, etc. will require the consideration of applications to multiple spray blocks.

For a study with multiple application cases, each case should be run as a single spray block analysis with results stored to files using the steps given previously herein. Then, a series of such cases can be imported into the SPRAYTRAN interface as separate sources, each applicable to their specific spray block area.

4.4 SPRAYTRAN Interface—Single Application Case Example

The SPRAYTRAN spray-application interface is a version of the DUSTAN modeling system embedded in ArcMap. The SPRAYTRAN interface is configured to consider the transport of drift from forestry and agricultural spraying operations using the EPA guideline model, CALPUFF. The SPRAYTRAN interface includes the option of defining an area source with spray block application data from AGDISP.

Guidance is provided here for spray-application features specific to the SPRAYTRAN interface. Step-by-step instructions are provided for the example case. This guidance for the SPRAYTRAN interface supplements the general application guidance for operating the DUSTRAN modeling system provided in Section 4.0 of the DUSTRAN report (Allwine, 2005). This section assumes that the DUSTRAN-based SPRAYTRAN interface has been installed per instructions in the DUSTRAN user's guide.

The SPRAYTRAN modeling system requires an estimate of the total amount of “residual” active chemical drift—and does not explicitly use, or consider, the direction of flight path or other similar details of application coverage such as are required in AGDISP. It is assumed in SPRAYTRAN that applications actively cover the spray blocks.

Once an AGDISP analysis is complete using the steps described previously, the data from the AGDISP interface are ready to be imported into the SPRAYTRAN interface. As noted earlier, three files are saved in the AGDISP interface for use in the SPRAYTRAN interface. These three files contain 1) Inputs Summary Data, 2) Calculated Profile Data, and 3) AGDISP Deposition Results, respectively.

Steps 1–3 following do not require direct input from AGDISP. The user has the option of performing these steps before the AGDISP analysis—as a means of better defining the specific AGDISP analyses that are needed.

Step 1. Start site analysis.

To start an analysis in the SPRAYTRAN interface, find and start the ArcMap program. When this program is started, an ArcMap window will be displayed with a “SPRAYTRAN” button as shown in Figure 4.16. This action starts a version of the DUSTRAN software that has a module for defining the source term from forest and agricultural spraying applications. This version is referred as the SPRAYTRAN interface.

- a) Select the box labeled “SPRAYTRAN.” A SPRAYTRAN site selection box will open on the right of the ArcMap window.
- b) Left click “Select Site” button. A configuration window will open (Figure 4.17).
- c) Select the site to be modeled from the pull-down menu.

For our example case, select “Tenn.” Values for site parameters, options, and databases are loaded with the data for the example case.

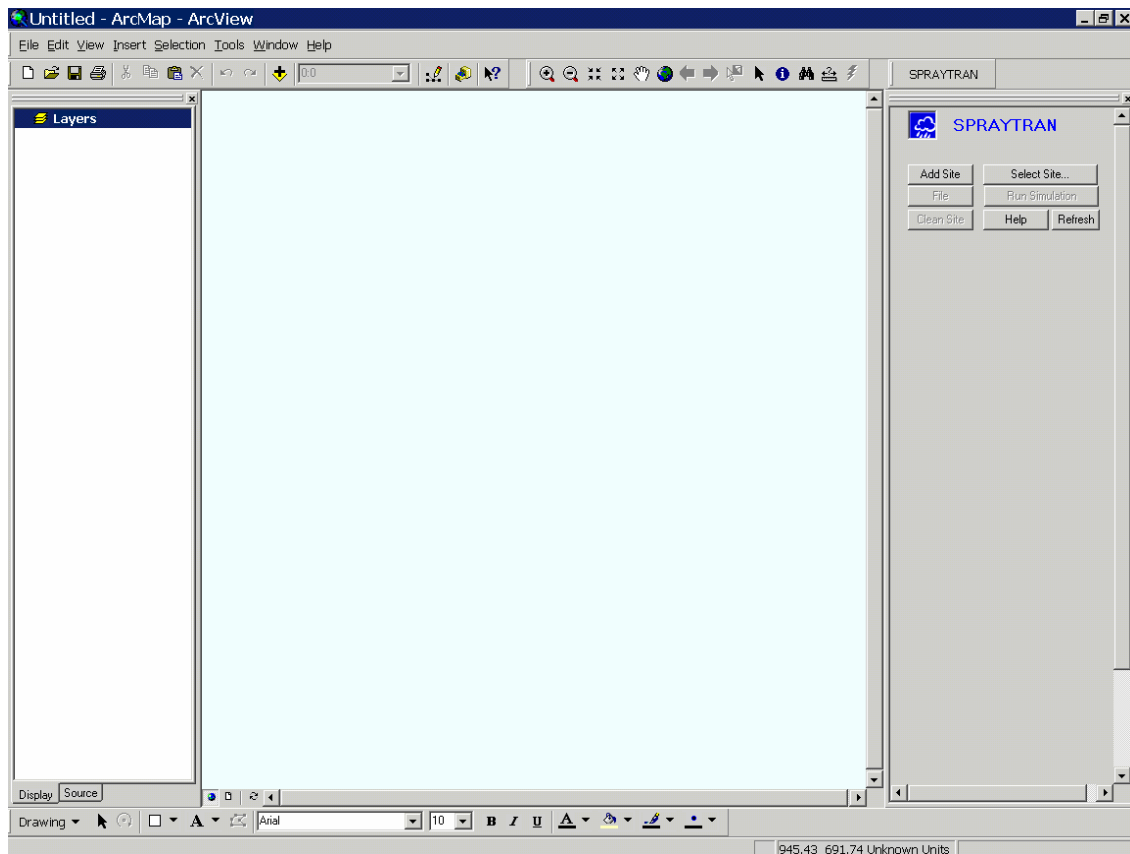


Figure 4.16 Main SPRAYTRAN Interface Screen at Startup

Most of the entries in the SPRAYTRAN Example Case shown in Figure 4.18 are preloaded.

On Figure 4.18:

Button Options: Site buttons are included for adding a site, selecting a site and cleaning data at a site. Run Simulation—runs current modeling analysis. Help—provides operating instructions, file instructions, and model version information. File—loads stored results. Refresh—cleans results plots from screen.

Domain: The values within the “Domain, Release Period, and Simulation Scenario” boxes should be listed as shown in Figure 4.18.

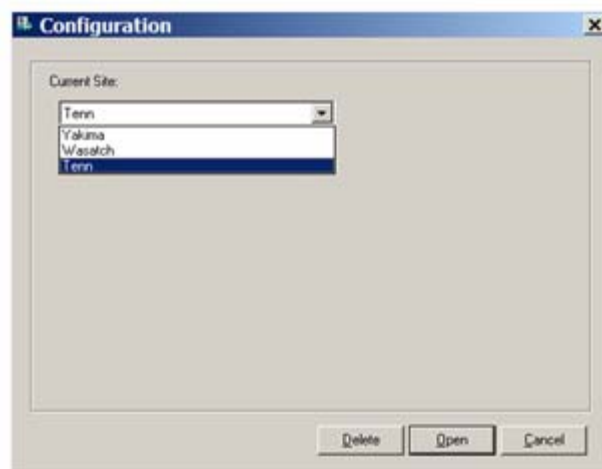


Figure 4.17 Select Site Window

The Domain/Name should be set to “AGDISP” and the Domain/Size set to 100 km.

Release Period: Start time and release period for spray application.

Simulation Scenario: Start date, start time, and simulation duration.

Tabs: At the bottom of the SPRAYTRAN interface panel are two lines of tabs for selecting run options. The meteorology tab is used to define the meteorological data that will be available for the analysis. For our example case, “Single Observation” is selected. The  button opens the screen for entering a single observation:

For our example case, meteorological data are pre-loaded in the Single Observation screen. These data are shown in Figure 4.19 and are equivalent to the data used in the example AGDISP run.⁽⁶⁾

Step 2. Spray block area.

A new spray block area can be entered (Step 2a), or a stored spray block area can be loaded (Step 2b). For our example case, the user can use either option to define the area. Step 2a will help the user understand how the size and location of spray blocks are defined. Step 2b will allow the user to repeat our exact example computation.

Step 2a. Define new spray block area.

To define a new source area, select the Draw Area Source button located on the Sources tab (Figure 4.20).

The source area is defined by a graphical process in the SPRAYTRAN user interface.

The process of defining new spray block areas assumes the user has a digitized map (or shape file) that is loaded and plotted as a base map in the ArcMap analysis screen. A source area is defined as a quadragon (i.e., four sided figure) by interactively tracing the sides of a spray

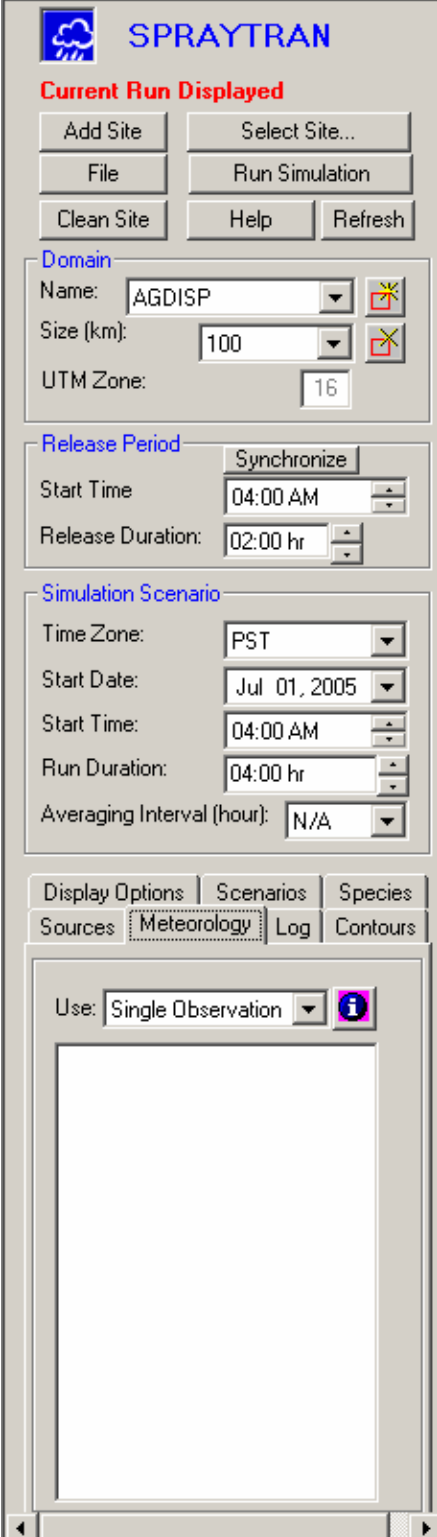
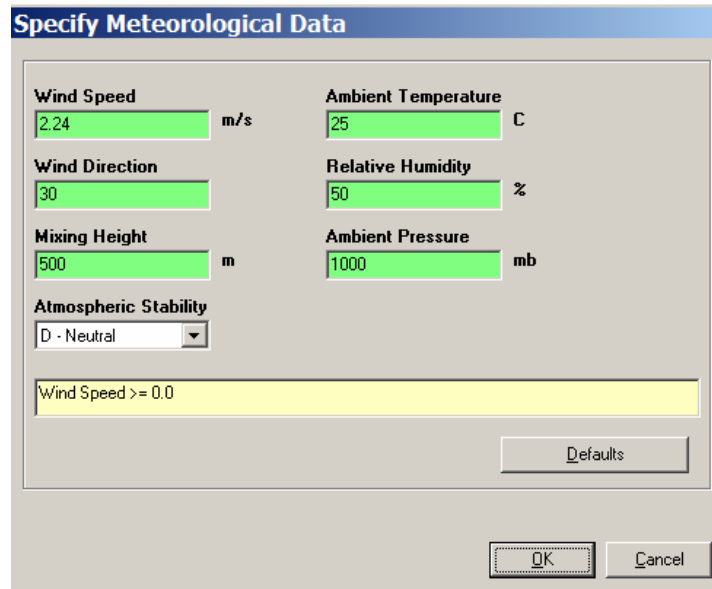


Figure 4.18 SPRAYTRAN Example Case

(6) Wind direction has different meanings in AGDISP and SPRAYTRAN, and thus the values are not expected to be the same.

block. If the shape has more than four sides, then the area should be approximated by a quadragon.

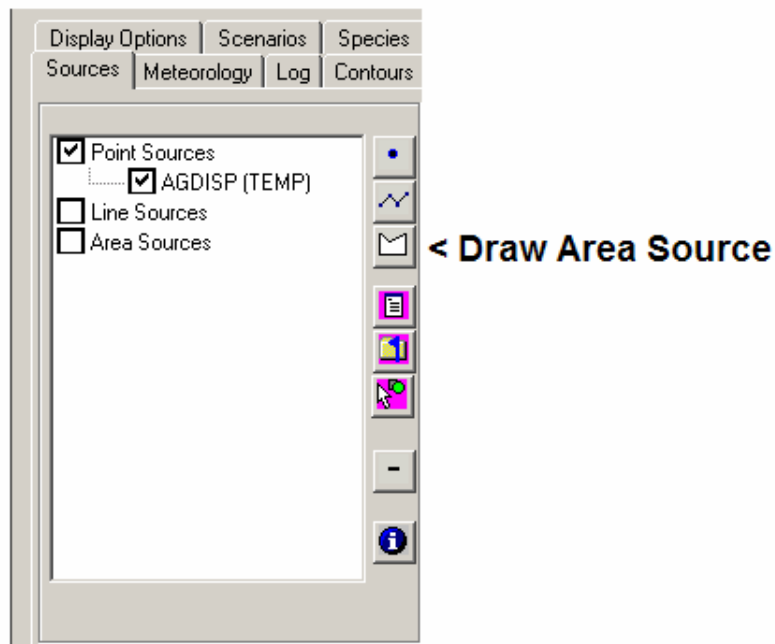


The 'Specify Meteorological Data' dialog box contains the following fields and controls:

Parameter	Value	Unit
Wind Speed	2.24	m/s
Wind Direction	30	
Mixing Height	500	m
Atmospheric Stability	D - Neutral (dropdown menu)	
Ambient Temperature	25	C
Relative Humidity	50	%
Ambient Pressure	1000	mb

Below the fields is a text area containing the text: 'Wind Speed >= 0.0'. At the bottom right are buttons for 'Defaults', 'OK', and 'Cancel'.

Figure 4.19 Example Case Meteorological Data



The 'Define Source Area' dialog box features a tabbed interface with 'Sources' selected. The 'Sources' tab contains a list of source types with checkboxes:

- ☒ Point Sources
 - ☒ AGDISP (TEMP)
- ☐ Line Sources
- ☐ Area Sources

To the right of the list is a vertical toolbar with icons for drawing and editing. A red arrow points to the 'Draw Area Source' icon (a square with a diagonal line) with the text '< Draw Area Source'.

Figure 4.20 Example Define Source Area

For our example case, the area outlined in blue should be used (Figure 4.21). This area is the same area as used in the analysis above using AGDISP. The area information can be saved using the “Save a Scenario” button, , under the Sources tab.

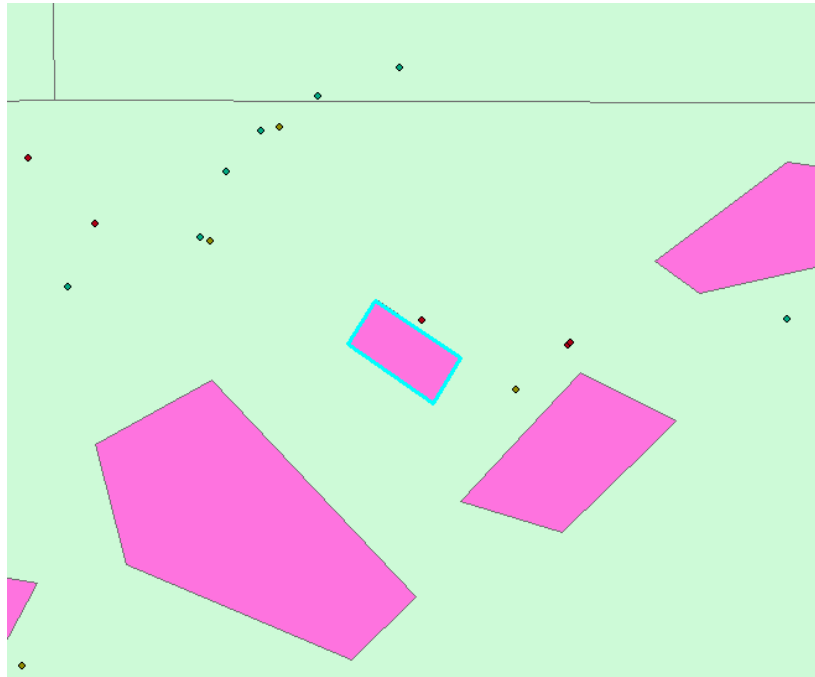


Figure 4.21 Example Case Spray Block Areas

Once the area source has been drawn and the name of the source entered (ForestUse for our example case), the Source Input Window should display the name of this new area source, and the application map should show the sides of the selected area.

Step 2b. Load scenario with stored spray block area(s).

Previously defined area source(s) can be loaded by selecting the “Scenarios” Tab. A list of “Available Sources” is listed. Select (highlight) the desired source scenario and use the “+” button to load that scenario. For the example case, select “TForest.”

The sources from the selected scenario will be added to the current analysis as listed under the “Sources” tab. The button to “Start a new scenario” may be used to clear the list of sources before adding new scenario.

Once the area source has been loaded, the “Sources” tab should now include an entry for the new area source. For the example case, the entry will be “ForestBlk.”

Step 3. Define sources.

Once Step 2 is completed, the sources tab will have an entry for an area source.

Figure 4.22 shows a typical display for the example case. Select and deselect the listed sources such that only “Area Sources” and “ForestBlk”⁽⁷⁾ have check marks.

Double click on the source name in the list found on the Sources tab of the main interface form. The name of the area source shown in this window is ForestBlk. The SPRAYTRAN window for defining the emission rate from this area source will then be displayed.

The Source Input Window, shown as Figure 4.23, shows the parameter values for the example case. The entries for emission rates are explained below, and may not be identical to the figure at this point.

Step 4. Define source emission parameters.

Source parameters from AGDISP, or an alternative source computation, can be used to define the source emission parameters. The example case uses the “Load AGDISP” option of importing source parameters directly from an AGDISP analysis.

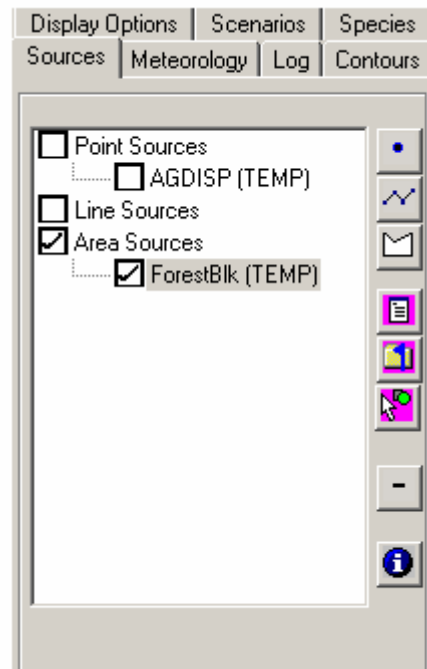


Figure 4.22 Sources Tab Window

In this step, input from AGDISP analyses can be imported. These AGDISP analyses need to use data equivalent to the data used in this section in Steps 1–3 in the SPRAYTRAN interface.

- a) Start the process of loading AGDISP data by clicking on the “Load AGDISP” button located on the Source Input Window (Figure 4.23).
- b) An information window will be displayed explaining the need to match the meteorological data used in the AGDISP simulation with the meteorological conditions entered for the SPRAYTRAN simulation. Click on the OK button to close the information window.

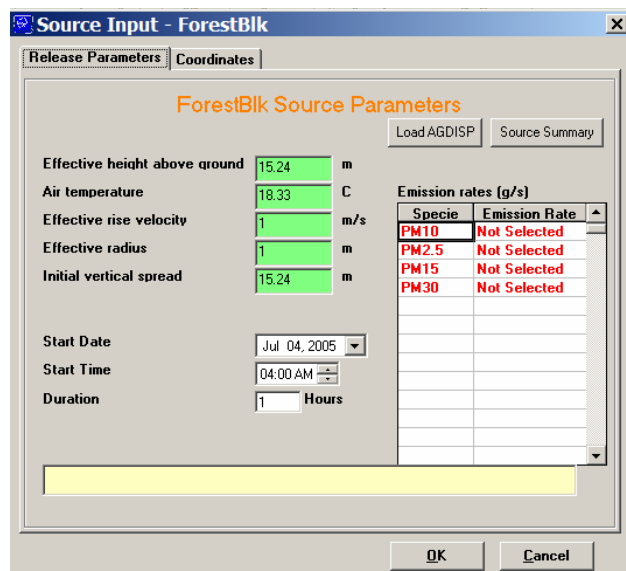


Figure 4.23 Source Input Window

(7) If the user defined the area graphically for the example case, the name of the file will be ForestUse, or some other name selected by the user.

The “residual” active chemical drift source term will be a function of ambient wind speed, moisture (temperature and humidity), and stability—and those conditions should be matched as closely as possible during the application time periods to be used in the STRAYTRAN analyses. Although the shape of the area and the application details are important in defining the local drift and deposition patterns in the immediate vicinity of the spray block, the source term for “residual” active chemical drift material that is used in SPRAYTRAN will be relatively insensitive to many of these application details. As a result, the source term for a selected application methodology (e.g., aircraft, nozzles, height) can be defined for a typical set of application conditions using AGDISP and then applied to a wider set of conditions in SPRAYTRAN.

The data in our example case are matched between AGDISP and STRAYTRAN as closely as possible so as to generate comparable results (Figure 4.24).

Source Input - ForestBlk

Release Parameters | Coordinates

ForestBlk Source Parameters

Load AGDISP | Source Summary

Effective height above ground: 15.24 m

Air temperature: 18.33 C

Effective rise velocity: 1 m/s

Effective radius: 1 m

Initial vertical spread: 1 m

Start Date: Jul 04, 2005

Start Time: 04:00 AM

Duration: 1 Hours

Specie	Emission Rate
PM10	Not Selected
PM2.5	Not Selected
PM15	Not Selected
PM30	Not Selected
AGDRIFT	0.10

SIGZ >= 1.0

OK | Cancel

Figure 4.24 Example Case Source Input with Calculated Emission Rate

- c) The user will just be prompted for the name of the AGDISP “input summary file” to use for the currently selected source. Click on the OK button to close the prompt, and an open file dialog window will be displayed. Navigate to the desired input summary file and then click on the Open button to load the file. The example file name is “ExCaseSummaryFile.txt.”
- d) The user will then be prompted for the name of the AGDISP vertical profile file. Click on the OK button to close the prompt, and an open file dialog window will be displayed. Navigate to the desired vertical profile file and then click on the Open button to load the file. The example file name is “ExCaseProfileFile.txt.”

- e) The user will then be prompted for the name of the AGDISP deposition results file. Click on the OK button to close the prompt, and an open file dialog window will be displayed. Navigate to the desired deposition results file and then click on the Open button to load the file. The example file name is “ExCaseDeposition.txt.” The data in the deposition profile file is not used in the SPRAYTRAN computation, but is imported to allow model results comparisons..
- f) Following the selection of the input files, a prompt will be displayed asking for the specie name that will be associated with the calculated emission rate. Enter the desired name into the text box of the prompt window and then click on the OK button to enter the new name and close the prompt window. For the example case, enter “AGDRIFT.” Once the new specie name has been entered, the name will appear in the species list of the area source input window along with the calculated emission rate. The new specie name will also be added to the Species List of the Species tab found on the main interface of the SPRAYTRAN modeling system.
- g) Click on the OK button of the Source Input Window to enter the changes and close the window.

Step 5. Review inputs.

Although the data entry process is complete, this step explains some special features for checking data inputs.

Species Properties: Select the Species Tab. A list of available species will appear. For the example case, the area source named AGDRIFT appears along with some unselected default species. Unused default species can be deleted by selecting/highlighting an entry and using the  button (Figure 4.25).

By double-clicking on the name, the properties of the species can be viewed and changed, as needed. For our example case, the mean droplet size imported from AGDISP can be reviewed using this option.

Source Characteristics: To review the source characteristics, reload the Source Input screen (Figure 4.24) by selecting the “Sources tab” and double-clicking on the “ForestBlk” entry. Press the “Source Summary” Button. A summary listing of SPRAYTRAN-interface parameter data will be displayed. These data include 1) size and coordinates of the area, 2) meteorological data, and 3) flight plan data.⁽⁸⁾

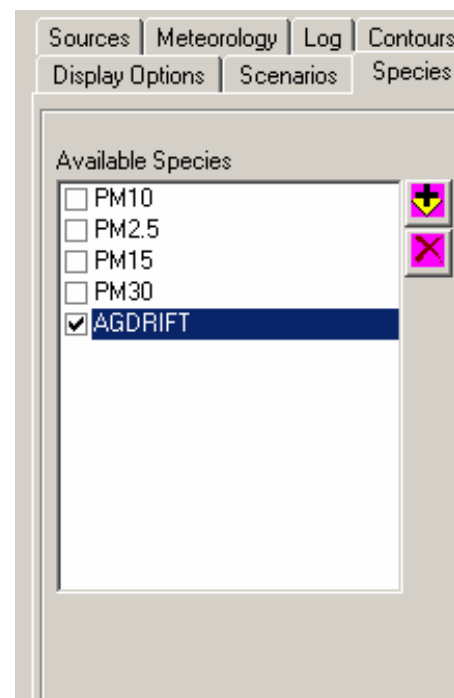


Figure 4.25 Species List

(8) This “Source Summary” listing can be quite useful in setting-up an equivalent AGDISP run. The user may want to revisit the AGDISP analysis using this summary.

Figure 4.26 shows the source summary for our example case. The value listed for “Source Area was defined graphically and should be close to the area size defined for the example case. Also for our example case, with the exception of wind direction (which should be 30 degrees in this listing), all other corresponding variables should be equivalent to those used in the AGDISP analysis.

Source Input - ForestBlk

Release Parameters | **Coordinates**

Source Location and Area
 Coordinates are based upon a UTM coordinate system
 UTM Zone: 16 Source Area = 124 hectares

Point #1:
 Easting = 778561 meters
 Northing = 4050239 meters

Point #2:
 Easting = 778978 meters
 Northing = 4050902 meters

Point #3:
 Easting = 780259 meters
 Northing = 4050047 meters

Point #4:
 Easting = 779847 meters
 Northing = 4049346 meters

Meteorological Data
 Wind Speed = 2.24 m/s
 Wind Direction = 30 degrees
 Mixing Height = 500 m
 Atmospheric Stability = D - Neutral
 Ambient Temperature = 25 C
 Relative Humidity = 50 percent
 Ambient Pressure = 1000 mb

Flight Path Selection

North
 Spray Block
 Flight Path
 Wind Direction

Flight Path Direction (Deg)
 AGDISP Wind Direction -30 (Deg)

Source View

OK Cancel

Figure 4.26 Source Input/Source Summary Window

Note that the “wind direction” and “AGDISP wind direction” in this window do not have the same meaning. The “AGDISP wind direction” is the direction of the wind relative to the application paths—and the SPRAYTRAN wind direction is the meteorological definition of the direction from which the winds are actually coming.

The summary display also contains a Flight Path Selection calculator that can be used to determine the flight path angle to be used in the AGDISP simulation, based upon the wind direction entered for the SPRAYTRAN simulation. Moving the scroll bar found underneath the flight path calculator to the right will result in rotating the displayed flight path in a clockwise manner. As the displayed flight path is rotated, the angle of the flight path direction and wind direction will be automatically recalculated and displayed in the appropriate text boxes found beneath the flight path calculator.

To return to the Source Input Window, click on the Source View button located at the bottom of the Source Input Summary Window.

Step 6. Run simulation.

The simulation is run from options in the top part of the main SPRAYTRAN interface. Domain size refers to the size of the modeling domain. By making several runs, a domain size of 20 km was identified as appropriate for the example case. For some simulations, the software resets the selected sources under the “Sources” tab. The “Sources” tab status should be routinely checked before runs are made. The DUSTRAN user’s guide provides detailed guidance for setting simulation options and running a simulation.

AGDISP considers only the relative angles of the wind and application trajectories and the cardinal direction for the deposition is not defined in the AGDISP input file. Figure 4.27 shows the deposition data imported from AGDISP plotted on the SPRAYTRAN domain over an image of the selected source. For the purpose of display, the AGDISP deposition data is arbitrarily shown as occurring to the East from a block orientated N-S. Although the widths match, the fact that the actual orientation of the source is not N-S is clearly shown by the mismatch of the orientations of source area and deposition plots.

Although the plot in Figure 4.27 is useful to compare and confirm consistency in the location and magnitude of the AGDISP and SPRAYTRAN results, the plot does not provide near-source details. Figure 4.28 which uses the same data as plotted within the AGDISP program, shows better definition of the near source deposition details.

Figure 4.29 shows the SPRAYTRAN screen and options used to run the example case. The relative wind direction that is imported from AGDISP needs to be changed in the SPARYTAN interface to an actual wind direction. For the example case, the wind direction in SPRAYTRAN needs to be set to 30 degrees to simulate the wind actually traveling over the spray block in the same manner as AGDIDP. Also note the domain size has to be changed to give better detail at distances close to the block.

To run our example case, click the “Run Simulation” button on Figure 4.27. The user should see a series of run status messages displayed over the SPRAYTRAN title location. When the computation is complete, the SPRAYTRAN logo will reappear, and the contours tab on the STRAYTRAN interface will be active. The contours from the AGDISP output are normally displayed at this point.

The contours from the AGDISP output may still be displayed at this point. and additional steps are required to display the SPRAYTRAN simulation results. In the example case, the "Emission Type" pull down window should be set to AGDRIFT and the "Contour Types" set to one of the listed modeling products. The CalPuff option, TotalDep, will provide plots of total deposition that can be compared to AGDISP deposition results.

The SPRAYTRAN plots of total deposition from CalPuff are shown in Figure 4.30. This plots defines deposition patterns at distances of 0.5km and greater. For closer distances, the AGDIST values should be used. To return to the AGDISP plots, select Contour type: AGDISP(dep) and Emission Type: AGDRIF

Comparing the deposition plots shows expected trends (Figure 4.31). An exact comparison of deposition patterns is not expected, although the near-block pattern from AGDISP should be consistent with the down-wind patterns from the SPARAYTRAN dispersion models. AGDISP deposition plots are based on a source term from the spray block for all released material. The SPRAYTRAN deposition plots are based on a source term from the spray block based on the “residual” active chemical mass airborne at 200 m downwind of the spray block downwind edge. The two models have consistent deposition patterns and magnitudes at transition distances (i.e., downwind distances of several kilometers).

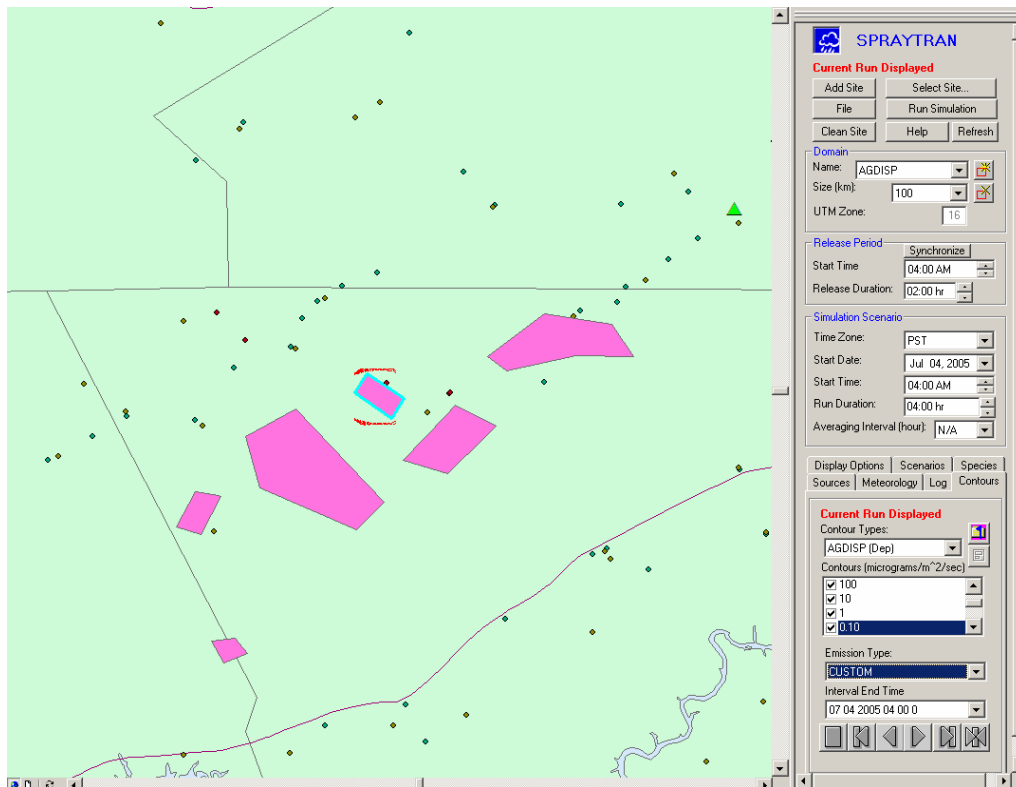


Figure 4.27 AGDISP East-West Oriented Near Source Deposition for the Example Case Plotted in the SPRAYTRAN Interface. AGDISP results are non-directional and are plotted arbitrarily with deposition occurring on an area to the east of the spray block.

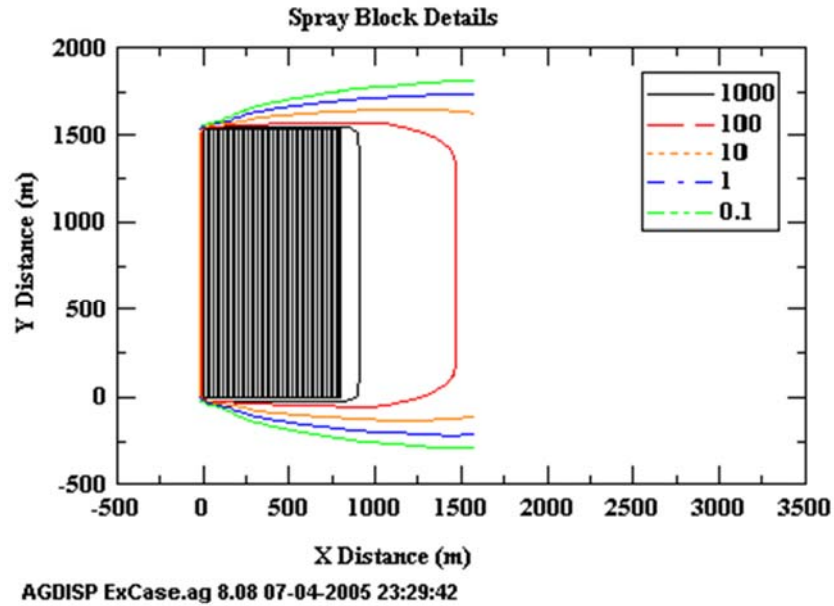


Figure 4.28 AGDISP Near Source Deposition for the Example

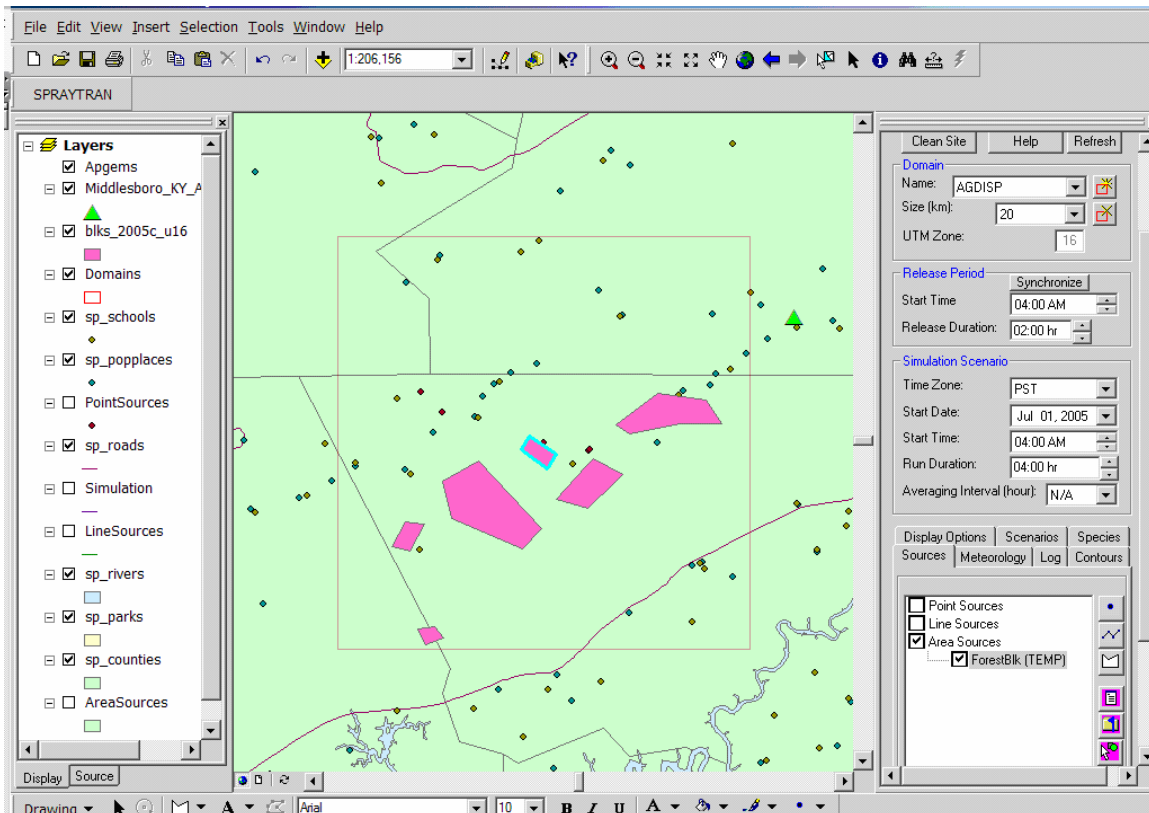


Figure 4.29 Example Case Main Screen Options in the SPRAYTRAN Interface

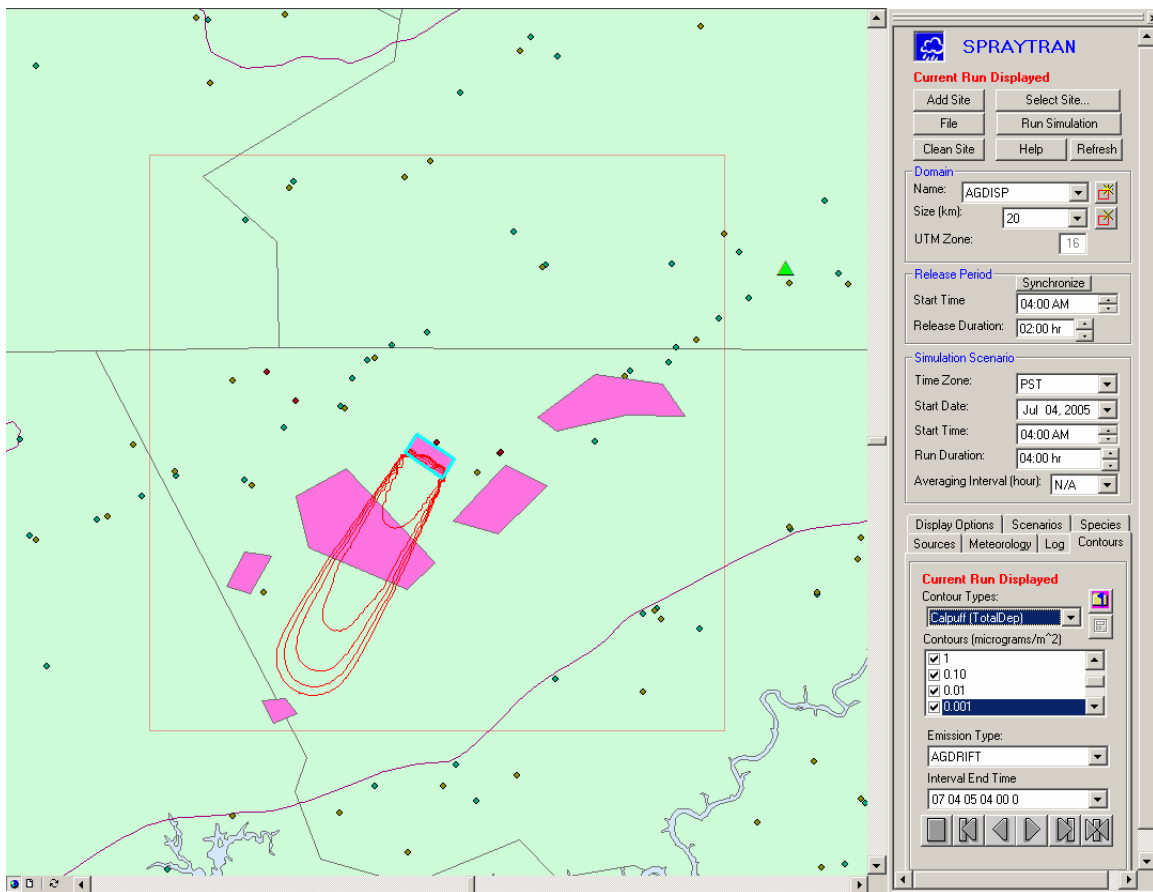


Figure 4.30 Example Case Results: CALPUFF Total

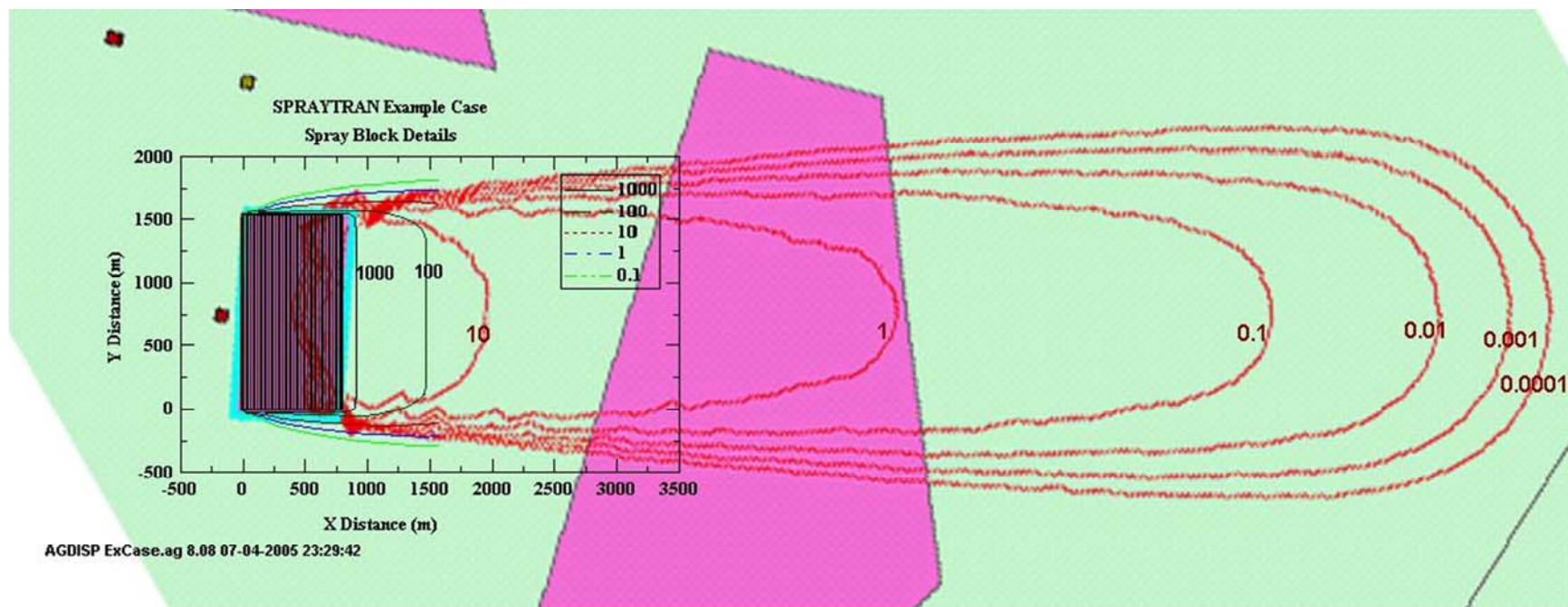


Figure 4.31 Comparison of AGDISP and SPRAYTRAN Total Deposition Patterns Based on Single Droplet Size

5.0 SPRAYTRAN Installation Instructions

This section describe the procedures for installing the SPRAYTRAN utility in the ArcMAP environment. ArcGIS 8.0 is required to install SPRAYTRAN. Please note the installation of the SPRAYTRAN software will require that the user has Administrator privileges on the machine in which it is being installed.

- 1) Install the SPRAYTRAN components by running the Setup program found in the SPRAYTRAN folder on the installation disk.
- 2) Install the Yakima site components by running the Yakima Setup program found in the Yakima folder on the installation disk.
- 3) Install the Tenn site components by running the Tenn Setup program found in the Tenn folder on the installation disk.
- 4) Using the ArcMap application, open the Yakima.mxd file found in the c:\SPRAYTRAN\Yakima directory.
- 5) If upon opening the Yakima.mxd file, the layers do not appear in the map display, the data source for the layers will need to be set.
- 6) To set the data source for the map layers, right click on the Simulation layer name and select the Set Data Source from the Data option on the popup menu.
- 7) Use the open file dialog window to navigate to the Yakima folder of the SPRAYTRAN directory and then select the Yakima.mdb file.
- 8) Double-click on the SiteWide table that is listed in the Open File dialog window, and then select the Simulation table from the list of available database tables.
- 9) Once the Simulation table has been selected, the data sources for all of the layers should be set automatically by the ArcMap application, and the map should be displayed.
- 10) Once the file has been opened and the data sources set, save the file and then close it.
- 11) Using the ArcMap application, open the Tenn.mxd file found in the c:\SPRAYTRAN\Tenn directory.
- 12) If upon opening the Tenn.mxd file, the layers do not appear in the map display, the data source for the layers will need to be set.
- 13) To set the data source for the map layers, right click on the Simulation layer name and select the Set Data Source from the Data option on the popup menu.
- 14) Use the open file dialog window to navigate to the Tenn folder of the SPRAYTRAN directory and then select the Tenn.mdb file.
- 15) Double-click on the SiteWide table that is listed in the Open File dialog window, and then select the Simulation table from the list of available database tables.
- 16) Once the Simulation table has been selected, the data sources for all of the layers should be set automatically by the ArcMap application, and the map should be displayed.

- 17) Once the file has been opened and the data sources set, save the file and then close it.
- 18) Under the “Tools” menu in the ArcMap application, select the “Customize” option (Figure 5.1).

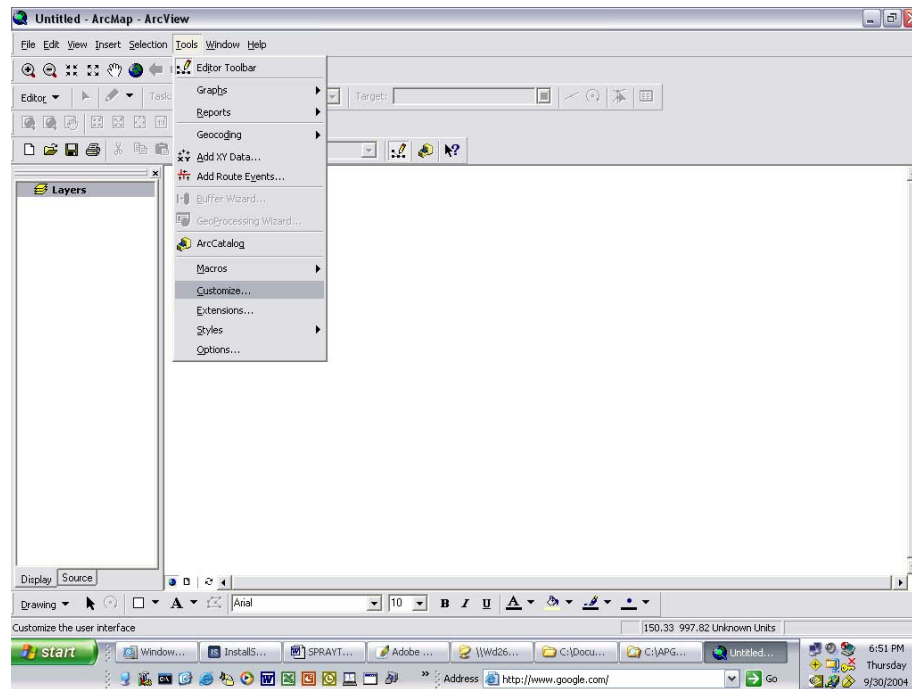


Figure 5.1 ArcMap Customize Menu Item

- 19) Once the “Customize” dialog window is opened, select the “Add from file” button (Figure 5.2).

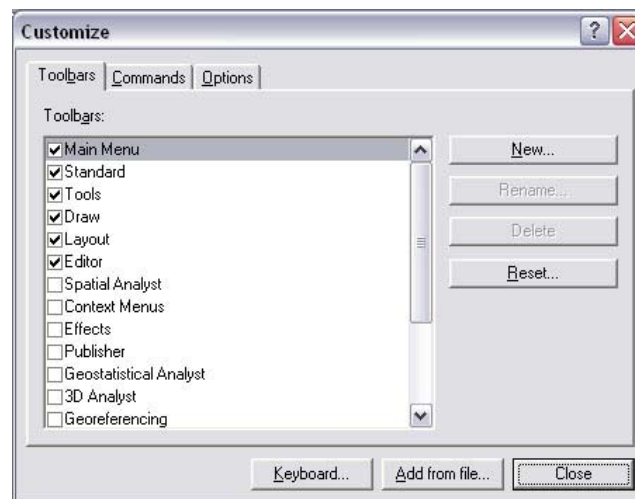


Figure 5.2 ArcMap Customize Window

- 20) Select the DUSTRAN.dll file found in the c:\SPRAYTRAN directory and then click “Open.”

- 21) A window displaying the objects to be added will then be displayed. Close this window by selecting the “OK” button (Figure 5.3).

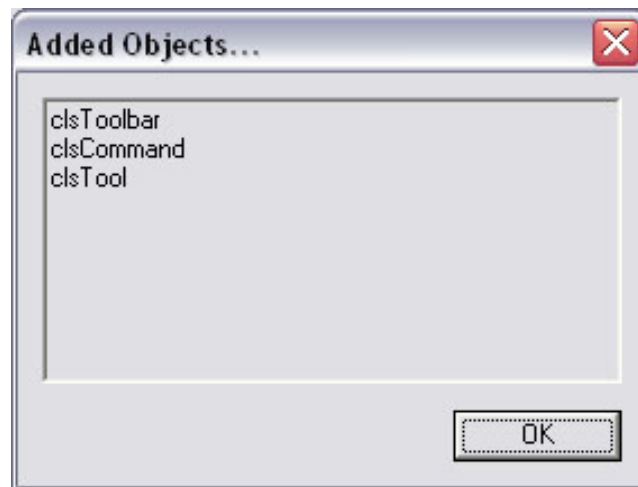


Figure 5.3 ArcMap Added Objects Window

- 22) Select “Apgems4” from the “Customize” check list and then drag the SPRAYTRAN button to the toolbar of the ArcMap application (Figure 5.4).

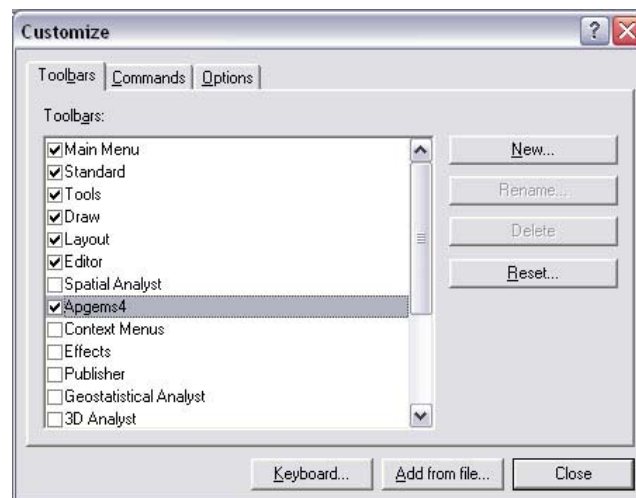


Figure 5.4 ArcMap Customize Window with Apgems4 Selected

- 23) Close the “Customize” window and shut down the ArcMap application.
- 24) In the c:\arcgis\arcexe82\bin directory, start the “categories” executable by double-clicking on the “categories” icon.
- 25) Once the “Component Category Manager” window is displayed, scroll down the list and select the “ESRI MxDockable Windows” option (Figure 5.5).

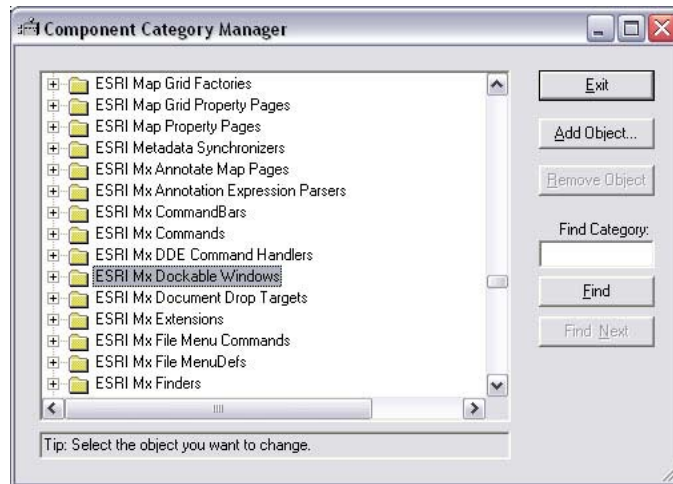


Figure 5.5 Component Category Manager Window with ESRI Mx Dockable Windows Selected

- 26) Click on the “Add Object” button and a file selection window will be displayed.
- 27) Using the file selection window navigate to the C:\SPRAYTRAN directory and select the DUSTRAN.dll.
- 28) Once the Add Objects window is displayed, select the “uncheck all” button and check the “DockWin” option from the list of objects (Figure 5.6).

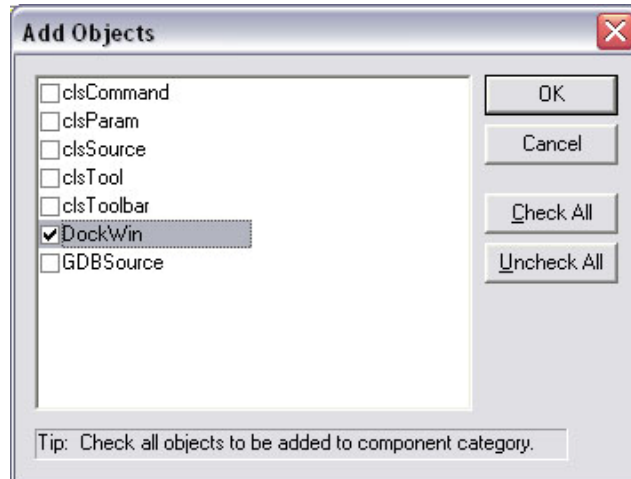


Figure 5.6 Add Objects Window with DockWin Selected

- 29) Close the program by selecting the “OK” buttons on the two remaining windows.

6.0 User's Guide

This section gives the detailed instructions for operating the ArcMap GIS interface for SPRAYTRAN.

6.1 Starting the Model

- Start the ArcMap application.
- Click on the SPRAYTRAN button found on the toolbar of the ArcMap application.
- Once the SPRAYTRAN main interface has loaded into the ArcMap interface, click on the Select Site button to load the site to be used in the simulation.
- Once the Select Site button has been clicked, the selection window will be displayed.
- Use the Current Site list to select the desired site name.
- Once the site is selected in the Current Site list, click on the Open button to load the site into the SPRAYTRAN modeling system.
- With the site selected, SPRAYTRAN will automatically load the appropriate GIS map files into the ArcMap application and set the map's extent to the first domain found in the domain panel.
- Figure 6.1 shows an example simulation site loaded into the SPRAYTRAN modeling system.

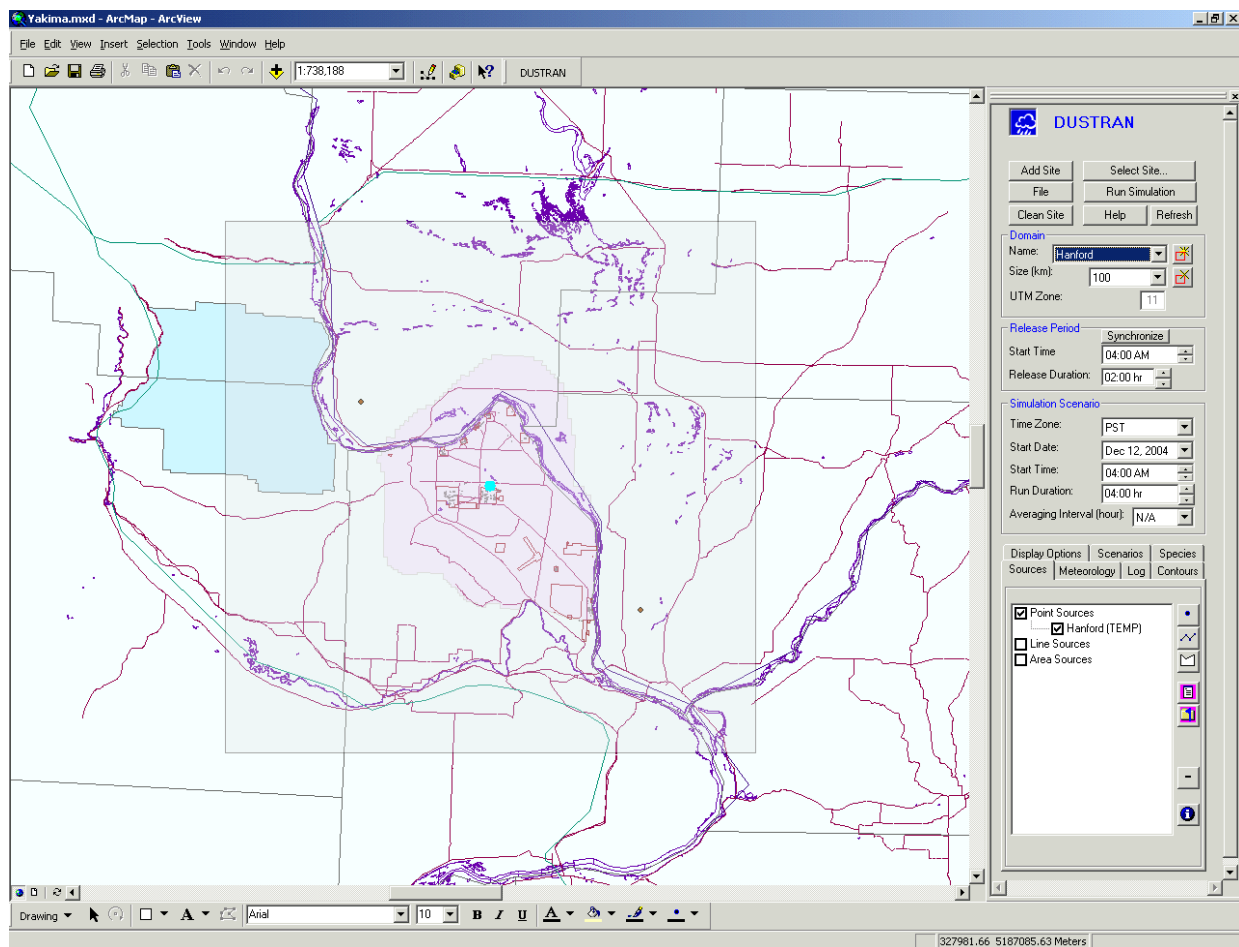


Figure 6.1 Simulation Site Loaded into the SPRAYTRAN Modeling System

6.2 Domain Panel

The Domain panel of the main SPRAYTRAN interface is used to set the location and size of the domain that will be used in the simulation run. The Domain panel is also the portion of the interface in which new domains can be added and existing domains deleted from the system. Figure 6.2 displays an example of the Domain panel with an existing domain name and size selected.

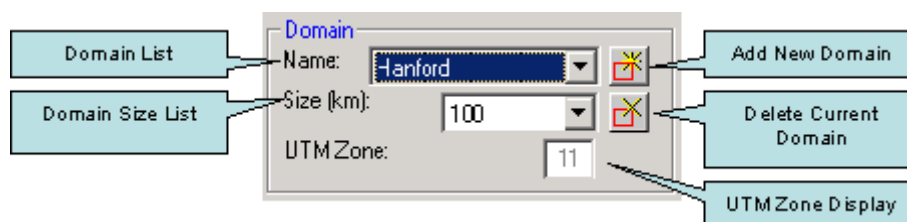


Figure 6.2 Example Domain Panel with Controls Labeled

6.2.1 Setting the Domain Location

- To use an existing domain, first select a domain name from the Name list found in the Domain panel of the main interface.
- To add a new domain to the modeling system, click on the Add Domain button located just to the right of the Name list.
- Once the Add Domain button has been selected, you will be prompted to select the location of the new domain by clicking on a location found on the map displayed within the ArcMap application.
- Following the selection of the domain's location, a prompt will be displayed asking for the name of the new domain.
- After a new domain has been added or an existing domain has been selected, the map display of the ArcMap application will automatically refresh to the selected domain location, and a shaded domain boundary will be displayed on the map.
- Deleting an existing domain can be accomplished by selecting the Delete Domain button located to the right of the Domain Size list.

6.2.2 Setting the Domain Size

- Domain sizes available for use within the modeling system include 20, 50, 80, 100, 150, 200, 250, 300, 350, and 400 kilometers, and can be selected using the Size list found in the Domain panel of the main interface.
- Following the selection of the appropriate domain size, the map display of the ArcMap application will automatically refresh to the selected domain location, and the domain boundary will be sized appropriately.

6.3 Release Period Panel

The Release Period panel is used to set a default start time and duration for all source releases selected for the simulation run. Figure 6.3 displays an example of the Release Period panel with the input controls labeled.

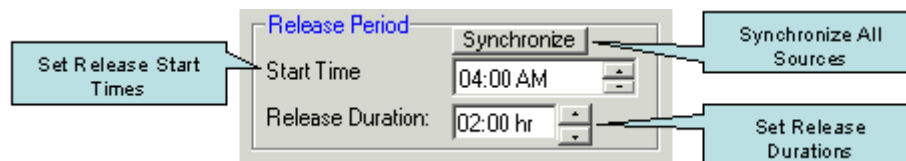


Figure 6.3 Example Release Period Panel with Controls Labeled

6.3.1 Setting the Release Start Time

- The start time for the source releases can be set by first clicking on the Start Time control and then entering the hour value using the keyboard of the computer or by clicking on the increase or decrease buttons found to the right of the control.

- Clicking the up- arrow will increase the time by one hour, and the down- arrow will decrease the time by an hour.
- Start times are limited to hour increments, and any minutes entered will be ignored by the simulation.

6.3.2 Setting the Release Duration

- The release duration for the source releases can be set by first clicking on the Release Duration control and then entering the hour values using the keyboard of the computer or by clicking on the increase or decrease buttons found to the right of the control.
- Clicking the up- arrow will increase the time by fifteen 15-minute intervals, and the down- arrow will decrease the time by fifteen 15-minute intervals.
- Currently, the model simulations only use hour increments, and any minutes entered will be ignored.

6.3.3 Synchronizing the Release Start Time for all Sources

- To synchronize the start times and durations of all sources that have been selected for the simulation, click on the Synchronize button.
- Once the Synchronize button is clicked, a dialog box will be displayed asking the user to confirm changing the time data for all of the sources.
- Selecting the OK option on the dialog box will result in the time data for all sources being changed to the values entered in the Release Period panel.
- Selecting the Cancel option will cancel the synchronize operation, and no changes will be performed on the time data of the sources.

6.4 Simulation Scenario Panel

The Simulation Scenario panel is used to set the start date and time for the simulation run. Figure 6.4 shows an example of the Simulation Scenario panel with selections made and the controls labeled.

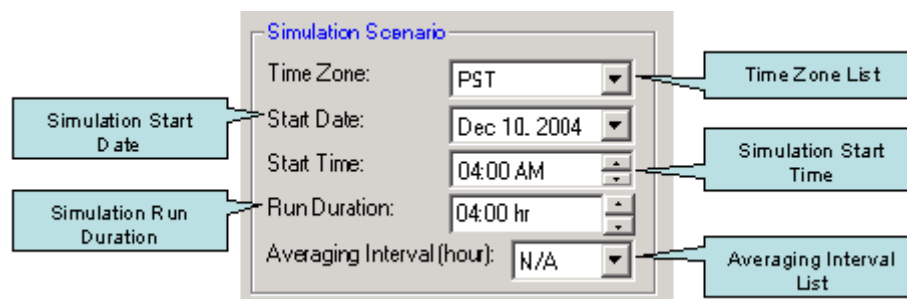


Figure 6.4 Example Simulation Scenario Panel with Controls Labeled

6.4.1 Setting the Time Zone

- The time zone used for the simulation run can be set by selecting the desired time zone from the Time Zone list.
- Time zones that are available for use during a simulation include Pacific Standard (PST), Central Standard (CST), Mountain Standard (MST), and Eastern Standard (EST).

6.4.2 Setting the Start Date

- The starting date of the simulation can be set by entering the date into the Start Date control directly from the keyboard or by making a selection using a calendar control.
- To enter the date by using the keyboard, first click on the month, day, or year portion of the date displayed in the control.
- Once the appropriate portion of the date has been selected, the new value can be entered using the keyboard.
- All values need to be entered as integers that the control will automatically check for correctness. In the case of the month, it will convert the integer to the appropriate name.
- To enter the date using the calendar control, first click on the button located on the right side of the control.
- Once the button has been selected, a calendar will be displayed directly under the Start Date control for the date that is currently entered in the Start Date control.
- To change months, click on the right or left button located at the top of the calendar control.
- Clicking on the left button decreases the month by one, and the right button increases the month by one.
- To select a day using the calendar control, click on the desired day, and the calendar control will then close, and the Start Date control will automatically update with the new date.

6.4.3 Setting the Start Time

- Please note that due to limitations in the CALMET model, simulations must start before sunrise.
- The start time for the simulation can be set by first clicking on the Start Time control and then entering the hour value using the keyboard of the computer or by clicking on the increase or decrease buttons found to the right of the control.
- Clicking the up- arrow will increase the time by one hour; the down- arrow will decrease the time by one hour.
- Start times are limited to hour increments, and any minutes entered will be ignored by the simulation.

6.4.4 Setting the Run Duration

- The run duration for the simulation can be set by first clicking on the Run Duration control and then entering the hour value using the keyboard of the computer or by clicking on the increase or decrease buttons found to the right of the control.
- Clicking the up- arrow will increase the time by fifteen 15-minute intervals; the down- arrow will decrease the time by fifteen 15-minute intervals.
- Currently, the model simulations only use hour increments, and any minutes entered will be ignored.

6.4.5 Setting the Averaging Interval

- The averaging interval of a simulation is the number of hours to use when processing the average of the results generated by the CalPuff and CalGrid models.
- Averaging intervals available for use in a simulation are as follows:

N/A	:	No averaging will be performed for the simulation.
3 Hours	:	3- hour averaging will be used for the processing of results.
8 Hours	:	8- hour averaging will be used for the processing of results.
24 Hours	:	24- hour averaging will be used for the processing of results.
Run Length	:	Averages will be calculated using the length of the simulation run.
- The averaging interval to be used in a simulation can be set by selecting the appropriate interval from the Averaging Interval list found within the Simulation Scenario panel.
- If an interval is selected that is greater than the total number of hours that the simulation is set to run, a message box will be displayed explaining the time mismatch.

6.5 Species Tab

The species tab is used to view, add, and delete species from the current simulation scenario. Figure 6.5 shows an example of the Species tab with four species selected and the controls labeled.

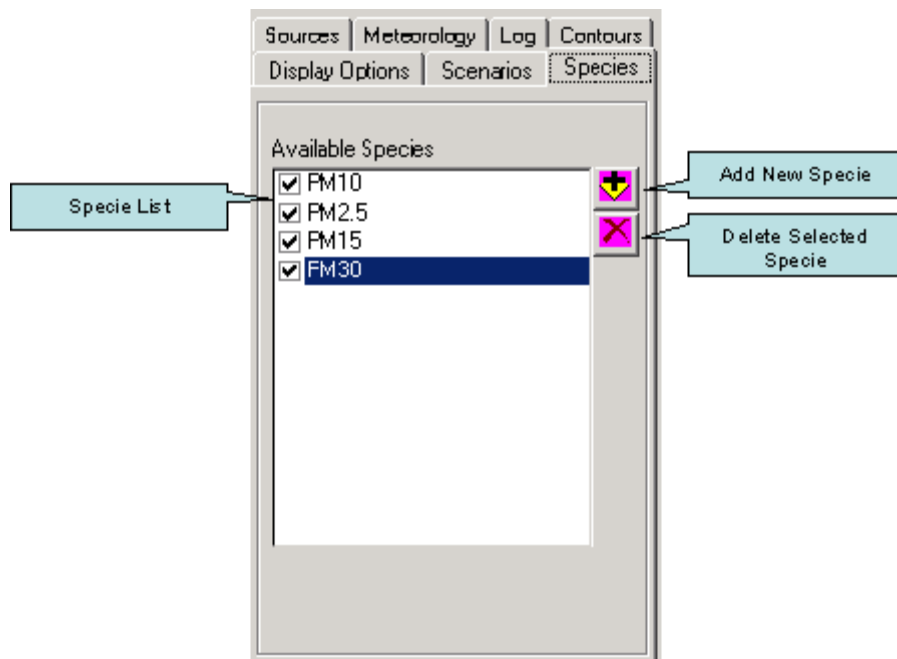


Figure 6.5 Example Species Tab

6.5.1 Selecting an Existing Specie

- To select an existing specie, click on the box located to the left of the desired specie.

6.5.2 Modify Data for an Existing Specie

- To modify an existing specie, double click on the name of the desired specie in the specie list.
- This will bring up the “Specie Input Data” window.
- To change the existing specie, click “Yes’.”
- Next, the user will need to state whether the specie is a particle or gas.
- The user will then be asked if they he/she would like deposition calculated for the specie.
- If the specie is a particle, the software will then ask for the particle mean diameter of the new specie.
- If the specie is a gas, the software will ask for the molecular weight of the gas along with its deposition velocity.

6.5.3 Adding a New Specie

- To add a new specie, click the “Add” button located within the specie tab.
- When prompted, enter a name for the new specie.
- Next, the user will need to state whether the specie is a particle or gas.
- The user will then be asked if deposition is to be calculated for the specie.

- If the specie is a particle, the software will then ask for the particle mean diameter of the new specie.
- If the specie is a gas, the software will ask for the molecular weight of the gas along with its deposition velocity.

6.5.4 Deleting an Existing Specie

- To delete an existing specie type, select the specie from the list and click the “Delete” button located to the right of the specie list.

6.6 Sources Tab

The Sources tab is where the user is able to select, add, delete, and modify the sources that will be used in a simulation run. The Sources tab contains the list of sources that have been entered by the user for use in the simulation. These sources can take the form of point, line, or area sources. Figure 6.6 shows examples of each of the available source types selected, as well as labels for the controls used to modify the sources.

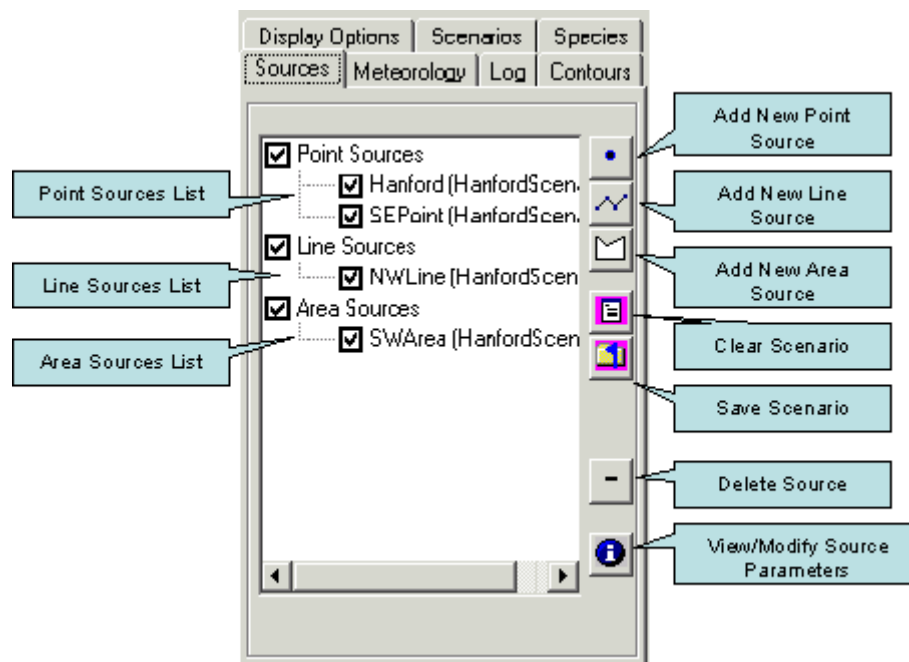


Figure 6.6 Example Sources Tab with Point, Line, and Area Sources Entered

6.6.1 Adding a New Point Source

- To add a new point source to the simulation, the Sources tab must first be selected by clicking on the Sources tab of SPRAYTRAN’s main interface.
- Once the Sources tab has been selected, the process for adding a new point source can be started by clicking on the Add Point Source button found on the right- hand side of the tab.

- Clicking-on the Add Point Source button will result in the mouse cursor changing to a crosshair, and the location of the new point source can be selected by clicking on the desired position of the map display in the ArcMap application.
- Following the selection of the point source location, a dialog box will be displayed asking for the name of the new point source.
- After entering a name for the new source, click on the OK button. Clicking-on the OK button will cause the map to display and the sources list to be updated to include the new point source.
- Once the name has been entered and the map display and sources list has been updated, the system will display the Point Source Input window.
- There are two tabs present on the Point Source Input window. When selected, the Release Parameters tab displays the parameters for the point source that can be changed/entered by the user, and the Coordinates tab displays the coordinate values for the point source that has been entered by the user. Data presented on the Coordinates tab is not editable by the user.

6.6.2 Setting Point Source Release Parameters

Once a new point source has been added or the name of an existing point source has been double-clicked in the sources list, the point source input window will be displayed. The point source input window consists of two tabs labeled “Release Parameters” and “Coordinates.” The “Release Parameters” tab is used to enter the characteristics of the point source, such as the stack diameter, release time period, and the emission rates of species emitted by the source. Figure 6.7 displays an example of the Source Input window.

Species	Emission Rate
PM10	10.0
PM2.5	0.0
PM15	0.0
PM30	0.0

Figure 6.7 Example Point Source Input Window

Changing the Height of Release

- Click on the text control labeled Height of release.

- Once the text control is selected, a value range will be displayed in the yellow text control located at the bottom of the screen.
- Enter the desired value using the keyboard of the computer.
- If the value entered is a valid number and is within the range displayed at the bottom of the screen, the text control will remain green.
- If an invalid character is entered or the value entered is outside of the range displayed at the bottom of the screen, the text control will turn red.

Changing the Stack Gas Exit Velocity

- Click on the text control labeled Stack gas exit velocity.
- Once the text control is selected, a value range will be displayed in the yellow text control located at the bottom of the screen.
- Enter the desired value using the keyboard of the computer.
- If the value entered is a valid number and is within the range displayed at the bottom of the screen, the text control will remain green.
- If an invalid character is entered or the value entered is outside of the range displayed at the bottom of the screen, the text control will turn red.

Changing the Stack Gas Exit Temperature

- Click on the text control labeled Stack gas exit temperature.
- Once the text control is selected, a value range will be displayed in the yellow text control located at the bottom of the screen.
- Enter the desired value using the keyboard of the computer.
- If the value entered is a valid number and is within the range displayed at the bottom of the screen, the text control will remain green.
- If an invalid character is entered or the value entered is outside of the range displayed at the bottom of the screen, the text control will turn red.

Setting the Stack Diameter

- Click on the text control labeled Stack diameter.
- Once the text control is selected, a value range will be displayed in the yellow text control located at the bottom of the screen.
- Enter the desired value using the keyboard of the computer.
- If the value entered is a valid number and is within the range displayed at the bottom of the screen, the text control will remain green.
- If an invalid character is entered or the value entered is outside of the range displayed at the bottom of the screen, the text control will turn red.

Setting the Building Cross Section

- Click on the text control labeled Building cross section.
- Once the text control is selected, a value range will be displayed in the yellow text control located at the bottom of the screen.
- Enter the desired value using the keyboard of the computer.
- If the value entered is a valid number and is within the range displayed at the bottom of the screen, the text control will remain green.
- If an invalid character is entered or the value entered is outside of the range displayed at the bottom of the screen, the text control will turn red.

Setting the Initial Horizontal Plume Size

- Click on the text control labeled Initial Horizontal Plume Size.
- Once the text control is selected, a value range will be displayed in the yellow text control located at the bottom of the screen.
- Enter the desired value using the keyboard of the computer.
- If the value entered is a valid number and is within the range displayed at the bottom of the screen, the text control will remain green.
- If an invalid character is entered or the value entered is outside of the range displayed at the bottom of the screen, the text control will turn red.

Setting the Initial Vertical Plume Size

- Click on the text control labeled Initial Vertical Plume Size.
- Once the text control is selected, a value range will be displayed in the yellow text control located at the bottom of the screen.
- Enter the desired value using the keyboard of the computer.
- If the value entered is a valid number and is within the range displayed at the bottom of the screen, the text control will remain green.
- If an invalid character is entered or the value entered is outside of the range displayed at the bottom of the screen, the text control will turn red.

Setting the Emission Rates

- Emission rates are displayed in a spreadsheet control that displays the names of the species present for the simulation run and the emission value assigned to each one.
- The list of species displayed within the spreadsheet control will contain the same species that are listed in the Specie tab of the main interface.

- If a species is not selected in the Species list, the emission value for that specie will show up as “Not Selected” in the spreadsheet control.
- To change/enter an emission value for a specie, click on the cell in the Emission Rate column of the spreadsheet that corresponds to the desired specie.
- Once the cell has been selected, the new emission value can be entered using the keyboard of the computer.
- Values entered into the spreadsheet will be checked for validity once the OK button of the Point Source Input window has been selected.
- If an invalid value has been entered, an error message will be displayed prompting the user to correct the value.

Setting the Start Date

- The Start Date of the point source is the month, day, and year that the source will start its release.
- The starting date of the source release can be set by entering the date into the Start Date control directly from the keyboard, or by making a selection using a calendar control.
- To enter the date by using the keyboard, first click on the month, day, or year portion of the date displayed in the control.
- Once the appropriate portion of the date has been selected, the new value can be entered using the keyboard.
- All values need to be entered as integers that the control will automatically check for correctness and in the case of the month convert the integer to the appropriate name.
- To enter the date using the calendar control, first click on the button located on the right side of the control.
- Once the button has been selected, a calendar will be displayed directly under the Start Date control for the date that is currently entered in the Start Date control.
- To change months, click on the right or left button located at the top of the calendar control.
- Clicking on the left button decreases the month by one, and the right button increases the month by one.
- To select a day using the calendar control, click on the desired day, and the calendar control will then close, and the Start Date control will automatically update with the new date.

Setting the Start Time

- The start time for the point source release can be set by first clicking on the Start Time control and then entering the hour value using the keyboard of the computer, or by clicking on the increase or decrease buttons found to the right of the control.
- Clicking the up- arrow will increase the time by one hour, and the down- arrow will decrease the time by an hour.

- Start times are limited to hour increments, and any minutes entered will be ignored by the simulation.

Setting the Release Duration

- The release duration for the point source can be set by first clicking on the Duration control and then entering the hour value using the keyboard of the computer.

6.6.3 Adding a New Line Source

- In order to add a new line source to the simulation, the Sources tab must first be selected by clicking on the Sources tab of SPRAYTRAN's main interface.
- Once the Sources tab has been selected, the process for adding a new line source can be started by clicking on the Add Line Source button found on the right hand side of the tab.
- Clicking on the Add Line Source button will result in the mouse cursor changing to a crosshair, and the location of the new line source can then be drawn onto the map display by clicking on the locations of the end points for each line segment that makes up the line source.
- Once the ends of the segments of the line have been drawn onto the map display, double-clicking on the map will finish the drawing of the line.
- Following the selection of the line source location, a dialog box will be displayed asking for the name of the new line source.
- After entering a name for the new source, click on the OK button. Clicking on the OK button will cause the map display and the sources list to be updated to include the new line source.
- Once the name has been entered and the map display and sources list have been updated, the system will display the Line Source Input window.
- There are three possible tabs that can be present on the Line Source Input window, depending on the settings entered by the user.
- The Release Parameters tab displays the parameters for the line source that can be changed/entered by the user.
- If the Emission Model option has been selected by the user on the Release Parameters tab, a Vehicle Parameters tab will be displayed that allows the user to set certain parameters that are used by the emission model.
- The Coordinates tab displays the coordinate values for the line source that has been entered by the user.
- Data presented on the Coordinates tab is are not editable by the user.

6.6.4 Setting Line Source Release Parameters

Once a new line source has been added or the name of an existing line source has been double-clicked in the sources list, the line source input window will be displayed (Figure 6.8). The line source input window consists of three tabs labeled "Release Parameters," "Vehicle Parameters," and "Coordinates." The "Release Parameters" tab is used to enter the characteristics of the line source such

as the release height above ground, release time period, and how the emission rates of species emitted by the source will be generated. For each line source present in the simulation, the user can elect to either have the emission model generate emission rates for the source or enter them by hand. The “Vehicle Parameters” tab is only displayed when the user has selected the “Emission Model” option, and is used to enter the data describing the vehicles that will travel along the path of the line source.

Setting the Source to Use the Emission Model

- Selecting the Emission Model option of the Release Parameters tab will cause all emission values for the source to be generated by the emission model.
- Using the Emission Model option will also cause the Vehicle Parameters tab to be displayed.
- Selecting the User Defined option of the Release Parameters tab will cause an emission rates spreadsheet to be displayed wherein the user can enter the emission rates for each of the species selected for the simulation run.
- Selecting the User Defined option of the Release Parameters tab will also cause the Vehicle Parameters tab to not be displayed.
- Figure 6.8 displays an example of the Line Source Input window with the Emission Model option selected.

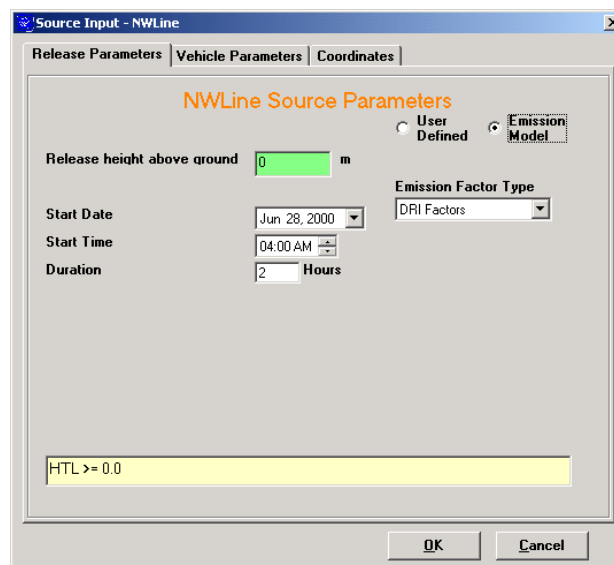


Figure 6.8 Example Line Source Input Window Using the Emission Model Option

Setting the User Defined Emission Rates

- Emission rates are displayed in a spreadsheet control that displays the names of the species present for the simulation run and the emission value assigned to each one.
- The list of species displayed within the spreadsheet control will contain the same species that are listed in the Specie tab of the main interface.

- If a species is not selected in the Species list, the emission value for that species will show up as “Not Selected” in the spreadsheet control.
- To change/enter an emission value for a species, first click on the cell in the Emission Rate column of the spreadsheet that corresponds with the desired specie.
- Once the cell has been selected, the new emission value can be entered using the keyboard of the computer.
- Values entered into the spreadsheet will be checked for validity once the OK button of the Line Source Input window has been selected.
- If an invalid value has been entered, an error message will be displayed prompting the user to correct the value.
- Figure 6.9 displays an example of the Line Source Input window with the User Defined option selected.

- The Start Date of the line source is the month, day, and year that the source will start its release.
- The starting date of the source release can be set by entering the date into the Start Date control directly from the keyboard or by making a selection using a calendar control.
- To enter the date by using the keyboard, first click on the month, day, or year portion of the date displayed in the control.
- Once the appropriate portion of the date has been selected, the new value can be entered using the keyboard.
- All values need to be entered as integers that the control will automatically check for correctness, and in the case of the month, convert the integer to the appropriate name.
- To enter the date using the calendar control, first click on the button located on the right side of the control.
- Once the button has been selected, a calendar will be displayed directly under the Start Date control for the date that is currently entered in the Start Date control.
- To change/enter months, click on the right or left button located at the top of the calendar control.
- Clicking on the left button decreases the month by one, and the right button increases the month by one.
- To select a day using the calendar control, click on the desired day, and the calendar control will then close, and the Start Date control will automatically update with the new date.

Setting the Start Time

- The start time for the line source release can be set by first clicking on the Start Time control and then entering the hour value using the keyboard of the computer, or by clicking on the increase or decrease buttons found to the right of the control.
- Clicking the up- arrow will increase the time by one hour, and the down- arrow will decrease the time by an hour.
- Start times are limited to hour increments, and any minutes entered will be ignored by the simulation.

Setting the Release Duration

- The release duration for the line source release can be set by first clicking on the Duration control and then entering the hour value using the keyboard of the computer.

Setting Line Source Vehicle Parameters

The line source “Vehicle Parameters” tab is used to enter the characteristics of the vehicles that will be traveling along the path of the line source. This information includes the types of vehicles as well as their speed, weight, and the distance traveled. Figure 6.10 shows the Vehicle Input window for a line source with example vehicles selected.

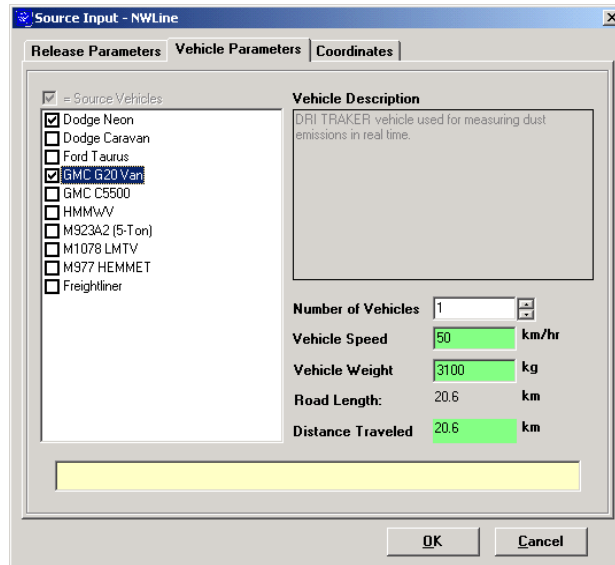


Figure 6.10 Example Vehicle Input Window for a Line Source

Selecting Vehicles

- Clicking on a vehicle name that is displayed within the vehicles list will cause the parameter values to automatically update to the values last entered for the selected vehicle.
- To select a vehicle and add it to the collection of vehicles in use for the line source, click on the checkbox to the left of the vehicle name.
- Clicking on a vehicle checkbox that has previously been selected will unselect the vehicle and remove it from the collection of vehicles present on the line source.

Setting the Number of Vehicles

- The number of vehicles that are present for a certain vehicle type at the line source release can be set by first clicking on the Number of Vehicles control and then entering the number of vehicles using the keyboard of the computer or by clicking on the increase or decrease buttons found to the right of the control.
- Clicking the up- arrow will increase the count by one vehicle, and the down- arrow will decrease the count by one vehicle.

Setting the Vehicle Speed

- Click on the text control labeled Vehicle Speed.
- Once the text control is selected, a value range will be displayed in the yellow text control located at the bottom of the screen.
- Enter the desired value using the keyboard of the computer.
- If the value entered is a valid number and is within the range displayed at the bottom of the screen, the text control will remain green.

- If an invalid character is entered or the value entered is outside of the range displayed at the bottom of the screen, the text control will turn red.

Setting the Vehicle Weight

- Click on the text control labeled Vehicle Weight.
- Once the text control is selected, a value range will be displayed in the yellow text control located at the bottom of the screen.
- Enter the desired value using the keyboard of the computer.
- If the value entered is a valid number and is within the range displayed at the bottom of the screen, the text control will remain green.
- If an invalid character is entered or the value entered is outside of the range displayed at the bottom of the screen, the text control will turn red.

Setting the Road Length

- The road length associated with the line source is automatically calculated by the software and displayed in the control labeled Road Length.
- For line sources, the Road Length parameter is not editable by the user.

Setting the Distance Traveled

- The Distance Traveled parameter of the line source is automatically calculated by multiplying the number of vehicles with the road length and displayed in the control labeled Distance Traveled.
- For line sources, the Distance Traveled parameter is not editable by the user.

6.6.5 Adding a New Area Source

- In order to add a new area source to the simulation, the Sources tab must first be selected by clicking on the Sources tab of SPRAYTRAN's main interface.
- Once the Sources tab has been selected, the process for adding a new area can be started by clicking on the Add Area Source button found on the right hand side of the tab.
- Clicking-on the Add Area Source button will result in a message dialog box being displayed that will explain that area sources can only consist of four vertices and that if more than four are entered, the extra points will be ignored by the modeling system.
- The mouse cursor then will change to a crosshair, and the location of the new area source can be drawn on the map display by clicking on the four locations that make-up the vertices of the polygon representing the area source.
- Once the end points of the segments of the line that outline the area source have been drawn onto the map display, double-clicking on the map will finish the drawing of the area source.
- Following the marking of the area source location, a dialog box will be displayed asking for the name of the new area source.

- After entering a name for the new source, click on the OK button. Clicking on the OK button will cause the map display and the sources list to be updated to include the new area source.
- Once the name has been entered and the map display and sources list have been updated, the system will display the Area Source Input Window.
- There are two possible tabs that can be present on the Area Source Input window, depending on the settings entered by the user. The Release Parameters tab displays the parameters for the area source that can be changed/entered by the user. The Coordinates tab displays the coordinate values for the area source that have been entered by the user. Data presented on the Coordinates tab is are not editable by the user.

6.6.6 Setting Area Source Release Parameters

The Area Source Input window will be displayed once a new area source has been added or the name of an existing area source has been double-clicked in the sources list (Figure 6.11). The area source input window consists of two tabs labeled “Release Parameters” , and “Coordinates.”. The “Release Parameters” tab is used to enter the characteristics of the area source, such as the effective height above ground, release time period, and how the emission rates of the various species emitted by the source will be generated. For each area source present in the simulation, the user can elect to either load AGDISP data to generate emission rates for the source or enter them by hand.

Steps for loading AGDISP data into a SPRAYTRAN area source.

- 1) If the desired area source has already been entered, double-click on its name in the source list found on the Sources tab of the main interface form. The Source Input window should then be displayed.
- 2) If the desired area source has not been entered into the modeling system, enter the area source now using the Draw area source button located on the Sources tab. Once the area source has been drawn and the name of the source entered, the Source Input window should be displayed.
- 3) The Source Input window that is displayed for area sources in the SPRAYTRAN version of the modeling system will only provide the User Defined option for the emission rates associated with the source. Figure 6.11 displays an example of a source input window for an area source that will use AGDISP data as input.

Source Input - SWArea

Release Parameters | Coordinates

SWArea Source Parameters

Load Agdisp | Agdisp Summary

Effective height above ground: 0 m

Air temperature: 25 C

Effective rise velocity: 1 m/s

Effective radius: 1 m

Initial vertical spread: 1 m

Start Date: Mar 12, 2005

Start Time: 04:00 AM

Duration: 2 Hours

Specie	Emission Rate
PM10	10.0
PM2.5	0.0
PM15	0.0
PM30	0.0

OK | Cancel

Figure 6.11 Example SPRAYTRAN Area Source Input Window

- 4) If data from an AGDISP simulation is not available, clicking on the AGDISP Summary button will display a summary of the data entered into the SPRAYTRAN system that can be used as input into an AGDISP simulation.
- 5) The summary data displayed in the Source Input window includes the coordinates of the vertices that make up the shape of the area source as well as data concerning the meteorological data entered for use in the SPRAYTRAN simulation. Figure 6.12 shows an example of an area source input window with the AGDISP summary displayed.

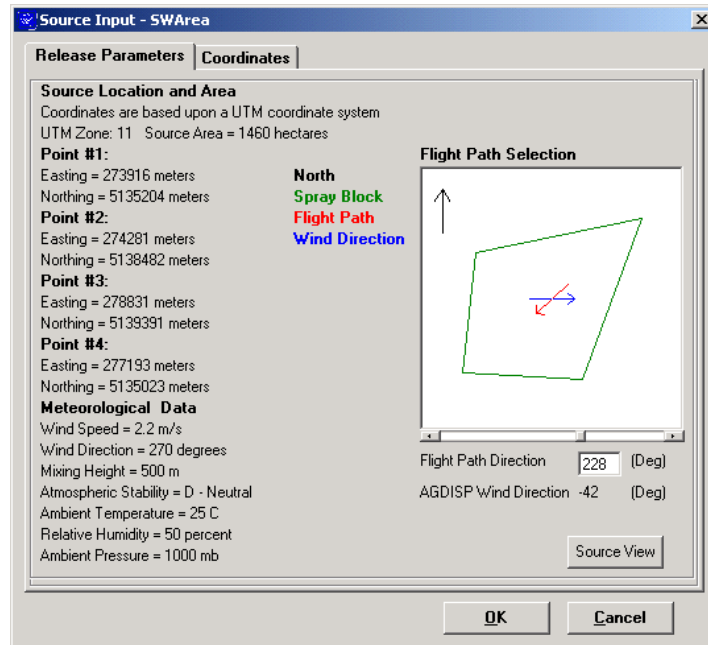


Figure 6.12 Example AGDISP Summary Display

- 6) The summary display also contains a Flight Path Selection calculator that can be used to determine the flight path angle to be used in the AGDISP simulation based upon the wind direction entered for the SPRAYTRAN simulation.
- 7) Moving the scroll bar found underneath the flight path calculator to the right will result in rotating the displayed flight path in a clockwise manner.
- 8) As the displayed flight path is rotated, the angle of the flight path direction and wind direction will be automatically recalculated and displayed in the appropriate text boxes found beneath the flight path calculator.
- 9) To return to the SPRAYTRAN Source Input window (Figure 6.11), click on the Source View button located at the bottom of the AGDISP summary (Figure 6.12).
- 10) Once the data from an AGDISIP simulation is available, it can be loaded by clicking on the Load AGDISP button located on the SPRAYTRAN Source Input window (Figure 6.11).
- 11) Once the Load AGDISP button has been clicked, an information window will be displayed explaining the need to match the meteorological data used in the AGDISP simulation with the meteorological conditions entered for the SPRAYTRAN simulation. Figure 6.13 shows the information window that is displayed prior to the selection of the AGDISP data files.

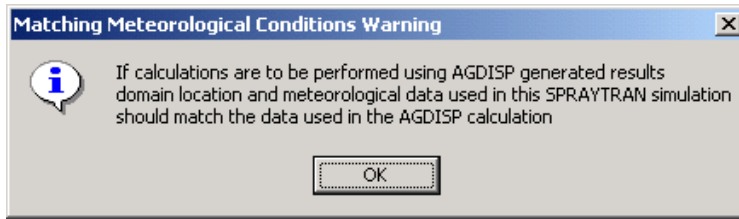


Figure 6.13 Meteorological Conditions Warning Window

- 12) Click on the OK button to close the information window.
- 13) A prompt will then be displayed asking for an AGDISP input summary file to be selected.
- 14) Click on the OK button to close the prompt and an open file dialog window will be displayed.
- 15) Navigate to the desired input summary file and then click on the Open button to load the file.
- 16) Once the input summary file has been selected, a prompt asking for the selection of an AGDISP vertical profile file will be displayed.
- 17) Click on the OK button to close the prompt and an open file dialog window will be displayed.
- 18) Navigate to the desired vertical profile file and then click on the Open button to load the file.
- 19) Once the vertical profile file has been selected, a prompt asking for the selection of an AGDISP deposition file will be displayed.
- 20) Click on the OK button to close the prompt and an open file dialog window will be displayed.
- 21) Navigate to the desired deposition file and then click on the Open button to load the file.
- 22) Following the selection of the input files, a prompt will be displayed asking for the specie name that will be associated with the calculated emission rate.
- 23) Enter the desired name into the text box of the prompt window and then click on the OK button to enter the new name and close the prompt window.
- 24) Once the new specie name has been entered, the name will appear in the species list of the area source input window along with the calculated emission rate.
- 25) The new specie name will also be added to the Species list of the Species tab found on the main interface of the SPRAYTRAN modeling system. Figure 6.14 shows the area source input window with the calculated emission rates entered.

Source Input - SWArea

Release Parameters | Coordinates

SWArea Source Parameters

[Load Agdisp] Agdisp Summary

Effective height above ground: 0 m

Air temperature: 25 C

Effective rise velocity: 1 m/s

Effective radius: 1 m

Initial vertical spread: 1 m

Start Date: Mar 12, 2005

Start Time: 04:00 AM

Duration: 2 Hours

Specie	Emission Rate
PM10	10.0
PM2.5	0.0
PM15	0.0
PM30	0.0
AGD1	56.91

OK Cancel

Figure 6.14 Example SPRAYTRAN Area Source Input Window with Calculated Emission Rate

26) Click on the OK button of the SPRAYTRAN Source Input window to enter the changes and close the window.

Once the data from the AGDISP simulation has been entered, the SPRAYTRAN simulation can be executed.

27) Setting the Effective Height Above Ground Parameter

- Click on the text control labeled Effective height above ground.
- Once the text control is selected, a value range will be displayed in the yellow text control located at the bottom of the screen.
- Enter the desired value using the keyboard of the computer.
- If the value entered is a valid number and is within the range displayed at the bottom of the screen, the text control will remain green.
- If an invalid character is entered or the value entered is outside of the range displayed at the bottom of the screen, the text control will turn red.

Setting the Air Temperature

- Click on the text control labeled Air Temperature.
- Once the text control is selected, a value range will be displayed in the yellow text control located at the bottom of the screen.
- Enter the desired value using the keyboard of the computer.
- If the value entered is a valid number and is within the range displayed at the bottom of the screen, the text control will remain green.

- If an invalid character is entered or the value entered is outside of the range displayed at the bottom of the screen, the text control will turn red.

Setting the Effective Rise Velocity

- Click on the text control labeled Effective rise velocity.
- Once the text control is selected, a value range will be displayed in the yellow text control located at the bottom of the screen.
- Enter the desired value using the keyboard of the computer.
- If the value entered is a valid number and is within the range displayed at the bottom of the screen the text control will remain green.
- If an invalid character is entered or the value entered is outside of the range displayed at the bottom of the screen, the text control will turn red.

Setting the Effective Radius

- Click on the text control labeled Effective radius.
- Once the text control is selected, a value range will be displayed in the yellow text control located at the bottom of the screen.
- Enter the desired value using the keyboard of the computer.
- If the value entered is a valid number and is within the range displayed at the bottom of the screen, the text control will remain green.
- If an invalid character is entered or the value entered is outside of the range displayed at the bottom of the screen, the text control will turn red.

Setting the Initial Vertical Spread

- Click on the text control labeled Initial vertical spread.
- Once the text control is selected, a value range will be displayed in the yellow text control located at the bottom of the screen.
- Enter the desired value using the keyboard of the computer.
- If the value entered is a valid number and is within the range displayed at the bottom of the screen, the text control will remain green.
- If an invalid character is entered or the value entered is outside of the range displayed at the bottom of the screen, the text control will turn red.

Setting the Start Date

- The Start Date of the area source is the month, day, and year that the source will start its release.
- The starting date of the source release can be set by entering the date into the Start Date control directly from the keyboard or by making a selection using a calendar control.

- To enter the date by using the keyboard, first click on the month, day, or year portion of the date displayed in the control.
- Once the appropriate portion of the date has been selected, the new value can be entered using the keyboard.
- All values need to be entered as integers that the control will automatically check for correctness and in the case of the month, convert the integer to the appropriate name.
- To enter the date using the calendar control, first click on the button located on the right side of the control.
- Once the button has been selected, a calendar will be displayed directly under the Start Date control for the date that is currently entered in the Start Date control.
- To change months, click on the right or left button located at the top of the calendar control.
- Clicking on the left button decreases the month by one, and the right button increases the month by one.
- To select a day using the calendar control, click on the desired day, and the calendar control will then close, and the Start Date control will automatically update with the new date.

Setting the Start Time

- The start time for the area source release can be set by first clicking on the Start Time control and then entering the hour value using the keyboard of the computer or by clicking on the increase or decrease buttons found to the right of the control.
- Clicking the up- arrow will increase the time by one hour, and the down- arrow will decrease the time by an hour.
- Start times are limited to hour increments, and any minutes entered will be ignored by the simulation.

Setting the Release Duration

- The release duration for the area source can be set by first clicking on the Duration control and then entering the hour value using the keyboard of the computer.

6.6.7 Selecting Sources in the Simulation

- To include a source in the simulation, click on the check box located to the left of the source name.
- Once a source is checked, the source will be displayed on the map display of the ArcMap application.
- If the source was checked prior to clicking on the check box, the source will be removed from the map display and will not be included in the simulation run.
- To select all of the sources of a particular type, click on the check box of the source type. For example, clicking on the check box of the “Point Sources” label will cause all of the point sources

present in the list to be selected. If the source type check box was already selected prior to before being clicked, all of the sources below it will be unselected.

6.6.8 Viewing Source Information

- Double-clicking a source name in the sources list will cause the appropriate source input window to be displayed for the selected source.
- Clicking on the information button located to the right of the sources list will also display the source input window for a selected source.

6.6.9 Modifying Source Data

- To modify the input parameters for an individual source, first double click on the source's name in the source list of the Sources tab.
- Once the name has been double-clicked, the source input window for the selected source will be displayed.
- The parameters for the source can then be modified in the same manner as adding a new source.

6.6.10 Deleting a Source

- To delete a source, first select the desired source by clicking on the source name in the sources list.
- Once the source has been selected, click on the Delete Source button located to the right of the sources list.
- A message window will be displayed asking the user to confirm the deletion. If the user selects Yes, the source will be deleted from the current scenario. If the user selects No, the action will be canceled, and the source will remain in the scenario.
- Once a source has been deleted, the sources list and the map display will be automatically updated to reflect the change.

6.6.11 Clearing All Sources

- To clear all sources from the sources list and remove them from the current scenario, click on the "Start a new scenario" button located to the right of the sources list.
- Once that button has been clicked, a message window will be displayed asking the user to confirm the clearing of the scenario. If the user selects Yes, the scenario will be cleared, and the sources list and the map display will be automatically updated to reflect the changes. If the user selects No, the action will be canceled, and the sources list and the map display will not be changed.

6.6.12 Saving Sources as a Scenario

- To save the sources as a new scenario, first click on the "Save current scenario" button located to the right of the sources list.

- Once the “Save current scenario” button has been clicked, a prompt will be displayed asking for a name for the new scenario.
- If a valid name has been entered and the user has clicked on the OK button of the prompt window, the current scenario will be saved under the name that the user has entered.
- Following the naming of the new scenario, each source present in the sources list will have the name of the saved scenario displayed to the right of the source’s name. The scenario will also be added to the scenarios list.

6.7 Scenarios Tab

The Scenarios tab is used to select, add, or delete scenarios from the simulation. When selected, the Scenarios tab displays the current scenario name, as well as a list of currently available scenarios. Figure 6.15 shows the Scenarios tab with an example scenario entered.

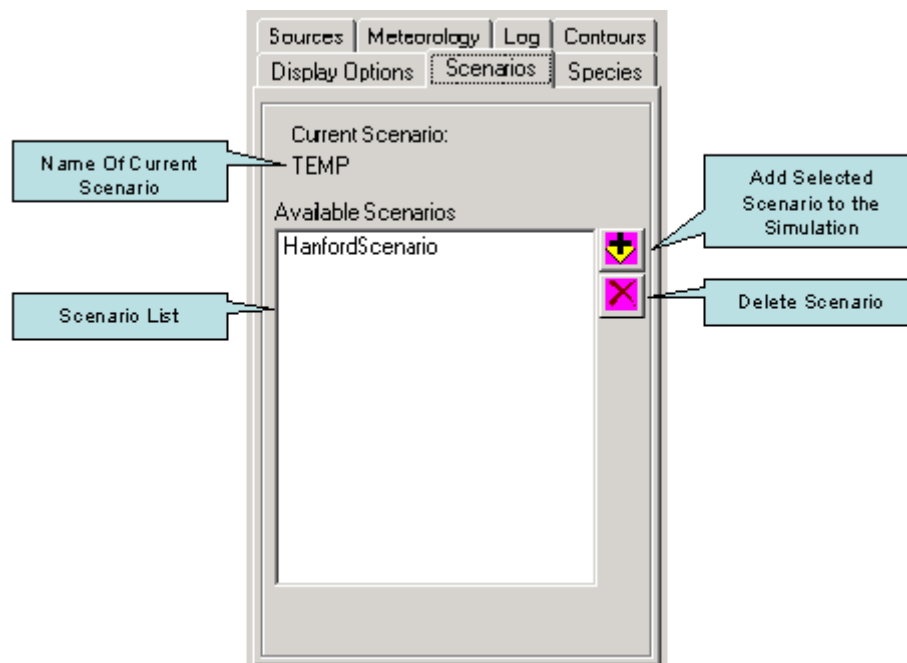


Figure 6.15 Example Scenario Tab with Controls Labeled

6.7.1 Adding an Existing Scenario to the Sources List

- To add the sources stored in a scenario to the sources list, select the Scenarios tab and single click on the scenario you wish to add.
- Once a scenario name has been selected on the list, the sources that are present in the scenario will be displayed upon the map.
- Then click the “Add Scenario” button in the upper right corner of the sources tab to add the scenario.
- Once the “Add Scenario” button has been clicked, the sources in the selected scenario will be automatically added to the sources list on the “Sources” tab.

6.7.2 Deleting an Existing Scenario

- To delete a scenario from the sources list, open the “Scenarios” tab and single click on the scenario you wish to delete.
- Next click the “Delete Scenario” button in the upper right corner of the sources tab to delete the scenario.

6.8 Meteorology Tab

The Meteorology tab is used to select the type of meteorology data that will be used for the simulation run. If there is upper air and surface station data available for the simulation site, the user can elect to use the existing data or enter in the values for a single observation that will then be used by the software to generate the meteorology data required by the modeling system.

6.8.1 Setting the Meteorology Type

- The type of meteorology data to be used for the simulation run can be set using the Use list control found on the Meteorology tab.
- Setting the Use list control to the Single Observation option will cause the Specify Meteorological Data window to be displayed with the input parameters needed to create the single observation data used by the modeling system.
- Selecting the Available Data option will cause the Specify Meteorological Data window to be displayed with meteorological station data parameters.
- Figure 6.16 provides examples of the Meteorology tab with the Single Observation and Available Data options selected.

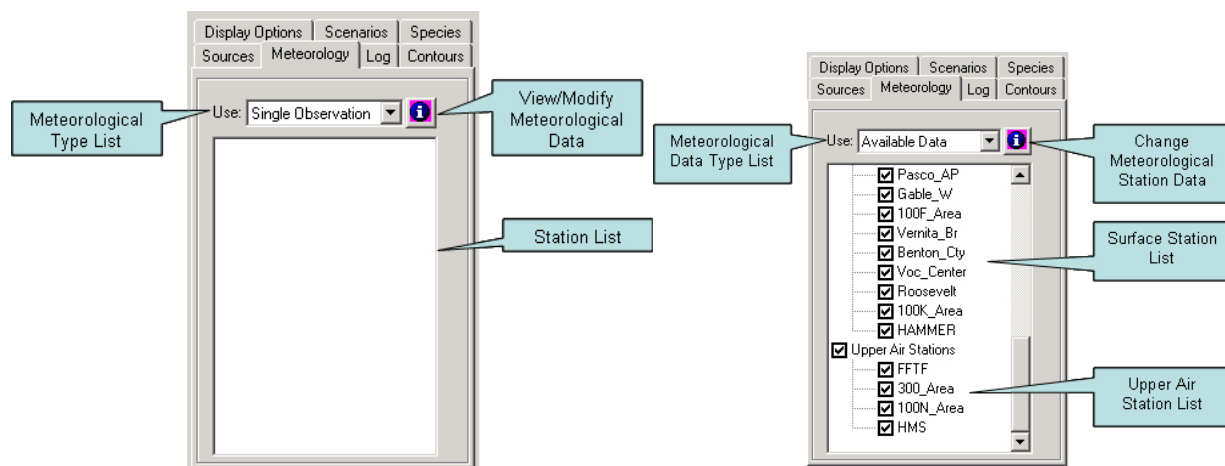


Figure 6.16 Examples of the Single Observation and Available Data Options Selected

6.8.2 Specifying Meteorology at One Site

- Single Observation Meteorology can be selected by setting the Use list control under the Meteorological tab to Single Observation.
- Once Single Observation has been selected, the Specify Meteorological Data window will be displayed with the input parameters needed to create the single observation data used by the modeling system.
- Figure 6.17 shows the meteorology input window for the Single Observation option with default values entered for the parameters.

The image shows a software window titled "Specify Meteorological Data". It contains several input fields for meteorological parameters. The "Wind Speed" field is set to 2.2 m/s. The "Wind Direction" field is set to 270. The "Mixing Height" field is set to 500 m. The "Ambient Temperature" field is set to 25 C. The "Relative Humidity" field is set to 50 %. The "Ambient Pressure" field is set to 1000 mb. The "Atmospheric Stability" dropdown menu is set to "D - Neutral". Below these fields, there is a text box containing the formula "Wind Direction >= 0 and Wind Direction <= 360". At the bottom right of the window, there are three buttons: "Defaults", "OK", and "Cancel".

Parameter	Value	Unit
Wind Speed	2.2	m/s
Wind Direction	270	
Mixing Height	500	m
Ambient Temperature	25	C
Relative Humidity	50	%
Ambient Pressure	1000	mb
Atmospheric Stability	D - Neutral	

Figure 6.17 Single Observation Meteorology Input Window

6.8.3 Use Available Meteorological Data

- Available Meteorological Data can be selected by setting the Use list control under the Meteorological tab to Available Data.
- Once Available Data has been selected, the Specify Meteorological Data window will be displayed listing the available Upper Air Station and Surface Station Meteorological Files available for potential use with the site (See Figure 6.18).
- Meteorological Files can be selected or deselected by checking the box located to the left of each file.
- The Meteorological Data files may also be edited manually by clicking the Edit Met Files button in the lower left corner of the window. This will display both the Upper Air Station and Surface Station data used in the simulation. The data may then be altered by entering new data and clicking the OK button.

- Figure 6.18 shows the meteorology input window for the Available Data option with example stations listed.

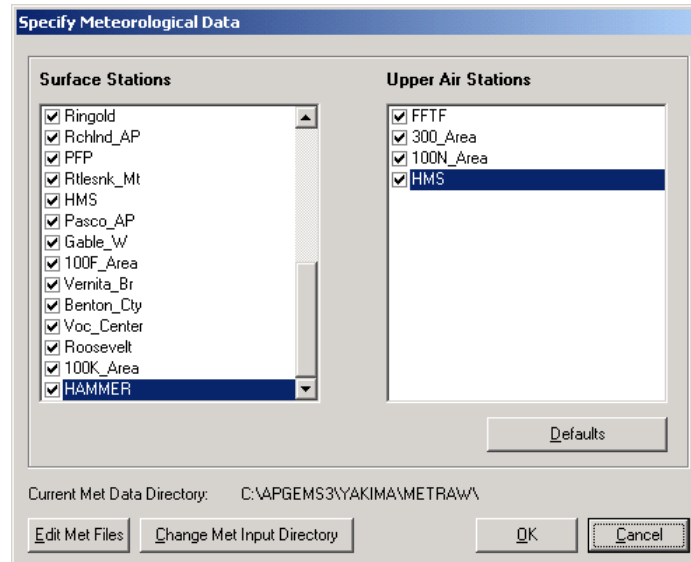


Figure 6.18 Available Data Input Window Showing Stations.

6.9 Contours Tab

The Contours tab is used to select, alter, and view contours generated by a simulation run. The Contours tab contains information regarding contour and emission types and levels, contour animation, and interval start times. Figure 6.19 displays an example of the Contours tab following a simulation run.

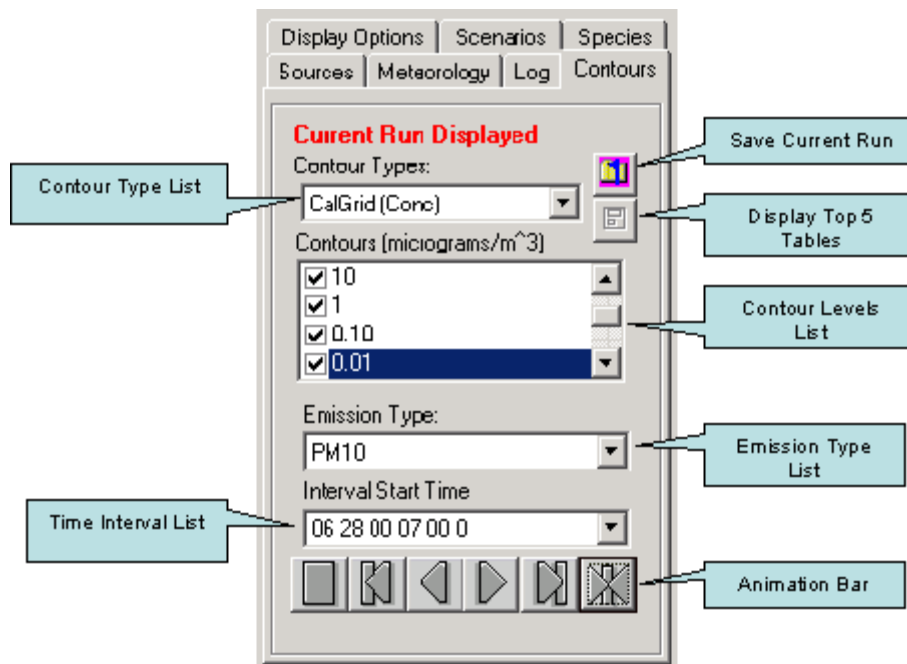


Figure 6.19 Example Contours Tab with Controls Labeled

6.9.1 Setting the Contour Type

- To set the contour type, click in the “Contour Types” list box and select the desired contour type.
- Depending upon the settings used for the simulation run, the following contour types can be present in the Contour Types list.

CalPuff Contour Types

- “CalPuff (Conc)” — Contours representing the concentration values generated by the CalPuff model.
- “CalPuff (ConcAVG##)” — Contours representing the averaged concentration values generated by the CalPuff model. The ## will be replaced by the hour value selected in the Averaging Interval control of the Simulation Scenario panel.
- “CalPuff (Dep)” — Contours representing the deposition values generated by the CalPuff model.
- “CalPuff (DepAVG##)” — Contours representing the averaged deposition values generated by the CalPuff model. The ## will be replaced by the hour value selected in the Averaging Interval control of the Simulation Scenario panel.
- “CalPuff (Exp)” — Contours representing the exposure values calculated by the contouring software.
- “CalPuff (TotalDep)” — Contours representing the total deposition values calculated by the contouring software.

CalGrid Contour Types

- “CalGrid (Conc)” — Contours representing the concentration values generated by the CalGrid model.
- “CalGrid (ConcAVG##)” — Contours representing the averaged concentration values generated by the CalGrid model. The ## will be replaced by the hour value selected in the Averaging Interval control of the Simulation Scenario panel.
- “CalGrid (Dep)” — Contours representing the deposition values generated by the CalGrid model.
- “CalGrid (DepAVG##)” — Contours representing the averaged deposition values generated by the CalGrid model. The ## will be replaced by the hour value selected in the Averaging Interval control of the Simulation Scenario panel.
- “CalGrid (Exp)” — Contours representing the exposure values calculated by the contouring software.
- “CalGrid (TotalDep)” — Contours representing the total deposition values calculated by the contouring software.

6.9.2 Selecting Contour Levels

- Within the “Contours” list, check the desired levels of the result values to be displayed. Levels can be removed by deselecting the check mark for the unwanted items.

6.9.3 Selecting Emission Type

- The emission types listed in the Emission Type list will correspond to the species that were selected for the simulation run.
- To set the “Emission Type,” click in the “Emission Type” list box and select the desired Emission Type.

6.9.4 Selecting Interval Start Time

- Within the “Interval Start Time” list box, click on the desired interval start time.
- The start time contains the month, day, year, hour, minute, and seconds pertinent to the start time.
- The start time is in the following format, (mm dd yy hh min sec).

6.9.5 Animating Contours

- From within the Contours Tab, a user can control the animation of the contours generated by the simulation run. Through use of the contour animation buttons located at the bottom of the contours tab, the following actions can be preformed (from left to right):
 - Stop
 - Clicking this button stops the current animation.
 - Reset
 - Clicking this button resets the contour animation to its start point.
 - Step Back
 - Clicking this button takes the contour animation back one iteration.

- Step Forward
 - Clicking this button takes the contour animation forward one iteration.
- Animate One Cycle
 - Clicking this button will run the current animation from beginning to end one time.
- Animate Continuously
 - Clicking this button will run the current animation in a continuous loop.
- Figure 6.20 displays the play-back bar used to animate the contours with the individual buttons labeled.

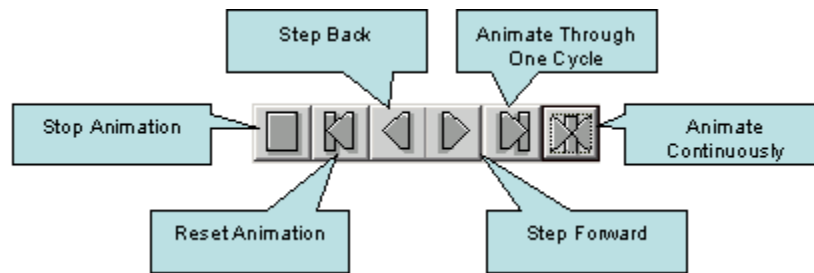


Figure 6.20 Play Back Bar with Controls Labeled

6.9.6 Saving a Simulation Run

- To save a simulation run, click the “Save Current Run” button located directly to the right of the “Contour Types” box.
- Once the “Save Current Run” button has been clicked, a prompt asking for a run name will be displayed. Enter a name for the run and click the “Ok” button.
- A dialog window will then be displayed where a description of the run or a comment can be entered to be saved with the run data.
- After entering the description or comment, click on the “Ok” button.
- The name of the current run will then be changed to the name entered for the run, and all data associated with the run will be saved.

6.9.7 Loading a Saved Simulation Run

- A prior run that has been saved can be loaded into the modeling system by first clicking on the “File” button found on the main SPRAYTRAN interface.
- Once the “File” button has been clicked, the “Prior Run Selection” window will be displayed with a list of saved simulation runs.
- Click on the name of the desired run to select it, and then click on the “OK” button to load the saved run.
- Once selected, all data concerning the saved run will be automatically loaded into the SPRAYTRAN interface, including the result contours.
- Figure 6.21 displays the Prior Run Selection window with an example run selected.

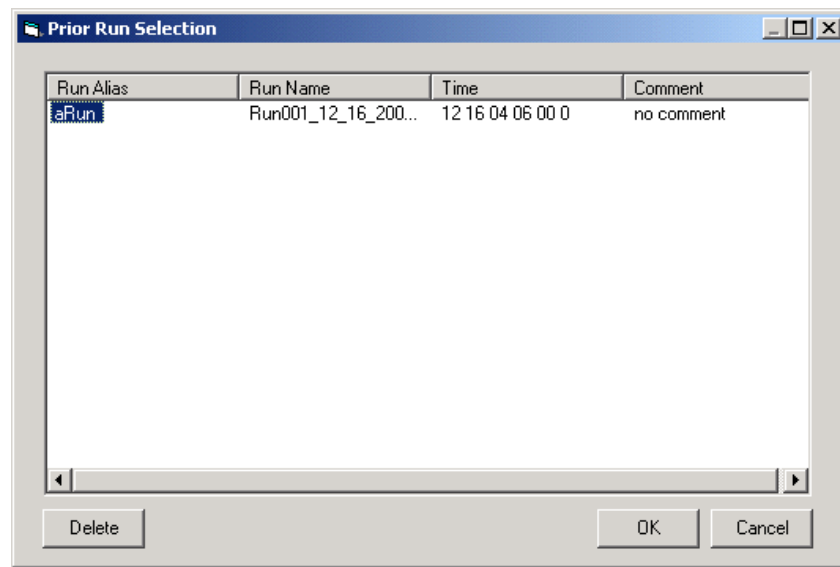


Figure 6.21 Example Prior Run Selection Window

6.10 Display Options Tab

The “Display Options” tab allows the user to choose what will be displayed within the ArcMap application, and how it will appear (i.e., color, size, symbol). The display for the following items can be altered using the “Display Options” tab: contours, receptors, wind vectors, surface stations, and station locations. Figure 6.22 displays the Display Options tab showing the available options for displaying the results of a simulation run.

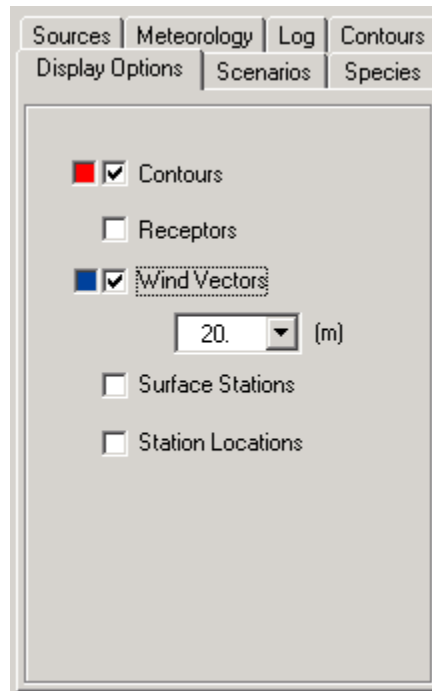


Figure 6.22 Display Options Tab

6.10.1 Setting the Contour Display

- The contours generated by the simulation run can be turned on or off by clicking on the box located to the left of the Contours label.
- In order to change the color of the contours within the ArcMap application, click on the colored box located to the left of the Contours check box.
- Once the colored box has been clicked on, a dialog window will be displayed that can be used to change the colors of the contours.

6.10.2 Display the Receptor Network

- The receptor field used in the simulation can be viewed by clicking on the box located to the left of the Receptors label.
- In order to change the color of the receptor field within the ArcMap application, click on the colored box located to the left of the Wind Vectors check box.
- Once the colored box has been clicked-on, a dialog window will be displayed that can be used to change the colors of the receptors.

6.10.3 Display the Wind Vectors

- The wind vectors used in the simulation can be viewed by clicking on the box located to the left of the Wind Vectors label.

- The differing height levels of the wind fields can also be viewed by selecting the desired height in the heights list located under the Wind Vectors label.
- In order to change the color of the Wind Vectors within the ArcMap application, click on the colored box located to the left of the Wind Vectors check box.
- Once the colored box has been clicked-on, a dialog window will be displayed that can be used to change the colors of the wind vectors.

7.0 Instructions for Adding a New Site to the SPRAYTRAN Modeling System

This section describes the steps for running the Add Site software and creating the Site MXD file.

7.1 Running the Add Site software

- 1) Click on the Add Site button located at the top of the SPRAYTRAN interface panel.
- 2) Once the Add Site window is displayed, enter a name for the new site into the text box and then click on the “Next Button” (Figure 7.1).



Figure 7.1 Enter Site Name Panel

- 3) The Add Site software will then request that you enter the paths for the Shapefiles that will be used to create the map representation of the new site. Please note that the Shapefiles used to define the simulation area need to have been projected in the appropriate UTM zone and have an extent that is greater than 400 km in the North to South direction and the East to West direction. The ESRI ArcMap and ArcToolbox applications provide the functionality to both clip and project Shapefiles. While the Add Site software only accepts Shapefiles during the creation of the new site, other types of files, such as raster images, can be added to the site map following the creation of the site using the Add Data functionality of the ArcMap application.
 - a. Click on the Browse button to bring-up the file selection window. Once the file selection window has been displayed, use it to navigate to the directory where the Shapefiles are stored.
 - b. Select the appropriate Shapefiles by clicking on their names in the file list.
 - c. Click on the Ok button to accept the selections and close the file selection window.
 - d. Once the file selection window has closed, the paths of the selected Shapefiles will now be displayed in the file list of the Add Site window.
 - e. Click on the Next button to continue the process of adding a new site (Figure 7.2).

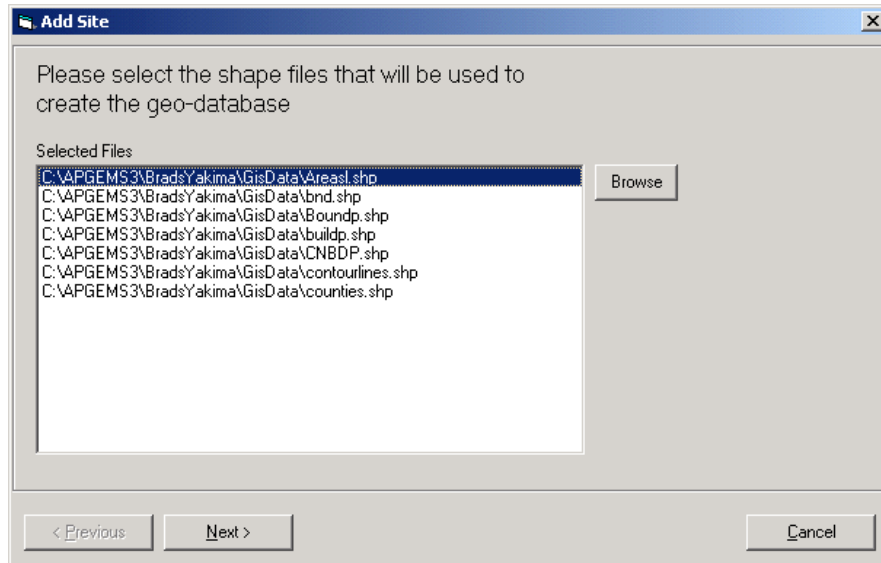


Figure 7.2 Select Site Shapefiles Panel

- f. If you have data for existing meteorological stations, you can enter that information in the Meteorological Station panel displayed next (Figure 7.3). If no data are available, this step can be skipped by clicking-on the Next button. Meteorological data for a site can be located in any directory with the following constraints. Surface and upper air meteorological station files need to be placed in the same directory and named in accordance with the naming conventions outlined in the file format documentation found in the appendix of this document. The files also need to conform to the file formats detailed for the upper air and surface station file documentation found in the appendix of this document.

	Name	ID	Longitude (m)	Latitude (m)	Elevation (m)	UTM E (m)	UTM N (m)
1							
2							
3							
4							
5							
6							
7							
8							

Figure 7.3 Meteorological Station Panel

- g. The final user screen of the Add Site software asks for the selection of the terrain and land-use files that will be used by the new site.
- h. By default, a set of GTOPO30 terrain files are supplied for the United States, as well as an appropriate land-use file.
- i. If different files are to be used, select the type of the terrain files that will be used from the list of types present in the Terrain File Type list box.
- j. Once the file type has been selected, the desired files can then be selected using the Add option.
- k. Land-use files are limited to .img files only, and selecting a file different from the default can be accomplished by selecting the Browse button.
- l. Once all of the desired files have been selected, click on the Next button (Figure 7.4).

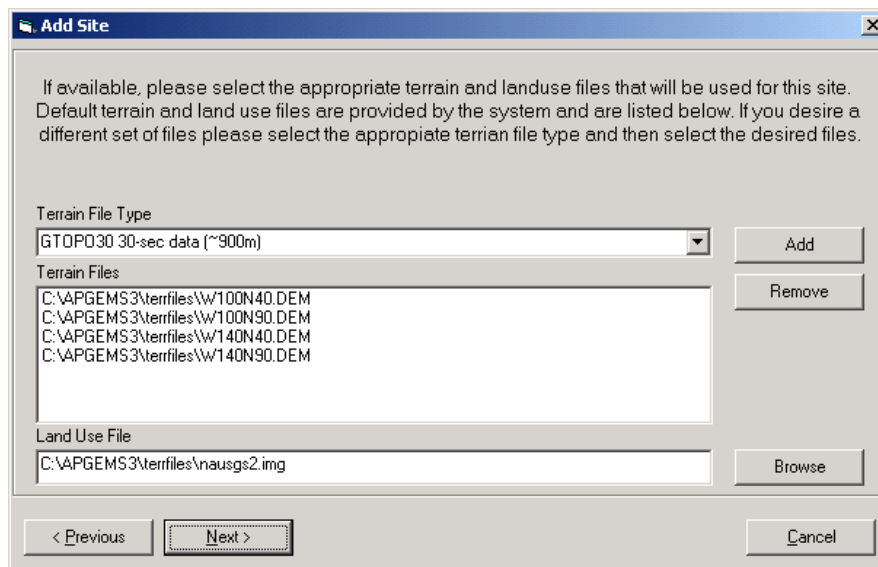


Figure 7.4 Terrain File Selection Panel

- m. The final panel of the Add Site software is then displayed (Figure 7.5). If there are no further changes to be made, the Finish button can be selected, and the software will then create the folders and files that are required by the SPRAYTRAN software to run simulations for the new site. Once the software has finished creating the folders and files, a message window will be displayed listing the success or failure of the creation of the new site.

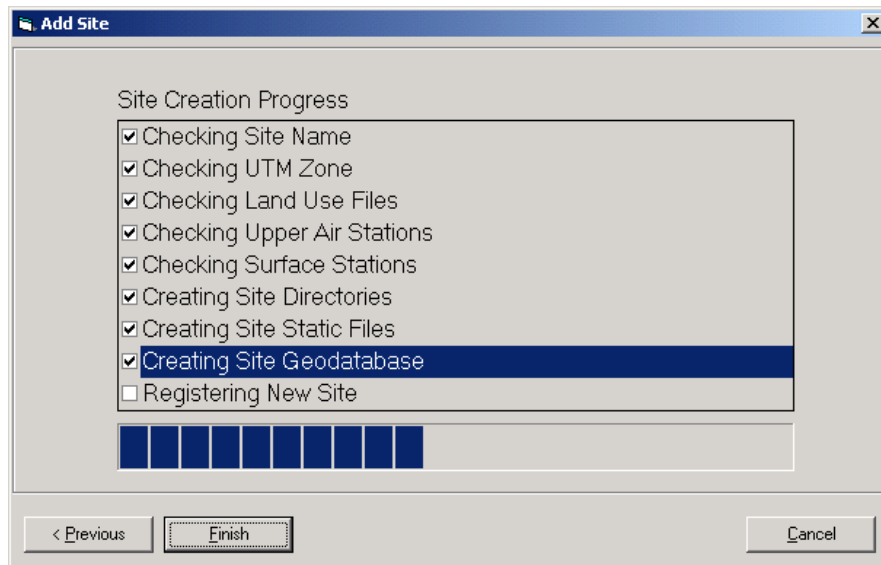


Figure 7.5 Site Creation Progress Panel

7.2 Creating the Site MXD File

- 1) Once the Add Site window has closed, close and then reopen the ArcMap application.
- 2) Without starting the SPRAYTRAN application, use the Add Data option of the ArcMap application to load the map layers that will be used for the site.
- 3) The layers will be located in an Access database file named the same as the site and will also be located in the site directory. The following is an example of the directory path used to store the database file. "C:\SPRAYTRAN\Yakima\Yakima.mdb"
- 4) Within the Add Data window, double-click on the database file, and one entry named SiteWide should appear in the file list.
- 5) Double-click on the SiteWide name, and the window should then display the individual map layers contained within the database file.
- 6) Once the layers are displayed, they can then be selected by clicking on their name.
- 7) Along with the layers entered earlier using the Add Site software, there will be five additional layers listed that will need to be added as map layers. The layers are automatically created during the process of adding a new site and are named as follows: AreaSources, Domains, LineSources, PointSources, and Simulation.
- 8) Once all the layers have been loaded into the ArcMap application, they can then be organized and displayed as desired with the following exceptions.
 - a. The Simulation and Domains layers must be the two top layers, with the Simulation layer at the very top.
 - b. The AreaSources, LineSources, and PointSources layers should be placed at the bottom of the layer listing.

- 9) Once all the layers have been added and organized, save the ArcMap project under the same name as the site, and place the resultant .mxd file into the same site directory as the site's database file.
- 10) With the .mxd file created, the new site can now be opened and used by the SPRAYTRAN modeling system.

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